

**BEFORE THE  
SURFACE TRANSPORTATION BOARD  
EX PARTE 766**

ENTERED  
Office of Proceedings  
February 10, 2021  
Part of  
Public Record

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JOINT PETITION FOR RULEMAKING—ANNUAL REVENUE ADEQUACY  
DETERMINATIONS

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**ERRATA**

Union Pacific Railroad Company, Norfolk Southern Railway Company, and the U.S. rail operating affiliates of Canadian National Railway Company (“CN”) (collectively, “Petitioners”) submit this Errata to correct several minor errors in their Joint Petition for Rulemaking filed September 1, 2020 and Response to Replies filed on October 13, 2020.

In the process of compiling workpapers responsive to the Board’s order of December 30, 2020, Petitioners discovered that their calculations for 2019 used an incorrect market risk premium, which slightly affected the cost of capital calculations. While this error did not materially affect the analysis presented in the Petition or the Response to Replies, in the interest of accuracy Petitioners are filing this Errata to correct the miscalculations.

Specifically, the Errata changes certain numbers on the following pages of the Petition and the Response to Replies:

**Petition**

- Petition Page 30 – Table 4
- Petition Page 34 – Table 1
- Verified Statement Page 39 - Table 1
- Verified Statement Page 40 – Paragraph 68
- Verified Statement Page 41 – Table 2

- Verified Statement Page 42 – Paragraph 71 and Table 3
- Verified Statement Page 44 - Table 4 and Paragraph 75
- Verified Statement Page 45 – Paragraph 76
- Verified Statement Page 46 – Table 5
- Verified Statement Page 48 – Table 6 and Paragraph 79
- Verified Statement Page 49 – Table 7
- Verified Statement Page 71 – Paragraph C-8
- Verified Statement Exhibits 1, 2, C1, and C2

### **Response to Replies**

- Response to Replies Page 3 – top paragraph
- Verified Statement Page 4 – Figure 1
- Verified Statement Page 9 – Paragraph 14

The changes made by the Errata to the Petition are shown in Attachment A, and the changes made to the Response to Replies are shown in Attachment B. Complete corrected copies of each filing are enclosed as Attachments C and D, respectively. In addition, a corrected replacement for the spreadsheet of supporting data that was filed with the Petition is being submitted today.

Respectfully submitted,

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Dated: February 10, 2021

## **CERTIFICATE OF SERVICE**

I hereby certify that on this 10th day of February, 2021, I served the foregoing Errata by email on the service list for Ex Parte 766.

/s/ Matthew J. Warren

**ATTACHMENT A**

**ERRATA PAGES TO SEPTEMBER 1, 2020  
JOINT PETITION FOR RULEMAKING**

using that same accounting measurement of financial performance, the railroad industry was outperformed by 87% of those unregulated firms with whom they compete for capital. As the Professors explain, “If the railroads earn a rate of return net of cost of capital no higher than the average or median S&P firm, then there would be no presumption that railroads are earning abnormal returns and can set rates without constraint from competition, or that shippers’ current protections under the Board’s SAC and related proceedings are not sufficient.”<sup>46</sup>

**Table 4**  
**S&P 500 Companies Excluding Railroads, Financial Institutions and Real Estate Companies**

| Number of Observations, Median, 25th Percentile, and % Positive ROIC minus COC Over 2006-2019 Period |         |         |         |         |
|------------------------------------------------------------------------------------------------------|---------|---------|---------|---------|
|                                                                                                      | Minimum | Maximum | Median  | Average |
| Number of Observations in Sample                                                                     | 393     | 415     | 409     | 406     |
| Median Adjusted ROIC minus COC                                                                       | 5%      | 12%     | 10%     | 9%      |
| 25th Percentile Adjusted ROIC minus COC                                                              | -2%     | 3%      | 2%      | 2%      |
| % with ROIC minus COC > 0.0%                                                                         | 68%     | 87%     | 83% 84% | 83%     |
| Railroad Percentile in the Distribution of Adjusted ROIC minus COC                                   |         |         |         |         |
| Industry Weighted Average ROIC                                                                       | 9       | 25 23   | 13      | 14      |
| BNSF Railway                                                                                         | 8       | 24      | 14      | 15      |
| CSX Corporation                                                                                      | 6       | 26 25   | 10      | 12      |
| Grand Trunk Corporation                                                                              | 4       | 15      | 9       | 10      |
| Kansas City Southern                                                                                 | 5       | 20      | 10      | 11      |
| Norfolk Southern Corporation                                                                         | 7       | 21      | 11      | 13      |
| Soo Line Corporation                                                                                 | 1       | 34      | 13      | 14      |
| Union Pacific Corporation                                                                            | 8       | 35 34   | 17      | 19      |

Sources: Bloomberg; Compustat; Ibbotson Yearbook (2006-2019); STB Revenue Adequacy Determination Report (2006-2018); RevAd 2019 AAR workpaper1.pdf, titled "AAR Duplication of STB Workpapers."

The Board should use this rich dataset to place the financial performance of the freight rail industry into proper context when evaluating railroad revenue adequacy. Consideration of this market evidence is consistent with Congress’s direction to “treat[] the American railroad industry as any other business.”<sup>47</sup> An

<sup>46</sup> Murphy & Zmijewski V.S. ¶ 32.

<sup>47</sup> *Burlington N. R.R. Co.*, 812 F.2d at 235 (citing 126 Cong. Rec. 28,431 (1980) (statement of Rep. Staggers)); see *Groome & Assocs., Inc.*, STB Docket No. 42087, at

**Table 1**  
**S&P 500 Companies Excluding Railroads, Financial Institutions and Real Estate Companies**

| Number of Observations, Median, 25th Percentile, and % Positive ROIC minus COC Over 2006-2019 Period |         |                  |        |                  |
|------------------------------------------------------------------------------------------------------|---------|------------------|--------|------------------|
|                                                                                                      | Minimum | Maximum          | Median | Average          |
| Number of Observations in Sample                                                                     | 368     | 405              | 395    | 391              |
| Median ROIC minus COC                                                                                | 13%     | 29%              | 19%    | 20%              |
| 25th Percentile ROIC minus COC                                                                       | -1%     | 6%               | 5%     | 4%               |
| % with ROIC minus COC > 0.0%                                                                         | 73%     | 91%              | 89%    | 88%              |
| <b><u>Railroad Percentile in the Distribution of ROIC minus COC</u></b>                              |         |                  |        |                  |
| Industry Weighted Average ROIC                                                                       | 9       | 22               | 13     | 15 <del>14</del> |
| BNSF Railway                                                                                         | 9       | 23               | 15     | 15               |
| CSX Corporation                                                                                      | 6       | 24 <del>23</del> | 10     | 12               |
| Grand Trunk Corporation                                                                              | 3       | 16               | 10     | 10               |
| Kansas City Southern                                                                                 | 4       | 18               | 8      | 9                |
| Norfolk Southern Corporation                                                                         | 10      | 24               | 13     | 15               |
| Soo Line Corporation                                                                                 | 2       | 26               | 13     | 13               |
| Union Pacific Corporation                                                                            | 8       | 30               | 22     | 20               |

The assumptions and methodology of this comparative analysis are set forth in the Verified Statement, and the key assumptions are summarized below.

Cost of Capital. Cost of Capital for each comparison firm was determined using the same methodology used by the STB, as explained in Appendix A to the Verified Statement.

Comparables. The S&P 500 was selected as the comparable group because it represents the largest companies in the United States, and thus is a proxy for the firms with which railroads compete for capital. The S&P 500 is a stock market index that measures the stock performance of 500 leading companies listed on stock exchanges in the United States.<sup>72</sup> It is one of the most commonly followed equity indices, and many consider it to be one of the best representations of the U.S. stock market.<sup>73</sup> In fact, the ICC and STB have consistently used data from the S&P 500

<sup>72</sup> See *Dow Jones & Co. v. Int'l Securities Exchange, Inc.*, 451 F.3d 295, 298 (2d Cir. 2006).

<sup>73</sup> *Standard & Poor's Corp. v. Commodity Exchange, Inc.*, 538 F. Supp. 1063, 1067 (S.D.N.Y. 1982) ("The S&P 500 Stock Price Index is a broad-based, weighted,

**Table 1**  
**S&P 500 Companies Excluding Railroads, Financial Institutions and Real Estate Companies**

| Number of Observations, Median, 25th Percentile, and % Positive ROIC minus COC Over 2006-2019 Period |         |         |        |         |
|------------------------------------------------------------------------------------------------------|---------|---------|--------|---------|
|                                                                                                      | Minimum | Maximum | Median | Average |
| Number of Observations in Sample                                                                     | 368     | 405     | 395    | 391     |
| Median ROIC minus COC                                                                                | 13%     | 29%     | 19%    | 20%     |
| 25th Percentile ROIC minus COC                                                                       | -1%     | 6%      | 5%     | 4%      |
| % with ROIC minus COC > 0.0%                                                                         | 73%     | 91%     | 89%    | 88%     |
| <b><u>Railroad Percentile in the Distribution of ROIC minus COC</u></b>                              |         |         |        |         |
| Industry Weighted Average ROIC                                                                       | 9       | 22      | 13     | 15 14   |
| BNSF Railway                                                                                         | 9       | 23      | 15     | 15      |
| CSX Corporation                                                                                      | 6       | 24 23   | 10     | 12      |
| Grand Trunk Corporation                                                                              | 3       | 16      | 10     | 10      |
| Kansas City Southern                                                                                 | 4       | 18      | 8      | 9       |
| Norfolk Southern Corporation                                                                         | 10      | 24      | 13     | 15      |
| Soo Line Corporation                                                                                 | 2       | 26      | 13     | 13      |
| Union Pacific Corporation                                                                            | 8       | 30      | 22     | 20      |

Sources: Bloomberg; Compustat; Ibbotson Yearbook (2006-2019); STB Revenue Adequacy Determination Report (2006-2018); RevAd 2019 AAR workpaper1.pdf, titled "AAR Duplication of STB Workpapers."

67. As shown in the top panel of Table 1, the number of companies in the S&P 500 benchmarking group varies from 368 to 405 across years (2006 through 2019). The number of observations differs from the possible number of observations because some companies in the S&P 500 benchmarking group have negative denominators based on the Board definition of Tax Adjusted Net Investment Base, so we exclude them from the S&P 500 benchmarking group because their ROIC is not meaningful. The median ROIC minus COC for the S&P 500 benchmarking group ranges from 13% to 29% over the 2006 – 2019 period, and the median of the annual medians is 19% (average 20%). The 25<sup>th</sup> percentile ROIC minus COC for the S&P 500 benchmarking group range from -1% to 6% over the 2006 – 2019 period, and the median of the annual 25<sup>th</sup> percentile is 5% (average 4%). The ROIC minus COC is positive in every year for most companies in the S&P benchmarking group. The percentage of companies in the S&P

500 benchmarking group annually that have a positive ROIC minus COC ranges from 73% to 91% over the 2006 – 2019 period.

68. As shown in the bottom panel of Table 1, the Industry Weighted Average ROIC minus COC percentile for the railroad companies in the S&P as a whole within the S&P 500 benchmarking group over this period ranges from the 9<sup>th</sup> percentile to the 22<sup>nd</sup> percentile. The median of the annual medians of the over this period for the Industry Weighted Average is the 13<sup>th</sup> percentile, and the average of the annual medians over this period is the ~~14<sup>th</sup>~~ <sup>15<sup>th</sup></sup> percentile. For the seven railroads, the median of the annual medians over this period range from the 8<sup>th</sup> percentile to the 22<sup>nd</sup> percentile, and the average of the annual medians over this period range from the 9<sup>th</sup> percentile to the 20<sup>th</sup> percentile.

69. Table 2 below presents the same type of analysis as that presented in Table 1 but for the S&P 500 Industrials Sector benchmarking group.<sup>70</sup> As shown in the top panel of Table 2, the number of observations annually in the S&P 500 Industrials Sector benchmarking group varies from 48 to 63. The median ROIC minus COC for the S&P 500 Industrials Sector ranges from 14% to 31% over the 2006 – 2019 period, and the median of the annual medians is 23% (average 23%). The 25<sup>th</sup> percentile ROIC minus COC for the S&P 500 Industrial Sector ranges from 4% to 14% over the 2006 – 2019 period, and the median of the annual 25<sup>th</sup> percentile is 13% (average 12%). The percentage of companies in the S&P 500 Industrial Sector benchmarking group that have a positive ROIC minus COC range from 83% to 100% over the 2006 – 2019 period.

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<sup>70</sup> See Exhibit 1 for the year-by-year results for the Industry Weighted Average and the seven railroads summarized in Table 2.

**Table 2**  
**S&P 500 Companies in the Industrials Sector Excluding Railroads**

| <b>Number of Observations, Median, 25th Percentile, and % Positive ROIC minus COC Over 2006-2019 Period</b> |                |                |               |                |
|-------------------------------------------------------------------------------------------------------------|----------------|----------------|---------------|----------------|
|                                                                                                             | <b>Minimum</b> | <b>Maximum</b> | <b>Median</b> | <b>Average</b> |
| <b>Number of Observations in Sample</b>                                                                     | 48             | 63             | 56            | 57             |
| <b>Median ROIC minus COC</b>                                                                                | 14%            | 31%            | 23%           | 23%            |
| <b>25th Percentile ROIC minus COC</b>                                                                       | 4%             | 14%            | 13%           | 12%            |
| <b>% with ROIC minus COC &gt; 0.0%</b>                                                                      | 83%            | 100%           | 96%           | 95%            |
| <b><u>Railroad Percentile in the Distribution of ROIC minus COC</u></b>                                     |                |                |               |                |
| <b>Industry Weighted Average ROIC</b>                                                                       | 2              | 12             | 7             | 7              |
| <b>BNSF Railway</b>                                                                                         | 2              | 13             | 7             | 7              |
| <b>CSX Corporation</b>                                                                                      | 2              | 11 9           | 5             | 6              |
| <b>Grand Trunk Corporation</b>                                                                              | 2              | 9              | 5             | 5              |
| <b>Kansas City Southern</b>                                                                                 | 2              | 9              | 4             | 5              |
| <b>Norfolk Southern Corporation</b>                                                                         | 2              | 14             | 8             | 7              |
| <b>Soo Line Corporation</b>                                                                                 | 2              | 15             | 6             | 6              |
| <b>Union Pacific Corporation</b>                                                                            | 4              | 21             | 9             | 10             |

Sources: Bloomberg; Compustat; Ibbotson Yearbook (2006-2019); STB Revenue Adequacy Determination Report (2006-2018); RevAd 2019 AAR workpaper1.pdf, titled "AAR Duplication of STB Workpapers."

70. As shown in the bottom panel of Table 2, the Industry Weighted Average ROIC minus COC percentile within the S&P 500 Industrials Sector benchmarking group over this period ranges from the 2<sup>nd</sup> percentile to the 12<sup>th</sup> percentile. The median of the annual medians over this period for the Industry Weighted Average is the 7<sup>th</sup> percentile, and the average of the annual medians over this period also is the 7<sup>th</sup> percentile. For the seven railroads, the median of the annual medians over this period range from the 4<sup>th</sup> percentile to the 9<sup>th</sup> percentile, and the average of the annual medians over this period range from the 5<sup>th</sup> percentile to the 10<sup>th</sup> percentile.

71. Table 3 below presents the same type of analysis as that presented in Tables 1 and 2 for the S&P 500 Railroad Customers benchmarking group.<sup>71</sup> As shown in the top panel of Table 3,

<sup>71</sup> See Exhibit 1 for the year-by-year results for the Industry Weighted Average and the seven railroads summarized in Table 3.

the number of observations in the S&P 500 Railroad Customers companies varies from 80 to 86. The median ROIC minus COC for the S&P 500 Railroad Customers companies ranges from 3% to 13% over the 2006 – 2019 period, and the median of the annual medians is ~~9%~~<sup>8%</sup> (average 9%). The 25<sup>th</sup> percentile ROIC minus COC for the S&P 500 companies ranges from -4% to 4% over the 2006 – 2019 period, and the median of the annual 25<sup>th</sup> percentile is 2% (average 2%). The ROIC minus COC is positive for most companies in the S&P companies. The percentage of the S&P 500 companies with a positive ROIC minus COC ranges from 61% to 88% over the 2006 – 2019 period.

**Table 3**  
**Railroad Customer Sample of S&P 500 Companies**

| Number of Observations, Median, 25th Percentile, and % Positive ROIC minus COC Over 2006-2019 Period |         |                             |                             |                             |
|------------------------------------------------------------------------------------------------------|---------|-----------------------------|-----------------------------|-----------------------------|
|                                                                                                      | Minimum | Maximum                     | Median                      | Average                     |
| Number of Observations in Sample                                                                     | 80      | 86                          | 84                          | 83                          |
| Median ROIC minus COC                                                                                | 3%      | 13%                         | <del>9%</del> <sup>8%</sup> | 9%                          |
| 25th Percentile ROIC minus COC                                                                       | -4%     | 4%                          | 2%                          | 2%                          |
| % with ROIC minus COC > 0.0%                                                                         | 61%     | 88%                         | 83%                         | 81%                         |
| <b>Railroad Percentile in the Distribution of ROIC minus COC:</b>                                    |         |                             |                             |                             |
| Industry Weighted Average ROIC                                                                       | 7       | 36                          | 22                          | 23                          |
| BNSF Railway                                                                                         | 7       | 36                          | 24                          | 24                          |
| CSX Corporation                                                                                      | 5       | <del>36</del> <sup>39</sup> | 16                          | 18                          |
| Grand Trunk Corporation                                                                              | 5       | 29                          | 14                          | 16                          |
| Kansas City Southern                                                                                 | 5       | 28                          | 13                          | 13                          |
| Norfolk Southern Corporation                                                                         | 15      | <del>34</del> <sup>33</sup> | 20                          | 23                          |
| Soo Line Corporation                                                                                 | 6       | 43                          | 19                          | <del>19</del> <sup>20</sup> |
| Union Pacific Corporation                                                                            | 6       | 49                          | 35                          | 31                          |

Sources: Bloomberg; Compustat; Ibbotson Yearbook (2006-2019); STB Revenue Adequacy Determination Report (2006-2018); RevAd 2019 AAR workpaper1.pdf, titled "AAR Duplication of STB Workpapers."

72. As shown in the bottom panel of Table 3, the Industry Weighted Average ROIC minus COC percentile within the sample over this period ranges from the 7<sup>th</sup> percentile to the 36<sup>th</sup> percentile. The median of the annual medians over this period for the Industry Weighted

to 3% over the 2006 – 2019 period, and the median of the annual 25<sup>th</sup> percentile is 2% (average 2%). The percentage of companies in the S&P 500 benchmarking group that have a positive Adjusted ROIC minus COC ranges from 68% to 87% over the 2006 – 2019 period.

**Table 4**  
**S&P 500 Companies Excluding Railroads, Financial Institutions and Real Estate Companies**

| Number of Observations, Median, 25th Percentile, and % Positive ROIC minus COC Over 2006-2019 Period |         |                  |                    |         |
|------------------------------------------------------------------------------------------------------|---------|------------------|--------------------|---------|
|                                                                                                      | Minimum | Maximum          | Median             | Average |
| Number of Observations in Sample                                                                     | 393     | 415              | 409                | 406     |
| Median Adjusted ROIC minus COC                                                                       | 5%      | 12%              | 10%                | 9%      |
| 25th Percentile Adjusted ROIC minus COC                                                              | -2%     | 3%               | 2%                 | 2%      |
| % with ROIC minus COC > 0.0%                                                                         | 68%     | 87%              | 83% <del>84%</del> | 83%     |
| <b>Railroad Percentile in the Distribution of Adjusted ROIC minus COC</b>                            |         |                  |                    |         |
| Industry Weighted Average ROIC                                                                       | 9       | <del>25</del> 23 | 13                 | 14      |
| BNSF Railway                                                                                         | 8       | 24               | 14                 | 15      |
| CSX Corporation                                                                                      | 6       | <del>26</del> 25 | 10                 | 12      |
| Grand Trunk Corporation                                                                              | 4       | 15               | 9                  | 10      |
| Kansas City Southern                                                                                 | 5       | 20               | 10                 | 11      |
| Norfolk Southern Corporation                                                                         | 7       | 21               | 11                 | 13      |
| Soo Line Corporation                                                                                 | 1       | 34               | 13                 | 14      |
| Union Pacific Corporation                                                                            | 8       | <del>35</del> 34 | 17                 | 19      |

Sources: Bloomberg; Compustat; Ibbotson Yearbook (2006-2019); STB Revenue Adequacy Determination Report (2006-2018); RevAd 2019 AAR workpaper1.pdf, titled "AAR Duplication of STB Workpapers."

75. As shown in the bottom panel of Table 4, the Industry Weighted Average Adjusted ROIC minus COC percentile within the S&P 500 benchmarking group over this period ranges from the 9<sup>th</sup> percentile to the ~~23<sup>rd</sup>~~ <sup>25<sup>th</sup></sup> percentile. The median of the annual medians of the over this period for the Industry Weighted Average is the 13<sup>th</sup> percentile, and the average of the annual medians over this period is the 14<sup>th</sup> percentile. For the seven railroads, the median of the annual medians over this period range from the 9<sup>th</sup> percentile to the 17<sup>th</sup> percentile, and the average of the annual medians over this period range from the 10<sup>th</sup> percentile to the 19<sup>th</sup> percentile.

76. Table 5 below presents the same type of analysis as that presented in Table 4 but for the S&P 500 Industrials Sector benchmarking group.<sup>73</sup> As shown in the top panel of Table 5, the number of observations in the S&P 500 Industrials Sector benchmarking group varies from 48 to 66. The median Adjusted ROIC minus COC for the S&P 500 Industrials Sector ranges from 5% to 15% over the 2006 – 2019 period, and the median of the annual medians is 13% (average ~~13%~~ 12%). The 25<sup>th</sup> percentile Adjusted ROIC minus COC for the S&P 500 Industrial Sector ranges from 1% to 9% over the 2006 – 2019 period, and the median of the annual 25<sup>th</sup> percentile is 7% (average 6%). The percentage of companies in the S&P 500 Industrial Sector benchmarking group that have a positive Adjusted ROIC minus COC ranges from 80% to 97% over the 2006 – 2019 period.

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<sup>73</sup> See Exhibit 2 for the year-by-year results for the Industry Weighted Average and the seven railroads summarized in Table 5.

**Table 5**  
**S&P 500 Companies in the Industrials Sector Excluding Railroads**

| <b>Number of Observations, Median, 25th Percentile, and % Positive ROIC minus COC Over 2006-2019 Period</b> |                |                |               |                    |
|-------------------------------------------------------------------------------------------------------------|----------------|----------------|---------------|--------------------|
|                                                                                                             | <b>Minimum</b> | <b>Maximum</b> | <b>Median</b> | <b>Average</b>     |
| <b>Number of Observations in Sample</b>                                                                     | 48             | 66             | 59            | 59                 |
| <b>Median Adjusted ROIC minus COC</b>                                                                       | 5%             | 15%            | 13%           | 12% <del>13%</del> |
| <b>25th Percentile Adjusted ROIC minus COC</b>                                                              | 1%             | 9%             | 7%            | 6%                 |
| <b>% with ROIC minus COC &gt; 0.0%</b>                                                                      | 80%            | 97%            | 93%           | 92%                |
| <b><u>Railroad Percentile in the Distribution of Adjusted ROIC minus COC</u></b>                            |                |                |               |                    |
| <b>Industry Weighted Average ROIC</b>                                                                       | 2              | 13             | 7             | 7                  |
| <b>BNSF Railway</b>                                                                                         | 2              | 16             | 6             | 7                  |
| <b>CSX Corporation</b>                                                                                      | 2              | 13             | 5             | 6                  |
| <b>Grand Trunk Corporation</b>                                                                              | 2              | 11             | 4             | 5                  |
| <b>Kansas City Southern</b>                                                                                 | 2              | 11             | 5             | 5                  |
| <b>Norfolk Southern Corporation</b>                                                                         | 2              | 13             | 5             | 6                  |
| <b>Soo Line Corporation</b>                                                                                 | 2              | 19             | 6             | 7                  |
| <b>Union Pacific Corporation</b>                                                                            | 3              | 23             | 7             | 9                  |

Sources: Bloomberg; Compustat; Ibbotson Yearbook (2006-2019); STB Revenue Adequacy Determination Report (2006-2018); RevAd 2019 AAR workpaper1.pdf, titled "AAR Duplication of STB Workpapers."

77. As shown in the bottom panel of Table 5, the Industry Weighted Average Adjusted ROIC minus COC percentile within the S&P 500 Industrials Sector benchmarking group over this period ranges from the 2<sup>nd</sup> percentile to the 13<sup>th</sup> percentile. The median of the annual medians of the over this period for the Industry Weighted Average is the 7<sup>th</sup> percentile, and the average of the annual medians over this period is the 7<sup>th</sup> percentile. For the seven railroads, the median of the annual medians over this period range from the 4<sup>th</sup> percentile to the 7<sup>th</sup> percentile, and the average of the annual medians over this period range from the 5<sup>th</sup> percentile to the 9<sup>th</sup> percentile.

**Table 6**  
**Railroad Customer Sample of S&P 500 Companies**

| Number of Observations, Median, 25th Percentile, and % Positive ROIC minus COC Over 2006-2019 Period |         |                  |                  |                  |
|------------------------------------------------------------------------------------------------------|---------|------------------|------------------|------------------|
|                                                                                                      | Minimum | Maximum          | Median           | Average          |
| Number of Observations in Sample                                                                     | 80      | 87               | 84               | 83               |
| Median Adjusted ROIC minus COC                                                                       | 0%      | 9%               | 5%               | 5%               |
| 25th Percentile Adjusted ROIC minus COC                                                              | -5%     | 2%               | 0%               | 0%               |
| % with ROIC minus COC > 0.0%                                                                         | 52%     | 84%              | 78%              | 76%              |
| <b>Railroad Percentile in the Distribution of Adjusted ROIC minus COC</b>                            |         |                  |                  |                  |
| Industry Weighted Average ROIC                                                                       | 7       | <del>40</del> 39 | 18               | 21               |
| BNSF Railway                                                                                         | 7       | <del>38</del> 36 | 20               | 22               |
| CSX Corporation                                                                                      | 6       | <del>40</del> 39 | 16               | 18               |
| Grand Trunk Corporation                                                                              | 5       | 29               | 14               | 15               |
| Kansas City Southern                                                                                 | 6       | 31               | <del>16</del> 15 | 16               |
| Norfolk Southern Corporation                                                                         | 11      | <del>36</del> 33 | 16               | <del>19</del> 18 |
| Soo Line Corporation                                                                                 | 6       | 39               | 19               | 21               |
| Union Pacific Corporation                                                                            | 7       | 49               | 26               | 29               |

Sources: Bloomberg; Compustat; Ibbotson Yearbook (2006-2019); STB Revenue Adequacy Determination Report (2006-2018); RevAd 2019 AAR workpaper1.pdf, titled "AAR Duplication of STB Workpapers."

79. As shown in the bottom panel of Table 6, the Industry Weighted Average Adjusted ROIC minus COC percentile within the sample over this period ranges from the 7<sup>th</sup> percentile to the ~~40<sup>th</sup>~~ ~~39<sup>th</sup>~~ percentile. The median of the annual medians over this period for the Industry Weighted Average is the 18<sup>th</sup> percentile, and the average of the annual medians over this period is the 21<sup>st</sup> percentile. The median of the annual medians over this period for the seven railroads range from the 14<sup>th</sup> percentile to the 26<sup>th</sup> percentile and the average of the annual medians over this period for the seven railroads range from the 15<sup>th</sup> percentile to the 29<sup>th</sup> percentile.

## F. Summary and Conclusions

80. In this section, we analyzed the two measures of the railroads' financial performance (ROIC minus COC and Adjusted ROIC minus COC) and compared them to the financial performance of three benchmarking groups. We summarize these results in Table 7.<sup>75</sup>

Table 7  
Summary of the Analysis of the Railroads' Relative Financial Performance

| Panel A: Benchmarking Groups' Median Statistics Across Years (2006 through 2019) |                        |                          |                        |                                 |                          |                        |
|----------------------------------------------------------------------------------|------------------------|--------------------------|------------------------|---------------------------------|--------------------------|------------------------|
|                                                                                  | STB ROIC minus STB COC |                          |                        | Adjusted STB ROIC minus STB COC |                          |                        |
|                                                                                  | S&P 500 <sup>1</sup>   | Industrials <sup>2</sup> | Customers <sup>3</sup> | S&P 500 <sup>1</sup>            | Industrials <sup>2</sup> | Customers <sup>3</sup> |
| Number of Observations in Sample                                                 | 395                    | 56                       | 84                     | 409                             | 59                       | 84                     |
| Median ROIC minus COC                                                            | 19%                    | 23%                      | 8% <del>9%</del>       | 10%                             | 13%                      | 5%                     |
| 25th Percentile ROIC minus COC                                                   | 5%                     | 13%                      | 2%                     | 2%                              | 7%                       | 0%                     |
| % with ROIC minus COC > 0.0%                                                     | 89%                    | 96%                      | 83%                    | 83% <del>84%</del>              | 93%                      | 78%                    |

| Panel B: Railroads' Median of the Annual Percentiles Across Years (2006 through 2019) |                        |                          |                        |                                 |                          |                        |
|---------------------------------------------------------------------------------------|------------------------|--------------------------|------------------------|---------------------------------|--------------------------|------------------------|
|                                                                                       | STB ROIC minus STB COC |                          |                        | Adjusted STB ROIC minus STB COC |                          |                        |
|                                                                                       | S&P 500 <sup>1</sup>   | Industrials <sup>2</sup> | Customers <sup>3</sup> | S&P 500 <sup>1</sup>            | Industrials <sup>2</sup> | Customers <sup>3</sup> |
| Industry Weighted Average ROIC                                                        | 13                     | 7                        | 22                     | 13                              | 7                        | 18                     |
| BNSF Railway                                                                          | 15                     | 7                        | 24                     | 14                              | 6                        | 20                     |
| CSX Corporation                                                                       | 10                     | 5                        | 16                     | 10                              | 5                        | 16                     |
| Grand Trunk Corporation                                                               | 10                     | 5                        | 14                     | 9                               | 4                        | 14                     |
| Kansas City Southern                                                                  | 8                      | 4                        | 13                     | 10                              | 5                        | 16 <del>15</del>       |
| Norfolk Southern Corporation                                                          | 13                     | 8                        | 20                     | 11                              | 5                        | 16                     |
| Soo Line Corporation                                                                  | 13                     | 6                        | 19                     | 13                              | 6                        | 19                     |
| Union Pacific Corporation                                                             | 22                     | 9                        | 35                     | 17                              | 7                        | 26                     |

Notes:

1 S&P 500 companies excluding Railroads, Financial Institutions and Real Estate Companies

2 S&P 500 companies in the Industrials Sector excluding Railroads

3 Railroad customer sample of S&P 500 companies

Sources: Bloomberg; Compustat; Ibbotson Yearbook (2006-2019); STB Revenue Adequacy Determination Report (2006-2018); RevAd 2019 AAR workpaper1 pdf, titled "AAR Duplication of STB Workpapers "

81. All of the analyses show that the relative financial performance of the railroad industry falls within the bottom quartile of the three benchmarking groups. Thus, the benchmarking analyses we conducted show that financial performance of the railroad industry and the seven

<sup>75</sup> Table 7 summarizes the result shown in Tables 1 through 6 for the median ROIC minus COC and median Adjusted ROIC minus COC.

one year. The median ROIC minus COC percentile over this period across the four railroads varies from 5<sup>th</sup> to 10<sup>th</sup> and the average varies from 6<sup>th</sup> to 10<sup>th</sup>.

C-6. Panel C of Exhibit C1 presents the railroads' percentile in the distribution of ROIC minus COC of the S&P 500 Railroad Customers benchmarking group. The range of the ROIC minus COC percentile over this period for the industry is from 17<sup>th</sup> to 44<sup>th</sup>, and the median ROIC minus COC percentile over this period for the industry is 31<sup>st</sup> (average 31<sup>st</sup>). The ROIC minus COC percentile for the seven railroads varies across years and across the railroads in any one year. The median ROIC minus COC percentile over this period across the seven railroads varies from 17<sup>th</sup> to 37<sup>th</sup> and the average varies from 18<sup>th</sup> to 32<sup>nd</sup>. In sum, the results shown in Exhibit C1 are qualitatively similar to the results shown in Exhibit 1.

C-7. The results in Exhibit C2 are analogous to the results presented in Exhibit C1, however, the results in Exhibit C2 are for the Adjusted ROIC minus COC whereby the results in Exhibit C1 are for the ROIC minus COC. The top section of each panel in Exhibit C2 presents the descriptive statistics about the S&P 500 benchmarking group and the bottom section of each panel in Exhibit C2 presents the railroads' percentile within the distribution of all companies in that benchmarking group. As stated previously, the inputs for measuring Adjusted ROIC and the cost of capital for the railroads are based on the Compustat (not STB) data that is also used for the companies in the S&P 500 benchmarking groups.

C-8. Panel A of Exhibit C2 presents the railroads' percentile in the distribution of ROIC minus COC of the S&P 500 benchmarking group. The range of the ROIC minus COC percentile over this period for the industry is from 11<sup>th</sup> to ~~31<sup>st</sup>~~<sup>30<sup>th</sup></sup>, and the median ROIC minus COC percentile over this period for the industry is 18<sup>st</sup> (average 19<sup>th</sup>). The ROIC minus COC percentile for the four

# Exhibit 1

Railroad Percentiles within Sample - STB Definition of Return on Invested Capital (ROIC) and STB Definition of Cost of Capital (COC)  
(Railroads' Return on Invested Capital and Cost of Capital Using STB Data)

|                                                                                                             | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019      | Min | Max   | Median | Average |
|-------------------------------------------------------------------------------------------------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|-----------|-----|-------|--------|---------|
| <b>Panel A: S&amp;P 500 Companies Excluding Railroads, Financial Institutions and Real Estate Companies</b> |      |      |      |      |      |      |      |      |      |      |      |      |      |           |     |       |        |         |
| <u>Sample Number of Observations, Median, 25th Percentile, and % Positive ROIC minus COC:</u>               |      |      |      |      |      |      |      |      |      |      |      |      |      |           |     |       |        |         |
| Number of Observations in Sample                                                                            | 398  | 395  | 402  | 405  | 402  | 401  | 397  | 395  | 392  | 383  | 371  | 368  | 378  | 380       | 368 | 405   | 395    | 391     |
| Median ROIC minus COC                                                                                       | 16%  | 16%  | 16%  | 13%  | 18%  | 19%  | 19%  | 21%  | 20%  | 22%  | 22%  | 20%  | 29%  | 25%       | 13% | 29%   | 19%    | 20%     |
| 25th Percentile ROIC minus COC                                                                              | 5%   | 5%   | 3%   | -1%  | 5%   | 6%   | 5%   | 4%   | 5%   | 4%   | 4%   | 5%   | 6%   | 5%        | -1% | 6%    | 5%     | 4%      |
| % with ROIC minus COC > 0.0%                                                                                | 90%  | 89%  | 86%  | 73%  | 89%  | 91%  | 89%  | 90%  | 90%  | 88%  | 85%  | 89%  | 90%  | 91%<br>89 | 73% | 91%   | 89%    | 88%     |
| <u>Railroad Percentile in the Distribution of ROIC minus COC:</u>                                           |      |      |      |      |      |      |      |      |      |      |      |      |      |           |     |       |        |         |
| Industry Weighted Average ROIC                                                                              | 11   | 9    | 12   | 21   | 10   | 10   | 13   | 15   | 19   | 18   | 18   | 12   | 12   | 22        | 9   | 22    | 13     | 15.44   |
| BNSF Railway                                                                                                | 15   | 9    | 11   | 23   | 10   | 11   | 16   | 17   | 19   | 22   | 17   | 12   | 11   | 21.20     | 9   | 23    | 15     | 15      |
| CSX Corporation                                                                                             | 8    | 6    | 10   | 20   | 10   | 9    | 11   | 7    | 9    | 12   | 15   | 9    | 13   | 24.23     | 6   | 24.23 | 10     | 12      |
| Grand Trunk Corporation                                                                                     | 10   | 9    | 10   | 16   | 7    | 5    | 10   | 12   | 13   | 14   | 15   | 8    | 3    | 7         | 3   | 16    | 10     | 10      |
| Kansas City Southern                                                                                        | 9    | 8    | 8    | 18   | 9    | 8    | 10   | 5    | 6    | 9    | 12   | 8    | 4    | 6.5       | 4   | 18    | 8      | 9       |
| Norfolk Southern Corporation                                                                                | 24   | 18   | 22   | 21   | 11   | 12   | 12   | 12   | 14   | 12   | 16   | 11   | 10   | 19.48     | 10  | 24    | 13     | 15      |
| Soo Line Corporation                                                                                        | 15   | 23   | 10   | 17   | 6    | 3    | 5    | 12   | 2    | 26   | 16   | 12   | 14   | 18.47     | 2   | 26    | 13     | 13      |
| Union Pacific Corporation                                                                                   | 8    | 8    | 11   | 23   | 13   | 13   | 22   | 25   | 30   | 28   | 27   | 22   | 22   | 28        | 8   | 30    | 22     | 20      |
| <b>Panel B: S&amp;P 500 Companies in the Industrials Sector Excluding Railroads</b>                         |      |      |      |      |      |      |      |      |      |      |      |      |      |           |     |       |        |         |
| <u>Sample Number of Observations, Median, 25th Percentile, and % Positive ROIC minus COC:</u>               |      |      |      |      |      |      |      |      |      |      |      |      |      |           |     |       |        |         |
| Number of Observations in Sample                                                                            | 48   | 52   | 55   | 53   | 54   | 56   | 53   | 56   | 57   | 59   | 63   | 62   | 62   | 61        | 48  | 63    | 56     | 57      |
| Median ROIC minus COC                                                                                       | 20%  | 23%  | 21%  | 14%  | 17%  | 21%  | 22%  | 22%  | 23%  | 24%  | 28%  | 28%  | 30%  | 31%       | 14% | 31%   | 23%    | 23%     |
| 25th Percentile ROIC minus COC                                                                              | 11%  | 13%  | 13%  | 4%   | 10%  | 13%  | 12%  | 14%  | 11%  | 13%  | 9%   | 14%  | 13%  | 13.44%    | 4%  | 14%   | 13%    | 12%     |
| % with ROIC minus COC > 0.0%                                                                                | 96%  | 92%  | 98%  | 83%  | 94%  | 96%  | 96%  | 96%  | 96%  | 97%  | 94%  | 100% | 95%  | 97%       | 83% | 100%  | 96%    | 95%     |
| <u>Railroad Percentile in the Distribution of ROIC minus COC:</u>                                           |      |      |      |      |      |      |      |      |      |      |      |      |      |           |     |       |        |         |
| Industry Weighted Average ROIC                                                                              | 6    | 6    | 4    | 11   | 7    | 5    | 6    | 7    | 10   | 12   | 9    | 2    | 6    | 8         | 2   | 12    | 7      | 7       |
| BNSF Railway                                                                                                | 10   | 6    | 4    | 11   | 7    | 5    | 6    | 7    | 10   | 13   | 9    | 2    | 6    | 8         | 2   | 13    | 7      | 7       |
| CSX Corporation                                                                                             | 4    | 6    | 4    | 9    | 7    | 5    | 6    | 4    | 5    | 5    | 8    | 2    | 6    | 11.8      | 2   | 11.9  | 5      | 6       |
| Grand Trunk Corporation                                                                                     | 6    | 6    | 4    | 7    | 4    | 2    | 6    | 5    | 9    | 7    | 8    | 2    | 2    | 3         | 2   | 9     | 5      | 5       |
| Kansas City Southern                                                                                        | 6    | 6    | 4    | 9    | 5    | 5    | 6    | 4    | 3    | 3    | 6    | 2    | 2    | 3         | 2   | 9     | 4      | 5       |
| Norfolk Southern Corporation                                                                                | 14   | 9    | 9    | 11   | 7    | 5    | 6    | 5    | 9    | 5    | 8    | 2    | 6    | 8         | 2   | 14    | 8      | 7       |
| Soo Line Corporation                                                                                        | 10   | 13   | 4    | 7    | 2    | 2    | 2    | 5    | 2    | 15   | 8    | 2    | 6    | 8         | 2   | 15    | 6      | 6       |
| Union Pacific Corporation                                                                                   | 4    | 6    | 4    | 11   | 9    | 5    | 7    | 9    | 21   | 15   | 11   | 6    | 13   | 15        | 4   | 21    | 9      | 10      |
| <b>Panel C: Railroad Customer Sample of S&amp;P 500 Companies</b>                                           |      |      |      |      |      |      |      |      |      |      |      |      |      |           |     |       |        |         |
| <u>Sample Number of Observations, Median, 25th Percentile, and % Positive ROIC minus COC:</u>               |      |      |      |      |      |      |      |      |      |      |      |      |      |           |     |       |        |         |
| Number of Observations in Sample                                                                            | 80   | 80   | 81   | 82   | 84   | 84   | 84   | 83   | 84   | 86   | 85   | 83   | 84   | 82        | 80  | 86    | 84     | 83      |
| Median ROIC minus COC                                                                                       | 13%  | 12%  | 9%   | 3%   | 12%  | 13%  | 10%  | 7%   | 7%   | 8%   | 6%   | 8%   | 11%  | 8.9%      | 3%  | 13%   | 8.9%   | 9%      |
| 25th Percentile ROIC minus COC                                                                              | 4%   | 4%   | 1%   | -4%  | 3%   | 3%   | 2%   | 2%   | 1%   | 2%   | -1%  | 2%   | 2%   | 1%        | -4% | 4%    | 2%     | 2%      |
| % with ROIC minus COC > 0.0%                                                                                | 88%  | 86%  | 79%  | 61%  | 86%  | 85%  | 83%  | 87%  | 83%  | 81%  | 72%  | 83%  | 85%  | 79%       | 61% | 88%   | 83%    | 81%     |
| <u>Railroad Percentile in the Distribution of ROIC minus COC:</u>                                           |      |      |      |      |      |      |      |      |      |      |      |      |      |           |     |       |        |         |
| Industry Weighted Average ROIC                                                                              | 14   | 7    | 18   | 30   | 15   | 19   | 25   | 24   | 34   | 28   | 36   | 20   | 20   | 36        | 7   | 36    | 22     | 23      |
| BNSF Railway                                                                                                | 17   | 7    | 16   | 33   | 14   | 20   | 27   | 29   | 34   | 36   | 35   | 20   | 16   | 35.34     | 7   | 36    | 24     | 24      |
| CSX Corporation                                                                                             | 11   | 5    | 13   | 30   | 15   | 16   | 15   | 10   | 16   | 18   | 29   | 17   | 20   | 39.36     | 5   | 39.36 | 16     | 18      |
| Grand Trunk Corporation                                                                                     | 12   | 7    | 13   | 24   | 14   | 8    | 14   | 17   | 24   | 21   | 29   | 13   | 5    | 18.47     | 5   | 29    | 14     | 16      |
| Kansas City Southern                                                                                        | 12   | 7    | 10   | 28   | 14   | 13   | 13   | 7    | 13   | 16   | 22   | 12   | 5    | 16.43     | 5   | 28    | 13     | 13      |
| Norfolk Southern Corporation                                                                                | 28   | 20   | 30   | 30   | 15   | 21   | 18   | 17   | 25   | 18   | 29   | 18   | 15   | 33.34     | 15  | 33.34 | 20     | 23      |
| Soo Line Corporation                                                                                        | 17   | 27   | 13   | 24   | 12   | 6    | 6    | 17   | 6    | 43   | 30   | 20   | 21   | 31.30     | 6   | 43    | 19     | 20.49   |
| Union Pacific Corporation                                                                                   | 11   | 6    | 16   | 33   | 16   | 21   | 35   | 42   | 49   | 46   | 45   | 36   | 34   | 45        | 6   | 49    | 35     | 31      |

Sources: Bloomberg; Compustat; Ibbotson Yearbook (2006-2019); STB Revenue Adequacy Determination Report (2006-2018); RevAd 2019 AAR workpaper1.pdf, titled "AAR Duplication of STB Workpapers."

## Exhibit 2

### Railroad Percentiles within Sample - Adjusted STB Definition of Return on Invested Capital (ROIC) and STB Definition of Cost of Capital (COC) (Railroads' Return on Invested Capital and Cost of Capital Using STB Data)

|                                                                                                             | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | Min | Max | Median | Average |
|-------------------------------------------------------------------------------------------------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|-----|-----|--------|---------|
| <b>Panel A: S&amp;P 500 Companies Excluding Railroads, Financial Institutions and Real Estate Companies</b> |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |     |        |         |
| <u>Sample Number of Observations, Median, 25th Percentile, and % Positive ROIC minus COC:</u>               |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |     |        |         |
| Number of Observations in Sample                                                                            | 405  | 401  | 409  | 415  | 413  | 414  | 413  | 412  | 410  | 408  | 402  | 393  | 395  | 394  | 393 | 415 | 409    | 406     |
| Median ROIC minus COC                                                                                       | 9%   | 9%   | 9%   | 5%   | 11%  | 11%  | 10%  | 11%  | 9%   | 10%  | 9%   | 7%   | 12%  | 10%  | 5%  | 12% | 10%    | 9%      |
| 25th Percentile ROIC minus COC                                                                              | 1%   | 2%   | 1%   | -2%  | 3%   | 3%   | 3%   | 2%   | 2%   | 2%   | 2%   | 2%   | 2%   | 1%   | -2% | 3%  | 2%     | 2%      |
| % with ROIC minus COC > 0.0%                                                                                | 81%  | 82%  | 80%  | 68%  | 86%  | 87%  | 86%  | 87%  | 87%  | 84%  | 82%  | 82%  | 84%  | 84%  | 68% | 87% | 84%    | 83%     |
|                                                                                                             |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |     | 82     | 83      |
| <u>Railroad Percentile in the Distribution of ROIC minus COC:</u>                                           |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |     |        |         |
| Industry Weighted Average ROIC                                                                              | 14   | 9    | 12   | 22   | 9    | 12   | 13   | 11   | 13   | 17   | 18   | 11   | 11   | 25   | 9   | 25  | 13     | 14      |
| BNSF Railway                                                                                                | 17   | 10   | 12   | 24   | 10   | 16   | 13   | 12   | 14   | 20   | 18   | 11   | 8    | 22   | 8   | 24  | 14     | 15      |
| CSX Corporation                                                                                             | 10   | 8    | 10   | 20   | 9    | 10   | 12   | 6    | 8    | 11   | 15   | 10   | 12   | 26   | 6   | 26  | 10     | 12      |
| Grand Trunk Corporation                                                                                     | 13   | 9    | 10   | 14   | 7    | 6    | 8    | 7    | 9    | 15   | 15   | 9    | 4    | 10   | 4   | 15  | 9      | 10      |
| Kansas City Southern                                                                                        | 15   | 11   | 10   | 20   | 11   | 10   | 13   | 9    | 9    | 12   | 14   | 9    | 5    | 9    | 5   | 20  | 10     | 11      |
| Norfolk Southern Corporation                                                                                | 16   | 12   | 17   | 21   | 7    | 11   | 11   | 8    | 9    | 10   | 15   | 11   | 8    | 21   | 7   | 21  | 11     | 13      |
| Soo Line Corporation                                                                                        | 28   | 34   | 10   | 16   | 7    | 5    | 4    | 13   | 1    | 23   | 18   | 11   | 14   | 17   | 1   | 34  | 13     | 14      |
| Union Pacific Corporation                                                                                   | 10   | 8    | 14   | 23   | 11   | 13   | 17   | 16   | 30   | 30   | 26   | 17   | 22   | 35   | 8   | 35  | 17     | 19      |
|                                                                                                             |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |     |        |         |
| <b>Panel B: S&amp;P 500 Companies in the Industrials Sector Excluding Railroads</b>                         |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |     |        |         |
| <u>Sample Number of Observations, Median, 25th Percentile, and % Positive ROIC minus COC:</u>               |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |     |        |         |
| Number of Observations in Sample                                                                            | 48   | 53   | 56   | 54   | 55   | 57   | 56   | 60   | 61   | 63   | 66   | 65   | 65   | 64   | 48  | 66  | 59     | 59      |
| Median ROIC minus COC                                                                                       | 13%  | 15%  | 15%  | 5%   | 12%  | 15%  | 13%  | 13%  | 12%  | 12%  | 11%  | 12%  | 13%  | 14%  | 5%  | 15% | 13%    | 13%     |
| 25th Percentile ROIC minus COC                                                                              | 9%   | 8%   | 7%   | 1%   | 6%   | 8%   | 6%   | 6%   | 4%   | 7%   | 7%   | 7%   | 6%   | 9%   | 1%  | 9%  | 7%     | 6%      |
| % with ROIC minus COC > 0.0%                                                                                | 92%  | 91%  | 95%  | 80%  | 95%  | 95%  | 93%  | 95%  | 90%  | 90%  | 92%  | 97%  | 94%  | 95%  | 80% | 97% | 93%    | 92%     |
|                                                                                                             |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |     |        | 94      |
| <u>Railroad Percentile in the Distribution of ROIC minus COC:</u>                                           |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |     |        |         |
| Industry Weighted Average ROIC                                                                              | 6    | 6    | 4    | 13   | 5    | 7    | 9    | 5    | 10   | 13   | 7    | 2    | 3    | 11   | 2   | 13  | 7      | 7       |
| BNSF Railway                                                                                                | 6    | 6    | 4    | 15   | 5    | 9    | 9    | 5    | 11   | 16   | 6    | 2    | 3    | 9    | 2   | 16  | 6      | 7       |
| CSX Corporation                                                                                             | 4    | 4    | 4    | 13   | 5    | 5    | 9    | 3    | 3    | 8    | 6    | 2    | 6    | 11   | 2   | 13  | 5      | 6       |
| Grand Trunk Corporation                                                                                     | 4    | 6    | 4    | 7    | 4    | 2    | 5    | 3    | 6    | 11   | 6    | 2    | 2    | 3    | 2   | 11  | 4      | 5       |
| Kansas City Southern                                                                                        | 6    | 6    | 4    | 11   | 5    | 5    | 9    | 5    | 6    | 8    | 6    | 2    | 2    | 3    | 2   | 11  | 5      | 5       |
| Norfolk Southern Corporation                                                                                | 6    | 6    | 5    | 13   | 4    | 5    | 9    | 5    | 6    | 5    | 6    | 2    | 3    | 9    | 2   | 13  | 5      | 6       |
| Soo Line Corporation                                                                                        | 16   | 19   | 4    | 7    | 4    | 2    | 4    | 7    | 2    | 17   | 6    | 2    | 8    | 8    | 2   | 19  | 6      | 7       |
| Union Pacific Corporation                                                                                   | 4    | 4    | 4    | 13   | 5    | 7    | 12   | 7    | 23   | 17   | 10   | 3    | 8    | 14   | 3   | 23  | 7      | 9       |
|                                                                                                             |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |     |        |         |
| <b>Panel C: Railroad Customer Sample of S&amp;P 500 Companies</b>                                           |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |     |        |         |
| <u>Sample Number of Observations, Median, 25th Percentile, and % Positive ROIC minus COC:</u>               |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |     |        |         |
| Number of Observations in Sample                                                                            | 80   | 80   | 81   | 82   | 84   | 84   | 84   | 83   | 84   | 87   | 86   | 84   | 85   | 83   | 80  | 87  | 84     | 83      |
| Median ROIC minus COC                                                                                       | 9%   | 7%   | 6%   | 0%   | 7%   | 8%   | 5%   | 4%   | 3%   | 3%   | 3%   | 3%   | 5%   | 4%   | 0%  | 9%  | 5%     | 5%      |
| 25th Percentile ROIC minus COC                                                                              | 1%   | 2%   | 0%   | -5%  | 2%   | 2%   | 0%   | 1%   | 0%   | 1%   | -2%  | 0%   | 1%   | 0%   | -5% | 2%  | 0%     | 0%      |
| % with ROIC minus COC > 0.0%                                                                                | 84%  | 81%  | 70%  | 52%  | 81%  | 83%  | 76%  | 81%  | 74%  | 79%  | 67%  | 76%  | 81%  | 76%  | 52% | 84% | 78%    | 76%     |
|                                                                                                             |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |     |        | 75      |
| <u>Railroad Percentile in the Distribution of ROIC minus COC:</u>                                           |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |     |        |         |
| Industry Weighted Average ROIC                                                                              | 12   | 7    | 20   | 34   | 15   | 16   | 21   | 17   | 27   | 22   | 31   | 15   | 16   | 40   | 7   | 40  | 18     | 21      |
| BNSF Railway                                                                                                | 14   | 7    | 18   | 36   | 15   | 20   | 22   | 19   | 27   | 33   | 31   | 14   | 12   | 38   | 7   | 38  | 20     | 22      |
| CSX Corporation                                                                                             | 9    | 6    | 17   | 31   | 15   | 16   | 18   | 10   | 15   | 16   | 29   | 13   | 16   | 40   | 6   | 40  | 16     | 18      |
| Grand Trunk Corporation                                                                                     | 12   | 7    | 15   | 22   | 14   | 9    | 11   | 10   | 16   | 22   | 29   | 13   | 5    | 21   | 5   | 29  | 14     | 15      |
| Kansas City Southern                                                                                        | 12   | 9    | 15   | 31   | 15   | 16   | 19   | 15   | 16   | 16   | 25   | 13   | 6    | 20   | 6   | 31  | 16     | 16      |
| Norfolk Southern Corporation                                                                                | 12   | 11   | 24   | 33   | 15   | 16   | 18   | 12   | 16   | 15   | 28   | 14   | 12   | 36   | 11  | 36  | 16     | 19      |
| Soo Line Corporation                                                                                        | 32   | 36   | 15   | 25   | 14   | 6    | 8    | 20   | 6    | 39   | 31   | 15   | 17   | 26   | 6   | 39  | 19     | 21      |
| Union Pacific Corporation                                                                                   | 9    | 7    | 22   | 36   | 15   | 16   | 29   | 24   | 49   | 49   | 47   | 24   | 29   | 49   | 7   | 49  | 26     | 29      |

Sources: Bloomberg; Compustat; Ibbotson Yearbook (2006-2019); STB Revenue Adequacy Determination Report (2006-2018); RevAd 2019 AAR workpaper1.pdf, titled "AAR Duplication of STB Workpapers."

# Appendix C, Exhibit C1

Railroad Percentiles within Sample - STB Definition of Return on Invested Capital (ROIC) and STB Definition of Cost of Capital (COC)  
(Railroads' Return on Invested Capital and Cost of Capital Measured Using Non-STB Public Data)

|                                                                                                             | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019   | Min | Max  | Median | Average |
|-------------------------------------------------------------------------------------------------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|--------|-----|------|--------|---------|
| <b>Panel A: S&amp;P 500 Companies Excluding Railroads, Financial Institutions and Real Estate Companies</b> |      |      |      |      |      |      |      |      |      |      |      |      |      |        |     |      |        |         |
| <u>Sample Number of Observations, Median, 25th Percentile, and % Positive ROIC minus COC:</u>               |      |      |      |      |      |      |      |      |      |      |      |      |      |        |     |      |        |         |
| Number of Observations in Sample                                                                            | 398  | 395  | 402  | 405  | 402  | 401  | 397  | 395  | 392  | 383  | 371  | 368  | 378  | 380    | 368 | 405  | 395    | 391     |
| Median ROIC minus COC                                                                                       | 16%  | 16%  | 16%  | 13%  | 18%  | 19%  | 19%  | 21%  | 20%  | 22%  | 22%  | 20%  | 29%  | 25%    | 13% | 29%  | 19%    | 20%     |
| 25th Percentile ROIC minus COC                                                                              | 5%   | 5%   | 3%   | -1%  | 5%   | 6%   | 5%   | 4%   | 5%   | 4%   | 4%   | 5%   | 6%   | 5%     | -1% | 6%   | 5%     | 4%      |
| % with ROIC minus COC > 0.0%                                                                                | 90%  | 89%  | 86%  | 73%  | 89%  | 91%  | 89%  | 90%  | 90%  | 88%  | 85%  | 89%  | 90%  | 91%    | 73% | 91%  | 89%    | 88%     |
| <u>Railroad Percentile in the Distribution of ROIC minus COC:</u>                                           |      |      |      |      |      |      |      |      |      |      |      |      |      |        |     |      |        |         |
| Industry Weighted Average ROIC                                                                              | 15   | 15   | 14   | 20   | 15   | 12   | 17   | 19   | 25   | 23   | 24   | 27   | 23   | 25.26  | 12  | 27   | 19     | 20      |
| CSX Corporation                                                                                             | 16   | 17   | 22   | 26   | 22   | 14   | 16   | 16   | 19   | 18   | 20   | 20   | 23   | 28     | 14  | 28   | 19     | 20      |
| Kansas City Southern                                                                                        | 11   | 13   | 11   | 14   | 10   | 6    | 10   | 9    | 11   | 12   | 16   | 13   | 8    | 12.43  | 6   | 16   | 11     | 11      |
| Norfolk Southern Corporation                                                                                | 24   | 22   | 26   | 23   | 17   | 14   | 13   | 13   | 19   | 14   | 19   | 22   | 17   | 23     | 13  | 26   | 19     | 19      |
| Union Pacific Corporation                                                                                   | 10   | 9    | 9    | 16   | 12   | 12   | 23   | 26   | 32   | 29   | 28   | 33   | 25   | 28     | 9   | 33   | 24     | 21      |
| <b>Panel B: S&amp;P 500 Companies in the Industrials Sector Excluding Railroads</b>                         |      |      |      |      |      |      |      |      |      |      |      |      |      |        |     |      |        |         |
| <u>Sample Number of Observations, Median, 25th Percentile, and % Positive ROIC minus COC:</u>               |      |      |      |      |      |      |      |      |      |      |      |      |      |        |     |      |        |         |
| Number of Observations in Sample                                                                            | 48   | 52   | 55   | 53   | 54   | 56   | 53   | 56   | 57   | 59   | 63   | 62   | 62   | 61     | 48  | 63   | 56     | 57      |
| Median ROIC minus COC                                                                                       | 20%  | 23%  | 21%  | 14%  | 17%  | 21%  | 22%  | 22%  | 23%  | 24%  | 28%  | 28%  | 30%  | 31%    | 14% | 31%  | 23%    | 23%     |
| 25th Percentile ROIC minus COC                                                                              | 11%  | 13%  | 13%  | 4%   | 10%  | 13%  | 12%  | 14%  | 11%  | 13%  | 9%   | 14%  | 13%  | 13.44% | 4%  | 14%  | 13%    | 12%     |
| % with ROIC minus COC > 0.0%                                                                                | 96%  | 92%  | 98%  | 83%  | 94%  | 96%  | 96%  | 96%  | 96%  | 97%  | 94%  | 100% | 95%  | 97%    | 83% | 100% | 96%    | 95%     |
| <u>Railroad Percentile in the Distribution of ROIC minus COC:</u>                                           |      |      |      |      |      |      |      |      |      |      |      |      |      |        |     |      |        |         |
| Industry Weighted Average ROIC                                                                              | 10   | 9    | 4    | 9    | 11   | 5    | 6    | 7    | 17   | 13   | 9    | 11   | 13   | 13     | 4   | 17   | 10     | 10      |
| CSX Corporation                                                                                             | 10   | 9    | 9    | 15   | 13   | 5    | 6    | 7    | 10   | 10   | 9    | 6    | 13   | 15     | 5   | 15   | 10     | 10      |
| Kansas City Southern                                                                                        | 6    | 9    | 4    | 7    | 7    | 5    | 6    | 5    | 7    | 5    | 8    | 2    | 5    | 5      | 2   | 9    | 5      | 6       |
| Norfolk Southern Corporation                                                                                | 14   | 13   | 11   | 11   | 11   | 5    | 6    | 5    | 10   | 7    | 9    | 6    | 6    | 8      | 5   | 14   | 9      | 9       |
| Union Pacific Corporation                                                                                   | 6    | 6    | 4    | 7    | 7    | 5    | 9    | 9    | 21   | 15   | 11   | 14   | 16   | 15     | 4   | 21   | 9      | 10      |
| <b>Panel C: Railroad Customer Sample of S&amp;P 500 Companies</b>                                           |      |      |      |      |      |      |      |      |      |      |      |      |      |        |     |      |        |         |
| <u>Sample Number of Observations, Median, 25th Percentile, and % Positive ROIC minus COC:</u>               |      |      |      |      |      |      |      |      |      |      |      |      |      |        |     |      |        |         |
| Number of Observations in Sample                                                                            | 80   | 80   | 81   | 82   | 84   | 84   | 84   | 83   | 84   | 86   | 85   | 83   | 84   | 82     | 80  | 86   | 84     | 83      |
| Median ROIC minus COC                                                                                       | 13%  | 12%  | 9%   | 3%   | 12%  | 13%  | 10%  | 7%   | 7%   | 8%   | 6%   | 8%   | 11%  | 8.9%   | 3%  | 13%  | 8.9%   | 9%      |
| 25th Percentile ROIC minus COC                                                                              | 4%   | 4%   | 1%   | -4%  | 3%   | 3%   | 2%   | 2%   | 1%   | 2%   | -1%  | 2%   | 2%   | 1%     | -4% | 4%   | 2%     | 2%      |
| % with ROIC minus COC > 0.0%                                                                                | 88%  | 86%  | 79%  | 61%  | 86%  | 85%  | 83%  | 87%  | 83%  | 81%  | 72%  | 83%  | 85%  | 79%    | 61% | 88%  | 83%    | 81%     |
| <u>Railroad Percentile in the Distribution of ROIC minus COC:</u>                                           |      |      |      |      |      |      |      |      |      |      |      |      |      |        |     |      |        |         |
| Industry Weighted Average ROIC                                                                              | 17   | 19   | 22   | 30   | 19   | 21   | 31   | 32   | 41   | 37   | 44   | 44   | 35   | 42     | 17  | 44   | 31     | 31      |
| CSX Corporation                                                                                             | 17   | 20   | 32   | 37   | 28   | 21   | 27   | 25   | 34   | 26   | 41   | 33   | 36   | 45     | 17  | 45   | 30     | 30      |
| Kansas City Southern                                                                                        | 14   | 17   | 16   | 22   | 15   | 9    | 13   | 13   | 21   | 20   | 29   | 24   | 13   | 25     | 9   | 29   | 17     | 18      |
| Norfolk Southern Corporation                                                                                | 28   | 26   | 37   | 33   | 24   | 22   | 25   | 19   | 34   | 22   | 36   | 36   | 25   | 36.37  | 19  | 37   | 27     | 29      |
| Union Pacific Corporation                                                                                   | 14   | 9    | 13   | 23   | 16   | 21   | 36   | 43   | 51   | 46   | 48   | 50   | 38   | 45     | 9   | 51   | 37     | 32      |

Sources: Bloomberg; Compustat; Ibbotson Yearbook (2006-2019); STB Revenue Adequacy Determination Report (2006-2018); RevAd 2019 AAR workpaper1.pdf, titled "AAR Duplication of STB Workpapers."

## Appendix C, Exhibit C2

Railroad Percentiles within Sample - Adjusted STB Definition of Return on Invested Capital (ROIC) and STB Definition of Cost of Capital (COC)  
(Railroads' Return on Invested Capital and Cost of Capital Measured Using Non-STB Public Data)

|                                                                                                             | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019      | Min | Max   | Median    | Average |
|-------------------------------------------------------------------------------------------------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|-----------|-----|-------|-----------|---------|
| <b>Panel A: S&amp;P 500 Companies Excluding Railroads, Financial Institutions and Real Estate Companies</b> |      |      |      |      |      |      |      |      |      |      |      |      |      |           |     |       |           |         |
| <u>Sample Number of Observations, Median, 25th Percentile, and % Positive ROIC minus COC:</u>               |      |      |      |      |      |      |      |      |      |      |      |      |      |           |     |       |           |         |
| Number of Observations in Sample                                                                            | 405  | 401  | 409  | 415  | 413  | 414  | 413  | 412  | 410  | 408  | 402  | 393  | 395  | 394       | 393 | 415   | 409       | 406     |
| Median ROIC minus COC                                                                                       | 9%   | 9%   | 9%   | 5%   | 11%  | 11%  | 10%  | 11%  | 9%   | 10%  | 9%   | 7%   | 12%  | 10%       | 5%  | 12%   | 10%       | 9%      |
| 25th Percentile ROIC minus COC                                                                              | 1%   | 2%   | 1%   | -2%  | 3%   | 3%   | 3%   | 2%   | 2%   | 2%   | 2%   | 2%   | 2%   | 1.2%      | -2% | 3%    | 2%        | 2%      |
| % with ROIC minus COC > 0.0%                                                                                | 81%  | 82%  | 80%  | 68%  | 86%  | 87%  | 86%  | 87%  | 87%  | 84%  | 82%  | 82%  | 84%  | 84%<br>82 | 68% | 87%   | 84%<br>83 | 83%     |
| <u>Railroad Percentile in the Distribution of ROIC minus COC:</u>                                           |      |      |      |      |      |      |      |      |      |      |      |      |      |           |     |       |           |         |
| Industry Weighted Average ROIC                                                                              | 16   | 16   | 19   | 23   | 14   | 11   | 14   | 12   | 19   | 18   | 20   | 24   | 24   | 30.34     | 11  | 30.34 | 18        | 19      |
| CSX Corporation                                                                                             | 15   | 17   | 21   | 25   | 16   | 12   | 14   | 10   | 11   | 15   | 18   | 18   | 27   | 31.32     | 10  | 31.32 | 17        | 18      |
| Kansas City Southern                                                                                        | 17   | 18   | 14   | 14   | 14   | 10   | 14   | 12   | 16   | 16   | 18   | 17   | 10   | 16.47     | 10  | 18    | 15        | 15      |
| Norfolk Southern Corporation                                                                                | 19   | 18   | 21   | 21   | 11   | 11   | 12   | 9    | 12   | 13   | 17   | 19   | 14   | 25.26     | 9   | 25.26 | 16        | 16      |
| Union Pacific Corporation                                                                                   | 14   | 14   | 17   | 23   | 15   | 11   | 17   | 18   | 31   | 28   | 26   | 34   | 30   | 32.33     | 11  | 34    | 20        | 22      |
| <b>Panel B: S&amp;P 500 Companies in the Industrials Sector Excluding Railroads</b>                         |      |      |      |      |      |      |      |      |      |      |      |      |      |           |     |       |           |         |
| <u>Sample Number of Observations, Median, 25th Percentile, and % Positive ROIC minus COC:</u>               |      |      |      |      |      |      |      |      |      |      |      |      |      |           |     |       |           |         |
| Number of Observations in Sample                                                                            | 48   | 53   | 56   | 54   | 55   | 57   | 56   | 60   | 61   | 63   | 66   | 65   | 65   | 64        | 48  | 66    | 59        | 59      |
| Median ROIC minus COC                                                                                       | 13%  | 15%  | 15%  | 5%   | 12%  | 15%  | 13%  | 13%  | 12%  | 12%  | 11%  | 12%  | 13%  | 14%       | 5%  | 15%   | 13%       | 12.43%  |
| 25th Percentile ROIC minus COC                                                                              | 9%   | 8%   | 7%   | 1%   | 6%   | 8%   | 6%   | 6%   | 4%   | 7%   | 7%   | 7%   | 6%   | 9%        | 1%  | 9%    | 7%        | 6%      |
| % with ROIC minus COC > 0.0%                                                                                | 92%  | 91%  | 95%  | 80%  | 95%  | 95%  | 93%  | 95%  | 90%  | 90%  | 92%  | 97%  | 94%  | 95%<br>94 | 80% | 97%   | 93%       | 92%     |
| <u>Railroad Percentile in the Distribution of ROIC minus COC:</u>                                           |      |      |      |      |      |      |      |      |      |      |      |      |      |           |     |       |           |         |
| Industry Weighted Average ROIC                                                                              | 6    | 9    | 5    | 13   | 9    | 5    | 11   | 5    | 18   | 14   | 9    | 8    | 9    | 11        | 5   | 18    | 9         | 9       |
| CSX Corporation                                                                                             | 6    | 9    | 7    | 15   | 9    | 7    | 9    | 5    | 10   | 11   | 7    | 5    | 11   | 11        | 5   | 15    | 9         | 9       |
| Kansas City Southern                                                                                        | 6    | 11   | 4    | 7    | 7    | 5    | 9    | 5    | 13   | 11   | 7    | 3    | 3    | 6         | 3   | 13    | 7         | 7       |
| Norfolk Southern Corporation                                                                                | 10   | 11   | 7    | 13   | 5    | 5    | 9    | 5    | 10   | 8    | 6    | 5    | 8    | 11        | 5   | 13    | 8         | 8       |
| Union Pacific Corporation                                                                                   | 6    | 9    | 5    | 13   | 9    | 5    | 12   | 7    | 23   | 17   | 10   | 14   | 14   | 11        | 5   | 23    | 11        | 11      |
| <b>Panel C: Railroad Customer Sample of S&amp;P 500 Companies</b>                                           |      |      |      |      |      |      |      |      |      |      |      |      |      |           |     |       |           |         |
| <u>Sample Number of Observations, Median, 25th Percentile, and % Positive ROIC minus COC:</u>               |      |      |      |      |      |      |      |      |      |      |      |      |      |           |     |       |           |         |
| Number of Observations in Sample                                                                            | 80   | 80   | 81   | 82   | 84   | 84   | 84   | 83   | 84   | 87   | 86   | 84   | 85   | 83        | 80  | 87    | 84        | 83      |
| Median ROIC minus COC                                                                                       | 9%   | 7%   | 6%   | 0%   | 7%   | 8%   | 5%   | 4%   | 3%   | 3%   | 3%   | 3%   | 5%   | 4.5%      | 0%  | 9%    | 5%        | 5%      |
| 25th Percentile ROIC minus COC                                                                              | 1%   | 2%   | 0%   | -5%  | 2%   | 2%   | 0%   | 1%   | 0%   | 1%   | -2%  | 0%   | 1%   | 0%        | -5% | 2%    | 0%        | 0%      |
| % with ROIC minus COC > 0.0%                                                                                | 84%  | 81%  | 70%  | 52%  | 81%  | 83%  | 76%  | 81%  | 74%  | 79%  | 67%  | 76%  | 81%  | 76%<br>75 | 52% | 84%   | 78%       | 76%     |
| <u>Railroad Percentile in the Distribution of ROIC minus COC:</u>                                           |      |      |      |      |      |      |      |      |      |      |      |      |      |           |     |       |           |         |
| Industry Weighted Average ROIC                                                                              | 12   | 19   | 27   | 35   | 20   | 16   | 26   | 19   | 32   | 25   | 37   | 36   | 31   | 45        | 12  | 45    | 26        | 27      |
| CSX Corporation                                                                                             | 12   | 20   | 32   | 39   | 22   | 16   | 25   | 15   | 20   | 22   | 32   | 25   | 36   | 45        | 12  | 45    | 24        | 26      |
| Kansas City Southern                                                                                        | 12   | 20   | 22   | 23   | 20   | 15   | 24   | 18   | 29   | 22   | 31   | 24   | 16   | 25        | 12  | 31    | 22        | 21      |
| Norfolk Southern Corporation                                                                                | 17   | 20   | 32   | 34   | 19   | 16   | 18   | 14   | 22   | 20   | 30   | 28   | 19   | 40        | 14  | 40    | 20        | 24      |
| Union Pacific Corporation                                                                                   | 12   | 12   | 24   | 35   | 20   | 16   | 29   | 25   | 51   | 48   | 48   | 48   | 42   | 45        | 12  | 51    | 32        | 33      |

Sources: Bloomberg; Compustat; Ibbotson Yearbook (2006-2019); STB Revenue Adequacy Determination Report (2006-2018); RevAd 2019 AAR workpaper1.pdf, titled "AAR Duplication of STB Workpapers."

**ATTACHMENT B**

**ERRATA PAGES TO OCTOBER 13, 2021  
RESPONSE TO REPLIES**

be an automatic trigger for wealth transfers under the ACC rate benchmarking approach—even though ACC members have an average return over their cost of capital well above that of the rail industry.<sup>5</sup> Compared to the AAR members, with a median ROIC less COC of -0.8%, the ACC members achieved a median ROIC less COC of ~~14.9%~~ ~~15%~~.<sup>6</sup> Yet the Joint Shipper coalition wants the Board to ignore that data and continue using an inaccurate metric developed four decades ago as a basis to transfer wealth from railroads to chemical companies.

Section I addresses arguments that the current measurement should not be changed. Tellingly, the shippers do not defend the current approach on the merits, but instead attack it as being too “conservative” and allegedly underestimating railroads’ revenue adequacy. But the recycled arguments Opponents make have long been discredited and do not negate the need for the Board to open a proceeding to explore ways to modernize and improve upon its current test.

Section II addresses Opponents’ few technical complaints. While Opponents argue that the S&P 500 does not provide an accurate benchmark for railroads, in fact the S&P 500 is a well-recognized proxy for the broader market and accurately reflects the diverse investment options with which railroads must compete for capital. Moreover, data from narrower groups like S&P Industrials or major rail customers produces results that are in line with the full S&P 500 comparison group. Section III responds to WCTL’s arguments and misunderstandings regarding the deferred taxes portion of the Petition.

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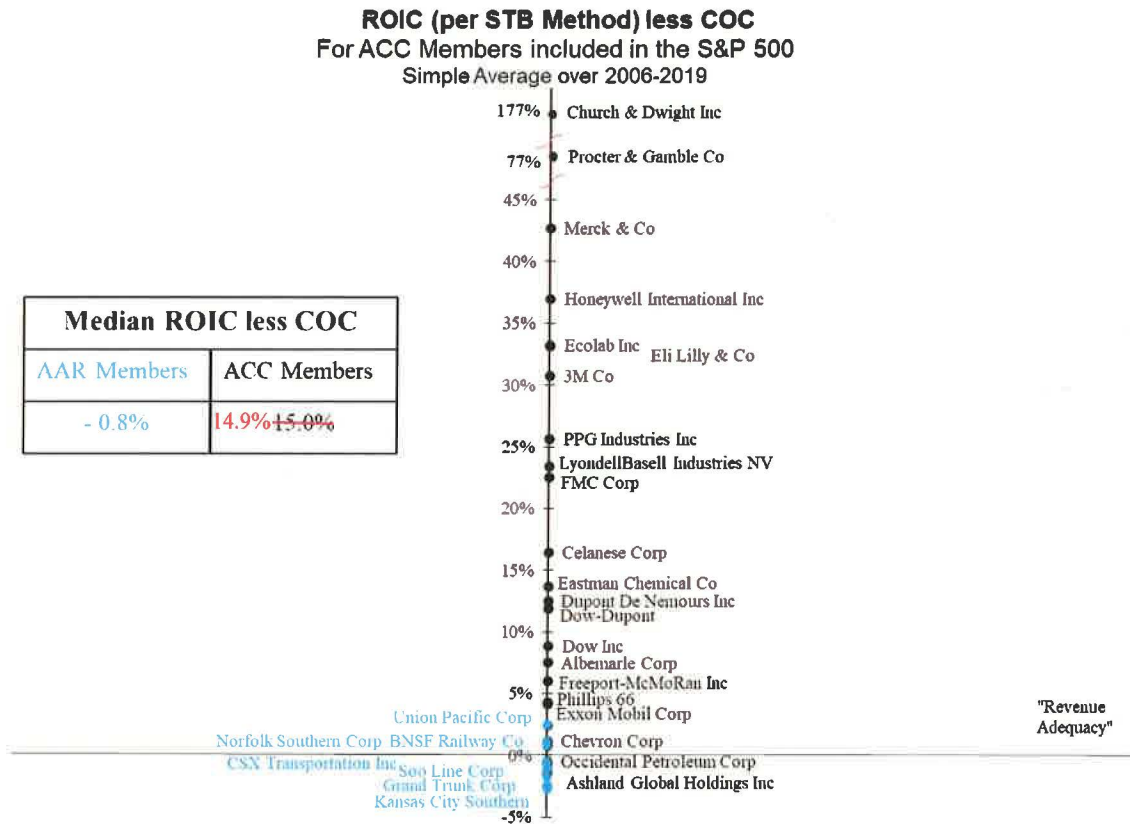
other capital market participants, which is a valid economic method for gaining insight into a firm’s level of economic returns. *See* Exhibit 1, Supplemental Verified Statement of Kevin M. Murphy and Mark E. Zmijewski (“Supplemental V.S.”) ¶ 8 (citing Sections III and IV of the initial Verified Statement).

<sup>5</sup> Supplemental V.S. ¶ 6, Figure 1.

<sup>6</sup> *Id.* at Figure 1. Note, the median is the median of the average ROIC less COC over the 2006–2019 period.

Professor Kalt compared the ACC members' and railroads' return on investment net of their cost of capital ("ROIC minus COC") from 2006 through 2018, and found that the ACC members performed substantially better than the railroads.<sup>12</sup> We extend their analysis through 2019 in Figure 1, below, and reach the same conclusion.

**Figure 1**



Source: Murphy & Zmijewski V.S.

Note: Simple average of annual values. For companies with data with less than full coverage, the average is taken over the years available.

<sup>12</sup> AAR Presentation, Slide 20.

2006-2019 rank of the STB's ROIC minus COC for the railroad industry relative to the S&P 500 benchmarking group (without the deferred tax adjustment) is the ~~14<sup>th</sup>~~<sup>15<sup>th</sup></sup> percentile,<sup>27</sup> and it is the ~~same~~ 14<sup>th</sup> percentile if we use the Adjusted ROIC (that reflects the deferred tax adjustments) instead.<sup>28</sup> Our conclusions similarly are unaffected for individual railroads<sup>29</sup> and the choice of the benchmarking sample (i.e. S&P 500 Industrials and S&P 500 Railroad Customers).<sup>30</sup>

## VI. EXAMPLE ILLUSTRATING ERRORS IN THE WCTL AND JOINT SHIPPERS REPLIES DISCUSSED ABOVE

15. In this section, we present an example using a simplified economic model for a railroad to illustrate three basic well-known economic principles:

- Observing a railroad making incremental investments that have expected economic returns greater than its cost of capital is not informative about whether the railroad's expected economic return on its *total* invested capital exceeds its cost of capital;
- Observing investors' actual returns from investing in railroads (which range from being very large to very negative) is not informative about whether the railroad's expected economic return on its total invested capital exceeds its cost of capital;

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<sup>27</sup> Murphy & Zmijewski V.S., Table 1.

<sup>28</sup> Murphy & Zmijewski V.S., Table 4.

<sup>29</sup> Murphy & Zmijewski V.S., Tables 1 and 4. BNSF Railway, CSX Corporation, and Grand Trunk Corporation ranked, on average, at the 15<sup>th</sup>, 12<sup>th</sup>, and 10<sup>th</sup> percentiles in terms of their relative performance using either ROIC or Adjusted ROIC. The Kansas City Southern's and Soo Line Corporation's relative performance is higher under the Adjusted ROIC metric (11<sup>th</sup> and 14<sup>th</sup> percentiles) and lower under the ROIC metric (9<sup>th</sup> and 13<sup>th</sup> percentiles), respectively. The opposite is true for the Norfolk Southern Corporation and Union Pacific; their relative performance is higher under the ROIC metric (15<sup>th</sup> and 20<sup>th</sup> percentiles) and lower under the Adjusted ROIC metric (13<sup>th</sup> and 19<sup>th</sup> percentiles), respectively.

<sup>30</sup> Murphy & Zmijewski V.S., Tables 2 and 5 (S&P 500 Industrials) and Tables 3 and 6 (S&P 500 Railroad Customers).

**ATTACHMENT C**

**CORRECTED SEPTEMBER 1, 2020**  
**JOINT PETITION FOR RULEMAKING**

**BEFORE THE  
SURFACE TRANSPORTATION BOARD  
  
EX PARTE 766**

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**JOINT PETITION FOR RULEMAKING  
TO MODERNIZE ANNUAL REVENUE ADEQUACY DETERMINATIONS**

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September 1, 2020 (Updated with errata corrections)

|                                                                                                                                                                  |           |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
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## EXECUTIVE SUMMARY

The Surface Transportation Board (STB or Board) has committed itself to “evidence-based decision-making.”<sup>1</sup> No stakeholder has opposed this wise policy choice, which is consistent with sound regulatory policy and the Board’s responsibilities under the Interstate Commerce Act. Using data to guide policy decisions is superior to reliance on anecdotal complaints, one-sided testimony, or unproven assumptions.

Evidence-based decisionmaking requires good evidence. Congress charged the Board with annually measuring the financial health of the rail industry and assisting each railroad in achieving revenue adequacy. As Professors Kevin Murphy and Mark Zmijewski observe in the attached statement:

Congress and the Board have an interest in monitoring the health of the railroad industry, given the vital importance of the railroad industry in the United States and even world economies for transporting goods to domestic and international markets and avoiding taxpayer subsidization of unprofitable railroads. And because of the importance of having a healthy railroad industry in the United States, it is critical that metrics used and the context in which those metrics are evaluated provide an accurate assessment of the railroads’ financial health.<sup>2</sup>

The Board currently attempts to fulfill this statutory responsibility with flawed and incomplete data, using tools designed three decades ago. It relies on *accounting* measures of return on investment, rather than the current *economic* value of those investment assets. The agency then removes billions of dollars of accumulated deferred taxes from that investment base, adding yet another distortion made evident in 2017 when corporate tax rates changed.<sup>3</sup> And the Board

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<sup>1</sup> STB Budget Request, Fiscal Year 2020, at 10.

<sup>2</sup> Verified Statement of Kevin M. Murphy and Mark E. Zmijewski at ¶ 27 (“Murphy & Zmijewski V.S.”).

<sup>3</sup> These recent distortions driven by exogenous tax policy changes have every chance of being repeated. Going forward, every time Congress decides to take a different

then analyzes these findings without considering evidence about typical rates of return for the companies with which railroads compete for capital. Modernization of this antiquated measurement would bring the annual revenue determinations closer to Congress's original purpose. In this Petition, Petitioners Union Pacific Railroad Company ("UP"), Norfolk Southern Railway Company ("NS"), and the U.S. rail operating affiliates of Canadian National Railway Company (collectively "CN") set forth a proposal to address these flaws and improve the evidence the Board considers to assist railroads in earning "a reasonable and economic profit or return (or both) on capital employed in the business." 49 U.S.C. § 10704(a)(2). Adoption of this proposal will provide the agency with publicly available information that can place its annual findings into the proper context.

This Petition does not focus on the debate over whether and how the Board might apply a "revenue adequacy constraint."<sup>4</sup> It is focused on a different question: are the Board's annual revenue adequacy determinations designed so that the Board may fulfill its statutory duties in accurately measuring and properly promoting railroad revenue adequacy? The answer is clearly no.

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approach to corporate tax policy, the Board will find itself having to make complex and awkward adjustments in its methodology.

<sup>4</sup> Petitioners emphasize there is no basis in the law or in sound regulatory policy for the Board to impose a top-down revenue adequacy constraint. Congress instructed the agency to "promote" revenue adequacy and to monitor financial health of railroads, not to place a cap on earnings or otherwise impose restrictive regulation on railroads using blunt system-wide tools. . For those reasons, the Board should abandon the top-down revenue adequacy constraint as an antiquated and unnecessary form of economic regulation. *See* Comments of the Association of American Railroads at 7-35, *Hearing on Railroad Revenue Adequacy*, Ex Parte 761 (filed Nov. 26, 2019). But regardless of what action it takes on the revenue adequacy constraint, the Board surely cannot make any rational and non-arbitrary decisions in this area without a more accurate measure of railroads' actual financial health. Nor can the Board comply with Congress's command to monitor and promote the health of the railroad industry without accounting for the abundant, readily available evidence of how the rail industry compares to other industries.

Specifically, this Petition outlines two changes by which the Board could provide itself, the public, and Congress with a better perspective on the “revenue adequacy” of the freight rail industry. First, the Board should use a comparison approach that contrasts its annual revenue adequacy determinations (however calculated) against the performance of other companies in the S&P 500, using the same methodology for both. Second, the Board should modify its treatment of deferred taxes in annual revenue adequacy determinations in order to provide an accurate view of railroad returns (and so the Board will not need to make manual adjustments every time Congress changes corporate tax policy).

The first proposal is the centerpiece of this Petition. One of the hallmarks of the Staggers Rail Act of 1980 was Congress’s desire to “treat[] the American railroad industry as any other business.”<sup>5</sup> An essential part of treating railroads like other businesses is recognizing that railroads compete for capital in the same markets as other firms in a variety of industries. Investors have a multitude of options for investing their capital, and they are naturally inclined to seek out options where they expect to earn more than the cost of capital. For this reason, the financial health of the railroad industry cannot be viewed in isolation, but rather must be considered in relation to the competition railroads face in the capital markets from other, unregulated firms.

Moreover, comparing railroad performance against other companies in the S&P 500—using the same methodology—mitigates some of the measurement errors in the current approach. For example, using accounting rather than economic measurements of profits has long bedeviled the agency. Use of economic

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<sup>5</sup> *Burlington N. R.R. Co. v. Pub. Util. Comm’n of Texas*, 812 F.2d 231, 235 (5th Cir. 1987) (citing 126 Cong. Rec. 28,431 (1980) (statement of Rep. Staggers)); see *Groome & Assocs., Inc. v. Greenville Cty. Economic Develop. Corp.*, STB Docket No. 42087, at 12 (served July 27, 2005) (“Congress directed [in the Staggers Act] that railroads be treated more like ordinary businesses than like public utilities.”).

measurements is superior, but has been considered impractical because of the complexities in calculating the replacement cost of assets. Yet examining companies in the S&P 500 using a consistent measurement provides the Board an important perspective into the relative performance of the industry, which is the most relevant inquiry that will guide the flow of capital.<sup>6</sup>

The Board has a rich dataset from which it can develop that comparative analysis. University of Chicago Professors Kevin Murphy and Mark Zmijewski have analyzed data on the relative performance of every company in the S&P 500 from 2006 to 2019. This data was first presented in summary form at the Railroad Revenue Adequacy hearing on December 13, 2019. It is presented herein again and in full.

Simply put, Professors Murphy and Zmijewski used the Board's own methodologies to derive a revenue adequacy calculation for nonrailroads in the S&P 500. The two professors painstakingly replicated the STB's approach. They calculated the ROI and cost of capital from the same public sources and using the same methodology used by the Board. So, for example, they used the average of the CAPM and MSDCF models to estimate the cost of equity, they used the same accounting measures of investment, and they removed (at least initially) the accumulated deferred taxes from that investment base. They even replicated the Board's adjustment to the 2017 findings that ignored the effect of the changes in corporate tax rates on the accumulated deferred taxes. In every respect, the S&P 500 dataset mirrors the Board's current method for determining revenue adequacy.

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<sup>6</sup> This change is thus in line with the suggestions by the Transportation Research Board's *Modernizing Freight Rail Regulation* report that the Board "obtain a richer set of information" to determine "whether a railroad's profits are consistently outside a reasonable band of profitability that characterizes many other industries over a business cycle." Transportation Research Board, *Modernizing Freight Rail Regulation*, at 8, 155, 202 (2015), available at <https://doi.org/10.17226/21759>.

All of these data are from public sources. They can be calculated, updated, and verified by any member of the public, and could be provided to the STB annually.

The results are striking. Using the Board’s “essentially mechanical” analysis,<sup>7</sup> Professors Murphy and Zmijewski show there is nothing unusual about a company earning an ROI above its cost of capital. Indeed, 89% of the S&P 500 earn ROIs over their cost of capital (using the same methodology the Board uses to calculate railroad ROI and cost of capital).<sup>8</sup> In other words, *a substantial majority of major public companies in nearly every industry is “revenue adequate” under the Board’s current definition—but by margins that dwarf those achieved by any railroad.*

This reality is at odds with the current dialogue before the agency. The agency has heard for years, from those who stand to gain from agency rent-seeking, that revenue adequacy is a sign of excessive profits that could only have been earned through abuses of market power. Parties then urge the Board to adopt aggressive regulatory changes that would snap into place once the Board calculated that a railroad’s return on investment exceeded the industry cost of capital by any amount over the measured period.

While snapping constraints into place would be misguided at any profit level, it is particularly inappropriate to trigger such constraints using a hurdle that nearly the entire S&P 500 clears. Put simply, the Board’s current revenue adequacy “thermometer” indicates everyone has a fever. To accurately measure where railroads stand, the Board should consider whether railroads are earning returns on cost of capital substantially higher than those of companies in other industries. If the goal is for the Board to determine whether system-wide earnings are evidence of

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<sup>7</sup> *Railroad Revenue Adequacy—2018 Determination*, at 1, STB Ex Parte No. 552 (Sub-No. 23) (served Sept. 5, 2019).

<sup>8</sup> Murphy & Zmijewski V.S. at 80 Table 7.

an abuse of market power, the Board cannot even begin to make that determination unless at the very least it finds railroads are earning substantially more than peer companies and rivals for capital.<sup>9</sup>

The Board would have a more accurate view of railroads' actual financial health if its annual revenue adequacy determinations incorporated information on whether railroads are earning ROIs over their cost of capital that are out of line from what a typical company earns. As detailed below, that could be done by an annual comparison to a representative group of peer firms, drawn from the S&P 500. This publicly available information could then be incorporated in the Association of American Railroads' filings in annual cost of capital proceedings and made available for comment and review by Board staff and interested parties.

In addition to incorporating public data on other peer firms into the revenue adequacy evaluation, Professors Murphy and Zmijewski recommend changing how the Board treats accumulated deferred taxes and including non-goodwill intangible assets in a company's investment base. As the data show, the median S&P 500 company earns an ROI 19% over its industry average cost of capital, if one copies the STB's methodology precisely. But these two flaws in the current 33-year old approach are distorting both the *absolute* measure of railroad financial health and the *relative* performance of the railroad industry.

Therefore, Professors Murphy and Zmijewski recommend two simple adjustments to improve the precision of the comparison. First, the Board should

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<sup>9</sup> To be sure, the fact that a company is earning substantially more than its cost of capital is not *per se* evidence of an abuse of market power, because such returns could be the result of innovation and competitive success that should be encouraged. But for purposes of the § 10704(a)(3) measuring stick, the Board would be justified in assuming that a railroad earning substantially over the median amount that a S&P 500 company earns over its cost of capital in a given year is "revenue adequate" for that year. Only then might further inquiry by the Board on the cause for such results be warranted.

include non-goodwill intangible assets. This change has little impact on railroads, which typically do not have significant non-goodwill intangible assets, but it has a significant effect on certain firms that do have such assets in the form of brand names or trademarks. Making this change thus allows for more meaningful comparisons between railroad performance and that of other firms. Second, the Board should remove the distorting effect of deferred taxes by adopting a “flow-through” approach like the one originally endorsed by the Department of Transportation, as discussed further below.<sup>10</sup>

These adjustments are *not* favorable to the railroad industry in this comparison analysis. Quite the contrary. But even with these adjustments, 84% of companies *still* earn an adjusted ROI above the cost of capital, but the median difference is now only 10%. So while it remains the case that a substantial majority of major public companies in nearly every industry are “revenue adequate,” these dual adjustments bring the railroad industry *closer* to the median performance of the S&P 500. Because the goal of this Petition is to provide the Board with a rich and reliable dataset for a comparative analysis, the railroad petitioners support the recommendations of Professors Murphy and Zmijewski, because they rest on a sound economic foundation and provide the Board with better data for evidence-based decisionmaking.

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<sup>10</sup> As demonstrated below, the flow-through approach produces a more accurate assessment of current cash flows and thus a more useful tool for the Board to measure railroad financial health. It also carries the significant benefit of not requiring regular manual adjustments upon changes in tax policy. The Board recently made a one-time adjustment to the 2017 revenue adequacy determination to prevent the absurd results that would have occurred as a result of the 2017 reduction in the corporate tax rate. If the Board does not change course, future adjustments may become a matter of course every time Congress amends the tax laws.

In sum, Petitioners urge the Board to initiate a rulemaking proceeding to solicit public comment on this proposal. In light of the Board's responsibility accurately to measure and analyze railroad ROI and to support the economic health of the railroad industry, the Board should institute a rulemaking to adopt rules that would (1) add a comparative analysis to the annual revenue adequacy determinations that calculates the amount by which the median S&P 500 company's ROI exceeded (or fell short of) its cost of capital ("S&P Differential"); (2) for purposes of annual determinations, define revenue adequacy to mean that a railroad's annual ROI exceeds the industry cost of capital net of the S&P Differential; and (3) use the flow-through method for deferred taxes when calculating ROI.

## **I. Background**

### **A. Regulatory Framework**

As noted above, the centerpiece of this Petition is for the agency to use a comparison approach that contrasts its annual revenue adequacy determinations (however calculated) against the performance of other companies in the S&P 500, using the same methodology for both railroad performance and non-railroad performance. This concept finds ample support in the plain language of the statute and the rail transportation policies of the United States.

#### **i. Section 10704(a)(2): the Statutory Definition**

Congress has instructed the STB and its predecessor to promote the revenue adequacy of railroads since enactment of the Railroad Revitalization and Regulatory Reform Act of 1976 ("4-R Act").<sup>11</sup> The Staggers Act included a further

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<sup>11</sup> Pub. L. No. 94-210, 90 Stat. 31 (1976).

requirement for the agency to annually measure revenue adequacy for each Class I railroad. This requirement is currently codified at 49 U.S.C. § 10704(a)(2) and (3):

- (2) The Board shall maintain and revise as necessary standards and procedures for establishing revenue levels for rail carriers providing transportation subject to its jurisdiction under this part that are adequate, under honest, economical, and efficient management, for the infrastructure and investment needed to meet the present and future demand for rail services and to cover total operating expenses, including depreciation and obsolescence, plus a reasonable and economic profit or return (or both) on capital employed in the business. The Board shall make an adequate and continuing effort to assist those carriers in attaining revenue levels prescribed under this paragraph. Revenue levels established under this paragraph should—
  - (A) provide a flow of net income plus depreciation adequate to support prudent capital outlays, assure the repayment of a reasonable level of debt, permit the raising of needed equity capital, and cover the effects of inflation; and
  - (B) attract and retain capital in amounts adequate to provide a sound transportation system in the United States.
- (3) On the basis of the standards and procedures described in paragraph (2), the Board shall annually determine which rail carriers are earning adequate revenues.

This provision calls for affirmative Board action to promote adequate revenues for every carrier. “Adequate” means “equal to, proportionate to, or fully sufficient for a specified or implied requirement.”<sup>12</sup> Section 10704(a)(2) defines that specific requirement as revenues that are sufficient to: i) allow for infrastructure and investment needed to meet present and future demand for rail services; ii) cover total operating expenses, including depreciation; and iii) provide for “a reasonable and economic profit or return (or both) on capital employed in the business.” The provision goes on to require that the Board make an “adequate and continuing effort to assist . . . carriers in attaining revenue levels” in accordance

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<sup>12</sup> 1 WEBSTER’S THIRD NEW INT’L DICTIONARY 25 (1976).

with this prescribed definition. 49 U.S.C. § 10704(a)(2). In other words, the statute calls for the Board to assist carriers in earning not up to their cost of capital, but rather revenue levels described by Section 10704(a)(2), which describes revenue *above and beyond* the cost of capital.

## **ii. Rail Transportation Policy Factors**

The Rail Transportation Policy (“RTP”) factors, contained in 49 U.S.C. § 10101, are not independent sources of regulatory authority but rather express the policies that are to guide the STB’s exercise of authority granted elsewhere in the statute.<sup>13</sup> In other words, the general provisions in § 10101 cannot trump the specific provisions dealing with rate reasonableness.<sup>14</sup> Nevertheless, the RTP factors reinforce the point that revenue adequacy is a goal toward which to strive, and they express the expectation and desire for carriers to earn returns comparable to other unregulated industries.

First, the legislative history of the Staggers Act explains the overall thrust of the (then) new RTPs. In reference to the RTPs, the conference report on the Staggers Act explains:

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<sup>13</sup> See *CSX Transp., Inc.—Abandonment Exemption—in LaPorte, Porter, & Starke Crys., Ind.*, AB 55 (Sub-No. 643X) et al., slip op. at 6 (STB served May 31, 2017) (“[T]he RTP does not create an independent basis for Board action in the absence of a violation of a substantive provision in the Interstate Commerce Act.”) (citations omitted).

<sup>14</sup> See *Perez-Guzman v. Lynch*, 835 F.3d 1066, 1075 (9th Cir. 2016) (The “canon [of] *generalia specialibus non derogant*—i.e., “the specific governs the general”] provides that a ‘narrow, precise, and specific’ statutory provision is not overridden by another provision ‘covering a more generalized spectrum’ of issues. *Radzanower v. Touche Ross & Co.*, 426 U.S. 148, 153–54 (1976). When two statutes come into conflict, courts assume Congress intended specific provisions to prevail over more general ones, see *Fourco Glass Co. v. Transmirra Prods. Corp.*, 353 U.S. 222, 228–29 (1957), the assumption being that the more specific of two conflicting provisions ‘comes closer to addressing the very problem posed by the case at hand and is thus more deserving of credence,’ Antonin Scalia & Bryan A. Garner, *Reading Law: The Interpretation of Legal Texts* 183 (2012).”).

Consistent with the new rail transportation policy of this Act, the Conferees intend that competition be recognized as the best control on the ability of railroads to raise rates. The purpose of this legislation is to reverse the decline of the railroad industry, which has been caused, in part, by excessive government regulation. The Conferees believe that by allowing the forces of the marketplace to regulate railroad rates wherever possible the financial health of the railroad industry will be improved and will benefit all parts of the economy, including shippers, consumers, and rail employees.<sup>15</sup>

Second, the agency is expressly encouraged to rely on unregulated markets to the maximum extent possible. Another provision of the RTP states that “[t]his new section [section 10101] directs the Commission to encourage primary reliance on the marketplace rather than regulation, to limit regulation of railroads to those areas where there is an absence of effective competition and to permit rates which provide revenues necessary to maintain the rail system and to attract capital.”<sup>16</sup> Here, this Petition would have the STB look to other industries and markets with whom the railroads compete for capital to gauge the relative financial success of the freight rail industry. At all times, these unregulated marketplaces should be the benchmark against which this regulated market is judged.

Finally, various specific RTP provisions promote the concept of comparing the performance of the rail industry to other industries Congress chose not to regulate. Specifically, RTP(3) contains the one express instruction on revenue adequacy in the RTP factors. RTP(3) directs the Board to “promote a safe and efficient rail transportation system by allowing rail carriers to earn adequate revenues.”<sup>17</sup> RTP(3) would be undermined if railroads were handicapped in their ability to

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<sup>15</sup> H.R. REP. NO. 96-1430, at 89 (1980) (Conf. Rep.), *as reprinted in* 1980 U.S.C.C.A.N. 4110, 4120-21.

<sup>16</sup> H.R. REP. NO. 96-1035, at 54 (1980), *as reprinted in* 1980 U.S.C.C.A.N. 3978, 3999.

<sup>17</sup> 49 U.S.C. § 10101(3).

compete for capital with other firms in the S&P 500. Indeed, RTP(6) makes this point bluntly. It declares Congress’s policy “to maintain reasonable rates where there is an absence of effective competition and where rail rates provide revenues which exceed the amount necessary to maintain the rail system and to attract capital.”<sup>18</sup>

In sum, Congress made clear “revenue adequacy” was about more than covering costs, but rather also required railroads to earn “a reasonable and economic profit or return (or both) on capital employed in the business” and necessitated an income flow sufficient to “permit the raising of needed equity capital.” *Id.* § 10704(a)(2)(A) It naturally follows from that directive to use an approach that *compares* the financial performance of freight railroads against other, unregulated firms with which railroads compete for capital.

#### **B. Prior ICC Decisions on Definition of Revenue Adequacy.**

In the wake of the Staggers Act, the Interstate Commerce Commission (“ICC”) developed standards for measuring railroad revenue adequacy in 1981.<sup>19</sup> These standards were amended in 1986, but have since undergone little significant change.<sup>20</sup> The Board has recognized that the process it inherited from the ICC is an “essentially mechanical” one, in which “a railroad is considered revenue adequate under 49 U.S.C. § 10704(a) if it achieves a rate of return on net investment (ROI) equal to at least the current cost of capital for the railroad industry.”<sup>21</sup>

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<sup>18</sup> *Id.* § 10101(6).

<sup>19</sup> *Standards for Railroad Revenue Adequacy*, 364 I.C.C. 803 (1981) (“*Standards I*”).

<sup>20</sup> *Standards for Railroad Revenue Adequacy*, 3 I.C.C.2d 261 (1986) (“*Standards II*”).

<sup>21</sup> *Railroad Revenue Adequacy—2018 Determination*, at 1, Ex Parte No. 552 (Sub-No. 23) (served Sept. 5, 2019).

**i. Use of Depreciated Original Costs.**

Under *Standards I* and *Standards II*, the Board uses accounting book values (*i.e.*, depreciated original costs) to determine each railroad's investment base, and thus to measure ROI. The agency has long recognized that replacement cost valuation is superior to book valuation, both because replacement costs "may better reflect the true economic costs associated with an investment" and because replacement costs "come[] closer to the competitive result." *Standards I*, 364 I.C.C. at 818. However, the ICC concluded that the replacement cost method was too difficult to implement, in part because of the "major difficulty with . . . the estimation of the actual value of individual investments." *Id.* at 819.<sup>22</sup> In 2008, the Board rejected a petition for rulemaking by the Association of American Railroads asking it to reconsider the ICC's decision and to adopt a mechanism for considering replacement costs in the annual revenue adequacy determinations.<sup>23</sup> The Board concluded that the AAR's proposal "failed to overcome the practical difficulties associated with using a replacement-cost approach."<sup>24</sup>

**ii. Removal of Deferred Taxes from Investment Base**

The ICC took different approaches to deferred taxes during its history of developing revenue adequacy measurements. The ICC initially chose to remove deferred taxes from the investment base (as the Board does today).<sup>25</sup> But in *Standards I*, the ICC chose the "hybrid method," which excludes deferred taxes

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<sup>22</sup> See also *Standards II*, 3 I.C.C.2d at 277 ("While current cost accounting is theoretically preferable to original cost valuation, it cannot be practically implemented in a manner that we can be confident would produce accurate and reliable results.").

<sup>23</sup> *Association of American Railroads—Pet. Regarding Methodology for Determining Railroad Revenue Adequacy*, STB Ex Parte No. 679, at 7 (served Oct. 24, 2008).

<sup>24</sup> *Id.*

<sup>25</sup> *Standards and Procedures for the Establishment of Adequate Railroad Revenue Levels*, 358 I.C.C. 844, 890 (1978) ("*Standards and Procedures*").

from ROI, but does not remove the accumulated deferred taxes from the investment base. The ICC reasoned that it would “thwart the intent of Congress . . . to provide business enterprise with tax benefits as a means of spurring capital spending” if “railroads are not allowed to earn a return on investments made with these funds.” *Id.* at 813-14. On appeal, the Third Circuit found the agency’s economic analysis reasonable because, for all businesses, tax benefits are “a source of funds which may be reinvested” such that if railroads are precluded from earning a rate of return on the investment of such funds, they would be at a “competitive disadvantage in seeking equity capital” and “would be encouraged to invest the funds . . . elsewhere than in the railroad business.”<sup>26</sup>

Three years later, the ICC changed course again, returning to its prior practice of removing deferred taxes from the investment base (an approach known as the “Utility Method”). The agency based this decision on a “double benefit” theory that would apply in only public-utility style regulation. *See Standards II*, 3 I.C.C.2d at 272. The Third Circuit affirmed *Standards II*, but with deep reservations—noting that the ICC was depriving railroads of their ability to earn a return on investments from tax savings, and thus putting them in a worse position than “unregulated firms which do retain the second benefit of an opportunity to earn a return on those funds.”<sup>27</sup> Given the deferential scope of its review, however, the Third Circuit affirmed *Standards II* in light of the ICC’s rationale that the hybrid method had created inaccuracies it wished to avoid by switching to the Utility Method. *Id.* at 93.

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<sup>26</sup> *Bessemer & Lake Erie R.R. Co. v. Interstate Commerce Comm’n*, 691 F.2d 1104, 1116 (1983) (“*Bessemer*”).

<sup>27</sup> *Consolidated Rail Corp. v. United States*, 855 F.2d 78, 90 (3d Cir. 1988) (the ICC was disadvantaging railroads that “have to *compete* for capital with unregulated firms which do retain the second benefit of an opportunity to earn a return on those funds.”) (emphasis in original).

### C. Measurement Errors

If the STB is going to make data-driven decisions, then the data supporting those decisions must be as accurate as possible. As Professors Murphy and Zmijewski caution, “[b]ecause of the importance of having a healthy railroad industry in the United States, it is critical that metrics used and the context in which those metrics are evaluated provide an accurate assessment of the railroads’ financial health. If the Board adopts and relies on a metric that systematically under- or overestimates the economic rate of return earned by railroads, then it cannot provide the oversight and monitoring guidance that Congress requires.”<sup>28</sup>

Unfortunately, the Board’s method of calculating revenue adequacy has significant measurement errors that result in a distorted and inaccurate picture of railroad revenue adequacy. The data problems are twofold: the use of book values and the treatment of deferred taxes.

The Board currently calculates railroad ROI for purposes of determining revenue adequacy by using the book value of railroad assets, rather than replacement value. This is despite the fact that both the ICC and the Board have repeatedly acknowledged that the preferred way to value the assets of a firm for purposes of assessing the adequacy of the firm’s revenues is the replacement cost of the assets.<sup>29</sup> As the Professors explain, “Economic research has shown that the limitations and inaccuracies of accounting-based rates of return make it difficult, some say impossible, to infer economic rates of return from accounting rates of

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<sup>28</sup> Murphy & Zmijewski V.S. at ¶ 27.

<sup>29</sup> *Standards I*, 364 I.C.C. at 820 (“While we perceive some difficulty in implementing a replacement cost valuation method, we believe that it is conceptually the best method available.”); *Standards II*, 3 I.C.C.2d at 277 (“While current cost accounting [*i.e.*, current replacement cost of assets] is theoretically preferable to original cost valuation, it cannot be practically implemented in a manner that we can be confident would produce accurate and reliable results.”).

return.”<sup>30</sup> In the attached report, the Professors summarize the peer-reviewed economic literature from the last 50 years. That literature has identified the well-known limitations and inaccuracies with accounting rates of return as measures of financial performance.

Once again, the Professors echo the consensus view of other notable economists. For example, Professor Joseph Kalt has explained that *accounting* rates of return are not probative of whether a railroad is actually earning an *economic* rate of return that exceeds its cost of capital, much less of any kind of anticompetitive conduct or exercise of market power as a source of returns in excess of the cost of capital.<sup>31</sup> Especially with the kind of durable and long-lived capital found in the rail industry, non-economic accounting measures of depreciated original book costs readily yield economically nonsensical conclusions as to the adequacy of revenues and returns. For example, using book value overstates railroad ROIs (and thus revenue adequacy).<sup>32</sup> Professor Kalt has also explained that the Board’s perceived difficulty in using current replacement cost as a measure “cannot justify the use of economically incoherent rates of return on depreciated

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<sup>30</sup> Murphy and Zmijewski Verified Statement at 8 & ¶ 83.

<sup>31</sup> Opening Comments of The Association of American Railroads, EP 722, Verified Statement of Joseph P. Kalt, at 4, 30-31 (filed Sep. 5, 2014) (“2014 Kalt V.S.”); see Franklin M. Fisher & John J. McGowan, *On the Misuse of Accounting Rates of Return to Infer Monopoly Profits*, 73 AM. ECON. REVIEW 82, 90 (1983) (“[T]here is no way in which one can look at accounting rates of return and infer anything about relative economic profitability or, a fortiori, about the presence or absence of monopoly profits”); *Hearing on Railroad Revenue Adequacy*, Ex Parte 722, Written Testimony of Joseph P. Kalt V.S. ¶ 34 (filed Nov. 26, 2019 (“Kalt 2019 Written Testimony”) (“It is important to note that even properly conceived measures of revenue adequacy do not provide sufficient evidence on which to base a finding of anticompetitive conduct or the exercise of market power.”)).

<sup>32</sup> Opening Comments of The Association of American Railroads, EP 722, Verified Statement of Roger Brinner, at 14-26 (filed Sep. 5, 2014) (“2014 Brinner V.S.”). As Dr. Brinner explains, book value is based on the historic cost of assets carried on a firm’s books as opposed to the current cost of assets.

historical book value to determine whether a railroad is realizing ‘excess revenues.’”<sup>33</sup> The flaws with using *accounting* measurements of ROI are now well documented. “The infirmities of using accounting profitability and rates of return to infer market power or above-competitive returns, particularly for capital industries like railroading with long-lived equipment, are well known. As starkly summarized by the classic treatment of the issue, ‘there is no way in which one can look at accounting rates of return and infer anything about relative economic profitability or, a fortiori, about the presence or absence of monopoly profits.’”<sup>34</sup> Notable economists caution against the use of accounting rather than economic measures of financial health. “If book depreciation and economic depreciation are different (they are rarely the same), then the book profitability measures will be wrong; that is, they will not measure true profitability.”<sup>35</sup> And “[p]rice regulation based on such misguided conclusions would likely make it more difficult for railroads to attract and retain capital investment on account of not being able to realize economically required rates of return.”<sup>36</sup> Celebrated economists Franklin Fisher and John McGowan long ago expressed one of the strongest conclusions against using accounting rates of return as estimates of economic rates of return:

[T]here is no way in which one can look at accounting rates of return and infer anything about relative economic profitability. . . . Economists (and others) who believe that analysis of accounting rates of return will tell them much (if they can only overcome the various definitional

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<sup>33</sup> 2014 Kalt V.S. at 31; *see also* Kalt 2019 Written Testimony at ¶¶ 34-47.

<sup>34</sup> 2014 Kalt V.S. at 32 (quoting Fisher & McGowan, *supra* note 30, at 90).

<sup>35</sup> RICHARD BREALEY, STEWART MYERS & FRANKLIN ALLEN, *PRINCIPLES OF CORPORATE FINANCE* 317 (8th ed. 2005).

<sup>36</sup> Opening Comments of Norfolk Southern Railway Company, EP 722, Verified Statement of Bradford Cornell, at 18 (filed Sep. 5, 2014).

problems which separate economists and accountants) are deluding themselves.<sup>37</sup>

Another problematic measurement error relates to the Board's treatment of deferred taxes. The ICC's treatment of deferred taxes has swayed back and forth.<sup>38</sup> The Commission eventually settled on the so-called "Utility Method," where accumulated deferred taxes are excluded from the investment base.<sup>39</sup> Even though the Third Circuit, reviewing the ICC's decision, believed that the Utility Method created a powerful disincentive for investment in the railroad industry, it felt compelled to reject the railroads' challenge due to the deferential scope of its review.<sup>40</sup>

Excluding deferred taxes from the investment base makes little economic sense. Because deferred taxes are a source of funds that railroads use to invest in their assets (*i.e.*, a source of capital that may be reinvested), it makes sense to treat deferred taxes in the same way as any other source of capital rather than remove them from the investment base. A group of leading economists urged the ICC back in 1985 to take this very stance and measure revenue adequacy as "a rate of return equal to the current cost of capital on the replacement value of all rail assets that are required to meet the demands for railroad service, *regardless of the source of*

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<sup>37</sup> Fisher & McGowan, *supra* note 30, at 90-91.

<sup>38</sup> See *Standards and Procedures*, 358 I.C.C. at 890 (excluding deferred taxes); *Standards I*, 364 I.C.C. at 813-14 (not excluding deferred taxes); *Standards II*, 3 I.C.C.2d at 269 (excluding deferred taxes).

<sup>39</sup> See *Standards II*, 3 I.C.C.2d at 271.

<sup>40</sup> See *Consolidated Rail Corp.*, 855 F.2d at 90 ("Given the competition between the railroads and unregulated firms for capital, the railroads are substantially disadvantaged by being deprived of the opportunity to earn a return on the funds in comparison to the unregulated firms, and therefore the incentive to all investors, including the railroads, is to invest in the unregulated firms where the advantage of the 'double benefit' is retained.").

*funds used in investing in those assets.”*<sup>41</sup> In other words, the appropriate standard for measuring return on investment does not depend on the source of those investment funds. Whether the source is debt financing, equity financing, returns from existing traffic, or tax benefits bestowed by Congress, the standard should be the same: a rate of return equal to the current cost of capital on the replacement value of all rail assets required to meet the demand for railroad service.

Leading economists concur. Professors Murphy and Zmijewski explain how the current treatment of deferred taxes is contrary to basic valuation principles and amplifies the distortions from using accounting rate of returns to measure the financial health of the railroad industry.<sup>42</sup> Professor Kalt agrees. As he explained last year, the Board’s current practice “in effect assumes that investors expect no return on assets ‘financed’ by deferred taxes. But such an assumption provides no incentive to the investors to keep those assets deployed in the rail industry. They have the incentive to, and would be better off, re-deploying that capital in industries where they could earn their cost of capital. It is therefore rational that investors do expect to earn a return on deferred taxes and such expectations are reflected in the market-based determinations of the cost of equity used by the STB. Therefore, the STB’s exclusion of deferred taxes overstates the attractiveness of railroad industry investments.”<sup>43</sup>

Moreover, the Board’s treatment of deferred taxes creates worrisome practical problems. As the Board experienced in 2017, changes to corporate tax rates can produce ridiculously inaccurate measurements of financial health. If the

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<sup>41</sup> Opening Comments of Norfolk Southern Railway Company, EP 722, Attachment A, Economists’ Statement in Support of Staggers Act (Feb. 25, 1985) (emphasis added).

<sup>42</sup> Murphy & Zmijewski V.S. at ¶¶ 57-59.

<sup>43</sup> Kalt 2019 Written Testimony at ¶ 68.

Board had not wisely acted, its 2017 figures would have suggested a one-year phantom surge in railroad profitability, as the net operating incomes would be inflated to reflect the change in accumulated deferred taxes. This is unlikely to be the last time the Board will have to manually adjust its ROI calculation. While the corporate tax rate was stable for years, one can anticipate the rate changing in future administrations, leaving the Board's revenue adequacy measurement at the mercy of changes in future corporate tax rates.

## **II. The Board Should Establish A Comparison Approach For The Annual Revenue Adequacy Determinations.**

The Board's revenue adequacy methodology has existed essentially unchanged in the over three decades since *Standards II* was decided in 1986. In light of the Board's recent interest in revenue adequacy, the Board should consider whether the methodology it inherited from the ICC is actually measuring railroad revenue adequacy in a reliable and accurate way. In other words, is it true that a railroad whose Board-calculated ROI exceeds the industry cost of capital has reached a point where it has adequate revenues to "support prudent capital outlays," earn "a reasonable and economic profit," and "attract and retain capital in amounts adequate to support a sound transportation system in the United States"?<sup>44</sup> Both sound economic theory and an empirical analysis of data from comparable firms show that the Board's current method is not providing accurate annual determinations, and thus is not providing good evidence from which the Board can assess its progress in assisting railroads in achieving revenue adequacy.

### **A. The Comparison Proposal**

To better align the annual revenue adequacy determinations with Congress's purpose, *the Board should define annual revenue adequacy to mean that a railroad's*

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<sup>44</sup> 49 U.S.C. § 10704(a)(2).

*Adjusted STB ROI exceeded the industry cost of capital by more than the median S&P 500 firm's ROI exceeded its cost of capital.* The STB would implement this proposal by modifying the ROI calculation for the Class 1 carriers by including non-goodwill intangible assets in the investment base, removing the effect of annual deferred taxes from the ROI numerator, and removing the effect of accumulated deferred taxes liabilities from the ROI denominator. Professors Murphy and Zmijewski referred to this modified calculation as the Adjusted STB ROI. Second, the STB would direct the AAR to submit annually the Adjusted STB ROI and cost of capital calculations for every company in the S&P 500, using the same methodology used to measure the financial health of the freight railroads. From this robust dataset, the STB would calculate the median difference between the Adjusted STB ROI and the cost of capital for all companies in the S&P 500, except for banking and real estate companies. This median difference is referred to as the S&P Differential. Finally, the STB would re-define “revenue adequacy” for purposes of the annual revenue adequacy determination as earning an Adjusted STB ROI above the industry average cost of capital in excess of the S&P Differential.

To allow the Board to measure the practical effects of this proposal, Professors Murphy and Zmijewski have calculated the proposed S&P Differential from 2006 through 2019. A summary of the results is provided below, from Table 4 of the Professors' report, and more detailed year-by-year calculations are provided in their accompanying report and workpapers. As shown, the *typical, unregulated non-railroad firms* in the S&P 500 from 2006 through 2019 earned a median adjusted ROI over the cost of capital (the S&P Differential) of 10 percent.<sup>45</sup> And

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<sup>45</sup> As the Professors' report shows, the median S&P 500 firm's *unadjusted* ROI is 19% above its cost of capital. Petitioners recommend, however, that the Board use the *adjusted* ROI to enable a superior comparison for the reasons described in the Professors' report.

using that same accounting measurement of financial performance, the railroad industry was outperformed by 87% of those unregulated firms with whom they compete for capital. As the Professors explain, “If the railroads earn a rate of return net of cost of capital no higher than the average or median S&P firm, then there would be no presumption that railroads are earning abnormal returns and can set rates without constraint from competition, or that shippers’ current protections under the Board’s SAC and related proceedings are not sufficient.”<sup>46</sup>

**Table 4**  
**S&P 500 Companies Excluding Railroads, Financial Institutions and Real Estate Companies**

| Number of Observations, Median, 25th Percentile, and % Positive ROIC minus COC Over 2006-2019 Period |         |         |        |         |
|------------------------------------------------------------------------------------------------------|---------|---------|--------|---------|
|                                                                                                      | Minimum | Maximum | Median | Average |
| Number of Observations in Sample                                                                     | 393     | 415     | 409    | 406     |
| Median Adjusted ROIC minus COC                                                                       | 5%      | 12%     | 10%    | 9%      |
| 25th Percentile Adjusted ROIC minus COC                                                              | -2%     | 3%      | 2%     | 2%      |
| % with ROIC minus COC > 0.0%                                                                         | 68%     | 87%     | 83%    | 83%     |
| <b><u>Railroad Percentile in the Distribution of Adjusted ROIC minus COC</u></b>                     |         |         |        |         |
| Industry Weighted Average ROIC                                                                       | 9       | 25      | 13     | 14      |
| BNSF Railway                                                                                         | 8       | 24      | 14     | 15      |
| CSX Corporation                                                                                      | 6       | 26      | 10     | 12      |
| Grand Trunk Corporation                                                                              | 4       | 15      | 9      | 10      |
| Kansas City Southern                                                                                 | 5       | 20      | 10     | 11      |
| Norfolk Southern Corporation                                                                         | 7       | 21      | 11     | 13      |
| Soo Line Corporation                                                                                 | 1       | 34      | 13     | 14      |
| Union Pacific Corporation                                                                            | 8       | 35      | 17     | 19      |

Sources: Bloomberg; Compustat; Ibbotson Yearbook (2006-2019); STB Revenue Adequacy Determination Report (2006-2018); RevAd 2019 AAR workpaper1.pdf, titled "AAR Duplication of STB Workpapers."

The Board should use this rich dataset to place the financial performance of the freight rail industry into proper context when evaluating railroad revenue adequacy. Consideration of this market evidence is consistent with Congress’s direction to “treat[] the American railroad industry as any other business.”<sup>47</sup> An

<sup>46</sup> Murphy & Zmijewski V.S. ¶ 32.

<sup>47</sup> *Burlington N. R.R. Co.*, 812 F.2d at 235 (citing 126 Cong. Rec. 28,431 (1980) (statement of Rep. Staggers)); see *Groome & Assocs., Inc.*, STB Docket No. 42087, at

essential part of treating railroads like other businesses is recognizing that railroads are private enterprises that must compete with other private enterprises for capital. As the ICC observed,

[R]ailroads can obtain funds for investment only by offering rates of return comparable to other investment opportunities. Investments earning less than the cost of capital will not be able to retain existing funding or obtain new funding, because investors could invest available funds elsewhere at a higher rate of return.<sup>48</sup>

And as Professors Murphy and Zmijewski explain, “the relevant question is what rate of return is consistent with a competitive market and how does the profitability of the railroads compare with competitive market outcomes? Only if that comparison shows that the railroad industry has been unusually profitable *measured against typical, unregulated non-railroad firms* for a sufficiently long period of time is there a reason to investigate whether there might be a market failure that has permitted railroads to charge noncompetitive rates to at least some shippers, and to consider whether the Board’s existing tools to evaluate and constrain unreasonable exercise of a railroad’s market power in the places where it possesses and has exercised such power are not sufficient.”<sup>49</sup>

The comparison approach outlined above is feasible and would substantially improve the revenue adequacy evidence the Board considers. The methodology set forth in the Verified Statement could be used on an annual basis to calculate an S&P Differential to be added to the annual revenue adequacy determinations. The Board could direct the AAR to supply the necessary data analysis with its annual

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12 (“Congress directed [in the Staggers Act] that railroads be treated more like ordinary businesses than like public utilities.”).

<sup>48</sup> *Coal Rate Guidelines, Nationwide*, Ex Parte No. 347 (Sub-No. 1), Notice of Proposed Policy, at 7 (served Feb. 24, 1983).

<sup>49</sup> *Murphy & Zmijewski V.S.* ¶ 31.

cost of capital submission, so that it would be available for review by Board staff and comments from interested parties.

Moreover, the approach is fair and impartial to all parties. Because the comparison approach is keyed to the S&P 500, railroads are not given any special advantage. Rather, railroads are simply compared to the other companies in the S&P 500—an independently determined collection of major firms available to investors. Indeed, an understanding of how railroads compare to their competitors for capital is *essential* for the Board to assess and promote revenue adequacy in the way that Congress instructed. Congress’s definition of revenue adequacy requires evidence about whether railroads are earning “a reasonable and economic profit or return (or both) on capital employed in the business” and whether their returns “permit the raising of needed equity capital.” 49 U.S.C. § 10704(a)(2). Adoption of the S&P Differential gives the Board essential evidence to measure its progress toward assisting railroads with achieving those statutory goals.

**B. The Comparison Proposal Is Justified By The Statute and Sound Public Policy.**

There are compelling reasons to adopt the Comparison Proposal. The change would give effect to Congress’s definition of revenue adequacy as including a reasonable profit. A comparison approach would mitigate some of the known measurement errors that the ICC and STB have acknowledged are embedded in the accounting measurement currently used, but for which the agency has been unable to find any feasible fix. Adopting a comparison proposal would provide Congress, the STB, and the general public with a superior dataset to gauge whether the agency is carrying out its responsibility to “make an adequate and continuing effort to assist those carriers in attaining revenue levels.” And the data are public, readily available, easily verifiable, and would impose virtually no burden on the agency.

**i. The Comparison Proposal provides a reasoned way to include a “reasonable and economic profit or return” in the annual determination, as directed by Congress.**

As discussed above, section 10704(a)(2) states that for a carrier’s revenues to be considered adequate, those revenues must be sufficient not only to cover infrastructure costs and operating expenses, but also to earn a profit. The level of profit required is specifically defined as “a reasonable and *economic* profit or return.” 49 U.S.C. § 10704(a)(2) (emphasis added). The word “economic” used as a modifier of “profit or return” has a plain meaning. First, it is widely understood that an “economic” profit or return is different from an “accounting” profit or return.<sup>50</sup> Unlike an “accounting” profit, which is based on the historical book value of assets, an “economic” profit must be based on a replacement cost assessment of asset values. As the Eleventh Circuit has explained:

Accounting profits differ from economic profits in several important ways . . . . [A]ccounting profits exceed economic profits. Thus, the perfectly competitive firm in equilibrium earns zero economic profits though its normal returns are reflected in positive accounting profits. Hence, substantial accounting profits—say, 20 percent—may be consistent with trivial or zero economic profit and thus do not necessarily indicate any market power.<sup>51</sup>

Thus, because the STB’s revenue adequacy calculations are based on “accounting” profits, the STB’s calculations necessarily overstate a railroad’s “economic” profitability. Likewise, section 10704(a)(2)’s revenue adequacy definition

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<sup>50</sup> See *In re Coca-Cola Co.*, 117 F.T.C. 795, 950 n.93 (1994) (“Economic profit accounts for the opportunity costs of all the assets that a firm uses in its business, while accounting profit reflects a firm’s explicit historical expenditures.”).

<sup>51</sup> *Bailey v. Allgas, Inc.*, 284 F.3d 1237, 1252 n.21 (11th Cir. 2002); see *In re Coca-Cola Co.*, 117 F.T.C. at 950 n.93 (1994) (“For purposes of antitrust analysis, ‘economic profit,’ rather than ‘accounting profit,’ is the appropriate measure of firm performance.”).

requires a greater level of profitability than that currently reflected by the STB's annual calculations.

This distinction between economic and accounting profit is widely acknowledged by economists as well:

- “The two concepts of profit differ because total cost, in the economist’s definition, includes the opportunity cost of any capital, labor, or other inputs supplied by the owner of the firm. Thus, if a small business earns just enough to pay the owner the fees (say, \$35,000 per year) that her labor and capital could have earned if they had been sold to others, economists say she is earning zero *economic* profit. In contrast, most accountants will say her profit is \$35,000.”<sup>52</sup>
- “In the calculation of the implicit rental rate of capital used to determine long-run economic profits, capital assets should be valued at **replacement cost**, which is the long-run cost of buying a comparable-quality asset.”<sup>53</sup>

With regard to “economic . . . return,” the Antitrust Division of the Justice Department has recognized that accounting returns do not reflect “true economic rates of return”:

High accounting profits do not necessarily reflect the exercise of monopoly power. In particular, cost measures are normally available only from reports prepared in conformity with accounting conventions, but economics and accounting have significantly different notions of cost. Accounting figures seldom reflect the firm’s true economic cost of producing its goods and services, and accounting rates of return will often differ from true economic rates of return. For example, determining if a firm is earning an economic profit requires accounting properly for depreciation and the economic replacement cost of the assets the firm is using to generate its income. Yet the information

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<sup>52</sup> WILLIAM J. BAUMOL & ALAN S. BLINDER, *ECONOMICS—PRINCIPLES AND POLICY* 108 (6th ed. 1994) (emphasis in original).

<sup>53</sup> DENNIS W. CARLTON & JEFFREY M. PERLOFF, *MODERN INDUSTRIAL ORGANIZATION* 247 (4th ed. 2005) (emphasis in original).

reported by accountants frequently is not designed to measure and accurately reflect those costs.<sup>54</sup>

Because the Board assesses revenue adequacy using “accounting” profits/returns based on the book value of a carrier’s assets, the Board’s revenue adequacy calculations say nothing about the level of “economic profit or return” the STB is to assist railroads in earning.

Second, the term “reasonable and economic profit or return (or both)” means a profit or return (or both) *above* the cost of capital, not a profit or return *equal* to the cost of capital (as the Board currently measures revenue adequacy).<sup>55</sup> For example, in *Bailey v. Allgas, Inc.*, the Eleventh Circuit explained that “[e]conomists regard capital’s opportunity cost as a cost and define *economic profit* as the return to investors *above and beyond* what is necessary to induce them to invest.” 284 F.3d at 1252 n.21. Likewise, the Transportation Research Board has stated that “zero economic profits” means “break even.”<sup>56</sup> Zero profit—*i.e.*, a break-even earning of no more than the cost of capital—is not a profit; it is, by definition, the absence of

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<sup>54</sup> U.S. Dep’t of Justice, *Competition and Monopoly: Single-Firm Conduct under Section 2 of the Sherman Act*, Chapter 2 (IV)(A) (2008) (internal citations omitted); *see id.* at 29 (contrasting accounting return with economic return: “[A]vailable estimates of a firm’s capital costs, an important input into calculating a firm’s profitability, are generally based on accounting rules that do not account for the riskiness of the investment. If the investment, at the time it was made, was quite risky, a very high accounting rate of return may reflect a modest economic return. More generally, when all relevant economic costs are properly accounted for, what may at first seem to be a supracompetitive return may be no more than a competitive one (or vice versa).”).

<sup>55</sup> As noted above, section 10704(a)(2) defines adequate revenues as those sufficient to: i) allow for infrastructure and investment needed to meet present and future demand for rail services; ii) cover total operating expenses, including depreciation; and iii) provide for “a reasonable and economic profit or return (or both) on capital employed in the business.” The STB’s current revenue adequacy measurement fails to effectively reflect these three requirements.

<sup>56</sup> *Modernizing Freight Rail Regulation*, *supra* note 6, at 125.

profit.<sup>57</sup> The reference to a “reasonable” economic profit or return naturally implies some *positive* amount of profit.

Economic literature is in accord. “Economic profit . . . is the amount a firm earns *over and above* the payments for all inputs, including the interest payments for the capital it uses and the opportunity cost of any capital provided by the owners of the firm.”<sup>58</sup> Accordingly, the Board’s determination that a railroad is “revenue adequate” when its accounting ROI equals the COC—and the unsupported statements in *Guidelines*, which suggested a revenue adequacy constraint would be triggered if accounting ROI equals the COC—are inconsistent with the requirements of Section 10704(a)(2). Such an interpretation reflects no economic profit to the railroad at all, much less a “reasonable” amount as required by the statute, while simultaneously overstating a railroad’s actual “economic” profits or returns.

Moreover, it cannot be disputed that the railroad industry competes for capital with all the other companies listed in the S&P 500. Capital flows from industry to industry based on the relative returns offered by each.

Subsections 10704(a)(2)(A) and (B) provide further support for a comparison approach to monitor revenue adequacy. Congress explained that adequate revenue levels must “permit the raising of needed equity capital” and “attract and retain capital in amounts adequate to provide a sound transportation system.” Any significant regulatory movements tied just to cost of capital risks putting railroads at a permanent disadvantage relative to other firms in the economy competing for capital, which is the exact opposite of Congress’s goal in the 4-R Act and Staggers Act. As demonstrated in this Petition, if the Board’s methods for calculating return

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<sup>57</sup> *Id.*

<sup>58</sup> WILLIAM J. BAUMOL & ALAN S. BLINDER, *ECONOMICS—PRINCIPLES AND POLICY* 412 (11th ed. 2009) (emphasis in original, and some emphasis omitted).

on invested capital and railroad industry cost of capital were applied to other firms in the S&P 500, the median S&P 500 firm would have an ROI well above its cost of capital.<sup>59</sup> If railroads face the risk of heightened regulatory intrusion merely for earning no more than their cost of capital (as calculated by the STB), they would not be able to compete fairly or equally for capital investment, as envisioned by the statutory revenue adequacy definition.

**ii. The Comparison Proposal provides a reasoned way to address the known measurement error in the current annual calculations.**

The Verified Statement of Kevin Murphy and Mark Zmijewski explains why the Board’s annual revenue adequacy determinations are flawed from an economic perspective. A meaningful measurement of revenue adequacy must be forward-looking, not backward-looking.<sup>60</sup> As the Professors explain, “Expected future returns determine investors’ decisions about where to invest their capital and business executives’ decisions how to allocate their scarce resources—they look for opportunities that generate the greatest return on incremental investment, and not to average rate of return on all invested capital.”<sup>61</sup> For this reason, a revenue adequacy measurement ideally would assess the expected *future* rate of return on a railroads’ actual investment base—not the rate of return on the accounting book value reflected on a balance sheet.<sup>62</sup> “Accounting measures based on backward

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<sup>59</sup> *Hearing on Railroad Revenue Adequacy*, Ex Parte Nos. 761 & 722, Written Testimony of Professor Kevin Murphy, Ph.D., and Professor Mark Zmijewski, Ph.D., on behalf of UP, NS, and CN, at 5 (Nov. 26, 2019).

<sup>60</sup> Murphy & Zmijewski V.S. at ¶ 22.

<sup>61</sup> *Id.*

<sup>62</sup> *Id.* ¶¶ 22-25.

looking historical purchase prices and depreciation of the railroad's assets often are uninformative about a firm's ability to attract capital in the future."<sup>63</sup>

The current measurement relies solely on inherently unreliable accounting measurements. The Verified Statement details "the limitations and inaccuracies of accounting-based rates of return as estimates of economic rates of return."<sup>64</sup> As Professors Murphy and Zmijewski explain, the consensus in economic literature is that accounting measures based on depreciated historical costs "often are uninformative about a firm's ability to attract capital in the future."<sup>65</sup> The current replacement cost of assets is the economically appropriate value for determining return on investment, as the Board has heard previously from multiple leading economic experts.<sup>66</sup>

The case for using replacement costs is strongly supported by the economic consensus. Indeed, the Board has long recognized that replacement costs are conceptually superior to book value.<sup>67</sup> However, the Board has held that it is difficult to implement a replacement cost solution and therefore has rejected past proposals to do so.<sup>68</sup>

Petitioners emphatically support a Board effort to revisit the question of using replacement costs in the annual determination and in efforts to develop a data-driven method of estimating replacement costs. Until such time as that fundamental flaw in the Board's use of accounting measures is resolved, and in

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<sup>63</sup> *Id.* at ¶ 23.

<sup>64</sup> *Id.* at ¶ 82.

<sup>65</sup> V.S. at ¶ 23.

<sup>66</sup> *See, e.g.*, 2014 Brinner V.S. at 14-26; 2014 Kalt V.S. at 31.

<sup>67</sup> *Standards I*, 364 I.C.C. at 818 (replacement costs "may better reflect the true economic costs associated with an investment").

<sup>68</sup> *See supra* at 13-14.

light of the Board's longstanding concerns about the "practicality" of such an analysis, this Petition proposes a more modest path by which the Board can incrementally improve the accuracy and reliability of its methodology – even as the inherent shortcomings of using book values remain unaddressed. Using a comparative approach to see how the returns of other S&P 500 companies on their book value compare to their cost of capital would give the Board information from the marketplace about typical relationships between accounting book values and cost of capital. While replacement costs would be superior, use of this marketplace information would improve the accuracy of revenue adequacy determinations.

For example, assume the STB were charged by Congress with determining whether the temperature in Washington D.C. was above or below the average for other major U.S. cities. But the only thermometer type the agency had was old and plagued with known measurement error and bias. One option would be to try to build a better thermometer. Another would be to use its existing flawed thermometer to measure the temperature for all major U.S. cities. Even though the thermometer might not be a trustworthy guide as to the precise D.C. temperature, using the same flawed thermometer across the board would still provide guidance as to whether D.C. was hotter or colder than the average.

Finally, contextualizing the Board's annual findings would address the flawed assumption that the cost of capital is a clear demarcation between revenue adequacy and revenue inadequacy. As Professors Murphy and Zmijewski explain, firms in a competitive marketplace often earn returns above their cost of capital.<sup>69</sup> Moreover, Congress specifically provided that revenue adequacy should provide for "a reasonable and economic profit or return." 49 U.S.C. § 10704(a)(2). What is reasonable economic profit? This S&P 500 comparison proposal can answer that

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<sup>69</sup> See Murphy & Zmijewski V.S. at ¶¶ 33-34.

question too. The median S&P Differential—the difference between accounting ROI enjoyed, and the cost of capital confronted, by S&P 500 firms—will capture both the measurement error and the normal and reasonable economic profit enjoyed by other unregulated companies in competitive markets. If the Board is interested in determining whether railroads are unusually profitable in a way that could be attributed to the undue exercise of market power, the test is not to compare accounting ROI to an arbitrary cost-of-capital line, but rather to compare the railroad industry to the normal profits in other competitive industries. If railroads are earning returns net cost of capital that are consistent with those earned by other large-scale companies, there can be no reasonable presumption that railroads are earning supra-competitive profits. Rather, contextualizing the annual findings would show whether the railroads are earning the “reasonable and economic profit or return” contemplated by Congress. 49 U.S.C. § 10704(a)(2).

**iii. The Comparison Proposal would offer a richer dataset to measure the relative financial success of the rail industry.**

The best way to assess the reliability of the Board’s 33-year-old methodology is to measure railroad financial performance against the performance of other companies in the marketplace with which railroads compete for capital. Georgetown University’s Professor Jeffrey Macher urges that “[d]espite the general inability to interpret increased profitability as an indication of excessive or monopolistic returns, it is nonetheless instructive to compare rail industry returns with those from other comparable industries.”<sup>70</sup> And the 2015 report, *Modernizing Freight Rail Regulation*, published by the Transportation Research Board, similarly noted that the “ritualistic” annual findings offered “little substantive information for

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<sup>70</sup> See Jeffrey T. Macher et al., *Revenue Adequacy: The Good, the Bad, and the Ugly*, 41 Transp. L.J. 85, 106 (2014).

regulators and policy makers” and urged the Board to “obtain a richer set of information” to determine “whether a railroad’s profits are consistently outside a reasonable band of profitability that characterizes many other industries over a business cycle.”<sup>71</sup>

Petitioners are providing the Board with that richer dataset to compare railroad returns with other industries. This proposed methodology measures railroads’ performance against their rivals in the marketplace for capital. As demonstrated by Professors Murphy and Zmijewski, under the Board’s methodology, the vast majority of firms in the S&P 500 earn returns on investment far above their cost of capital.

Table 1 from the Professors’ report shows the crux of the analysis, a survey of S&P 500 firms’ ROI relative to their cost of capital from 2006 through 2019. This analysis shows that an average of 88% of all firms earned an ROI above their cost of capital, and that the median firm earned an ROI at 19% above its cost of capital. (In other words, if the cost of capital were 10%, the median firm earned an ROI of 29% using the Board’s existing methodology.) Under this analysis, each of the Class I railroads earned an ROI net cost of capital substantially below the median S&P 500 company in each of the studied years.

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<sup>71</sup> *Modernizing Freight Rail Regulation*, *supra* note 6, at 8, 155, 202, 215.

**Table 1**  
**S&P 500 Companies Excluding Railroads, Financial Institutions and Real Estate Companies**

| Number of Observations, Median, 25th Percentile, and % Positive ROIC minus COC Over 2006-2019 Period |         |         |        |         |
|------------------------------------------------------------------------------------------------------|---------|---------|--------|---------|
|                                                                                                      | Minimum | Maximum | Median | Average |
| Number of Observations in Sample                                                                     | 368     | 405     | 395    | 391     |
| Median ROIC minus COC                                                                                | 13%     | 29%     | 19%    | 20%     |
| 25th Percentile ROIC minus COC                                                                       | -1%     | 6%      | 5%     | 4%      |
| % with ROIC minus COC > 0.0%                                                                         | 73%     | 91%     | 89%    | 88%     |
| <b><u>Railroad Percentile in the Distribution of ROIC minus COC</u></b>                              |         |         |        |         |
| Industry Weighted Average ROIC                                                                       | 9       | 22      | 13     | 15      |
| BNSF Railway                                                                                         | 9       | 23      | 15     | 15      |
| CSX Corporation                                                                                      | 6       | 24      | 10     | 12      |
| Grand Trunk Corporation                                                                              | 3       | 16      | 10     | 10      |
| Kansas City Southern                                                                                 | 4       | 18      | 8      | 9       |
| Norfolk Southern Corporation                                                                         | 10      | 24      | 13     | 15      |
| Soo Line Corporation                                                                                 | 2       | 26      | 13     | 13      |
| Union Pacific Corporation                                                                            | 8       | 30      | 22     | 20      |

The assumptions and methodology of this comparative analysis are set forth in the Verified Statement, and the key assumptions are summarized below.

Cost of Capital. Cost of Capital for each comparison firm was determined using the same methodology used by the STB, as explained in Appendix A to the Verified Statement.

Comparables. The S&P 500 was selected as the comparable group because it represents the largest companies in the United States, and thus is a proxy for the firms with which railroads compete for capital. The S&P 500 is a stock market index that measures the stock performance of 500 leading companies listed on stock exchanges in the United States.<sup>72</sup> It is one of the most commonly followed equity indices, and many consider it to be one of the best representations of the U.S. stock market.<sup>73</sup> In fact, the ICC and STB have consistently used data from the S&P 500

<sup>72</sup> See *Dow Jones & Co. v. Int'l Securities Exchange, Inc.*, 451 F.3d 295, 298 (2d Cir. 2006).

<sup>73</sup> *Standard & Poor's Corp. v. Commodity Exchange, Inc.*, 538 F. Supp. 1063, 1067 (S.D.N.Y. 1982) ("The S&P 500 Stock Price Index is a broad-based, weighted,

from the year 1926 to calculate the market risk premium in the Capital Asset Pricing Model (“CAPM”).<sup>74</sup>

Certain firms in the S&P 500 were excluded from the analysis because the nature of their business causes them to have different capital structures from other firms. In particular, financial services firms and real estate firms were excluded from the comparison group. Railroads were also excluded.

ROI calculation. Two versions of ROIC were calculated for each firm in the comparison group. First, an “STB ROIC” was calculated that reflects the precise methodology that the STB currently uses in its annual determinations. Second, an Adjusted STB ROIC was calculated that makes two corrections to the STB’s methodology designed to enhance comparability. *See supra*, Table 4.

The first correction in Adjusted STB ROIC is to include non-goodwill intangible assets in a company’s investment base. While this adjustment has little impact on railroads (which typically do not have significant non-goodwill intangible assets), it has a significant effect on certain firms that do have such assets in the form of brand names or trademarks. Including these assets in the investment bases of the comparable group improves the comparability of the group by more accurately reflecting the total assets of the comparable firm. The practical effect is to lower the ROIC for companies with those assets.

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composite index based on the prices of 500 selected stocks. The index is designed to accurately portray a pattern of common stock price movement. Due to its broad base, the 500 Index is less susceptible to manipulation than an index based on a small number of stocks, and it also provides a more accurate barometer of market performance. Of the broad-based stock indexes, the S&P 500 is the best known, the most widely used, and the most accurate indicator of market conditions. The 500 is the most popular stock price index used by institutional investors and investment advisors.”).

<sup>74</sup> *See, e.g., Methodology to be Employed in Determining the Railroad Industry’s Cost of Capital*, at 7, 9, 11, Ex Parte No. 664 (served Jan. 17, 2008); *Railroad Cost of Capital – 2006*, at 1, Ex Parte No. 559 (Sub-No. 10) (served Jan. 17, 2008).

The second correction is to remove the distorting impacts of deferred taxes by adopting a “flow-through” approach to deferred taxes. This adjustment both removes the effect of annual deferred taxes from the ROI numerator and removes the effect of accumulated deferred taxes liabilities from the ROI denominator. The adjustment effectively makes the changes proposed in Section III of this Petition.

After these adjustments are made, the comparison analysis still shows that 84% of S&P 500 firms earn Adjusted STB ROICs over their cost of capital, and that the median S&P firm earns an Adjusted STB ROIC 10% over the cost of capital (*i.e.*, if the cost of capital were 10%, the median Adjusted STB ROIC would be 20%).

The conclusions from the data analysis in the Verified Statement are clear. When the median firm in the S&P 500 is earning an accounting return 10% over its cost of capital—and given the well-known measurement errors with its existing calculation and Congressional directive to help carriers earn “a reasonable and economic profit or return,” 49 U.S.C. § 10704(a)(2)—it is indefensible for the Board to declare a railroad has achieved “revenue adequacy” after earning an accounting ROI equal to its cost of capital (and even less defensible for the Board to adopt special regulatory restrictions to prevent that railroad from earning “excess” revenues above its cost of capital). The Board should amend its methodology so that it is incorporating real world information about what typical firms earn above their cost of capital. That information would aid the Board in executing its statutory obligations to monitor and promote revenue adequacy, and create a measuring stick that the Board could use to identify situations where a railroad’s earnings above cost of capital have reached a level warranting further investigation.

**iv. The Comparison Proposal is easily implemented and verifiable.**

Finally, the comparison approach is feasible and would substantially improve the revenue adequacy evidence the Board considers. While the calculations are

numerous, they are drawn from public sources that are reliable and verifiable. A good analogy is the annual cost of capital calculation by the STB. The methods for determining the cost of capital for the freight rail industry are complex and the details important. But once the agency prescribed in a separate rulemaking with broad public input the methodology it would use, the annual cost-of-capital calculations became a simple, mechanical application of that complex methodology. The same would be true here. Once the STB prescribes how it would compare the performance of the freight railroads against unregulated companies in the S&P 500, the annual revenue adequacy proceeding would remain a mechanical application of that comparison analysis, fully accessible and transparent to the public.

Moreover, the work to gather the data and implement the approach would be borne by the railroad community. Application of the methodology set forth in the Verified Statement would be used on an annual basis to calculate an S&P Differential to be added to the annual revenue adequacy determinations. But we would expect the Board to require the AAR to supply the necessary data analysis with its annual cost of capital submission, and to perform all the necessary calculations, so that it would be readily available for Board staff review and for comments from any interested parties.

Given the measurement errors with its existing calculation and Congressional directive to help carriers earn “a reasonable and economic profit or return,” Petitioners request that the STB initiate a rulemaking proceeding to seek public comment on this proposal, where the agency would re-define “revenue adequacy” in the annual determinations to mean earning a return on investment that exceeds the cost of capital by more than the median S&P 500 company exceeds its cost of capital.

### **III. The Board Should Also Adopt a Common Sense Approach to the Treatment of Deferred Taxes.**

#### **A. The Flow-Through Proposal**

The current utility approach inherited from the ICC decades ago is painting a distorted picture of the financial strength of the freight rail industry by artificially reducing the investment base by billions of dollars. Accordingly, Petitioners also urge the STB to institute a rulemaking proceeding to explore the so-called flow-through approach originally advocated by United States Department of Transportation (DOT) in the mid-1980s. At the time, DOT touted the superiority of the flow-through approach for several reasons. First, it would be sensitive to the situation of the individual carriers. Second, DOT observed that this alternative was far superior to the Utility Method because railroads expect a return on all assets, regardless of how they are financed. *See Standards II*, 3 I.C.C.2d at 271. Third, DOT observed that the agency's concern about closely following generally accepted accounting ("GAAP") principles was unfounded, as the ICC was under no obligation to abide by GAAP in all proceedings; and the Net Railway Operating Income ("NROI") is defined by the agency, not GAAP. Fourth, DOT correctly observed that the flow-through approach would require only a simple addition or subtraction of the deferred tax figure from NROI, not a major restructuring of the Uniform System of Accounts. Finally, DOT observed that a flow-through method for railroads would not hinder comparisons with other industries. While the ICC vacillated between the shipper-preferred alternative (the current method) and the railroad-preferred alternative, it never explained why it rejected DOT's alternative proposal.

Under DOT's flow-through approach, annual deferred taxes are not deducted from net operating income in calculating the ROI for a given year. Similarly, accumulated deferred taxes are not deducted from the investment bases. The practical effect is an annual measurement that is on a cash basis, where the impact

of any deferred taxes is captured by the measurement of financial health if and when those taxes come due.

This approach is based on sound economics. As Professors Murphy and Zmijewski explain, eliminating the effect of deferred taxes “is consistent with basic valuation principles, which measures the value of a company as the discounted value of the cash flows the company is expected to generate for its investors. Eliminating the effect of deferred income taxes in the Provision of Income Taxes is one of the required adjustments to measure a company’s cash flows in order to align the company’s operating income with the economic concept used in measuring a company’s economic profit.”<sup>75</sup> And removing the distorting effect on the net investment base “mitigates—but does not eliminate—the effect of two of the factors that make accounting rates of return inaccurate estimates of the cost of capital: depreciation in excess of economic depreciation and the book value of the assets relative to the market value of the assets.”<sup>76</sup>

The Professors’ recommendation is echoed by virtually every economist to have testified on this issue. *See, e.g.,* Opening Comments of Norfolk Southern Railway Company, EP 722, Verified Statement of Bradford Cornell, at 23 (filed Sep. 5, 2014) (“using an ROI calculation that backs deferred taxes out of invested capital” means that “railroads will not be able to either attract or retain as much equity capital as they otherwise would, leading to the environment of which the ICC spoke wherein ‘there is an incentive to take funds generated within the railroad industry and invest them elsewhere, where market-determined rates of return are available.’” (citations omitted)). Indeed, abandoning the Utility Method was

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<sup>75</sup> Murphy & Zmijewski V.S. at ¶ 57 (citing ROBERT W. HOLTHAUSEN & MARK E. ZMIJEWSKI, CORPORATE VALUATION: THEORY, EVIDENCE AND PRACTICE, Chapters 13 and 14 (2d ed. 2020)).

<sup>76</sup> *Id.* ¶ 58.

supported by the 1985 joint statement of leading economists, who urged the ICC that: “The appropriate standard for determining the adequacy of railroad revenues is a rate of return equal to the current cost of capital on the replacement value of all rail assets that are required to meet the demands for railroad service, regardless of the source of funds used in investing in those assets.”<sup>77</sup>

Moreover, as discussed below, shifting to DOT’s flow-through approach – as recommended by Professors Murphy and Zmijewski – has many practical benefits. It avoids the absurd result of portraying a railroad with a mountain of deferred debt owed the federal government as financially healthier than an otherwise identical railroad with no deferred taxes. It is plainly better suited for a non-utility industry, like the freight rail industry. And it would prevent future artificial fluctuations in the Board’s regulatory calculations driven by changes in tax policy.

Therefore, even if the Board rejects other aspects of the S&P comparison approach to revenue adequacy, it should adopt DOT’s flow-through approach for deferred taxes—a reasonable proposal that remains well-calibrated to improve the accuracy of the Board’s regulatory calculations.

**B. The Flow-Through Treatment of Deferred Taxes Avoids Absurd Results and Is A Better Fit For The Rail Industry.**

**i. The Current Utility-Based Method for Deferred Taxes Produces Absurd Results.**

The Board inherited its current approach to deferred taxes from the ICC, which adopted it in 1986 out of a desire to come closer to “a realistic picture of the current state of the railroad industry.”<sup>78</sup> In reality, this quarter-century-old approach does not portray a realistic picture. Rather, it portrays a distorted one.

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<sup>77</sup> Opening Comments of Norfolk Southern Railway Company, EP 722, Attachment A, Economists’ Statement in Support of Staggers Act (Feb. 25, 1985).

<sup>78</sup> *Standards for Railroad Revenue Adequacy*, Decision of May 30, 1986 (served June 5, 1986).

The flaw in the way the Board currently calculates deferred taxes is best described with an illustration. Imagine two railroads. Railroad A has \$2.5 million in annual operating revenues, incurs \$1 million in annual operating expenses, pays \$500,000 in annual taxes, and has an investment base of \$10 million. Railroad B is identical in every respect save one. Railroad B has the same revenues, operating expenses, annual tax expenses, and investment base as Railroad A, but Railroad B also has historical deferred tax liabilities of \$3 million that it must eventually pay to the government.

Which of these two railroads is more financially healthy? The common sense answer is obvious—it's Railroad A. All things being equal, a railroad that does not have deferred tax liabilities is plainly in a superior financial position. But under the Board's current methodologies, *Railroad B* is deemed to have a significantly higher return on investment. Table A illustrates how this happens. Because the Board would subtract Railroad B's deferred tax liability from its investment base before calculating its ROI, its calculations produce a substantially higher ROI for the railroad with a substantial balance of deferred taxes.

**Table A**

|                            | Railroad A   | Railroad B   |
|----------------------------|--------------|--------------|
| Revenue                    | \$2,500,000  | \$2,500,000  |
| Operating Expenses         | \$1,000,000  | \$1,000,000  |
| Taxes                      | \$500,000    | \$500,000    |
| Annual Deferred Taxes      | \$0          | \$0          |
| Investment Base            | \$10,000,000 | \$10,000,000 |
| Accumulated Deferred Taxes | \$0          | \$3,000,000  |
| ROI Current Methodology    | 10.0%        | 14.3%        |

This result makes no economic sense. It vividly demonstrates that the Board's practice of reducing a railroad's investment base by its accumulated

deferred taxes produces inaccurate measurements of a railroad's financial health. It creates significant regulatory distortions—both in annual revenue adequacy determinations and in important regulatory tools like the RSAM benchmark and URCS costing. Removing deferred taxes from a railroad's investment base before calculating its ROI produces artificially inflated returns, and prevents the Board from accurately measuring actual railroad financial performance.

The Tax Cuts and Jobs Act of 2017 provides an apt example of the distorted results of the current methodology. The Act adopted a lower corporate tax rate, which reduced the value of accumulated deferred taxes. As a result, 2017 deferred taxes for all Class I railroads were substantially negative, amounting to billions of dollars for several railroads. Unless the STB excluded the impacts of these massive negative deferred taxes, under its utility-based methodology the 2017 ROI for all Class I carriers would have skyrocketed. The Board understood that this result was absurd and ultimately decided simply to ignore the impact of the legislation in its calculation of deferred taxes. Yet, ignoring this change in tax law is not a permanent solution. Similar adjustments will be needed in future years if other Congresses change tax policy again.

The Board should adopt a better, permanent solution. At the time that the ICC adopted the approach currently used by the Board, the U.S. Department of Transportation proposed the ICC instead adopt a flow-through approach for deferred taxes.<sup>79</sup> Under a flow-through approach, annual deferred taxes are not removed from a railroad's net operating income, and accumulated deferred taxes are not subtracted from its investment base. The result is an approach that avoids distortions and is better tailored for the rail industry.

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<sup>79</sup> *Standards II*, 3 I.C.C.2d at 270-71.

The flow-through approach reflects the economic realities of railroad financial health. A simple example set forth in Appendix A illustrates the point. Assume a railroad with \$2.5 million in annual revenue, operating costs of \$500,000 and a book value of investments equal to \$10 million. All this stays constant over time, ignoring the effect of inflation or depreciation, with only the taxes of the company changing. We hold everything constant to pinpoint how the different treatments of deferred taxes affect the annual revenue adequacy (ROI) calculations. In this hypothetical, the railroad would normally pay \$750,000 in taxes a year, but \$250,000 is tax deferred for the first four years, so the railroad only pays \$500,000 in taxes. In years 5 through 8, the tax bill comes due, with the taxes rising to \$1 million a year as \$250,000 in deferred taxes are paid to the government.

This hypothetical railroad is earning more after-tax income in years 1 through 4 (when it is benefiting from deferred taxes) and less after-tax income in years 5 through 8 (when it is paying those taxes). So an accurate measure of its ROI ought to show a higher ROI in years 1 through 4 and a lower measure of its ROI in years 5 through 8. But that is not what the Utility Method produces.

As Appendix A shows, between the Utility Method and the flow-through approach, only the flow-through approach accords with the economic reality that the railroad has a higher return on investment and better overall financial performance when its taxes are lower due to deferred taxes than it does when it is paying those deferred taxes. Under the flow-through approach, in Years 1 through 4, the railroad enjoys higher after-tax cash flows and returns (a 15% return on investment) because of the deferred taxes. When the tax bills come due, the financial performance of the railroad worsens, with lower after-tax cash flows and only a 10% return on investment. This result is just as one would expect.

The Utility Method, by contrast, produces indefensibly arbitrary results, because it both smooths over the timing of returns *and* systemically skews

upwardly the average return on investment over the 8-year tax cycle. As Appendix A shows, the Utility Method would suggest the following distorted pattern of returns over the 8-year cycle: 12.8%, 13.2%, 13.5%, 13.9%, 13.5%, 13.2%, 12.8%, and 12.5%. This pattern of returns is facially flawed. It suggests that the health of the railroad is improving steadily from years 1 through 4, when in the hypothetical nothing has changed. The reported financial health under the Utility Method would peak in year 4, when the deferred taxes are coming due, then fall steadily in years 5 through 8, when again in the hypothetical nothing has changed. And the problem with the Utility Method is not just the bizarre pattern of rising and falling returns, but a systematic bias—as the overall “average” is 13.2%, which is above the real average return of 12.5%. The reason the Utility Method is producing such odd results flows from the removal of accumulated deferred taxes from the investment base when calculating the ROI. Rather than improve precision—as the ICC hoped in the 1980s—shifting to the Utility Method has created more distortions and introduced a new bias in the annual revenue adequacy findings.

**ii. The Utility Method Is a Poor Fit for the Railroad Industry.**

The Utility Method was not invented by the ICC. It reflects a common way of dealing with deferred taxes in heavily regulated industries (like utilities). But the rationale for this approach only makes sense in public utility markets where the regulator provides guaranteed returns. This is not the case for the railroad industry.

For many public utilities, the government regulators permit the utility to charge customers higher rates *immediately* to cover the future deferred taxes. This is necessary to give the benefit of the deferred taxes to the utility and promote investment. If the regulator forces the utility to charge lower rates because of the lower taxes (thus passing the deferred tax benefit from the utility to the public), it

would strip the utility of all the benefits of the deferred tax program. This, in turn, would defeat the congressional purpose of deferred taxes by destroying the incentive to invest.

As an over-simplified illustration, assume an electric utility had \$500,000 in deferred taxes in Year 1. The regulators, to provide the utility a regulated but guaranteed return, would permit the utility immediately to collect \$500,000 from its customers and place that money into a reserve to pay the future tax liability. But utility regulators would not permit the utility to earn a return on that \$500,000 while it sits in the reserve awaiting payment to the federal government. And so when it calculates the regulated (and guaranteed) ROI for the utility, it backs out \$500,000 from the net investment base (that would otherwise include this cash reserve). The ICC echoed this equitable concern when it adopted the Utility Method, noting that “when we allowed railroads to treat deferred taxes as an expense without a corresponding reduction in the net investment base we allowed the railroads a double benefit: they were allowed to demand rates sufficient to cover tax liabilities not yet paid and also to collect additional profits on the funds held on reserve to pay such deferred taxes.” *Standards II*, 3 I.C.C.2d at 272.

Whether or not that decision makes sense in the utility context, it makes no sense in the railroad context. The railroad industry is fundamentally different from public utilities. There are no guaranteed returns for rail carriers, and revenues are driven by market forces not by regulatory fiat. To use the same simplified example, if a railroad had \$500,000 in deferred taxes in Year 1, even if that figure were used to offset the net income in the annual revenue adequacy findings, it would have virtually no impact on the rates a railroad can or will collect from its customers. Those are driven by market forces, because there are no guaranteed returns in the railroad industry.

Moreover, even if the STB had some residual concerns about the “fairness” of a double-benefit (as it did regarding the hybrid approach), any conceivable double-benefit is removed by shifting to the flow-through approach. Under that approach, annual net income is not offset by future tax liability, so there is no double-benefit. In other words, under the flow-through approach, no carrier could conceivably be “allowed to demand rates sufficient to cover tax liabilities not yet paid” and thus there is no reason to remove accumulated deferred taxes from the investment base. In sum, there is no reason to continue using the Utility Method. That Method is a poor fit for the economics of the rail industry. A superior approach is available.

### **iii. The Flow-Through Approach Has Many Benefits.**

The flow-through approach, where ROI is calculated based simply on real net income and the actual value of railroad assets, is superior to the continued use of the Utility Method for five reasons.

First, as demonstrated above, the flow-through approach better matches the Board’s monitoring tools with railroads’ real-world financial performance. Under the flow-through approach, the Board’s findings would be tied directly to the real financial performance of the industry. As shown in Appendix A, when the industry is enjoying higher real income because of deferred taxes, that return would be captured in the Board’s annual financial snapshot. Similarly, if real income fell when taxes are due, the lower railroad return would be accurately captured in the annual revenue adequacy findings. The discrepancy between changes in real income and the agency’s annual findings – a discrepancy that the ICC claimed justified the adoption of the Utility Model – would vanish and never return.

Second, the sole economic justification for the ICC’s decision to reduce the investment base by accumulated deferred taxes was the perception that deferred taxes reflect an “interest-free” loan from the federal government and that a

regulated entity therefore deserves no return on investments funded with that cash flow. This idea is fundamentally flawed.

No matter the source of internally generated funds, the opportunity costs of making investments with those funds is the same. The number of ways a railroad can generate internal funds to re-invest in the industry is nearly infinite. It could improve productivity, expand into new markets, improve service and take market share from the trucking industry, sell assets, or make investments designed to reduce taxes by taking advantage of deferred tax programs. The source of the internal funds is irrelevant to the economic cost of re-investing that money in the railroad industry. And the opportunity cost of deploying capital internally is the cost of capital.<sup>80</sup>

Third, the flow-through approach provides optimal incentives for capital investment. Providing the optimal incentive for private investment in the railroad industry is a paramount public policy for the STB. The benefits that flow from private capital are numerous. And the Board can only foster private investment by creating a regulatory environment that is hospitable to capital investments, as it has no authority to compel investments in the industry.

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<sup>80</sup> The ICC thus got it right the first time it considered this question. “If we exclude internally generated funds, whether stemming from accelerated depreciation or any other railroad activity, from the investment base, the effect will be to establish a rate of return below the cost of capital. This, in turn, will result in incentives to railroads to invest these funds in nonrail operations.” *Standards I*, 364 I.C.C. at 813; see also *Bessemer*, 691 F.2d at 1116 (explaining the “simple fact” that “for all businesses[,] accelerated depreciation is a source of funds which may be reinvested. If the railroad industry were to be put in the position that unlike unregulated industries it could not earn a rate of return on investment of such funds, it would be at a competitive disadvantage in seeking equity capital, and it would be encouraged to invest the funds generated from accelerated depreciation elsewhere than in the railroad business. . . . It would, moreover, produce a rate of return below the cost of capital, since capital markets act with knowledge of the availability of accelerated depreciation as a source of funds.”).

In the 1980s, the ICC justified its choice to use the Utility Method by reasoning that it would have no impact on the investment incentives of the railroad industry. That was actually true in the 1980s, when the annual revenue adequacy findings had virtually no impact on any important regulatory function because they were used to just monitor the health of the railroad industry.<sup>81</sup> In that case, investors and the railroads base their decisions on the real economics of the industry, not on figures published by the STB. Now, however, the annual revenue adequacy findings are slowly creeping into rate setting, first in the Three-Benchmark test and more recently in the Board's widely-criticized limit-price test for market dominance. But even if the STB only uses the RSAM figure as originally designed (in the Three-Benchmark cases), the Board's refusal to provide the railroad a return on the value of capital investments will create an environment that is hostile to private investment and drive capital to other industries.

Continued use of the Utility Method would have the counter-productive effect of penalizing a railroad that invests in new rail property. The ICC recognized this concern that "the use of the utility method would result in lower allowable rates of return for those railroads that have made the largest investment in new rail property." *Standards II*, 3 I.C.C.2d at 269. This observation is correct, as the more investment a railroad makes in new rail property, the more deferred taxes that will flow from features such as accelerated depreciation, and the lower the allowable

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<sup>81</sup> However, the Third Circuit was not impressed with the ICC's argument. It observed that the ICC's argument "ignores the fact, emphasized by the railroads, that they have to compete for capital with unregulated firms which do retain the second benefit of an opportunity to earn a return on those funds." *Consol. Rail Corp.*, 855 F.2d at 90. The Court reasoned that "Given the competition between the railroads and unregulated firms for capital, the railroads are substantially disadvantaged by being deprived of the opportunity to earn a return on the funds in comparison to the unregulated firms, and therefore the incentive to all investors, including the railroads, is to invest in the unregulated firms where the advantage of the 'double benefit' is retained." *Id.*

rate of return under the Utility Method. While the ICC ignored its own reservations, the STB should not follow suit.

Fourth, the flow-through approach would help to prevent future artificial fluctuations in the Board's regulatory calculations driven by changes in tax policy. Under this approach, the annual measurement of the financial health of the industry will be a function of real net operating income and the value of railroad assets. If there is a significant change in tax policy, it will have no impact on the annual revenue adequacy findings until those changes materialize in lower (or higher) taxes and higher (or lower) net operating income. If the Board stays with the Utility Method, in contrast, these issues will resurface time and time again. The flow-through approach would provide welcomed stability to the agency's monitoring responsibility, and promote the comparability of its findings over time. Otherwise, the Board's revenue adequacy findings will have less to do with real economic market conditions facing the industry, and be driven more by accounting treatment of future tax liability that may become increasingly volatile.

Finally, implementing the flow-through approach would be straightforward and eminently reasonable. The Board does not need any new information from the railroads to implement the flow-through approach—it already has all the information it needs. Prospectively, some modest changes to the Schedule 250 form would be needed to reflect the implementation of the flow-through method.<sup>82</sup> Schedule 210 and 250 could be kept the same, and the Board would not need to delay its monitoring function, or any other regulatory function.<sup>83</sup>

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<sup>82</sup> Specifically, the calculations in Line 12 and 13 of the Form that subtract accumulated deferred taxes from the net investment base in Line 11 are unnecessary. Going forward, the net investment base before adjustment for deferred taxes in Line 11 would be the final net investment base.

<sup>83</sup> Implementing this change through the URCS program is similarly straightforward. No changes to the underlying URCS code are needed. Instead, once

## CONCLUSION

As Petitioners stated at the outset, these proposed changes should be made regardless of whatever action the Board takes on revenue adequacy in other dockets. They will improve the accuracy and reliability of the financial health measurements Congress has required the Board to undertake. They will enable the Board to carry out faithfully its statutory responsibility to promote the financial health of the railroad industry.

The Board should emphatically not continue to rely on a fundamentally flawed and misleading measure of revenue adequacy inherited from its predecessor. The Board instead should improve its measurement tool. And then the Board should place its annual findings into real-world financial context: by properly comparing the performance of the freight rail industry to that of other American industries joined in the intense and relentless struggle for scarce capital.

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the Board issued a final rule indicating that it will no longer remove accumulated deferred taxes from the investment base (either road property investment or equipment), its staff can quickly implement that decision when releasing the next year's URCS model but zeroing out the deferred tax input into the URCS model.

Respectfully submitted,

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September 1, 2020

Appendix A

|                       | Year 1       | Year 2       | Year 3       | Year 4       | Year 5       | Year 6       | Year 7       | Year 8       |
|-----------------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| Revenue               | \$2,500,000  | \$2,500,000  | \$2,500,000  | \$2,500,000  | \$2,500,000  | \$2,500,000  | \$2,500,000  | \$2,500,000  |
| Operating Costs       | \$500,000    | \$500,000    | \$500,000    | \$500,000    | \$500,000    | \$500,000    | \$500,000    | \$500,000    |
| Taxes                 | \$500,000    | \$500,000    | \$500,000    | \$500,000    | \$1,000,000  | \$1,000,000  | \$1,000,000  | \$1,000,000  |
| Annual Deferred Taxes | \$250,000    | \$250,000    | \$250,000    | \$250,000    | (\$250,000)  | (\$250,000)  | (\$250,000)  | (\$250,000)  |
| Investment Base       | \$10,000,000 | \$10,000,000 | \$10,000,000 | \$10,000,000 | \$10,000,000 | \$10,000,000 | \$10,000,000 | \$10,000,000 |
| Total Deferred Taxes  | \$250,000    | \$500,000    | \$750,000    | \$1,000,000  | \$750,000    | \$500,000    | \$250,000    | \$0          |
| Utility ROI           | 12.8%        | 13.2%        | 13.5%        | 13.9%        | 13.5%        | 13.2%        | 12.8%        | 12.5%        |
| Flow-Through          | 15.0%        | 15.0%        | 15.0%        | 15.0%        | 10.0%        | 10.0%        | 10.0%        | 10.0%        |

**BEFORE THE  
SURFACE TRANSPORTATION BOARD**

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**JOINT PETITION FOR RULEMAKING  
TO MODERNIZE ANNUAL REVENUE ADEQUACY DETERMINATIONS**

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**VERIFIED STATEMENT OF**

**PROFESSOR KEVIN M. MURPHY**

**PROFESSOR MARK E. ZMIJEWSKI**

**SEPTEMBER 1, 2020  
(UPDATED FEBRUARY 10, 2021)**

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## **I. INTRODUCTION**

### **A. Credentials of the Witnesses**

#### **1. Professor Kevin M. Murphy**

1. Professor Murphy is the George J. Stigler Distinguished Service Professor of Economics in the Booth School of Business and the Department of Economics at The University of Chicago, where he has taught since 1983. He earned a doctorate degree in economics from The University of Chicago in 1986 and his bachelor's degree, also in economics, from the University of California, Los Angeles, in 1981.

2. At The University of Chicago, Professor Murphy teaches economics in both the Booth School of Business and the Department of Economics. He teaches graduate level courses in microeconomics, price theory, empirical labor economics, and sports analytics. In these courses, he covers a wide range of topics, including the incentives that motivate firms and individuals, the operation of markets, the determinants of market prices, and the impacts of regulation and the legal system. Most of his teaching focuses on two things: how to use the tools of economics to understand the behavior of individuals, firms and markets; and how to apply economic analysis to data. His focus in both research and teaching has been on integrating economic principles and empirical analysis.

3. Professor Murphy has authored or co-authored more than 65 articles in a variety of areas in economics and co-authored a book titled *Chicago Price Theory*. His articles have been published in leading scholarly and professional journals, including the *American Economic Review*, the *Journal of Law and Economics*, and the *Journal of Political Economy*.

4. Professor Murphy is a Fellow of the Econometric Society and a member of the American Academy of Arts and Sciences. In 1997, he was awarded the John Bates Clark Medal, which the American Economic Association awarded once every two years to an outstanding American

economist under the age of forty. In 2005, he was named a MacArthur Fellow, an award that provides a five-year fellowship to individuals who show exceptional merit and promise for continued and enhanced creative work. Also in 2005, he was elected a Fellow of the Society of Labor Economists.

5. In addition to his positions at The University of Chicago, Professor Murphy also is a Senior Consultant to Charles River Associates (“CRA”), a consulting firm that specializes in the application of economics to law and regulatory matters. He has consulted on a variety of antitrust, intellectual property, fraud, and other matters involving economic and legal issues, such as damages, class certification, mergers, labor practices, joint ventures, and allegations of anticompetitive exclusionary access, tying, price fixing, and price discrimination. He has submitted testimony in Federal Court, the U.S. Senate, and to state regulatory bodies, and has submitted expert reports in numerous cases, testified on behalf of the U.S. Federal Trade Commission, and consulted for the U.S. Department of Justice. Professor Murphy has provided expert testimony to the Surface Transportation Board (“Board”) on behalf of both Union Pacific Railroad and CSXT in the past, including in connection with the Board’s previous consideration of revenue adequacy issues. Professor Murphy’s CV is attached to this Statement.

## **2. Professor Mark E. Zmijewski**

6. Professor Mark E. Zmijewski specializes in the areas of accounting, economics, and finance as they relate to valuation, financial analysis, and security analysis, or more generally, financial economics. Professor Zmijewski is Professor Emeritus at The University of Chicago Booth School of Business (“Chicago Booth”), and previously held the Charles T. Horngren Professorship and the Leon Carroll Marshall Professorship in his 30-year career at Chicago Booth. In addition to his faculty duties, Professor Zmijewski also held the positions of Deputy

Dean, PhD Program faculty director, and the Center for Research in Security Prices faculty director, all at Chicago Booth.

7. Professor Zmijewski earned his BS in 1976, MBA in 1981, and PhD (with major in accounting and minors in economics and finance) in 1983, all from the State University of New York at Buffalo. In addition to The University of Chicago, Professor Zmijewski has taught at the State University of New York at Buffalo and at York University in Toronto, Canada. Professor Zmijewski teaches various courses in accounting (financial accounting, managerial accounting, and advanced accounting/mergers and acquisitions), finance (corporate finance, financial strategy and corporate transactions, financial analysis, and valuation of companies and corporate transactions), and entrepreneurship. His research focuses on firm valuation, the pricing of publicly-traded securities, and the ways in which various capital market participants use information to value securities. He has published articles in academic journals in the areas of accounting and financial economics and also co-authored a textbook (with Professor Robert Holthausen of The Wharton School of the University of Pennsylvania) on how to value companies, parts of companies, and the securities issued by companies, titled, *Corporate Valuation: Theory, Evidence and Practice*. Professor Zmijewski has been an Associate Editor of *The Accounting Review*, and has served on the Editorial Boards of both the *Journal of Accounting Research* and *The Accounting Review*.

8. Professor Zmijewski also is a Senior Consultant to Charles River Associates, a consulting firm that provides economic, financial, and management consulting services. He also is a Senior Advisor to, and a member of, the Investment Committee at Patron Capital Partners (Funds IV and V), a private equity investment company with a focus on real estate related investments. Professor Zmijewski was a founding partner of Chicago Partners, LLC, which was acquired by

Navigant Consulting; a former managing director of Navigant Economics (a subsidiary of Navigant Consulting); and a former member of the corporate executive committee of Navigant Consulting.

9. Professor Zmijewski has worked as a consultant or expert in litigation matters in U.S. state and federal courts, in the Supreme Court of Victoria in Australia, and in U.S. and international arbitrations. He has been engaged by the U.S. Department of Justice, the U.S. Federal Trade Commission, and the U.S. Securities and Exchange Commission, as well as by companies, classes of plaintiffs, and individuals. Professor Zmijewski has consulted on business valuation and securities valuation (valuation of corporate transactions, companies, and parts of companies, intangible assets and intellectual property, and securities); securities litigation (Rule 10b-5, Section 11, Section 12, ERISA, Martin Act, effect of disclosures, analysis of how markets work, and insider trading); mergers and acquisitions (appraisals and price disputes, analyzing merger synergies, material adverse changes, corporate transactions, and the process of purchasing and selling companies); antitrust matters (measuring profitability, measuring and analyzing rates of return, and assessing merger efficiencies), and a variety of other valuation, financial analysis, and accounting related issues. Professor Zmijewski's CV is attached to this Statement.

#### **B. Assignment**

10. We have been asked by Canadian National Railway ("CN"), Norfolk Southern Railway ("NS") and Union Pacific Railroad ("UP") to apply economic principles to develop a methodology to modernize how the Surface Transportation Board (the "STB" or "the Board") monitors the financial health of the freight rail industry. Specifically, we propose a refined methodology to assess revenue adequacy that uses the types of accounting-based rates of return

on which the Board historically has relied in its comparison with the railroad industry's cost of capital, but that mitigates some of the limitations and inaccuracies of using accounting-based rates of return in this way. We begin by explaining the economic principles that should guide the assessment of revenue adequacy and use of these principles to minimize the economic harm to both railroads and shippers that could result from misguided rate-of-return regulations based on erroneous and unfounded analyses of the railroads' rates of return. The methodology we then propose is a standard and widely used financial methodology that compares a company's financial performance to that of one or more comparison groups. As applied here, we propose a benchmarking methodology that compares the financial performance of the railroads to the financial performance of companies operating in competitive (unregulated) markets for purposes of assessing revenue adequacy.

### **C. Summary of Conclusions**

11. Based on the analyses that we present in this Statement, we have reached the following conclusions:

- Railroads were deregulated so that they could operate (without financial support from the government) as private firms responsible for purchasing, operating and maintaining the infrastructure and equipment they require. Railroads must compete for the necessary capital with the vast number of other private firms, not just in the United States but worldwide.
- Misguided regulation of railroad rates in response to a conclusion drawn from misleading measurement of railroads' rate of return and misinterpretation of what a measured rate of return implies about a railroad's competitiveness could lead to the classic problems of rate of return regulation and endanger the industry's success. Forces of competition have

motivated railroads to assure a “safe, adequate, economical, efficient, and financially stable rail transportation system.”<sup>1</sup> The potential harm from imposing regulation does not cease once a railroad is profitable.

- Economic efficiency requires that railroads be able to aim for a rate of return greater than their cost of capital. Operational and investment decisions—lowering operating costs, investing in high-return projects, developing new services valued by shippers, changing management—that benefit customers can enable a railroad to earn a rate of return that exceeds its cost of capital for extended periods of time, an outcome that benefits its customers and should be encouraged by the Board.
- Economic research has shown that the limitations and inaccuracies of accounting-based rates of return make it difficult, some say impossible, to infer economic rates of return from accounting rates of return. Fisher and McGowan (1983) expressed one of the strongest conclusions against using accounting rates of return as estimates of economic rates of return: “... there is no way in which one can look at accounting rates of return and infer anything about relative economic profitability ... Economists (and others) who believe that analysis of accounting rates of return will tell them much (if they can only

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<sup>1</sup> Staggers Rail Act of 1980. This point was made long ago by two economists at Princeton University: Professors William Baumol and Robert Willig (see Baumol, William J., and Robert D. Willig, “Verified Statement,” EP 347, Coal Rate Guidelines - Nationwide, May 11, 1981). They explained in their Verified Statement in support of the ICC’s proposal to adopt Ramsey pricing and the stand-alone cost standard in regulating rail rates that “Ramsey pricing and stand-alone costs [are] sufficient pricing restraints,” noting that “it is neither necessary nor desirable to adopt any [] additional pricing constraints. The entire purpose of the Staggers Act and the movement toward (partial) deregulation of rail transportation can be frustrated by adoption of such unnecessary restraints” (pp. 77-78). They concluded further that “those same pricing principles continue to apply with equal validity under adequacy of revenues...the regime of financial solvency will therefore require no modification” in the ICC’s pricing principles (p. 85).

overcome the various definitional problems which separate economists and accountants) are deluding themselves.”<sup>2</sup>

- If it is necessary to compare accounting rates of return to the cost of capital to assess profitability, we propose a widely used benchmarking methodology that compares the railroads’ financial performance to the financial performance of companies operating in competitive (unregulated) markets. This approach provides a more reliable assessment of the financial performance of the railroads relative to their cost of capital.
- Our benchmarking analyses show that the financial performance of the railroad industry and the seven railroads generally was below the financial performance of companies operating in competitive (unregulated) markets. Using two alternative measures of financial performance and three benchmarking groups, we conclude that, over the 2006 through 2019 period, the financial performance of the railroad industry and each of the seven Class I railroads fell well below the median and mostly in the bottom quartile of the financial performance of all three benchmarking groups.

## **II. ECONOMIC PRINCIPLES FOR EVALUATING RAILROADS’ ECONOMIC RATE OF RETURN**

12. Since 1981, the Board or its predecessor agency, the Interstate Commerce Commission (“ICC”), has made an annual determination whether rail carriers are “revenue adequate.” It has done so by comparing each rail carrier’s annual return on the depreciated book value of its assets

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<sup>2</sup> Fisher, Franklin M., and McGowan, John J., “On the Misuse of Accounting Rates of Return to Infer Monopoly Profits,” *American Economic Review*, March 1983, 73, pp. 92 – 93.

(net of “deferred taxes”)<sup>3</sup> with the rail industry’s average cost of capital.<sup>4</sup> Congress mandated an annual evaluation of whether railroads are earning “adequate revenue” when it substantially deregulated the railroad industry in order to “promote a safe and efficient rail transportation system by allowing rail carriers to earn adequate revenues.”<sup>5</sup>

13. We understand some stakeholders are urging the Board to impose additional regulatory constraints on railroads’ pricing and operating flexibility based on a misguided belief that the carriers are earning profits suggestive of noncompetitive pricing. However, fundamental principles of economics counsel caution and careful consideration of how to measure railroad profitability (revenue adequacy), how to interpret a measurement, and whether competition would be enhanced or harmed if the Board mandated additional regulatory action based on inferences drawn from a measure of revenue adequacy.

#### **A. The Goal of the Staggers Act is to Create Conditions for Railroads that Mimic Competitive Markets**

14. The fundamental goal in deregulating the railroads was to provide them with incentives and flexibility to undertake necessary investments and operational changes to become profitable and competitive. Congress recognized that this would benefit shippers and consumers.<sup>6</sup>

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<sup>3</sup> The Board uses historical cost minus accumulated depreciation (net of deferred taxes) as its measure of a railroad’s assets for purposes of calculating revenue adequacy. For ease of exposition, in the rest of our report, we refer to the historical cost minus accumulated depreciation as “book value.”

<sup>4</sup> See STB Decision EP 679, *Association of American Railroads – Petition Regarding Methodology for Determining Railroads Revenue Adequacy*, decided October 23, 2008, pp. 1-2 (“For a railroad, ROI has traditionally been calculated by dividing net income from railroad operations by the depreciated original cost, or book value, of the railroad’s assets. This is done by dividing net railway operating income (an after-tax, before-interest figure) by an investment base that consists of the firm’s net investment in railroad property, plus working capital, less accumulated deferred income tax credits.”).

<sup>5</sup> Staggers Rail Act of 1980, Pub. L. No. 96-448, § 3, 94 Stat. 1897, section 3(a).

<sup>6</sup> The move to deregulate the railroads began with the 1976 Railroad Revitalization and Regulatory Reform Act (“4R Act”), which provided for reduced federal oversight of the railroads. Deregulation was furthered by the 1980 Staggers Rail Act, which gave railroads flexibility to set rates and discontinue unprofitable service.

Railroads had been in extreme financial difficulty for many years. Congress was concerned about their survival as private firms and the risk that taxpayers might have to support the railroads if their financial performance did not improve.<sup>7</sup> Congress appears to have recognized, and the Board and its predecessor agency acted accordingly, that the prospect of earning higher profits not limited by unnecessary rate of return and operational regulation would create incentives for railroads to undertake operational and capital investments to improve service and win customers. And this turned out to be right—deregulation created incentives for private investment in railroads because investors could expect to make profits by investing in railroads. Railroads then invested available capital to become more efficient and profitable.

15. Outcomes since passage of the Staggers Act demonstrate how competition can work to eliminate inefficiencies created by regulation. When the railroads were first deregulated in 1980, many were inefficiently sized and configured.<sup>8</sup> This was especially problematic in a network industry such as this, where freight can travel large distances and move on multiple railroads that must coordinate and perform efficiently to serve shippers well. Railroads responded to

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<sup>7</sup> In contrast to the privately financed freight railroads, Congress passed the Rail Passenger Service Act of 1970, establishing the National Railroad Passenger Corporation to “take over the intercity passenger rail service that had been operated by private railroads. Amtrak began service on May 1, 1971 serving 43 states with a total of 21 routes” (see <http://history.amtrak.com/amtraks-history/1970s>). This federally supported rail service recently requested \$1.7 billion in federal grants for its 2019 fiscal year (see <http://www.amtrak.com/ccurl/412/537/Amtrak-FY2015-Federal-Budget-Request-ATK-14-028,0.pdf>). Freight railroads outside North America also are generally government owned or subsidized.

<sup>8</sup> Committee for a Study of Freight Rail Transportation and Regulation Transportation Research Board, The National Academies of Sciences, Engineering and Medicine, *Modernizing Freight Rail Regulation*, Special Report 318 (2015) at p. 180: “The Staggers Rail Act of 1980 made fundamental changes in the federal railroad regulatory program. When the act was passed, the country’s private freight railroad industry was in financial and physical decline. It had been overregulated and had lost large amounts of traffic to trucks. Some railroads were receiving government subsidies, and the industry’s nationalization was a possibility... The railroads, which had once dominated the transportation of freight and passengers, were left with an asset base that had become oversized and misaligned with demand. They were generating too little revenue to pay for basic upkeep, much less reinvestment. Reducing expansive networks and other legacy capacity that had become uneconomic and making more intensive use of the capacity that remained were critical to the industry’s survival as a private enterprise. The Staggers Rail Act sought to enable such changes, which had been hindered for decades by the federal regulatory regime... The act allowed railroads to shed excess capacity and to concentrate traffic on fewer lines using fewer locomotives and workers.”

deregulation by abandoning many unprofitable operations (that had been sustained only by regulatory requirements or distortions) and integrating many inefficiently sized independent railroads to create strong regional competitors with more efficiently configured networks. The process was not always smooth, but the result has been improved operations on the railroad side (e.g., higher velocity, fewer work events, lower costs, and greater productivity) and better service on the customer side (e.g., faster cycle time, more reliable service, improved car utilization, and single-line service to more markets). The resulting increase in railroads' efficiency and profitability since passage of the Staggers Act is evidence that deregulation enabled railroads to become more financially healthy by improving their service and increasing and diversifying the traffic they carry.

16. The incentive to gain sales and reduce costs in order to increase profitability is the motivation of successful firms in competitive markets free from regulatory restrictions on firms' ability to benefit from their investments and innovation.<sup>9</sup> Competition motivates firms to become more efficient and improve quality, reduce quality-adjusted price, and innovate. For example, when a railroad faces increased competition from trucks, it will be motivated to reduce rates, increase output (through improved quality of rail service—e.g., better schedules, more rapid delivery, etc.) and other actions likely to benefit shippers on those competitive routes.

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<sup>9</sup> See, e.g., Adam Smith, *An Inquiry into the Nature and Causes of the Wealth of Nations* (1776): "Every individual necessarily labors to render the annual revenue of the society as great as he can ... He intends only his own gain, and he is in this, as in many other cases, led by an invisible hand to promote an end which was no part of his intention ... By pursuing his own interests, he frequently promotes that of the society more effectually than when he really intends to promote it. I have never known much good done by those who affected to trade for the public good."; see also Paul I Joskow and Nancy L. Rose, "The Effects of Economic Regulation," *Handbook of Industrial Organization*, Vol. II (R. Schmalensee and R.D. Willig eds.) 1989 at 1449, 1497: "Economic regulation has important direct and indirect effects on the costs of production and the quality of service. Regulatory influences on input choices, X-inefficiency, and technological change tend to increase costs. Regulation also alters the quality and variety of services, although these effects often are difficult to quantify. It tends to increase service quality through non-price competition when regulated prices in structurally competitive industries are above competitive levels. Regulation may lower service quality when its intention is to keep prices below their market-clearing levels."

Because of the network nature of the rail industry, when a railroad improves service for one group of shippers, other customers often benefit as well, even if competition for those other customers did not increase.

17. Competition motivates firms to become more efficient and thus reduces deadweight loss. Deadweight loss occurs when firms allocate resources inefficiently in response to artificial price constraints, such as those imposed through regulation, that do not reflect demand and supply. It represents a loss to society because it reflects wasted resources and is an unnecessary cost to society when competition is sufficient to discipline firms' conduct.

18. Cost-based regulation that forces rail rates toward marginal costs in an attempt to limit railroads' profitability does not produce the same economic welfare benefits as market competition. The reason is simple—with regulated rates and profits, railroads and their investors do not benefit, or benefit fully, from becoming more efficient and innovative, and thus do not have the same incentives to improve their performance. Many products in the broad economy are sold at prices that exceed marginal cost, yet the short-run gain in reduced deadweight loss from forcing down prices would not improve consumer welfare, but instead would cause substantial (and long-lasting) harm to consumers through distorted producer incentives.

19. For example, the price of an iPhone is substantially higher than its marginal cost (and Apple earns large profits from iPhone sales). Yet, few would argue for regulation to force the price of an iPhone down to marginal cost, and wisely so. While sales of iPhones might increase in the short run as more consumers purchase iPhones at the lower, regulated price, in the longer run consumer welfare and output are likely to fall because the price controls would immediately reduce Apple's incentives to innovate and introduce new products with improved features and

quality. Over the longer run, the harm to consumers from forgoing new improved iPhones is likely to far outweigh any short-run benefits consumers receive from lower prices.

20. The danger of price controls is well-established as a matter of both economic theory and empirical fact.<sup>10</sup> For example, the use of rent controls to reduce property rental rates has been studied extensively to understand whether rent controls are an efficient way to increase consumer welfare. Economists find that they are not—instead, they lead to housing shortages and quality declines. Lower rents might benefit those lucky enough to obtain an apartment at a controlled rate, but harm the many who find such apartments unavailable and that those available are not well maintained or modernized because capital does not flow into rental housing but instead into other investments such as commercial real estate where rates of return are not capped.

21. Thus, the well-established economic principles that motivated the Staggers Act and deregulation of railroads teach that, absent strong evidence of market failure, consumers benefit from allowing competition, not regulation, to determine firms' pricing and operational decisions,

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<sup>10</sup> See, e.g., Averch, Harvey, and Leland L. Johnson. "Behavior of the Firm Under Regulatory Constraint," *The American Economic Review* (1962), pp. 1052-69; Baumol, William J., and Alvin K. Klevorick. "Input Choices and Rate-of-Return Regulation: An Overview of the Discussion," *The Bell Journal of Economics and Management Science* (1970), pp. 162-90. There is broad consensus among economists documented in surveys of the literature and of economists' opinions about the inefficiencies created by price controls. For example, a 1992 article reported results of a survey of 1,350 economists (of which 34.4 percent responded) on the question whether "A ceiling on rents reduces the quantity and quality of housing available." About 93.5 percent of respondents agreed – the highest consensus obtained for any of the 40 policy questions asked. See R. M. Alston, J.R. Kearl and M. B. Vaughan, "Is There a Consensus Among Economists in the 1990's?" 82(2) *AEA Papers and Proceedings* 203 (1992), p. 204. A 2012 poll of economists at major U.S. universities (the IGM Economic Experts Panel) found that 95 percent of responses (weighted by each expert's confidence) disagreed with the proposition that "Local ordinances that limit rent increases for some rental housing units... have had a positive impact over the past three decades on the amount and quality of broadly affordable rental housing in cities that have used them." See [http://www.igmchicago.org/igmeconomicexpertspanel/pollresults?SurveyID=SV\\_6upyzeUpI73V5k0](http://www.igmchicago.org/igmeconomicexpertspanel/pollresults?SurveyID=SV_6upyzeUpI73V5k0). As summarized in a survey article reporting on the near unanimity of opinion on the harmful impact of rent controls, "Economists have shown that rent control diverts new investment, which would otherwise have gone to rental housing, toward greener pastures – greener in terms of consumer need. They have demonstrated that it leads to housing deterioration, fewer repairs, and less maintenance." See Walter Block, "Rent Control," *Concise Encyclopedia of Economics* (<http://www.econlib.org/library/Enc/RentControl.html>). According to a well-regarded textbook, rent control "reduces the incentive to build new rental housing, exacerbating the shortage in the long run. Similarly, owners have less of an incentive to maintain rental housing, so it deteriorates faster than otherwise." See D. W. Carlton and J. M. Perloff, *Modern Industrial Organization* 3rd ed. (1999), p. 769.

subject to the discipline of product and capital markets. The original rationale for deregulation was recognition that, overall, the railroads were not potential beneficiaries of market failures that would allow them to earn excessive profits if not constrained, but instead were the victim of regulation that forced them to abandon competitive market principles and deprived them of capital needed to operate efficiently.

**B. Forward-Looking Economic Return on Investment is the Relevant Measure of Railroad Revenue Adequacy**

22. As a matter of economics, the proper way to measure whether a railroad is earning a return on investment sufficient to allow it to meet demands for service in the long run is a return on forward-looking investment costs. The same is true for operating costs—one would not conclude based on wage rates set five years ago in a labor union contract expiring today that the firm could operate profitably in the future if the firm would have to pay much higher wages going forward given changes over the five years in market conditions. Expected future returns determine investors' decisions about where to invest their capital and business executives' decisions how to allocate their scarce resources—they look for opportunities that generate the greatest return on incremental investment, and not to average rate of return on all invested capital.

23. For this reason, the return on the historical net investment base that the Board uses to calculate revenue adequacy can be a misleading indicator of whether railroads can attract the needed capital necessary replace their assets as they depreciate or become economically obsolete, or to invest in order to serve new demands for their services. Accounting measures based on backward looking historical purchase prices and depreciation of the railroad's assets often are uninformative about a firm's ability to attract capital in the future.

24. The relevant economic rate of return for purposes of understanding whether railroads are sufficiently revenue adequate to provide efficient and competitive service to shippers is a forward-looking measure of a company's ability to cover future operating expenses, assure repayment of its debt, and attract and retain the necessary capital to maintain, upgrade and replace its assets. Economic profitability is calculated as the rate at which expected *future* cash flows from making an investment today must be discounted to equal the initial investment.<sup>11</sup> Investors will be willing to lend to a company if the expected future returns on investment will be as high as the investor can expect (after accounting for risk) from alternative investment opportunities. As explained in a popular corporate finance textbook,

The company's book rate of return may not be a good measure of profitability. It is also an *average* across all of the firm's activities. The average profitability of past investments is not usually the right hurdle for new investments.<sup>12</sup>

25. The proper economic rationale for evaluating whether a railroad is revenue adequate is to determine whether it can raise the funds necessary for financial health and growth in the long term. In order for a railroad to be financially healthy in the long term, it must be able to raise capital in markets where investors have numerous potential investment opportunities, whether such investments would be financed out of retained earnings or financed by attracting new capital. For both sources of capital, the return on reinvesting in the railroad's assets must be compared with the return on alternative investments. Investors are not concerned primarily with how successful firms have been with past investments, but how firms will use capital in the future and thus the investor's expected return if it invests in one firm rather than another.

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<sup>11</sup> See J. Berk and P. De Marzo, *Corporate Finance*, 2007 ("Berk and DeMarzo"), pp. 156-158.

<sup>12</sup> R. A. Brealey, S. C. Myers, F. Allen, *Principles of Corporate Finance* 8<sup>th</sup> ed. (2006), p. 89.

26. The methodology used by the Board which relies on book value of assets cannot reveal whether railroads will be able to attract investors in the future. In deciding whether to replace or upgrade track, for example, a railroad does not ask whether the return on book value of existing track exceeds the cost of capital, but whether it can earn an adequate rate of return (above its cost of capital) on the replacement cost of that track. Accounting rates-of-return cannot inform such decision making.

27. Congress and the Board have an interest in monitoring the health of the railroad industry, given the vital importance of the railroad industry in the United States and even world economies for transporting goods to domestic and international markets and avoiding taxpayer subsidization of unprofitable railroads. And because of the importance of having a healthy railroad industry in the United States, it is critical that metrics used and the context in which those metrics are evaluated provide an accurate assessment of the railroads' financial health. If the Board adopts and relies on a metric that systematically under- or overestimates the economic rate of return earned by railroads, then it cannot provide the oversight and monitoring guidance that Congress requires.

28. Congress deregulated the railroads after concluding that the railroad industry could not continue to serve the public well in the long run if the carriers were denied a sufficient economic return on future investments to cover their future cost of capital. But the ICC was unwilling to adopt for its revenue adequacy analysis a measure of a railroad's rate of return based on forward-looking data and evaluations because doing so would be both too costly and too time consuming for such evaluation to be informative and relevant.<sup>13</sup> Historical costs are easier to measure. And

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<sup>13</sup> See *Standards for Railroad Revenue Adequacy* ("Standards II"), 3 I.C.C.2d 261, 277 (1986) (acknowledging that "current cost accounting is theoretically preferable to original cost valuation"); *Standards for Railroad Revenue Adequacy* ("Standards I"), 364 I.C.C. 803, 818 (1981) (explaining that "the replacement cost method is preferable because it comes closer to the competitive result").

at the time of passage of the Staggers Act, the railroads' poor financial health was evident even using returns on book value. Moreover, a fulsome investigation of a railroad's future investment incentives would require investigation of expected supply and demand conditions facing the railroad industry and an understanding of how best to invest to meet demand. For example, it would require understanding whether a railroad would be willing to incur risks associated with building substantial infrastructure to serve demand arising in new geographic areas and for shipment of new commodities when both demand and the return on investment are uncertain.

29. The advantage of using historical costs is that it permits as easy and mechanical calculation of a rate of return using only publicly available data available either from a railroad's financial submissions to the Board or collected from public third-party sources. We discuss the limitation of this approach further below.

### **C. It is Consistent with Competitive Markets for Firms to Earn an Economic Rate of Return Above Their Cost of Capital**

30. Once the Board settles on a methodology for measuring the two necessary components of a revenue adequacy quantification—the rate of return on invested capital (“ROIC”) and the cost of capital—it faces two further determinations: (1) is a railroad or the railroad industry as a whole excessively revenue adequate in a way that indicates that additional regulation would improve competition and (2) if so, what form should such regulation take? Our analysis in this Statement focuses on the first question—how to evaluate whether railroads' rate of return exceeds their cost of capital by an amount that suggests a failure of competition rather than the normal variation of rates of return expected in a competitive marketplace.

31. The goal of the Staggers Act—to rely on competition to the maximum extent possible to discipline rates and services provided by the railroad industry<sup>14</sup>—provides guidance in interpreting a measure of revenue adequacy. The relevant question is what rate of return is consistent with a competitive market and how does the profitability of the railroads compare with competitive market outcomes? Only if that comparison shows that the railroad industry has been unusually profitable *measured against typical, unregulated non-railroad firms* for a sufficiently long period of time is there a reason to investigate whether there might be a market failure that has permitted railroads to charge noncompetitive rates to at least some shippers, and to consider whether the Board’s existing tools to evaluate and constrain unreasonable exercise of a railroad’s market power in the places where it possesses and has exercised such power are not sufficient.

32. In order to understand whether railroads are earning a return on invested capital that is indicative of at least the potential for rates to be unconstrained by competition, it is necessary to benchmark any revenue adequacy measure adopted by the Board against corresponding measures we observe for firms operating under competitive conditions. We propose below in Part IV that the firms included in the S&P 500 stock market index, which are the 500 large companies listed on U.S. stock exchanges designed to represent the U.S. stock market, exclusive of any railroad companies, provide a benchmark for evaluating whether revenue adequacy measures using accounting data indicate that railroads are unusually profitable. The firms whose stock is included in the index are large firms that compete with railroads for capital, including many customers of the railroads. If the railroads earn a rate of return net of cost of capital no higher than the average or median S&P firm, then there would be no presumption that railroads

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<sup>14</sup> See 49 U.S.C. §§ 10101(1), 10701(d)(1).

are earning abnormal returns and can set rates without constraint from competition, or that shippers' current protections under the Board's SAC and related proceedings are not sufficient.

33. In a competitive environment, like that in which railroads operate, CN, NS and UP can obtain a competitive rate of return *on average* only if they have the opportunity to earn above its cost of capital for periods of time. It cannot earn the competitive rate of return necessary to compete for capital if it must endure periods where its rate of return falls below the competitive level, yet it would be denied the prospect of earning a return above its cost of capital at other times. Using regulation to reduce rates that are not above the competitive level creates immediate inefficiencies in investment choices and operational decisions that, over the longer run, would reduce the quantity and quality of railroad service, both for shippers whose rates are adjusted downward and for other shippers using the rail network.

34. There are many reasons why a firm can earn an above average rate of return that do not signal market failure but instead more likely reflect the opposite—increased productivity or the firm benefiting from successful, risky investments in new competitive businesses. A railroad that is especially innovative, risk-taking, efficient in making use of its resources, provides high-level service, or otherwise succeeds relative to its peers in returning profits to its stakeholders should not be penalized for its success, because doing so through regulation unrelated to any anticompetitive pricing will deter the type of procompetitive conduct that should be encouraged. Moreover, measuring the industry's return on investment based on accounting data may give a misleading picture of economic rates of return on current and future investments.

**D. Even if, Contrary to the Evidence, Railroads' ROIC Exceeded Their COC by an Atypically Large Amount, Rate of Return Regulation is Likely to Worsen Competition and Distort Investment and Operational Decisions**

35. A properly calculated measure of economic rate of return could provide information about whether the railroads are earning profits sufficient to achieve and maintain long-run financial solvency. However, there is no economic reason why a finding that a railroad is earning a rate of return at or above its cost of capital or even above that of the average firm in a benchmarking group warrants regulation to force lower rates or cap rate increases across-the-board. Finding that a railroad has achieved or exceeded the profitability of other competitive firms does not tell us that particular rail transportation rates are above or below a competitive level. That determination only can be made after evaluating supply and demand conditions for a particular shipper and shipments (taking into account that a railroad must charge rates above variable cost to some shippers in order to be healthy in the long run). Imposing broad-scale rate regulation when only a fraction of a railroad's services is priced at a level unconstrained by sufficient competition would induce inefficient investment decisions and harm railroads and shippers.

36. A railroad's overall financial condition, even if measured by return on current asset costs, provides no information about whether rates on particular shipments are noncompetitive.

Congress directed that, to the maximum extent possible, railroads should be free to set rates based on competition and the demand for their services, with rates subject to potential regulatory review only if the railroad is "market dominant"—that is, if it faces no effective competition.<sup>15</sup>

The Board implemented this directive by regulating rates for traffic over which railroads are

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<sup>15</sup> See 49 U.S.C. §§ 10101(1), 10701(d)(1).

found to have market dominance only if it determines that those rates exceed a simulated competitive level.<sup>16</sup> Constraints that would restrict railroad pricing or reduce rates below competitive levels irrespective of whether the rates at issue exceed the competitive level would endanger the ability of the railroads to replace and grow their network over the long term.

37. The railroads' improved financial condition since 1980 is evidence of the benefits created when they have flexibility to set rates to shippers freely except when an individualized investigation indicates that a rate exceeds the competitive level. A finding that the railroad as a whole is revenue adequate provides no information about whether an individual rate for a particular shipment is unreasonable—whether the railroad is market dominant for that shipment and whether the challenged rate is noncompetitive.

38. Allocative efficiency requires that individual prices are set competitively, not that prices generate some overall level of return in total. It is efficient to allocate scarce capacity based on willingness to pay, because this allocates capacity to those shippers that value it most. Rate freezes or caps prevent market signals from allocating scarce capacity to where it is most valuable (e.g., to shippers with time critical needs or with more limited competitive options). When rates cannot respond freely to demand, then the critical signal that there is unmet demand for additional capacity is absent.

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<sup>16</sup> Any price that passes the stand-alone cost ('SAC') test is at or below a hypothetical long-run competitive market price in a contestable market where a competing railroad is free to enter (i.e., faces neither entry nor exit costs) by building a railroad network to serve the challenged traffic as well as other traffic that it would be efficient to serve (assuming the other traffic is served at current rates). Rates at or below the SAC level would not induce entry by a competing railroad since such a railroad could not cover its costs even if prices did not fall post entry. Thus, any price consistent with the SAC constraint together with the constraints imposed by alternative modes of shipping (such as truck) is a competitive price.

**E. Revenue Adequacy Determination Will be More Distortionary if Based on Railroad-Specific Evaluation**

39. Regulation will typically disadvantage a regulated firm relative to its unregulated competitors if it is regulated but its competitors are not. The reason is simple: an unregulated profit-maximizing firm will make optimal choices across all the dimensions on which it can compete—price, quality, product features, product selection etc.—but a regulated company is constrained on one or more of these competitive dimensions. These additional constraints will force the firm to make “conditional” profit-maximizing decisions that are less profitable overall.

40. For example, a firm that is compelled to charge prices lower than it would find optimal if it were unregulated will select the optimal combination of quality, features and supply conditional on that price, but its resulting offering will be less attractive than if it could charge a market-determined price. This is what happens with rent control—“price” is below market levels and quality and availability are reduced as a consequence. While regulation may be intended only to prevent the regulated firm from earning “excessive” profits, the result is to induce sub-optimal decisions regarding all the ways in which the firm can compete. Regulations that govern behavior other than price (such as conditions under which a railroad must interchange with its competitors) similarly will distort a wide range of choices made by the regulated firm.

41. Regulating one firm in an industry because it has been relatively profitable while other firms have been less successful would be especially likely to harm competition. It is likely to hobble a firm that has been especially successful because of its efficiency and success with customers. Regulation that restricts a profitable firm’s flexibility to price and to adapt its services to satisfy changing demands of the marketplace will erode its efficiency, which in turn eventually will deprive its customers of high-quality service. This could induce customers to

switch to the regulated firm's competitors, even though the regulated firm could offer a superior option absent regulation.

42. The harmful impact of regulation of some but not all market participants has been illustrated in a different context. In an article that Professor Murphy co-authored, he explained why partial economic reform in some countries, such as occurred in Russia, can create worse outcomes than if all market participants are subject to the same reform or the same regulations. The reason is that resources (inputs) flow into the unregulated sector even if those inputs would create more value if they were available to the regulated firms. The end result can be lower output than with complete regulation, rather than the increased output and efficiency that was the intended result of the partial deregulation.

43. Regulation of some, but not all, competitors also harms the marketplace because it reduces the competitive constraint on unregulated competitors. An unregulated competitor that knows that regulation limits its rival's ability to respond to changes in consumers' demands will feel less competitive pressure to innovate and price competitively. Because of the additional inefficiency that could result if one or some railroads are found to be sufficiently revenue adequate to warrant additional regulation while other railroads are not constrained by those regulations, economics shows that both evaluation of revenue adequacy and imposition of any regulations as a consequence of such a finding should be made on an industry-wide basis, and not as currently performed for each railroad individually.

### **III. IT IS WELL ESTABLISHED THAT ACCOUNTING RATES OF RETURN ARE POOR MEASURES OF ECONOMIC RATES OF RETURN**

44. The measure of financial performance used in the Board's Annual Revenue Adequacy Determinations<sup>17</sup> compares a railroad's accounting-based (or financial statement-based) rate of return on invested capital ("ROIC") to the railroad industry's cost of capital ("COC"), specifically, ROIC minus COC ("ROIC minus COC").<sup>18</sup> However, as we explain in this section, it is well known that accounting-based rates of return do not accurately measure economic rates of return.<sup>19</sup> The magnitude and direction of the inaccuracy when accounting-based rates of return are used as estimates of economic rates of return can be substantial and depend on the specific characteristics of the companies being analyzed. Below, we summarize the peer-reviewed economic literature from the last 50 years that has identified the well-known limitations and inaccuracies of accounting rates of return as measures of financial performance.

45. Early research showed that accounting-based rates of return are poor measures of economic rates of return. These studies, which include Solomon (1961),<sup>20</sup> Harcourt (1965),<sup>21</sup>

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<sup>17</sup> See, for example, Surface Transportation Board, Railroad Adequacy – 2018 Determination, Docket No. EP 552 (Sub-No. 23), September 5, 2019 ("STB 2018 Revenue Adequacy Determination").

<sup>18</sup> STB 2018 Revenue Adequacy Determination, Appendices A and B.

<sup>19</sup> The economic cost of capital (or economic rate of return) is equal to the discount rate that equates the sum of the discounted value of the cash flows generated by an investment to the value of the investment. This economic rate of return concept is often called an internal rate of return ("IRR"), which is discussed in corporate finance textbooks; for example, see BREALEY, R. A., MYERS, S. C., & ALLEN, F. (2006). *Principles of corporate finance*. New York, NY, McGraw-Hill/Irwin, pp.111-118; BERK, J. B., & DEMARZO, P. M. (2011). *Corporate finance*. Boston, MA, Prentice Hall, pp.128-131 and 222-227.

<sup>20</sup> Solomons, D., "Economic and Accounting Concepts of Income," *The Accounting Review*, 1961 36, pp. 374 – 383.

<sup>21</sup> Harcourt, G. C., "The Accountant in a Golden Age," *Oxford Economic Papers*, March 1965, pp. 66-80.

Solomon (1966),<sup>22</sup> Sarnat and Levy (1969),<sup>23</sup> Livingstone and Solomon (1970),<sup>24</sup> Solomon (1970),<sup>25</sup> Stauffer (1971),<sup>26</sup> Weiss (1974),<sup>27</sup> Kay (1976),<sup>28</sup> and Wright (1978),<sup>29</sup> identified numerous factors that affect the relationship between accounting rates of return and economic rates of return. These include accounting capitalization rules; cash flow patterns; accounting depreciation and amortization rules; economic rate of return of the investment; growth rates (current and past); income tax regulations; market value of the investment relative to the book value of the investment (which implicitly includes the degree of conservativeness of accounting rules); price level changes; and project (investment) length. These studies conclude that any specification that includes all of the factors that affect the ability of ROIC to measure a company's economic rate of return is too complex to model; and that the impacts of various factors that determine the magnitude and direction of the difference between measured accounting rates of return and economic rates of return are interrelated. Depending on the

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<sup>22</sup> Solomon, E., "Return on Investment: The Relation of Book Yield to True Yield," in *Research in Accounting Measurement*, ed. R. K. Jaedicke, Y. Ijiri, and O. W. Nielsen, American Accounting Association, 1966; later published in J. Leslie Livingstone and Thomas J. Burns, eds., *Income Theory and Rate of Return*, Columbus: Ohio State University Press, 1971, 105-17.

<sup>23</sup> Sarnat, M. and H. Levy, "The Relationship of Rules of Thumb to the Internal Rate of Return: A Restatement and Generalization," *Journal of finance* June 1969, pp. 470 – 490.

<sup>24</sup> Livingstone, John, and Gerald Solomon, "Relationship Between the Accounting and the Internal Rate of Return Measures: A Synthesis and an Analysis," *Journal of Accounting Research*, Autumn 1970, pp. 199 – 216.

<sup>25</sup> Solomon, Ezra, "Alternative Rate of Return Concepts and Their Implications for Utility Regulation," *Bell Journal of Economics*, Spring 1970, 1, pp. 65 – 81.

<sup>26</sup> Stauffer, Thomas R., "The Measurement of Corporate Rates of Return: A Generalized Formulation," *Bell Journal of Economics* Autumn 1971, 2, pp. 434 – 469.

<sup>27</sup> Weiss (1974) provides a detailed review of this literature; Weiss, Leonard W., "The Concentration-Profits Relationship and Antitrust," in Harvey J. Goldschmid et al., *Industrial Concentration: The New Learning*, Boston, Little, Brown and Co., 1974.

<sup>28</sup> Kay, J. A., "Accountants, Too, Could Be Happy in the Golden Age: The Accountants Rate of Profit and the Internal Rate of Return," 1976, *Oxford Economic Papers* 17 November, pp. 66 – 80.

<sup>29</sup> Wright, F. K., "Accounting Rate of Profit and Internal Rate of Return," *Oxford Economic Papers*, November 1978, pp. 464 – 468.

characteristics of a particular firm, the difference between accounting rates of return and its economic rate of return can be very large and can be either positive or negative.

46. A series of subsequent studies focused on the regulatory implications of the limitations and inaccuracies of using accounting-based rates of return as estimates of economic rates of return. These studies include: Benston (1979),<sup>30</sup> Fisher and McGowan (1983),<sup>31</sup> Fisher (1984),<sup>32</sup> Benston (1985),<sup>33</sup> Salamon (1985),<sup>34</sup> and Salamon (1988).<sup>35</sup> These studies, which expanded on earlier research, analyzed how these factors affect the extent to which accounting-based rates of return reasonably approximate economic rates of return. A common finding, as expressed by Fisher and McGowan (1983), is that the difference between accounting rates of return and economic rates of return can be very large: “the theoretical effects are not so small that they can be neglected in practice. Indeed, they are very large ....”<sup>36</sup> They also concluded that the sign of the difference (error) depends on the characteristics of the company: “the accounting rate of return depends *crucially* on the time shape of benefits [cash flows], and the effect of growth on the accounting rate of return also depends on that time shape. In particular, it is not true that

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<sup>30</sup> Benston, George J., “The FTC’s Line of Business Program: A Benefit-Cost Analysis,” in Harvey Goldschmid, ed., *Business Disclosure. Government’s Need to Know*, New York: McGraw-Hill, 1979, pp. 58 – 118.

Cooper, Joseph D., Proceedings of the Second

<sup>31</sup> Fisher, Franklin M., and McGowan, John J., “On the Misuse of Accounting Rates of Return to Infer Monopoly Profits,” *American Economic Review*, March 1983, 73, pp. 82 – 97.

<sup>32</sup> Fisher, Franklin M., “The Misuse of Accounting Rates of Return: Reply,” *American Economic Review*, June 1984, 74, pp. 509-17.

<sup>33</sup> Benston, George J., “The Validity of Profits- Structure Studies with Particular Reference to the FTC’s Line of Business Data,” *American Economic Review*, March 1985, 75, pp. 37 – 67.

<sup>34</sup> Salamon, Gerald L., “Accounting Rates of Return,” *American Economic Review*, June 1985, 75, pp. 495 – 504.

<sup>35</sup> Salamon, G. (1988), “On the Validity of Accounting Rate of Return in Cross-sectional Analysis: Theory, Evidence and Implications,” *Journal of Accounting and Public Policy*, 7, 1988, pp. 267 – 292.

<sup>36</sup> Fisher and McGowan (1983), p. 83. Fisher (1984) responded to comments on the Fisher and McGowan (1983) paper regarding the magnitude of the difference (error) and did not change their conclusion in Fisher and McGowan (1983) that the difference (error) can be “very large.” See Fisher, Franklin M., “The Misuse of Accounting Rates of Return: Reply,” *American Economic Review*, June 1984, 74, p. 512.

rapidly growing firms tend to understate their profits and slowly growing firms tend to overstate them. The effect can go the other way.”<sup>37, 38</sup>

47. Recent research has developed more generalized models of accounting rates of return. For example, Rajan, Reichelstein, and Soliman (2007) model the complexity of the interrelation among accounting conservatism, growth in new investments, the useful life of assets, and the internal rate of return of projects available to the firm. The authors illustrate the complexity of using accounting rates of return to measure economic rates of return and show that, for example, accounting conservatism and past growth in investments are interrelated and jointly determine how accounting rates of return compare to economic rates of return: “Given conservative accounting, faster growth tends to depress ROI and this decline will be more pronounced for more conservative accounting rules. Conversely, the impact of higher degree of conservatism on ROI will depend on whether past growth rates are above or below a critical level, given by the internal rate of return of the firm’s projects.”<sup>39</sup>

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<sup>37</sup> Fisher and McGowan (1983), p. 84.

<sup>38</sup> Some of these studies, for example, McFarland (1990), analyze how accounting rules for depreciation affect the accuracy of accounting rates of return as estimates of economic rates of return. As noted by Fisher and McGowan (1983) and Fisher (1984), the only way to accurately measure depreciation is to use the depreciation method developed by Hotelling (1925), which measures economic depreciation, and which is similar to using replacement cost to value depreciable assets each year. Fisher (1979), however, shows that accounting rates of return are still inaccurate measures of economic rates of return even when a machine has an infinite life. Regardless, accounting rules for depreciation (and amortization) are only one of the factors that drive the inaccuracy of accounting rates of return as estimates of economic rates of return.

Hotelling, Harold, “A General Mathematical Theory of Depreciation,” *Journal of the American Statistical Association*, September 1925, 20, pp. 340 – 353.

Fisher, Franklin M., “Diagnosing Monopoly,” *Quarterly Review of Economics and Business*, Summer 1979, 19, pp. 7-33.

McFarland, Henry, “Alternative Methods of Depreciation and the Reliability of Accounting Measures of Economic Profits,” *The Review of Economics and Statistics*, Vol. 72, No. 3, August 1990, pp. 521-524.

<sup>39</sup> Rajan, Reichelstein, and Soliman, “Conservatism, Growth, and Return on Investment,” *Review of Accounting Studies*, Vol 12, No. 2-3, 2007, pp. 325-370 at 355-356.

48. In sum, economic research has identified several factors that determine the accuracy and direction of the error of accounting rates of return as estimates of economic rates of return, but no study has derived a closed-form specification for an accounting rate of return based on all of these factors.<sup>40</sup> Economic research shows that the complex relationship among these factors makes it difficult, and some say impossible, to draw any conclusions about economic rates of return based on accounting rates of return. Fisher and McGowan (1983) expressed one of the strongest conclusions against using accounting rates of return as estimates of economic rates of return: "... there is no way in which one can look at accounting rates of return and infer anything about relative economic profitability ... Economists (and others) who believe that analysis of accounting rates of return will tell them much (if they can only overcome the various definitional problems which separate economists and accountants) are deluding themselves."<sup>41</sup>

49. The Fisher and McGowan (1983) results and conclusions do not imply that accounting rates of return are not informative for other purposes, such as by investors to set security prices. Accounting rates of return are widely used in financial analysis,<sup>42</sup> and empirical research shows a statistically significant (although weakening) relation (correlation) between accounting rates of

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<sup>40</sup> Rajan, Reichelstein, and Soliman (2007) have the most comprehensive closed-form specification for a steady-state ROIC based on a subset of these factors.

<sup>41</sup> Fisher and McGowan (1983), pp. 90 – 91.

<sup>42</sup> See Chapters 2 and 4 in Robert W. Holthausen and Mark E. Zmijewski. *Corporate Valuation: Theory, Evidence and Practice*. 2<sup>nd</sup> edition, Cambridge Business Publishers, 2020 ("Holthausen and Zmijewski").

return and stock price movements (for example, Jacobson (1987)).<sup>43</sup> However, that relationship is weak (Lev (1989)<sup>44</sup>) and has weakened over time (Lev and Feng (2016)).<sup>45</sup>

#### **IV. MEASURING FINANCIAL PERFORMANCE OF THE RAILROAD INDUSTRY BASED ON THE BENCHMARKING METHODOLOGY PRODUCES MORE INFORMATIVE RESULTS**

50. In this section, we propose and implement an alternative to the current methodology used by the Board in its Annual Revenue Adequacy Determinations. The methodology we propose is more informative than comparing the railroads' accounting-based rates of return to the industry cost of capital in isolation because it mitigates some of the limitations and inaccuracies identified in the previous section of using accounting-based rates as approximation for economic rates of return as implemented by the STB. More specifically, in this section we analyze two measures of the railroads' financial performance (ROIC minus COC and Adjusted ROIC minus COC) and compared them to the financial performance of three benchmarking groups: (a) S&P 500

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<sup>43</sup> Jacobson, Robert, "The Validity of ROI as a Measure of Business Performance," *American Economic Review*, Vol. 77, No. 3 June 1987, pp. 470-478. Lev, B., "On the Usefulness of Earnings and Earnings Research: Lessons and Directions from Two Decades of Empirical Research," *Journal of Accounting Research* Vol. 27, *Current Studies on The Information Content of Accounting Earnings*, 1989, pp. 153 – 192 and Lev, Baruch and Gu, Feng, *The End of Accounting and the Path Forward for Investors and Managers*, Hoboken, New Jersey: John Wiley & Sons, Inc., 2016. | Series: Wiley finance series; p. xiii ("Based on a comprehensive, large-sample empirical analysis, spanning the past half century, we document a fast and continuous deterioration in the usefulness and relevance of financial information to investors' decisions. Moreover, the pace of this usefulness deterioration has accelerated in the past two decades").

<sup>44</sup> Lev, B., "On the Usefulness of Earnings and Earnings Research: Lessons and Directions from Two Decades of Empirical Research," *Journal of Accounting Research* Vol. 27, *Current Studies on The Information Content of Accounting Earnings*, 1989, pp. 153 – 192.

<sup>45</sup> Lev, Baruch and Gu, Feng, *The End of Accounting and the Path Forward for Investors and Managers*, Hoboken, New Jersey: John Wiley & Sons, Inc., 2016. | Series: Wiley finance series; p. xiii, the authors state: ... "we examine in the first part of this book the usefulness of financial (accounting) information to investors and, regrettably, provide an unsatisfactory report, to put it mildly. Based on a comprehensive, large-sample empirical analysis, spanning the past half century, we document a fast and continuous deterioration in the usefulness and relevance of financial information to investors' decisions. Moreover, the pace of this usefulness deterioration has accelerated in the past two decades."

(excluding railroads, financial institutions, and real estate companies); (b) S&P 500 Industrials Sector; and (c) S&P 500 Railroad Customers.

51. All of the analyses show that the relative financial performance of the railroad industry falls within the bottom quartile of the three benchmarking groups. Furthermore, with a single exception (one railroad for one benchmarking group), all of the analyses show that the relative financial performance of all seven railroads also falls within the bottom quartile of the three benchmarking groups.<sup>46</sup> Thus, the benchmarking analyses we conducted show that financial performance of the railroad industry and the seven railroads was well below the financial performance of companies operating in competitive (unregulated) markets.

#### **A. Benchmarking Methodology**

52. Simply stated, we propose a benchmarking methodology that compares the railroads' financial performance (ROIC minus COC) to the financial performance of companies operating in competitive (unregulated) markets over a sufficiently long period of time to reasonably estimate relative financial performance. Benchmarking methodologies are widely used in many fields and for many purposes. The types of benchmarking that are most useful for evaluating revenue adequacy are benchmarking used to evaluate investment portfolio performance, conduct a financial analysis of a company and its competitive position, and value companies.

53. A financial benchmark is a standard (or reference point) by which to evaluate financial performance. For example, when evaluating an investment portfolio's performance, the process involves comparing "the return of a managed portfolio over some evaluation period to the return

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<sup>46</sup> The one exception is UP for the S&P 500 Railroad Customers sample, which has a median across years equal to the 35<sup>th</sup> percentile for ROIC minus COC and 26<sup>th</sup> percentile for Adjusted ROIC minus COC; however, UP's median percentile for the S&P 500 and S&P 500 Industrials benchmarking groups are all below the 25<sup>th</sup> percentile for both financial performance measures. See Table 7, Panel B.

of a benchmark portfolio. The benchmark portfolio should represent a feasible investment alternative to the managed portfolio being evaluated.”<sup>47</sup> Because accounting-based financial metrics, including accounting rates of return, are inaccurate estimates of the economic concepts of profits, we benchmark a company’s financial metrics against comparable financial metrics of a chosen benchmark group.<sup>48</sup> In forecasting a company’s future financial performance, benchmarking is used both to determine the drivers (financial metrics) generating the output of the forecasting model and to evaluate the reasonableness of the model’s forecasts.<sup>49</sup> Benchmarking also is used in several ways when valuing a company, for example, to measure the company’s cost of capital<sup>50</sup> or to measure the company’s price to earnings, EBITDA to enterprise value, and other market multiples.<sup>51</sup> Establishing the long-run historical performance of a company requires that we analyze time-series of benchmarking results over a sufficiently long period of time to reasonably estimate relative financial performance.

54. Our proposed benchmarking methodology is not innovative or new. It is a standard and well-accepted methodology for analyzing a company’s financial performance. The benchmarking methodology mitigates the erroneous inferences that result from using accounting-based financial rates of return and other financial metrics to estimate the concept of economic profits.

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<sup>47</sup> Argon, G. O. and W. E. Ferson, “Portfolio Performance Evaluation,” *Foundations and Trends in Finance*, Vol. 2, No. 2, 2006, pp. 83–190; see p. 89.

<sup>48</sup> Holthausen and Zmijewski, Chapter 2.

<sup>49</sup> Holthausen and Zmijewski, Chapter 4.

<sup>50</sup> Holthausen and Zmijewski, Chapters 8 and 10.

<sup>51</sup> Holthausen and Zmijewski, Chapters 13 and 14.

## **B. Alternative Specifications of the Return on Invested Capital (ROIC)**

55. In addition to using the Board’s definition of ROIC in our benchmark analysis, we also use an alternative definition of ROIC, Adjusted STB ROIC, which we believe is a more informative measure of financial performance for assessing the financial performance of the railroads. The STB’s Annual Revenue Adequacy Determinations<sup>52</sup> defines ROIC as follows:<sup>53</sup>

$$\text{STB ROIC} = \frac{\text{Adjusted Net Railway Operating Income}}{\text{Tax Adjusted Net Investment Base}}$$

56. The Adjusted STB ROIC makes one adjustment to the Board’s definition of Adjusted Net Railway Operating Income (STB ROIC numerator) and two adjustments to the Board’s definition of Tax Adjusted Net Investment Base (STB ROIC denominator). The adjustment to the Board’s definition of Adjusted Net Railway Operating Income (STB ROIC numerator) eliminates the effect of deferred income taxes in the Provision of Income Taxes. The two adjustments to the Board’s definition of Tax Adjusted Net Investment Base (STB ROIC denominator) are: (a) eliminating the effect of Deferred Tax Liabilities in the calculation of the

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<sup>52</sup> See, for example, STB 2018 Revenue Adequacy Determination, Appendix B. For 2017, the STB adjusted this formula because the decrease in the federal income tax rate (2017 Tax Cut and Jobs Creation Act) resulted in a revaluation of deferred income taxes on the balance sheet (companies, like the railroads, with a net deferred tax liability position on their balance sheet recorded a reduction of that liability, which decreased the provision for income taxes and thus, increased income, in that year). The adjustment had the effect of essentially eliminating this reduction in income tax. “By decision served on July 27, 2018, the Board explained that its revenue adequacy determination, among other calculations for 2017, would be affected by the carriers’ revaluation of their deferred tax liabilities as a result of the Tax Cuts and Jobs Act. R.R. Revenue Adequacy—2017 Determination... The Board adopted this proposal in Railroad Revenue Adequacy—2017 Determination, EP 552 (Sub-No. 22) et al., slip op. at 6-9 (STB served Dec. 6, 2018), and, consistent with that decision, the revenue adequacy determination here reflects the adjustments made in the carriers’ Schedule 250 filings,” STB 2017 Revenue Adequacy Determination, December 21, 2018, footnote 2.

<sup>53</sup> In Appendix A, we provide a detailed description of this formula and the data sources for every input for the railroads and the S&P 500 companies.

Net Investment Base and (b) including the company's investments in non-goodwill intangible assets. The resulting formula for Adjusted STB ROIC is:<sup>54</sup>

$$\text{Adjusted STB ROIC} = \frac{\text{Adjusted Net Railway Operating Income} + \text{Deferred Tax Expense}}{\text{Tax Adjusted Net Investment Base} + \text{Deferred Tax Liabilities} + \text{Non-Goodwill Intangible Assets}}$$

57. The adjustment to the Board's definition of Adjusted Net Railway Operating Income (STB ROIC numerator) to eliminate the effect of deferred income taxes in the Provision of Income Taxes is consistent with basic valuation principles, which measures the value of a company as the discounted value of the cash flows the company is expected to generate for its investors.<sup>55</sup> Eliminating the effect of deferred income taxes in the Provision of Income Taxes is one of the required adjustments to measure a company's cash flows in order to align the company's operating income with the economic concept used in measuring a company's economic profit.

58. The first adjustment to the Board's definition of Tax Adjusted Net Investment Base (STB ROIC denominator) is eliminating the effect of Deferred Tax Liabilities in the calculation of the Net Investment Base. IRS rules for depreciation (and other items resulting in deferred tax liabilities) are not intended for, and do not purport to be, better estimates of economic depreciation and other types of expenses. The basic concept of economic depreciation (Hotelling (1925) or replacement cost as proxy) indicates that accelerated IRS depreciation is not a better estimate of economic depreciation. Thus, this adjustment mitigates—but does not eliminate—the effect of two of the factors that make accounting rates of return inaccurate estimates of the

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<sup>54</sup> Adding Deferred Tax Liabilities to the denominator of the Adjusted STB ROIC has the effect of eliminating the deduction of Deferred Tax Liabilities used in the STB definition of ROIC.

<sup>55</sup> Holthausen and Zmijewski, Chapters 13 and 14.

cost of capital: depreciation in excess of economic depreciation and the book value of the assets relative to the market value of the assets.

59. The second adjustment to the Board's definition of Tax Adjusted Net Investment Base (STB ROIC denominator) is including the company's investments in non-goodwill intangible assets. This adjustment has no meaningful effect on the railroads' ROICs, and thus, no meaningful effect on the ROIC minus COC measure of financial performance used by the Board. However, it can have a meaningful effect on the ROIC of other S&P 500 companies that have substantial investments in non-goodwill intangible assets.<sup>56</sup>

60. As an illustration, consider JM Smucker Company ("Smucker"). In 2016, Smucker's total assets included \$1.6 billion in net property and equipment and \$6.1 billion in non-goodwill intangible assets.<sup>57</sup> Using the STB definition, Smucker's 2016 Tax Adjusted Net Investment Base is \$171.3 million. The value of Smucker's 2016 Tax Adjusted Net Investment Base is substantially less than the book value of its net property and equipment because the STB calculation subtracts Accumulated Deferred Income Tax Credits, which were \$2.4 billion for Smucker in 2016. Using the STB definition, Smucker's Adjusted Operating Income is \$958.8 million and its 2016 ROIC is over 550% ( $5.597 = \$958.8 / \$171.3$ ). Including Smucker's non-goodwill intangible assets in the calculation of its 2016 Tax Adjusted Net Investment Base, increases Smucker's 2016 ROIC denominator to \$6,493.5 million, which reduces its 2016 ROIC to 14.8% ( $0.1477 = \$958.8 / \$6,493.5$ ).

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<sup>56</sup> Examples of non-goodwill intangible assets include assets such as patents, copyrights, trademarks, computer software, licenses, films, and import quotas. Accounting rules generally require companies to expense – as opposed to capitalize – expenditures that result in such assets but require companies to record the value of non-goodwill intangible assets when they acquire another company.

<sup>57</sup> The non-goodwill intangible assets consist of "Customer and contractual relationships, Patents and technology, and Trademarks". See 2016 JM Smucker Annual Report, p. 57.

61. The Smucker’s example illustrates the bias of excluding non-goodwill intangible assets in the ROIC calculation, resulting in overstating a company’s ROIC. Because none of the railroads have meaningful non-goodwill intangible assets, this adjustment has no effect for assessing their financial performance. However, it has a substantial effect for assessing the railroads’ financial performance relative to other companies that may have substantial non-goodwill intangible assets. Generally, excluding non-goodwill intangible assets has the effect of increasing ROIC and thus ROIC minus COC for the benchmark groups.

62. We believe the ROIC measure based on these adjustments are a more useful, albeit still noisy and inaccurate, measure of financial performance to use to compare to a company’s COC.

### **C. Data**

63. Our methodology compares the measure of railroads’ financial performance used by the Board in its Annual Revenue Adequacy Determinations to the financial performance of three benchmarking groups over the 2006–2019 period:<sup>58</sup> (a) S&P 500 companies excluding railroads, financial institutions, and real estate companies (“S&P 500” benchmarking group);<sup>59</sup> (b) S&P 500 Industrials Sector excluding railroads, the industry sector to which railroads belong (“S&P 500 Industrials Sector” benchmarking group);<sup>60</sup> and (c) customers (shippers) of CN, NS, and/or

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<sup>58</sup> We use this time period as illustration to show the analysis over a sufficiently long period of time to reasonably estimate relative financial performance.

<sup>59</sup> The S&P 500 is “is widely regarded as the best single gauge of large-cap U.S. equities... The index includes 500 leading companies and covers approximately 80% of available market capitalization.” See, <http://us.spindices.com/indices/equity/sp-500>. We exclude financial institutions and real estate companies because they have substantially different capital structures and business operations; however, none of the conclusions in our analyses change if we include financial institutions and real estate companies.

<sup>60</sup> Industry Sectors are based on the Global Industry Classification Standard (“GICS”).

The GICS methodology aims to enhance the investment research and asset management process for financial professionals worldwide. It is the result of numerous discussions with asset owners, portfolio managers and investment analysts around the world. It was designed in response to the global financial community’s need for accurate, complete and standard industry definitions.

UP in the S&P 500 that accounted for at least \$1.0 million of combined revenues to those railroads during 2018 (“S&P 500 Railroad Customers” benchmarking group). All three alternative benchmarking groups include a broad selection of companies that compete with railroads to raise capital. In our analyses, we evaluate each railroad’s relative financial performance by determining the percentile of the distribution of the financial performance of the members of a benchmarking group into which that railroad falls. In addition, we calculate the financial performance of the railroad industry (“Industry Weighted Average”) and benchmark the relative financial performance of the railroad industry as a whole in the same way.<sup>61</sup>

64. Naturally, a company’s ROIC minus COC requires the calculation of that company’s ROIC and industry cost of capital. ROIC does not have a single generally accepted or standard definition. The Board uses a specific definition for ROIC (“STB ROIC”), and we use that definition as one alternative for our analysis. We also use an alternative definition of ROIC (“Adjusted STB ROIC”), which we believe is a more informative measure of accounting-based financial performance for assessing the financial performance of the railroads based on ROIC minus COC. Although we do not agree with the Board’s definition and implementation of the cost of capital, we do not adjust it and instead use the Board’s definition and implementation to measure the cost of capital for the railroads and the companies within the S&P 500 benchmarking groups.

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The GICS structure consists of 11 Sectors, 24 Industry groups, 69 Industries and 158 sub-industries. The railroads are included in the Industrial Sector 20. GICS® Global Industry Classification Standard accessed on August 14, 2020 at [https://www.spglobal.com/marketintelligence/en/documents/112727-gics-mapbook\\_2018\\_v3\\_letter\\_digitalspreads.pdf](https://www.spglobal.com/marketintelligence/en/documents/112727-gics-mapbook_2018_v3_letter_digitalspreads.pdf)

<sup>61</sup> The Industry Weighted Average is equal to the weighted average of the ROICs of the seven railroads minus the industry cost of capital. See Appendix A for detailed description of the Industry Weighted Average calculation.

65. In Appendix A, we provide a detailed description of the formulas used and the data sources for all of the inputs in our analysis.<sup>62</sup> As explained in detail in Appendix A, we use the same data sources and measurement of inputs in calculating railroads' ROIC as those used in the Board's Revenue Adequacy Determinations.<sup>63</sup> Compustat, a publicly available database widely used in peer reviewed academic studies, is our source of data for measuring ROIC for the S&P 500 benchmarking groups. As also explained in detail in Appendix A, the data sources and measurement of the inputs for the railroads cost of capital are the same as those used in the STB's Annual Cost of Capital Decisions.<sup>64</sup> The data sources used to measure the industry cost of capital for the S&P 500 benchmarking groups are Ibbotson<sup>65</sup> and Duff & Phelps,<sup>66</sup> which are publicly available and widely used in peer reviewed academic studies. In Exhibit A1 of Appendix A, we present a list of the S&P 500 benchmarking group for each year in the analysis.<sup>67</sup>

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<sup>62</sup> As explained in detail in Appendix A, for ROIC and the cost of capital for the railroads, we use the same data sources and measurement of the inputs for the calculation of railroads' ROIC as those in the STB Revenue Adequacy Determinations; the data source used to measure ROIC for the S&P 500 companies is Compustat, which is publicly available and widely used in such analyses and in peer reviewed academic studies.

<sup>63</sup> For example, see STB 2018 Revenue Adequacy Determination. See Appendix A for citations to each of these data sources. Appendix B presents the ROIC minus COC for the railroads for each year.

<sup>64</sup> For example, see Surface Transportation Board Decision, Railroad Cost of Capital – 2018, Docket No. EP 558 (Sub-No. 22), August 6, 2019 ("STB 2018 Cost of Capital Decision"). See Appendix A for citations to each of these data sources.

<sup>65</sup> The Ibbotson Cost of Capital Yearbook, originally published by Ibbotson and Associates, had been subsequently published by Morningstar, Inc. through 2014 when it was discontinued. According to Morningstar, the "Cost of Capital Yearbook... includes five separate measures of cost of equity, weighted average cost of capital, detailed statistics for sales and profitability, capitalization, beta, equity valuation multiples,... The publication is considered an invaluable independent resource to a large number of financial professionals." See, Ibbotson Cost of Capital 2012 Yearbook, p. 1.

<sup>66</sup> Duff and Phelps acquired the cost of capital publication business from Morningstar and replaced the discontinued Cost of Capital Yearbook with the Duff & Phelps Valuation Handbook – U.S. Industry Cost of Capital.

<sup>67</sup> As shown in this exhibit, because the S&P 500 has turnover in its membership, the S&P 500 includes 795 companies during 2006 – 2019 period. Only 273 companies (34%) were members of the S&P 500 in every year from 2006 – 2019. 162 companies (21%) were members of the S&P 500 for nine to thirteen years, 135 companies (17%) were members of the S&P 500 for five to eight years, and with 225 companies (28%) members of the S&P 500 for one to four years. The companies marked with an asterisk next right to a company's ticker are financial

#### **D. Railroads' Relative Financial Performance Based on the Board's Definitions of ROIC and Cost of Capital**

66. In this section, we present the results of our comparison of the relative financial performance of seven railroads based on the Board's definitions of ROIC and industry COC: BNSF Railway; CSX Corporation; Grand Trunk Corporation; Kansas City Southern; Norfolk Southern Corporation; Soo Line Corporation; and Union Pacific Corporation. Table 1 below compares the financial performance of the railroads to the S&P 500 excluding railroads, financial institutions, and real estate companies (see Appendix Exhibit A1 for list of companies in the S&P 500 each year).<sup>68</sup> This table has two panels. In the top panel, we present descriptive statistics about the S&P 500 benchmarking group and in the bottom panel, we present the minimum, maximum, median,<sup>69</sup> and average percentile of ROIC minus COC within the distribution of the S&P 500 benchmarking group for the railroad industry and for each of the seven railroads.

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institutions or real estate companies, which we exclude from our analyses because financial institutions and real estate companies have substantially different capital structures, assets, and business models than other companies in the S&P 500. The number of S&P 500 Companies excluding financial institutions and real estate companies is shown at the top of the exhibit and range from 396 to 414 over this period.

<sup>68</sup> See Exhibit 1 for the year-by-year results for the Industry Weighted Average and the seven railroads summarized in Table 1.

<sup>69</sup> We use medians and 25<sup>th</sup> percentiles in our analyses to mitigate the effect of outliers. See Chapter 2 in Holthausen and Zmijewski for a discussion of mitigating the effect of outliers when conducting a financial analysis.

**Table 1**  
**S&P 500 Companies Excluding Railroads, Financial Institutions and Real Estate Companies**

| <b>Number of Observations, Median, 25th Percentile, and % Positive ROIC minus COC Over 2006-2019 Period</b> |                |                |               |                |
|-------------------------------------------------------------------------------------------------------------|----------------|----------------|---------------|----------------|
|                                                                                                             | <b>Minimum</b> | <b>Maximum</b> | <b>Median</b> | <b>Average</b> |
| <b>Number of Observations in Sample</b>                                                                     | 368            | 405            | 395           | 391            |
| <b>Median ROIC minus COC</b>                                                                                | 13%            | 29%            | 19%           | 20%            |
| <b>25th Percentile ROIC minus COC</b>                                                                       | -1%            | 6%             | 5%            | 4%             |
| <b>% with ROIC minus COC &gt; 0.0%</b>                                                                      | 73%            | 91%            | 89%           | 88%            |
| <b><u>Railroad Percentile in the Distribution of ROIC minus COC</u></b>                                     |                |                |               |                |
| <b>Industry Weighted Average ROIC</b>                                                                       | 9              | 22             | 13            | 15             |
| <b>BNSF Railway</b>                                                                                         | 9              | 23             | 15            | 15             |
| <b>CSX Corporation</b>                                                                                      | 6              | 24             | 10            | 12             |
| <b>Grand Trunk Corporation</b>                                                                              | 3              | 16             | 10            | 10             |
| <b>Kansas City Southern</b>                                                                                 | 4              | 18             | 8             | 9              |
| <b>Norfolk Southern Corporation</b>                                                                         | 10             | 24             | 13            | 15             |
| <b>Soo Line Corporation</b>                                                                                 | 2              | 26             | 13            | 13             |
| <b>Union Pacific Corporation</b>                                                                            | 8              | 30             | 22            | 20             |

Sources: Bloomberg; Compustat; Ibbotson Yearbook (2006-2019); STB Revenue Adequacy Determination Report (2006-2018); RevAd 2019 AAR workpaper1.pdf, titled "AAR Duplication of STB Workpapers."

67. As shown in the top panel of Table 1, the number of companies in the S&P 500 benchmarking group varies from 368 to 405 across years (2006 through 2019). The number of observations differs from the possible number of observations because some companies in the S&P 500 benchmarking group have negative denominators based on the Board definition of Tax Adjusted Net Investment Base, so we exclude them from the S&P 500 benchmarking group because their ROIC is not meaningful. The median ROIC minus COC for the S&P 500 benchmarking group ranges from 13% to 29% over the 2006 – 2019 period, and the median of the annual medians is 19% (average 20%). The 25<sup>th</sup> percentile ROIC minus COC for the S&P 500 benchmarking group range from -1% to 6% over the 2006 – 2019 period, and the median of the annual 25<sup>th</sup> percentile is 5% (average 4%). The ROIC minus COC is positive in every year for most companies in the S&P benchmarking group. The percentage of companies in the S&P

500 benchmarking group annually that have a positive ROIC minus COC ranges from 73% to 91% over the 2006 – 2019 period.

68. As shown in the bottom panel of Table 1, the Industry Weighted Average ROIC minus COC percentile for the railroad companies in the S&P as a whole within the S&P 500 benchmarking group over this period ranges from the 9<sup>th</sup> percentile to the 22<sup>nd</sup> percentile. The median of the annual medians of the over this period for the Industry Weighted Average is the 13<sup>th</sup> percentile, and the average of the annual medians over this period is the 15<sup>th</sup> percentile. For the seven railroads, the median of the annual medians over this period range from the 8<sup>th</sup> percentile to the 22<sup>nd</sup> percentile, and the average of the annual medians over this period range from the 9<sup>th</sup> percentile to the 20<sup>th</sup> percentile.

69. Table 2 below presents the same type of analysis as that presented in Table 1 but for the S&P 500 Industrials Sector benchmarking group.<sup>70</sup> As shown in the top panel of Table 2, the number of observations annually in the S&P 500 Industrials Sector benchmarking group varies from 48 to 63. The median ROIC minus COC for the S&P 500 Industrials Sector ranges from 14% to 31% over the 2006 – 2019 period, and the median of the annual medians is 23% (average 23%). The 25<sup>th</sup> percentile ROIC minus COC for the S&P 500 Industrial Sector ranges from 4% to 14% over the 2006 – 2019 period, and the median of the annual 25<sup>th</sup> percentile is 13% (average 12%). The percentage of companies in the S&P 500 Industrial Sector benchmarking group that have a positive ROIC minus COC range from 83% to 100% over the 2006 – 2019 period.

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<sup>70</sup> See Exhibit 1 for the year-by-year results for the Industry Weighted Average and the seven railroads summarized in Table 2.

**Table 2**  
**S&P 500 Companies in the Industrials Sector Excluding Railroads**

| <b>Number of Observations, Median, 25th Percentile, and % Positive ROIC minus COC Over 2006-2019 Period</b> |                |                |               |                |
|-------------------------------------------------------------------------------------------------------------|----------------|----------------|---------------|----------------|
|                                                                                                             | <b>Minimum</b> | <b>Maximum</b> | <b>Median</b> | <b>Average</b> |
| <b>Number of Observations in Sample</b>                                                                     | 48             | 63             | 56            | 57             |
| <b>Median ROIC minus COC</b>                                                                                | 14%            | 31%            | 23%           | 23%            |
| <b>25th Percentile ROIC minus COC</b>                                                                       | 4%             | 14%            | 13%           | 12%            |
| <b>% with ROIC minus COC &gt; 0.0%</b>                                                                      | 83%            | 100%           | 96%           | 95%            |
| <b><u>Railroad Percentile in the Distribution of ROIC minus COC</u></b>                                     |                |                |               |                |
| <b>Industry Weighted Average ROIC</b>                                                                       | 2              | 12             | 7             | 7              |
| <b>BNSF Railway</b>                                                                                         | 2              | 13             | 7             | 7              |
| <b>CSX Corporation</b>                                                                                      | 2              | 11             | 5             | 6              |
| <b>Grand Trunk Corporation</b>                                                                              | 2              | 9              | 5             | 5              |
| <b>Kansas City Southern</b>                                                                                 | 2              | 9              | 4             | 5              |
| <b>Norfolk Southern Corporation</b>                                                                         | 2              | 14             | 8             | 7              |
| <b>Soo Line Corporation</b>                                                                                 | 2              | 15             | 6             | 6              |
| <b>Union Pacific Corporation</b>                                                                            | 4              | 21             | 9             | 10             |

Sources: Bloomberg; Compustat; Ibbotson Yearbook (2006-2019); STB Revenue Adequacy Determination Report (2006-2018); RevAd 2019 AAR workpaper1.pdf, titled "AAR Duplication of STB Workpapers."

70. As shown in the bottom panel of Table 2, the Industry Weighted Average ROIC minus COC percentile within the S&P 500 Industrials Sector benchmarking group over this period ranges from the 2<sup>nd</sup> percentile to the 12<sup>th</sup> percentile. The median of the annual medians over this period for the Industry Weighted Average is the 7<sup>th</sup> percentile, and the average of the annual medians over this period also is the 7<sup>th</sup> percentile. For the seven railroads, the median of the annual medians over this period range from the 4<sup>th</sup> percentile to the 9<sup>th</sup> percentile, and the average of the annual medians over this period range from the 5<sup>th</sup> percentile to the 10<sup>th</sup> percentile.

71. Table 3 below presents the same type of analysis as that presented in Tables 1 and 2 for the S&P 500 Railroad Customers benchmarking group.<sup>71</sup> As shown in the top panel of Table 3,

<sup>71</sup> See Exhibit 1 for the year-by-year results for the Industry Weighted Average and the seven railroads summarized in Table 3.

the number of observations in the S&P 500 Railroad Customers companies varies from 80 to 86. The median ROIC minus COC for the S&P 500 Railroad Customers companies ranges from 3% to 13% over the 2006 – 2019 period, and the median of the annual medians is 8% (average 9%). The 25<sup>th</sup> percentile ROIC minus COC for the S&P 500 companies ranges from -4% to 4% over the 2006 – 2019 period, and the median of the annual 25<sup>th</sup> percentile is 2% (average 2%). The ROIC minus COC is positive for most companies in the S&P companies. The percentage of the S&P 500 companies with a positive ROIC minus COC ranges from 61% to 88% over the 2006 – 2019 period.

**Table 3**  
**Railroad Customer Sample of S&P 500 Companies**

| <b>Number of Observations, Median, 25th Percentile, and % Positive ROIC minus COC Over 2006-2019 Period</b> |                |                |               |                |
|-------------------------------------------------------------------------------------------------------------|----------------|----------------|---------------|----------------|
|                                                                                                             | <b>Minimum</b> | <b>Maximum</b> | <b>Median</b> | <b>Average</b> |
| <b>Number of Observations in Sample</b>                                                                     | 80             | 86             | 84            | 83             |
| <b>Median ROIC minus COC</b>                                                                                | 3%             | 13%            | 8%            | 9%             |
| <b>25th Percentile ROIC minus COC</b>                                                                       | -4%            | 4%             | 2%            | 2%             |
| <b>% with ROIC minus COC &gt; 0.0%</b>                                                                      | 61%            | 88%            | 83%           | 81%            |
| <b>Railroad Percentile in the Distribution of ROIC minus COC:</b>                                           |                |                |               |                |
| <b>Industry Weighted Average ROIC</b>                                                                       | 7              | 36             | 22            | 23             |
| <b>BNSF Railway</b>                                                                                         | 7              | 36             | 24            | 24             |
| <b>CSX Corporation</b>                                                                                      | 5              | 39             | 16            | 18             |
| <b>Grand Trunk Corporation</b>                                                                              | 5              | 29             | 14            | 16             |
| <b>Kansas City Southern</b>                                                                                 | 5              | 28             | 13            | 13             |
| <b>Norfolk Southern Corporation</b>                                                                         | 15             | 33             | 20            | 23             |
| <b>Soo Line Corporation</b>                                                                                 | 6              | 43             | 19            | 20             |
| <b>Union Pacific Corporation</b>                                                                            | 6              | 49             | 35            | 31             |

Sources: Bloomberg; Compustat; Ibbotson Yearbook (2006-2019); STB Revenue Adequacy Determination Report (2006-2018); RevAd 2019 AAR workpaper1.pdf, titled "AAR Duplication of STB Workpapers."

72. As shown in the bottom panel of Table 3, the Industry Weighted Average ROIC minus COC percentile within the sample over this period ranges from the 7<sup>th</sup> percentile to the 36<sup>th</sup> percentile. The median of the annual medians over this period for the Industry Weighted

Average is the 22<sup>nd</sup> percentile, and the average of the annual medians over this period is the 23<sup>rd</sup> percentile. The median of the annual medians over this period for the seven railroads range from the 13<sup>th</sup> percentile to the 35<sup>th</sup> percentile and the average of the annual medians over this period for the seven railroads range from the 13<sup>th</sup> percentile to the 31<sup>st</sup> percentile.

#### **E. Railroads' Relative Financial Performance Based on the Adjusted ROIC and the Board's Definition of the Cost of Capital**

73. In this section, we discuss the relative financial performance of the railroads based on the Adjusted STB ROIC and the industry cost of capital (COC). Recall that the difference between the STB ROIC and the Adjusted STB ROIC is (a) eliminating the effect of deferred income taxes in the Provision of Income Taxes in the Adjusted Net Railway Operating Income (STB ROIC numerator) and (b) eliminating the effect of Deferred Tax Liabilities and including the company's investments in non-goodwill intangible assets in the Tax Adjusted Net Investment Base (STB ROIC denominator). The results in Tables 4 through 6 in this section correspond to the results in Tables 1 through 3 in the preceding section except that the measure of financial performance is Adjusted STB ROIC minus the industry cost of capital (COC), i.e. Adjusted ROIC minus COC.

74. Table 4 below presents the results of this analysis comparing the financial performance of the railroads to the S&P 500 benchmarking group.<sup>72</sup> As shown in the top panel of Table 4, the number of companies in the S&P 500 benchmarking group varies from 393 to 415. The median Adjusted ROIC minus COC for the S&P 500 benchmarking group range from 5% to 12% over the 2006 – 2019 period, and the median of the annual medians is 10% (average 9%). The 25<sup>th</sup> percentile of Adjusted ROIC minus COC for the S&P 500 benchmarking group ranges from -2%

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<sup>72</sup> See Exhibit 2 for the year-by-year results for the Industry Weighted Average and the seven railroads summarized in Table 4.

to 3% over the 2006 – 2019 period, and the median of the annual 25<sup>th</sup> percentile is 2% (average 2%). The percentage of companies in the S&P 500 benchmarking group that have a positive Adjusted ROIC minus COC ranges from 68% to 87% over the 2006 – 2019 period.

**Table 4**  
**S&P 500 Companies Excluding Railroads, Financial Institutions and Real Estate Companies**

| <b>Number of Observations, Median, 25th Percentile, and % Positive ROIC minus COC Over 2006-2019 Period</b> |                |                |               |                |
|-------------------------------------------------------------------------------------------------------------|----------------|----------------|---------------|----------------|
|                                                                                                             | <b>Minimum</b> | <b>Maximum</b> | <b>Median</b> | <b>Average</b> |
| <b>Number of Observations in Sample</b>                                                                     | 393            | 415            | 409           | 406            |
| <b>Median Adjusted ROIC minus COC</b>                                                                       | 5%             | 12%            | 10%           | 9%             |
| <b>25th Percentile Adjusted ROIC minus COC</b>                                                              | -2%            | 3%             | 2%            | 2%             |
| <b>% with ROIC minus COC &gt; 0.0%</b>                                                                      | 68%            | 87%            | 83%           | 83%            |
| <b><u>Railroad Percentile in the Distribution of Adjusted ROIC minus COC</u></b>                            |                |                |               |                |
| <b>Industry Weighted Average ROIC</b>                                                                       | 9              | 25             | 13            | 14             |
| <b>BNSF Railway</b>                                                                                         | 8              | 24             | 14            | 15             |
| <b>CSX Corporation</b>                                                                                      | 6              | 26             | 10            | 12             |
| <b>Grand Trunk Corporation</b>                                                                              | 4              | 15             | 9             | 10             |
| <b>Kansas City Southern</b>                                                                                 | 5              | 20             | 10            | 11             |
| <b>Norfolk Southern Corporation</b>                                                                         | 7              | 21             | 11            | 13             |
| <b>Soo Line Corporation</b>                                                                                 | 1              | 34             | 13            | 14             |
| <b>Union Pacific Corporation</b>                                                                            | 8              | 35             | 17            | 19             |

Sources: Bloomberg; Compustat; Ibbotson Yearbook (2006-2019); STB Revenue Adequacy Determination Report (2006-2018); RevAd 2019 AAR workpaper1.pdf, titled "AAR Duplication of STB Workpapers."

75. As shown in the bottom panel of Table 4, the Industry Weighted Average Adjusted ROIC minus COC percentile within the S&P 500 benchmarking group over this period ranges from the 9<sup>th</sup> percentile to the 25<sup>th</sup> percentile. The median of the annual medians of the over this period for the Industry Weighted Average is the 13<sup>th</sup> percentile, and the average of the annual medians over this period is the 14<sup>th</sup> percentile. For the seven railroads, the median of the annual medians over this period range from the 9<sup>th</sup> percentile to the 17<sup>th</sup> percentile, and the average of the annual medians over this period range from the 10<sup>th</sup> percentile to the 19<sup>th</sup> percentile.

76. Table 5 below presents the same type of analysis as that presented in Table 4 but for the S&P 500 Industrials Sector benchmarking group.<sup>73</sup> As shown in the top panel of Table 5, the number of observations in the S&P 500 Industrials Sector benchmarking group varies from 48 to 66. The median Adjusted ROIC minus COC for the S&P 500 Industrials Sector ranges from 5% to 15% over the 2006 – 2019 period, and the median of the annual medians is 13% (average 12%). The 25<sup>th</sup> percentile Adjusted ROIC minus COC for the S&P 500 Industrial Sector ranges from 1% to 9% over the 2006 – 2019 period, and the median of the annual 25<sup>th</sup> percentile is 7% (average 6%). The percentage of companies in the S&P 500 Industrial Sector benchmarking group that have a positive Adjusted ROIC minus COC ranges from 80% to 97% over the 2006 – 2019 period.

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<sup>73</sup> See Exhibit 2 for the year-by-year results for the Industry Weighted Average and the seven railroads summarized in Table 5.

**Table 5**  
**S&P 500 Companies in the Industrials Sector Excluding Railroads**

| <b>Number of Observations, Median, 25th Percentile, and % Positive ROIC minus COC Over 2006-2019 Period</b> |                |                |               |                |
|-------------------------------------------------------------------------------------------------------------|----------------|----------------|---------------|----------------|
|                                                                                                             | <b>Minimum</b> | <b>Maximum</b> | <b>Median</b> | <b>Average</b> |
| <b>Number of Observations in Sample</b>                                                                     | 48             | 66             | 59            | 59             |
| <b>Median Adjusted ROIC minus COC</b>                                                                       | 5%             | 15%            | 13%           | 12%            |
| <b>25th Percentile Adjusted ROIC minus COC</b>                                                              | 1%             | 9%             | 7%            | 6%             |
| <b>% with ROIC minus COC &gt; 0.0%</b>                                                                      | 80%            | 97%            | 93%           | 92%            |
| <b><u>Railroad Percentile in the Distribution of Adjusted ROIC minus COC</u></b>                            |                |                |               |                |
| <b>Industry Weighted Average ROIC</b>                                                                       | 2              | 13             | 7             | 7              |
| <b>BNSF Railway</b>                                                                                         | 2              | 16             | 6             | 7              |
| <b>CSX Corporation</b>                                                                                      | 2              | 13             | 5             | 6              |
| <b>Grand Trunk Corporation</b>                                                                              | 2              | 11             | 4             | 5              |
| <b>Kansas City Southern</b>                                                                                 | 2              | 11             | 5             | 5              |
| <b>Norfolk Southern Corporation</b>                                                                         | 2              | 13             | 5             | 6              |
| <b>Soo Line Corporation</b>                                                                                 | 2              | 19             | 6             | 7              |
| <b>Union Pacific Corporation</b>                                                                            | 3              | 23             | 7             | 9              |

Sources: Bloomberg; Compustat; Ibbotson Yearbook (2006-2019); STB Revenue Adequacy Determination Report (2006-2018); RevAd 2019 AAR workpaper1.pdf, titled "AAR Duplication of STB Workpapers."

77. As shown in the bottom panel of Table 5, the Industry Weighted Average Adjusted ROIC minus COC percentile within the S&P 500 Industrials Sector benchmarking group over this period ranges from the 2<sup>nd</sup> percentile to the 13<sup>th</sup> percentile. The median of the annual medians of the over this period for the Industry Weighted Average is the 7<sup>th</sup> percentile, and the average of the annual medians over this period is the 7<sup>th</sup> percentile. For the seven railroads, the median of the annual medians over this period range from the 4<sup>th</sup> percentile to the 7<sup>th</sup> percentile, and the average of the annual medians over this period range from the 5<sup>th</sup> percentile to the 9<sup>th</sup> percentile.

78. Finally, Table 6 below presents the same type of analysis as presented in Tables 4 and 5 but for the S&P 500 Railroad Customers benchmarking group.<sup>74</sup> As shown in the top panel of Table 6, the number of observations in the S&P 500 Railroad Customers companies varies from 80 to 87. The median Adjusted ROIC minus COC for the S&P 500 Railroad Customers companies ranges from 0% to 9% over the 2006 – 2019 period, and the median of the annual medians is 5% (average 5%). The 25<sup>th</sup> percentile Adjusted ROIC minus COC for the S&P 500 Railroad Customers companies ranges from -5% to 2% over the 2006 – 2019 period, and the median of the annual 25<sup>th</sup> percentile is 0% (average 0%). The percentage of the S&P 500 Railroad Customers companies that have a positive Adjusted ROIC minus COC ranges from 52% to 84% over the 2006 – 2019 period.

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<sup>74</sup> See Exhibit 2 for the year-by-year results for the Industry Weighted Average and the seven railroads summarized in Table 6.

**Table 6**  
**Railroad Customer Sample of S&P 500 Companies**

| <b>Number of Observations, Median, 25th Percentile, and % Positive ROIC minus COC Over 2006-2019 Period</b> |                |                |               |                |
|-------------------------------------------------------------------------------------------------------------|----------------|----------------|---------------|----------------|
|                                                                                                             | <b>Minimum</b> | <b>Maximum</b> | <b>Median</b> | <b>Average</b> |
| <b>Number of Observations in Sample</b>                                                                     | 80             | 87             | 84            | 83             |
| <b>Median Adjusted ROIC minus COC</b>                                                                       | 0%             | 9%             | 5%            | 5%             |
| <b>25th Percentile Adjusted ROIC minus COC</b>                                                              | -5%            | 2%             | 0%            | 0%             |
| <b>% with ROIC minus COC &gt; 0.0%</b>                                                                      | 52%            | 84%            | 78%           | 76%            |
| <b>Railroad Percentile in the Distribution of Adjusted ROIC minus COC</b>                                   |                |                |               |                |
| <b>Industry Weighted Average ROIC</b>                                                                       | 7              | 40             | 18            | 21             |
| <b>BNSF Railway</b>                                                                                         | 7              | 38             | 20            | 22             |
| <b>CSX Corporation</b>                                                                                      | 6              | 40             | 16            | 18             |
| <b>Grand Trunk Corporation</b>                                                                              | 5              | 29             | 14            | 15             |
| <b>Kansas City Southern</b>                                                                                 | 6              | 31             | 16            | 16             |
| <b>Norfolk Southern Corporation</b>                                                                         | 11             | 36             | 16            | 19             |
| <b>Soo Line Corporation</b>                                                                                 | 6              | 39             | 19            | 21             |
| <b>Union Pacific Corporation</b>                                                                            | 7              | 49             | 26            | 29             |

Sources: Bloomberg; Compustat; Ibbotson Yearbook (2006-2019); STB Revenue Adequacy Determination Report (2006-2018); RevAd 2019 AAR workpaper1.pdf, titled "AAR Duplication of STB Workpapers."

79. As shown in the bottom panel of Table 6, the Industry Weighted Average Adjusted ROIC minus COC percentile within the sample over this period ranges from the 7<sup>th</sup> percentile to the 40<sup>th</sup> percentile. The median of the annual medians over this period for the Industry Weighted Average is the 18<sup>th</sup> percentile, and the average of the annual medians over this period is the 21<sup>st</sup> percentile. The median of the annual medians over this period for the seven railroads range from the 14<sup>th</sup> percentile to the 26<sup>th</sup> percentile and the average of the annual medians over this period for the seven railroads range from the 15<sup>th</sup> percentile to the 29<sup>th</sup> percentile.

## F. Summary and Conclusions

80. In this section, we analyzed the two measures of the railroads' financial performance (ROIC minus COC and Adjusted ROIC minus COC) and compared them to the financial performance of three benchmarking groups. We summarize these results in Table 7.<sup>75</sup>

**Table 7**  
**Summary of the Analysis of the Railroads' Relative Financial Performance**

| <b>Panel A: Benchmarking Groups' Median Statistics Across Years (2006 through 2019)</b>      |                                |                                |                              |                                        |                                |                              |
|----------------------------------------------------------------------------------------------|--------------------------------|--------------------------------|------------------------------|----------------------------------------|--------------------------------|------------------------------|
|                                                                                              | <b>STB ROIC minus STB COC</b>  |                                |                              | <b>Adjusted STB ROIC minus STB COC</b> |                                |                              |
|                                                                                              | <b>S&amp;P 500<sup>1</sup></b> | <b>Industrials<sup>2</sup></b> | <b>Customers<sup>3</sup></b> | <b>S&amp;P 500<sup>1</sup></b>         | <b>Industrials<sup>2</sup></b> | <b>Customers<sup>3</sup></b> |
| <b>Number of Observations in Sample</b>                                                      | 395                            | 56                             | 84                           | 409                                    | 59                             | 84                           |
| <b>Median ROIC minus COC</b>                                                                 | 19%                            | 23%                            | 8%                           | 10%                                    | 13%                            | 5%                           |
| <b>25th Percentile ROIC minus COC</b>                                                        | 5%                             | 13%                            | 2%                           | 2%                                     | 7%                             | 0%                           |
| <b>% with ROIC minus COC &gt; 0.0%</b>                                                       | 89%                            | 96%                            | 83%                          | 83%                                    | 93%                            | 78%                          |
| <b>Panel B: Railroads' Median of the Annual Percentiles Across Years (2006 through 2019)</b> |                                |                                |                              |                                        |                                |                              |
|                                                                                              | <b>STB ROIC minus STB COC</b>  |                                |                              | <b>Adjusted STB ROIC minus STB COC</b> |                                |                              |
|                                                                                              | <b>S&amp;P 500<sup>1</sup></b> | <b>Industrials<sup>2</sup></b> | <b>Customers<sup>3</sup></b> | <b>S&amp;P 500<sup>1</sup></b>         | <b>Industrials<sup>2</sup></b> | <b>Customers<sup>3</sup></b> |
| <b>Industry Weighted Average ROIC</b>                                                        | 13                             | 7                              | 22                           | 13                                     | 7                              | 18                           |
| <b>BNSF Railway</b>                                                                          | 15                             | 7                              | 24                           | 14                                     | 6                              | 20                           |
| <b>CSX Corporation</b>                                                                       | 10                             | 5                              | 16                           | 10                                     | 5                              | 16                           |
| <b>Grand Trunk Corporation</b>                                                               | 10                             | 5                              | 14                           | 9                                      | 4                              | 14                           |
| <b>Kansas City Southern</b>                                                                  | 8                              | 4                              | 13                           | 10                                     | 5                              | 16                           |
| <b>Norfolk Southern Corporation</b>                                                          | 13                             | 8                              | 20                           | 11                                     | 5                              | 16                           |
| <b>Soo Line Corporation</b>                                                                  | 13                             | 6                              | 19                           | 13                                     | 6                              | 19                           |
| <b>Union Pacific Corporation</b>                                                             | 22                             | 9                              | 35                           | 17                                     | 7                              | 26                           |

Notes:

1 S&P 500 companies excluding Railroads, Financial Institutions and Real Estate Companies

2 S&P 500 companies in the Industrials Sector excluding Railroads

3 Railroad customer sample of S&P 500 companies

Sources: Bloomberg; Compustat; Ibbotson Yearbook (2006-2019); STB Revenue Adequacy Determination Report (2006-2018); RevAd 2019 AAR workpaper1 pdf, titled "AAR Duplication of STB Workpapers "

81. All of the analyses show that the relative financial performance of the railroad industry falls within the bottom quartile of the three benchmarking groups. Thus, the benchmarking analyses we conducted show that financial performance of the railroad industry and the seven

<sup>75</sup> Table 7 summarizes the result shown in Tables 1 through 6 for the median ROIC minus COC and median Adjusted ROIC minus COC.

railroads was well below the financial performance of companies operating in competitive (unregulated) markets.

## **V. SUMMARY AND RECOMMENDATIONS**

82. Economic research has shown that the limitations and inaccuracies of accounting-based rates of return make it difficult, and some say impossible, to draw any inferences about economic rates of return based on accounting rates of return. To the extent it is necessary to use accounting rates of return in comparison to the cost of capital to assess financial performance, using the proposed benchmarking methodology mitigates the limitations and inaccuracies of accounting rates of return as estimates of the cost of capital.

83. Our benchmarking analyses show that the financial performance of the railroad industry as a whole and each of the seven railroads was well below the financial performance of companies operating in competitive (unregulated) markets over the 2006-2019 period. Specifically, using two alternative measures of financial performance and three benchmarking groups, we find that, over this period, the financial performance of the railroad industry and the seven railroads fell well below the median and mostly in the bottom quartile of the financial performance of all three benchmarking groups.

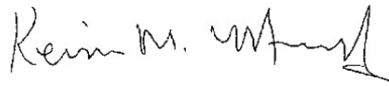
84. If in the future ROIC minus COC exceeds the median for the benchmarking group, then we recommend that the Board should first investigate whether the railroads are above the median for procompetitive reasons – greater efficiency, benefits from risky investments, increases in demand that exceeded expected etc. If, after such investigation, the Board can rule out such procompetitive reasons, and the Board concludes that there is a basis for concern that there is a lack of competition in serving some shippers or some geographic areas, the Board should look to

use its existing tools more effectively and perhaps to make it easier for shippers to challenge specific rates where there may be noncompetitive pricing.

85. In order to avoid penalizing especially efficient railroads and introducing distortions in competition among railroads that would occur if one railroad were subject to additional regulation not imposed on others, the Board should look at the railroad industry as a whole in evaluating whether there is a basis for considering additional regulation in response to potential lack of competition. If the Board determines that such regulation is warranted, it should be imposed on the entire industry, and not just on individual railroads.

**VERIFICATION**

I, Kevin M. Murphy, declare under penalty of perjury that the foregoing is true and correct. Further, I certify that I am qualified and authorized to file this Verified Statement.

A handwritten signature in black ink that reads "Kevin M. Murphy". The signature is written in a cursive style with a large, stylized 'M'.

Kevin M. Murphy

I, Mark E. Zmijewski, declare under penalty of perjury that the foregoing is true and correct. Further, I certify that I am qualified and authorized to file this Verified Statement.

A handwritten signature in black ink that reads "Mark E. Zmijewski". The signature is written in a cursive style with a large, stylized 'Z'.

Mark E. Zmijewski

## APPENDIX A

### SAMPLES, DEFINITIONS, AND DATA SOURCES

A-1. In this Appendix, we describe the calculation methodology and data sources used in the analysis of railroads' financial performance and the railroads' financial performance relative to the financial performance of three benchmarking samples: (a) S&P 500 companies excluding railroads, financial institutions, and real estate companies;<sup>76</sup> (b) S&P 500 Industrials Sector excluding railroads, the industry sector to which railroads belong;<sup>77</sup> and (c) customers of CN, NS, and/or UP in the S&P 500 that account for at least \$1 million of combined revenue in 2018.<sup>78</sup> We analyze the period from 2006 through 2019. Exhibit A1 presents a list of the S&P 500 companies for each year in the analysis. As shown in this exhibit, because the S&P 500 has turnover in its membership, the S&P 500 includes 795 companies during 2006 through 2019 period.<sup>79</sup> If a company is a member of the S&P 500 on December 31 in a given year, that year is marked with 1 and is 0 otherwise. The companies marked with an asterisk next right to the company's ticker are financial institutions or real estate companies, which we exclude from our

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<sup>76</sup> The S&P 500 stock market index, maintained by S&P Dow Jones Indices, comprises 505 common stocks issued by 500 large-cap companies and traded on American stock exchanges. S&P U.S. Indices Methodology Update, January 21, 2015.

<sup>77</sup> Industry Sectors are based on the Global Industry Classification Standard ("GICS"). GICS "was developed by S&P Dow Jones Indices, ..., and MSCI. ... The GICS structure consists of 11 Sectors, 24 Industry groups, 69 Industries and 158 sub-industries." The railroads are included in the Industrial Sector 20. GICS® Global Industry Classification Standard accessed on November 10, 2019 at [https://www.spglobal.com/marketintelligence/en/documents/112727-gics-mapbook\\_2018\\_v3\\_letter\\_digitalspreads.pdf](https://www.spglobal.com/marketintelligence/en/documents/112727-gics-mapbook_2018_v3_letter_digitalspreads.pdf)

<sup>78</sup> We were provided with a list of S&P 500 customers from CN, NS, and UP. The customer companies with a combined 2018 revenue greater than \$1 million are selected as S&P 500 customers for ranking.

<sup>79</sup> Only 273 companies (34%) were members of the S&P 500 in every year from 2006 through 2019. 162 companies (34%) were members of the S&P 500 for nine to thirteen years, 135 companies (17%) were members of the S&P 500 for five to eight years, and 225 companies (28%) were members of the S&P 500 for one to four years.

analyses because financial institutions and real estate companies have substantially different capital structures, assets, and business models than other companies in the S&P 500.

A-2. The Surface Transportation Board's (STB) measure of financial performance used in the STB's Annual Revenue Adequacy Determinations<sup>80</sup> compares a company's accounting-based (or financial statement-based) rate of return on invested capital (ROIC) to that company's industry economic cost of capital (COC);<sup>81</sup> more specifically, it determines whether ROIC minus COC is negative or positive. In our analyses, we calculate each railroad's financial performance (measured by ROIC minus COC) relative to the financial performance (measured by ROIC minus COC) of the benchmarking samples by calculating each railroad's percentile in the distribution of the benchmarking samples. In addition, we calculate the financial performance of the railroad industry, using weighted average ROIC minus COC (Industry Weighted Average), and calculate the relative financial performance of the railroad industry as a whole in the same manner.

A-3. Naturally, a company's ROIC minus COC requires the calculation of that company's ROIC and industry cost of capital. ROIC does not have a single generally accepted or standard definition. The STB has developed a specific definition for ROIC to calculate the financial performance of the railroads; thus, we adopt the STB definition for ROIC ("STB ROIC"). We also use an alternative definition of ROIC ("Adjusted STB ROIC"), which we believe is a more

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<sup>80</sup> See, for example, Surface Transportation Board, Railroad Adequacy – 2018 Determination, Docket No. EP 552 (Sub-No. 23), September 5, 2019 ("STB 2018 Revenue Adequacy Determination").

<sup>81</sup> "Pursuant to those procedures, which are essentially mechanical, a railroad is considered revenue adequate under 49 U.S.C. § 10704(a) if it achieves a rate of return on net investment (ROI) equal to at least the current cost of capital for the railroad industry." Surface Transportation Board, Railroad Revenue Adequacy – 2018 Determination, September 5, 2019.

useful measure of accounting-based financial performance for assessing the financial performance of the railroads based on ROIC minus COC.

**A. Return on Invested Capital (ROIC) – STB definition**

A-4. The STB’s Annual Revenue Adequacy Determinations<sup>82</sup> define ROIC as follows:<sup>83</sup>

$$\text{STB ROIC} = \frac{\text{Adjusted Net Railway Operating Income}}{\text{Tax Adjusted Net Investment Base}}$$

where adjusted Net Railway Operating Income is defined as:

$$\begin{aligned} & \text{Consolidated Net Railway Operating Income} \\ & + \text{Interest Income from Working Capital Allowance – Cash Portion} \\ & + \text{Income Taxes Associated with Non-Rail Income and Deductions} \\ & + \text{Gain or (Loss) from Transfer/Reclassification to Nonrail-Status (Net of Income Taxes)} \\ & = \text{Adjusted Net Railway Operating Income} \end{aligned}$$

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<sup>82</sup> See, for example, STB 2018 Revenue Adequacy Determination, Appendix B.

<sup>83</sup> For 2017, the STB adjusted this formula because the decrease in the federal income tax rate (2017 Tax Cut and Jobs Creation Act) resulted in a revaluation of deferred income taxes on the balance sheet (companies, like the railroads, with a net deferred tax liability position on their balance sheet recorded a reduction of that liability, which decreased the provision for income taxes and thus, increased income, in that year). The adjustment had the effect of essentially eliminating this reduction in income tax. “By decision served on July 27, 2018, the Board explained that its revenue adequacy determination, among other calculations for 2017, would be affected by the carriers’ revaluation of their deferred tax liabilities as a result of the Tax Cuts and Jobs Act. R.R. Revenue Adequacy—2017 Determination... The Board adopted this proposal in Railroad Revenue Adequacy—2017 Determination, EP 552 (Sub-No. 22) et al., slip op. at 6-9 (STB served Dec. 6, 2018), and, consistent with that decision, the revenue adequacy determination here reflects the adjustments made in the carriers’ Schedule 250 filings,” STB 2017 Revenue Adequacy Determination, December 21, 2018, footnote 2.

and where Tax Adjusted Net Investment Base is defined as:<sup>84</sup>

$$\begin{aligned} & \text{Combined Investment in Railroad Property Used in Transportation Service} \\ & - \text{Interest During Construction} \\ & - \text{Other Elements of Investment} \\ & + \text{Net Rail Assets of Rail Related Affiliates} \\ & + \text{Working Capital Allowance}^{85} \\ & - \text{Accumulated Deferred Income Tax Credits} \\ \hline & = \text{Tax Adjusted Net Investment Base} \end{aligned}$$

A-5. For the railroads, we use the same data sources and measurement of the inputs for the calculation of railroads' ROIC as those in the STB's Revenue Adequacy Determinations; thus, our railroad ROICs are numerically identical to those reported in the STB Revenue Adequacy Determinations for all years in the analysis from 2006 through 2019.<sup>86</sup> The data source used to measure ROIC for the S&P 500 companies is Compustat,<sup>87</sup> which is publicly available and widely used in peer reviewed academic studies. For S&P 500 companies, Adjusted Net Railway Operating Income is equal to operating income ("Earnings Before Interest and Taxes" ("EBIT")) minus income taxes ("Income Tax Provision") plus marginal income tax on non-operating

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<sup>84</sup> The Tax Adjusted Net Investment Base is calculated using the average of the beginning (end of prior year) and ending (end of current year) balances for each year.

<sup>85</sup> The STB defines the Working Capital Allowance as the lesser Cash Working Capital Required and Cash and Temporary Cash Balance. Cash Working Capital Required is defined as Days of Working Capital Required (Days of Operating Revenue in Current Operating Assets + 15 days - Days of Operating Expenses in Current Operating Liabilities) multiplied by Average Daily Expenditures.

<sup>86</sup> STB 2006 Revenue Adequacy Determination, May 6, 2008; STB 2007 Revenue Adequacy Determination, September 26, 2008; STB 2008 Revenue Adequacy Determination, October 26, 2009; STB 2009 Revenue Adequacy Determination, November 10, 2010; STB 2010 Revenue Adequacy Determination, January 2, 2014; STB 2011 Revenue Adequacy Determination, January 2, 2014; STB 2012 Revenue Adequacy Determination, January 2, 2014; STB 2013 Revenue Adequacy Determination, September 2, 2014; STB 2014 Revenue Adequacy Determination, September 8, 2015; STB 2015 Revenue Adequacy Determination, September 8, 2016; STB 2016 Revenue Adequacy Determination, September 6, 2017; STB 2017 Revenue Adequacy Determination, December 21, 2018; STB 2018 Revenue Adequacy Determination, September 5, 2019; 2019 Revenue Adequacy Workpapers, May 1, 2020 (document titled "AAR Duplication of STB Workpapers," RevAd 2019 AAR workpaper1.pdf).

<sup>87</sup> Compustat is a "comprehensive database with standardized, historical and point-in-time data, with flexible delivery options to power your quantitative research and analysis... [with] history back to the 1950s, and extended interim history back to 1962." Source: [https://www.spglobal.com/marketintelligence/en/documents/compustat-brochure\\_digital.pdf](https://www.spglobal.com/marketintelligence/en/documents/compustat-brochure_digital.pdf).

income (expense). Tax Adjusted Net Investment Base for the S&P 500 companies is equal to Net Property, Plant & Equipment (“PPE”) plus Inventory plus Working Capital Allowance<sup>88</sup> minus Accumulated Deferred Income Tax Credits.<sup>89</sup> The formula for measuring ROIC using Compustat data is as follows:<sup>90</sup>

$$ROIC = \frac{ebit - txt + \tau * nopi}{Average(ppent + invt + Min(Max(\frac{rectr}{revt} * 360 + 15) - \frac{ap}{xopr - dp} * 360, 0) * \frac{xopr - dp}{360}, che) - txndbl)}$$

where:

- Compustat mnemonic (ebit) = Earnings Before Interest and Taxes
- Compustat mnemonic (txt) = Income Taxes – Total
- Compustat mnemonic (nopi) = Non-Operating Income (Expense)
- $\tau$  = Marginal Tax Rate; 37.5% (2006-2017) and 24% (2018-2019)
- Compustat mnemonic (ppent) = Property, Plant and Equipment - Total (Net)<sup>91</sup>
- Compustat mnemonic (invt) = Inventories – Total<sup>92</sup>
- Compustat mnemonic (rectr) = Receivables – Trade
- Compustat mnemonic (revt) = Revenue – Total
- Compustat mnemonic (ap) = Accounts Payable – Trade
- Compustat mnemonic (xopr) = Operating Expenses – Total
- Compustat mnemonic (dp) = Depreciation and Amortization, and
- Compustat mnemonic (che) = Cash and Short-Term Investments
- Compustat mnemonic (txndbl) = Net Deferred Tax Liability.<sup>93</sup>

<sup>88</sup> To calculate Working Capital Allowance, we followed the methodology outlined in Schedule 245 to the railroads’ Class I Railroad Annual Report R-1.

<sup>89</sup> We calculated Tax Adjusted Net Investment Base using the average of the beginning (end of prior year) and ending (end of current year) balances for each year.

<sup>90</sup> If the average Tax Adjusted Net Investment Base is non-positive, STB ROIC is set to be empty for that observation. If Earnings Before Interest and Taxes (EBIT) is missing from Compustat’s data pull, STB ROIC is set to be empty. For example, EBITs are missing for Commerce Bancorp (ticker: CBH.1) in 2006 and 2007, so the STB ROICs are set to empty for Commerce Bancorp for both years.

<sup>91</sup> If the data point is missing from Compustat’s data pull, it is set to zero.

<sup>92</sup> If the data point is missing from Compustat’s data pull, it is set to zero.

<sup>93</sup> If the data point is missing from Compustat’s data pull, it is set to zero.

## B. Return on Invested Capital (ROIC) – Adjusted STB ROIC Definition

A-6. Also, we propose and analyze an adjusted STB definition of ROIC, which we believe is a more appropriate ROIC measure to use when comparing a company's accounting-based ROIC to its economic cost of capital. The definition of Adjusted STB ROIC makes one adjustment to the STB definition of Adjusted Net Railway Operating Income (i.e. to the STB ROIC numerator) and two adjustments to the STB definition of Tax Adjusted Net Investment Base (i.e. to the STB ROIC denominator). The adjustment to the STB definition of Adjusted Net Railway Operating Income (STB ROIC numerator) is eliminating the effect of deferred income taxes in the Provision of Income Taxes. The two adjustments to the STB definition of Tax Adjusted Net Investment Base (STB ROIC denominator) are: (a) eliminating the effect of Deferred Tax Liabilities in the calculation of the Net Investment Base; and (b) including the company's investments in non-goodwill intangible assets. The resulting formula for Adjusted STB ROIC is:<sup>94</sup>

$$\text{Adjusted STB ROIC} = \frac{\text{Adjusted Net Railway Operating Income} + \text{Deferred Tax Expense}}{\text{Tax Adjusted Net Investment Base} + \text{Deferred Tax Liabilities} + \text{Non-Goodwill Intangible Assets}}$$

Stated in terms of Compustat data items, the resulting formula for Adjusted STB ROIC is:<sup>95</sup>

$$\text{Adjusted STB ROIC} = \frac{ebit - txt + \tau * nopi + txdi}{\text{Average} \left( ppent + invt + \text{Min} \left( \text{Max} \left( \left( \frac{rectr}{revt} * 360 + 15 \right) - \frac{ap}{xopr - dp} * 360, 0 \right) * \frac{xopr - dp}{360}, che \right) - txndbl + txndbl + intano \right)}$$

where:

<sup>94</sup> Adding Deferred Tax Liabilities to the denominator of the Adjusted STB ROIC has the effect of eliminating the deduction of Deferred Tax Liabilities used in the STB definition of ROIC.

<sup>95</sup> If the average denominator for Adjusted STB ROIC is non-positive, Adjusted STB ROIC is set to be empty for that observation. If Earnings Before Interest and Taxes (EBIT) is missing from Compustat's data pull, Adjusted STB ROIC is set to be empty.

Compustat mnemonic (txdi) = Income Taxes - Deferred<sup>96</sup>

Compustat mnemonic (intano) = Other Intangibles<sup>97</sup>

All other Compustat data items are as defined previously.

A-7. One of these adjustments, i.e. adding the company's investments in non-goodwill intangible assets in the calculation of the STB definition of Tax Adjusted Net Investment Base, has no meaningful effect on the railroads' ROICs, and thus, no meaningful effect on the ROIC minus COC measure of financial performance used by the STB. This adjustment has no meaningful effect on railroads' ROICs because railroads do not have substantial investments in non-goodwill intangible assets. However, this adjustment can have a meaningful effect on the ROIC of other S&P 500 companies who have substantial investments in non-goodwill intangible assets.<sup>98</sup>

A-8. Because none of the railroads have meaningful non-goodwill intangible assets, this adjustment has no effect for assessing the financial performance of the railroads, but it has a substantial effect for assessing the financial performance of the railroads relative to other companies that may have substantial non-goodwill intangible assets.

### **C. Industry Weighted Average Return on Invested Capital (ROIC)**

A-9. In addition to analyzing the ROIC minus COC for each of the railroads, we also analyze ROIC minus COC based on an Industry Weighted Average ROIC. We calculate the Industry

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<sup>96</sup> If Income Taxes – Deferred is missing from Compustat's data pull, Income Taxes – Deferred is calculated as Income Taxes – Total minus Income Taxes – Current. However, if either Income Taxes – Total or Income Taxes – Current is also missing, Income Taxes – Deferred is set to zero.

<sup>97</sup> If the data point is missing from Compustat's data pull, it is set to zero.

<sup>98</sup> Examples of non-goodwill intangible assets include assets such as patents, copyrights, trademarks, computer software, licenses, films, and import quotas. Accounting rules generally require companies to expense – as opposed to capitalize – expenditures that result in such assets but require companies to record the value of non-goodwill intangible assets when they acquire another company.

Weighted Average ROIC as the weighted average ROIC of the seven railroads listed in the STB Revenue Adequacy Determinations.<sup>99</sup>

A-10. We use the STB definition of the cost of capital to measure the cost of capital for the railroads and companies in the S&P 500. The STB outlines its cost of capital methodology in the STB's Railroad Cost of Capital Decisions:<sup>100</sup>

$$\begin{aligned} & \text{Industry Cost of Debt} \quad \quad \quad \times \text{Industry Debt Weight} \\ & + \text{Industry Cost of Preferred Equity} \times \text{Industry Preferred Equity Weight} \\ & + \text{Industry Cost of Common Equity} \times \text{Industry Common Equity Weight} \\ & = \text{Industry Cost of Capital} \end{aligned}$$

where Industry Cost of Debt, Industry Cost of Preferred Equity, and Industry Cost of Common Equity, as well as their respective weights, are determined based on individual railroads' accounting and market data. In the following paragraphs, we provide further details on how STB measures each component of the Industry Cost of Capital.

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<sup>99</sup> In mathematical terms, we define the Industry Weighted Average ROIC in each year equal to the sum of the seven railroads' STB ROIC numerators divided by the sum of the seven railroads' STB ROIC denominators using the reported ROIC components in the STB Revenue Adequacy Determinations. For example, based on the STB 2018 Revenue Adequacy Determination, Appendix B, the 2018 Industry Weighted Average ROIC is 12.70% =  $(5,859,642 + 3,124,995 + 820,915 + 364,179 + 2,774,609 + 472,522 + 6,383,168) / (49,292,436 + 23,714,297 + 10,668,213 + 4,535,569 + 23,850,288 + 3,503,522 + 40,396,642)$ , where \$5,859,642, \$3,124,995, \$820,915, \$364,179, \$2,774,609, \$472,522, and \$6,383,168 refer to the 2018 Adjusted Net Railway Operating Income (in USD thousand) for BNSF Railway, CSX Corporation, Grand Trunk Corporation, Kansas City Southern, Norfolk Southern Corporation, Soo Line Corporation, and Union Pacific Corporation, respectively; and where \$49,292,436, \$23,714,297, \$10,668,213, \$4,535,569, \$23,850,288, \$3,503,522, and \$40,396,642 refer to the 2018 Tax Adjusted Net Investment Base (in USD thousand) for BNSF Railway, CSX Corporation, Grand Trunk Corporation, Kansas City Southern, Norfolk Southern Corporation, Soo Line Corporation, and Union Pacific Corporation, respectively.

<sup>100</sup> See, for example, Surface Transportation Board Decision, Railroad Cost of Capital – 2018, Docket No. EP 558 (Sub-No. 22), August 6, 2019 (“STB 2018 Cost of Capital Decision”). To estimate the railroad cost of capital, STB relies on inputs from the Association of American Railroads (“AAR”) who “calculated the cost of capital for a ‘composite railroad’ based on criteria developed in the Railroad Cost of Capital – 1984, 1 I.C.C.2d 989 (1985),” STB 2008 Cost of Capital Decision, p. 2.

A-11. The STB measures the Industry Cost of Debt based on individual railroads' cost of bonds and cost of equipment trust certificates ("ETCs").<sup>101</sup> The cost of bonds is the market value weighted average yield of the publicly traded bonds of all railroads. The cost of ETCs is the market value weighted average yield of the railroads ETCs.<sup>102</sup> In calculating the cost of bonds and cost of ETCs, the STB also considers the flotation cost<sup>103</sup> associated with the issuance of such securities and adds the flotation costs to the respective estimates of the costs of bonds and ETCs. The market value weighted average of cost of bonds and cost of ETC is the Industry Cost of Debt. The STB measures Debt Weight based on railroads' combined market values of debt, common equity, and preferred equity.

A-12. The STB measures the Cost of Preferred Equity as the market value weighted average of the dividend yields (dividend divided by market price of preferred stock) for the preferred stock of the individual railroads.<sup>104</sup> The STB measures the Preferred Equity Weight based on railroads' combined market values of debt, common equity, and preferred equity.

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<sup>101</sup> ETC is "a debt instrument that allows a company to take possession of and enjoy the use of an asset while paying for it over time. The debt issue is secured by the equipment or physical asset. During this time, the title for the equipment is held in trust for the holders of the issue." See, <https://www.investopedia.com/terms/e/equipmenttrustcertificate.asp>. In addition to the cost of bonds and cost of ETCs, the STB also considers the cost of (i) conditional sales agreements and (ii) capitalized leases and miscellaneous debt, however, these debt instruments either have minimal value or are not publicly traded, so they have insignificant effect on the Industry Cost of Debt calculations.

<sup>102</sup> ETCs are not actively traded on the secondary markets and their yield and market values are estimated by adding a spread to the yield of other securities that are actively traded such as government securities with similar maturity.

<sup>103</sup> "Flotation costs are incurred by a publicly traded company when it issues new securities, and includes expenses such as underwriting fees, legal fees and registration fees." See, <https://www.investopedia.com/terms/f/flotationcost.asp>. The calculation of flotation cost is based on the difference in yields between a new issue with flotation cost and an issues without flotation cost. For more details see, for example, STB 2018 Cost of Capital Decision, p. 6 and Table 7.

<sup>104</sup> See, for example, STB 2018 Cost of Capital Decision, p. 11 and Table 13.

A-13. The STB measures the Cost of Common Equity by equally weighting a Capital Asset Pricing Model-based (“CAPM”) and a Multi-Stage Discounted Cash Flow Model-based (“MSDCF”) equity cost of capital. The STB measures the Common Equity Weight based on railroads’ combined market values of debt, common equity, and preferred equity.

A-14. The CAPM has three inputs: beta, risk-free rate, and market risk premium. The STB measures an industry beta by regressing five years of merger-adjusted weekly returns of the portfolio of all publicly traded railroads over the weekly returns of the S&P 500 Index.<sup>105</sup> The STB measures the risk-free rate based on the average yield to maturity for a 20-year U.S. Treasury Bond.<sup>106</sup> The STB measures the market risk premium based on the Ibbotson/Duff & Phelps Cost of Capital Valuation Handbook.<sup>107</sup> The CAPM equity cost of capital for the railroad industry is calculated as the risk-free rate plus the industry beta times the market risk premium.

A-15. The STB measures the MSDCF equity cost of capital using accounting and market data for the publicly traded railroads and the following methodology. Step one – create a cash flow

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<sup>105</sup> See, for example, STB 2018 Cost of Capital Decision, p.8 and Table 9.

<sup>106</sup> See, for example, STB 2018 Cost of Capital Decision, p.7.

<sup>107</sup> See, for example, STB 2018 Cost of Capital Decision, pp. 7-8, “The Ibbotson SBBI Classic Yearbook, published by Morningstar, which was previously used as the source of the market risk premium for 2013 and 2014, has been discontinued. AAR replaced the former source with the Duff & Phelps’ Valuation Handbook—U.S. Guide to Cost of Capital, as the source of the market risk premium for 2015 and 2016. However, in 2018, Duff & Phelps discontinued the publication of that book in hardcover form and replaced it with an online tool called the Cost of Capital Navigator. According to AAR, the Cost of Capital Navigator uses the same method as Ibbotson and provides the same data reflecting the market-risk premium.”

forecast for each railroad using historical accounting data<sup>108</sup> and expected growth rates.<sup>109</sup> Step two – calculate each railroad’s discount rate by equating that railroad’s observed market value with the present value of its future cash flows from step one. Step three – calculate a market value weighted average of the discount rates determined in step two. The resulting estimate is the MSDCF equity cost of capital for the railroad industry.

A-16. Our data sources and measurement of the inputs for the cost of capital of the railroads are the same as those in the STB’s Cost of Capital Decisions.<sup>110</sup> Thus, our cost of capital estimates

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<sup>108</sup> See, for example, STB 2018 Cost of Capital Decision, pp. 9-10 and Table 11. The cash flow (“CF”) is defined as income before extraordinary items (“IBEI”), minus capital expenditures (“CAPEX”), plus depreciation (“DEP”) and deferred taxes (“DT”). That is,  $CF = IBEI - CAPEX + DEP + DT$ . The MSDCF model assumes three stages. Cash flows are projected using different growth rates in each stage, however, all cash flows are derived starting with a base cash flow (“Base CF”) in the current year. The Base CF is the product of the CF ratio and the revenue for the current year, i.e. year zero. The CF ratio is measured by the ratio of the last five years of historical CF divided by the last five years of historical revenue. The cash flow projections are constructed as follows. In the first stage, years 1 to 5, the cash flows are calculated using Base CF and stage-one growth rate (“g-rate\_1”). The estimated cash flows for years 1 to 5 are  $Base\ CF \cdot (1+g\text{-}rate\_1)$ ,  $Base\ CF \cdot (1+g\text{-}rate\_1)^2$ ,  $Base\ CF \cdot (1+g\text{-}rate\_1)^3$ ,  $Base\ CF \cdot (1+g\text{-}rate\_1)^4$ , and  $Base\ CF \cdot (1+g\text{-}rate\_1)^5$ , respectively. In the second stage, years 6 to 10, the cash flows are assumed to continue to grow at stage-two growth rate (“g-rate\_2”). The estimated cash flows for years 6 to 10 are  $Base\ CF \cdot (1+g\text{-}rate\_1)^5 \cdot (1+g\text{-}rate\_2)$ ,  $Base\ CF \cdot (1+g\text{-}rate\_1)^5 \cdot (1+g\text{-}rate\_2)^2$ ,  $Base\ CF \cdot (1+g\text{-}rate\_1)^5 \cdot (1+g\text{-}rate\_2)^3$ ,  $Base\ CF \cdot (1+g\text{-}rate\_1)^5 \cdot (1+g\text{-}rate\_2)^4$ , and  $Base\ CF \cdot (1+g\text{-}rate\_1)^5 \cdot (1+g\text{-}rate\_2)^5$ , respectively. Finally, in the third stage, years 11 and beyond, the cash flows are assumed to grow indefinitely at a constant rate (“g-rate\_3”). The cash flow for year 11 is  $Base\ CF \cdot (1+g\text{-}rate\_1)^5 \cdot (1+g\text{-}rate\_2)^5 \cdot (1+g\text{-}rate\_3)$ . The cash flow in year 11 is used to calculate the terminal value for each railroad.

<sup>109</sup> See, for example, STB 2018 Cost of Capital Decision, pp. 9-10 and Table 11. The MSDCF model assumes three stages with a different growth rate in each stage. The stage-one growth rate, g-rate\_1, is railroad-specific and is based on earnings per share (“EPS”) forecasts. G-rate\_1 is measured using the median of the long-term (three- to five-year) EPS growth rate forecasts published by the financial analysts following each publicly traded railroad. The source for g-rate\_1 is the Institutional Brokers Estimate System (“I/B/E/S”). The stage-two growth rate, g-rate\_2, is the same for all railroads and is calculated as the average of the individual stage-one growth rates. The stage-three growth rate, g-rate\_3, is estimated based on the sum of the long-run historical growth in real Gross Domestic Product (“GDP”) and the long-run expected inflation.

<sup>110</sup> STB 2006 Cost of Capital Decision, STB 2007 Cost of Capital Decision, STB 2008 Cost of Capital Decision, STB 2009 Cost of Capital Decision, STB 2010 Cost of Capital Decision, STB 2011 Cost of Capital Decision, STB 2012 Cost of Capital Decision, STB 2013 Cost of Capital Decision, STB 2014 Cost of Capital Decision, STB 2015 Cost of Capital Decision, STB 2016 Cost of Capital Decision, STB 2017 Cost of Capital Decision, and STB 2018 Cost of Capital Decision.

for the railroad industry are numerically identical to those reported by STB in all years from 2006 to 2019.<sup>111</sup>

A-17. We measure the industry cost of capital for the S&P 500 companies for each two-digit Standard Industry Classification (“SIC”) code.<sup>112</sup> The data source used to measure the industry cost of capital for the S&P 500 companies is Ibbotson/Duff & Phelps Cost of Capital yearbooks,<sup>113</sup> all of which are publicly available and widely used in such analyses and in peer reviewed academic studies.

A-18. The Industry Cost of Debt for the S&P 500 companies is measured using the cost of debt as reported in the Ibbotson/Duff & Phelps Cost of Capital yearbooks.<sup>114</sup> The Debt Weight is measured by the Debt to Total Capital ratio as reported in the Ibbotson/Duff & Phelps Cost of

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<sup>111</sup> 2019 STB Cost of Capital is used from 2019 Revenue Adequacy Workpapers, May 1, 2020 (document titled “AAR Duplication of STB Workpapers,” RevAd 2019 AAR workpaper1.pdf), which is based on the R1 submissions by the carriers and the AAR cost-of-capital submission.

<sup>112</sup> “The Standard Industrial Classification Codes that appear in a company’s disseminated EDGAR filings indicate the company’s type of business. These codes are also used in the Division of Corporation Finance as a basis for assigning review responsibility for the company’s filings.” U.S. Security and Exchange Commission website, accessed on November 16, 2019 at <https://www.sec.gov/info/edgar/siccodes.htm>.

<sup>113</sup> Ibbotson Cost of Capital 2006 Yearbook, Ibbotson Cost of Capital 2007 Yearbook, Ibbotson Cost of Capital 2008 Yearbook, Ibbotson Cost of Capital 2009 Yearbook, Ibbotson Cost of Capital 2010 Yearbook, Ibbotson Cost of Capital 2011 Yearbook, Ibbotson Cost of Capital 2012 Yearbook, Ibbotson Cost of Capital 2013 Yearbook, Duff & Phelps 2014 Valuation Handbook – U.S. Industry Cost of Capital, Duff & Phelps 2015 Valuation Handbook – U.S. Industry Cost of Capital, Duff & Phelps 2016 Valuation Handbook – U.S. Industry Cost of Capital, Duff & Phelps 2017 Valuation Handbook – U.S. Industry Cost of Capital, and Duff & Phelps 2018 Valuation Handbook – U.S. Industry Cost of Capital, Duff & Phelps Cost of Capital Navigator, U.S. Industry Benchmarking Module, [costofcapital.duffandphelps.com](http://costofcapital.duffandphelps.com), collectively (“Ibbotson/Duff & Phelps Cost of Capital”) yearbooks. The industry data in the cost of capital yearbooks are reported at different levels of aggregation for an industry (one-, two-, three-, and four-digit SIC code levels) and within that industry (median, SIC composite, large composite, and small composite). All inputs from the cost of capital yearbooks we use in our analyses are based on two-digit SIC code industry level and SIC composite data aggregation level.

<sup>114</sup> The Industry Cost of Debt was first published as a standalone reported item in 2011. For years 2006-2010, we calculate the Industry Cost of Debt in a year by adding the 2011 figure to the difference in the spread of a 10-year BBB corporate bond between 2011 and that year. For example, Ibbotson Cost of Capital 2011 Yearbook reports cost of debt of 4.63% for the two-digit SIC code 27. The average spread over the risk-free rate of a 10-year BBB corporate bond, as reported by Bloomberg, was 2.07% in 2011 and 3.27% in 2008. Thus, for 2008, we estimate the cost of debt for SIC code 27 at 5.83% (= 4.63% + 3.27% - 2.07%).

Capital yearbooks. Both the Industry Cost of Debt and Debt Weight are measured at the two-digit SIC code level.<sup>115</sup>

A-19. The Industry Cost of Common Equity for the S&P 500 companies is calculated by equally weighing the common equity cost estimates based on the CAPM and MSDCF methods<sup>116</sup> as reported in the Ibbotson/Duff & Phelps Cost of Capital yearbooks. We calculate the Common Equity Weight as one minus Debt Weight.<sup>117</sup> Both Industry Cost of Common Equity and Common Equity Weight are calculated at the two-digit SIC code level.<sup>118</sup>

A-20. As discussed earlier, the CAPM has three inputs: risk-free rate; market risk premium; and beta. The risk-free rate and the market risk premium are economy-wide estimates. The risk-free rate and the market risk premium for the S&P 500 companies are the annual figures reported in the STB Cost of Capital Decisions. Industry beta for the S&P 500 companies is the levered raw beta reported in the Ibbotson/Duff & Phelps Industry Cost of Capital books at the two-digit SIC code level.<sup>119</sup>

A-21. The MSDCF cost of equity for each company is the 3-Stage Discounted Cash Flow cost of equity reported in Ibbotson/Duff & Phelps Cost of Capital yearbooks at the two-digit SIC

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<sup>115</sup> We used the reported “SIC Composite” definition.

<sup>116</sup> Note that prior to 2008, STB calculated Cost of Common Equity based on CAPM alone. Respectively, for the two years prior to 2008 in my sample, 2006 and 2007, we used only CAPM to estimate the Cost of Common Equity.

<sup>117</sup> This calculation of the Common Equity Weights assumes that the companies in our sample finance their operations with debt and common equity only. In reality, companies use other equity securities, such as preferred equity. Thus, we effectively assume that costs of common and preferred equity are the same. We expect the impact of this assumption on our cost of capital calculations to be *de minimis* due to the usually small proportion of preferred equity to total capital. For example, over the last 13 years, STB determined that the preferred equity accounted for less than 0.005% of the publicly traded railroads’ total capital in 5 of the 13 years and zero % in the other 8 years.

<sup>118</sup> We used the reported “SIC Composite” definition.

<sup>119</sup> We use the reported “SIC Composite” definition.

code level.<sup>120</sup> The methodology of the 3-Stage Discounted Cash Flow Model<sup>121</sup> forms the foundation of STB's MSDCF Model.<sup>122</sup> Thus the 3-Stage Discounted Cash Flow cost of equity and the MSDCF cost of equity are calculated based on the same methodology.

A-22. The Industry Cost of Capital for the S&P 500 companies is equal to the weighted averages of the Industry Cost of Debt and Industry Cost of Equity. The data to measure the industry cost of capital is not available for all years for all two-digit SIC codes because these codes were not available in some of the Ibbotson/Duff & Phelps Cost of Capital yearbooks.<sup>123</sup> When the industry cost of capital was not available for a two-digit SIC code in a year, we estimate the cost of capital for that two-digit SIC code based on the average cost of capital across all two-digit SIC codes in that year.<sup>124</sup>

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<sup>120</sup> We use the reported "SIC Composite" definition.

<sup>121</sup> See, for example, Ibbotson Cost of Capital 2013 Yearbook, p. 13, "The three-stage model identifies three separate growth rates: a growth rate applicable to cash flows during the first five years of future performance, a growth rate applicable to cash flows over the sixth through tenth years, and a growth rate applicable to earnings for all future years following the first ten years... Cash flow is defined as income before extraordinary items plus depreciation less capital expenditures plus deferred taxes. Normal cash flows and income before extraordinary items are used because of the potential for anomalous years. 'Normal' cash flows and income before extraordinary items are estimated by multiplying the last five years average cash flow and earnings rates, both as a percent of sales, by the most recent year's sales... Earnings are used in place of cash flows in the third term, because over extended periods of time it is assumed that capital expenditures and depreciation will be equal... In those instances where companies in the composite do not have a Thomson Reuters earnings growth estimate, the industry average is substituted."

<sup>122</sup> See paragraph A-16 and the footnotes thereto.

<sup>123</sup> The methodology underlying the analyses in the yearbooks require a minimum of 5 companies per industry.

<sup>124</sup> More specifically, if the cost of capital is not available for a given two-digit SIC code in a year, we add the average cost of capital calculated across all two-digit SIC codes ("sample average") in that year to the mean deviation from the sample average across all other years in which there is a cost of capital figure available for the two-digit SIC code with missing cost of capital in the current year. The industry cost of capital was not available for any year for two-digit SIC code 99, Nonclassifiable Establishments. For industries with SIC code 99, we use the sample average cost of capital. The issue of missing industry cost of capital affects less than 3% of our sample.

## **APPENDIX B**

### **RAILROAD'S FINANCIAL PERFORMANCE BASED ON STB DEFINITIONS OF RETURN ON INVESTED CAPITAL (STB ROIC) AND COST OF CAPITAL (STB COC)**

#### **(STB ROIC MINUS STB COC, 2006 – 2019)**

B-1. In Appendix B, we present the STB data for the seven railroads overseen by Board and the Industry Weighted Average over the 2006 - 2019 period; specifically, we present the STB's railroad industry cost of capital, the STB's financial performance metric used in its Annual Revenue Adequacy Determinations (ROIC minus COC), and our alternative measure of financial performance (Adjusted ROIC minus COC).

B-2. In Panel A of Exhibit B1, we present the STB's railroad cost of capital over this period. The range of the STB's railroad cost of capital over this period is from 8.9% to 12.2%. The median cost of capital over this period is 10.8% (average 10.7%).

B-3. In Panel B of Exhibit B1, we present ROIC minus COC for the Industry Weighted Average and for the seven railroads. The range of the ROIC minus COC over this period for the industry is from -2.5% to 3.1%, and the median ROIC minus COC over this period for the industry is 0.7% (average 0.7%). The ROIC minus COC for the seven railroads varies across years and across the railroads in any one year. The median ROIC minus COC over this period across the seven railroads varies from -2.6% to 3.6% and the average varies from -2.5% to 2.4%.

B-4. In Panel C of Exhibit B1, we present Adjusted ROIC minus COC for the Industry Weighted Average and for the seven railroads. The range of the Adjusted ROIC minus COC over this period for the industry is from -3.5% to 1.4%, and the median Adjusted ROIC minus COC over this period for the industry is -1.2% (average -1.3%). The Adjusted ROIC minus COC for the seven railroads also varies across years and across the railroads in any one year.

The median Adjusted ROIC minus COC over this period across the seven railroads varies from -3.0% to 0.3% and the average varies from -3.1% to 0.1%.

## **APPENDIX C**

### **RAILROAD'S (ROIC MINUS COC) PERCENTILES WITHIN S&P 500 SAMPLES**

#### **(RAILROADS' RETURN ON INVESTED CAPITAL AND COST OF CAPITAL MEASURED USING NON-STB PUBLIC DATA)**

C-1. In Appendix C, we present the Industry Weighted Average and each railroad's ROIC minus COC percentile within the distribution of all companies in three benchmarking samples: (a) S&P 500 excluding railroads, financial institutions, and real estate companies ("S&P 500" benchmarking group)); (b) S&P 500 Industrials Sector excluding railroads (industry sector to which railroads belong, "S&P 500 Industrials Sector" benchmarking group); and (c) customers (shippers) of CN, NS, and/or UP in the S&P 500 that accounted for at least \$1.0 million of combined revenues to those railroads during the last year ("S&P 500 Railroad Customers" benchmarking group).

C-2. The analyses we present in Appendix C, Exhibits C1 and C2 are the same as those in Exhibits 1 and 2 except the inputs for the ROIC and cost of capital for the railroads are based on the Compustat data (and not the STB data). That is, we use the same Compustat data for both the railroads and the companies in the S&P 500 benchmarking samples. The percentile numbers of only four (out of seven) railroad companies are presented because only four of the seven railroad companies are publicly traded and, thus, have Compustat financial data.<sup>125</sup> The results for the railroads reported in Exhibits 1 and 2 differ from the results reported in Appendix C, Exhibits C1 and C2 due to differences in data sources. The Compustat data used for the calculation of ROIC are for the consolidated company rather than the U.S. railroad operations

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<sup>125</sup> The four companies are: CSX Corporation, Kansas City Southern, Norfolk Southern Corporation, and Union Pacific Corporation.

only as in the STB filings. The costs of capital also differ because of differences in the STB and the non-STB publicly available databases.<sup>126</sup>

C-3. The results in Exhibit C1 are analogous to the results presented in Exhibit 1. The top section of each panel presents the descriptive statistics about the S&P 500 benchmarking group and the bottom section of each panel presents the railroads' percentile within the distribution of all companies in that benchmarking group; however, as stated above, the inputs for measuring ROIC and the cost of capital for the railroads are based on the Compustat (not STB) data that is also used for the companies in the S&P 500 benchmarking groups.

C-4. Panel A of Exhibit C1 presents the railroads' percentile in the distribution of ROIC minus COC of the S&P 500 benchmarking group. The range of the ROIC minus COC percentile over this period for the industry is from 12<sup>th</sup> to 27<sup>th</sup>, and the median ROIC minus COC percentile over this period for the industry is 19<sup>th</sup> (average 20<sup>th</sup>). The ROIC minus COC percentile for the four publicly traded railroads varies across years and across the railroads in any one year. The median ROIC minus COC percentile over this period across the four railroads varies from 11<sup>th</sup> to 24<sup>th</sup> and the average varies from 11<sup>th</sup> to 21<sup>st</sup>.

C-5. Panel B of Exhibit C1 presents the railroads' percentile in the distribution of ROIC minus COC of the S&P 500 Industrials Sector benchmarking group. The range of the ROIC minus COC percentile over this period for the industry is from 4<sup>th</sup> to 17<sup>th</sup>, and the median ROIC minus COC percentile over this period for the industry is 10<sup>th</sup> (average 10<sup>th</sup>). The ROIC minus COC percentile for the four publicly traded railroads varies across years and across the railroads in any

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<sup>126</sup> One such example is difference in beta, an input for calculating the CAPM equity cost of capital.

one year. The median ROIC minus COC percentile over this period across the four railroads varies from 5<sup>th</sup> to 10<sup>th</sup> and the average varies from 6<sup>th</sup> to 10<sup>th</sup>.

C-6. Panel C of Exhibit C1 presents the railroads' percentile in the distribution of ROIC minus COC of the S&P 500 Railroad Customers benchmarking group. The range of the ROIC minus COC percentile over this period for the industry is from 17<sup>th</sup> to 44<sup>th</sup>, and the median ROIC minus COC percentile over this period for the industry is 31<sup>st</sup> (average 31<sup>st</sup>). The ROIC minus COC percentile for the seven railroads varies across years and across the railroads in any one year. The median ROIC minus COC percentile over this period across the seven railroads varies from 17<sup>th</sup> to 37<sup>th</sup> and the average varies from 18<sup>th</sup> to 32<sup>nd</sup>. In sum, the results shown in Exhibit C1 are qualitatively similar to the results shown in Exhibit 1.

C-7. The results in Exhibit C2 are analogous to the results presented in Exhibit C1, however, the results in Exhibit C2 are for the Adjusted ROIC minus COC whereby the results in Exhibit C1 are for the ROIC minus COC. The top section of each panel in Exhibit C2 presents the descriptive statistics about the S&P 500 benchmarking group and the bottom section of each panel in Exhibit C2 presents the railroads' percentile within the distribution of all companies in that benchmarking group. As stated previously, the inputs for measuring Adjusted ROIC and the cost of capital for the railroads are based on the Compustat (not STB) data that is also used for the companies in the S&P 500 benchmarking groups.

C-8. Panel A of Exhibit C2 presents the railroads' percentile in the distribution of ROIC minus COC of the S&P 500 benchmarking group. The range of the ROIC minus COC percentile over this period for the industry is from 11<sup>th</sup> to 30<sup>th</sup>, and the median ROIC minus COC percentile over this period for the industry is 18<sup>st</sup> (average 19<sup>th</sup>). The ROIC minus COC percentile for the four

publicly traded railroads varies across years and across the railroads in any one year. The median ROIC minus COC percentile over this period across the four railroads varies from 15<sup>th</sup> to 20<sup>th</sup> and the average varies from 15<sup>th</sup> to 22<sup>nd</sup>.

C-9. Panel B of Exhibit C2 presents the railroads' percentile in the distribution of ROIC minus COC of the sample of S&P 500 Industrials Sector companies. The range of the ROIC minus COC percentile over this period for the industry is from 5<sup>th</sup> to 18<sup>th</sup>, and the median ROIC minus COC percentile over this period for the industry is 9<sup>th</sup> (average 9<sup>th</sup>). The ROIC minus COC percentile for the four publicly traded railroads varies across years and across the railroads in any one year. The median ROIC minus COC percentile over this period across the four railroads varies from 7<sup>th</sup> to 11<sup>th</sup> and the average varies from 7<sup>th</sup> to 11<sup>th</sup>.

C-10. Panel C of Exhibit C2 presents the railroads' percentile in the distribution of ROIC minus COC of the sample customers of CN, NS, and UP in the S&P 500. The range of the ROIC minus COC percentile over this period for the industry is from 12<sup>th</sup> to 45<sup>th</sup>, and the median ROIC minus COC percentile over this period for the industry is 26<sup>th</sup> (average 27<sup>th</sup>). The ROIC minus COC percentile for the four publicly traded railroads varies across years and across the railroads in any one year. The median ROIC minus COC percentile over this period across the four railroads varies from 20<sup>th</sup> to 32<sup>nd</sup> and the average varies from 21<sup>st</sup> to 33<sup>rd</sup>. In sum, the results shown in Exhibit C2 are qualitatively similar to the results shown in Exhibit 2.

C-11. Overall, while the results shown in Appendix C, Exhibits C1 and C2 are naturally not identical to the results shown in Exhibits 1 and 2, on the balance, they are qualitatively similar.

Curriculum Vitae  
of  
Professor Kevin M. Murphy

# *Curriculum Vitae*

## **Kevin M. Murphy**

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### *Business Address:*

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### **Current Positions**

July 2005-Present: George J. Stigler Distinguished Service Professor of Economics,  
Department of Economics and Booth School of Business, The University of Chicago

Faculty Research Associate, National Bureau of Economic Research

Co-Director, Health and Human Capital Program, Health Economics Initiative, Becker  
Friedman Institute

### **Education**

University of California, Los Angeles, A.B., Economics, 1981

The University of Chicago, Ph.D., 1986

Thesis Topic: *Specialization and Human Capital*

### **Previous Research and Academic Positions**

2002-2005: George J. Stigler Professor of Economics, Department of Economics and  
Booth School of Business, The University of Chicago

1993 – 2002: George Pratt Shultz Professor of Business Economics and Industrial  
Relations, The University of Chicago

1989 – 1993: Professor of Business Economics and Industrial Relations, The University  
of Chicago

1988 – 1989: Associate Professor of Business Economics and Industrial Relations, The University of Chicago

1986 – 1988: Assistant Professor of Business Economics and Industrial Relations, The University of Chicago

1983 – 1986: Lecturer, Booth School of Business, The University of Chicago

1982 – 1983: Teaching Associate, Department of Economics, The University of Chicago

1979 – 1981: Research Assistant, Unicon Research Corporation, Santa Monica, California

### **Honors and Awards**

2008: John von Neumann Lecture Award, Rajk College, Corvinus University, Budapest

2007: Kenneth J. Arrow Award (with Robert H. Topel)

October 2005: Garfield Research Prize (with Robert H. Topel)

September 2005: MacArthur Foundation Fellow

1998: Elected to the American Academy of Arts & Sciences

1997: John Bates Clark Medalist

1993: Fellow of The Econometric Society

1989 – 1991: Sloan Foundation Fellowship, The University of Chicago

1983 – 1984: Earhart Foundation Fellowship, The University of Chicago

1981 – 1983: Fellowship, Friedman Fund, The University of Chicago

1980 – 1981: Phi Beta Kappa, University of California, Los Angeles

1980 – 1981: Earhart Foundation Fellowship, University of California, Los Angeles

1979 – 1981: Department Scholar, Department of Economics, University of California, Los Angeles

### **Publications**

#### **Books**

Social Economics: Market Behavior in a Social Environment with Gary S. Becker, Cambridge, MA: Harvard University Press (2000).

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Comment on “High Technology Industries and Market Structure” by Hal R. Varian.  
Federal Reserve Bank of Kansas City (2001).

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“Rethinking Antitrust,” with Gary S. Becker, *Wall Street Journal* (February 26, 2001), A22.

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### Articles About Murphy

“Higher Learning Clearly Means Higher Earning,” by Carol Kleiman. *Chicago Tribune*, March 12, 1989, Jobs Section pp. 1. Long article about “The Structure of Wages” with picture of Murphy.

“Why the Middle Class Is Anxious,” by Louis S. Richman. *Fortune*, May 21, 1990, pp. 106. Extensive reference to Murphy's work on returns to education.

“Unequal Pay Widespread in U.S.,” by Louis Uchitelle, *New York Times*, August 14, 1990, Business Day section pp. 1. Long piece on income inequality.

“One Study’s Rags to Riches Is Another’s Rut of Poverty,” by Sylvia Nasar, *New York Times*, June 17, 1992, Business Section pp. 1. Long piece on the income inequality research.

“Nobels Pile Up for Chicago, but Is the Glory Gone?” by Sylvia Nasar, *New York Times* November 4, 1993, Business Section pp. 1. Long piece on Chicago School of economics. Featured a photo of five of the “brightest stars on the economics faculty” (including Murphy) and a paragraph about Murphy’s research.

“This Sin Tax is Win-Win,” by Christopher Farrell. *Business Week*, April 11, 1994, pp. 30. Commentary section refers to Murphy, Becker, and Grossman’s work on rational addiction.

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“A Pay Raise’s Impact,” by Louis Uchitelle. *New York Times*, January 12, 1995, Business Section pp. 1. Article about consequences of proposed increase in the minimum wage. Articles featuring Murphy's comments on the minimum wage appeared in numerous

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Expert Report of Kevin M. Murphy, February 23, 2017, in the Matter of 1-800 Contacts, Inc., Before the Federal Trade Commission, Office of Administrative Law Judges, United States of America. Docket No. 9372.

Expert Report of Kevin M. Murphy, March 1, 2017, in the Matter of Gene R. Romero, et al. v. Allstate Insurance, et al., The United States District Court for the Eastern District of Pennsylvania. Case No. 01-3894 (consolidated with other matters) (E.D. Pa.).

Deposition of Kevin M. Murphy, March 16, 2017, in the Matter of 1-800 Contacts, Inc., Before the Federal Trade Commission, Office of Administrative Law Judges, United States of America. Docket No. 9372.

Deposition of Kevin M. Murphy, March 27, 2017, in the Matter of Gene R. Romero, et al. v. Allstate Insurance, et al., The United States District Court for the Eastern District of Pennsylvania. Case No. 01-3894 (consolidated with other matters) (E.D. Pa.).

Supplemental Expert Report of Kevin M. Murphy, April 3, 2017, in the Matter of Parallel Networks Licensing, LLC v. Microsoft Corporation, The United States District Court for the District of Delaware. Case No. 13-2073-SLR.

Expert Report of Kevin M. Murphy, April 3, 2017, in the Matter of Optical Disc Drive Products Litigation (Acer America Corp., et al. v. Lite-On Corporation, et al.), The United States District Court for the Northern District of California, San Francisco Division. No. 3:10-md-2143, RS 5:13-cv-04991.

Expert Report of Kevin M. Murphy, April 3, 2017, in the Matter of Optical Disc Drive Products Litigation (Dell Inc. and Dell Products L.P., v. Hitachi, Ltd., et al.), The United States District Court for the Northern District of California, San Francisco Division. No. 3:10-md-2143 RS.

Expert Report of Kevin M. Murphy, April 3, 2017, in the Matter of Optical Disc Drive Products Litigation (Hewlett-Packard Company v. Toshiba Corporation, et al.), The United States District Court for the Northern District of California, San Francisco Division. MDL No. 2143, No. 3:13-cv-05370 RS.

Expert Report of Kevin M. Murphy, April 3, 2017, in the Matter of Optical Disc Drive Products Litigation (Ingram Micro Inc., et al. v. LG Electronics, Inc., et al.), The United States District Court for the Northern District of California, San Francisco Division. No. 3:10-md-2143 RS.

Expert Report of Kevin M. Murphy, April 3, 2017, in the Matter of Optical Disc Drive Products Litigation (All Indirect Purchaser Actions), The United States District Court for the Northern District of California, San Francisco Division. No. 3:10-md-2143 RS.

Expert Report of Kevin M. Murphy, April 3, 2017, in the Matter of Optical Disc Drive Products Litigation (Alfred H. Siegel v. Sony Corporation, et al. and Peter Kravitz v. Sony Corporation, et al.), The United States District Court for the Northern District of California, San Francisco Division. No. 3:10-md-2143 RS.

Deposition of Kevin M. Murphy, April 30, 2017 and May 1, 2017, in the Matter of Optical Disc Drive Products Litigation, The United States District Court for the Northern District of California, San Francisco Division. No. 3:10-md-2143 RS.

Trial Testimony of Kevin M. Murphy, May 10, 2017 and May 11, 2017, in the Matter of 1-800 Contacts, Inc., Before the Federal Trade Commission, Office of Administrative Law Judges, United States of America. Docket No. 9372.

Expert Report of Kevin M. Murphy, July 3, 2017, in the Matter of Blue Cross Blue Shield Antitrust Litigation (MDL No.: 2406), The United States District Court for the Northern District of Alabama Southern Division. Master File No. 2:13-CV-20000-RDP.

Deposition of Kevin M. Murphy, July 22, 2017, in the Matter of Blue Cross Blue Shield Antitrust Litigation (MDL No.: 2406), The United States District Court for the Northern District of Alabama Southern Division. Master File No. 2:13-CV-20000-RDP.

Expert Report of Kevin M. Murphy, August 25, 2017, in the Matter of Gene R. Romero, et al. v. Allstate Insurance, et al., The United States District Court for the Eastern District of Pennsylvania. Case No. 01-3894 (consolidated with other matters) (E.D. Pa.).

Expert Rebuttal Report of Kevin M. Murphy, September 18, 2017, in the Matter of Gene R. Romero, et al. v. Allstate Insurance, et al., The United States District Court for the Eastern District of Pennsylvania. Case No. 01-3894 (consolidated with other matters) (E.D. Pa.).

Expert Report of Kevin M. Murphy, November 3, 2017, in the Matter of Valassis Communications, Inc. v. News Corporation, News America Marketing, a/k/a News America Incorporated, a/k/a News America Marketing Group, a/k/a News America Marketing FSI L.L.C., a/k/a News America Marketing FSI, Inc.; and News America

Marketing In-Store Services L.L.C., a/k/a News America Marketing In-Store Services, Inc., The United States District Court for the Southern District of New York. Case No. 1:17-cv-07378-PKC.

Deposition of Kevin M. Murphy, January 17, 2018, in the Matter of Valassis Communications, Inc. v. News Corporation, News America Marketing, a/k/a News America Incorporated, a/k/a News America Marketing Group, a/k/a News America Marketing FSI L.L.C., a/k/a News America Marketing FSI, Inc.; and News America Marketing In-Store Services L.L.C., a/k/a News America Marketing In-Store Services, Inc., The United States District Court for the Southern District of New York. Case No. 1:17-cv-07378-PKC.

Verified Statement of Kevin M. Murphy, January 19, 2018, In Re Biogen '755 Patent Litigation, The United States District Court for the District of New Jersey. Civil Action No. 10-2734 (CCC/JAD).

Trial Testimony of Kevin M. Murphy, February 1, 2018, In Re Biogen '755 Patent Litigation, The United States District Court for the District of New Jersey. Civil Action No. 10-cv-2734 (CCC/JBC).

Expert Report and Testimony of Kevin M. Murphy, February 28, 2018 in the Matter of Washington Metropolitan Area Transit Authority and Amalgamated Transit Union Local 689, Interest Arbitration Under Sections 66(C) Of the WMATA Compact, The United States District Court for the District of Columbia.

Expert Report of Kevin M. Murphy, June 29, 2018, in the Matter of Gene R. Romero, et al. v. Allstate Insurance, et al., The United States District Court for the Eastern District of Pennsylvania. Case No. 01-3894 (consolidated with other matters) (E.D. Pa.).

Expert Report of Kevin M. Murphy, July 30, 2018, in the Matter of Daniel Gordon, et al. v. Amadeus IT Group, S.A. et al. The United States District Court for the Southern District of New York. Civ. A. No. 1:15-cv-05457-KPF.

Declaration of Kevin M. Murphy, August 16, 2018, in the Matter of Genentech, Inc., Biogen, Inc., Hoffmann-La Roche Inc., and City of Hope v. Celltrion, Inc., Celltrion Healthcare Co., Ltd., Teva Pharmaceuticals USA, Inc., and Teva Pharmaceuticals International GmbH, The United States District Court for the District of New Jersey. Civ. A. No. 18-cv-00574 (RMB) (KMW).

Expert Report of Kevin M. Murphy, September 21, 2018, in the Matter of Certain Memory Modules and Components Thereof, International Trade Commission, Washington, DC 20436. No. 337-TA-1089.

Reply Declaration of Kevin M. Murphy, September 26, 2018, in the Matter of Genentech, Inc., Biogen, Inc., Hoffmann-La Roche Inc., and City of Hope v. Celltrion, Inc., Celltrion Healthcare Co., Ltd., Teva Pharmaceuticals USA, Inc., and Teva Pharmaceuticals International GmbH, The United States District Court for the District of New Jersey. Civ. A. No. 18-cv-00574 (RMB) (KMW).

Expert Rebuttal Report of Kevin M. Murphy, October 9, 2018, in the Matter of Certain Memory Modules and Components Thereof, International Trade Commission, Washington, DC 20436. No. 337-TA-1089.

Deposition of Kevin M. Murphy, October 29, 2018, in the Matter of Certain Memory Modules and Components Thereof, International Trade Commission, Washington, DC 20436. No. 337-TA-1089.

Confidential Submission to the U.S. Department of Justice, Economic Considerations for Modification and Termination of the ASCAP Consent Decree, October 30, 2018.

Expert Report of Kevin M. Murphy, March 1, 2019, in the Matter of First Impressions Salon, Inc., Roy Mattson, KPH Healthcare Services, Inc., d/b/a Kinney Drugs, Inc. and Piggly Wiggly Midwest, LLC. v. National Milk Producers Federation, Cooperatives Working Together, Dairy Farmers of America, Inc., Land O'Lakes, Inc., Dairy Lea Cooperative Inc., Agri-Mark, Inc. d/b/a Cabot Creamery Cooperative, Inc., The United States District Court for the Southern District of Illinois. Case No. 3:13-cv-00454-SCW.

Expert Report of Kevin M. Murphy, March 15, 2019, in the Matter of Robert Binz V, Michael Binz, Leslie Clemenson, William Clynes, Andrew Margolick, Gregory Melita, and Nili Sinai-Nathan v. Amadeus IT Group, S.A., Amadeus North America, Inc., Amadeus Americas, Inc., Sabre Corporation f/k/a Holdings Corporation, Sabre Holdings Corporation, Sabre GLBL Inc., Sabre Travel International Limited, Travelport Worldwide Limited, and Travelport LP d/b/a Travelport, The United States District Court for the Southern District of New York. Civ A. No. 1:15-cv-05457-KPF.

Verified Statement of Kevin M. Murphy, April 25, 2019, On Behalf of Union Pacific Railroad Company in NAFCA vs. Union Pacific Railroad Company, Before the Surface Transportation Board. STB Docket No. NOR 42144.

Deposition of Kevin M. Murphy, May 9, 2019, in the Matter of Robert Binz V, Michael Binz, Leslie Clemenson, William Clynes, Andrew Margolick, Gregory Melita, and Nili Sinai-Nathan v. Amadeus IT Group, S.A., Amadeus North America, Inc., Amadeus Americas, Inc., Sabre Corporation f/k/a Holdings Corporation, Sabre Holdings Corporation, Sabre GLBL Inc., Sabre Travel International Limited, Travelport Worldwide Limited, and Travelport LP d/b/a Travelport, The United States District Court for the Southern District of New York. Civ A. No. 1:15-cv-05457-KPF.

Expert Report of Kevin M. Murphy, May 10, 2019, in the Matter of National Prescription Opiate Litigation (MDL No. 2804), The United States District Court for the Northern District of Ohio Eastern Division. Case No. 17-op-5004 and Case No. 18-op-45090. (Corrected and Restated Expert Report filed June 21, 2019).

Expert Report of Kevin M. Murphy, May 10, 2019, In Re Packaged Seafood Products Antitrust Litigation (Associated Wholesale Grocers, Inc. v. Bumble Bee Foods, LLC et al.), In the United States District Court of the Southern District of California. No. 15-md-2670.

Expert Report of Kevin M. Murphy, May 10, 2019, In Re Packaged Seafood Products Antitrust Litigation (W. Lee Flowers & Co., Inc. v. Bumble Bee Foods LLC, et al.), In the United States District Court of the Southern District of California. No. 15-md-2670.

Expert Report of Kevin M. Murphy, May 10, 2019, In Re Packaged Seafood Products Antitrust Litigation (Winn-Dixie Stores, Inc. and Bi-Lo Holding, LLC. v. Bumble Bee Foods, LLC et al.), In the United States District Court of the Southern District of California. No. 15-md-2670.

Expert Addendum Report of Kevin M. Murphy, May 24, 2019, In Re Packaged Seafood Products Antitrust Litigation (Affiliated Foods Midwest Cooperative, Inc. v. Bumble Bee Foods LLC, et al.), In the United States District Court of the Southern District of California. No. 15-md-2670.

Deposition of Kevin M. Murphy, June 6, 2019, in the Matter of National Prescription Opiate Litigation (MDL No. 2804), The United States District Court for the Northern District of Ohio Eastern Division. Case No. 17-op-5004 and Case No. 18-op-45090.

Expert Report of Kevin M. Murphy, June 10, 2019, In Re Payment Card Interchange Fee and Merchant Discount Antitrust Litigation, In the United States District Court for the Eastern District of New York. No. 05-md-1720 (MKB) (JO).

Deposition of Kevin M. Murphy, June 25, 2019, In Re Packaged Seafood Products Antitrust Litigation, In the United States District Court of the Southern District of California. No. 15-md-2670.

Expert Report of Kevin M. Murphy, July 15, 2019, in the Matter of Blue Cross Blue Shield Antitrust Litigation (MDL No.: 2406), The United States District Court for the Northern District of Alabama Southern Division. Master File No. 2:13-CV-20000-RDP.

Submission to the U.S. Department of Justice, Economic Considerations for Modification and Termination of the ASCAP Consent Decree, August 9, 2019.

Expert Report of Kevin M. Murphy, November 15, 2019, In Re Dealer Management Systems Antitrust Litigation, MDL 2817, The United States District Court for the Northern District of Illinois Eastern Division. No. 1:18-CV-00864. (Corrected and Restated Expert Report filed January 15, 2020).

Expert Report of Kevin M. Murphy, December 6, 2019, in the Matter of North American Soccer League, LLC v. United States Soccer Federation, Inc., and Major League Soccer, LLC, In the United States District Court for The Eastern District of New York. No. 1:17-cv-05495-MKB-ST.

Expert Report of Kevin M. Murphy, December 20, 2019, in the Matter of The United States of America v. Sabre Corporation, Sabre GLBL Inc., Farelogix, Inc., and Sandler Capital Partners V, L.P., In the United States District Court for The District of Delaware. No: 1:19-cv-01548-LPS.

Expert Rebuttal Report of Kevin M. Murphy, January 3, 2020, in the Matter of The United States of America v. Sabre Corporation, Sabre GLOB Inc., Farelogix, Inc., and Sandler Capital Partners V, L.P., In the United States District Court for The District of Delaware. No: 1:19-cv-01548-LPS.

Expert Rebuttal Report of Kevin M. Murphy, January 10, 2020, in the Matter of The United States of America v. Novelis Inc. and Aleris Corporation, In the United States District Court for the Northern District of Ohio. No.: 1:19-cv-02033-CAB.

Expert Reply Report of Kevin M. Murphy, January 15, 2020, in the Matter of The United States of America v. Sabre Corporation, Sabre GLOB Inc., Farelogix, Inc., and Sandler Capital Partners V, L.P., In the United States District Court for The District of Delaware. No: 1:19-cv-01548-LPS.

Deposition of Kevin M. Murphy, January 18, 2020, in the Matter of The United States of America v. Sabre Corporation, Sabre GLOB Inc., Farelogix, Inc., and Sandler Capital Partners V, L.P., In the United States District Court for The District of Delaware. No: 1:19-cv-01548-LPS.

Deposition of Kevin M. Murphy, January 21, 2020, and January 22, 2020, In Re Payment Card Interchange Fee and Merchant Discount Antitrust Litigation, In the United States District Court for the Eastern District of New York. No. 05-md-1720 (MKB) (JO).

Deposition of Kevin M. Murphy, January 24, 2020, In Re Dealer Management Systems Antitrust Litigation, MDL 2817, The United States District Court for the Northern District of Illinois Eastern Division. No. 1:18-CV-00864.

Deposition of Kevin M. Murphy, January 27, 2020, in the Matter of The United States of America v. Novelis Inc. and Aleris Corporation, In the United States District Court for the Northern District of Ohio. No.: 1:19-cv-02033-CAB.

Expert Report of Kevin M. Murphy, February 3, 2020, In Re Opioid Litigation, In the Supreme Court of the State of New York County of Suffolk. Index No.:400001/2017, Index No.: 400008/2017, and Index No.: 400016/2018.

Trial Testimony of Kevin M. Murphy, February 3, 2020, in the Matter of The United States of America v. Sabre Corporation, Sabre GLOB Inc., Farelogix, Inc., and Sandler Capital Partners V, L.P., In the United States District Court for The District of Delaware. No: 1:19-cv-01548-LPS.

Deposition of Kevin M. Murphy, February 13, 2020, in the Matter of North American Soccer League, LLC v. United States Soccer Federation, Inc., and Major League Soccer, LLC, In the United States District Court for The Eastern District of New York. No. 1:17-cv-05495-MKB-ST.

Deposition of Kevin M. Murphy, February 19, 2020, In Re Opioid Litigation, In the Supreme Court of the State of New York County of Suffolk. Index No.:400001/2017, Index No.: 400008/2017, and Index No.: 400016/2018.

Arbitration Testimony of Kevin M. Murphy, February 25, 2020, in the Matter of The United States of America v. Novelis Inc. and Aleris Corporation, In the United States District Court for the Northern District of Ohio. No.: 1:19-cv-02033-CAB.

Expert Report of Kevin M. Murphy, May 30, 2020, in the Matter of an Independent Review Process, Afiliis Domains No. 3 Limited v. Internet Corporation for Assigned Names and Numbers, before The International Centre for Dispute Resolution.

Expert Report of Kevin M. Murphy, July 24, 2020, in the Matter of The State of Ohio v. McKesson Corporation, Cardinal Health, Inc., AmerisourceBergen Drug Corporation, and Miami-Luken, Inc., In the Court of Common Pleas for Madison County, Ohio. Case No. CVH20180055.

Expert Report of Kevin M. Murphy, August 27, 2020, in the Matters of The City of Huntington v. AmerisourceBergen Drug Corporation, et al., and Cabell County Commission v. AmerisourceBergen Drug Corporation, et al., In the United States District Court for the Southern District of West Virginia. Civil Action Nos. 3:17-01362 and 3:17-01665.

Curriculum Vitae  
of  
Professor Mark E. Zmijewski

## Mark E. Zmijewski (Zme – yev’ -ski) Bio

Professor Zmijewski specializes in the areas of accounting, economics, and finance as they relate to valuation, financial analysis, and security analysis, or more generally, financial economics. He is Professor Emeritus at The University of Chicago Booth School of Business, and previously held the Charles T. Horngren Professorship and the Leon Carroll Marshall Professorship in his 30-year career at the Booth. In addition to his research and teaching activities, Professor Zmijewski also held the positions of Deputy Dean, Associate Dean for PhD Studies, and the Faculty Director of the Center for Research in Security Prices (CRSP), all at the Booth School of Business. Professor Zmijewski is a Senior Consultant to Charles River Associates, a consulting firm that provides economic, financial, and management consulting services. He is also a Senior Advisor to, and a member of, the Investment Committee at Patron Capital Partners (Funds IV and V), a private equity investment company with a focus on real estate related investments. Professor Zmijewski was a Founding Partner of Chicago Partners, LLC, which was acquired by Navigant Consulting. He is the former Managing Director of Navigant Economics (a subsidiary of Navigant Consulting) and a former member of the Corporate Executive Committee of Navigant Consulting.

Professor Zmijewski earned his BS in 1976, MBA in 1981, and PhD with a major in accounting and minors in economics and finance in 1983, all from the State University of New York at Buffalo. In addition to The University of Chicago, he has taught at the State University of New York at Buffalo and at York University in Toronto, Canada. He has taught various courses in accounting (financial accounting, managerial accounting, and advanced accounting/mergers and acquisitions), finance (corporate finance, financial strategy and corporate transactions, financial analysis, and valuation of companies and corporate transactions), and entrepreneurship. Professor Zmijewski’s research has focused on firm valuation and the ways in which various capital market participants use information to value securities. He has published articles in academic journals in the areas of accounting and financial economics and has co-authored a textbook (with Professor Robert Holthausen of The Wharton School of the University of Pennsylvania) on how to value companies, parts of companies, and the securities issued by companies, titled “Corporate Valuation: Theory, Evidence and Practice.” He has been an Associate Editor of *The Accounting Review*, and has been on the Editorial Boards of both the *Journal of Accounting Research* and *The Accounting Review*.

Professor Zmijewski has worked as a consultant or expert in litigation matters in US state and federal courts, in the Supreme Court of Victoria in Australia, and in US and international arbitrations. The issues on which he has consulted include: business valuation and securities valuation (valuation of corporate transactions, companies, and parts of companies, intangible assets and intellectual property, and securities); securities litigation (10b-5, section 11, section 12, ERISA, Martin Act, and insider trading); mergers and acquisitions (appraisals and price disputes, analyzing merger synergies, material adverse changes, corporate transactions, and the process of purchasing and selling companies); solvency and ability to pay (fraudulent conveyance, solvency assessment, and ability to pay government fines); antitrust litigation (analysis of merger efficiencies, failing firm defense, and financial analyses of alleged anticompetitive behavior); commercial and stockholder disputes (measurement of damages, accounting analyses, and economic assessment of transactions); accounting issues (measuring and analyzing revenue, cost structures, profitability, rates of return, interest rates, and other financial metrics and concepts); and creating and evaluating business plans.

The frameworks and tools used in his work are generally applicable to all industries, and he has applied his expertise in a broad range of sectors, including the airline, auto, chemical, computer hardware and software, credit card, energy, entertainment, financial services, for-profit education, health care, insurance, heavy and light manufacturing, pharmaceutical, retail, real estate investment fund, technology, telecommunications, and transportation industries, among others.

**Mark E. Zmijewski**  
**(Zme-yev'-ski)**

Senior Consultant

PhD, Accounting  
State University of New York  
at Buffalo

MBA, Accounting  
State University of New York  
at Buffalo

BA, Accounting  
State University of New York  
at Buffalo

## Academic employment

|              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|--------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1984–Present | The University of Chicago Booth School of Business<br><i>Professor Emeritus</i> (2018–Present)<br><i>Charles T. Horngren Professor of Accounting</i> (2015–2018)<br><i>Leon Carroll Marshall Professor of Accounting</i> (1999–2015)<br><i>Deputy Dean</i> (1996–2011)<br><i>Professor of Accounting</i> (1992–1999)<br><i>Associate Dean for PhD Studies</i> (1995–1996)<br><i>Executive Director, Center for Research in Securities Prices (CRSP)</i><br>(1992–1998)<br><i>Associate Professor of Accounting</i> (1988–1992)<br><i>Assistant Professor of Accounting</i> (1984–1988) |
| 1980–1984    | <i>Assistant Professor of Accounting</i> , State University of New York at Buffalo                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| 1979–1982    | <i>Course Director</i> , York University, Toronto Canada                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| 1977–1980    | <i>Teaching Assistant</i> , State University of New York at Buffalo                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |

## Honors and awards

Business Information Professional of the Year—Education, Beta Alpha Psi, 2007.

Hillel J. Einhorn Excellence in Teaching Award, The Executive MBA Program, The University of Chicago Graduate School of Business, 1999.

Emory Williams Award for Excellence in Teaching, The University of Chicago, 1988

Competitive Manuscript Award, American Accounting Association, 1984.

Beta Alpha Psi, Honorary Accounting Society, 1981.

Beta Gamma Sigma, Honorary Business Society, 1980.

## Grants

Research Grant, SEC and Financial Reporting Institute, 1985.

University Fellowship, State University of New York at Buffalo, 1979.

Graduate Fellowship, State University of New York at Buffalo, 1976–1978.

## Publications

*Corporate Valuation: Theory, Evidence and Practice (textbook)*. With Robert W. Holthausen, Cambridge Business Publishers, LLC, 1<sup>st</sup> Edition, 2014; 2nd edition, 2020.

“Valuation with Market Multiples: How to Avoid Pitfalls When Identifying and Using Comparable Companies.” With R. Holthausen. *Journal of Applied Corporate Finance*, Summer 2012.

“Pitfalls in Levering and Unlevering Beta and Cost of Capital Estimates in DCF Valuations.” With R. Holthausen. *Journal of Applied Corporate Finance*, Summer 2012.

“Accounting and Disclosure Issues in Structured Finance.” With Keith Bockus and W. Dana Northcut. In *Corporate Aftershock: The Public Policy Lessons from the Collapse of Enron and Other Major Corporations*, C.L. Culp and W.A. Niskanen, eds., Wiley, 2003.

“Discovery and the Financial Analyst.” With Roger Hickey. *Litigation Services Handbook*, January 1995.

“How Useful Are *Wall Street Week* Stock Recommendations?” With P. Griffin and J. Jones. *Journal of Financial Statement Analysis*, Fall 1995.

“Contemporaneous Announcements of Dividends and Earnings.” With R. Leftwich. *Journal of Accounting, Auditing, and Finance*, Autumn 1994.

“The Relative Informativeness of Accounting Disclosures in Different Countries.” With A. Alford, J. Jones, and R. Leftwich. *Journal of Accounting Research*, Supplement, 1993.

“Extensions and Violations of the Statutory SEC Form 10-K Filing Requirements.” With A. Alford and J. Jones. *Journal of Accounting and Economics*, 1993.

“SEC Form 10-K/10-Q Reports and Annual Reports to Shareholders: Reporting Lags and Squared Market Model Prediction Errors.” With P. Easton. *Journal of Accounting Research*, Winter 1993.

*The Phish Corporation: A Practice Case in Managerial Accounting*, With R. Derstine, R. Huefner, and S. Gunn. McGraw-Hill, 1991.

“Cross-Sectional Variation in the Stock Market Response to the Announcement of Accounting Earnings.” With P. Easton. *Journal of Accounting and Economics*, 1989.

“An Evaluation of Alternative Proxies for the Market’s Expectation of Earnings.” With L. Brown, P. Griffin, and R.L. Hagerman. *Journal of Accounting and Economics*, 1987.

"Predictive Value of Accounting Information." With P. Griffin. In *Usefulness to Investors and Creditors of Information Provided by Financial Reporting*, 2<sup>nd</sup> Edition, P. Griffin, ed. Financial Accounting Standards Board, 1987.

"Security Analyst Superiority Relative to Univariate Time-Series Models in Forecasting Quarterly Earnings." With L. Brown, P. Griffin, and R. Hagerman. *Journal of Accounting and Economics*, 1987.

"The Effect of Labor Strikes on Security Analysts' Forecast Superiority and on the Association between Risk-Adjusted Stock Returns and Unexpected Earnings." With L. Brown. *Contemporary Accounting Research*, 1987.

"Estimating Models with Binary Dependent Variables: Some Theoretical and Empirical Observations." With G. Gessner, W. Kamakura, and N. Malhotra. *Journal of Business Research*, 1987.

"Methodological Issues Related to the Estimation of Financial Distress Prediction Models." *Journal of Accounting Research*, 1984.

"The Association Between the Magnitude of Quarterly Earnings Forecast Errors and Risk-Adjusted Stock Returns." With R.L. Hagerman and P. Shah. *Journal of Accounting Research*, 1984.

"An Income Strategy Approach to the Positive Theory of Accounting Policy Setting/Choice." With R.L. Hagerman. *Journal of Accounting and Economics*, 1981. Reprinted in *The Economics of Accounting Policy Choice*, Ray Ball and Clifford Smith, Jr., eds. McGraw-Hill, 1992.

"A Test of Accounting Bias and Market Structure: Some Additional Evidence." With R.L. Hagerman. *Review of Business and Economic Research*, 1981.

"Some Economic Determinants of Accounting Policy Choice." With R.L. Hagerman. *Journal of Accounting and Economics*, 1979.

Comments on "Earnings Forecasting Research: Its Implications for Capital Markets Research." *International Journal of Forecasting*.

## Dissertation committees

Sandip Madan, The University of Chicago, 1999, Member

Keith Bockus, The University of Chicago, 1998, Co-Chairperson

Beverly Walther, The University of Chicago, 1995, Member

Howard Bunsis, The University of Chicago, 1993, Co-Chairperson

Phillip Berger, The University of Chicago, 1992, Member

Stuart Essig, The University of Chicago, 1991, Member

Sherri Jarrell, The University of Chicago, 1991, Member

Andrew Alford, The University of Chicago, 1990, Chairperson

Mark Lang, The University of Chicago, 1990, Member

Laureen Maines, The University of Chicago, 1990, Member

Walter Teets, The University of Chicago, 1988, Member

Siew Teoh, The University of Chicago, 1988, Member

Kirsten Ely, The University of Chicago, 1988, Member

M. Daniel Beneish, The University of Chicago, 1987, Member

Pat O'Brien, The University of Chicago, 1986, Member

W. Forbes Cavanagh, State University of New York at Buffalo, 1985, Member

## University activities

Accounting Advisory Counsel, State University of New York at Buffalo, 1993–1995.

Faculty Facilitator, Leadership, Education, and Development (LEAD) Program, The University of Chicago, Graduate School of Business, 1989, 1991.

Dean's Advisory Committee on MBA Students and Curriculum, The University of Chicago, 1988.

Executive Director, Management Development Council, State University of New York at Buffalo, 1981–1984.

Advisor, Center for Management Development, State University of New York at Buffalo, 1979–1980.

## Editorial service and boards

Associate Editor, *The Accounting Review*, 1993–1997.

Editorial Board, *Journal of Accounting Research*, 1988–1993.

Editorial Board, *The Accounting Review*, 1985–1987.

## Ad hoc referee

*Journal of Accounting, Auditing, and Finance*

*The Accounting Review*

*Contemporary Accounting Research*

*The Financial Review*

*Journal of Accounting and Economics*

*Journal of Accounting Research*

*Journal of Banking and Finance*

*Journal of Business*

*Journal of Forecasting*

*International Journal of Forecasting*

*Management Science*

## Professional organizations

American Accounting Association

The American Finance Association

## Testimony, declarations, and other court filings and submissions in the past five years

*Federal Trade Commission v. Peabody Energy Corporation and Arch Coal, Inc.* In the United States District Court for the Eastern District of Missouri, C.A. No 4:20-cv-00317-SEP. Deposition testimony June 26, 2020. Trial testimony July 24, 2020.

*Zantran Pty Limited, Applicant vs. Crown Resorts Limited, Respondent.* In the Federal Court of Australia Victoria Registry, Case No. VID 1317/2017. Expert Reports April 18, 2019 and March 27, 2020.

*Alison Court, et al., Applicants vs. Spotless Group Holdings Limited, Respondent.* In the Federal Court of Australia Victoria Registry, Case No. VID 561/2017. Expert Reports December 22, 2019 and March 25, 2020.

*In Re American Realty Capital Properties, Inc. Litigation.* In the United States District Court for the Southern District of New York, C.A. No. 1:15-mc-00040-AKH. Deposition testimony July 26, 2019.

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*Ahmed D. Hussein, Plaintiff, v. Sheldon Razin et al., Defendants.* In the Superior Court of the State of California For the County of Orange, Case No. 30-2013-00679600-CU-NP-CJC. Deposition testimony June 10, 2015.

*Lavastone Capital LLC, Plaintiff, v. Coventry First LLC, LST I LLC, LST II LLC, LST Holdings Ltd., Montgomery Capital, Inc., Alan Buerger, Reid Buerger, Constance Buerger, and Krista Lake, Defendants.* In the United States District Court for the Southern District of New York, Case No. 14-CF-7139 (JSR)(DCF). Deposition testimony April 29, 2015. Trial testimony October 23, 2015.

# Exhibit 1

## Railroad Percentiles within Sample - STB Definition of Return on Invested Capital (ROIC) and STB Definition of Cost of Capital (COC) (Railroads' Return on Invested Capital and Cost of Capital Using STB Data)

|                                                                                                             | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | Min | Max  | Median | Average |
|-------------------------------------------------------------------------------------------------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|-----|------|--------|---------|
| <b>Panel A: S&amp;P 500 Companies Excluding Railroads, Financial Institutions and Real Estate Companies</b> |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |      |        |         |
| <b>Sample Number of Observations, Median, 25th Percentile, and % Positive ROIC minus COC:</b>               |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |      |        |         |
| Number of Observations in Sample                                                                            | 398  | 395  | 402  | 405  | 402  | 401  | 397  | 395  | 392  | 383  | 371  | 368  | 378  | 380  | 368 | 405  | 395    | 391     |
| Median ROIC minus COC                                                                                       | 16%  | 16%  | 16%  | 13%  | 18%  | 19%  | 19%  | 21%  | 20%  | 22%  | 22%  | 20%  | 29%  | 25%  | 13% | 29%  | 19%    | 20%     |
| 25th Percentile ROIC minus COC                                                                              | 5%   | 5%   | 3%   | -1%  | 5%   | 6%   | 5%   | 4%   | 5%   | 4%   | 4%   | 5%   | 6%   | 5%   | -1% | 6%   | 5%     | 4%      |
| % with ROIC minus COC > 0.0%                                                                                | 90%  | 89%  | 86%  | 73%  | 89%  | 91%  | 89%  | 90%  | 90%  | 88%  | 85%  | 89%  | 90%  | 89%  | 73% | 91%  | 89%    | 88%     |
| <b>Railroad Percentile in the Distribution of ROIC minus COC:</b>                                           |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |      |        |         |
| Industry Weighted Average ROIC                                                                              | 11   | 9    | 12   | 21   | 10   | 10   | 13   | 15   | 19   | 18   | 18   | 12   | 12   | 22   | 9   | 22   | 13     | 15      |
| BNSF Railway                                                                                                | 15   | 9    | 11   | 23   | 10   | 11   | 16   | 17   | 19   | 22   | 17   | 12   | 11   | 21   | 9   | 23   | 15     | 15      |
| CSX Corporation                                                                                             | 8    | 6    | 10   | 20   | 10   | 9    | 11   | 7    | 9    | 12   | 15   | 9    | 13   | 24   | 6   | 24   | 10     | 12      |
| Grand Trunk Corporation                                                                                     | 10   | 9    | 10   | 16   | 7    | 5    | 10   | 12   | 13   | 14   | 15   | 8    | 3    | 7    | 3   | 16   | 10     | 10      |
| Kansas City Southern                                                                                        | 9    | 8    | 8    | 18   | 9    | 8    | 10   | 5    | 6    | 9    | 12   | 8    | 4    | 6    | 4   | 18   | 8      | 9       |
| Norfolk Southern Corporation                                                                                | 24   | 18   | 22   | 21   | 11   | 12   | 12   | 12   | 14   | 12   | 16   | 11   | 10   | 19   | 10  | 24   | 13     | 15      |
| Soo Line Corporation                                                                                        | 15   | 23   | 10   | 17   | 6    | 3    | 5    | 12   | 2    | 26   | 16   | 12   | 14   | 18   | 2   | 26   | 13     | 13      |
| Union Pacific Corporation                                                                                   | 8    | 8    | 11   | 23   | 13   | 13   | 22   | 25   | 30   | 28   | 27   | 22   | 22   | 28   | 8   | 30   | 22     | 20      |
| <b>Panel B: S&amp;P 500 Companies in the Industrials Sector Excluding Railroads</b>                         |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |      |        |         |
| <b>Sample Number of Observations, Median, 25th Percentile, and % Positive ROIC minus COC:</b>               |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |      |        |         |
| Number of Observations in Sample                                                                            | 48   | 52   | 55   | 53   | 54   | 56   | 53   | 56   | 57   | 59   | 63   | 62   | 62   | 61   | 48  | 63   | 56     | 57      |
| Median ROIC minus COC                                                                                       | 20%  | 23%  | 21%  | 14%  | 17%  | 21%  | 22%  | 22%  | 23%  | 24%  | 28%  | 28%  | 30%  | 31%  | 14% | 31%  | 23%    | 23%     |
| 25th Percentile ROIC minus COC                                                                              | 11%  | 13%  | 13%  | 4%   | 10%  | 13%  | 12%  | 14%  | 11%  | 13%  | 9%   | 14%  | 13%  | 13%  | 4%  | 14%  | 13%    | 12%     |
| % with ROIC minus COC > 0.0%                                                                                | 96%  | 92%  | 98%  | 83%  | 94%  | 96%  | 96%  | 96%  | 96%  | 97%  | 94%  | 100% | 95%  | 97%  | 83% | 100% | 96%    | 95%     |
| <b>Railroad Percentile in the Distribution of ROIC minus COC:</b>                                           |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |      |        |         |
| Industry Weighted Average ROIC                                                                              | 6    | 6    | 4    | 11   | 7    | 5    | 6    | 7    | 10   | 12   | 9    | 2    | 6    | 8    | 2   | 12   | 7      | 7       |
| BNSF Railway                                                                                                | 10   | 6    | 4    | 11   | 7    | 5    | 6    | 7    | 10   | 13   | 9    | 2    | 6    | 8    | 2   | 13   | 7      | 7       |
| CSX Corporation                                                                                             | 4    | 6    | 4    | 9    | 7    | 5    | 6    | 4    | 5    | 5    | 8    | 2    | 6    | 11   | 2   | 11   | 5      | 6       |
| Grand Trunk Corporation                                                                                     | 6    | 6    | 4    | 7    | 4    | 2    | 6    | 5    | 9    | 7    | 8    | 2    | 2    | 3    | 2   | 9    | 5      | 5       |
| Kansas City Southern                                                                                        | 6    | 6    | 4    | 9    | 5    | 5    | 6    | 4    | 3    | 3    | 6    | 2    | 2    | 3    | 2   | 9    | 4      | 5       |
| Norfolk Southern Corporation                                                                                | 14   | 9    | 9    | 11   | 7    | 5    | 6    | 5    | 9    | 5    | 8    | 2    | 6    | 8    | 2   | 14   | 8      | 7       |
| Soo Line Corporation                                                                                        | 10   | 13   | 4    | 7    | 2    | 2    | 2    | 5    | 2    | 15   | 8    | 2    | 6    | 8    | 2   | 15   | 6      | 6       |
| Union Pacific Corporation                                                                                   | 4    | 6    | 4    | 11   | 9    | 5    | 7    | 9    | 21   | 15   | 11   | 6    | 13   | 15   | 4   | 21   | 9      | 10      |
| <b>Panel C: Railroad Customer Sample of S&amp;P 500 Companies</b>                                           |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |      |        |         |
| <b>Sample Number of Observations, Median, 25th Percentile, and % Positive ROIC minus COC:</b>               |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |      |        |         |
| Number of Observations in Sample                                                                            | 80   | 80   | 81   | 82   | 84   | 84   | 84   | 83   | 84   | 86   | 85   | 83   | 84   | 82   | 80  | 86   | 84     | 83      |
| Median ROIC minus COC                                                                                       | 13%  | 12%  | 9%   | 3%   | 12%  | 13%  | 10%  | 7%   | 7%   | 8%   | 6%   | 8%   | 11%  | 8%   | 3%  | 13%  | 8%     | 9%      |
| 25th Percentile ROIC minus COC                                                                              | 4%   | 4%   | 1%   | -4%  | 3%   | 3%   | 2%   | 2%   | 1%   | 2%   | -1%  | 2%   | 2%   | 1%   | -4% | 4%   | 2%     | 2%      |
| % with ROIC minus COC > 0.0%                                                                                | 88%  | 86%  | 79%  | 61%  | 86%  | 85%  | 83%  | 87%  | 83%  | 81%  | 72%  | 83%  | 85%  | 79%  | 61% | 88%  | 83%    | 81%     |
| <b>Railroad Percentile in the Distribution of ROIC minus COC:</b>                                           |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |      |        |         |
| Industry Weighted Average ROIC                                                                              | 14   | 7    | 18   | 30   | 15   | 19   | 25   | 24   | 34   | 28   | 36   | 20   | 20   | 36   | 7   | 36   | 22     | 23      |
| BNSF Railway                                                                                                | 17   | 7    | 16   | 33   | 14   | 20   | 27   | 29   | 34   | 36   | 35   | 20   | 16   | 35   | 7   | 36   | 24     | 24      |
| CSX Corporation                                                                                             | 11   | 5    | 13   | 30   | 15   | 16   | 15   | 10   | 16   | 18   | 29   | 17   | 20   | 39   | 5   | 39   | 16     | 18      |
| Grand Trunk Corporation                                                                                     | 12   | 7    | 13   | 24   | 14   | 8    | 14   | 17   | 24   | 21   | 29   | 13   | 5    | 18   | 5   | 29   | 14     | 16      |
| Kansas City Southern                                                                                        | 12   | 7    | 10   | 28   | 14   | 13   | 13   | 7    | 13   | 16   | 22   | 12   | 5    | 16   | 5   | 28   | 13     | 13      |
| Norfolk Southern Corporation                                                                                | 28   | 20   | 30   | 30   | 15   | 21   | 18   | 17   | 25   | 18   | 29   | 18   | 15   | 33   | 15  | 33   | 20     | 23      |
| Soo Line Corporation                                                                                        | 17   | 27   | 13   | 24   | 12   | 6    | 6    | 17   | 6    | 43   | 30   | 20   | 21   | 31   | 6   | 43   | 19     | 20      |
| Union Pacific Corporation                                                                                   | 11   | 6    | 16   | 33   | 16   | 21   | 35   | 42   | 49   | 46   | 45   | 36   | 34   | 45   | 6   | 49   | 35     | 31      |

Sources: Bloomberg; Compustat; Ibbotson Yearbook (2006-2019); STB Revenue Adequacy Determination Report (2006-2018); RevAd 2019 AAR workpaper1 pdf, titled "AAR Duplication of STB Workpapers "

## Exhibit 2

**Railroad Percentiles within Sample - Adjusted STB Definition of Return on Invested Capital (ROIC) and STB Definition of Cost of Capital (COC)**  
**(Railroads' Return on Invested Capital and Cost of Capital Using STB Data)**

|                                                                                                             | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | Min | Max | Median | Average |
|-------------------------------------------------------------------------------------------------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|-----|-----|--------|---------|
| <b>Panel A: S&amp;P 500 Companies Excluding Railroads, Financial Institutions and Real Estate Companies</b> |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |     |        |         |
| <b>Sample Number of Observations, Median, 25th Percentile, and % Positive ROIC minus COC:</b>               |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |     |        |         |
| Number of Observations in Sample                                                                            | 405  | 401  | 409  | 415  | 413  | 414  | 413  | 412  | 410  | 408  | 402  | 393  | 395  | 394  | 393 | 415 | 409    | 406     |
| Median ROIC minus COC                                                                                       | 9%   | 9%   | 9%   | 5%   | 11%  | 11%  | 10%  | 11%  | 9%   | 10%  | 9%   | 7%   | 12%  | 10%  | 5%  | 12% | 10%    | 9%      |
| 25th Percentile ROIC minus COC                                                                              | 1%   | 2%   | 1%   | -2%  | 3%   | 3%   | 3%   | 2%   | 2%   | 2%   | 2%   | 2%   | 2%   | 1%   | -2% | 3%  | 2%     | 2%      |
| % with ROIC minus COC > 0.0%                                                                                | 81%  | 82%  | 80%  | 68%  | 86%  | 87%  | 86%  | 87%  | 87%  | 84%  | 82%  | 82%  | 84%  | 82%  | 68% | 87% | 83%    | 83%     |
| <b>Railroad Percentile in the Distribution of ROIC minus COC:</b>                                           |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |     |        |         |
| Industry Weighted Average ROIC                                                                              | 14   | 9    | 12   | 22   | 9    | 12   | 13   | 11   | 13   | 17   | 18   | 11   | 11   | 25   | 9   | 25  | 13     | 14      |
| BNSF Railway                                                                                                | 17   | 10   | 12   | 24   | 10   | 16   | 13   | 12   | 14   | 20   | 18   | 11   | 8    | 22   | 8   | 24  | 14     | 15      |
| CSX Corporation                                                                                             | 10   | 8    | 10   | 20   | 9    | 10   | 12   | 6    | 8    | 11   | 15   | 10   | 12   | 26   | 6   | 26  | 10     | 12      |
| Grand Trunk Corporation                                                                                     | 13   | 9    | 10   | 14   | 7    | 6    | 8    | 7    | 9    | 15   | 15   | 9    | 4    | 10   | 4   | 15  | 9      | 10      |
| Kansas City Southern                                                                                        | 15   | 11   | 10   | 20   | 11   | 10   | 13   | 9    | 9    | 12   | 14   | 9    | 5    | 9    | 5   | 20  | 10     | 11      |
| Norfolk Southern Corporation                                                                                | 16   | 12   | 17   | 21   | 7    | 11   | 11   | 8    | 9    | 10   | 15   | 11   | 8    | 21   | 7   | 21  | 11     | 13      |
| Soo Line Corporation                                                                                        | 28   | 34   | 10   | 16   | 7    | 5    | 4    | 13   | 1    | 23   | 18   | 11   | 14   | 17   | 1   | 34  | 13     | 14      |
| Union Pacific Corporation                                                                                   | 10   | 8    | 14   | 23   | 11   | 13   | 17   | 16   | 30   | 30   | 26   | 17   | 22   | 35   | 8   | 35  | 17     | 19      |
| <b>Panel B: S&amp;P 500 Companies in the Industrials Sector Excluding Railroads</b>                         |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |     |        |         |
| <b>Sample Number of Observations, Median, 25th Percentile, and % Positive ROIC minus COC:</b>               |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |     |        |         |
| Number of Observations in Sample                                                                            | 48   | 53   | 56   | 54   | 55   | 57   | 56   | 60   | 61   | 63   | 66   | 65   | 65   | 64   | 48  | 66  | 59     | 59      |
| Median ROIC minus COC                                                                                       | 13%  | 15%  | 15%  | 5%   | 12%  | 15%  | 13%  | 13%  | 12%  | 12%  | 11%  | 12%  | 13%  | 14%  | 5%  | 15% | 13%    | 12%     |
| 25th Percentile ROIC minus COC                                                                              | 9%   | 8%   | 7%   | 1%   | 6%   | 8%   | 6%   | 6%   | 4%   | 7%   | 7%   | 7%   | 6%   | 9%   | 1%  | 9%  | 7%     | 6%      |
| % with ROIC minus COC > 0.0%                                                                                | 92%  | 91%  | 95%  | 80%  | 95%  | 95%  | 93%  | 95%  | 90%  | 90%  | 92%  | 97%  | 94%  | 94%  | 80% | 97% | 93%    | 92%     |
| <b>Railroad Percentile in the Distribution of ROIC minus COC:</b>                                           |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |     |        |         |
| Industry Weighted Average ROIC                                                                              | 6    | 6    | 4    | 13   | 5    | 7    | 9    | 5    | 10   | 13   | 7    | 2    | 3    | 11   | 2   | 13  | 7      | 7       |
| BNSF Railway                                                                                                | 6    | 6    | 4    | 15   | 5    | 9    | 9    | 5    | 11   | 16   | 6    | 2    | 3    | 9    | 2   | 16  | 6      | 7       |
| CSX Corporation                                                                                             | 4    | 4    | 4    | 13   | 5    | 5    | 9    | 3    | 3    | 8    | 6    | 2    | 6    | 11   | 2   | 13  | 5      | 6       |
| Grand Trunk Corporation                                                                                     | 4    | 6    | 4    | 7    | 4    | 2    | 5    | 3    | 6    | 11   | 6    | 2    | 2    | 3    | 2   | 11  | 4      | 5       |
| Kansas City Southern                                                                                        | 6    | 6    | 4    | 11   | 5    | 5    | 9    | 5    | 6    | 8    | 6    | 2    | 2    | 3    | 2   | 11  | 5      | 5       |
| Norfolk Southern Corporation                                                                                | 6    | 6    | 5    | 13   | 4    | 5    | 9    | 5    | 6    | 5    | 6    | 2    | 3    | 9    | 2   | 13  | 5      | 6       |
| Soo Line Corporation                                                                                        | 16   | 19   | 4    | 7    | 4    | 2    | 4    | 7    | 2    | 17   | 6    | 2    | 8    | 8    | 2   | 19  | 6      | 7       |
| Union Pacific Corporation                                                                                   | 4    | 4    | 4    | 13   | 5    | 7    | 12   | 7    | 23   | 17   | 10   | 3    | 8    | 14   | 3   | 23  | 7      | 9       |
| <b>Panel C: Railroad Customer Sample of S&amp;P 500 Companies</b>                                           |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |     |        |         |
| <b>Sample Number of Observations, Median, 25th Percentile, and % Positive ROIC minus COC:</b>               |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |     |        |         |
| Number of Observations in Sample                                                                            | 80   | 80   | 81   | 82   | 84   | 84   | 84   | 83   | 84   | 87   | 86   | 84   | 85   | 83   | 80  | 87  | 84     | 83      |
| Median ROIC minus COC                                                                                       | 9%   | 7%   | 6%   | 0%   | 7%   | 8%   | 5%   | 4%   | 3%   | 3%   | 3%   | 3%   | 5%   | 4%   | 0%  | 9%  | 5%     | 5%      |
| 25th Percentile ROIC minus COC                                                                              | 1%   | 2%   | 0%   | -5%  | 2%   | 2%   | 0%   | 1%   | 0%   | 1%   | -2%  | 0%   | 1%   | 0%   | -5% | 2%  | 0%     | 0%      |
| % with ROIC minus COC > 0.0%                                                                                | 84%  | 81%  | 70%  | 52%  | 81%  | 83%  | 76%  | 81%  | 74%  | 79%  | 67%  | 76%  | 81%  | 75%  | 52% | 84% | 78%    | 76%     |
| <b>Railroad Percentile in the Distribution of ROIC minus COC:</b>                                           |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |     |        |         |
| Industry Weighted Average ROIC                                                                              | 12   | 7    | 20   | 34   | 15   | 16   | 21   | 17   | 27   | 22   | 31   | 15   | 16   | 40   | 7   | 40  | 18     | 21      |
| BNSF Railway                                                                                                | 14   | 7    | 18   | 36   | 15   | 20   | 22   | 19   | 27   | 33   | 31   | 14   | 12   | 38   | 7   | 38  | 20     | 22      |
| CSX Corporation                                                                                             | 9    | 6    | 17   | 31   | 15   | 16   | 18   | 10   | 15   | 16   | 29   | 13   | 16   | 40   | 6   | 40  | 16     | 18      |
| Grand Trunk Corporation                                                                                     | 12   | 7    | 15   | 22   | 14   | 9    | 11   | 10   | 16   | 22   | 29   | 13   | 5    | 21   | 5   | 29  | 14     | 15      |
| Kansas City Southern                                                                                        | 12   | 9    | 15   | 31   | 15   | 16   | 19   | 15   | 16   | 16   | 25   | 13   | 6    | 20   | 6   | 31  | 16     | 16      |
| Norfolk Southern Corporation                                                                                | 12   | 11   | 24   | 33   | 15   | 16   | 18   | 12   | 16   | 15   | 28   | 14   | 12   | 36   | 11  | 36  | 16     | 19      |
| Soo Line Corporation                                                                                        | 32   | 36   | 15   | 25   | 14   | 6    | 8    | 20   | 6    | 39   | 31   | 15   | 17   | 26   | 6   | 39  | 19     | 21      |
| Union Pacific Corporation                                                                                   | 9    | 7    | 22   | 36   | 15   | 16   | 29   | 24   | 49   | 49   | 47   | 24   | 29   | 49   | 7   | 49  | 26     | 29      |

Sources: Bloomberg; Compustat; Ibbotson Yearbook (2006-2019); STB Revenue Adequacy Determination Report (2006-2018); RevAd 2019 AAR workpaper1 pdf, titled "AAR Duplication of STB Workpapers "

### S&P 500 Companies by Year

### S&P 500 Companies by Year

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# Appendix A, Exhibit A1

## S&P 500 Companies by Year

| Company Name                                                 | Company Ticker | GICS Sector            | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 |
|--------------------------------------------------------------|----------------|------------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| Number of S&P 500 Companies                                  |                |                        | 500  | 500  | 500  | 500  | 500  | 500  | 500  | 500  | 500  | 500  | 500  | 500  | 500  | 500  |
| Railroads, Financial Institutions, and Real Estate Companies |                |                        | 92   | 99   | 90   | 85   | 87   | 86   | 87   | 87   | 89   | 91   | 96   | 104  | 103  | 101  |
| Sample Number of S&P 500 Companies                           |                |                        | 408  | 401  | 410  | 415  | 413  | 414  | 413  | 413  | 411  | 409  | 404  | 396  | 397  | 399  |
| VIACOMCBS INC                                                | VIAC           | Communication Services | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| WINDSTREAM HOLDINGS INC                                      | WINMQ          | Communication Services | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 0    | 0    | 0    | 0    | 0    |
| ABERCROMBIE & FITCH -CL A                                    | ANF            | Consumer Discretionary | 0    | 1    | 1    | 1    | 1    | 1    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| ADTALEM GLOBAL EDUCATION INC                                 | ATGE           | Consumer Discretionary | 0    | 0    | 0    | 1    | 1    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| ADVANCE AUTO PARTS INC                                       | AAP            | Consumer Discretionary | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 1    | 1    | 1    | 1    | 1    |
| ALTABA INC                                                   | AABA           | Consumer Discretionary | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 0    | 0    | 0    |
| AMAZON.COM INC                                               | AMZN           | Consumer Discretionary | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| APOLLO EDUCATION GROUP INC                                   | APOL           | Consumer Discretionary | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| APTIV PLC                                                    | APTIV          | Consumer Discretionary | 0    | 0    | 0    | 0    | 0    | 0    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| AUTONATION INC                                               | AN             | Consumer Discretionary | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 0    | 0    | 0    |
| AUTOZONE INC                                                 | AZO            | Consumer Discretionary | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| BED BATH & BEYOND INC                                        | BBBY           | Consumer Discretionary | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 0    | 0    | 0    |
| BEST BUY CO INC                                              | BBY            | Consumer Discretionary | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| BIG LOTS INC                                                 | BIG            | Consumer Discretionary | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| BLACK & DECKER CORP                                          | BDK            | Consumer Discretionary | 1    | 1    | 1    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| BLOCK H & R INC                                              | HRB            | Consumer Discretionary | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| BOOKING HOLDINGS INC                                         | BKNG           | Consumer Discretionary | 0    | 0    | 0    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| BORGWARNER INC                                               | BWA            | Consumer Discretionary | 0    | 0    | 0    | 0    | 0    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| BRUNSWICK CORP                                               | BC             | Consumer Discretionary | 1    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| CAESARS ENTERTAINMENT CORP                                   | CZR            | Consumer Discretionary | 1    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| CAPRI HOLDINGS LTD                                           | CPRI           | Consumer Discretionary | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| CARMAX INC                                                   | KMX            | Consumer Discretionary | 0    | 0    | 0    | 0    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| CARNIVAL CORPORATION & PLC                                   | CCL            | Consumer Discretionary | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| CENTEX CORP                                                  | CTX.2          | Consumer Discretionary | 1    | 1    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| CHIPOTLE MEXICAN GRILL INC                                   | CMG            | Consumer Discretionary | 0    | 0    | 0    | 0    | 0    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| CIRCUIT CITY STORES INC                                      | CCTYQ          | Consumer Discretionary | 1    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| D R HORTON INC                                               | DHI            | Consumer Discretionary | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| DARDEN RESTAURANTS INC                                       | DRI            | Consumer Discretionary | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| DILLARDS INC -CL A                                           | DDS            | Consumer Discretionary | 1    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| DIRECTV                                                      | DTV.2          | Consumer Discretionary | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 0    | 0    | 0    | 0    | 0    |
| DOLLAR GENERAL CORP                                          | DG             | Consumer Discretionary | 1    | 0    | 0    | 0    | 0    | 0    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| DOLLAR TREE INC                                              | DLTR           | Consumer Discretionary | 0    | 0    | 0    | 0    | 0    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| DOW JONES & CO INC                                           | DJ             | Consumer Discretionary | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| EBAY INC                                                     | EBAY           | Consumer Discretionary | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| EXPEDIA GROUP INC                                            | EXPE           | Consumer Discretionary | 0    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| FAMILY DOLLAR STORES                                         | FDO            | Consumer Discretionary | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 0    | 0    | 0    | 0    | 0    |
| FOOT LOCKER INC                                              | FL             | Consumer Discretionary | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 1    | 1    | 1    | 0    |
| FORD MOTOR CO                                                | F              | Consumer Discretionary | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| FOSSIL GROUP INC                                             | FOSL           | Consumer Discretionary | 0    | 0    | 0    | 0    | 0    | 0    | 1    | 1    | 1    | 1    | 0    | 0    | 0    | 0    |
| GAMESTOP CORP                                                | GME            | Consumer Discretionary | 0    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 0    | 0    | 0    | 0    |

## S&P 500 Companies by Year

| Company Name                                                 | Company Ticker | GICS Sector            | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 |
|--------------------------------------------------------------|----------------|------------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| Number of S&P 500 Companies                                  |                |                        | 500  | 500  | 500  | 500  | 500  | 500  | 500  | 500  | 500  | 500  | 500  | 500  | 500  | 500  |
| Railroads, Financial Institutions, and Real Estate Companies |                |                        | 92   | 99   | 90   | 85   | 87   | 86   | 87   | 87   | 89   | 91   | 96   | 104  | 103  | 101  |
| Sample Number of S&P 500 Companies                           |                |                        | 408  | 401  | 410  | 415  | 413  | 414  | 413  | 413  | 411  | 409  | 404  | 396  | 397  | 399  |
| GAP INC                                                      | GPS            | Consumer Discretionary | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| GARMIN LTD                                                   | GRMN           | Consumer Discretionary | 0    | 0    | 0    | 0    | 0    | 0    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| GENERAL MOTORS CO                                            | GM             | Consumer Discretionary | 1    | 1    | 1    | 0    | 0    | 0    | 0    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| GENUINE PARTS CO                                             | GPC            | Consumer Discretionary | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| GOODYEAR TIRE & RUBBER CO                                    | GT             | Consumer Discretionary | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 0    |
| GRAHAM HOLDINGS CO                                           | GHC            | Consumer Discretionary | 0    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 0    | 0    | 0    | 0    | 0    | 0    |
| HANESBRANDS INC                                              | HBI            | Consumer Discretionary | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 1    | 1    | 1    | 1    | 1    |
| HARLEY-DAVIDSON INC                                          | HOG            | Consumer Discretionary | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| HARMAN INTERNATIONAL INDS                                    | HAR            | Consumer Discretionary | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 0    | 0    | 0    |
| HASBRO INC                                                   | HAS            | Consumer Discretionary | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| HILTON WORLDWIDE HOLDINGS                                    | HLT            | Consumer Discretionary | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 1    | 1    | 1    |
| HOME DEPOT INC                                               | HD             | Consumer Discretionary | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| INTL GAME TECHNOLOGY                                         | IGT.1          | Consumer Discretionary | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 0    | 0    | 0    | 0    | 0    | 0    |
| JONES GROUP INC                                              | JNY            | Consumer Discretionary | 1    | 1    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| KATE SPADE & CO                                              | KATE           | Consumer Discretionary | 1    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| KB HOME                                                      | KBH            | Consumer Discretionary | 1    | 1    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| KOHL'S CORP                                                  | KSS            | Consumer Discretionary | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| L BRANDS INC                                                 | LB             | Consumer Discretionary | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| LAS VEGAS SANDS CORP                                         | LVS            | Consumer Discretionary | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 1    |
| LEGGETT & PLATT INC                                          | LEG            | Consumer Discretionary | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| LENNAR CORP                                                  | LEN            | Consumer Discretionary | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| LKQ CORP                                                     | LKQ            | Consumer Discretionary | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 1    | 1    | 1    | 1    |
| LOWE'S COS INC                                               | LOW            | Consumer Discretionary | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| MACY'S INC                                                   | M              | Consumer Discretionary | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| MARRIOTT INTL INC                                            | MAR            | Consumer Discretionary | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| MATTEL INC                                                   | MAT            | Consumer Discretionary | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 0    |
| MCDONALD'S CORP                                              | MCD            | Consumer Discretionary | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| MGM RESORTS INTERNATIONAL                                    | MGM            | Consumer Discretionary | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 1    | 1    | 1    |
| MOHAWK INDUSTRIES INC                                        | MHK            | Consumer Discretionary | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| NEWELL BRANDS INC                                            | NWL            | Consumer Discretionary | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| NIKE INC -CL B                                               | NKE            | Consumer Discretionary | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| NORDSTROM INC                                                | JWN            | Consumer Discretionary | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| NORWEGIAN CRUISE LINE HLDGS                                  | NCLH           | Consumer Discretionary | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 1    | 1    | 1    |
| NVR INC                                                      | NVR            | Consumer Discretionary | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 1    |
| ODP CORP                                                     | ODP            | Consumer Discretionary | 1    | 1    | 1    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| OFFICEMAX INC                                                | OMX            | Consumer Discretionary | 1    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| O'REILLY AUTOMOTIVE INC                                      | ORLY           | Consumer Discretionary | 0    | 0    | 0    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| PENNEY (J C) CO                                              | JCPNQ          | Consumer Discretionary | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| PETSMART INC                                                 | PETM           | Consumer Discretionary | 0    | 0    | 0    | 0    | 0    | 0    | 1    | 1    | 1    | 0    | 0    | 0    | 0    | 0    |
| PULTEGROUP INC                                               | PHM            | Consumer Discretionary | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |

## S&P 500 Companies by Year

[illegible]

# Appendix A, Exhibit A1

## S&P 500 Companies by Year

| Company Name                                                 | Company Ticker | GICS Sector      | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 |
|--------------------------------------------------------------|----------------|------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| Number of S&P 500 Companies                                  |                |                  | 500  | 500  | 500  | 500  | 500  | 500  | 500  | 500  | 500  | 500  | 500  | 500  | 500  | 500  |
| Railroads, Financial Institutions, and Real Estate Companies |                |                  | 92   | 99   | 90   | 85   | 87   | 86   | 87   | 87   | 89   | 91   | 96   | 104  | 103  | 101  |
| Sample Number of S&P 500 Companies                           |                |                  | 408  | 401  | 410  | 415  | 413  | 414  | 413  | 413  | 411  | 409  | 404  | 396  | 397  | 399  |
| CONAGRA BRANDS INC                                           | CAG            | Consumer Staples | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| CONSTELLATION BRANDS                                         | STZ            | Consumer Staples | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| COSTCO WHOLESALE CORP                                        | COST           | Consumer Staples | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| COTY INC                                                     | COTY           | Consumer Staples | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 1    | 1    | 1    | 1    |
| DEAN FOODS CO                                                | DFODQ          | Consumer Staples | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| DR PEPPER SNAPPLE GROUP INC                                  | DPS            | Consumer Staples | 0    | 0    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 0    | 0    |
| GENERAL MILLS INC                                            | GIS            | Consumer Staples | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| HERSHEY CO                                                   | HSY            | Consumer Staples | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| HILLSHIRE BRANDS CO                                          | HSI            | Consumer Staples | 1    | 1    | 1    | 1    | 1    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| HORMEL FOODS CORP                                            | HRL            | Consumer Staples | 0    | 0    | 0    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| KELLOGG CO                                                   | K              | Consumer Staples | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| KEURIG DR PEPPER INC                                         | KDP            | Consumer Staples | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 1    | 1    | 0    | 0    | 0    | 0    |
| KIMBERLY-CLARK CORP                                          | KMB            | Consumer Staples | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| KRAFT FOODS GROUP INC                                        | KRFT           | Consumer Staples | 0    | 0    | 0    | 0    | 0    | 0    | 1    | 1    | 1    | 0    | 0    | 0    | 0    | 0    |
| KRAFT HEINZ CO                                               | KHC            | Consumer Staples | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 0    | 0    | 1    | 1    | 1    | 1    | 1    |
| KROGER CO                                                    | KR             | Consumer Staples | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| LAMB WESTON HOLDINGS INC                                     | LW             | Consumer Staples | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 1    | 1    |
| LAUDER (ESTEE) COS INC -CL A                                 | EL             | Consumer Staples | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| LORILLARD INC                                                | LO             | Consumer Staples | 0    | 0    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 0    | 0    | 0    | 0    | 0    |
| MCCORMICK & CO INC                                           | MKC            | Consumer Staples | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| MEAD JOHNSON NUTRITION CO                                    | MJN            | Consumer Staples | 0    | 0    | 0    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 0    | 0    | 0    |
| MOLSON COORS BEVERAGE CO                                     | TAP            | Consumer Staples | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| MONDELEZ INTERNATIONAL INC                                   | MDLZ           | Consumer Staples | 0    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| MONSTER BEVERAGE CORP                                        | MNST           | Consumer Staples | 0    | 0    | 0    | 0    | 0    | 0    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| PEPSI BOTTLING GROUP INC                                     | PBG            | Consumer Staples | 1    | 1    | 1    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| PEPSICO INC                                                  | PEP            | Consumer Staples | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| PHILIP MORRIS INTERNATIONAL                                  | PM             | Consumer Staples | 0    | 0    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| PROCTER & GAMBLE CO                                          | PG             | Consumer Staples | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| REYNOLDS AMERICAN INC                                        | RAI            | Consumer Staples | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 0    | 0    | 0    |
| SAFEWAY INC                                                  | SWY            | Consumer Staples | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 0    | 0    | 0    | 0    | 0    |
| SMUCKER (JM) CO                                              | SJM            | Consumer Staples | 0    | 0    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| SUPERVALU INC                                                | SVU            | Consumer Staples | 1    | 1    | 1    | 1    | 1    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| SYSCO CORP                                                   | SY             | Consumer Staples | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| TYSON FOODS INC -CL A                                        | TSN            | Consumer Staples | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| UST INC                                                      | UST.1          | Consumer Staples | 1    | 1    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| WALGREENS BOOTS ALLIANCE INC                                 | WBA            | Consumer Staples | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| WALMART INC                                                  | WMT            | Consumer Staples | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| WHOLE FOODS MARKET INC                                       | WFM            | Consumer Staples | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 0    | 0    | 0    |
| WRIGLEY (WM) JR CO                                           | WWY            | Consumer Staples | 1    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| ALPHA NATURAL RESOURCES INC                                  | ANRZQ          | Energy           | 0    | 0    | 0    | 0    | 0    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |

## S&P 500 Companies by Year

[illegible]

### S&P 500 Companies by Year

[illegible]

## Appendix A, Exhibit A1

### S&P 500 Companies by Year

| Company Name                                                 | Company Ticker | GICS Sector | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 |
|--------------------------------------------------------------|----------------|-------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| Number of S&P 500 Companies                                  |                |             | 500  | 500  | 500  | 500  | 500  | 500  | 500  | 500  | 500  | 500  | 500  | 500  | 500  | 500  |
| Railroads, Financial Institutions, and Real Estate Companies |                |             | 92   | 99   | 90   | 85   | 87   | 86   | 87   | 87   | 89   | 91   | 96   | 104  | 103  | 101  |
| Sample Number of S&P 500 Companies                           |                |             | 408  | 401  | 410  | 415  | 413  | 414  | 413  | 413  | 411  | 409  | 404  | 396  | 397  | 399  |
| CBOE GLOBAL MARKETS INC                                      | CBOE*          | Financials  | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 1    | 1    | 1    |
| CHUBB CORP                                                   | CB.1*          | Financials  | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 0    | 0    | 0    | 0    |
| CHUBB LTD                                                    | CB*            | Financials  | 1    | 1    | 0    | 0    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| CINCINNATI FINANCIAL CORP                                    | CINF*          | Financials  | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| CIT GROUP INC                                                | CIT*           | Financials  | 1    | 1    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| CITIGROUP INC                                                | C*             | Financials  | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| CITIZENS FINANCIAL GROUP INC                                 | CFG*           | Financials  | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 1    | 1    | 1    | 1    |
| CME GROUP INC                                                | CME*           | Financials  | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| COMERICA INC                                                 | CMA*           | Financials  | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| COMMERCE BANCORP INC/NJ                                      | CBH.1*         | Financials  | 1    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| COUNTRYWIDE FINANCIAL CORP                                   | CFC.3*         | Financials  | 1    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| DISCOVER FINANCIAL SVCS                                      | DFS*           | Financials  | 0    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| E TRADE FINANCIAL CORP                                       | ETFC*          | Financials  | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| EQUITY OFFICE PROPERTIES TR                                  | EOP*           | Financials  | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| EVEREST RE GROUP LTD                                         | RE*            | Financials  | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 1    | 1    | 1    |
| FEDERAL HOME LOAN MORTG CORP                                 | FMCC*          | Financials  | 1    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| FEDERAL NATIONAL MORTGA ASSN                                 | FNMA*          | Financials  | 1    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| FEDERATED HERMES INC                                         | FHI*           | Financials  | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| FIFTH THIRD BANCORP                                          | FITB*          | Financials  | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| FIRST HORIZON NATIONAL CORP                                  | FHN*           | Financials  | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| FIRST REPUBLIC BANK                                          | FRC*           | Financials  | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 1    |
| FRANKLIN RESOURCES INC                                       | BEN*           | Financials  | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| GENWORTH FINANCIAL INC                                       | GNW*           | Financials  | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 0    | 0    | 0    | 0    | 0    |
| GLOBE LIFE INC                                               | GL*            | Financials  | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| GOLDMAN SACHS GROUP INC                                      | GS*            | Financials  | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| HARTFORD FINANCIAL SERVICES                                  | HIG*           | Financials  | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| HUDSON CITY BANCORP INC                                      | HCBK*          | Financials  | 0    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 0    | 0    | 0    | 0    | 0    |
| HUNTINGTON BANCSHARES                                        | HBAN*          | Financials  | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| INTERCONTINENTAL EXCHANGE                                    | ICE*           | Financials  | 0    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| INVESCO LTD                                                  | IVZ*           | Financials  | 0    | 0    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| JANUS CAPITAL GROUP INC                                      | JNS*           | Financials  | 1    | 1    | 1    | 1    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| JEFFERIES FINANCIAL GRP INC                                  | JEF*           | Financials  | 0    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 0    |
| JPMORGAN CHASE & CO                                          | JPM*           | Financials  | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| KEYCORP                                                      | KEY*           | Financials  | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| LEGG MASON INC                                               | LM*            | Financials  | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 0    | 0    | 0    | 0    |
| LEHMAN BROTHERS HOLDINGS INC                                 | LEHMQ*         | Financials  | 1    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| LINCOLN NATIONAL CORP                                        | LNC*           | Financials  | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| LOEWS CORP                                                   | L*             | Financials  | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| M & T BANK CORP                                              | MTB*           | Financials  | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| MARKETAXESS HOLDINGS INC                                     | MKTX*          | Financials  | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 1    |

## Appendix A, Exhibit A1

### S&P 500 Companies by Year

| Company Name                                                 | Company Ticker | GICS Sector | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 |
|--------------------------------------------------------------|----------------|-------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| Number of S&P 500 Companies                                  |                |             | 500  | 500  | 500  | 500  | 500  | 500  | 500  | 500  | 500  | 500  | 500  | 500  | 500  | 500  |
| Railroads, Financial Institutions, and Real Estate Companies |                |             | 92   | 99   | 90   | 85   | 87   | 86   | 87   | 87   | 89   | 91   | 96   | 104  | 103  | 101  |
| Sample Number of S&P 500 Companies                           |                |             | 408  | 401  | 410  | 415  | 413  | 414  | 413  | 413  | 411  | 409  | 404  | 396  | 397  | 399  |
| MARSH & MCLENNAN COS                                         | MMC*           | Financials  | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| MARSHALL & ILSLEY CORP                                       | ML1*           | Financials  | 1    | 1    | 1    | 1    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| MBIA INC                                                     | MBI*           | Financials  | 1    | 1    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| MELLON FINANCIAL CORP                                        | MEL.3*         | Financials  | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| MERRILL LYNCH & CO INC                                       | BAC2*          | Financials  | 1    | 1    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| METLIFE INC                                                  | MET*           | Financials  | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| MGIC INVESTMENT CORP/WI                                      | MTG*           | Financials  | 1    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| MOODY'S CORP                                                 | MCO*           | Financials  | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| MORGAN STANLEY                                               | MS*            | Financials  | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| MSCI INC                                                     | MSCI*          | Financials  | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 1    | 1    |
| NASDAQ INC                                                   | NDAQ*          | Financials  | 0    | 0    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| NATIONAL CITY CORP                                           | NCC*           | Financials  | 1    | 1    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| NAVIENT CORP                                                 | NAVI*          | Financials  | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 0    | 0    |
| NORTHERN TRUST CORP                                          | NTRS*          | Financials  | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| NYSE EURONEXT                                                | NYX*           | Financials  | 0    | 1    | 1    | 1    | 1    | 1    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| PEOPLE'S UNITED FINL INC                                     | PBCT*          | Financials  | 0    | 0    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| PLUM CREEK TIMBER CO INC                                     | PCL*           | Financials  | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 0    | 0    | 0    | 0    |
| PNC FINANCIAL SVCS GROUP INC                                 | PNC*           | Financials  | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| PRICE (T. ROWE) GROUP                                        | TROW*          | Financials  | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| PRINCIPAL FINANCIAL GRP INC                                  | PFG*           | Financials  | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| PROGRESSIVE CORP-OHIO                                        | PGR*           | Financials  | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| PRUDENTIAL FINANCIAL INC                                     | PRU*           | Financials  | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| RAYMOND JAMES FINANCIAL CORP                                 | RJF*           | Financials  | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 1    | 1    | 1    |
| REGIONS FINANCIAL CORP                                       | RF*            | Financials  | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| S&P GLOBAL INC                                               | SPGI*          | Financials  | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| SAFECO CORP                                                  | SAF.3*         | Financials  | 1    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| SANTANDER HOLDINGS USA INC                                   | STD2*          | Financials  | 1    | 1    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| SCHWAB (CHARLES) CORP                                        | SCHW*          | Financials  | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| STATE STREET CORP                                            | STT*           | Financials  | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| SUNTRUST BANKS INC                                           | STI*           | Financials  | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 0    |
| SVB FINANCIAL GROUP                                          | SIVB*          | Financials  | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 1    | 1    |
| SYNCHRONY FINANCIAL                                          | SYF*           | Financials  | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 1    | 1    | 1    | 1    | 1    |
| SYNOVUS FINANCIAL CORP                                       | SNV*           | Financials  | 1    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| TRAVELERS COS INC                                            | TRV*           | Financials  | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| TRUIST FINANCIAL CORP                                        | TFC*           | Financials  | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| U S BANCORP                                                  | USB*           | Financials  | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| UNUM GROUP                                                   | UNM*           | Financials  | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| WACHOVIA CORP                                                | WB.3*          | Financials  | 1    | 1    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| WASHINGTON MUTUAL INC                                        | WAMUQ*         | Financials  | 1    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| WELLS FARGO & CO                                             | WFC*           | Financials  | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |

### S&P 500 Companies by Year

| Company Name                                                 | Company Ticker | GICS Sector | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 |
|--------------------------------------------------------------|----------------|-------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| Number of S&P 500 Companies                                  |                |             | 500  | 500  | 500  | 500  | 500  | 500  | 500  | 500  | 500  | 500  | 500  | 500  | 500  | 500  |
| Railroads, Financial Institutions, and Real Estate Companies |                |             | 92   | 99   | 90   | 85   | 87   | 86   | 87   | 87   | 89   | 91   | 96   | 104  | 103  | 101  |
| Sample Number of S&P 500 Companies                           |                |             | 408  | 401  | 410  | 415  | 413  | 414  | 413  | 413  | 411  | 409  | 404  | 396  | 397  | 399  |
| WILLIS TOWERS WATSON PLC                                     | WLTW*          | Financials  | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 1    | 1    | 1    | 1    |
| XL GROUP LTD                                                 | XL*            | Financials  | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 0    | 0    |
| ZIONS BANCORPORATION NA                                      | ZION*          | Financials  | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| ABBOTT LABORATORIES                                          | ABT            | Health Care | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| ABBVIE INC                                                   | ABBV           | Health Care | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| ABIOMED INC                                                  | ABMD           | Health Care | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 1    | 1    |
| AETNA INC                                                    | AET            | Health Care | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 0    | 0    |
| AGILENT TECHNOLOGIES INC                                     | A              | Health Care | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| ALEXION PHARMACEUTICALS INC                                  | ALXN           | Health Care | 0    | 0    | 0    | 0    | 0    | 0    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| ALIGN TECHNOLOGY INC                                         | ALGN           | Health Care | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 1    | 1    | 1    |
| ALLERGAN INC                                                 | AGN.2          | Health Care | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 0    | 0    | 0    | 0    | 0    |
| ALLERGAN PLC                                                 | AGN            | Health Care | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| AMERISOURCEBERGEN CORP                                       | ABC            | Health Care | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| AMGEN INC                                                    | AMGN           | Health Care | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| ANTHEM INC                                                   | ANTM           | Health Care | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| APPLIED BIOSYSTEMS INC                                       | ABL3           | Health Care | 1    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| BARD (C.R.) INC                                              | BCR            | Health Care | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 0    | 0    |
| BARR PHARMACEUTICALS INC                                     | BRL            | Health Care | 1    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| BAUSCH & LOMB HLDGS -REDH                                    | 6583B          | Health Care | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| BAXALTA INC                                                  | BXLT           | Health Care | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 1    | 0    | 0    | 0    | 0    |
| BAXTER INTERNATIONAL INC                                     | BAX            | Health Care | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| BECTON DICKINSON & CO                                        | BDX            | Health Care | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| BIOGEN INC                                                   | BIIB           | Health Care | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| BIOMET INC                                                   | 5938B          | Health Care | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| BOSTON SCIENTIFIC CORP                                       | BSX            | Health Care | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| BRISTOL-MYERS SQUIBB CO                                      | BMJ            | Health Care | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| CARDINAL HEALTH INC                                          | CAH            | Health Care | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| CAREFUSION CORP                                              | CFN            | Health Care | 0    | 0    | 0    | 1    | 1    | 1    | 1    | 1    | 1    | 0    | 0    | 0    | 0    | 0    |
| CAREMARK RX INC                                              | CMX.1          | Health Care | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| CELGENE CORP                                                 | CELG           | Health Care | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 0    |
| CENTENE CORP                                                 | CNC            | Health Care | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 1    | 1    | 1    | 1    |
| CEPHALON INC                                                 | CEPH           | Health Care | 0    | 0    | 1    | 1    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| CERNER CORP                                                  | CERN           | Health Care | 0    | 0    | 0    | 0    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| CIGNA CORP                                                   | CI             | Health Care | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| COOPER COS INC (THE)                                         | COO            | Health Care | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 1    | 1    | 1    | 1    |
| COVENTRY HEALTH CARE INC                                     | CVH            | Health Care | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| COVIDIEN PLC                                                 | COV            | Health Care | 0    | 1    | 1    | 0    | 0    | 1    | 1    | 1    | 1    | 0    | 0    | 0    | 0    | 0    |
| CVS HEALTH CORP                                              | CVS            | Health Care | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| DANAHER CORP                                                 | DHR            | Health Care | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| DAVITA INC                                                   | DVA            | Health Care | 0    | 0    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |

### S&P 500 Companies by Year

[illegible]

# Appendix A, Exhibit A1

## S&P 500 Companies by Year

| Company Name                                                 | Company Ticker | GICS Sector | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 |
|--------------------------------------------------------------|----------------|-------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| Number of S&P 500 Companies                                  |                |             | 500  | 500  | 500  | 500  | 500  | 500  | 500  | 500  | 500  | 500  | 500  | 500  | 500  | 500  |
| Railroads, Financial Institutions, and Real Estate Companies |                |             | 92   | 99   | 90   | 85   | 87   | 86   | 87   | 87   | 89   | 91   | 96   | 104  | 103  | 101  |
| Sample Number of S&P 500 Companies                           |                |             | 408  | 401  | 410  | 415  | 413  | 414  | 413  | 413  | 411  | 409  | 404  | 396  | 397  | 399  |
|                                                              |                |             |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| QUEST DIAGNOSTICS INC                                        | DGX            | Health Care | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| REGENERON PHARMACEUTICALS                                    | REGN           | Health Care | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| RESMED INC                                                   | RMD            | Health Care | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 1    | 1    | 1    |
| SCHERING-PLOUGH                                              | SGP            | Health Care | 1    | 1    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| ST JUDE MEDICAL INC                                          | STJ            | Health Care | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 0    | 0    | 0    |
| STERIS PLC                                                   | STE            | Health Care | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 1    |
| STRYKER CORP                                                 | SYK            | Health Care | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| TELEFLEX INC                                                 | TFX            | Health Care | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 1    |
| TENET HEALTHCARE CORP                                        | THC            | Health Care | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 0    | 0    | 0    | 0    |
| THERMO FISHER SCIENTIFIC INC                                 | TMO            | Health Care | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| UNITEDHEALTH GROUP INC                                       | UNH            | Health Care | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| UNIVERSAL HEALTH SVCS INC                                    | UHS            | Health Care | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 1    | 1    | 1    | 1    | 1    | 1    |
| VARIAN MEDICAL SYSTEMS INC                                   | VAR            | Health Care | 0    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| VERTEX PHARMACEUTICALS INC                                   | VRTX           | Health Care | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| WATERS CORP                                                  | WAT            | Health Care | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| WELLCARE HEALTH PLANS INC                                    | WCG            | Health Care | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 1    | 1    |
| WYETH                                                        | WYE            | Health Care | 1    | 1    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| ZIMMER BIOMET HOLDINGS INC                                   | ZBH            | Health Care | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| ZOETIS INC                                                   | ZTS            | Health Care | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| 3M CO                                                        | MMM            | Industrials | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| ACUITY BRANDS INC                                            | AYI            | Industrials | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 1    | 1    | 0    | 0    |
| ADT CORP                                                     | ADT.4          | Industrials | 0    | 0    | 0    | 0    | 0    | 0    | 1    | 1    | 1    | 1    | 0    | 0    | 0    | 0    |
| ALASKA AIR GROUP INC                                         | ALK            | Industrials | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 1    | 1    | 1    | 1    |
| ALLEGION PLC                                                 | ALLE           | Industrials | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| ALLIED WASTE INDUSTRIES INC                                  | AW             | Industrials | 1    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| AMERICAN AIRLINES GROUP INC                                  | AAL            | Industrials | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 1    | 1    | 1    | 1    | 1    |
| AMERICAN POWER CONVERSION CP                                 | APCC.          | Industrials | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| AMETEK INC                                                   | AME            | Industrials | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| BOEING CO                                                    | BA             | Industrials | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| BURLINGTON NORTHERN SANTA FE                                 | BRK3           | Industrials | 1    | 1    | 1    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| C H ROBINSON WORLDWIDE INC                                   | CHRW           | Industrials | 0    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| CATERPILLAR INC                                              | CAT            | Industrials | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| CINTAS CORP                                                  | CTAS           | Industrials | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| COOPER INDUSTRIES PLC                                        | CBE            | Industrials | 1    | 1    | 1    | 0    | 0    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| COPART INC                                                   | CPRT           | Industrials | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 1    | 1    |
| CSX CORP                                                     | CSX            | Industrials | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| CUMMINS INC                                                  | CMI            | Industrials | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| DEERE & CO                                                   | DE             | Industrials | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| DELTA AIR LINES INC                                          | DAL            | Industrials | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| DONNELLEY (R R) & SONS CO                                    | RRD            | Industrials | 1    | 1    | 1    | 1    | 1    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |

## S&P 500 Companies by Year

[illegible]

# Appendix A, Exhibit A1

## S&P 500 Companies by Year

| Company Name                                                 | Company Ticker | GICS Sector            | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 |
|--------------------------------------------------------------|----------------|------------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| Number of S&P 500 Companies                                  |                |                        | 500  | 500  | 500  | 500  | 500  | 500  | 500  | 500  | 500  | 500  | 500  | 500  | 500  | 500  |
| Railroads, Financial Institutions, and Real Estate Companies |                |                        | 92   | 99   | 90   | 85   | 87   | 86   | 87   | 87   | 89   | 91   | 96   | 104  | 103  | 101  |
| Sample Number of S&P 500 Companies                           |                |                        | 408  | 401  | 410  | 415  | 413  | 414  | 413  | 413  | 411  | 409  | 404  | 396  | 397  | 399  |
| PENTAIR PLC                                                  | PNR            | Industrials            | 0    | 0    | 0    | 0    | 0    | 0    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| PITNEY BOWES INC                                             | PBI            | Industrials            | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 0    | 0    | 0    |
| PRECISION CASTPARTS CORP                                     | PCP            | Industrials            | 0    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 0    | 0    | 0    | 0    |
| QUANTA SERVICES INC                                          | PWR            | Industrials            | 0    | 0    | 0    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| RAYTHEON CO                                                  | RTN            | Industrials            | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| RAYTHEON TECHNOLOGIES CORP                                   | RTX            | Industrials            | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| REPUBLIC SERVICES INC                                        | RSG            | Industrials            | 0    | 0    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| ROBERT HALF INTL INC                                         | RHI            | Industrials            | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| ROCKWELL AUTOMATION                                          | ROK            | Industrials            | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| ROCKWELL COLLINS                                             | COL            | Industrials            | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 0    | 0    |
| ROLLINS INC                                                  | ROL            | Industrials            | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 1    | 1    |
| ROPER TECHNOLOGIES INC                                       | ROP            | Industrials            | 0    | 0    | 0    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| RYDER SYSTEM INC                                             | R              | Industrials            | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 0    | 0    | 0    |
| SMITH (A.O.)                                                 | AOS            | Industrials            | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 1    | 1    | 1    |
| SNAP-ON INC                                                  | SNA            | Industrials            | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| SOUTHWEST AIRLINES                                           | LUV            | Industrials            | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| STANLEY BLACK & DECKER INC                                   | SWK            | Industrials            | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| STERICYCLE INC                                               | SRCL           | Industrials            | 0    | 0    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 0    | 0    |
| TEREX CORP                                                   | TEX            | Industrials            | 1    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| TEXTRON INC                                                  | TXT            | Industrials            | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| TRANE INC                                                    | TT.2           | Industrials            | 1    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| TRANE TECHNOLOGIES PLC                                       | TT             | Industrials            | 1    | 1    | 1    | 0    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| TRANSDIGM GROUP INC                                          | TDG            | Industrials            | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 1    | 1    | 1    | 1    |
| TYCO INTERNATIONAL PLC                                       | TYC            | Industrials            | 1    | 1    | 1    | 0    | 1    | 1    | 1    | 1    | 1    | 1    | 0    | 0    | 0    | 0    |
| UNION PACIFIC CORP                                           | UNP            | Industrials            | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| UNITED AIRLINES HOLDINGS INC                                 | UAL            | Industrials            | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 1    | 1    | 1    | 1    | 1    |
| UNITED PARCEL SERVICE INC                                    | UPS            | Industrials            | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| UNITED RENTALS INC                                           | URI            | Industrials            | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 1    | 1    | 1    | 1    | 1    | 1    |
| VERISK ANALYTICS INC                                         | VRSK           | Industrials            | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 1    | 1    | 1    | 1    | 1    |
| WABTEC CORP                                                  | WAB            | Industrials            | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 1    |
| WASTE MANAGEMENT INC                                         | WM             | Industrials            | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| XYLEM INC                                                    | XYL            | Industrials            | 0    | 0    | 0    | 0    | 0    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| ACCENTURE PLC                                                | ACN            | Information Technology | 0    | 0    | 0    | 0    | 0    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| ADC TELECOMMUNICATIONS INC                                   | ADCT.1         | Information Technology | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| ADOBE INC                                                    | ADBE           | Information Technology | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| ADVANCED MICRO DEVICES                                       | AMD            | Information Technology | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 0    | 0    | 0    | 0    | 1    | 1    | 1    |
| AFFILIATED COMPUTER SERVICES                                 | ACS            | Information Technology | 1    | 1    | 1    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| AKAMAI TECHNOLOGIES INC                                      | AKAM           | Information Technology | 0    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| ALLIANCE DATA SYSTEMS CORP                                   | ADS            | Information Technology | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| ALTERA CORP                                                  | ALTR.1         | Information Technology | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 0    | 0    | 0    | 0    | 0    |

## Appendix A, Exhibit A1

### S&P 500 Companies by Year

| Company Name                                                 | Company Ticker | GICS Sector            | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 |
|--------------------------------------------------------------|----------------|------------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| Number of S&P 500 Companies                                  |                |                        | 500  | 500  | 500  | 500  | 500  | 500  | 500  | 500  | 500  | 500  | 500  | 500  | 500  | 500  |
| Railroads, Financial Institutions, and Real Estate Companies |                |                        | 92   | 99   | 90   | 85   | 87   | 86   | 87   | 87   | 89   | 91   | 96   | 104  | 103  | 101  |
| Sample Number of S&P 500 Companies                           |                |                        | 408  | 401  | 410  | 415  | 413  | 414  | 413  | 413  | 411  | 409  | 404  | 396  | 397  | 399  |
| AMPHENOL CORP                                                | APH            | Information Technology | 0    | 0    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| ANALOG DEVICES                                               | ADI            | Information Technology | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| ANSYS INC                                                    | ANSS           | Information Technology | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 1    | 1    | 1    |
| APPLE INC                                                    | AAPL           | Information Technology | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| APPLIED MATERIALS INC                                        | AMAT           | Information Technology | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| ARISTA NETWORKS INC                                          | ANET           | Information Technology | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 1    | 1    |
| AUTODESK INC                                                 | ADSK           | Information Technology | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| AUTOMATIC DATA PROCESSING                                    | ADP            | Information Technology | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| AVAYA INC                                                    | 5933B          | Information Technology | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| BMC SOFTWARE INC                                             | BMC            | Information Technology | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| BROADCOM CORP                                                | BRCM           | Information Technology | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 0    | 0    | 0    | 0    |
| BROADCOM INC                                                 | AVGO           | Information Technology | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 1    | 1    | 1    | 1    | 1    | 1    |
| BROADRIDGE FINANCIAL SOLUTNS                                 | BR             | Information Technology | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 1    | 1    |
| CA INC                                                       | CA             | Information Technology | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 0    | 0    |
| CADENCE DESIGN SYSTEMS INC                                   | CDNS           | Information Technology | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 1    | 1    | 1    |
| CDW CORP                                                     | CDW            | Information Technology | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 1    |
| CIENA CORP                                                   | CIEN           | Information Technology | 1    | 1    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| CISCO SYSTEMS INC                                            | CSCO           | Information Technology | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| CITRIX SYSTEMS INC                                           | CTXS           | Information Technology | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| COGNIZANT TECH SOLUTIONS                                     | CTSH           | Information Technology | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| COMPUWARE CORP                                               | CPWR.1         | Information Technology | 1    | 1    | 1    | 1    | 1    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| COMVERSE TECHNOLOGY INC                                      | CMVT           | Information Technology | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| CONVERGYS CORP                                               | CVG            | Information Technology | 1    | 1    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| CORNING INC                                                  | GLW            | Information Technology | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| CSRA INC                                                     | CSRA           | Information Technology | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 1    | 1    | 1    | 0    | 0    |
| DELL TECHNOLOGIES INC                                        | DELL           | Information Technology | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| DXC TECHNOLOGY CO                                            | DXC            | Information Technology | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 0    | 0    | 1    | 1    | 1    |
| EASTMAN KODAK CO                                             | KODK           | Information Technology | 1    | 1    | 1    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| ELECTRONIC DATA SYSTEMS CORP                                 | EDS.           | Information Technology | 1    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| EMC CORP/MA                                                  | EMC            | Information Technology | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 0    | 0    | 0    | 0    |
| F5 NETWORKS INC                                              | FFIV           | Information Technology | 0    | 0    | 0    | 0    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| FIDELITY NATIONAL INFO SVCS                                  | FIS            | Information Technology | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| FIRST DATA CORP                                              | FDC            | Information Technology | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| FIRST SOLAR INC                                              | FSLR           | Information Technology | 0    | 0    | 0    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 0    | 0    | 0    |
| FISERV INC                                                   | FISV           | Information Technology | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| FLEETCOR TECHNOLOGIES INC                                    | FLT            | Information Technology | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 1    | 1    |
| FLIR SYSTEMS INC                                             | FLIR           | Information Technology | 0    | 0    | 0    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| FORTINET INC                                                 | FTNT           | Information Technology | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 1    | 1    |
| GARTNER INC                                                  | IT             | Information Technology | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 1    | 1    | 1    |
| GLOBAL PAYMENTS INC                                          | GPN            | Information Technology | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 1    | 1    | 1    | 1    |

# Appendix A, Exhibit A1

## S&P 500 Companies by Year

| Company Name                                                 | Company Ticker | GICS Sector            | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 |
|--------------------------------------------------------------|----------------|------------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| Number of S&P 500 Companies                                  |                |                        | 500  | 500  | 500  | 500  | 500  | 500  | 500  | 500  | 500  | 500  | 500  | 500  | 500  | 500  |
| Railroads, Financial Institutions, and Real Estate Companies |                |                        | 92   | 99   | 90   | 85   | 87   | 86   | 87   | 87   | 89   | 91   | 96   | 104  | 103  | 101  |
| Sample Number of S&P 500 Companies                           |                |                        | 408  | 401  | 410  | 415  | 413  | 414  | 413  | 413  | 411  | 409  | 404  | 396  | 397  | 399  |
| HENRY (JACK) & ASSOCIATES                                    | JKHY           | Information Technology | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 1    | 1    |
| HEWLETT PACKARD ENTERPRISE                                   | HPE            | Information Technology | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 1    | 1    | 1    | 1    | 1    |
| HP INC                                                       | HPQ            | Information Technology | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| INTEL CORP                                                   | INTC           | Information Technology | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| INTL BUSINESS MACHINES CORP                                  | IBM            | Information Technology | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| INTUIT INC                                                   | INTU           | Information Technology | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| IPG PHOTONICS CORP                                           | IPGP           | Information Technology | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 1    | 1    |
| JABIL INC                                                    | JBL            | Information Technology | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 0    | 0    | 0    | 0    | 0    | 0    |
| JUNIPER NETWORKS INC                                         | JNPR           | Information Technology | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| KEYSIGHT TECHNOLOGIES INC                                    | KEYS           | Information Technology | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 1    | 1    |
| KLA CORP                                                     | KLAC           | Information Technology | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| LAM RESEARCH CORP                                            | LRCX           | Information Technology | 0    | 0    | 0    | 0    | 0    | 0    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| LEIDOS HOLDINGS INC                                          | LDOS           | Information Technology | 0    | 0    | 0    | 1    | 1    | 1    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 1    |
| LEXMARK INTL INC -CL A                                       | LXK            | Information Technology | 1    | 1    | 1    | 1    | 1    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| LINEAR TECHNOLOGY CORP                                       | LLTC           | Information Technology | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 0    | 0    | 0    |
| LSI CORP                                                     | LSI.1          | Information Technology | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 0    | 0    | 0    | 0    | 0    | 0    |
| MASTERCARD INC                                               | MA             | Information Technology | 0    | 0    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| MAXIM INTEGRATED PRODUCTS                                    | MXIM           | Information Technology | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 1    | 1    |
| MCAFEE INC                                                   | MFE            | Information Technology | 0    | 0    | 1    | 1    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| MICROCHIP TECHNOLOGY INC                                     | MCHP           | Information Technology | 0    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| MICRON TECHNOLOGY INC                                        | MU             | Information Technology | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| MICROSOFT CORP                                               | MSFT           | Information Technology | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| MOLEX INC                                                    | MOLX           | Information Technology | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| MONSTER WORLDWIDE INC                                        | MWW            | Information Technology | 1    | 1    | 1    | 1    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| MOTOROLA MOBILITY HLDGS INC                                  | MML3           | Information Technology | 0    | 0    | 0    | 0    | 0    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| MOTOROLA SOLUTIONS INC                                       | MSI            | Information Technology | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| NATIONAL SEMICONDUCTOR CORP                                  | NSM.2          | Information Technology | 1    | 1    | 1    | 1    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| NCR CORP                                                     | NCR            | Information Technology | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| NETAPP INC                                                   | NTAP           | Information Technology | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| NORTONLIFELOCK INC                                           | NLOK           | Information Technology | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| NOVELL INC                                                   | NOVL           | Information Technology | 1    | 1    | 1    | 1    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| NOVELLUS SYSTEMS INC                                         | NVLS.1         | Information Technology | 1    | 1    | 1    | 1    | 1    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| NVIDIA CORP                                                  | NVDA           | Information Technology | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| ORACLE CORP                                                  | ORCL           | Information Technology | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| PAYCHEX INC                                                  | PAYX           | Information Technology | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| PAYPAL HOLDINGS INC                                          | PYPL           | Information Technology | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 1    | 1    | 1    | 1    | 1    |
| PMC-SIERRA INC                                               | PMCS           | Information Technology | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| PTC INC                                                      | PTC            | Information Technology | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| QLOGIC CORP                                                  | QLGC           | Information Technology | 1    | 1    | 1    | 1    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| QORVO INC                                                    | QRVO           | Information Technology | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 1    | 1    | 1    | 1    | 1    |

### S&P 500 Companies by Year

| Company Name                                                 | Company Ticker | GICS Sector            | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 |
|--------------------------------------------------------------|----------------|------------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| Number of S&P 500 Companies                                  |                |                        | 500  | 500  | 500  | 500  | 500  | 500  | 500  | 500  | 500  | 500  | 500  | 500  | 500  | 500  |
| Railroads, Financial Institutions, and Real Estate Companies |                |                        | 92   | 99   | 90   | 85   | 87   | 86   | 87   | 87   | 89   | 91   | 96   | 104  | 103  | 101  |
| Sample Number of S&P 500 Companies                           |                |                        | 408  | 401  | 410  | 415  | 413  | 414  | 413  | 413  | 411  | 409  | 404  | 396  | 397  | 399  |
|                                                              |                |                        |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| QUALCOMM INC                                                 | QCOM           | Information Technology | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| RED HAT INC                                                  | RHT            | Information Technology | 0    | 0    | 0    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 0    |
| SABRE HOLDINGS CORP -CL A                                    | TSG.2          | Information Technology | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| SALESFORCE.COM INC                                           | CRM            | Information Technology | 0    | 0    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| SANDISK CORP                                                 | SNDK           | Information Technology | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 0    | 0    | 0    | 0    |
| SANMINA CORP                                                 | SANM           | Information Technology | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| SEAGATE TECHNOLOGY PLC                                       | STX            | Information Technology | 0    | 0    | 0    | 0    | 0    | 0    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| SERVICENOW INC                                               | NOW            | Information Technology | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 1    |
| SKYWORKS SOLUTIONS INC                                       | SWKS           | Information Technology | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 1    | 1    | 1    | 1    | 1    |
| SOLECTRON CORP                                               | SLR            | Information Technology | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| SUN MICROSYSTEMS INC                                         | JAVA           | Information Technology | 1    | 1    | 1    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| SUNEDISON INC                                                | SUNEQ          | Information Technology | 0    | 1    | 1    | 1    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| SYMBOL TECHNOLOGIES                                          | SBL.2          | Information Technology | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| SYNOPSYS INC                                                 | SNPS           | Information Technology | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 1    | 1    | 1    |
| TE CONNECTIVITY LTD                                          | TEL            | Information Technology | 0    | 1    | 1    | 0    | 0    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| TEKTRONIX INC                                                | TEK.1          | Information Technology | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| TELLABS INC                                                  | TLAB           | Information Technology | 1    | 1    | 1    | 1    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| TERADATA CORP                                                | TDC            | Information Technology | 0    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 0    | 0    | 0    |
| TERADYNE INC                                                 | TER            | Information Technology | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| TEXAS INSTRUMENTS INC                                        | TXN            | Information Technology | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| TOTAL SYSTEM SERVICES INC                                    | TSS            | Information Technology | 0    | 0    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 0    |
| UNISYS CORP                                                  | UIS            | Information Technology | 1    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| VERISIGN INC                                                 | VRSN           | Information Technology | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| VIAVI SOLUTIONS INC                                          | VIAV           | Information Technology | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| VISA INC                                                     | V              | Information Technology | 0    | 0    | 0    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| WESTERN DIGITAL CORP                                         | WDC            | Information Technology | 0    | 0    | 0    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| WESTERN UNION CO                                             | WU             | Information Technology | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| XEROX HOLDINGS CORP                                          | XRX            | Information Technology | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| XILINX INC                                                   | XLNX           | Information Technology | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| ZEBRA TECHNOLOGIES CP -CL A                                  | ZBRA           | Information Technology | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 1    |
| AIR PRODUCTS & CHEMICALS INC                                 | APD            | Materials              | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| AIRGAS INC                                                   | ARG            | Materials              | 0    | 0    | 0    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 0    | 0    | 0    | 0    |
| AK STEEL HOLDING CORP                                        | AKS            | Materials              | 0    | 0    | 1    | 1    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| ALBEMARLE CORP                                               | ALB            | Materials              | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 1    | 1    | 1    | 1    |
| ALCOA INC                                                    | AA.3           | Materials              | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 0    | 0    | 0    | 0    |
| ALLEGHENY TECHNOLOGIES INC                                   | ATI            | Materials              | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 0    | 0    | 0    | 0    | 0    |
| AMCOR PLC                                                    | AMCR           | Materials              | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 1    |
| ASHLAND GLOBAL HOLDINGS INC                                  | ASH            | Materials              | 1    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| AVERY DENNISON CORP                                          | AVY            | Materials              | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |
| BALL CORP                                                    | BLL            | Materials              | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |

### S&P 500 Companies by Year

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## S&P 500 Companies by Year

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## Appendix A, Exhibit A1

### S&P 500 Companies by Year

| Company Name                                                        | Company Ticker | GICS Sector | 2006       | 2007       | 2008       | 2009       | 2010       | 2011       | 2012       | 2013       | 2014       | 2015       | 2016       | 2017       | 2018       | 2019       |
|---------------------------------------------------------------------|----------------|-------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| <b>Number of S&amp;P 500 Companies</b>                              |                |             | <b>500</b> | <b>500</b> | <b>500</b> | <b>500</b> | <b>500</b> | <b>500</b> | <b>500</b> | <b>500</b> | <b>500</b> | <b>500</b> | <b>500</b> | <b>500</b> | <b>500</b> | <b>500</b> |
| <b>Railroads, Financial Institutions, and Real Estate Companies</b> |                |             | <b>92</b>  | <b>99</b>  | <b>90</b>  | <b>85</b>  | <b>87</b>  | <b>86</b>  | <b>87</b>  | <b>87</b>  | <b>89</b>  | <b>91</b>  | <b>96</b>  | <b>104</b> | <b>103</b> | <b>101</b> |
| <b>Sample Number of S&amp;P 500 Companies</b>                       |                |             | <b>408</b> | <b>401</b> | <b>410</b> | <b>415</b> | <b>413</b> | <b>414</b> | <b>413</b> | <b>413</b> | <b>411</b> | <b>409</b> | <b>404</b> | <b>396</b> | <b>397</b> | <b>399</b> |
| CMS ENERGY CORP                                                     | CMS            | Utilities   | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          |
| CONSOLIDATED EDISON INC                                             | ED             | Utilities   | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          |
| CONSTELLATION ENERGY GRP INC                                        | CEG            | Utilities   | 1          | 1          | 1          | 1          | 1          | 1          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          |
| DOMINION ENERGY INC                                                 | D              | Utilities   | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          |
| DTE ENERGY CO                                                       | DTE            | Utilities   | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          |
| DUKE ENERGY CORP                                                    | DUK            | Utilities   | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          |
| DYNEGY INC                                                          | DYN            | Utilities   | 1          | 1          | 1          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          |
| EDISON INTERNATIONAL                                                | EIX            | Utilities   | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          |
| ENERGY FUTURE HOLDINGS CORP                                         | 0033A          | Utilities   | 1          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          |
| ENERGY CORP                                                         | ETR            | Utilities   | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          |
| EVERGY INC                                                          | EVERG          | Utilities   | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 1          | 1          |
| EVERSOURCE ENERGY                                                   | ES             | Utilities   | 0          | 0          | 0          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          |
| EXELON CORP                                                         | EXC            | Utilities   | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          |
| FIRSTENERGY CORP                                                    | FE             | Utilities   | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          |
| INTEGRYS HOLDING INC                                                | WEC3           | Utilities   | 0          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 0          | 0          | 0          | 0          | 0          |
| KEYSPAN CORP                                                        | KSE            | Utilities   | 1          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          |
| NEXTERA ENERGY INC                                                  | NEE            | Utilities   | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          |
| NICOR INC                                                           | GAS.2          | Utilities   | 1          | 1          | 1          | 1          | 1          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          |
| NISOURCE INC                                                        | NI             | Utilities   | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          |
| NRG ENERGY INC                                                      | NRG            | Utilities   | 0          | 0          | 0          | 0          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          |
| PEOPLES ENERGY CORP                                                 | PGL.1          | Utilities   | 1          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          |
| PEPCO HOLDINGS INC                                                  | POM            | Utilities   | 0          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 0          | 0          | 0          | 0          |
| PG&E CORP                                                           | PCG            | Utilities   | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 0          |
| PINNACLE WEST CAPITAL CORP                                          | PNW            | Utilities   | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          |
| PPL CORP                                                            | PPL            | Utilities   | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          |
| PROGRESS ENERGY INC                                                 | DUK8           | Utilities   | 1          | 1          | 1          | 1          | 1          | 1          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          |
| PUBLIC SERVICE ENTRP GRP INC                                        | PEG            | Utilities   | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          |
| QUESTAR CORP                                                        | STR            | Utilities   | 1          | 1          | 1          | 1          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          | 0          |
| SCANA CORP                                                          | SCG            | Utilities   | 0          | 0          | 0          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 0          |
| SEMPRA ENERGY                                                       | SRE            | Utilities   | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          |
| SOUTHERN CO                                                         | SO             | Utilities   | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          |
| SOUTHERN CO GAS                                                     | SO7            | Utilities   | 0          | 0          | 0          | 0          | 0          | 1          | 1          | 1          | 1          | 1          | 0          | 0          | 0          | 0          |
| TECO ENERGY INC                                                     | TE             | Utilities   | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 0          | 0          | 0          | 0          |
| WEC ENERGY GROUP INC                                                | WEC            | Utilities   | 0          | 0          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          |
| XCEL ENERGY INC                                                     | XEL            | Utilities   | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          | 1          |

Source: Compustat.

Note: Ticker DD corresponds to Dow Chemical Company before 2017 and DowDuPont after 2017 following its merger with DuPont on August 31, 2017.

**Appendix B, Exhibit B1**  
**Railroad Return on Invested Capital (ROIC) minus Industry Cost of Capital (COC)**

|                                                                                                                          | 2006  | 2007  | 2008  | 2009  | 2010  | 2011  | 2012  | 2013  | 2014   | 2015  | 2016  | 2017  | 2018  | 2019  | Min    | Max   | Median | Average |
|--------------------------------------------------------------------------------------------------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|--------|-------|-------|-------|-------|-------|--------|-------|--------|---------|
| <b>Panel A: Railroad STB Definition of Cost of Capital</b>                                                               |       |       |       |       |       |       |       |       |        |       |       |       |       |       |        |       |        |         |
| Railroad Industry Cost of Capital                                                                                        | 9.9%  | 11.3% | 11.8% | 10.4% | 11.0% | 11.6% | 11.1% | 11.3% | 10.7%  | 9.6%  | 8.9%  | 10.0% | 12.2% | 9.3%  | 8.9%   | 12.2% | 10.8%  | 10.7%   |
| <b>Panel B: Railroad ROIC minus COC - Based on STB Definition of ROIC and STB Definition of Cost of Capital</b>          |       |       |       |       |       |       |       |       |        |       |       |       |       |       |        |       |        |         |
| Industry Weighted Average ROIC                                                                                           | 0.2%  | -1.5% | -1.0% | -2.5% | -0.3% | 0.5%  | 1.4%  | 1.8%  | 2.2%   | 2.5%  | 1.5%  | 0.8%  | 0.5%  | 3.1%  | -2.5%  | 3.1%  | 0.7%   | 0.7%    |
| BNSF Railway                                                                                                             | 1.5%  | -1.4% | -1.2% | -1.8% | -0.8% | 0.8%  | 2.4%  | 2.7%  | 2.2%   | 3.2%  | 1.2%  | 0.7%  | -0.3% | 2.7%  | -1.8%  | 3.2%  | 1.0%   | 0.9%    |
| CSX Corporation                                                                                                          | -1.8% | -3.7% | -2.4% | -3.1% | -0.2% | 0.0%  | -0.3% | -1.3% | -0.5%  | -0.6% | -0.3% | -1.2% | 1.0%  | 3.5%  | -3.7%  | 3.5%  | -0.5%  | -0.8%   |
| Grand Trunk Corporation                                                                                                  | -0.5% | -1.2% | -1.9% | -4.4% | -1.8% | -2.8% | -0.9% | 0.5%  | 0.6%   | 1.2%  | -0.3% | -2.3% | -4.5% | -1.9% | -4.5%  | 1.2%  | -1.5%  | -1.4%   |
| Kansas City Southern                                                                                                     | -0.6% | -2.0% | -4.1% | -3.9% | -1.3% | -0.8% | -1.6% | -2.7% | -2.5%  | -2.4% | -2.6% | -2.9% | -4.2% | -3.1% | -4.2%  | -0.6% | -2.6%  | -2.5%   |
| Norfolk Southern Corporation                                                                                             | 4.4%  | 2.2%  | 2.0%  | -2.7% | -0.1% | 1.3%  | 0.4%  | 0.7%  | 1.0%   | -0.6% | 0.3%  | 0.0%  | -0.6% | 2.3%  | -2.7%  | 4.4%  | 0.6%   | 0.8%    |
| Soo Line Corporation                                                                                                     | 1.7%  | 3.9%  | -2.5% | -4.1% | -3.0% | -4.4% | -6.0% | 0.7%  | -11.1% | 4.9%  | 0.7%  | 0.7%  | 1.3%  | 2.0%  | -11.1% | 4.9%  | 0.7%   | -1.1%   |
| Union Pacific Corporation                                                                                                | -1.7% | -2.4% | -1.3% | -1.8% | 0.5%  | 1.5%  | 3.6%  | 4.1%  | 6.7%   | 5.9%  | 4.5%  | 4.0%  | 3.6%  | 6.2%  | -2.4%  | 6.7%  | 3.6%   | 2.4%    |
| <b>Panel C: Railroad ROIC minus COC - Based on Adjusted STB Definition of ROIC and STB Definition of Cost of Capital</b> |       |       |       |       |       |       |       |       |        |       |       |       |       |       |        |       |        |         |
| Industry Weighted Average ROIC                                                                                           | -2.2% | -3.5% | -2.5% | -3.1% | -1.7% | -0.5% | -0.9% | -1.0% | -0.3%  | 0.5%  | -0.3% | -2.6% | -1.5% | 1.4%  | -3.5%  | 1.4%  | -1.2%  | -1.3%   |
| BNSF Railway                                                                                                             | -0.7% | -3.1% | -2.7% | -2.2% | -1.5% | 1.1%  | -0.2% | -0.4% | 0.1%   | 1.2%  | -0.4% | -2.9% | -2.3% | 0.9%  | -3.1%  | 1.2%  | -0.5%  | -0.9%   |
| CSX Corporation                                                                                                          | -3.6% | -5.0% | -3.4% | -3.7% | -1.7% | -1.2% | -2.0% | -3.4% | -2.6%  | -1.9% | -1.7% | -4.0% | -1.0% | 1.5%  | -5.0%  | 1.5%  | -2.3%  | -2.4%   |
| Grand Trunk Corporation                                                                                                  | -2.3% | -3.3% | -4.3% | -5.5% | -2.9% | -3.1% | -3.4% | -2.8% | -1.8%  | -0.5% | -1.4% | -4.7% | -5.1% | -2.3% | -5.5%  | -0.5% | -3.0%  | -3.1%   |
| Kansas City Southern                                                                                                     | -1.3% | -2.7% | -3.8% | -3.8% | -1.1% | -0.9% | -1.3% | -1.7% | -1.8%  | -1.8% | -2.2% | -4.5% | -3.9% | -3.5% | -4.5%  | -0.9% | -2.0%  | -2.5%   |
| Norfolk Southern Corporation                                                                                             | -0.9% | -2.2% | -0.7% | -3.5% | -2.2% | -0.8% | -2.1% | -2.1% | -1.6%  | -2.4% | -1.7% | -3.1% | -2.3% | 0.8%  | -3.5%  | 0.8%  | -2.1%  | -1.8%   |
| Soo Line Corporation                                                                                                     | 2.3%  | 4.1%  | -4.0% | -5.0% | -3.1% | -4.7% | -7.1% | -0.1% | -13.7% | 1.9%  | -0.4% | -2.6% | -0.3% | 0.0%  | -13.7% | 4.1%  | -1.5%  | -2.3%   |
| Union Pacific Corporation                                                                                                | -3.6% | -4.1% | -2.1% | -2.5% | -1.1% | -0.2% | 1.2%  | 0.9%  | 3.0%   | 3.0%  | 2.0%  | -0.4% | 1.0%  | 4.0%  | -4.1%  | 4.0%  | 0.3%   | 0.1%    |

Sources: Bloomberg; Compustat; Ibbotson Yearbook (2006-2019); STB Revenue Adequacy Determination Report (2006-2018); RevAd 2019 AAR workpaper1.pdf, titled "AAR Duplication of STB Workpapers."

## Appendix C, Exhibit C1

Railroad Percentiles within Sample - STB Definition of Return on Invested Capital (ROIC) and STB Definition of Cost of Capital (COC)  
(Railroads' Return on Invested Capital and Cost of Capital Measured Using Non-STB Public Data)

|                                                                                                             | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | Min | Max  | Median | Average |
|-------------------------------------------------------------------------------------------------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|-----|------|--------|---------|
| <b>Panel A: S&amp;P 500 Companies Excluding Railroads, Financial Institutions and Real Estate Companies</b> |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |      |        |         |
| <b>Sample Number of Observations, Median, 25th Percentile, and % Positive ROIC minus COC:</b>               |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |      |        |         |
| Number of Observations in Sample                                                                            | 398  | 395  | 402  | 405  | 402  | 401  | 397  | 395  | 392  | 383  | 371  | 368  | 378  | 380  | 368 | 405  | 395    | 391     |
| Median ROIC minus COC                                                                                       | 16%  | 16%  | 16%  | 13%  | 18%  | 19%  | 19%  | 21%  | 20%  | 22%  | 22%  | 20%  | 29%  | 25%  | 13% | 29%  | 19%    | 20%     |
| 25th Percentile ROIC minus COC                                                                              | 5%   | 5%   | 3%   | -1%  | 5%   | 6%   | 5%   | 4%   | 5%   | 4%   | 4%   | 5%   | 6%   | 5%   | -1% | 6%   | 5%     | 4%      |
| % with ROIC minus COC > 0.0%                                                                                | 90%  | 89%  | 86%  | 73%  | 89%  | 91%  | 89%  | 90%  | 90%  | 88%  | 85%  | 89%  | 90%  | 89%  | 73% | 91%  | 89%    | 88%     |
| <b>Railroad Percentile in the Distribution of ROIC minus COC:</b>                                           |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |      |        |         |
| Industry Weighted Average ROIC                                                                              | 15   | 15   | 14   | 20   | 15   | 12   | 17   | 19   | 25   | 23   | 24   | 27   | 23   | 25   | 12  | 27   | 19     | 20      |
| CSX Corporation                                                                                             | 16   | 17   | 22   | 26   | 22   | 14   | 16   | 16   | 19   | 18   | 20   | 20   | 23   | 28   | 14  | 28   | 19     | 20      |
| Kansas City Southern                                                                                        | 11   | 13   | 11   | 14   | 10   | 6    | 10   | 9    | 11   | 12   | 16   | 13   | 8    | 12   | 6   | 16   | 11     | 11      |
| Norfolk Southern Corporation                                                                                | 24   | 22   | 26   | 23   | 17   | 14   | 13   | 13   | 19   | 14   | 19   | 22   | 17   | 23   | 13  | 26   | 19     | 19      |
| Union Pacific Corporation                                                                                   | 10   | 9    | 9    | 16   | 12   | 12   | 23   | 26   | 32   | 29   | 28   | 33   | 25   | 28   | 9   | 33   | 24     | 21      |
| <b>Panel B: S&amp;P 500 Companies in the Industrials Sector Excluding Railroads</b>                         |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |      |        |         |
| <b>Sample Number of Observations, Median, 25th Percentile, and % Positive ROIC minus COC:</b>               |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |      |        |         |
| Number of Observations in Sample                                                                            | 48   | 52   | 55   | 53   | 54   | 56   | 53   | 56   | 57   | 59   | 63   | 62   | 62   | 61   | 48  | 63   | 56     | 57      |
| Median ROIC minus COC                                                                                       | 20%  | 23%  | 21%  | 14%  | 17%  | 21%  | 22%  | 22%  | 23%  | 24%  | 28%  | 28%  | 30%  | 31%  | 14% | 31%  | 23%    | 23%     |
| 25th Percentile ROIC minus COC                                                                              | 11%  | 13%  | 13%  | 4%   | 10%  | 13%  | 12%  | 14%  | 11%  | 13%  | 9%   | 14%  | 13%  | 13%  | 4%  | 14%  | 13%    | 12%     |
| % with ROIC minus COC > 0.0%                                                                                | 96%  | 92%  | 98%  | 83%  | 94%  | 96%  | 96%  | 96%  | 96%  | 97%  | 94%  | 100% | 95%  | 97%  | 83% | 100% | 96%    | 95%     |
| <b>Railroad Percentile in the Distribution of ROIC minus COC:</b>                                           |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |      |        |         |
| Industry Weighted Average ROIC                                                                              | 10   | 9    | 4    | 9    | 11   | 5    | 6    | 7    | 17   | 13   | 9    | 11   | 13   | 13   | 4   | 17   | 10     | 10      |
| CSX Corporation                                                                                             | 10   | 9    | 9    | 15   | 13   | 5    | 6    | 7    | 10   | 10   | 9    | 6    | 13   | 15   | 5   | 15   | 10     | 10      |
| Kansas City Southern                                                                                        | 6    | 9    | 4    | 7    | 7    | 5    | 6    | 5    | 7    | 5    | 8    | 2    | 5    | 5    | 2   | 9    | 5      | 6       |
| Norfolk Southern Corporation                                                                                | 14   | 13   | 11   | 11   | 11   | 5    | 6    | 5    | 10   | 7    | 9    | 6    | 6    | 8    | 5   | 14   | 9      | 9       |
| Union Pacific Corporation                                                                                   | 6    | 6    | 4    | 7    | 7    | 5    | 9    | 9    | 21   | 15   | 11   | 14   | 16   | 15   | 4   | 21   | 9      | 10      |
| <b>Panel C: Railroad Customer Sample of S&amp;P 500 Companies</b>                                           |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |      |        |         |
| <b>Sample Number of Observations, Median, 25th Percentile, and % Positive ROIC minus COC:</b>               |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |      |        |         |
| Number of Observations in Sample                                                                            | 80   | 80   | 81   | 82   | 84   | 84   | 84   | 83   | 84   | 86   | 85   | 83   | 84   | 82   | 80  | 86   | 84     | 83      |
| Median ROIC minus COC                                                                                       | 13%  | 12%  | 9%   | 3%   | 12%  | 13%  | 10%  | 7%   | 7%   | 8%   | 6%   | 8%   | 11%  | 8%   | 3%  | 13%  | 8%     | 9%      |
| 25th Percentile ROIC minus COC                                                                              | 4%   | 4%   | 1%   | -4%  | 3%   | 3%   | 2%   | 2%   | 1%   | 2%   | -1%  | 2%   | 2%   | 1%   | -4% | 4%   | 2%     | 2%      |
| % with ROIC minus COC > 0.0%                                                                                | 88%  | 86%  | 79%  | 61%  | 86%  | 85%  | 83%  | 87%  | 83%  | 81%  | 72%  | 83%  | 85%  | 79%  | 61% | 88%  | 83%    | 81%     |
| <b>Railroad Percentile in the Distribution of ROIC minus COC:</b>                                           |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |      |        |         |
| Industry Weighted Average ROIC                                                                              | 17   | 19   | 22   | 30   | 19   | 21   | 31   | 32   | 41   | 37   | 44   | 44   | 35   | 42   | 17  | 44   | 31     | 31      |
| CSX Corporation                                                                                             | 17   | 20   | 32   | 37   | 28   | 21   | 27   | 25   | 34   | 26   | 41   | 33   | 36   | 45   | 17  | 45   | 30     | 30      |
| Kansas City Southern                                                                                        | 14   | 17   | 16   | 22   | 15   | 9    | 13   | 13   | 21   | 20   | 29   | 24   | 13   | 25   | 9   | 29   | 17     | 18      |
| Norfolk Southern Corporation                                                                                | 28   | 26   | 37   | 33   | 24   | 22   | 25   | 19   | 34   | 22   | 36   | 36   | 25   | 36   | 19  | 37   | 27     | 29      |
| Union Pacific Corporation                                                                                   | 14   | 9    | 13   | 23   | 16   | 21   | 36   | 43   | 51   | 46   | 48   | 50   | 38   | 45   | 9   | 51   | 37     | 32      |

Sources: Bloomberg; Compustat; Ibbotson Yearbook (2006-2019); STB Revenue Adequacy Determination Report (2006-2018); RevAd 2019 AAR workpaper1 pdf, titled "AAR Duplication of STB Workpapers "

## Appendix C, Exhibit C2

Railroad Percentiles within Sample - Adjusted STB Definition of Return on Invested Capital (ROIC) and STB Definition of Cost of Capital (COC)  
(Railroads' Return on Invested Capital and Cost of Capital Measured Using Non-STB Public Data)

|                                                                                                             | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | Min | Max | Median | Average |
|-------------------------------------------------------------------------------------------------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|-----|-----|--------|---------|
| <b>Panel A: S&amp;P 500 Companies Excluding Railroads, Financial Institutions and Real Estate Companies</b> |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |     |        |         |
| <b>Sample Number of Observations, Median, 25th Percentile, and % Positive ROIC minus COC:</b>               |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |     |        |         |
| Number of Observations in Sample                                                                            | 405  | 401  | 409  | 415  | 413  | 414  | 413  | 412  | 410  | 408  | 402  | 393  | 395  | 394  | 393 | 415 | 409    | 406     |
| Median ROIC minus COC                                                                                       | 9%   | 9%   | 9%   | 5%   | 11%  | 11%  | 10%  | 11%  | 9%   | 10%  | 9%   | 7%   | 12%  | 10%  | 5%  | 12% | 10%    | 9%      |
| 25th Percentile ROIC minus COC                                                                              | 1%   | 2%   | 1%   | -2%  | 3%   | 3%   | 3%   | 2%   | 2%   | 2%   | 2%   | 2%   | 2%   | 1%   | -2% | 3%  | 2%     | 2%      |
| % with ROIC minus COC > 0.0%                                                                                | 81%  | 82%  | 80%  | 68%  | 86%  | 87%  | 86%  | 87%  | 87%  | 84%  | 82%  | 82%  | 84%  | 82%  | 68% | 87% | 83%    | 83%     |
| <b>Railroad Percentile in the Distribution of ROIC minus COC:</b>                                           |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |     |        |         |
| Industry Weighted Average ROIC                                                                              | 16   | 16   | 19   | 23   | 14   | 11   | 14   | 12   | 19   | 18   | 20   | 24   | 24   | 30   | 11  | 30  | 18     | 19      |
| CSX Corporation                                                                                             | 15   | 17   | 21   | 25   | 16   | 12   | 14   | 10   | 11   | 15   | 18   | 18   | 27   | 31   | 10  | 31  | 17     | 18      |
| Kansas City Southern                                                                                        | 17   | 18   | 14   | 14   | 14   | 10   | 14   | 12   | 16   | 16   | 18   | 17   | 10   | 16   | 10  | 18  | 15     | 15      |
| Norfolk Southern Corporation                                                                                | 19   | 18   | 21   | 21   | 11   | 11   | 12   | 9    | 12   | 13   | 17   | 19   | 14   | 25   | 9   | 25  | 16     | 16      |
| Union Pacific Corporation                                                                                   | 14   | 14   | 17   | 23   | 15   | 11   | 17   | 18   | 31   | 28   | 26   | 34   | 30   | 32   | 11  | 34  | 20     | 22      |
| <b>Panel B: S&amp;P 500 Companies in the Industrials Sector Excluding Railroads</b>                         |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |     |        |         |
| <b>Sample Number of Observations, Median, 25th Percentile, and % Positive ROIC minus COC:</b>               |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |     |        |         |
| Number of Observations in Sample                                                                            | 48   | 53   | 56   | 54   | 55   | 57   | 56   | 60   | 61   | 63   | 66   | 65   | 65   | 64   | 48  | 66  | 59     | 59      |
| Median ROIC minus COC                                                                                       | 13%  | 15%  | 15%  | 5%   | 12%  | 15%  | 13%  | 13%  | 12%  | 12%  | 11%  | 12%  | 13%  | 14%  | 5%  | 15% | 13%    | 12%     |
| 25th Percentile ROIC minus COC                                                                              | 9%   | 8%   | 7%   | 1%   | 6%   | 8%   | 6%   | 6%   | 4%   | 7%   | 7%   | 7%   | 6%   | 9%   | 1%  | 9%  | 7%     | 6%      |
| % with ROIC minus COC > 0.0%                                                                                | 92%  | 91%  | 95%  | 80%  | 95%  | 95%  | 93%  | 95%  | 90%  | 90%  | 92%  | 97%  | 94%  | 94%  | 80% | 97% | 93%    | 92%     |
| <b>Railroad Percentile in the Distribution of ROIC minus COC:</b>                                           |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |     |        |         |
| Industry Weighted Average ROIC                                                                              | 6    | 9    | 5    | 13   | 9    | 5    | 11   | 5    | 18   | 14   | 9    | 8    | 9    | 11   | 5   | 18  | 9      | 9       |
| CSX Corporation                                                                                             | 6    | 9    | 7    | 15   | 9    | 7    | 9    | 5    | 10   | 11   | 7    | 5    | 11   | 11   | 5   | 15  | 9      | 9       |
| Kansas City Southern                                                                                        | 6    | 11   | 4    | 7    | 7    | 5    | 9    | 5    | 13   | 11   | 7    | 3    | 3    | 6    | 3   | 13  | 7      | 7       |
| Norfolk Southern Corporation                                                                                | 10   | 11   | 7    | 13   | 5    | 5    | 9    | 5    | 10   | 8    | 6    | 5    | 8    | 11   | 5   | 13  | 8      | 8       |
| Union Pacific Corporation                                                                                   | 6    | 9    | 5    | 13   | 9    | 5    | 12   | 7    | 23   | 17   | 10   | 14   | 14   | 11   | 5   | 23  | 11     | 11      |
| <b>Panel C: Railroad Customer Sample of S&amp;P 500 Companies</b>                                           |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |     |        |         |
| <b>Sample Number of Observations, Median, 25th Percentile, and % Positive ROIC minus COC:</b>               |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |     |        |         |
| Number of Observations in Sample                                                                            | 80   | 80   | 81   | 82   | 84   | 84   | 84   | 83   | 84   | 87   | 86   | 84   | 85   | 83   | 80  | 87  | 84     | 83      |
| Median ROIC minus COC                                                                                       | 9%   | 7%   | 6%   | 0%   | 7%   | 8%   | 5%   | 4%   | 3%   | 3%   | 3%   | 3%   | 5%   | 4%   | 0%  | 9%  | 5%     | 5%      |
| 25th Percentile ROIC minus COC                                                                              | 1%   | 2%   | 0%   | -5%  | 2%   | 2%   | 0%   | 1%   | 0%   | 1%   | -2%  | 0%   | 1%   | 0%   | -5% | 2%  | 0%     | 0%      |
| % with ROIC minus COC > 0.0%                                                                                | 84%  | 81%  | 70%  | 52%  | 81%  | 83%  | 76%  | 81%  | 74%  | 79%  | 67%  | 76%  | 81%  | 75%  | 52% | 84% | 78%    | 76%     |
| <b>Railroad Percentile in the Distribution of ROIC minus COC:</b>                                           |      |      |      |      |      |      |      |      |      |      |      |      |      |      |     |     |        |         |
| Industry Weighted Average ROIC                                                                              | 12   | 19   | 27   | 35   | 20   | 16   | 26   | 19   | 32   | 25   | 37   | 36   | 31   | 45   | 12  | 45  | 26     | 27      |
| CSX Corporation                                                                                             | 12   | 20   | 32   | 39   | 22   | 16   | 25   | 15   | 20   | 22   | 32   | 25   | 36   | 45   | 12  | 45  | 24     | 26      |
| Kansas City Southern                                                                                        | 12   | 20   | 22   | 23   | 20   | 15   | 24   | 18   | 29   | 22   | 31   | 24   | 16   | 25   | 12  | 31  | 22     | 21      |
| Norfolk Southern Corporation                                                                                | 17   | 20   | 32   | 34   | 19   | 16   | 18   | 14   | 22   | 20   | 30   | 28   | 19   | 40   | 14  | 40  | 20     | 24      |
| Union Pacific Corporation                                                                                   | 12   | 12   | 24   | 35   | 20   | 16   | 29   | 25   | 51   | 48   | 48   | 48   | 42   | 45   | 12  | 51  | 32     | 33      |

Sources: Bloomberg; Compustat; Ibbotson Yearbook (2006-2019); STB Revenue Adequacy Determination Report (2006-2018); RevAd 2019 AAR workpaper1 pdf, titled "AAR Duplication of STB Workpapers "

**ATTACHMENT D**

**CORRECTED OCTOBER 13, 2020  
RESPONSE TO REPLIES**

**BEFORE THE  
SURFACE TRANSPORTATION BOARD**

**EX PARTE 766**

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JOINT PETITION FOR RULEMAKING  
TO MODERNIZE ANNUAL REVENUE ADEQUACY DETERMINATIONS

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October 13, 2020 (Updated with errata corrections)

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Exhibit 1: Supplemental Verified Statement of Kevin M. Murphy and Mark E. Zmijewski

The Petition for Rulemaking identified a new approach for the Board to measure revenue adequacy that would respond to long-established concerns about measurement error in the analysis and give the Board valuable information about how railroad performance compares to that of other companies in the marketplace. The Petition would largely preserve the structure of the Board's current measurement, but would add information about how railroads compare to their competitors in the capital markets. As explained in the Petition, the revised approach is consistent with Congress's command that the Board accurately measure the financial performance of Class I railroads and addresses recognized measurement errors in the current approach in an easily administrable way.

Three replies were filed in response to the Petition. One "unreservedly supports" a proceeding to explore this new approach.<sup>1</sup> The other two comments, which oppose the Petition, were filed by the Western Coal Traffic League and a coalition of advocacy groups labeling themselves the "Joint Shippers" (collectively, "Opponents").<sup>2</sup> These opposing comments did not contest Petitioners' statutory arguments that the Board is required to annually measure railroad financial performance and ensure that railroads earn "a reasonable and economic profit or return (or both) on capital employed in the business." 49 U.S.C. § 10704(a)(2). Nor did they argue that the Board's current approach produces an accurate measurement, instead preferring to resurrect years-old filings alleging that the current approach is too conservative. And they did not meaningfully dispute the basic conclusion presented by Professors Murphy and Zmijewski ("the professors"),

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<sup>1</sup> See Reply of CSX Transportation, Inc., Ex Parte 766 (filed Sept. 21, 2020) ("CSXT Reply"), at 1.

<sup>2</sup> Reply of Joint Shippers, Ex Parte 766 (filed Sept. 21, 2020) ("Joint Shippers Reply"); Reply of the Western Coal Traffic League in Opposition to Petition, Ex Parte 766 (filed Sept. 21, 2020) ("WCTL Reply").

which is that an evenhanded application of the Board's revenue adequacy methodology to non-railroads in the S&P 500 shows that railroads are not earning unusually high economic rates of return.

Instead, Opponents attack the messengers, claiming that the Petition's approach should be rejected because it is being proposed by railroads that have an interest in how the Board calculates revenue adequacy. Yet Opponents all but admit that their own objective is to use annual determinations as fuel to pursue a revenue adequacy constraint, either through the rate caps advocated by WCTL or the rate-of-return regulation in the American Chemistry Council's ("ACC") econometric "rate benchmarking" approach.<sup>3</sup> And they equally do not disguise their lack of interest in improving the accuracy of the Board's annual assessments if those improvements would not result in annual determinations that comport with their desired result.

These results-oriented positions are particularly ironic for ACC and its fellow Joint Shippers. The Joint Shippers demand that a flawed Board-measured railroad accounting-based rate of return,<sup>4</sup> equal to or above a market-based cost of capital,

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<sup>3</sup> See WCTL Reply at 5; Joint Shipper Reply at 13–14.

<sup>4</sup> While Opponents and Petitioners both use the terms "return," "return on investment," and "ROI" to describe the numerator of the Board's current revenue adequacy measure—see WCTL Reply at 8; Joint Shippers Reply at 2—it is important to clarify that a "return on investment," or "ROI" is a measure of *economic* profit or return, not accounting-based rate of return. Because accounting-based rates of return do not equal economic rates of return, the current STB methodology is not informative about "ROI." Thus, even if revenue adequacy were defined as the point at which "ROI" equals the cost of capital (which Petitioners maintain is not correct in light of the language in 49 U.S.C. § 10704(a)(2) requiring an additional economic profit or return (or both)), the STB's methodology is not measuring the "ROI" metric at all, and thus is not informative about whether railroads' *economic* return is equal to or greater than their cost of capital. By contrast, the benchmarking methodology provides useful information to assess—given the lack of ability of accounting-based rates of return to measure economic rates of return—how railroads' accounting-based rates of return compare to those of

be an automatic trigger for wealth transfers under the ACC rate benchmarking approach—even though ACC members have an average return over their cost of capital well above that of the rail industry.<sup>5</sup> Compared to the AAR members, with a median ROIC less COC of -0.8%, the ACC members achieved a median ROIC less COC of 14.9%.<sup>6</sup> Yet the Joint Shipper coalition wants the Board to ignore that data and continue using an inaccurate metric developed four decades ago as a basis to transfer wealth from railroads to chemical companies.

Section I addresses arguments that the current measurement should not be changed. Tellingly, the shippers do not defend the current approach on the merits, but instead attack it as being too “conservative” and allegedly underestimating railroads’ revenue adequacy. But the recycled arguments Opponents make have long been discredited and do not negate the need for the Board to open a proceeding to explore ways to modernize and improve upon its current test.

Section II addresses Opponents’ few technical complaints. While Opponents argue that the S&P 500 does not provide an accurate benchmark for railroads, in fact the S&P 500 is a well-recognized proxy for the broader market and accurately reflects the diverse investment options with which railroads must compete for capital. Moreover, data from narrower groups like S&P Industrials or major rail customers produces results that are in line with the full S&P 500 comparison group. Section III responds to WCTL’s arguments and misunderstandings regarding the deferred taxes portion of the Petition.

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other capital market participants, which is a valid economic method for gaining insight into a firm’s level of economic returns. *See* Exhibit 1, Supplemental Verified Statement of Kevin M. Murphy and Mark E. Zmijewski (“Supplemental V.S.”) ¶ 8 (citing Sections III and IV of the initial Verified Statement).

<sup>5</sup> Supplemental V.S. ¶ 6, Figure 1.

<sup>6</sup> *Id.* at Figure 1. Note, the median is the median of the average ROIC less COC over the 2006–2019 period.

Section IV concludes by addressing Opponents' complaints that the Petition's approach should be rejected because it is being proposed by railroads allegedly seeking a "results-oriented" way to avoid a revenue adequacy constraint.<sup>7</sup> Opponents' accusations ring hollow because, while the Petition addresses years of criticism about the recognized flaws in the Board's approach, Opponents urge the Board to continue using its outdated and inaccurate measure of revenue adequacy—not on the basis of law, data, or expert economic opinion—but because that would enable them to make use of the similarly outdated and economically invalid revenue adequacy constraint. The Board should adopt an approach to revenue adequacy determinations that provides robust data and is most consistent with Congress' intent in § 10704(a)(2), regardless of whether stakeholders prefer a less accurate approach that wrongly suggests that railroads are earning outsized returns.

**I. OPPONENTS' FAILURE TO DEFEND THE CURRENT MEASURE SPEAKS VOLUMES.**

As explained in the Petition, the Board has a clear statutory duty to measure and monitor railroads' progress toward revenue adequacy and their ability to compete for capital. *See* Pet. at 8–12, 25–29. The Board's current measure does not do that accurately, and it should be improved regardless of whether the Board attaches consequences to revenue adequacy. *See id.* at 2, n.4 (“[R]egardless of what action it takes on the revenue adequacy constraint, the Board surely cannot make any rational and non-arbitrary decisions in this area without a more accurate measure of railroads' actual financial health.”).

Opponents do not point to any economic literature that undermines the analysis and conclusions in Petitioners' thorough expert report. Nor do Opponents

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<sup>7</sup> *See* WCTL Reply at 2.

challenge Petitioners' data.<sup>8</sup> Critically, Opponents do not explain how the current measure is consistent with Congress's instruction that railroads be permitted to earn "a reasonable and *economic* profit or return (or both) on capital employed in the business." 49 U.S.C. § 10704(a)(2) (emphasis added). Instead, Opponents' rationale is that, merely because the Board has used its current approach to revenue adequacy for decades, it should continue using a methodology with well-established flaws despite being presented with new evidence indicating such methodologies do not comply with the Board's statutory duties.

**A. Opponents Have Effectively Conceded that the Term "Economic Profit" Cannot Mean "Zero Profit."**

The Board's measure of revenue adequacy must not only account for the ability to cover costs and attract capital, but must also permit an additional "reasonable and economic profit or return (or both) on capital employed in the business." 49 U.S.C. § 10704(a)(2); Pet. at 9–12. In other words, the term "reasonable and economic profit" in § 10704(a)(2) cannot mean an economic rate of return—much less an accounting-based rate of return—equal to the cost of capital (*i.e.*, zero profit). Thus, defining revenue adequacy as the Board currently does—as an accounting-based rate of return equal to or above the cost of capital—is contrary to section 10704(a)(2)'s plain language.

WCTL complains that Petitioners have not pointed to legislative history in support of their position that "economic profit" cannot mean "zero profit."<sup>9</sup> But Petitioners do not need any legislative history to support the plain language of the statute's text. The term "economic profit" must mean something, and it cannot mean "zero profit" (or a nominal profit based on accounting-based rates of return),

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<sup>8</sup> See Pet. at 4–6; *id.*, Verified Statement of Professor Kevin M. Murphy & Professor Mark E. Zmijewski ("Verified Statement") ¶¶ 30–38.

<sup>9</sup> See WCTL Reply at 10.

or the term “economic” would be superfluous. As the U.S. Supreme Court has explained, “one of the most basic interpretive canons” is that a “statute should be construed so that effect is given to all its provisions, so that no part will be inoperative or superfluous, void, or insignificant.”<sup>10</sup> Opponents can produce no alternative explanation of this language and instead insist on a revenue adequacy approach that would simply ignore it.

**B. Opponents’ Argument that Congress Ratified the Board’s Current Concept of Revenue Adequacy Is Flawed and Unsupported.**

Rather than defend the accuracy of the Board’s current concept of revenue adequacy, WCTL asserts that Congress has legislatively ratified it.<sup>11</sup> WCTL is mistaken. Mere re-adoption of a statute does not ratify all existing agency interpretation. Rather, a necessary requirement for legislative ratification is evidence that Congress was aware of, and expressly approved, the particular agency action or interpretation.<sup>12</sup> WCTL does not even attempt to show this required

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<sup>10</sup> *Corley v. United States*, 556 U.S. 303, 314 (2009) (internal quotation marks omitted).

<sup>11</sup> WCTL Reply at 9–10.

<sup>12</sup> See Supplemental Comments of the Association of American Railroads, *Hearing on Revenue Adequacy*, Ex Parte 761 (filed Feb. 13, 2020), at 9 n.23 (“there is no legal basis for concluding that the revenue adequacy constraint has been ratified or otherwise approved by Congress. This is because there is no indication at all that Congress was aware of the obscure and never applied “revenue adequacy constraint” created in *Coal Rate Guidelines* when it reenacted the relevant legislation, much less “evidence of express approval[,]” as required. *Beverly Enters., Inc. v. Herman*, 119 F. Supp. 2d 1, 9 (D.D.C. 2000) (emphasis added); see *id.* (“[I]n order to construe congressional reenactment of a statute as an adoption of an agency interpretation thereunder, there must be a showing that Congress was aware of, and expressly approved of, the prior agency position. See *General Am. Transp. Corp. v. I.C.C.*, 872 F.2d 1048, 1053 (D.C.Cir.1989) ... [A]ssuming Congress was even aware of the [agency’s] construction, there is simply no evidence of express approval. ... [And] ‘[i]t is at best treacherous to find in congressional silence alone the adoption of a controlling rule of law....’” (quoting *Girouard v. United States*, 328 U.S. 61, 69 (1946)); *Isaacs v. Bowen*, 865 F.2d 468, 473 (2d Cir. 1989) (“[T]he

criterion.<sup>13</sup> And WCTL’s reliance on the outdated opinions of the Railroad Accounting Principles Board (“RAPB”), an entity that has not existed for decades, shows WCTL is clinging to the past at the expense of a more accurate future. On the merits, and in the year 2020, the flaws of the current measure used by the Board are clear.

**C. Opponents’ Claim that the Current Measure of Revenue Adequacy Is “Conservatively High” Is Unsupported.**

In lieu of a defense of the Board’s current approach, Joint Shippers claim that the current revenue adequacy measure is “conservatively high.”<sup>14</sup> This assertion is not based on the accuracy of the Board’s measure, but on “financial market data” that shippers argue indicate that railroads are able to “attract[] capital.”<sup>15</sup> Joint Shippers do not support this assertion with any recent expert testimony or analysis; instead, they rehash old filings and reports dating from 2001, 2005, and 2013.

These arguments have been repeatedly discredited over the years. As Professor Joseph P. Kalt<sup>16</sup> explained in Ex Parte 722: “The suggestion that revenue adequacy should be divorced from long-run rates of return relative to the cost of capital is *ad hoc* and without coherent economic foundation. Ultimately, revenue adequacy depends on the long-term relationship between the cost of capital and

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doctrine applies when Congress indicates not only an awareness of the administrative view, but also takes an affirmative step to ratify it.”).

<sup>13</sup> In contrast, there is significant legislative history indicating that Congress expressly approved and ratified other Board policies, namely the *Midtec* standard for competitive access. *See, e.g.*, Opening Comments of Norfolk Southern Railway Co., Ex Parte 711 (Sub-No. 1) (filed Oct. 26, 2016), at 39–45.

<sup>14</sup> Joint Shippers Reply at 4; *see id.* at 4–8.

<sup>15</sup> *Id.* at 4, 7.

<sup>16</sup> Professor Kalt is the Ford Foundation Professor (Emeritus) of International Political Economy at the John F. Kennedy School of Government at Harvard University.

rates of return. ... Claims of ‘revenue adequacy’ based on other criteria, such as a rising stock price or the willingness of the capital market to fund incremental investments, is unfounded.”<sup>17</sup> Professor Kalt’s explanation is consistent with the Board’s duty under section 10704, which explicitly ties railroad revenue adequacy to not only the ability to recover costs and attract capital, but also “a reasonable and economic profit or return (or both) on capital employed in the business.” 49 U.S.C. § 10704(a)(2).

Opponents argue that financial metrics like stock performance indicate revenue adequacy, relying largely on 2001 testimony from Dr. Harvey Levine.<sup>18</sup> But Professor Kalt has explained the fallacy in Dr. Levine’s ideas:

“The litany of financial metrics Dr. Levine asserts should be used ... in determining revenue adequacy suffer from ... shortcomings. His proffered metrics are just a handful of a long list of financial ratios that ... do not ... provide a basis for determining overall revenue adequacy, ... [as they] bear no direct connection to the relevant comparison of capital costs to rates of return ... [and] provide no indication of revenue adequacy—i.e., that revenues overall are at least sufficient to cover the costs, including the risk-adjusted cost of capital, that would be incurred by an efficient entrant in a contestable market pricing at competitive levels.”<sup>19</sup>

Similarly, arguments that railroads’ ability to raise capital proves railroads are revenue adequate have been debunked repeatedly. As Professor Kalt explained in Ex Parte 722:

Obtaining the *minimum* capital to remain ‘viable’ or merely avoiding bankruptcy is not the competitive standard by which capital markets operate. In an industry with large sunk costs (as in the railroad industry), revenues only need to be able to cover going-forward variable costs to keep a firm viable. But no competitive capital market free of *de facto* expropriation of sunk costs would commit capital to a firm seeking

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<sup>17</sup> Reply Comments of the Association of American Railroads, *Railroad Revenue Adequacy*, Ex Parte 722 (filed Nov. 4, 2014), Reply Verified Statement of Joseph P. Kalt (“Kalt Reply Verified Statement”), at 11.

<sup>18</sup> Joint Shipper Reply at 4–6.

<sup>19</sup> Kalt Reply Verified Statement, Ex Parte 722 (filed Nov. 4, 2014), at 12–13.

to enter and compete in a market if, once the firm made sunk investments, its revenues would be allowed to cover no more than going-forward costs. Under a standard of “mimic competition,” revenue is required to provide compensatory returns to investors in a system-wide stand-alone railroad *over the life of their investments*. In well-functioning competitive markets, it is that prospect that calls forth the investments that are needed to optimally serve the demands of shippers and the ultimate consumers they serve.”<sup>20</sup>

Thus, the Board’s current concept of revenue adequacy is inconsistent with modern economic standards. By contrast, a comparative approach to determining revenue adequacy, as proposed by Petitioners, would align the Board’s concept of revenue adequacy with economic principles and would provide the Board with an informative tool for assessing how railroads are performing financially compared to their peers in capital markets and thus whether railroads are earning excessive economic profits.

The reality is that decades have passed since the ICC determined that revenue adequacy should be defined as an accounting-based rate of return equal to the cost of capital. That determination does not accord with the modern accepted understanding of economic principles as they relate to revenue adequacy and good regulatory policy.<sup>21</sup> The Board’s methodologies should reflect the fact that the concept of revenue adequacy as “ROI=COC,”<sup>22</sup> even for regulated entities, is no longer economically valid.

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<sup>20</sup> Kalt Reply Verified Statement, Ex Parte 722 (filed Nov. 4, 2014), at 10 (emphasis in original); *accord* Pet., Verified Statement ¶¶ 22–24.

<sup>21</sup> See, e.g., Supplemental V.S. ¶¶ 8–11, 15–23.

<sup>22</sup> WCTL Reply at 9.

## **II. OPPONENTS' TECHNICAL CRITICISMS OF THE PETITION LACK MERIT.**

### **A. The S&P 500 Is a Valid Metric for Determining Railroad Revenue Adequacy.**

Opponents critique the use of the S&P 500 as a benchmarking group against which to compare railroad earnings. In particular, Opponents argue that this use of the S&P 500 is “a new tack” for avoiding the revenue adequacy constraint because it compares railroad earnings to an “elite group” of companies that “by definition are among the most profitable in the country.”<sup>23</sup>

First, using the S&P 500 as a benchmark for understanding railroad earnings is not a radical idea. Professors Murphy and Zmijewski explain that “[b]enchmarking methodologies are widely used in many fields and for many purposes” as “a standard (or reference point) by which to evaluate financial performance.”<sup>24</sup> Thus, the “proposed benchmarking methodology is not innovative or new” but, rather, is “a standard and well-accepted methodology for analyzing a company’s financial performance.”<sup>25</sup>

Second, contrary to WCTL’s assertions, the companies included in the S&P 500 are not required to be “the most profitable [companies] in the country.”<sup>26</sup> Rather, “the criteria for a company to be included in the S&P 500 ... focus primarily on market capitalization and liquidity.”<sup>27</sup> In simple terms, the S&P 500 is made up of companies with the largest market capitalization within industry sectors. For this reason, the S&P 500 is an informative benchmark because it includes large-cap companies—including the four U.S. publicly traded railroads subject to the STB’s

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<sup>23</sup> Joint Shippers Reply at 9;

<sup>24</sup> Pet., Verified Statement ¶¶ 52–53.

<sup>25</sup> *Id.* ¶ 54.

<sup>26</sup> WCTL Reply at 12.

<sup>27</sup> Supplemental V.S. ¶ 3.

revenue adequacy determinations and the companies with which railroads primarily compete for capital.<sup>28</sup> Far from being an “elite” and irrelevant group of companies,<sup>29</sup> the S&P 500 is a “broad market index made up of stocks of 500 large to medium-sized U.S. companies” and in fact is the metric used by the federal government in its Thrift Savings Plan Common Stock Index Investment Fund (C Fund) for federal employees.<sup>30</sup>

WCTL similarly complains that the makeup of the S&P 500 comparison groups proposed by Petitioners is not appropriate because the companies included “have different capital structures than railroads” and many “are not capital intensive, and do not have a focus on returns on invested capital as a primary measure of financial health.”<sup>31</sup> WCTL’s concerns are unfounded because, as Professors Murphy and Zmijewski explain, “to the extent there are differences in ‘risk profiles’ between the benchmarking group companies and the railroads, the cost-of-capital adjustment in the STB metric (ROIC minus COC) and the adjusted STB metric (Adjusted ROIC minus COC) takes those differences into account.”<sup>32</sup> In other words, the differences among the S&P 500 members do not undermine the economic validity of the comparison.<sup>33</sup> In any event, the professors provided two alternative S&P 500 comparison groups—the Industrials Sector group and the

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<sup>28</sup> Supplemental V.S. ¶ 4.

<sup>29</sup> See WCTL Reply at 12.

<sup>30</sup> *C Fund*, Thrift Savings Plan, <https://www.tsp.gov/funds-individual/c-fund/> (last accessed Oct. 13, 2020).

<sup>31</sup> WCTL Reply at 12.

<sup>32</sup> Supplemental V.S. ¶ 7.

<sup>33</sup> See Pet., Verified Statement ¶ 63 (stating that “[a]ll three alternative benchmarking groups include a broad selection of companies that compete with railroads to raise capital” and thus are relevant and meaningful comparison sources); Supplemental V.S. ¶¶ 3–4.

Customers group.<sup>34</sup> If the Board wishes to limit the comparison to the Industrials group—the group in which railroads are classified—the data show that the results would be similar to that of the main S&P 500 group.<sup>35</sup> Likewise, the professors’ analysis using a group of major rail customers produced similar results.<sup>36</sup>

The S&P 500 is an economically valid benchmarking group for understanding railroads’ financial performance, as it consists of peers with which railroads primarily compete for capital.<sup>37</sup> And the fact that the data the professors used are consistent across different benchmarking groups is a strong indication of the integrity of their analysis and conclusions.

The Board could explore in a rulemaking what might be the most appropriate comparison groups for it to consider. But vague assertions that the S&P 500 may not be the right comparison group provide insufficient reason to cut off this promising approach without a proceeding.

**B. The Flow-Through Approach to Deferred Taxes Will Result in a More Accurate Picture of Railroad Financial Health.**

As explained in the Petition, the flow-through approach to deferred taxes has been supported by leading economists again and again since the 1980s to the present day. *See* Pet. at 39–40. Opponents provide no evidence to undermine this longstanding support from experts. Likewise, Opponents do not rebut the opinion of Professors Murphy and Zmijewski that the flow-through approach is the more accurate, and more economically sound, way to calculate railroad cost of capital for the purposes of determining revenue adequacy. *Id.* at 39. Neither do Opponents deny that the flow-through approach is simpler, with multiple practical benefits.

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<sup>34</sup> *See* Verified Statement ¶ 62 and Tables 2 and 3; Supplemental V.S. ¶¶ 4–5.

<sup>35</sup> *See* Verified Statement at Table 2.

<sup>36</sup> *See id.* at Table 3.

<sup>37</sup> Supplemental V.S. ¶¶ 3–5, 7.

*Id.* at 40, 46–49. And finally, Opponents do not rebut the fact that the flow-through approach mitigates and often eliminates absurd outcomes that result in regulatory distortions that infect the Board’s regulatory tools. *Id.* at 42.

Instead, the opposition is primarily based on misunderstandings of the proposal. First, WCTL claims that the flow-through approach “ignores the reality that railroads uniformly pay taxes below the corporate tax rate, and those tax savings provide a substantial benefit.”<sup>38</sup> WCTL Reply at 15. But this is irrelevant to the question at hand. Because the flow-through approach reflects the movement of real income, whatever amount the railroad *does* pay in taxes will be reflected when the taxes are paid. Nothing about the flow-through approach would pretend that railroads pay taxes that they do not. Tax payments would be deducted in the rate of return measurement (just as they are now). The only difference is that accumulated deferred taxes would no longer be deducted from the investment base.

Second, WCTL admits that changes in the corporate tax rate would alter the value of accumulated deferred tax liabilities, but claims that “[t]ax rates change only rarely.” WCTL Reply at 16. This claim is objectively false. Since the 1980s through 2019, major tax legislation has been enacted *almost every year*.<sup>39</sup> Moreover, the corporate tax rate in the United States, while remaining steady in the 2000s until the 2017 Tax Cuts and Jobs Act, has changed 27 times since the 1920s.<sup>40</sup> And significant tax policy changes have been proposed in the current

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<sup>38</sup> Essentially no company (including WCTL’s members), or person, pays their statutory tax rate. Yet, that does not keep economists and accountants from using the flow-through method in measuring economic profit. *See* Pet. at 39 (citing Verified Statement ¶¶ 57–58).

<sup>39</sup> *See* Laws & Proposals, Tax Policy Center, <https://www.taxpolicycenter.org/laws-proposals/major-enacted-tax-legislation-2000-2009> (last accessed Oct. 13, 2020).

<sup>40</sup> United States Federal Corporate Tax Rate, Trading Economics, <https://tradingeconomics.com/united-states/corporate-tax-rate> (last accessed Oct. 13, 2020).

presidential campaign (including a potential rollback of some of the tax cuts in the 2017 Tax Cuts and Jobs Act). There is a significant benefit in the Board adopting an approach to deferred taxes that will not require future manual adjustments if (and when) tax policy changes.

Finally, WCTL claims that because deferred taxes are “interest-free loan[s],”<sup>41</sup> they should not be ignored in the revenue adequacy calculation, as they provide a benefit to railroads.<sup>42</sup> The flow-through approach does not “ignore” the benefits of deferred tax liabilities but, rather, shifts the time at which such liabilities (and benefits) are recognized to when they show up in the company’s cash flow. *See* Pet. at 43. In other words, the flow-through approach reflects the movement of “real income,” which is precisely what determines the financial health of a company in the real world. *See* Pet. at 46. There is nothing “distortion[ary]” or “inaccura[te]” about that. WCTL Reply at 17; *see* Pet., Verified Statement ¶¶ 57–58.

### **III. OPPONENTS’ RESULTS-ORIENTED ARGUMENTS FAIL TO REBUT THE PETITION.**

Opponents’ remaining comments focus less on the merits of the Petition than on the fact that railroads are proposing it. Opponents suggest that the Petition should be rejected because it proposes an approach that allegedly is a “reversal” of railroads’ past position and that is “results-oriented” because railroads have an interest in the ultimate results of the annual revenue adequacy determination. But the Petition is designed to solve longstanding problems that the rail industry has regularly brought to the Board’s attention. And cries of “railroad self-interest” ring

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<sup>41</sup> Petitioners have already addressed this flawed concept in the Petition and will not repeat its points herein. *See* Pet. at 46–47. For the same reasons set forth in the Petition, WCTL’s reliance on the RAPB’s opinion in this regard from three decades ago is not persuasive. *See* WCTL Reply at 19.

<sup>42</sup> *See* WCTL Reply at 15–17, 19.

hollow from these shipper commenters, who make clear that their primary goal is to weaponize the annual findings for use in a revenue adequacy constraint, not to ensure that the annual determinations accord with the intent of § 10704(a)(2).

**A. The Petition Addresses Longstanding Issues with the Revenue Adequacy Calculations and the Concerns of Independent Experts.**

WCTL alleges that the proposals in the Petition represent a reversal from the industry's prior position and suggests that the Board should be suspicious of a newly proposed approach. But the "reversal" WCTL cites refers to positions taken by railroads in 1981.<sup>43</sup> The idea that the Board is precluded from considering ways to improve a methodology developed a generation ago is ludicrous. And WCTL's "reversal" allegations are definitively disproven by its self-contradictory statements that railroads "consistently defended this test" while "repeatedly press[ing] for changes in the method."<sup>44</sup>

While the precise proposal in the Petition has been developed recently, the problems the Petition is designed to address are longstanding and well-known. For many years, the rail industry has argued, and the Board itself has acknowledged, that using book values instead of replacement costs in the annual revenue adequacy determinations results in significant inaccuracies.<sup>45</sup> The Board has not disagreed that replacement costs are more accurate, but rather has held that calculating them is too complicated.<sup>46</sup> Similarly, the logical economic argument that railroads must

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<sup>43</sup> See WCTL Reply at 3 (arguing that railroads "advocated strongly" for *Standards for Railroad Revenue Adequacy*, 364 I.C.C. 803 (1981)).

<sup>44</sup> *Id.*

<sup>45</sup> See Pet. at 13, 15 & n.29; see also Petition for Rulemaking, *Association of American Railroads—Pet. Regarding Methodology for Determining Railroad Revenue Adequacy*, Ex Parte 679 (filed May 1, 2008); CSXT Reply at 4.

<sup>46</sup> *Standards I*, 364 I.C.C. at 820; *Standards II*, 3 I.C.C.2d at 277.

have some ability to earn returns above their cost of capital is one that railroads have made for years.<sup>47</sup>

Petitioners have designed an approach that mitigates these longstanding and very real problems. The only arguably new aspect of Petitioners' proposal is the proposal to enhance annual revenue adequacy determinations by adding a comparison to S&P 500 data. But even that builds off an approach that was presented to the Board in December 2019 and in recommendations in the 2015 Modernizing Freight Rail Regulation report by the Transportation Research Board.<sup>48</sup> TRB recommended that the Board "obtain a richer set of information" to determine "whether a railroad's profits are consistently outside a reasonable band of profitability that characterizes many other industries over a business cycle."<sup>49</sup>

The proposed approach builds on TRB's recommendation in a way that retains the fundamental structure of the Board's annual revenue adequacy determinations. Comparing railroad performance to that of other companies is valuable information, and the Board would benefit from considering it in the annual analysis.

## **B. Opposition to the Petition Is Results-Oriented.**

In the same vein, Opponents suggest that the proposed approach is "results-oriented," because comparing railroads' accounting-based rate of return net of cost of capital to those of the S&P 500 comparison groups shows that currently Class I

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<sup>47</sup> See, e.g., Opening Comments of Norfolk Southern Railway Company, *Railroad Revenue Adequacy*, Ex Parte 722 (filed Sept. 5, 2014), Verified Statement of Bradford Cornell.

<sup>48</sup> See Pet. at 4, n.6.

<sup>49</sup> Transportation Research Board, National Academies of Sciences, Engineering, and Medicine, *Special Report 318: Modernizing Freight Rail Regulation*, 8, 154–56, 202, 214–15 (2015), available at <https://doi.org/10.17226/21759>.

railroads are all under the median.<sup>50</sup> According to Opponents, the Petition is questionable simply because adopting it would benefit railroads. But Opponents elsewhere admit that they themselves are self-interested, admitting they want annual revenue adequacy results that will allow them to invoke a revenue adequacy constraint. In particular, Joint Shippers hope to use the ACC benchmarking approach, but they fear the approach would be less friendly to their members if the annual revenue adequacy determinations were based on *economic* profit.<sup>51</sup>

There is of course nothing surprising or untoward about stakeholders having an interest in the results of Board proceedings. Every stakeholder that appears before the Board has an interest in the result. An argument that the Board should not act on proposals in which the proponents have an interest is an argument for the Board to not do anything at all. The Board's decision here, as always, should be determined by the goals of the statute, sound regulatory policy, and the merits of the positions before it, not the identity of the proponents.

Petitioners' proposal to modernize revenue adequacy determinations would serve the Board's interests of accuracy, economic integrity, and good governance. Indeed, the proposals solve or neutralize the significant measurement errors in the Board's current methodology and provide an objective, data-driven tool that will enable the Board to interpret railroads' financial health using tools of modern economics and good regulatory policy. In contrast, despite the overwhelming evidence that it is not producing accurate assessments of railroad financial performance, Opponents do not want the Board to even open a proceeding to consider whether it should update a standard developed four decades ago. The Board's § 10704(a) duty to accurately measure the health of the rail industry does

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<sup>50</sup> WCTL Reply at 2; *see* Joint Shippers Reply at 3.

<sup>51</sup> Joint Shippers Reply at 13–14.

not depend on whether railroads or shippers “win,” and the Board should not forego this opportunity to materially improve its revenue adequacy measurements simply because a subset of shippers would like to use a less-accurate measurement to force rate reductions.

## CONCLUSION

For the above reasons, and those set forth in the Petition, Petitioners respectfully petition the Board to initiate a rulemaking to adopt the proposals for modernizing the way it measures and determines railroad revenue adequacy, as proposed by Petitioners.

Respectfully submitted,

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October 13, 2020

**BEFORE THE  
SURFACE TRANSPORTATION BOARD**

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**JOINT PETITION FOR RULEMAKING  
TO MODERNIZE ANNUAL REVENUE ADEQUACY DETERMINATIONS**

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**SUPPLEMENTAL VERIFIED STATEMENT OF**

**PROFESSOR KEVIN M. MURPHY**

**PROFESSOR MARK E. ZMIJEWSKI**

**OCTOBER 13, 2020  
(UPDATED FEBRUARY 10, 2021)**

## I. INTRODUCTION

1. On September 1, 2020, we submitted a verified statement (“Murphy & Zmijewski V.S.”)<sup>1</sup> as part of a Joint Petition for Rulemaking to Modernize Annual Revenue Adequacy Determinations filed by Canadian National, Norfolk Southern, and Union Pacific (“Joint Petition”)<sup>2</sup> before the Surface Transportation Board (“STB”). In the Murphy & Zmijewski V.S., we explained: (a) economic principles for evaluating the financial performance of the railroad industry and we proposed a benchmarking methodology consistent with those principles; (b) why the benchmarking methodology provides a more informative assessment of the railroads’ financial performance than the Revenue Adequacy Determination methodology currently employed by the STB; and (c) the results from implementing the benchmarking methodology using two financial performance metrics<sup>3</sup> and three benchmarking groups.<sup>4</sup>

2. On September 21, 2020, The American Chemistry Council, Corn Refiners Association, American Fuel & Petrochemical Manufacturers, The National Industrial Transportation League, The Chlorine Institute, and The Fertilizer Institute submitted a reply in opposition to the Joint Petition (“Joint Shippers Reply”).<sup>5</sup> Also on September 21, 2020, the Western Coal Traffic

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<sup>1</sup> Verified Statement of Professor Kevin M. Murphy and Professor Mark E. Zmijewski Before the Surface Transportation Board, September 1, 2020 (“Murphy & Zmijewski V.S.”). All capitalized terms in the Murphy & Zmijewski V.S. retain their meaning in this supplemental verified statement.

<sup>2</sup> Joint Petition for Rulemaking to Modernize Annual Revenue Adequacy Determinations, Before the Surface Transportation Board, Ex Parte No. 766, September 1, 2020.

<sup>3</sup> We used the STB’s definition of ROIC minus COC and an alternative measure of ROIC with the STB’s definition of COC, which we refer to as Adjusted ROIC minus COC. (See Murphy & Zmijewski V.S., Section IV.)

<sup>4</sup> The three benchmarking groups are the S&P 500 (excluding railroads, financial institutions, and real estate companies), the S&P 500 Industrials Sector (excluding railroads), and Railroad Customers in the S&P 500. We exclude financial institutions and real estate companies from the broadest group because these companies have substantially different capital structures and business operations. (See Murphy & Zmijewski V.S., ¶63.) We note that our conclusions are unchanged if we use a benchmarking group of the S&P 500 including financial institutions and real estate companies. (See Murphy & Zmijewski V.S., footnote 59.)

<sup>5</sup> Joint Petition for Rulemaking to Modernize Annual Revenue Adequacy Determinations, Before the Surface Transportation Board, Reply of Joint Shippers, Ex Parte No. 766, September 21, 2020.

League submitted a reply in opposition to the Joint Petition (“WCTL Reply”).<sup>6</sup> In this supplemental verified statement, we respond to certain critiques that relate to the Murphy & Zmijewski V.S. made in the Joint Shippers Reply and WCTL Reply. Our choice to not address other critiques of our submission or the Joint Petition should not be interpreted to mean that we agree with those critiques.

## **II. S&P 500 COMPANIES CONSTITUTE A REASONABLE BENCHMARKING GROUP**

3. The WCTL Reply asserts that the railroads propose to “arbitrarily compare their returns on investment with those of companies that by definition are among the most profitable in the country (which is how they end up on the S&P 500 list in the first place). This obviously biases the outcome of the comparison in the railroads’ favor, as the ‘target’ return is drawn from a high-return sample of U.S. firms.”<sup>7</sup> This critique is unwarranted. First, it is factually incorrect because the criteria for a company to be included in the S&P 500 are not based on selecting the most currently profitable or historically profitable companies. Rather, those criteria focus primarily on market capitalization and liquidity, and not on high or highest profitability currently or historically.<sup>8</sup>

4. We did not select the S&P 500 arbitrarily for purposes of benchmarking the railroads’ financial performance. Rather, we chose those companies because (a) the S&P 500 is the widely-accepted index that measures market performance of equities of the large-cap segment of

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<sup>6</sup> Joint Petition for Rulemaking to Modernize Annual Revenue Adequacy Determinations, Before the Surface Transportation Board, Reply of Western Coal Traffic League in Opposition to Petition, Ex Parte No. 766, September 21, 2020 (“WCTL Reply”).

<sup>7</sup> WCTL Reply, p. 12.

<sup>8</sup> S&P U.S. Indices Methodology, August 2020. Last accessed on October 7, 2020 at <https://www.spglobal.com/spdji/en/documents/methodologies/methodology-sp-us-indices.pdf>

the U.S. equities market, a segment that also includes the four U.S. publicly traded railroads subject to the STB's Revenue Adequacy Determinations<sup>9</sup> and (b) these are the companies with which the railroads primarily compete for capital.<sup>10</sup> Comparing the railroads' financial performance to other firms with whom the railroads compete for capital is a reasonable proxy for whether railroads are earning sufficient returns to attract the capital needed to invest and maintain their systems in the long-run.

5. Notably, the WCTL Reply does not propose or analyze an alternative benchmarking group, or suggest criteria for selecting an allegedly more informative benchmarking group. To check that our conclusions are robust to the choice of benchmarking group, we analyzed two smaller benchmarking groups selected for their comparability to the railroads – (i) S&P 500 Industrials Sector (the sector under which the railroads are classified) and (ii) S&P 500 Railroad Customers – in addition to the entirety of the S&P 500 companies (excluding financial institutions and real estate companies) (“S&P 500 benchmarking group”). Conclusions from comparisons with these alternative benchmarking groups are the same as the conclusions from comparison with the S&P 500 benchmarking group.

6. Analysis similar to that presented in the Murphy & Zmijewski V.S. but applied to the members of the American Chemistry Council (“ACC”) that are included in the S&P 500 was presented by Professor Joseph Kalt at the Hearing on Railroad Revenue Adequacy on December 12, 2019. He reached the same conclusion as we did in our statement.<sup>11</sup> The analysis by

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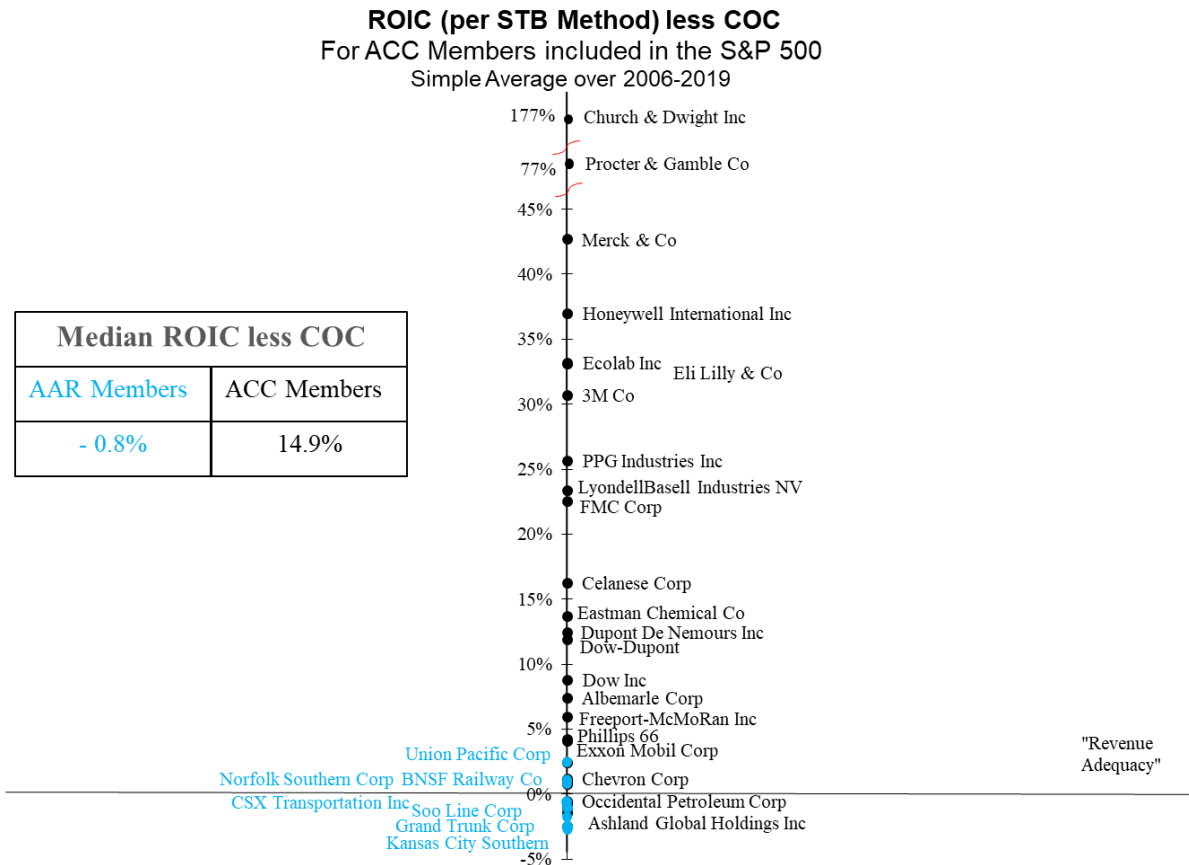
<sup>9</sup> See Murphy & Zmijewski V.S., footnote 59.

<sup>10</sup> See Murphy & Zmijewski V.S., ¶32. In addition, the S&P 500 Index includes many of the large customers of the railroads; see Murphy & Zmijewski V.S., Appendix A, ¶A-1 and Exhibit A1.

<sup>11</sup> Hearing on Railroad Revenue Adequacy, Surface Transportation Board, Docket No. EP 761 & 722, Presentation on Behalf of Association of American Railroads, December 12, 2019 (“AAR Presentation”).

Professor Kalt compared the ACC members' and railroads' return on investment net of their cost of capital ("ROIC minus COC") from 2006 through 2018, and found that the ACC members performed substantially better than the railroads.<sup>12</sup> We extend their analysis through 2019 in Figure 1, below, and reach the same conclusion.

**Figure 1**



Source: Murphy & Zmijewski V.S.

Note: Simple average of annual values. For companies with data with less than full coverage, the average is taken over the years available.

<sup>12</sup> AAR Presentation, Slide 20.

### **III. THE STB'S CURRENT METHODOLOGY FOR EVALUATING REVENUE ADEQUACY IS NOT INFORMATIVE ABOUT WHETHER THE RAILROAD INDUSTRY IS EARNING AN ECONOMIC RETURN GREATER THAN ITS COST OF CAPITAL**

7. The Joint Shippers Reply claims that there is “no rational basis to conclude that Congress wanted the rail industry to earn more than its cost-of-capital to the same degree as the median S&P 500 firm, which likely has a different risk profile.”<sup>13</sup> The Joint Shippers Reply ignores the fact that the market-based cost of capital used in the STB’s financial performance metric is a risk-based measure. Thus, to the extent there are differences in “risk profiles” between the benchmarking group companies and the railroads, the cost-of-capital adjustment in the STB metric (ROIC minus COC) and the adjusted STB metric (Adjusted ROIC minus COC) takes those differences into account.<sup>14</sup>

8. In the *Murphy & Zmijewski V.S.*, we first explained why the STB’s Revenue Adequacy Determination methodology does not evaluate how economic earnings of the railroad industry compare to its cost of capital.<sup>15</sup> We then proposed, and empirically implemented, the benchmarking methodology that provides a more informative way to make that assessment.<sup>16</sup> We demonstrate that, based on that methodology, the financial performance of the railroad industry is well below the median of the three S&P 500-based comparison groups. Thus, the STB’s current Revenue Adequacy Determination methodology is not informative about whether

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<sup>13</sup> Joint Shippers Reply, p. 11.

<sup>14</sup> Cost of capital differences between the railroads and the three benchmarking group are small when compared to the differences in financial performance. For example, the average cost of capital of the seven railroads over the 2006 – 2019 period is 10.7% and the average cost of capital for the S&P 500 Companies (excluding railroads, financial institutions, and real estate companies), S&P 500 Industrials Sector (excluding railroads), and S&P 500 Railroad Customers benchmarking groups are, 9.8%, 10.4%, and 9.3%, respectively. These averages are not reported in the *Murphy & Zmijewski V.S.*, they can be calculated from backup data provided to the STB.

<sup>15</sup> *Murphy & Zmijewski V.S.*, Section III.

<sup>16</sup> *Murphy & Zmijewski V.S.*, Section IV.

the railroad industry is earning an economic rate of return consistent with competitive firms with which the railroads compete for capital.

**IV. RAILROADS' ABILITY TO RAISE CAPITAL IS NOT EVIDENCE THAT THEIR ECONOMIC RETURNS ON TOTAL INVESTED CAPITAL EXCEED THEIR COST OF CAPITAL**

9. The Joint Shippers Reply asserts that “the rail industry has had ample access to capital for decades, even when most Class I railroads were not earning their cost-of-capital by the Board’s conservatively high measure. Notably, the Joint Petitioners do not claim otherwise. Nevertheless, the implication of the Joint Petition is that the rail industry is in jeopardy of being unable to raise capital even at current revenue levels.”<sup>17</sup> First, the assertion that “the rail industry has had ample access to capital for decades, even when most Class I railroads were not earning their cost-of-capital”<sup>18</sup> is based on the STB’s current methodology and the resulting financial performance metric (accounting-based ROIC minus COC). As we explained in the *Murphy & Zmijewski V.S.*, the STB’s current methodology and the resulting financial performance metric is neither conservative nor informative about whether the railroads’ economic returns are greater than their cost of capital.

10. Second, we did not conclude that “the rail industry is in jeopardy of being unable to raise capital even at current revenue levels.”<sup>19</sup> In order to compete for capital, the railroads’ risk-adjusted expected returns must be comparable to that of companies with which the railroads compete for capital. Otherwise, investors will invest elsewhere.<sup>20</sup> Given that some railroad

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<sup>17</sup> Joint Shippers Reply, p. 11.

<sup>18</sup> Joint Shippers Reply, p. 11.

<sup>19</sup> Joint Shippers Reply, p. 11.

<sup>20</sup> See *Murphy & Zmijewski V.S.*, ¶ 25.

investments will prove to be unprofitable, economic efficiency requires that railroads, like firms in competitive industries, are free to seek above average returns without concern about having their rates regulated and depressed if they are successful.<sup>21</sup> The proper economic rationale for measuring revenue adequacy is to determine whether the railroads can raise the capital necessary for their financial health and growth in the long term.<sup>22</sup> Economic efficiency requires that railroads can seek a rate of return greater than their cost of capital; if they cannot, then investors will seek other investment opportunities with greater potential for upside (risk-adjusted expected returns).

11. Lastly, as we explain in Section VI below, railroads' ability to raise capital for specific projects is not informative about whether the railroads are earning an economic return sufficient to attract the capital needed to invest and maintain their systems in the long-run. That is why comparing the railroads' financial performance to that of other firms with which the railroads compete for capital is a reasonable method for understanding whether railroads are earning sufficient returns to attract the capital needed to invest and maintain their systems in the long-run.

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<sup>21</sup> We do not claim that railroads should be free of all regulation. As we explained in the *Murphy & Zmijewski V.S.*, ¶ 84, noncompetitive rates charged to individual captive shippers on particular shipments should be evaluated using other STB tools for rate evaluation.

<sup>22</sup> See *Murphy & Zmijewski V.S.*, ¶ 25.

**V. TREATMENT OF DEFERRED TAXES HAS NO EFFECT ON THE CONCLUSIONS FROM THE PROPOSED BENCHMARKING METHODOLOGY**

12. The WCTL Reply argues that there is no need to change the treatment of deferred tax liabilities.<sup>23</sup> However, contrary to WCTL's claims, treatment of deferred taxes in our proposed benchmarking methodology is neither arbitrary nor result oriented.

13. As we discuss in the *Murphy & Zmijewski V.S.*, well-regarded economic studies published over decades have shown that limitations and inaccuracies of accounting-based rates of return make them uninformative for evaluating economic rates of return.<sup>24</sup> Our proposed adjustments for deferred taxes – one to the STB ROIC numerator and the other to the STB ROIC denominator – are intended to mitigate these inaccuracies and align accounting-based rates of return more closely to the basic economic principles underpinning economic rates of return. The adjustment to the STB ROIC numerator is made to eliminate the effect of deferred income taxes in the Provision of Income Taxes and thus align the company's operating income with the economic concept used in measuring a company's economic profit.<sup>25</sup> The adjustment to the STB ROIC denominator is made to eliminate the effect of Deferred Tax Liabilities in the calculation of the Net Investment Base, an adjustment consistent with the basic concept of economic depreciation.<sup>26</sup>

14. Our fundamental conclusions do not depend on whether the STB adopts our recommended changes in the treatment of deferred taxes, however. For example, the average

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<sup>23</sup> WCTL Reply, pp. 14-21.

<sup>24</sup> *Murphy & Zmijewski V.S.*, ¶11.

<sup>25</sup> *Murphy & Zmijewski V.S.*, ¶57.

<sup>26</sup> *Murphy & Zmijewski V.S.*, ¶58. IRS rules for depreciation (and other items resulting in deferred tax liabilities) are not intended, and do not purport, to be better estimates of economic depreciation and other types of expenses.

2006-2019 rank of the STB's ROIC minus COC for the railroad industry relative to the S&P 500 benchmarking group (without the deferred tax adjustment) is the 15<sup>th</sup> percentile,<sup>27</sup> and it is the 14<sup>th</sup> percentile if we use the Adjusted ROIC (that reflects the deferred tax adjustments) instead.<sup>28</sup> Our conclusions similarly are unaffected for individual railroads<sup>29</sup> and the choice of the benchmarking sample (i.e. S&P 500 Industrials and S&P 500 Railroad Customers).<sup>30</sup>

## **VI. EXAMPLE ILLUSTRATING ERRORS IN THE WCTL AND JOINT SHIPPERS REPLIES DISCUSSED ABOVE**

15. In this section, we present an example using a simplified economic model for a railroad to illustrate three basic well-known economic principles:

- Observing a railroad making incremental investments that have expected economic returns greater than its cost of capital is not informative about whether the railroad's expected economic return on its *total* invested capital exceeds its cost of capital;
- Observing investors' actual returns from investing in railroads (which range from being very large to very negative) is not informative about whether the railroad's expected economic return on its total invested capital exceeds its cost of capital;

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<sup>27</sup> Murphy & Zmijewski V.S., Table 1.

<sup>28</sup> Murphy & Zmijewski V.S., Table 4.

<sup>29</sup> Murphy & Zmijewski V.S., Tables 1 and 4. BNSF Railway, CSX Corporation, and Grand Trunk Corporation ranked, on average, at the 15<sup>th</sup>, 12<sup>th</sup>, and 10<sup>th</sup> percentiles in terms of their relative performance using either ROIC or Adjusted ROIC. The Kansas City Southern's and Soo Line Corporation's relative performance is higher under the Adjusted ROIC metric (11<sup>th</sup> and 14<sup>th</sup> percentiles) and lower under the ROIC metric (9<sup>th</sup> and 13<sup>th</sup> percentiles), respectively. The opposite is true for the Norfolk Southern Corporation and Union Pacific; their relative performance is higher under the ROIC metric (15<sup>th</sup> and 20<sup>th</sup> percentiles) and lower under the Adjusted ROIC metric (13<sup>th</sup> and 19<sup>th</sup> percentiles), respectively.

<sup>30</sup> Murphy & Zmijewski V.S., Tables 2 and 5 (S&P 500 Industrials) and Tables 3 and 6 (S&P 500 Railroad Customers).

- Observing a railroad making distributions to its investors (such as paying dividends or buying back shares) is not informative about whether the railroad's expected economic return on its total invested capital exceeds its cost of capital.

**a. Initial Investment and Initial Expected Financial Performance**

16. Assume a railroad makes an initial investment to build its railroad, and that the railroad expects to earn an economic return on that investment equal to the railroad's cost of capital.

Specifically, assume that, at the beginning of Year 1, the railroad invests \$500 million to build its (only) railroad, which has a risk-adjusted cost of capital of 10%, and is expected to generate annual cash flows of \$50 million to investors.<sup>31</sup> As long as the annual expected economic return on the railroad's total invested capital continues to equal its cost of capital of 10% ( $\$50 / \$500$ ), the railroad will replace its long-lived assets at the end of their useful lives and the value of the railroad will remain at \$500 million ( $\$50 / 0.10$ ).

17. The \$50 million annual expected cash flow already includes a deduction for all investments that have an expected economic return at least equal to the cost of capital.

Therefore, the railroad will distribute \$50 million annually to its investors.<sup>32</sup> If it did not, but instead used the \$50 million for additional investments with an expected economic return below the cost of capital, the value of the railroad will decline until the expected economic return on the investment based on the railroad's suboptimal investment behavior is equal to the cost of capital,

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<sup>31</sup> Cash flows are those generated from the business operations, net of any required investment to maintain productive capacity as well as other investment opportunities that have an expected economic return of at least the cost of capital (often called free cash flows). To simplify the example, we assume cash flows to continue in perpetuity with no specific price level or general price level changes. We also assume all railroad assets and investments have the same cost of capital, which does not change in the example.

<sup>32</sup> A basic economic principle in corporate finance is that, ignoring income taxes and other transaction costs and assuming all else equal, a company should reinvest internally generated capital if it has investment opportunities with an expected economic return at least equal to the cost of capital and distribute any additional internally generated capital to its investors (for example, pay dividends or repurchase stock).

imposing a loss on investors. By distributing the \$50 million cash flow to investors, their expected return equals the cost of capital, but it is not informative about whether the railroad's expected economic return on its total invested capital is greater than its cost of capital.

**b. Decline in Expected Financial Performance**

18. To illustrate the effect of declining financial performance, we assume that, after one year of operation (as of the beginning of Year 2), the railroad's expected financial performance declines such that its expected economic return is less than the railroad's cost of capital. Specifically, by the beginning of Year 2, the railroad's expected annual cash flows decline from \$50 million to \$30 million. Given this decline, the railroad's expected economic return on total invested capital declines from 10% to 6% ( $\$30 / \$500$ ), and the value of the railroad falls from \$500 million to \$300 million ( $\$30 / 0.10$ ) or by 40%. The railroad will not replace its long-lived assets at the end of their useful lives now that the expected economic return on its total invested capital is less than its cost of capital.<sup>33</sup>

19. Investors who owned the railroad before the decline in expected financial performance incurred a loss of \$200 million (\$500 million – \$300 million) or 40%. The actual (observed) return to the investors of -40% is not informative about whether the railroad's expected economic return on its total invested capital exceeds its cost of capital, because the investors' actual return is based on the *changes* in the railroad's expected financial performance and not the *level* of its expected financial performance.

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<sup>33</sup> Naturally, because the railroad will no longer replace its long-lived assets at the end of their useful lives, the value of the railroad would fall below \$300 million and the railroad's expected economic return would fall below 6%, depending on the useful economic lives of the long-lived assets. We ignore this additional effect throughout this example to simplify the calculations and discussion, which has no effect on the conclusions provided by the example.

20. Because market prices adjust, new investors who purchased the railroad from the old investors for \$300 million expect to earn a 10% return on their investment ( $\$30 / \$300$ ), which is equal to the cost of capital, even though the railroad's expected economic return is only 6% ( $\$30 / \$500$ ) on its initial investment. Again, even though the railroad's expected economic return on its total invested capital is less than its cost of capital, investors still expect the railroad to distribute its annual cash flow of \$30 million. Making distributions of \$30 million annually is required so that the expected return to investors is equal to the cost of capital, but again it is not informative about whether the railroad's expected economic return on its total invested capital is greater than its cost of capital.

**c. Partial Recovery Expected Financial Performance**

21. To illustrate the effect of a partial recovery of the railroad's financial performance, we assume that, by the beginning of Year 3, the railroad improved its operations (for example, eliminate certain bottlenecks) by making an incremental investment that allowed the railroad to partially recover from the decline in its expected performance that occurred in Year 2. Specifically, as of the beginning of Year 3, as the result of the incremental investment, the railroad now expects to generate annual cash flows of \$40 million (net of the incremental investment) instead of \$30 million each year. The railroad's expected economic return on its total invested capital increases from 6% to 8% ( $\$40 / \$500$ ), and the value of the railroad increases from \$300 million to \$400 million ( $\$40 / 0.10$ ).

22. The railroad would only make such an incremental investment if the expected economic return on the incremental investment is at least equal the cost of capital. This incremental investment that improved the railroad's operations increased its expected cash flows and value by 33% ( $\$40/\$30 - 1$  and  $\$400 / \$300 - 1$ , respectively), substantially more than the railroad's

cost of capital of 10%. Thus, observing that the railroad made the incremental investment is evidence that the expected economic return on that investment exceeds the railroad's cost of capital, but tells us nothing about whether the railroad's expected economic return on its total invested capital is greater than its cost of capital. While the incremental investment improved the railroad's expected economic return on its total invested capital from 6% to 8%, its expected economic return on its total invested capital remains below its cost of capital of 10%.

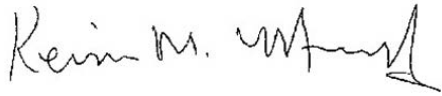
23. The partial recovery case illustrates the same points illustrated in the Decline in Financial Performance case. First, even though the railroad's operations partially recovered, the railroad will not replace its long-lived assets at the end of their useful lives because the railroad's expected economic return on its total invested capital is less than its cost of capital. Second, even though the value of the railroad increased in Year 3 relative to Year 2 by 33%, the actual (observed) return to the investors of 33% is not informative about whether the railroad's expected economic return on its total invested capital is greater than its cost of capital.<sup>34</sup> Third, if the railroad does not make the expected distribution (\$40 in our example) but invests in suboptimal investments, investors will incur a loss and the value of the railroad will decline until the expected economic return on the investment based on the railroad's suboptimal investment behavior is equal to the cost of capital.

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<sup>34</sup> Another example of an incremental investment is replacing the railroad's long-lived asset that was destroyed early in its economic life so that the railroad can maintain its productive capacity. For example, assume a section of the railroad (tracks, bridges, etc.) was destroyed by an unexpected event (storm, earthquake, etc.) very early in its economic life, and that this section of the railroad was required for any part of the railroad to operate. Assume that if the railroad does not replace that section, the railroad's expected economic return on its total invested capital decreases to 0% because it will no longer operate, but if the railroad replaces that section, the railroad's expected economic return on its total invested capital would continue at 6%, decreased by the cost of the investment which we are assuming is relatively small. Naturally, the railroad will replace that section to continue to operate. But, again, making that incremental investment is not informative about the railroad's expected economic return on its total invested capital or whether the railroad's expected economic return on its total invested capital is greater than its cost of capital.

**VERIFICATION**

I, Kevin M. Murphy, declare under penalty of perjury that the foregoing is true and correct. Further, I certify that I am qualified and authorized to file this Verified Statement.

A handwritten signature in cursive script, appearing to read "Kevin M. Murphy".

Kevin M. Murphy

I, Mark E. Zmijewski, declare under penalty of perjury that the foregoing is true and correct. Further, I certify that I am qualified and authorized to file this Verified Statement.

A handwritten signature in cursive script, appearing to read "Mark E. Zmijewski".

Mark E. Zmijewski