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**BEFORE THE
SURFACE TRANSPORTATION BOARD
Docket No. EP 664 (Sub No. 2)**

PETITION OF THE WESTERN COAL TRAFFIC LEAGUE TO INSTITUTE A
RULEMAKING PROCEEDING TO ABOLISH THE USE OF THE MULTI-STAGE
DISCOUNTED CASH FLOW MODEL IN DETERMINING THE RAILROAD
INDUSTRY'S COST OF EQUITY CAPITAL

**REPLY COMMENTS OF THE
ASSOCIATION OF AMERICAN RAILROADS**

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Pursuant to the procedural schedule established by the Board in its decision served on June 16, 2014, the Association of American Railroads ("AAR") submits its reply comments in the above-referenced proceeding.¹

For the reasons stated herein, in the supporting reply verified statement of Dr. Bente Villadsen, and the AAR Opening Comments, the Board should deny the petition of the Western Coal Traffic League ("WCTL") to abolish the use of the multi-stage discounted cash flow model ("MSDCF") in the Board's annual determinations of the railroad industry's cost of capital. Neither WCTL nor any of the other shipper-participants has submitted the "compelling evidence" required before the Board will change the current methodology.²

¹ The AAR submitted its opening comments in this proceeding on September 5, 2014. *See* Opening Comments of the Association Railroads, filed September 5, 2014 ("AAR Opening Comments").

² *Cost of Capital – 2005*, Ex Parte No. 558 (Sub-No. 9), Decision served February 12, 2007, at 4 (requiring showing of "compelling evidence" that longstanding methodology is flawed before Board will change that methodology).

INTRODUCTION

WCTL criticizes both the MSDCF and the Board's application of the Capital Asset Pricing Model ("CAPM"). It argues that the MSDCF model is flawed and disfavored by finance professionals and that the agency should use only a single model, CAPM, to estimate the cost of equity ("COE"). But WCTL argues that the Board's CAPM is also out of step with best practices, largely because it incorporates a Market Risk Premium ("MRP") that exceeds the "reasonable" value of 5%.

Yet contemporaneously, WCTL's own members have taken conflicting positions before their state Public Utility Commissions ("PUCs"). There, they have extolled the virtues of DCF models and have warned against relying on a single model to estimate the COE. They have advocated MRPs well above the level that WCTL denounces in this proceeding as unreasonably high. And they have claimed that the CAPM is currently understating the cost of equity due to the government's intervention in the debt markets to artificially lower long-term interest rates. WCTL is entitled to be inconsistent if circumstances have changed, or if best finance practices have shifted in some meaningful way. But that is not the case here.

There is *overwhelming* evidence that the modern practice in regulatory settings is to use multiple techniques to estimate the cost of equity. In the words of WCTL's own member, Minnesota Power, "[a]uthoritative financial literature strongly supports the use of multiple methods."³ The Wireline Competition Bureau of

³ Direct Testimony of Roger A. Morin on behalf of Minnesota Power in Minnesota PUC Docket No. E-015/GR-08-415, *In the Matter of the Application of ALLETE, Inc., d/b/a Minnesota Power, For Authority To Increase Rates for Electric Utility Service in Minnesota*, dated May 2, 2008, at 22 (emphasis added) ("Minnesota Power Testimony").

the Federal Communications Commission (“FCC Staff Report”) released a report on May 16, 2013 canvassing the literature.⁴ This FCC Staff Report (at 7147) explains why using multiple models is preferred:

As the cost of capital reflects the uncertain expectations of investors, there is the potential for introducing significant errors into the estimates, and no single methodology can be counted on exclusively to provide a precise estimate of the cost of equity. Each methodology has conceptual shortcomings, requires the use of informed judgment, and involves measurement error.

WCTL also argues that CAPM is systematically overstating the true cost of equity because the STB is using an unreasonably high estimate of the MRP. But it is undeniable that the precise MRP is unknowable and undetectable. This observation was made in the following story told by Professor Merton Miller – a giant in the field of financial economics – about the ribbing he endured while accepting the Nobel Prize in Economics in Stockholm:

I still remember the teasing we financial economists – Harry Markowitz, William Sharpe, and I – had to put up with from the physicists and chemists in Stockholm when we conceded that the basic unit of our research, the expected rate of return, was not actually observable. I tried to tease back by reminding them of their neutrino -- a particle with no mass whose presence was inferred only as a missing residual from the interactions of other particles. But that was eight years ago. In the meantime, the neutrino has been detected.⁵

However, there is a recent body of research that suggests that the MRP is at an all time historical high. As discussed below, reputable commercial vendors

⁴ *In the Matter of Connect America Fund*, Wireline Competition Staff Report, 2013 WL 2146005, 28 FCC Rcd. 7123 (2013) (“FCC Staff Report”).

⁵ Merton Miller, *The History of Finance: An Eyewitness Account*, 13 J. Applied Corp. Finance 2 (2000), at 13.

report MRP using forward-looking techniques that are well above the figure used by the STB. And a recent report by two economists from the Federal Reserve surveyed over 20 different models and 100 economic variables and concluded that the current MRP has been steadily rising to an all-time high. Given the unknowable and unobservable nature of the precise MRP, and with findings from reputable experts that the MRP may have reached an all time high, the Board should reject WCTL's assertion that the MRP cannot exceed 5%. It bears repeating that in proceedings before their own state PUCs, WCTL members have advocated for a MRP that equals or exceeds the estimate used by the STB.

In the end, the AAR submits that no party has justified abandoning the MSDCF or modifying the CAPM used by the STB. **Section I** below reviews the evidence in support of using multiple models and explains why WCTL's arguments for abandoning the MSDCF are baseless. **Section II** demonstrates that the MRP estimate used by the STB is reasonable and that there is no reason to make ad hoc adjustments to beta due to unsupported claims that betas are rising because of alleged increases in market power. **Section III** explains that there would be negative consequences in shifting the regulatory landscape, particularly now. Given the long life of railroad investments, stability in how the agency estimates the cost of capital for the railroad industry will encourage greater capital investment to satisfy the Nation's demand for more private investment by the industry. In turn, more capital investment will help improve service, safety, and network agility.

I. THERE IS NO BASIS FOR ABANDONING THE USE OF THE MORNINGSTAR IBBOTSON MSDCF MODEL.

Five years ago, the Board completed a long and exhaustive journey to find a suitable way to estimate the cost of equity for the railroad industry. At the end

of its quest, the agency concluded that “if our exploration of this issue has revealed nothing else, it has shown that there is no single simple or correct way to estimate the cost of equity for the railroad industry, and countless reasonable options are available.”⁶ The agency chose to follow the best practice of using multiple models, averaging the estimates produced by the CAPM and the Morningstar / Ibbotson MSDCF model. The STB reasoned that “a simple average of the two results will produce the best estimate of the rail industry’s cost of equity that will aid us in performing a variety of regulatory responsibilities.”⁷

The STB has set a high bar for any party seeking to modify the method used to estimate the cost of capital. Understanding that “switching our methodology will have a widespread impact on the industry,”⁸ the STB has properly cautioned that it will not depart from its established approach unless a party “presents compelling evidence that it is flawed.”⁹

No party has met this demanding standard. Indeed, no party has offered any persuasive basis for discarding the MSDCF or modifying the CAPM. Most of WCTL’s arguments, for example, are a rehash of arguments that it made – unsuccessfully – five and even seven years ago in the Ex Parte No. 664 proceeding and other Board proceedings. The Board ruled correctly in those proceedings, and those holdings remain valid today.

⁶ *Use of a Multi-Stage Discounted Cash Flow Model in Determining the Railroad Industry’s Cost of Capital*, Ex Parte No. 664 (Sub-No. 1), slip op. at 15 (released Jan. 28, 2009) (“MSDCF Decision”).

⁷ *MSDCF Decision* at 15.

⁸ *Railroad Cost of Capital – 2005*, Ex Parte No. 558, Decision served February 9, 2007, at 5.

⁹ *Id.* at 4; *see also* Ex Parte No. 558 (Sub-No. 9), Decision served September 15, 2006, at 7 (same).

A. The Best Practice Is to Use Multiple Models.

WCTL argues that the use of CAPM exclusively will “better reflect standard practices within the financial community” and that CAPM is “vastly preferred to other COE approaches.” WCTL Opening Comments at 4-5, 20. In reality, however, many regulators use multiple models, including single-stage and multi-stage DCF models. A report issued last year by the Wireline Competition Bureau Staff of the Federal Communications Commission (“FCC”) found that “[o]utside of the regulatory context, CAPM is the most widely used model for determining the cost of equity. *DCF is the [model] most widely used in regulation.*” See FCC Staff Report at 7148 (emphasis added).

Various federal regulatory agencies use a single-stage or multi-stage DCF model in conjunction with other models. For example, the FCC Staff Report used both the DCF and the CAPM “because both models have different limitations.” *Id.* at 7146, 7148.¹⁰ Similarly, FERC has used a DCF model in its rate determinations for the natural gas and oil pipeline industries, while using other models as a “check.”¹¹ In June 2014, FERC decided to use the same model for the electric industry. See *Coakley v. Bangor Hydro-Electric Co.*, Opinion No. 531, 147 FERC ¶ 61,234, at PP 8, 13-42 (2014). FERC stated that because of “anomalous” capital market conditions, it would consider other models, including the CAPM, “to inform the just and reasonable placement of the ROE.” *Id.* at PP 145-147

¹⁰ The FCC Report was prepared to assist the FCC in prescribing a new rate of return for incumbent local exchange carriers on specified investment in plant that is used and useful in the efficient provision of telecommunications services.

¹¹ See, e.g., *Distrigas of Mass. Corp.*, 41 FERC ¶ 61,205, at 61,550 (1987) (endorsing DCF methodology, but stating that DCF “is but one analytical tool,” and weight to be given each methodology rests on accuracy and sensibleness of judgmental inputs and factors used by witnesses).

(noting that other models, including CAPM, produced a median ROE *higher* than the midpoint of the DCF analysis).

Many State regulatory commissions use the single-stage or multi-stage of the DCF model either in combination with CAPM or as the sole model in their calculation of the cost of equity.¹² Regulatory agencies outside the United States also use multiple models. Although WCTL selectively quotes the 2011 decision of the Canadian Transportation Agency (“CTA”) to reject the MSDCF (after years of using multiple models) and to rely only on CAPM (WCTL Opening Comments at 5-6), it ignores the fact that the Alberta Utilities Commission and the Ontario Energy Board all use more than one model, including CAPM and DCF. Brattle Group, *Review of Regulatory Cost of Capital Methodologies* (September 2010) at 95-97.¹³

¹² See, e.g., Villadsen Opening V.S., App.A., *MidAmerican Energy Co.*, 2014 WL 1117641, at *11 (Iowa Utilities Board considered both DCF and CAPM, although “[h]istorically, the Board has not given much weight to any CAPM analysis because there were concerns about its reliability”); *In the Matter of the Application of Rio Rico Utilities, Inc.*, 2013 Ariz. PUC LEXIS 188, at *89 (Ariz. P.U.C. 2013) (using both CAPM and DCF); *Aquarion Water Co. of New Hampshire, Inc.*, 2013 WL 3756507 (N.H.P.U.C. 2013), at *11 (finding that “the DCF results are well supported and documented in this proceeding and that the CAPM results provide little additional value”); *The Peoples Gas Light and Coke Co.*, 2012 WL 681749 (Ill. C.C. 2012), at 101 (“we rely on multiple models to determine the cost [of] equity”); *Application of the Connecticut Light & Power Co.*, 2010 WL 2648016 (Conn. D.P.U.C 2010), at 90 (agency “conducted its own cost of equity analysis using both DCF and CAPM methodologies”); *Kansas City Power & Light Co.*, 2010 WL 5865979 (Kan. S.C.C. 2010), at 19 (“Using both CAPM and DCF generates an analysis that encompasses the current economic climate”); *Pennsylvania Public Utility Commission v. Columbia Water Co.*, 2009 WL 1708836 (Pa. P.U.C. 2009), at 38 (relying on DCF “and informed judgment,” while also consulting CAPM, CE and RP analyses performed by parties); *Entergy Arkansas, Inc. v. Arkansas Public Service Commission*, 104 Ark.App.147, 166, 289 S.W.3d 513, 528 (2008) (PSC relies primarily on DCF method).

¹³ WCTL cites a statement from The Brattle Group report (quoted in the CTA’s decision) to support its argument that the MSDCF is unreliable when it employs a limited number of growth estimates with a substantial divergence. WCTL Opening Comments at 16. However, as the Board previously found with respect to another statement from The Brattle Group report quoted in the CTA decision, “it appears that the Brattle Group is

Indeed, in various regulatory proceedings Edison Electric Institute (“EEI”) and WCTL’s own members have endorsed the use of multiple models, and use of a DCF model specifically. In a FERC proceeding, EEI stated that “dependence on a single, mechanical approach heightens the risk that the evidence considered by the Commission will not reflect realities in the capital markets accurately. The DCF methodology is a useful tool in estimating investors’ requirements, but there is no ‘perfect’ method to calculate a fair and reasonable ROE.” EEI, *Transmission Investment*, *supra*, at 12. Other members of WCTL have endorsed multiple models and/or the use of a DCF model in the return on equity calculation in State proceedings.¹⁴ Here are some examples of WCTL’s own members cautioning against of the dangers of relying on a single model to estimate the cost of equity:

- *Wisconsin Public Service Corporation* (2014): “It is essential that the Commission employ a variety of techniques to measure the Company’s cost of equity because of the limitations/infirmities that are inherent in each method.” WPSC elaborated that “In general, the use of more than one method provides a superior foundation to

referring to a single-stage DCF model, rather than a multi-stage model.” *Railroad Cost of Capital – 2011*, Ex Parte No. 558 (Sub-No. 15), 2012 WL 4038890, at *10 n.84 (served Sept. 13, 2012). *See also* Villadsen Reply V.S. at 10-11.

¹⁴ *See, e.g.*, Direct Testimony of Ann E. Bulkey, Northern States Power Company, filed June 23, 2014, in South Dakota PUC Docket No. EL14-058, *In the Matter of the Application of Northern States Power Co. d/b/a Excel Energy For Authority To Increase Rates For Electric Service in South Dakota*, (“Northern States Power Testimony”) at 6 (“it is common to consider several models in determining the Cost of Equity”); *id.* at 26 (“I use multiple models to estimate the cost of equity”); *id.* at 29 (“DCF models are widely used in regulatory proceedings and have sound theoretical bases”); *id.* at 32 (“the three-stage [MSDCF] model allows for a gradual transition from the first stage growth rate to the long-term growth rate, thereby avoiding the often unrealistic assumption that growth will change abruptly between the first and final stages”); *MidAmerican Energy Co.*, *supra*, 2014 WL 1117641 at *11 (MidAmerican submitted both DCF and CAPM models); *Kansas City Power & Light Co.*, 2012 WL 7018090 (Kan. S.C.C. 2012), at 4 (KCP&L’s ROE witness based his recommendation on DCF model). If the Board desires copies of the testimony of the various witnesses in State proceedings cited in these Reply Comments, the AAR will provide them.

arrive at the cost of equity. At any point in time, any single method can provide an incomplete measure of the cost of equity. This concern is particularly apparent during periods, such as the recent past, where artificially low interest rates have a distortive influence on the results of some models of the cost of equity.”¹⁵

- *CLECO Corporation* (2008): CLECO advocated that different methods be used as “each [method] will complement the others and will provide a result that will alleviate the unavoidable shortcomings found in each method.”¹⁶
- *Ameren* (2014): Expert witness Robert Hevert on behalf of Ameren cautioned that “Both practitioners and academics, however, recognize that financial models simply are tools to be used in the ROE estimation process, and that strict adherence to any single approach, or to the specific results of any single approach, can lead to flawed or misleading conclusions.”¹⁷
- *Minnesota Power* (2008): Expert witness Roger Morin argued that it is “extremely dangerous to rely on only one generic methodology to estimate equity costs. The difficulty is compounded when only one variant of that methodology is employed.”¹⁸ He explained that “Each methodology has its own way of examining investor behavior, its own premises, and its own set of simplifications of reality. Investors do not necessarily subscribe to any one method, nor does the stock price reflect the application of any one single method by the price-setting investor. Absent any hard evidence as to which method outperforms the other, all relevant evidence should be used, without discounting the value of any results, in order to minimize judgmental error, measurement error, and

¹⁵ Direct Testimony of Paul R. Moul on behalf of Wisconsin Public Service Corporation in Wisconsin PSC Docket No. 6690-UR-123, *Application of Wisconsin Public Service Corporation For Authority To Adjust Electric and Natural Gas Rates*, dated April 1, 2014, (“Moul WPS Testimony”), at 5, 40.

¹⁶ Direct Testimony of Paul R. Moul on behalf of CLECO Power LLC in Louisiana PSC Docket No. U-30689 Vol 2, *Application of CLECO Power LLC*, dated July 14, 2008, (“Moul Cleco Testimony”), at 57-58.

¹⁷ Direct Testimony of Robert B. Hevert on behalf of Union Electric Company d/b/a Ameren Missouri in Missouri PSC File No. ER-2014-0258, dated July 3, 2014, at 7 (“Ameren Testimony”).

¹⁸ Minnesota Power Testimony at 19.

conceptual infirmities.”¹⁹ According to Morin, “*Authoritative financial literature strongly supports the use of multiple methods.*”²⁰

B. WCTL’s Criticisms of the MSDCF Are Baseless.

Notwithstanding that the authoritative financial literature strongly supports the use of multiple models,²¹ WCTL urges the STB to abandon the use of any MSDCF model. WCTL asserts that (1) the MSDCF overstates the cost of equity; (2) stock repurchases distort the application of the MSDCF; (3) there is no smooth transition in growth rates from the first stage to the third stage of the MSDCF; (4) the MSDCF lacks a smooth transition in cash flows in the third stage; and (5) the MSCDF suffers from “circularity problems.” WCTL Opening Comments at 8-30. AAR already showed in its opening comments that the first four arguments do not justify abandoning MSDCF. The circularity argument is baseless.

1. The MSDCF Does Not “Overstate” the Cost of Equity.

WCTL’s principal criticism of the MSDCF is that it “has caused overstatement in the COE” and that its “values are too high.” WCTL Opening Comments at 8-13. WCTL’s argument, however, is based on the erroneous assumption that the CAPM calculates the precise, “correct” cost of equity. AAR showed in its opening comments that the cost of equity as estimated by the CAPM has been downward biased due to extremely low interest rates. Villadsen Opening V.S. at 21-25. As was explained recently by Professor Myers,

Costs of equity derived from multi-stage dividend discount models are particularly useful now. With extremely low current interest rates, routine applications of the CAPM,

¹⁹ *Id.* at 21-22.

²⁰ *Id.* at 22 (emphasis added).

²¹ Villadsen Opening V.S. at 4-8.

which use “normal” equity risk premiums, can now yield cost of equity estimates that seem unreasonably low.²²

WCTL’s rosy endorsement of CAPM is not shared by some of WCTL’s own members. As noted above, WTCL’s own members caution that it is dangerous to rely on only one generic methodology to estimate equity costs. Moreover, in 2012 on behalf of KCP&L, expert witness Samuel Hadaway stated that he did not use CAPM in his ROE estimates because it would understate the true value. Specifically, he states that “the government’s continuing intervention in the debt markets has created artificially low long-term interest rates and the recent sharp decline in interest rates has created risk premium ROE estimates that are not consistent with observed equity market turmoil.”²³ KCP&L and Dr. Villadsen are on the same page. Dr. Villadsen echoed the same concerns about artificially low interest rates in her opening statement. KCP&L later criticized the CAPM model as producing unreasonably low result:

The risk-free rate, R_f , is understated because, due to governmental credit market policies and investors’ increased risk aversion, the U.S. Treasury rates used for R_f are artificially low. The second input, the expected market risk premium $[E(R_m) - R_f]$, when based on historical data, may also be understated because such data cannot reflect the heightened investor risk aversion that has resulted from the financial crisis.²⁴

²² See Villadsen Opening V.S. at 22 (quoting Myers AER Report at 8).

²³ Direct Testimony of Samuel Hadaway on behalf of KCP&L Greater Missouri Operations Company, in Missouri PSC Case No. ER-2012-0175, at 5, dated February 27, 2012, (“KCPL Testimony”). See also Northern States Power Testimony at 41 (“It is important to recognize both academic literature and market evidence indicating that the equity risk premium ... is inversely related to the level of interest rates. That is, as interest rates increase (decrease), the equity risk premium decreases (increases)”).

²⁴ KCPL Testimony at 34-35.

Furthermore, the fact that the estimates from the MSDCF model are higher than those generated by CAPM does not show that the MSDCF is flawed. The MSDCF and CAPM are separate models, each of which is independent of the other and takes different approaches to estimating the same elusive figure. Villadsen Opening V.S. at 10-11, 20-21. Thus, one would expect the results of the two models to be different.²⁵

The Board recognized that the MSDCF and CAPM are *expected* to diverge from each other. In the Arizona Electric Power Cooperative (“AEPCO”) rate case, AEPCO argued that the MSDCF resulted in an unreasonably high COE because it exceeded the estimate produced by the CAPM. The Board properly dismissed this argument: “Whereas AEPCO contends that the MSDCF results in a cost of equity that is too high when compared to CAPM, it is just as likely that CAPM results in a cost of equity that is too low.” *Ariz. Electric Power Cooperative, Inc. v. BNSF Ry. Co.*, Docket No. 42113, Decision served November 22, 2011, at 137 (“AEPCO”), *petitions for review denied sub nom. BNSF Ry. Co. v. STB*, 748 F.3d 1295 (D.C. Cir. 2014).²⁶

It is precisely because results can and do vary from model to model that agencies have used different models to measure the cost of equity. Thus, in

²⁵ Cf. EEL, *Transmission Investment*, at 14 “[L]ow and high DCF values are independent estimates, and the fact that one is considered to be an outlier does not compromise the remaining estimate, as the two methods are independent of each other”).

²⁶ WCTL acknowledges the holding of *AEPCO*, but contends that “[c]onfirming that MSDCF values are too high, and that the CAPM values are not too low, is not difficult,” relying on a valuation analyses by Goldman Sachs. WCTL Opening Comments at 10-14. As discussed by Dr. Villadsen, WCTL is comparing apples to oranges. The figure used by Goldman Sachs is an *after-tax* cost of capital, while the figure used by the STB is an “unlevered” cost of capital—a weighted average of the *pre-tax* cost of debt and the *after-tax* cost of equity. Dr. Villadsen shows that after correcting for these differences, the Goldman Sachs figures validate the Board’s findings. Villadsen Reply V.S. at 42-48.

AEPCO, the Board stated that it “recognize[d] that, for some years, there can be a difference between the figures derived under CAPM and MSDCF, but that is in part why we decided to average the two figures, to smooth out the fluctuations.... We use an averaging method to diminish the chances that one model’s result for a cost of equity is either too high or too low.” *AEPCO* at 137

2. Stock Repurchases Do Not Produce an Overstated Cost of Equity.

Contrary to WCTL’s argument, railroad stock repurchases do not “distort [the MSDCF’s] application by creating a mismatch between even accurate projections of growth in earnings per share and future firm-wide earnings and cashflows.” *See* WCTL Opening Comments at 5, 23-24. The Board properly rejected this argument in 2008, and it should do so again. *MSDCF Decision* at 12. As Dr. Villadsen has already explained, because the Morningstar Ibbotson MSDCF model does not include distributions to shareholders through stock repurchases (which pulls distributions to shareholders forward in time), it understates the cash that is actually available to shareholders in early years – and, therefore, is likely to understate, not overstate, the cost of equity. *See* AAR Opening Comments at 34; Villadsen Opening V.S. at 14.

3. The MSDCF Provides a Reasonable Transition In Growth Rates From the First to the Third Stage.

WCTL repeats the argument, made in its Petition for a Declaratory Order, that the second stage of the Morningstar Ibbotson MSDCF fails to provide a “smooth transition” in growth rates from the first stage to the third stage, but instead produces an “abrupt reduction” in growth rates in the third stage. WCTL Opening Comments at 22-23. As AAR has shown, however, the assumptions and growth rates – including the assumption that growth rates in the third stage will

standardize around the growth rate for the economy – are reasonable. *See* AAR Opening Comments at 35.

4. The Third Stage of the MSDCF Achieves a Reasonable Transition In Cash Flows.

WCTL's concerns surrounding the increase in cash flows in the third stage are misplaced. *See* WCTL Opening Comments at 23. The jump in cash flows in the final period is due to reasonable assumptions about the level of capital expenditures that the railroad industry will make in the long term. In the first two stages, the model defines free cash flow as earnings before extraordinary items, minus CapEx in excess of depreciation, plus deferred taxes. In the steady-state period, however, the model assumes that CapEx will consist only of maintenance capital (no growth capital), so that CapEx and depreciation are equal. Further, because deferred taxes are linked to CapEx, this amount is expected to disappear as CapEx approaches maintenance levels in the long term steady-state equilibrium, and that the adjustment to earnings before taxes (depreciation minus CapEx plus deferred taxes) will approach zero in the long term. Therefore, the Morningstar/Ibbotson MSDCF implicitly assumes a steady state for *both* growth and cash flow generation. AAR Opening Comments at 35-36.

5. The Board Should Again Reject WCTL's "Circularity" Argument.

WCTL argues that the MSDCF suffers from "circularity problems" because the purportedly high COE enables the railroads to raise their rates, and these rate increases result in projections of high earnings that "drive" the MSDCF COE. WCTL Opening Comments at 25-30. The Board, however, has previously

rejected this “fatal circularity” argument in at least *four decisions*. WCTL offers no basis for changing that result.

The Board rejected WCTL’s circularity argument in the *MSDCF Decision*, finding that (1) because only a fraction of railroad traffic is subject to STB rate review, the growth rates in the model “are driven more by market forces than regulatory concerns”; (2) “growth is not driven solely by rates, but can be driven by volume and productivity”; (3) any relationship between the COE determination and the returns that railroads may earn on regulated traffic is so small that it would not create a “circularity” problem; and (4) WCTL’s argument was inconsistent with its earlier position regarding growth rates. *MSDCF Decision* at 9-10.

In July 2013, the Board again rejected WCTL’s circularity argument, relying on the *MSDCF Decision*. See *Western Coal Traffic League – Petition For Declaratory Order*, Finance Docket 35506, at 18 (served July 25, 2013). The Board noted WCTL’s admission that the Board had previously held “that circularity is not a concern in the existing regulatory structure for railroads, because most rail rates are not subject to regulation.” *Id.* at 18. The Board further noted two other decisions of the ICC and the Board had “rejected the claim that the agency’s rate regulation policies are tainted by circularity.” *Id.* ²⁷

²⁷ In addition to its *MSDCF Decision*, the Board cited the ICC’s decision in *Railroad Revenue Adequacy – 1988 Determination*, 6 I.C.C.2d 933, 938-939 (1990), *aff’d sub nom. Assn. of American Railroads v. ICC*, 978 F.2d 737 (D.C. Cir. 1992), where “the ICC determined that circularity was not a problem in railroad regulation, because a large share of revenues was determined by competitive markets and not by regulation,” and the Board’s decision in *CSX Corp. – Control – Conrail, Inc.*, 3 S.T.B. 196, 262 (1998), *aff’d sub nom. Erie-Niagara Rail Steering Comm. v. STB*, 247 F.3d 437 (2d Cir. 2001), which found “not credible” the argument that NS and CSX would pay a multi-billion dollar “premium” based on the expectation of extracting increased monopoly rents through adjustments in the regulatory rate base from the “very small number of shippers that are

WCTL, understandably, fails to acknowledge the consistent rejection of its position by the ICC and the Board, discussing only the *MSDCF Decision*. WCTL Opening Comments at 25-30. But even leaving aside these repeated rejections, WCTL's circularity argument is fatally flawed.

Even if all railroad rates were regulated by the STB, there would still be no circularity concern. Simply put, there is no direct correlation between the COE and changes in rail rates. As Dr. Villadsen explains, the cost of equity would increase only if the non-diversifiable risk increased. If investors expect earnings to increase without any change in non-diversifiable risk, stock prices will also increase (and you would discount the new cash flows by the same factor (the cost of equity) to get the new stock price). Villadsen Reply V.S. at 5-9. WCTL's allegation of "circularity" ignores the fundamental theory of efficient markets (the relationship between cash flow, risk, and stock prices) on which both MSDCF and CAPM rest.

Indeed, WCTL cites no regulatory decision accepting its "circularity" argument. Although the MSDCF is used frequently in more heavily regulated pipeline and electric utility industries, where all the rates are subject to regulation, WCTL cites no regulator who rejected the DCF method due to the "circularity" concerns expressed by WCTL. Nor has WCTL cited any academic research that raises this concern.

truly captive." See *Western Coal Traffic League – Petition For Declaratory Order*, Finance Docket 35506, at 18.

II. THE “MODIFICATIONS” TO CAPM THAT WCTL AND AECC REQUEST ARE WITHOUT MERIT.

WCTL’s petition for a rulemaking failed to mention any weaknesses in the CAPM. AAR Opening Comments at 33. Now, however, WCTL belatedly contends that the CAPM contains flaws – but only flaws that “overstate” the railroad industry COE. WCTL Opening Comments at 6-7, 30-45. WCTL does not explain why it did not raise these issues in its Petition, even though it argued about one of them in the Ex Parte No. 664 proceeding and even though another (the Blume adjustment) has been debated for at least four decades.²⁸ In any event, neither of the alleged “flaws” in CAPM warrants modification of the CAPM adopted by the Board. The Arkansas Electric Cooperative Corporation’s (“AECC’s”) criticisms of the beta used by the Board are equally baseless.

A. Market Risk Premium is Reportedly at a Historic High.

WCTL contends that the Board’s use of all available data going back to 1926 to calculate the MRP does not “reflect current investor expectations” and overstates the MRP. WCTL asserts that the Board should instead use data going back only 50 years, and that the MRP should not exceed the “current norm” of 5.0 percent. *See* WCTL Opening Comments at 31-40. This argument is without merit. As WCTL admits (*id.* at 31), the Board rejected virtually the same argument concerning the time period of the data in the 2007-2008 Ex Parte No. 664 proceeding. *See Methodology to be Employed in Determining the Railroad Industry’s Cost of Capital*, Ex Parte 664, at 7-9 (served Jan. 17, 2008) (“CAPM Decision”). The reasons that WCTL offers for “revisiting” the issue do not withstand scrutiny.

²⁸ WCTL’s witnesses, in discussing the Blume adjustment, cite articles published by Blume in 1971 and 1975. *Levine V.S.* at 23 n.23; *Triantis V.S.* at 8 n.4.

First, the MRP is as elusive as the cost of equity. See *AEP Texas North Co. v. STB*, 609 F.3d 432, 435, 443 (D.C. Cir. 2010) (cost of equity is an “elusive” value “difficult to estimate,” because it is “not directly observable”).²⁹ The MRP has been referred to by academics as “a big guess. ... No one knows what the market risk premium is.” See, e.g., S. H. Penman, *FINANCIAL STATEMENT ANALYSIS AND SECURITY VALUATION*, at 691-692 (1st ed. 2001).

Thus, contrary to WCTL’s suggestion (WCTL Opening Comments at 6, 33), there are numerous ways to calculate the MRP, and no single “correct” method. See, e.g., P. Fernandez, *The Equity Premium in 150 Textbooks*, Working Paper WP-829 (IESE Business School, University of Nevada, October 2009), at 9 (“There is no generally accepted equity premium point estimate ... nor is there a common method to estimate it, even for the” historical equity premium); M. Zenner, S. Hill, J. Clark, & N. Mago, *The Most Important Number in Finance: The Quest for the Market Risk Premium*, at 2 (Report, J.P. Morgan Capital Structure Advisory & Solutions, May 2008) (“No single method to estimate the MRP is used universally ... [E]ach have strengths and weaknesses. They also generate a wide range of results...”).³⁰ Indeed, the survey submitted by WCTL makes the same point:

²⁹ See also, e.g., *Application of Aquarion Water Co. of Connecticut To Amend Its Rates*, Docket No. 13-02-20 2013 WL 5503829 (Conn. D.P.U.C., Sept. 24, 2013, at 90 (“The ... equity risk premium ... of the CAPM formula is the hardest to measure”); *Application of California Water Service Co. (U60W) for Authority to Establish Its Authorized Cost of Capital For the Period From January 1, 2009 Through December 31, 2011*, App. Nos. 08-05-002, et al. 2009 WL 1353259 (Cal. P.U.C., May 7, 2009), at 10 (“Of these three [CAPM] inputs, the most difficult to measure is the expected equity risk premium because data on both Treasury bond interest rates and various measures of beta are readily available, but disputed. An expected market risk premium is a highly subjective forecast of future market returns”).

³⁰ See also F. Duarte & C. Rosa, *Are Stocks Cheap? A Review of the Evidence*, Liberty Street Economics, May 08, 2013, <http://libertystreeteconomics.newyorkfed.org/2013/05/are-stocks-cheap-a-review-of-the-evidence.html> (analysis of “twenty-nine of the most

The choice of the appropriate level of the market risk premium to use is, at present, the subject of considerable discussion and controversy. There is significant variation in the premium used by organizations, and that variation is not surprising considering the lack of agreement on how market risk is calculated.³¹

Second, the 6.96% estimate used by the STB based on historical returns from 1926 is entirely reasonable. Duarte and Rosa (economists at the Federal Reserve Bank of New York) recently studied 20 different approaches for estimating the MRP and found the models converging, but uniformly found the MRP at an all-time historical high. Their “preferred estimator places the one-year-ahead MRP in July 2013 at 14.5%, the highest level in fifty years and well above the 10.5 percent that was reached during the financial crisis in 2009.” J. Duarte & C. Rosa, *The Equity Risk Premium: A Consensus of Models*, *supra*, at 1.³² This 14.5% measurement cannot be directly compared with the 6.96% figure used by the STB. Duarte and Rose were measuring the short-term estimate of the expected market return over 90-day T-bills. To compare the Duarte and Rose estimate to the STB estimate, Dr. Villadsen first approximated the long-term MRP and subtracted the difference between the 20-year government bond and the 90-day T-bill rate. The preferred estimate of Duarte and Rose translates into a

popular and widely used models to compute the equity risk premium for the last fifty years”); F. Duarte & C. Rosa, *The Equity Risk Premium: A Consensus of Models*, at 1 (2013) http://www.newyorkfed.org/research/economists/duarte/Duarte_Rosa_EquityRiskPremium.pdf (estimating equity risk premium by combining information from 20 models prominently used by practitioners and featured in the economic literature).

³¹ 2013 AFP: *Estimating and Applying Cost of Capital: Report of Survey Results*, at 11 (Exhibit 4 to WCTL Opening Comments).

³² Some economists have predicted that the MRP will *increase* over the next few years, as the ratio of the retired population to the working-age population increases and retired households rebalance their portfolios to hedge against outliving their assets. *See, e.g.,* R. Mehra, “The Equity Premium Puzzle Revisited,” in *Rethinking the Equity Risk Premium*, at 153 (CFA Institute 2011).

MRP of approximately 6.5% during 2008-2010, rising to 7.7% for 2010-2012, and culminating at the historic high rate of 8.0%-8.7% since 2012. Villadsen Reply V.S. at 16.

The Duarte and Rose estimate is consistent with the “forward-looking” MRP published by Bloomberg. Forward-looking estimates of the MRP place no reliance on historical returns. Instead, this technique uses current stock prices, expectations about future growth for the entire marketplace, and versions of the DCF model to estimate the overall expected market return implicit from today’s stock prices. This technique is a transparent, alternative approach that can be replicated from public information. If the Board were inclined to reconsider the standard practice of using historical data in the CAPM, the Board could consider using a forward-looking estimate of MRP (a technique often advocated by WCTL’s own members before state PUCs). As reproduced from Dr. Villadsen’s statement (Villadsen Reply V.S. at 17), the recent forward-looking estimate of the MRP from Bloomberg are higher than the Ibbotson historical MRP.

Table 1
Bloomberg Forecasted MRP and Ibbotson Historical MRP

Year	Annual Forecasted MRP (Bloomberg)	Annual Historical MRP (Ibbotson)
2008	7.83%	6.47%
2009	8.55%	6.67%
2010	8.03%	6.72%
2011	7.97%	6.62%
2012	8.86%	6.70%
2013	7.72%	6.96%

Given the wide range of expert opinions about the MRP, it is hardly surprising that WCTL can find literature citations that support using a figure lower than the historical return calculated by the STB. A review of 150 textbooks on corporate finance and valuation published between 1979 and 2009 found that

their recommendations regarding the MRP ranged from 3 percent to 10 percent, with an average of 6.7%.³³ The inability for any financial economist to provide a definitive answer on where the MRP falls is apparent. There are noted financial economists who advocate that the MRP is at an all time high, while others believe the MRP is low.³⁴ But after reviewing 20 models and more than 100 different economic variables, Duarte and Rosa wrote in 2013 that the historical mean is simple to calculate and “quite difficult to improve upon when considering out-of-sample performance measures.” Duarte & C. Rosa, *The Equity Risk Premium: A Consensus of Models*, *supra*, at 4. This sentiment is echoed by Professors Ross, Westerfield and Jaffe, who “are comfortable with an estimate based on the historical U.S. equity risk premium”³⁵

Third, surveys are unreliable. WCTL places almost its entire case for a 4.7% MRP on the strength of two surveys (although provides a copy of only one of them). See WCTL Opening Comments at 7, 35-37. However, the FCC Staff Report cautioned against relying on these surveys. FCC Staff Report at 7153 (“There are risks associated with using surveys”). The FCC Staff Report considered these kinds of surveys, but concluded they were unreliable because of the range of results made under different assumptions, such as the purpose of the survey, the specific market portfolio, and the specific risk free rate. “Perhaps,” the FCC Staff Report opined, they “provide a rough sanity test

³³ P. Fernandez, *The Equity Premium in 150 Textbooks*, Working Paper WP-829 (IESE Business School, University of Nevada, October 2009); see also FCC Staff Report at 7152 (citing Fernandez).

³⁴ Contrast Duarte & C. Rosa with WCTL Opening Comments at 34 (citing Dimson, Marsh, and Staunton who believe the Ibbotson historical premium is too high as an estimate of prospective equity premium).

³⁵ Stephen A. Ross, Randolph W. Westerfield, and Jeffrey F. Jaffe, *Corporate Finance*, (10th ed. 2013) p. 326.

ranges.” *Id.* The report then compared a range of estimates for the MRP from these surveys against the “commonly used source, Ibbotson” estimate based on market returns since 1926. *Id.* at 7152. The report concluded that the same historical average relied on by the STB lies well within the ranges from the surveys. *Id.* at 7153. That is, the STB’s calculation withstands a “sanity test.”

Dr. Villadsen similarly cautions against reliance on survey data. Villadsen Reply V.S. at 21. It is not clear that the survey captures a representative cross-section of the academics or practitioners that estimate the cost of capital. It is also unclear what MRP the respondents have in mind. Were the survey respondents reporting a conditional or unconditional MRP, or an MRP over a short-term or a long-term risk-free rate? How far into the future are the respondents forecasting the MRP? And the surveys cannot be replicated or audited by an outsider. “Therefore, surveys are to be used with caution” *Id.* at 21-22.

Fourth, WCTL offers no basis for its proposed 50-year measurement period. Why 50 years? Although WCTL argues that the 50-year period better reflects “current markets” and “current market conditions” than the period beginning in 1926, its statements are unsupported by any empirical evidence. WCTL Opening Comments at 32-35; Levine V.S. at 24. As Dr. Villadsen explains, “It is also common among regulatory cost of capital experts in the U.S. to base the MRP on the historical average MRP back to 1926; often using the Morningstar / Ibbotson data.” Villadsen Reply V.S. at 23. For example, Professor Morin writes in his textbook that “to avoid data mining, a reasonable solution is to use the entire period for which reliable data is available.”³⁶ This approach is echoed by

³⁶ Roger A. Morin, “*New Regulatory Finance*,” Public Utilities Report, Inc., 2006, p. 156.

many practitioners that estimate the cost of equity for regulated entities.³⁷ Put differently, there is no specific reason for restricting the data to 50 years as opposed to 60, 40 or something else. Dr. Villadsen's position that "the use [of] historical data back to 1926 continues to be the norm in many settings" (Villadsen Reply V.S. at 24) is confirmed by the FCC Staff Report finding that "[i]t is common to rely on as long a time series as possible when calculating the average historical market premium" (FCC Staff Report at 7152). As Giacchino and Lesser state in their treatise on the principles of utility corporate finance, "[S]ince history tends to repeat itself, for good or ill, arbitrary exclusions of certain historic years 'because they can never occur again' strikes us as either naïve, or an exercise in wishful thinking."³⁸

Furthermore, shortening the measurement period may not materially affect the MRP estimate. For example, if only Ibbotson data from post-World War II (1947) were used, the historic MRP would be more than 6.5%. Villadsen Reply V.S. at 15. Only by picking 50 years does WCTL reach a MRP that comports with its position that the estimate cannot exceed 5%.

Finally, when their own financial wherewithal is at stake, WCTL's members advocate a MRP that equals or exceeds the estimate used by the STB. In the time permitted for these reply filings, AAR canvassed state filings by WCTL's

³⁷ See, for example, Minnesota Power Testimony at 40; Moul WPS Testimony at 36; Moul Cleco Testimony at 60-61; Direct Testimony of James H. Vander Weide on behalf of MidAmerican Energy Company in Illinois C.C. Case No. 14-0066, *Proposed General Increase in Electric Rates*, June 25, 2014 ("Vander Weide MidAmerican Testimony"), at 36-37. Many of these experts also relied on a forward-looking MRP. Direct Testimony of Paul R. Moul on behalf of CLECO Power LLC in Louisiana PSC Docket No. U-30689 Vol 2, *Application of CLECO Power LLC*, dated July 14, 2008, ("Moul Cleco Testimony"), at 57-58.

³⁸ See Villadsen Reply V.S. at 22-23 (quoting Leonardo R. Giacchino and Jonathan A. Lesser, *Principles of Utility Corporate Finance*, Public Utilities Report, Inc., 2011, p. 236).

own members. As discussed above, WCTL’s members routinely urge state PUCs to rely on multiple methodologies to estimate the cost of equity. But when applying CAPM, they also submit testimony from finance experts who advocate a MRP above the current figure 6.96% based on historical data from 1926. For example, in a recent rate filing on July 3, 2014, expert witness Robert Hevert performed a CAPM analysis for Ameren, in which he used a DCF derived ex-ante market risk premium using growth rates from Value Line and Bloomberg. This yielded market risk premiums of 10.02% and 9.28%. Other WCTL members use slightly lower estimates. But as shown in **Table 2**, WCTL’s members use estimates for the MRP that are considerably higher than the 4.7% proposed by WCTL, and virtually meet or exceed the historical figures used by the STB.

Table 2
WCTL Member Statements about Market Risk Premium

Utility	Date	Risk Premium Estimate	Contemporaneous STB Estimate
Ameren	03-Jul-14	9.28 – 10.02%	6.96% (2013)
MidAmerican Energy	25-Jun-14	7.2%	6.96% (2013)
Wisconsin Public Service	01-Apr-14	6.68%	6.96% (2013)
CLECO	14-Jul-08	8.3%	6.47% (2008)
Minnesota Power	02-May-08	7.1-7.7%	6.47% (2008)

In sum, WCTL cannot cherry-pick the least transparent method (surveys) that cannot be replicated by the public or the STB and insist that the Board not use any figure that exceeds its desired “ceiling” of five percent. The above-cited Duarte/Rosa article demonstrates that there are at least 20 different models, each with different results. The Fernandez survey of 150 textbooks on corporate finance and valuation published between 1979 and 2009 found that their recommendations regarding the MRP ranged from three percent to ten percent, with an average of 6.7%. Current forward-looking estimates from reputable commercial vendors like Bloomberg (**Table 1**) confirm that the MRP is at a

historic high. And WCTL's own members take positions that unequivocally reject the low MRP advocated here by WCTL. "Survey results and literature that pre-date the financial crisis estimate the MRP below its historical average, while forward-looking methodologies estimate the MRP above its historical average. Therefore, the historical average is a reasonable compromise." Villadsen Reply V.S. at 3. Given the STB's demanding standard for changes to the cost of capital methodology, there is no basis to disturb the current approach.

B. There is No Correlation Between An Increase In Beta and The Exercise of Market Power.

WCTL and AECC contend that the betas used by the Board are too high, and reflect an increase in the railroads' exercise of market power. WCTL Opening Comments at 43-44; AECC Opening Comments, App. A at 4-8. WCTL argues that the Board should therefore use a Blume adjustment for the CAPM betas "to mitigate the market power that may reside in the relatively high beta values." WCTL Opening Comments at 45. AECC, by contrast, contends that to eliminate the "artificial growth in beta," the Board should not apply a rail beta coefficient greater than 1 when the rail industry's earnings as a whole are at or below the revenue adequacy level. AECC Opening Comments, App. A at 7-8.³⁹

WCTL's and AECC's arguments are based on the flawed assumption that an increase in beta reflects an increase in market power.⁴⁰ That assumption is

³⁹ The Board can summarily dismiss AECC's "solution" of placing a cap of one on beta. AECC neither provides nor cites any evidence to support its assertion that the Board should not adopt a beta value greater than 1 when rail industry earnings exceed the revenue adequacy level. AECC Opening Comments at 7-8. And AECC proposes no "solution" in the opposite scenario, when the railroad industry is *not* revenue-adequate. *Id.*

⁴⁰ AAR also disagrees with the factual premise that the industry is exercising more market power.

incorrect. There is no correlation between an increase in beta and the exercise of market power. *See, e.g.,* R.Moyer & R. Chatfield, *Market Power and Systemic Risk*, 35 J.Econ. & Bus. 123-130 (1983). To the contrary, studies have indicated that as market power increases, the riskiness of such firms – and, therefore, beta – decreases. *Id.*; Villadsen Reply V.S. at 34-37; T. Sullivan, *The Cost of Capital and the Market Power of Firms*, 50 Rev. of Econ. & Stats. 209-217 (1978). Even the article cited by AECC does not contend that an increase in market power produces an increase in beta. *See* P. Peyser, *Beta, Market Power and Wage Uncertainty*,” 42 J. Ind. Econ. 217-226 (1994) (cited in AECC Opening Comments, App. A at 6 n.5).⁴¹ As Dr. Villadsen explains, “there is no evidence that the estimated railroad betas have increased due to ‘market power.’ It is much more plausible that railroad betas have simply recovered from the impact of the financial crisis. It is also possible that they have increased due to other factors such as capital expansions and / or because of a change in the risk of the railroads’ cash flow caused by changing traffic mix.” Villadsen Reply V.S. at 37.

Moreover, the solution proposed by WCTL is wholly arbitrary. Only three years ago, the Board rejected the Blume adjustment advocated by WCTL because WCTL “did not provide academic research or empirical evidence to show that its own preferred application would be appropriate here.” *Railroad Cost of Capital – 2010*, Ex Parte No. 558 (Sub-No. 14), at 8 (served October 3, 2011). WCTL has failed to make such a showing in this proceeding as well.

⁴¹ It is ironic that WCTL seeks to dismiss this 1994 article as “dated.” WCTL Opening Comments at 43. At the same time, WCTL urges the Board to perform a Blume adjustment based on a 1971 article that, in turn, is based on regression analysis of data from 1930-1960.

Dr. Villadsen observes that this adjustment is based on empirical research that relies on data from 1930 through 1960. Moreover, “there is no theoretical explanation for why any individual company’s systematic risk should become more ‘average’ over time.” Villadsen Reply V.S. at 30. As explained by Dr. Villadsen, the Blume adjustment has the goal of making the empirical *measurements* of a particular stock’s beta more likely to accurately estimate the “true beta.” When a company’s beta is estimated using historical market data, there is some sampling error caused by “noise” in the data and estimation process. The Blume adjustment adjusts the estimated beta to account for the empirical observation (made by Blume in his 1971 paper) that the beta measure for an individual stock tends to move toward the market-weighted average of 1.0 over time. More specifically, “Blume adjusted” beta can be derived from the “raw” beta as follows:

$$\beta_{adj}^{Blume} = \frac{1}{3} \cdot 1 + \frac{2}{3} \beta_{raw}$$

As noted by Dr. Villadsen, the weights used in the Blume adjustment are “an artifact of Blume’s estimates using NYSE data from the 1930s through the 1960s.” Villadsen Reply V.S. at 28 n.63.

Academics caution that the assumptions that underlie the Blume adjustment may not hold for all industries. As Professor Marin Lally points out in his 1998 paper, “Blume’s explanation of the observed tendency of true betas to regress towards one invites certain doubts. Blume (1973) attributes the regression to the fact that ‘...new projects taken on by firms may tend to have less extreme risk characteristics than existing projects.’ However there is no reason to believe that this is an immutable law. If it were, all betas would eventually become

one!”⁴² Indeed, Professor Kevin Murphy testified in EP 722 that railroads “increasingly will have to raise and commit greater amounts of capital for investments that are sunk and risky, rather than taking its existing facilities and making them more productive.”⁴³

WCTL is simply being opportunistic in its advocacy of the Blume adjustment. When the industry beta was below one, the Blume adjustment would have arbitrarily *raised* the cost of equity. So it comes as no surprise that during the prior rulemaking proceedings – when the railroad estimates were all below 1 – WCTL never suggested that the Board should use the Blume adjustment. Neither did the railroad industry, which argued instead that the agency should estimate a beta for a portfolio of the entire industry.

Now, WCTL proposes this adjustment. As Dr. Villadsen observes, however, there is no consensus opinion or best practice regarding whether a regulatory agency should use this adjustment. Professor Triantis claims that a study by the Association of Financial Professionals “confirms the widespread use of the Blume adjustment,” but fails to acknowledge that the publication finds that of all respondents, fifty percent use unadjusted betas.⁴⁴

Moreover, a superior adjustment is the “Vasicek” adjustment. The Vasicek adjustment weighs the raw beta and the market beta according to the relative

⁴² M. Lally, *An Examination of Blume and Vasicek Betas*, 33 THE FINANCIAL REVIEW 183-198, at 189 (1998).

⁴³ Union Pacific Opening Comments, *Railroad Revenue Adequacy*, Ex Parte 722, Murphy V.S. at 17-18 (filed Sept. 5, 2014).

⁴⁴ Triantis Statement at 9; Association of Financial Professionals, “2013 AFP Estimating and Applying Cost of Capital: Report of Survey Results.” (Attached to Triantis Statement as Exhibit 4).

reliability (standard error) of the estimates.⁴⁵ As noted by Dr. Villadsen, the Vasicek adjustment uses information tailored to the data at hand while the Blume adjustment does not. In particular, the raw beta estimate for a particular company would be adjusted not necessarily toward 1.0, but rather toward a representative beta for companies in the same industry. “This is particularly noteworthy in this proceeding,” Dr. Villadsen explains, “since the STB estimates beta for a value-weighted *portfolio* designed to represent the railroad industry; in this context, a Vasicek adjustment with an industry prior would not adjust the raw beta at all!” Villadsen Reply V.S. at 29 (emphasis added). Nonetheless, Dr. Villadsen shows that the re-stated beta estimates using the Vasicek adjustment are not materially different from those used by the STB and any tiny difference is likely subsumed within random noise that surrounds *any* cost of equity estimate. *Id.* at 29-30. Moreover, the Vasicek adjustment is more commonly relied upon to adjust company-specific betas rather than portfolio betas as used by the Board. “Given that the Board relies on the portfolio beta, which is statistically more robust than company-specific betas, the econometrically-grounded Vasicek adjustment to beta is not very impactful, as it merely adjusts the beta towards that of the industry.” *Id.* at 32-33.

The STB should not devote its scarce resources to reopening the CAPM model to consider the Blume or Vasicek adjustments. Dr. Villadsen cautions the Board that while adjustments to beta are one way to complicate the CAPM model, there are others. “The Board has implemented the CAPM in its original form without any adjustments. The Board should not selectively adjust one

⁴⁵ See, for example, Morningstar, “Ibbotson SBBI 2013 Valuation Yearbook,” pp. 77-78 for an exposition.

parameter without considering all plausible adjustments.” Villadsen Reply V.S. at 3.

III. STABILITY IN THE METHODOLOGY USED TO ESTIMATE THE COST OF CAPITAL WILL ENCOURAGE GREATER CAPITAL INVESTMENT THAT WILL IMPROVE SERVICE, SAFETY, AND NETWORK AGILITY.

There is a norm of regularity in government conduct that presumes an agency’s duties are “carried out best if the settled rule is adhered to.” *Atchison, Topeka & S.F. Ry. v. Wichita Bd. of Trade*, 412 U.S. 800, 808 (1973); *Black v. Romano*, 471 U.S. 606, 622 n.18 (1985) (Marshall, J., concurring); *Otter Tail Power Co. v. BNSF Ry.*, NOR 42058, at 19 (STB served Jan. 27, 2006), *aff’d sub nom. Otter Tail Power Co. v. STB*, 484 F.3d 959 (8th Cir. 2007). Departing from that principle in today’s environment would be a grave mistake. A paramount issue facing the railroad industry is the surge in demand for rail transportation and corresponding need for additional rail investment to meet growing and shifting demand.

Manipulating the methodology used to estimate the cost of capital – as desired by WCTL – would be counterproductive. Rail investments have a long economic life. To justify making billions in capital investment, the railroads must forecast the expected returns over the long life of those assets. In this way, rail investments are similar to transmission investments, which EEI observes must be measured over their lives of 30-40 years.⁴⁶ Risk is not the friend of long-term investments. A constantly shifting regulatory landscape undermines investor confidence, raises the cost of capital, and discourages long-term capital

⁴⁶ Reply Comments of the Edison Electric Institute, FERC Docket No RM11-26-000, *Promoting Transmission Investment Through Pricing Reform*, filed May 21, 2012, at 8, available at <http://www.stoppathwv.com/documents/eei-comments.pdf>.

investment. Below, we elaborate on how unjustified reductions in the cost of equity will discourage future rail investments, and remind the Board of the public outcry for more investments.

A. Lowering the Cost of Equity Would Reduce the Railroads' Incentive For Future Rail Investments.

Continuous tinkering with the cost of capital methodology would increase the risk profile of the railroad industry, raising the return investors would demand and raising the cost of capital. That uncertainty, in turn, will impair the railroads' ability to raise necessary capital, and reduce their incentive to make the substantial capital investments necessary to maintain and improve their systems. The Board recognized in Ex Parte No. 558 (Sub-No. 9) that there is value to regulatory certainty regarding the methodology to be used in calculating the cost of capital:

There is a norm of regularity in government conduct that presumes an agency's duties are best carried out by adhering to the settled rule. This presumption is particularly strong where, as here, a party seeks to replace an established methodology with one the agency has previously rejected. And as there are many different ways to estimate the cost of equity, the Board must take care not to swing back-and-forth between parties' preferred methodologies based on the results of the different approaches.⁴⁷

The Board further found in that proceeding that "switching our methodology will have a widespread impact on the industry."⁴⁸ Indeed, a substantial reduction in the cost of capital is likely to result in a reduction in capital

⁴⁷ *Railroad Cost of Capital – 2005*, Ex Parte No. 558 (Sub-No. 9), at 7 (served September 15, 2006).

⁴⁸ *Railroad Cost of Capital – 2005*, Ex Parte No. 558 (Sub-No. 9), at 5 (served February 9, 2007).

expenditures, at a time when such expenditures are demanded by industry stakeholders.

Other regulatory agencies have recognized the need for regulatory certainty to encourage substantial investment in infrastructure. *See, e.g., Tesoro High Plains Pipeline Co. LLC*, 148 FERC ¶ 61,160, 2010 WL 1638320, at *5 (2014) (“Granting the Petition in part will provide regulatory certainty for the substantial capital investment required for the Dunn Center Gathering System”); *In the Matter of Reexamination of Roaming Obligations of Commercial Mobile Radio Service Providers and Other Providers of Mobile Data Services*, 25 FCC Rcd. 4181, 4207 at P 52 (2010) (“resolving the issue will provide regulatory certainty, which will itself help to establish an environment conducive to network deployment and investment”); *Nevada Power Co. v. Duke Energy Trading & Marketing, L.L.C.*, 99 FERC ¶ 61,047, at 61,184, 61,190 (2002) (“Competitive power markets simply cannot attract the capital needed to build adequate generating infrastructure without regulatory certainty”) (cited in *NRG Power Marketing, LLC v. Maine Public Utilities Comm’n*, 558 U.S. 165, 174 (2010)).

FERC has also recognized this point in the context of electric utility regulation. In its recent Opinion No. 531, FERC stated that it had an obligation to ensure “that ROE be set at a level to attract investment in interstate electric transmission ... there is also record evidence that a decrease in ROE [from 11.14 percent to 9.39 percent] could undermine the ability of the [utilities] to attract capital for new investment in electric transmission”). Opinion No. 531, 147 FERC ¶ 61,234, at P 150.

Similarly, only last year, EEI strongly cautioned FERC against making the same kind of ill-advised changes proposed here by WCTL and other shippers

because of their effect on capital investment. EEI emphasized that electric utilities must make substantial investments in their infrastructure to meet future demand. EEI stated:

Now is not the time to make significant reductions to ROEs on transmission investments. The competition for capital for infrastructure is growing, as illustrated by projected and significant capital needs in other industries. In addition to the electric power industry's capital expenditure needs, the American Petroleum Institute projects oil and natural gas industry investments of \$5 trillion through 2035. Also, a 2012 study on drinking water infrastructure needs estimates that the most urgent investments could be spread over 25 years at a cost of approximately \$1 trillion. There are other studies that identify infrastructure needs that will require significant amounts of capital.

Edison Electric Institute, *Transmission Investment*, *supra*, at 10-11 & n.45 (footnotes omitted) (emphasis added). *See also* NS Opening Comments at 7 (quoting EEI's statement seeking higher ROEs because of need for substantial investment). EEI's statement is equally applicable to the railroad industry, which must make substantial capital investments to meet rail infrastructure needs.

B. Stakeholders Are Demanding More Capital Investment.

A broad and bipartisan coalition of members of Congress have been vocal in emphasizing the critical need for improvements to rail infrastructure to meet future demand. For example, at a September 10, 2014 hearing before the Senate Committee on Commerce, Science, and Transportation, members of Congress emphasized the need for more capital investment by railroads to meet demand. For example, Senator Hoeven stated: "[R]ailroads need to bring more resources to meet the needs [of] North Dakota. . . . we need more capacity on the part of the

railroads. . . They need to bring more cars, more locomotives, more people and they need to build more track.”⁴⁹ Senator Heitkamp similarly stated:

[T]his is a permanent problem, we’re going to continue to ship crude by rail, we’re going to continue to see bumper crops and increase deals in our state, which is going [to] put more stress on track time. . . .

I happen to believe that that we need a permanent increase build out [in the rail infrastructure], given the history of si[t]ing pipelines in this country, we’re going to move oil on the rails . . .

We think that’s going to grow another 20 percent, 30 percent. Where is that oil going to move? It’s going to move on the tracks. It’s going to move in pipelines, but it’s also still going to move on the tracks. . . .

[T]his is a permanent problem and these huge amounts of capital infusion [are needed] to order to solve it.⁵⁰

In the public field hearing that the Board held in Fargo, North Dakota, regarding service problems in the U.S. rail network in September 2014, the need for substantial capital investment was repeatedly stressed by members of Congress, state regulatory officials, and shippers. *See* Ex Parte No. 724, *United States Rail Service Issues*, Notice of Public Hearing served August 18, 2014. In the written testimony that they prepared for the hearing, for example, witnesses stated:

- “A number of factors are contributing to the delays, including strained track capacity, growth in volume, crew and personnel shortages, lack

⁴⁹ *See* “Freight Rail Service: Improving the Performance of America’s Rail System.” hearing before the Senate Committee on Commerce, Science, and Transportation, September 10, 2014, Congressional Quarterly transcript (“Transcript”) at 2 (found at <http://www.cq.com/doc/congressionaltranscripts-4547727?6&print=true>).

⁵⁰ *Id.* at 5, 9.

of locomotives, and congestion in major gateways – particularly Chicago. What this all adds up to is the need for more infrastructure and personnel. ... The bottom line on all of this is that we need greater rail capacity to meet the growing needs of North Dakota's expanding economy and dynamic businesses. To make that happen, Canadian Pacific Railway and BNSF must commit to investing in more rail infrastructure, including more locomotives, more railcars and more crews." Prepared Testimony of Senator John Hoeven (North Dakota) at 1-2 (Sept. 4, 2014) (found at [http://www.stb.dot.gov/FILINGS/all.nsf/UNID/EF27EF3088B6E50885257D51006547F2/\\$file/236662.pdf](http://www.stb.dot.gov/FILINGS/all.nsf/UNID/EF27EF3088B6E50885257D51006547F2/$file/236662.pdf)).

- "The STB should demand more infor[mation] on investments CP is making to address the current backlog and prevent future ones. For example – How many new sidings are being installed and where? How many employees are they hiring, and how many of them are new as opposed to filling vacant positions? Will centralized train control really facilitate enough traffic to prevent delays?" Prepared Testimony of Senator Heidi Heitkamp (North Dakota) at 2 (Sept. 24, 2014) (found at [http://www.stb.dot.gov/FILINGS/all.nsf/UNID/FE4DF39E99EDB3D385257D5D0067BE0B/\\$file/236725.pdf](http://www.stb.dot.gov/FILINGS/all.nsf/UNID/FE4DF39E99EDB3D385257D5D0067BE0B/$file/236725.pdf)).
- "While we have seen some improvement in service and can appreciate the move by both carriers to invest in infrastructure improvements to address the congestion problem, service delays continue and we still have an estimated 100-150 million bushels of commercially and farm stored grain to move in the next 30 days, to create space for new crop." Prepared Testimony of Minnesota Grain & Feed Association at 2 (Sept. 4, 2014) (found at [http://www.stb.dot.gov/FILINGS/all.nsf/UNID/406AC82D5784A14685257D4F0053961E/\\$file/236635.pdf/](http://www.stb.dot.gov/FILINGS/all.nsf/UNID/406AC82D5784A14685257D4F0053961E/$file/236635.pdf/)
- "Please be assured that the Commission has no interest in second guessing railroad management. It sincerely appreciates the carriers' announced infrastructure, equipment, and manpower investments in our State in order to help put the ongoing service situation 'back on track.'" Prepared Testimony of Randy Christmann, Commissioner, North Dakota Public Service Commission at 2 (Sept. 11, 2014) (found at [http://www.stb.dot.gov/FILINGS/all.nsf/UNID/8731BBDE7909AC4F85257D5000732028/\\$file/236657.pdf](http://www.stb.dot.gov/FILINGS/all.nsf/UNID/8731BBDE7909AC4F85257D5000732028/$file/236657.pdf)).
- "The STB should also consider requiring railroads to provide more detailed short and long-term planning and service performance

reporting. This could include forecasted and actual demand for principal commodities and actual service performance in relation to projections and actual service requests; *planned and completed capital investment and maintenance programs to meet expected demand; capital investment and maintenance programs that still need to be performed, but that have not yet been undertaken (or have only been partially undertaken); planned and actual actions undertaken to minimize service disruptions on key corridors as the result of capital investment and maintenance programs; the allocation of human, operating, and capital resources within and across traffic groups and operating budgets that might affect service; expected changes in operations or traffic group volumes that might affect service; and related subjects.*" Prepared Testimony of Randy Christmann, Commissioner, North Dakota Public Service Commission at 3-4 (Sept. 11, 2014) (emphasis added) (found at [http://www.stb.dot.gov/FILINGS/all.nsf/UNID/8731BBDE7909AC4F85257D5000732028/\\$file/236657.pdf](http://www.stb.dot.gov/FILINGS/all.nsf/UNID/8731BBDE7909AC4F85257D5000732028/$file/236657.pdf)).

- "Additional capacity is being built in the Midwest but the rail system must step up or real life and death problems could be just around the corner and no one wants that wrapped around their necks." Prepared Testimony of Midwest Turkey Producers at 1 (Sept. 4, 2014) (found at [http://www.stb.dot.gov/FILINGS/all.nsf/UNID/0F081F30207E653485257D4F006890E6/\\$file/236645.pdf](http://www.stb.dot.gov/FILINGS/all.nsf/UNID/0F081F30207E653485257D4F006890E6/$file/236645.pdf)).

Furthermore, in Ex Parte No. 711, a bipartisan group of U.S.

Representatives cautioned the STB of the rail industry's critical need to invest in infrastructure to improve efficiency and grow their networks. For example, the Committee on Transportation and Infrastructure of the House of Representatives filed a letter with the Board noting that the U.S. rail industry is "the most efficient, affordable and environmentally-friendly freight rail network in the world." Letter from U.S. House of Rep. Committee on Transportation & Infrastructure, filed Mar. 20, 2014 in Ex Parte No. 711, at 1. The Committee went on to note that any Board policy change that "decreases the railroads' efficiency, and limits their ability to reinvest, grow their networks and meet the nation's freight transportation demands both today and in the future will be opposed by this Committee." *Id.* at 2. Representative William L. Enyart filed similar

comments supporting the rail industry's need "to make the necessary investments in their systems to match the rising demand for capacity." Letter from Representative W. Enyart, Ex Parte No. 711, at 1 (filed May 14, 2014).

More than fifty Senators and Congressmen filed similar statements in the Board's Ex Parte 705 proceeding. Senators Blunt, Chambliss, DeMint, Graham, Isakson, Johans, Kyl, Moran, Nelson, and Warner all filed letters with the Board supporting the railroad's ability to invest in their networks, as did Members of the House Committee on Transportation and Infrastructure and the following Representatives: Altmire, Brown, Costello, Culberson, Diaz-Balart, Granger, Graves, Hanna, Holden, LaTourette, Mica, Miller, Miller, Neal, Rahall, Rigell, Ruppersberger, Shuster, Smith, and Terry. Indeed, members of the House Committee accurately prophesized recent events, observing that:

Transportation experts are united in predicting massive increases in freight movements over the next 20 years. It is imperative that our rail network be positioned to handle a large share of the burden.⁵¹

Satisfying these demands will require the investment of tens of billions of dollars. In the last decade (2004-2013), railroads invested approximately \$98 billion in private capital expenditures (excluding maintenance spending). The railroad industry is on track to have a record breaking level of capital expenditures in 2014. But the railroads will be discouraged from making those massive levels of private investment if the cost of capital is reduced to the unreasonable level sought by WCTL and other shippers.

⁵¹ See Letter from Richard L. Hanna, Richard E. Neal, and other Members of Congress to Chairman Daniel R. Elliott, III, Ex Parte 705, at 1, filed June 9, 2011.

CONCLUSION

In Ex Parte No. 664 and Ex Parte No. 664 (Sub-No. 1), the Board began and completed a long and exhaustive journey to find a suitable way to estimate the cost of equity for the railroad industry. It decided to follow the best practice of using multiple models, which enables the Board to harness the strengths of each model while mitigating their known weaknesses, resulting in a more reliable estimate of an inherently undetectable figure. The Board then averaged the results of a reasonable CAPM model designed by the agency with a reasonable commercial MSDCF model to arrive at an estimate of this elusive cost-of-equity figure. Understanding that “switching our methodology will have a widespread impact on the industry,”⁵² the STB has properly stated that it will not depart from its established approach “unless a party presents compelling evidence that it is flawed.”⁵³

No party has met this appropriately high standard. The AAR demonstrated in its opening comments that the critiques leveled at the MSDCF model, if corrected, would have no material effect on the estimates. The circularity argument is baseless and should be rejected. And claims that the MRP used by the STB is too high run contrary to numerous sources showing the MRP is at an all time high and to testimony by the utilities themselves in proceedings before their PUCs.

In the end, there is no objective way to determine whether the MSDCF model or the CAPM model is “performing better” in today’s fiscal environment. AAR therefore urges the Board to deny WCTL’s petition to discard the MSDCF

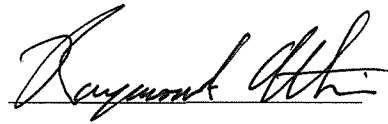
⁵² *Railroad Cost of Capital – 2005*, Ex Parte No. 558, Decision served February 9, 2007, at 5

⁵³ *Id.* at 4; *see also* Ex Parte No. 558 (Sub-No. 9), Decision served September 15, 2006, at 7 (same).

model. Rather, the Board should continue to follow the sage advice of Professor Myers: "Use more than one model when you can. Because estimating the opportunity cost of capital is difficult, only a fool throws away useful information."⁵⁴

For these reasons, WCTL's Petition should be denied.

Respectfully submitted,



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⁵⁴ Stewart C. Myers, "On the Use of Modern Portfolio Theory in Public Utility Rate Cases: Comment," *Financial Management*, Autumn 1978, at 67.

**BEFORE THE
SURFACE TRANSPORTATION BOARD**

PETITION OF THE WESTERN COAL)
TRAFFIC LEAGUE TO INSTITUTE A)
RULEMAKING PROCEEDING TO)
ABOLISH THE USE OF THE MULTI-)
STAGE DISCOUNTED CASH FLOW)
MODEL IN DETERMINING THE)
RAILROAD INDUSTRY'S COST OF)
EQUITY CAPITAL)

Docket No. EP 664
(Sub-No. 2)

**REPLY VERIFIED STATEMENT
OF
BENTE VILLADSEN

ON BEHALF OF THE
ASSOCIATION OF AMERICAN RAILROADS**

November 4, 2014

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EXHIBIT BV-1: Rolling Five-Year Betas for the Railroad Industry

EXHIBIT BV-2: Review of Regulatory Cost of Capital Methodologies, CTA Report

EXHIBIT BV-3: Figure 1 from Duarte & Rosa 2014

EXHIBIT BV-4: Derivation of the Value Line Forecasted MRP

I. Introduction and Summary

My name is Bente Villadsen and I am the same Bente Villadsen who filed a Verified Statement in support of the Association of American Railroads (AAR) opening comments in this proceeding on September 5, 2014.

I have been asked by the AAR to review and respond to the Opening Comments by the Western Coal Traffic League (WCTL), the Verified Statement of Dr. Harvey A. Levine (Levine Statement), and the Verified Statement of Professor Alexander J. Triantis (Triantis Statement). I have also been asked to review and respond to the Opening Comments of Arkansas Electric Cooperative Corporation (AECC Comments).

Based on my review of the filed material, as well as some of the cited data and literature, I continue to support the conclusions in my Verified Statement.¹ In addition, I also find that:

- The MSDCF as applied by the Board is not circular, as an increase in cash flow will be reflected in market prices, and not the cost of equity.
- The MSDCF is well-specified and auditable as done annually by the Surface Transportation Board.
- Reliance on the historical average MRP remains a valid method with textbooks, commercial data providers, and cost of capital experts recommending it.

¹ Verified Statement of Bente Villadsen, Docket No. EP 664 (Sub-No. 2), September 5, 2014 (Villadsen Statement), pp. 2-3.

- It is common to estimate the MRP using as many years as there are reliable data for.
- Survey results and literature that pre-date the financial crisis estimate the MRP below its historical average, while forward-looking methodologies estimate the MRP above its historical average. Therefore, the historical average is a reasonable compromise.
- The historical average MRP is objective and easy to implement and audit, whereas surveys are subjective and not auditable.
- Historical data, forecasted MRPs, recent studies, and even surveys show that the MRP exceeds 5%.
- The beta estimate as of the relevant estimation date remains the best proxy for the expected railroad beta. There is no support for restricting the railroad beta to a specific number or range.
- The beta estimate for a portfolio of publicly traded railroads that meets the Board's criteria is the best estimate for the industry.
- Evidence provided by the WCTL indicates that it is equally common for publicly traded companies to use raw and adjusted betas. Hence the Board's practice is in line with industry practice.
- The Board has implemented the CAPM in its original form without any adjustments. The Board should not selectively adjust one parameter without considering all plausible adjustments.

- There is no evidence that railroad betas have increased due to market power; there are plenty of more plausible alternative explanations for why railroad betas may have increased.
- It is a fundamental principle in finance that the cost of capital depends on its use and not on the ownership. BNSF's cost of equity depends on the systematic risk of BNSF's assets and cash flow; **not** on Berkshire Hathaway's or Union Pacific's beta.
- The fairness opinion on the sale of BNSF to Berkshire Hathaway is consistent with the Board's 2009 estimated cost of capital.
- The use of more than one method is endorsed by many utility cost-of-capital experts for regulatory purposes.

II. MSDCF

A. INTRODUCTION

WCTL's Opening Comments repeat many of the same criticisms of the MSDCF that WCTL and its witnesses, Professor Hodder and Mr. Fapp, made in WCTL's petition for a rulemaking proceeding, including the arguments that: (1) the MSDCF values are overstated because they are higher than values determined under the CAPM; (2) the second stage of the MSDCF fails to implement a smooth transition from Stage 1 to Stage 3; (3) Stage 3 of the model is deficient because it fails to achieve a smooth transition in cash flows; and (4) the MSDCF bases growth in firm-wide cash flow on earnings per share that increase faster than firm-wide earnings due to stock buybacks. The testimonies of WCTL's witnesses Dr. Levine and Professor Triantis largely echo the

criticisms made by WCTL's prior witnesses, Professor Hodder and Mr. Fapp. I have already addressed the criticisms noted above in my September Verified Statement.

Therefore the remainder of this section addresses the following new criticisms: (1) that the use of the MSDCF inherently is circular and (2) that the MSDCF is not transparent. This section also addresses the WCTL's use of a report that I co-authored for the Canadian Transportation Agency (CTA). I discuss the claim that the MSDCF is "far from the preferred method of determining the COC among regulatory agencies, the financial community, and academia"² in Section IV below.

B. CIRCULARITY

In its Opening Comments, the WCTL argues that there is an inherent "circularity" in the use of the MSDCF model to determine the cost of capital for the railroads. It claims that "the high MSDCF COE enables the railroads to raise their rates, and the rate increases result in projections of high earnings growth that drive the MSDCF COE. In other words, the model derives an increased cost of capital due to the railroads' ability to impose rate increases."³ This argument is fundamentally flawed in that it ignores the basic finance principle of market efficiency. Specifically, the WCTL assumes that a rate increase by the railroads would lead to an increase in their expected future cash flows *without* a commensurate increase in the market prices of their stock.⁴

² Verified Statement of Harvey A. Levine, Docket No. EP 664 (Sub-No. 2), September 5, 2014 (Levine Statement), p. 20.

³ Opening Comments of the Western Coal Traffic League, Docket No. EP 664 (Sub-No.2), September 5, 2014 (WCTL), p. 25.

⁴ In the Board's MSDCF model, if forecasted cash flows increase and prices remain unchanged, the implied cost of equity capital will increase such that the higher cash flows are more heavily discounted to reach the same present value.

However, unless the rate increase was to somehow substantially increase the railroads' systematic risk, this situation could not occur in an efficient market. Rather, the rise in expected cash flows would make railroad stock more attractive to investors, leading market prices to increase to a level reflecting the higher fundamental value, while the cost of equity capital remains unchanged. In the remainder of this section, I explain how the principle of market efficiency – a core and essential assumption for the implementation of all market models used to estimate the cost of capital,⁵ including the CAPM that the WCTL recommends – prevents any possibility of “circularity” in the MSDCF model.

At its most basic, the DCF model sets the value of an asset equal to the present value of its future cash flows. When performing DCF valuation of a stock, the current *fundamental* value (V_0) is determined by taking the sum of all future cash flows (C_t) expected to accrue to the stockholder, discounted at the appropriate cost of equity capital (r).

$$V_0 = \sum_{t=1}^{\infty} \frac{C_t}{(1+r)^t}$$

As I explained in my Verified Statement, the cost of capital represents an opportunity cost for an investor considering a particular investment: it is the return he or she could expect to earn on some other investment of equivalent risk.⁶ Therefore, if the current market price of a stock (P_0) were lower than the expected present value of its future cash flows (V_0), rational investors would want to purchase the stock, seeing it as

⁵ Stephen A. Ross, Randolph W. Westerfield, and Jeffrey F. Jaffe, *Corporate Finance*, 10th ed, 2013, (Ross, Westerfield and Jaffe 2013), Chapter 11.

⁶ Villadsen Statement, p. 4.

an opportunity to earn a return higher than the opportunity cost of capital (r) for an investment of equivalent risk. The resulting increased demand for the stock would tend to drive the price up until it matched the fundamental value (i.e., $P_0 = V_0$). Conversely, if P_0 were higher than V_0 , a rational investor would view the stock as “overpriced”, since purchasing it at the market price would yield an expected return below the cost of capital, r ; this would push the stock’s price downward toward its fundamental value. Only when $P_0 = V_0$ do investors view the stock as “fairly priced”.

Under the *efficient markets hypothesis*,⁷ we would expect securities markets to behave in precisely this fashion: investors collectively process the available information (e.g., financial data, price histories, analyst forecasts, etc.) about each security to determine its fundamental value. Their collective investment behavior then ensures that all securities are “fairly priced” such that $P_0 = V_0$ and any individual investment earns a return exact equal its opportunity cost of capital (r).

Whether markets are in fact efficient is a matter of substantial academic debate.⁸ However, market efficiency is an essential assumption when DCF models are used in a regulatory setting to estimate the cost of capital. Estimating r in the DCF requires inputs for the future cash flows C_t and current value V_0 of each company in the proxy group. By setting the latter equal to the current market price ($P_0 = V_0$), regulators *implicitly assume that the stocks are fairly priced by the market*, i.e., that securities markets are efficient.

⁷ See, for example, Richard A. Brealey, Stewart C. Myers, Franklin Allen, “*Principles of Corporate Finance*,” 10th ed, 2011 (Brealey, Myers and Allen, 2011), pp. 314-325.

⁸ See the discussion in Brealey, Myers, and Allen, 2011.

Under this same assumption, an increase in expected future cash flows (e.g., due to a rate increase by the railroads) would, all else equal, lead to a commensurate increase in the market prices of railroad stocks, *not* an increase in the DCF-estimated cost of capital.

To see this point, consider the example of a hypothetical regulated firm that is expected to generate cash of \$5 per share next year ($C_1 = 5$), with perpetual 4% growth ($g = 4\%$) thereafter. If the current market value of the firm's stock is \$100 per share, then *assuming the stock is fairly priced*, the implied cost of equity capital is 9% according to the discounted cash flow model⁹:

$$r = \frac{C_1}{P_0} + g = \frac{\$5}{\$100} + 4\% = 9\%$$

Now suppose that the firm is permitted to increase its rates such that it will grow its cash by $g^* = 5\%$ in perpetuity instead of 4%. Since the rate increase is not likely to have changed the firm's systematic risk in any meaningful way, the appropriate cost of capital for investing in the firm will remain at 9%. In an efficient market, investors will incorporate the firm's improved future cash flows into their investing decisions, so that the market will arrive at the new fair value for the stock.

$$P_0^* = \frac{c_1}{r - g^*} = \frac{\$5}{0.09 - 0.05} = \$125$$

⁹ The discounted cash flow model is sometimes also called the "constant growth DCF" or "simple DCF" model. Note that this example uses a constant perpetual growth rate for simplicity. The principle demonstrated would be the same under the more complex assumptions of the Board's MSDCF model.

As this example illustrates, it is market prices, and **not** the cost of equity, that increase when forecasted cash flows go up under the assumptions of the Board's MSDCF model. WCTL's argument that the MSDCF has an issue with "circularity" is therefore unsound according to basic finance principles.

C. TRANSPARENCY OF THE MSDCF

WCTL contends that the MSDCF is not transparent but rather "an opaque and presumptuous methodology" that is "is effective only when the projections are correct."¹⁰

First, the MSDCF is clearly transparent. The model is well-specified and all of the parameters that it relies upon are publicly available, so that it readily can be audited.¹¹ I understand that the Surface Transportation Board reviews and, if needed, adjusts the MSDCF figures annually.¹² That is hardly characteristic of an opaque model.

Second, while the MSDCF model is in fact dependent on the projected growth in cash flow, the CAPM—to which Dr. Levine advocates shifting all weight from the MSDCF—is dependent on the estimated market risk premium, beta, and risk-free rate. Because each cost of capital model has its strengths and weaknesses, no single model is ideal and the implementation of any model necessarily requires choices that involve

¹⁰ WCTL, p. 20. See also Levine Statement, p. 16.

¹¹ As discussed in my co-authored report, "Estimating the Cost of Equity for Regulated Companies" prepared for the Australian Energy Regulator for the Australian Pipeline Industry Association, February 2013 (AER Report) p. 30, when well specified, the MSDCF is easily replicated and therefore easy to audit. Note that the DCF model is referenced as DDM in Australia.

¹² See, for example, Surface Transportation Board Decision, Docket No. EP 558 (Sub-No. 17), Railroad Cost of Capital – 2013, decided July 30, 2014, p. 10.

subjective judgments.¹³ Just as the outcome of the MSDCF hinges on the accuracy of projected growth rates, the CAPM is only effective when the estimated beta reflects the actual forecasted systematic risk, the relied upon risk-free rate reflects the expected risk-free rate, and the market risk premium reflects the actual premium that investors require to hold stock rather than risk-free bonds.

D. CTA REPORT

Finally, the WCTL cites a portion of the Canadian Transportation Agency's (CTA) 2011 decision,¹⁴ which is attributed to a 2010 report that I co-authored regarding cost of capital methodologies.¹⁵ The WCTL uses this quote to support its criticism of the MSDCF. The WCTL quotes from the CTA's decision, but fails to recognize the context in which the statements were made. Therefore, its reliance on the report is misplaced.

The WCTL cites ¶207 of the CTA decision as support that

the DCF model is highly sensitive to growth rate estimates, which can vary widely among analysts – and that variation may increase in times of greater economic uncertainty. As such, the reliability of DCF methods can be questionable in times of economic turmoil or when an industry is in transition.¹⁶

While this statement is a quote from the CTA Decision, it pertains to the single-stage DCF model and is taken out of context. The portion of the Brattle CTA Report that the WCTL appears to be referencing continues:

¹³ AER Report, p. 9.

¹⁴ Canadian Transportation Agency, Decision No. 425-R-2011, December 2011 (CTA Decision).

¹⁵ "Review of Regulatory Cost of Capital Methodologies" by Michael J. Vilbert, Bente Villadsen and Matthew Aharonian, prepared for the *Canadian Transportation Agency*, September 2010 (Brattle CTA Report). The report is attached as Exhibit BV-2.

¹⁶ WCTL p. 16.

If five-year growth rate forecasts are used as the constant growth rate, as is often the case, then the reliability of the [single-stage DCF] model can be significantly reduced in periods of abnormally high or low growth. Moreover, the results of applying the methodology can be unstable over time, leading to rapid shifts from high cost of capital estimates to low ones. Some of this sensitivity can be mitigated in the DCF framework by adjusting the growth path more realistically, but this then opens the DCF model to some of the same subjective parameter concerns raised in implementing the CAPM.¹⁷
[emphasis added]

Thus, the CTA Decision was referencing the single-stage DCF and therefore the portion cited by the WCTL leaves out an important qualifier about using the single-stage DCF (with a constant company or industry-specific growth rate) and the ability of the MSDCF to mitigate those outcomes by relying on economy-wide growth in stage 3. In general, the Brattle CTA report simply analyzed the strengths and weaknesses of each model, including the CAPM and MSDCF. It did not endorse the use of only one model, nor did it find that one model was superior to others.

III. CAPM

A. INTRODUCTION

In its Opening Comments, the WCTL argues that “the CAPM is superior to the MSDCF both conceptually and pragmatically.”¹⁸ However, the CAPM, like every other model, has its strengths and weaknesses, both of which I discussed in my Verified Statement. Then, the WCTL, despite its overall glowing depiction of CAPM, contends

¹⁷ Brattle CTA Report, p. 4.

¹⁸ WCTL, p. 14.

that the CAPM “overstates” the cost of equity and requires certain “modifications” and “adjustments” to correct such “overstatements.” However, the discussion is one-sided in that the WCTL only points to “flaws” that could “overstate” the cost of equity, while failing to point out any aspects of the CAPM implementation that would result in an understatement of the COE. If the implementation of the CAPM is to be re-examined, it is necessary to review all aspects of the model and its performance during different circumstances; e.g., before and after the financial crisis.

The more detailed comments from the WCTL and its experts focus on the market risk premium (MRP) and the beta estimates that the Board’s cost of capital methodology relies upon. Therefore my comments on the WCTL filing focus on those parameters, although I caution against looking at the any one of the parameters that enters the CAPM estimate in isolation.

B. MARKET RISK PREMIUM

The WCTL and its experts focus their review of the MRP on surveys and on changing the period over which the historical arithmetic average MRP is estimated. The filing does not provide a literature review, textbook evidence, or evidence of regulatory practice for estimating the MRP. Instead, it references select surveys and a website. The academic literature on the MRP is vast and has changed over time. Much of the literature pertaining to the early 2000s (during the stock market boom) indicates an MRP that is lower than the long-term historical average MRP, while the more recent literature and current forward-looking methods suggest that the MRP is currently higher than the historical average MRP. Thus, there is no true consensus on what the

MRP is. But there are reasonable ranges, and the historical average MRP as currently relied upon by the Board is in the middle of that range.

In the following sections, I first discuss the evidence on the plausible range of the MRP and show that the historical average is near the middle of that range. I then respond to particular points in the WCTL and AECC filings. Specifically, I address the claims that the Board's use of data going back to 1926 does not "reflect current investor expectations" and "the 1926 base is no longer the norm for measuring the MRP," as well as the assertion that that the Board should instead rely on 50 years of data.¹⁹ I also address the claims that a 4.7% risk premium is "consistent with, if not somewhat higher than, [the MRP] currently used by financial professionals"²⁰ and that "the MRP in the current environment should not exceed 4.7%."²¹ Finally, I comment on the use of survey data.

1. Evidence on the MRP Range

As noted above, there is currently no real consensus on what the expected MRP is. However, there are a number of articles and textbooks published by academics, estimates provided by commercial vendors, and regulatory precedents. Morningstar / Ibbotson argues to use a period going as far back as 1926 stating that:

"some analysts estimate the expected equity risk premium using a shorter, more recent time period on the basis that recent events are

¹⁹ WCTL p. 31, Levine Statement p. 13 and 24, Verified Statement of Prof. Alexander J. Triantis, Docket No. EP 664 (Sub-No. 2), September 5, 2014 (Triantis Statement), pp. 11-12

²⁰ Triantis Statement, p. 12.

²¹ WCTL, p. 7.

more likely to be repeated in the near future; furthermore, they believe that the 1920s, 1930s, and 1940s contain too many unusual events. This view is suspect because all periods contain “unusual” events. Some of the most unusual events of the last hundred years took place quite recently, including the inflation of the late 1970s and early 1980s, the October 1987 stock market crash, the collapse of the high-yield bond market, the major contraction and consolidation of the thrift industry, the collapse of the Soviet Union, the development of the European Economic Community, the attacks of September 11, 2001 and the more recent liquidity crisis of 2008 and 2009.”²²

Similarly, Professors Ross, Westerfield and Jaffe find that an estimate based on the historical U.S. MRP over as long a period as possible to be reasonable. The figure cited by the authors uses the period 1900 – today; for 1900 – 2013 the estimated MRP is 6.6%.²³ The 2014 Valuation Handbook put forth by Duff & Phelps estimates a risk premium of 6.96% for the period 1926 -2013. The text also reports a so-called supply side MRP that adjusts the MRP downward for the growth in the price to earnings ratio, resulting in an MRP of 6.18% for the period 1926 to 2013.²⁴ Table 1 below shows the historical MRP over 20-year government bonds from the 2013 SBBI Valuation Yearbook, the Credit Suisse Global Investment Returns Sourcebook 2014, and from my calculations using NYSE returns.²⁵ Only a select 50-year period (i.e., 1964-2013) yields a historical average MRP below 5%, whereas the use of other periods indicates an MRP

²² Morningstar, “Ibbotson SBBI 2013 Valuation Yearbook,” p. 59.

²³ Ross, Westerfield and Jaffe 2013, p. 326 discuss the methodology. “Credit Suisse Global Investment Return Sourcebook 2014,” Table 10 of that text provides the long-term arithmetic MRP referenced above and Table 9 of the text provides the short-term MRP – currently 7.5%.

²⁴ Duff & Phelps, “2014 Valuation Handbook,” p. 3 – 19.

²⁵ Morningstar, “Ibbotson SBBI 2013 Valuation Yearbook,” p. 46.

close to the current 6.96%, regardless of whether the 1926-today period is expanded to include 1900-1925 or restricted to include only the post-war years: 1947-today.

Table 1: Historical Long-Term MRP Estimates

	NYSE Long Term MRP	S&P Long Term MRP	US Long Term MRP
	[1]	[2]	[3]
1900 - 2013		6.66%	6.60%
1926 - 2013	6.64%	6.96%	
1947 - 2013	6.61%	6.84%	
1964 - 2013	4.68%	4.67%	
1974 - 2013	5.47%	5.50%	

Sources and Notes:

[1]: NYSE Returns from CRSP between 1926 and 2005. NYSE Returns from Bloomberg 2006 onwards. Interest rates from Ibbotson Associates, *Stocks Bonds Bills and Inflation (SBB)* 2014 Classic Yearbook.

[2]: Duff & Phelps, 2014 *Valuation Handbook*, Exhibit 3-6. S&P refers to Standard & Poor 500 Index. For the period 1947-2013, the 1947-2012 average reported in the 2013 Ibbotson Valuation Yearbook, page 74, was recalculated using the 2013 MRP reported in the 2014 Ibbotson Classic Yearbook, page 145.

[3]: Dimson, Marsh and Staunton, *Global Investment Returns Sourcebook 2014*, p.28.

Long term MRPs are average spreads between market returns and income or total returns on long-term Treasuries.

Academic articles that were written in the late 1990s or early 2000s often found that the MRP was lower than the historical MRP based on various forward-looking models, such as market-wide versions of the DCF model. A recent article by Duarte and Rosa of the Federal Reserve of New York summarizes many of these models and also estimates the MRP from the models each year from 1960 through 2013.²⁶ The authors

²⁶ Fernando Duarte and Carlo Rosa, "The Equity Risk Premium: A Consensus of Models," Federal Reserve Bank of New York, 2014 (Duarte & Rosa 2014).

then report the average as well as the 25 and 75-percentile of results. The authors find that the models are converging to provide a more comparable estimate and that the average annual estimate of the MRP is consistent with the academic literature and with forward-looking estimates such as Bloomberg's. Their analysis shows that the MRP was lower than its long-term historical average in the early 2000s, **but** is currently at an all-time high. Figure 1 from Duarte & Rosa 2014 is replicated as Exhibit BV-3, which shows the average estimated MRP (over 30-day T-bills) for 20 models.²⁷

For example, the authors estimate that the MRP reached an all-time high of 14.5% over 90-day T-bills in July 2013 for an approximate long-term MRP of 10.2%. Looking at the authors' figures and subtracting the difference between the 20-year government bond²⁸ and the 90-day T-bill, it appears that they find an MRP over 20-year Treasury bonds of approximately 6.5% during the 2008-10 period, 7.7% for 2010-12 and 8.0 – 8.7% since 2012.²⁹ These figures are broadly consistent with the forward-looking MRP calculated by Bloomberg and shown in Table 2 below. Bloomberg estimates its forecasted MRP using a DCF model for the market as a whole.³⁰ The table also shows the forecasted MRP for 2012-13 using Value Line data. The Value Line forecasted MRP was calculated using the basic same methodology as Bloomberg, but relying on Value

²⁷ Technically, Figure 1 from Duarte & Rosa plots the "first principal component" of the 20 models. This means that the authors used statistics to compute a weighted average that captures the most variability among the 20 models over time.

²⁸ The Board uses the yield on a 20-year government bond as its risk-free rate in the CAPM, so that the relevant MRP is over a 20-year government bond.

²⁹ Duarte & Rosa (2014) Figure 1, p. 18 and Bloomberg data on the yield on 90-day T-Bills and 20-year Government bonds.

³⁰ Bloomberg measures the market as the S&P 500 and uses the 10-year Treasury bond yield as the risk-free rate.

Line growth rates.³¹ For comparison, the table also shows the historical average MRP as reported by Ibbotson.

Table 2: Bloomberg and Value Line Forecasted MRP and Ibbotson Historical MRP³²

Year	Annual Forecasted MRP (Bloomberg)	Annual Historical MRP (Ibbotson)	Forecasted MRP (Value Line)
	[1]	[2]	[3]
2008	7.83%	6.47%	
2009	8.55%	6.67%	
2010	8.03%	6.72%	
2011	7.97%	6.62%	
2012	8.86%	6.70%	12.52%
2013	7.72%	6.96%	9.97%
<i>Average</i>	8.16%	6.69%	<i>nmf</i>

Sources and Notes:

[1]: Bloomberg as of 10/1/2014; Average of all MRP reported at the end of each month in year of interest. The MRP is calculated over the 10-Year Treasury bond yield.

[2]: Ibbotson SBBI 2014 Classic Yearbook, page 158. Average MRP from 1926 to year of interest.

[3]: Year-end Value Line data pulled 10/22/2014. MRP calculated over the 10-Year Treasury bond yield. Companies with no dividend yield or estimated growth rate were excluded from the analysis.

As Table 2 demonstrates, the forecasted MRP has been consistently higher than the historical average during the 2008-2013 period. I note that Bloomberg's forecasted MRP and the forecasted MRP calculated using Value Line represent the excess market return over the 10-year Treasury bond yield, which merits two comments. First, Ibbotson's historical MRP appropriately uses the realized return on Treasury bonds,

³¹ For comparability to the Bloomberg forecast, I used the 10-year Treasury bond yield as the risk-free rate. The details of the calculation are attached as Exhibit BV-4.

³² I do not have access to Value Line data for 2008-2011, but note that Roger A. Morin found the forward-looking MRP using Value Line data to be 7.7% over long-term bonds in 2008 (Direct Testimony and Exhibits of Roger A. Morin in the matter of the application of ALLETE d/b/a Minnesota Power in Docket E-015/GR-08-415, May 2008, p. 43).

while the forecasted MRP uses the yield on Treasury bonds. For the purpose of measuring a historical MRP it is the realized return rather than the forward-looking yield that is relevant.³³ Similarly, a forward-looking MRP appropriately uses a forward-looking yield as the risk-free measure. Second, the Board uses the 20-year Treasury Bond yield as the risk-free rate in its CAPM. Therefore, the forecasted MRPs in Table 2 should be adjusted downward for the difference between the 20-year and 10-year Treasury bond yields in order to form a valid comparison for the Board's current CAPM (with a 20-year risk-free rate). Even with this adjustment, the forecasted MRP has been well above the historical MRP as reported by Morningstar / Ibbotson every year from 2008 through 2012; the two figures became equal in 2013 (once the difference in yield was has been accounted for).³⁴

There may be several reasons why the current MRP is estimated to be higher than the historical average. The literature includes studies of the impact of a recession on investors' attitude towards risk, the impact of volatility, and the fear of large disasters to mention a few.

For example, Professor Constantinides studies a classical utility model where consumers are risk averse and also summarizes some of the empirical literature. Constantinides draws from empirical evidence that shows that consumers become risk averse in times of economic recession or downturn, and equity investments accentuate

³³ Morningstar, *"Ibbotson SBBI 2013 Valuation Yearbook,"* pp. 55-56; Leonardo R. Giacchino and Jonathan A. Lesser, *"Principles of Utility Corporate Finance,"* Public Utilities Report, Inc., 2011, pp. 234-235.

³⁴ To illustrate: Bloomberg's MRP for 2013 was 7.72% and the average spread between the 20-year and the 10-year government bonds in 2013 was 0.77%, so the Bloomberg forecasted MRP over a 10-year risk-free rate would be 7.72% minus 0.77% or 6.95%.

this risk.³⁵ (Increased risk aversion leads to a higher expected return for investors before they will invest.) Specifically, equities are pro-cyclical and decline in value when the probability of a job loss increases; thus, they fail to hedge against income shocks that are more likely to occur during recessions.³⁶ Consequently, investors require an added risk premium to hold equities during economic downturns. Constantinides writes:

In economic recessions, investors are exposed to the double hazard of stock market losses and job loss. Investment in equities not only fails to hedge the risk of job loss but also accentuates its implications. Investors require a hefty equity premium in order to be induced to hold equities. This is the argument that I formalize below and address the predictability of asset returns and their unconditional moments.³⁷

And

The first implication of the theory is an explanation of the counter-cyclical behavior of the equity risk premium: the risk premium is highest in a recession because the stock is a poor hedge against the uninsurable income shocks, such as job loss, that are more likely to arrive during a recession.

The second implication is an explanation of the unconditional equity premium puzzle: even though per capita consumption growth is poorly correlated with stocks returns, investors require a hefty premium to hold stocks over short-term bonds because stocks

³⁵ G.M. Constantinides, "Understanding the equity risk premium puzzle". In R. Mehra, ed., *Handbook of the Equity Risk Premium*, 2008, Elsevier, Amsterdam.

³⁶ G.M. Constantinides, G.M., and D. Duffie, "Asset Pricing with Heterogeneous Consumers", *Journal of Political Economy*, Vol. 104 (2), 1996: 219-240.

³⁷ G.M. Constantinides, "Understanding the equity risk premium puzzle." In R. Mehra, ed., *Handbook of the Equity Risk Premium*. 2008 Elsevier, Amsterdam.

perform poorly in recessions, when the investor is most likely to be laid off.³⁸

Empirically, several authors have found that market volatility and the market risk premium are positively related. For example, Kim, Morley and Nelson 2004³⁹ find that

When the effects of volatility feedback are fully taken into account, the empirical evidence supports a significant positive relationship between stock market volatility and the equity premium.⁴⁰

Additionally, in their article that won the annual Smith-Breeden Paper Award given by the American Finance Association and the *Journal of Finance*, Bansal and Yaron (2004) demonstrate that economic uncertainty plays an important role in explaining the MRP.⁴¹ In particular, they show that uncertainty is priced in the market. In their model, higher uncertainty (measured in their paper by volatility of consumption) leads to higher conditional MRP. Another implication of the analysis in the Bansal and Yaron paper is that even the unconditional MRP can increase if any of the following materialize: (i) investors become more risk-averse; (ii) shocks to economic uncertainty become more pronounced; (iii) periods of high economic uncertainty becomes longer lasting. To the extent that investors' risk aversion has experienced an adverse shock (i.e., gone up), the MRP must have increased. Furthermore, perception of more severe

³⁸ *Ibid.*.

³⁹ C-J. Kim, J.C. Morley and C.R. Nelson (2004), "Is There a Positive Relationship Between Stock Market Volatility and the Equity Premium," *Journal of Money, Credit and Banking*, Vol. 36.

⁴⁰ *Ibid.* p. 357. The authors rely on a statistical (Markov-switching) model of the ARCH type and data for the period 1926 to 2000 for their analysis.

⁴¹ Bansal, R., and A. Yaron (2004), "Risks for the Long Run: A Potential Resolution of Asset Pricing Puzzles", *Journal of Finance*, Vol. 59 (4): 1481-1509.

shocks to economic uncertainty and slower decay of higher uncertainty periods are likely to cause the MRP to remain higher even in the absence of any specific shock to the risk aversion parameter.

Finally, survey evidence such as that provided in the WCTL filing generally find the MRP is somewhat lower than the historical arithmetic average although the range of estimates vary widely. For example, the Fernandez et al paper cited by the WCTL finds that the average MRP used by respondents in the U.S. is 5.7%, which is well above the 4.7% suggested by the WCTL and its experts.⁴²

There are several methodological problems with surveys. First, it is not clear that the survey captures a representative cross-section of the academics or practitioners who estimate the cost of capital. Second, it is not clear what MRP the respondents have in mind: (a) is the MRP over a short-term or a long-term risk-free rate, (b) are the respondents considering today's economic conditions or expected conditions, and (c) how far into the future are the respondents forecasting the MRP (e.g., for the next month, year, or decade)? Without knowing the answer to these questions, it is difficult to know what the reported MRP measures. Furthermore, even if the average of the reported risk-free rate is consistent with a 10-year government bond yield as indicated by Professor Triantis,⁴³ it is not clear that this is the benchmark used by the respondents. Third, the surveys cannot be replicated and/or audited by an outsider. These three factors mean that surveys are not transparent. Therefore, surveys are to be used with

⁴² Pablo Fernandez, Javier Aguirreamalloa, and Pablo Linares, "Market Risk Premium and Risk Free Rate Used for 51 Countries in 2013: A Survey with 6.237 Answers," Working paper dated June 26, 2013.

⁴³ Triantis Statement, p. 14.

caution and the Board **cannot**, as suggested by the WCTL, “rely credibl[y] on surveys of the MRP values.”⁴⁴

Having looked at the historical, forecasted, and survey evidence on the MRP, I concur with Professors Ross, Westerfield, and Jaffe that an estimate based on the historical MRP is reasonable.⁴⁵

2. Response to Issues Raised

The WCTL and its experts suggest that the Board relies on 50-years of data to determine the MRP because data going back to 1926 does not “reflect current investor expectations” and is not the current norm.⁴⁶ Further, the WCTL and its experts suggest that an MRP above 5% is unreasonable.⁴⁷

Clearly, current investor expectations are not reflected in 50 years of data but rather in today’s markets, so a better measure of the *current* investor expectation would be the market forecasted MRP (using Bloomberg or Value Line data) illustrated in Table 2 (above at p. 17). In addition, if it is not the norm to determine the MRP using historical data back to 1926, then why are MBA textbooks such as Ross, Westerfield, and Jaffe (2013), investment banking publications, and cost of capital experts continuing to rely on this data? The reasons are eloquently stated by Professor Morin: “to avoid data mining”⁴⁸ and by Ciacchino and Lesser: “since history tends to repeat itself, for good or

⁴⁴ WCTL, p. 7.

⁴⁵ See, Ross, Westerfield and Jaffe 2013, p. 326.

⁴⁶ WCTL, p. 7 and p. 31.

⁴⁷ WCTL, p. 37, Levine Statement, p. 13, and Triantis Statement, p. 12-15.

⁴⁸ Roger A. Morin, “*New Regulatory Finance*,” Public Utilities Report, Inc., 2006, p. 156.

ill, arbitrary exclusions of certain historic years ‘because they can never occur again’ strikes us as either naïve, or an exercise in wishful thinking.”⁴⁹ I concur.

As discussed above, the textbook of Professors Ross, Westerfield and Jaffe uses as long a period as possible (1900 to 2013) to determine the MRP using the commercial data put together by Credit Suisse.⁵⁰ The text by Professors Ross, Westerfield and Jaffe is widely used in MBA programs and while the Morningstar / Ibbotson is a commonly used source for the MRP in the U.S., the data by Credit Suisse is commonly used in Europe. It is also common among regulatory cost of capital experts in the U.S. to base the MRP on the historical average MRP back to 1926, often using the Morningstar / Ibbotson data. For example, Professor Morin writes in his textbook that

to avoid data mining, a reasonable solution is to use the entire period for which reliable data is available.⁵¹

This approach is echoed by many practitioners who estimate the cost of equity for regulated entities.⁵² Put differently, there are certainly many applications that use all

⁴⁹ Leonardo R. Giacchino and Jonathan A. Lesser, “*Principles of Utility Corporate Finance*,” Public Utilities Report, Inc., 2011, p. 236.

⁵⁰ Ross, Westerfield and Jaffe 2013, p. 326 and “*Credit Suisse Global Investment Return Sourcebook 2014*.”

⁵¹ Roger A. Morin, “*New Regulatory Finance*,” Public Utilities Report, Inc., 2006, p. 156.

⁵² See, for example, Federal Communication Commission, “Prescribing the Authorized Rate of Return: Analysis of Methods for Establishing Just and Reasonable Rates for Local Exchange Carriers,” Wireline Competition Bureau, Staff Report, May 16, 2013 (FCC Staff Report), Direct Testimony and Exhibits of Roger A. Morin in the matter of the application of ALLETE d/b/a Minnesota Power in Docket E-015/GR-08-415, May 2008 (Morin Minnesota Testimony) p. 40; Direct Testimony of Paul R. Moul on behalf of Wisconsin Public Service Corporation in Application for Authority to Adjust Electric and Natural Gas Rates, April 1, 2014 (Moul WPS Testimony) p. 36; Direct testimony of Paul R. Moul for CLECO, July 14, 2008 (Moul Cleco

available data to determine the MRP and there is no specific reason for restricting the data to 50 years as opposed to 60, 40 or something else. Therefore, the use historical data back to 1926 continues to be the norm in many settings and I find that the reliance on all available data to be a reasonable approach. I also note that going back to the post-WWII period or all the way back to 1900 does not change the results substantially (See Table 1). It is noteworthy that **only if** the MRP is measured over a 50-year period does it approach the 5% that the WCTL argues is an upper bound; using a longer or shorter period leads to a substantially higher MRP.

3. Conclusions on the MRP

As Professor Triantis acknowledges:

The standard textbook method to estimate the MRP is to measure the historical difference between returns on an equity index and the returns on a risk-free benchmark.⁵³

I concur and further note that, at 6.96%, the historical average MRP estimated over the period 1926 to 2013 is between the survey results of 4-6% and the forward-looking market-based MRP estimates of 7-10%. Therefore, the historical average MRP is not only objective and easy to measure, but also represents a compromise between the survey results / early academic literature and the forecasted results. In addition, I note

Continued from previous page

Testimony), p. 60-61; Direct Testimony of James H. Vander Weide on behalf of MidAmerican Energy Company, June 25, 2014 (Vander Weide MidAmerican Testimony), p. 36-37. Many of these experts also relied on a forward-looking MRP.

⁵³ Triantis Statement, p. 9.

that it is actually is quite common for textbooks, commercial data providers as well as cost of capital experts to rely on the historical average back to 1926.⁵⁴

C. BETA

1. Magnitude of Beta

The Arkansas Electric Cooperative Corporation (AECC) suggests that the Board

could consider setting beta at the "0.8 range" estimate originally provided to the Board by AAR's finance experts, or some other fixed estimate lower than 1 that is reasonably reflective of the unique stability of a revenue adequate rail industry relative to the market.⁵⁵

It appears that the AECC uses the .8 railroad industry beta cited by Professor Myers at the hearing on December 4, 2007 in the Ex. Parte 664 proceeding.⁵⁶ However, the AECC misrepresents Professor Myers statement, which was a summary of the **empirical results from estimating the railroad beta as of 2007**. Professor Myers made no statements about the plausible railroad beta in future years. Professor Myers goes on to

recommend the Commission consider weekly betas, betas weighed based on weekly rates of return here, as well as monthly.⁵⁷

The attached Exhibit BV-1 updates the so-called rolling betas that Professor Myers presented to the Board in 2007. The betas are rolling in the sense that each point

⁵⁴ See e.g., footnote 532 and Ross, Westerfield and Jaffe 2013.

⁵⁵ AECC Comments Regarding Cost-of-Capital Methodology Issues, p. 7.

⁵⁶ Ex Part 664, Transcript from December 4, 2007 Hearing, pp. 39-40.

⁵⁷ Ex Part 664, Transcript from December 4, 2007 Hearing, p. 40.

on the Exhibit BV-1 p. 1 shows the beta you would get looking at the weekly returns over the five years ending on each particular week. Clearly, the railroad beta has increased from about .8 in late 2007 to about 1.3 in 2013-14. Page 2 of the same exhibit presents the same data using monthly returns.

I note that the Board has relied on weekly returns since 2008 using market-value weighted data, which is the data shown in Exhibit BV-1. This continues to be a reasonable and commonly used estimation method.

2. Beta Adjustments

The WCTL and its experts, Dr. Levine and Professor Triantis, argue that the Board should adopt the Blume adjustment for the relied-upon betas and suggest that the Board use Blume-adjusted betas from Value Line or Bloomberg.⁵⁸ The WCTL also notes that other adjustments are sometimes applied, such as the Vasicek adjustment, which weighs the raw beta and what is believed to be the true beta according to the relative reliability (e.g., standard error) of the estimates.⁵⁹ Before discussing the pros and cons of either adjustment, it is important to understand what the adjustments are.

Both Blume (1971)⁶⁰ and Vasicek (1973)⁶¹ formulate their adjustments with the goal of making the empirical *measurements* of a particular stock's beta more likely to accurately estimate the "true beta" reflecting that stock's systematic risk in the context

⁵⁸ WCTL, p. 7. 40-43; Levine Statement, p. 10-12, and Triantis Statement, p. 8-9 and, p. 22-24.

⁵⁹ See, for example, Morningstar, "Ibbotson SBBI 2013 Valuation Yearbook," p. 78 for an exposition.

⁶⁰ M.E. Blume, "On the Assessment of Risk," *Journal of Finance* 26, 1971, pp. 1-10.

⁶¹ O.A. Vasicek, "A Note on Using Cross-Sectional Information in Bayesian Estimation of Security Betas," *Journal of Finance* 28, 1973, pp. 1233-1239.

of the CAPM. When a company's beta is estimated using historical market data, there is some sampling error caused by "noise" in the data and estimation process. The noise is somewhat reduced when a portfolio is used as is the case for the railroad beta. The market-weighted average beta for all assets is by definition 1.0, and repeated measurements indicate that the betas for **individual stocks** are clustered between 0.5 and 1.5. Given this information about the distribution of true betas across the entire market, an extremely high (e.g., 1.8) or low (e.g., 0.2) estimate of beta is more likely to reflect measurement (sampling) error than an accurate reflection of the security's systematic risk. I note that neither the railroad portfolio nor individual railroad betas are in the extreme range.

The Blume adjustment has an additional explicit goal of accounting for the empirical observation (made by Blume in his 1971 paper) that the beta measure for an individual stock tends to move toward the market-weighted average of 1.0 over time. Blume therefore performed a linear regression analysis comparing betas measured in one time period to betas measured in a subsequent time period.⁶² He found that the first period betas were not the best predictor of the subsequent period betas. Rather his 1970s analysis indicated that second-period betas were better predicted by taking a weighted average of the first-period beta estimates and the market-average beta of 1.0. The estimated coefficients of his regression equations suggested a weight of 2/3 on the first-period beta estimate and 1/3 on the market beta of 1.0. This regression analysis

⁶² M.E. Blume, "On the Assessment of Risk," *Journal of Finance* 26, 1971, pp. 1-10.

was the basis for calculating a “Blume adjusted” beta from the “raw” beta estimated based on historical market data:⁶³

$$\beta_{adj}^{Blume} = \frac{1}{3} \cdot 1 + \frac{2}{3} \beta_{raw}$$

Vasicek’s proposed adjustment, by contrast, focuses only on the issue of sampling error. In his 1973 paper on the topic,⁶⁴ Vasicek suggested adjusting an **individual company’s** estimated beta based on its sampling error (variance), relative to the variance in estimates based on prior knowledge/beliefs about the distribution of betas in the market. The Vasicek-adjusted beta for a company is also a weighted average – this one combining the “raw” beta estimate with an estimate based on the assumed prior distribution.⁶⁵ The weights are proportional to the variances of the raw beta estimate and prior beta, such that the estimate with smaller variance (i.e., the one that is estimated with less “noise”, and is thus considered more reliable) receives a higher weight:

$$\beta_{adjusted}^{Vasicek} = \frac{var(\beta_{prior})}{var(\beta_{prior}) + var(\beta_{raw})} \beta_{raw} + \left(1 - \frac{var(\beta_{prior})}{var(\beta_{prior}) + var(\beta_{raw})}\right) \beta_{raw}$$

⁶³ Note that while the “2/3” and “1/3” weightings have been widely adopted as intrinsic to the Blume adjustment, they are really an artifact of Blume’s estimates using NYSE data from the 1930s through the 1960s.

⁶⁴ O.A. Vasicek, “A Note on Using Cross-Sectional Information in Bayesian Estimation of Security Betas,” *Journal of Finance* 28, 1973, pp. 1233-1239.

⁶⁵ The term “prior distribution” refers to a concept in Bayesian statistics, in which statistical inference proceeds by updating an initial set of probability estimates – the “prior” – about a quantity to be estimated based on new information available in the data.

It is important to note that the assumed “prior” in a Vasicek adjustment *need not* be the market as a whole. Vasicek (1973, p 1237) suggested that the distribution of betas within a particular industry may be a better prior in some cases:

In some cases, more can be known about a stock than that it comes from a certain population. ... Thus, if a utility stock is considered, and it is known from previous measurement that betas of utilities are centered around 0.8 with a dispersion of 0.3, the [raw beta] estimate b is adjusted toward 0.8...

Under this interpretation,⁶⁶ the raw beta estimate for a particular company would be adjusted not necessarily toward 1.0, but rather toward a representative beta for companies in the same industry. This is particularly noteworthy in this proceeding, since the STB estimates beta for a value-weighted portfolio designed to represent the railroad industry; in this context, a Vasicek adjustment with an industry prior that uses the Board’s criteria for inclusion in the composite index would not adjust the raw beta at all!

The Blume adjustment, by contrast, always adjusts raw betas towards 1, in accordance with Blume’s empirical observations. However, as Professor Martin Lally points out in his 1998 paper weighing the relative merits of the Blume and Vasicek adjustments,

Blume’s explanation for the observed tendency of true betas to regress towards one invites certain doubts. Blume (1973) attributes the regression to the fact that “...new projects taken on by firms may tend to have less extreme risk characteristics than existing

⁶⁶ For an extensive discussion of the Blume and Vasicek adjustments, including a discussion of how the “industry prior” interpretation for Vasicek is widespread in the financial literature, see M. Lally, “An examination of Blume and Vasicek betas,” *The Financial Review* 33, 1998, pp. 183-198).

projects.”” However there is no reason to believe that this is an immutable law. If it were, all betas would eventually become one! ⁶⁷

Lally’s critique highlights the fact that the tendency of betas to regress towards 1.0 on a market-wide basis is an empirical artifact; there is no theoretical explanation for why any individual company’s systematic risk should become more “average” over time.

As a result, if the railroad industry is restricted to the portfolio of railroads that qualify for inclusion in the composite railroad index,⁶⁸ the Vasicek adjusted beta and the raw beta are identical. However, if the railroad industry is expanded to include additional railroads from Value Line Investment Survey (Canadian National, Canadian Pacific, and Genesee & Wyoming),⁶⁹ it is possible to illustrate the adjustment. I emphasize that it is an illustration as the additional entities do not meet the Board’s criteria for inclusion. I also note that while the larger industry has a slightly lower beta, it also has a higher growth rate, so an inclusion in the CAPM but not the MSDCF would be selective and inappropriate.

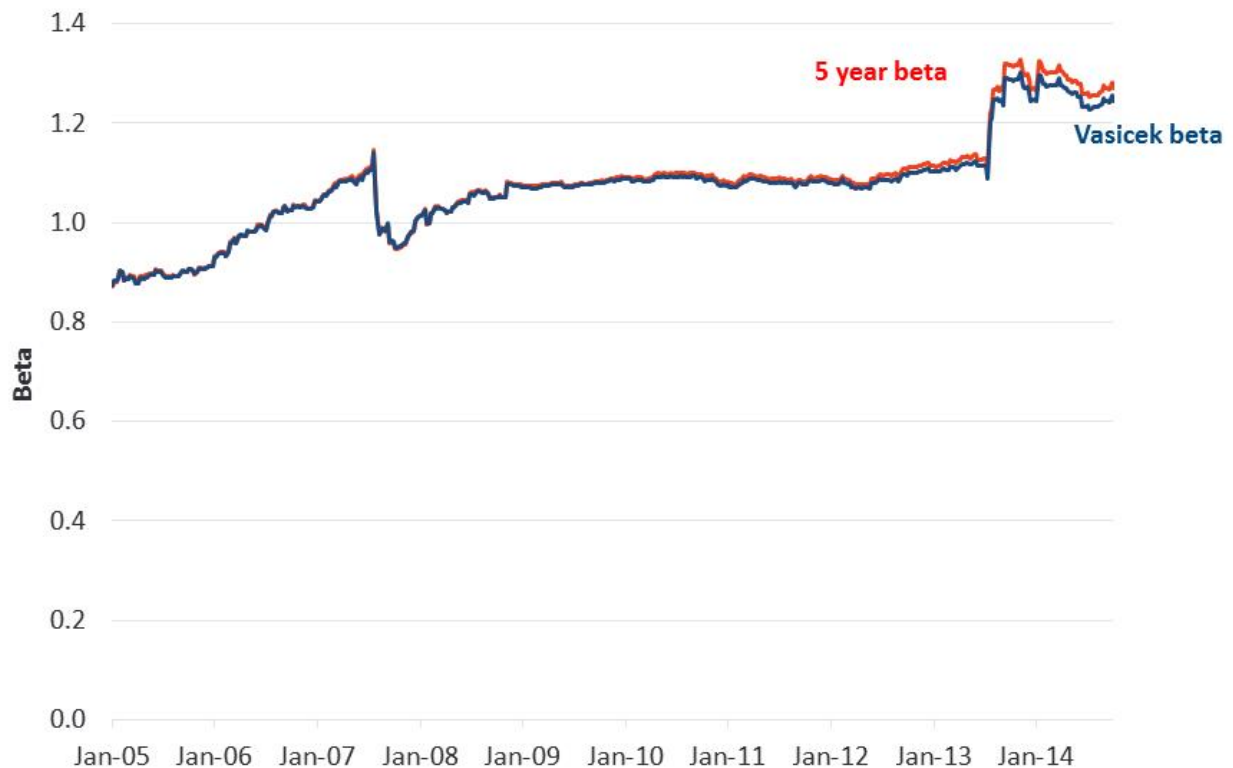
The effect of adjusting the railroad portfolio beta towards the beta of a larger railroad industry using Vasicek’s method is illustrated in Figure 1.

⁶⁷ *Ibid.*, p. 189.

⁶⁸ Class I carriers that (1) are listed on either the New York or American Stock Exchange, (2) paid dividends throughout the year, (3) had rail assets greater than 50% of their total assets, and (4) had a debt rating of at least BBB (Standard & Poor’s) and BAA (Moody’s). See Surface Transportation Board, Decision Docket No. EP 558 (Sub-No. 17), Railroad Cost of Capital – 2013, July 31, 2014, footnote 15.

⁶⁹ Other entities listed in Value Line’s railroad sector (American Railcar, GATX Corp., Greenbrier, and Trinity Inds.) appear to be manufacturing or leasing entities rather than operators of railroads.

**Figure 1: Railroad Composite Beta and Vasicek Adjusted Railroad Beta
(5-Year Weekly Beta)**



As noted in my co-authored report for the CTA, the Vasicek adjustment uses information tailored to the data at hand while the Blume adjustment does not. As a result, the Vasicek adjustment is theoretically preferable but also more complex.⁷⁰ I also note that the report discussed available adjustment methodologies as well as their strengths and weaknesses but did not recommend a specific methodology.⁷¹

⁷⁰ Brattle CTA Report, pp. 40-42.

⁷¹ For an extensive discussion of the Blume and Vasicek adjustments, see M. Lally, "An examination of Blume and Vasicek betas," *The Financial Review* 33, 1998, pp. 183-198).

Further, while Value Line report Blume adjusted betas, as stated by Dr. Levine and Professor Triantis,⁷² Bloomberg provides both raw and Blume-adjusted betas, so both adjusted and raw betas are commercially available. I also note that the Australian Energy Regulator examined both the Blume and Vasicek adjustment and rejected both.⁷³

Finally, while Professor Triantis claims that a study by the Association of Financial Professionals (AFP Study)⁷⁴ “confirms the widespread use of the Blume adjustment”⁷⁵ he fails to note that the publication finds that of all respondents, the use of adjusted versus unadjusted betas is 50-50.⁷⁶

The Board has chosen to adopt a mainstream form of the CAPM model. Consistency and a balanced approach are important, so betas should not be adjusted for the purpose of lowering the cost of equity. Any modifications to the CAPM as currently implemented would need to consider the downward pressure on the risk-free rate from monetary policy and all evidence on the market risk premium rather than unilaterally complicate the beta estimates. As the methodology is used for a period of time, it is important to consider its performance over time; *e.g.*, before and after the financial crisis. Given that the Board relies on the portfolio beta, which is statistically more robust than company-specific betas, the econometrically-grounded Vasicek adjustment

⁷² WCTL, p. 7; Levine Statement, p. 11, and Triantis Statement, p. 22.

⁷³ *Australian Energy Regulator*, “Better Regulation: Equity Beta Issues Paper”, October 2013, p. 25.

⁷⁴ *Association of Financial Professionals*, “2013 AFP Estimating and Applying Cost of Capital: Report of Survey Results.” Attached to Triantis Statement as Exhibit 4

⁷⁵ Triantis Statement, p. 9.

⁷⁶ AFP Study, p. 9.

to beta is not very impactful, as it merely adjusts the beta towards that of the industry. In summary, it would not be appropriate to focus exclusively on beta adjustments or on a specific point in time. Rather, the evaluation of the CAPM implementation should consider both potential upward and downward biases. For betas in particular, it would be important to fully explore the factors that may have impacted the systematic risks of the industry before changing the methodology.

3. Beta and Market Power

The AECC claims that the “CAPM incorrectly interprets an increase in the exercise of rail market power as increased risk”⁷⁷ while the WCTL suggest using adjustments to “address the substantial possibility that the high beta for at least 2013 reflects the exercise of market power by the railroads.”⁷⁸

Neither the AECC nor the WCTL and its experts cite any academic support for this claim. Instead they criticize a 1994 article on the subject⁷⁹ that was provided in prior hearings. The WCTL categorizes the article as “dated,”⁸⁰ while the AECC argues that its empirical findings on the relationship between market power and beta were equivocal.⁸¹ Thus, the totality of academic “evidence” provided by the AECC and WCTL for the proposition that beta increases with market power is that a single paper

⁷⁷ AECC, p. 2.

⁷⁸ WCTL p. 7, 42-43, and 45.

⁷⁹ Paul S. Peyser, “Beta, Market Power, and Wage Uncertainty,” *Journal of Industrial Economics* 217, June 1994.

⁸⁰ WCTL, p. 43. See also AECC, Appendix A p. 6, note 5.

⁸¹ AECC, Appendix A p. 6, note 5.

from 1994 fails to conclusively demonstrate a relationship between beta and market power.

In place of the academic citations or empirical evidence, the AECC cites its own statements from previous proceedings before the Board, in which it argued that if the exercise of market power were to lead to higher stock returns for the railroad industry, this could drive an increase in betas.⁸² This logic is flawed, indicating a fundamental misunderstanding of how beta reflects systematic risk; namely by measuring how company (or portfolio) returns move *relative* to returns on the market. The *level* of returns is immaterial. For an entity's measured beta to increase, its returns would have to increase *more* when the market increases *and decrease more* when the market decreases. If returns were to reach a stable elevated level due to an exercise of market power (or for any other reason), they might reasonably be expected to vary *less* with the market's ups and downs. This would *decrease beta*. Thus, the AECC's claims about the relationship between market power and beta rests on the flawed argument that higher levels of returns would necessarily lead to higher betas.

To the best of my knowledge, there is no literature that finds a positive relationship between market power and systematic risk (beta). The literature on the relationship between beta and market power found that market power reduced beta or that it the relationship could not be measured – **not** that market power increased beta. As a matter of theory, I would expect that a firm that has higher market power and therefore better controls its market would – all else equal – have a lower cost of capital, although it may be impossible to measure the magnitude of the effect. As I discuss

⁸² AECC, Appendix A p. 5, note 3.

below, there are many academic studies confirming that systematic risk is decreased by the exercise of market power. But I have yet to find any academic paper that finds a positive relationship between beta and market power.

To elaborate, Moyer and Chatfield (1983) concluded that “industry concentration ratios and market risk (beta) are strongly related. Firms in highly concentrated industries tend to be associated with low levels of systematic risk and vice versa, ...”⁸³ A similar result is found in Sullivan (1978)⁸⁴ and confirmed in Lee, Chen & Liaw (1995),⁸⁵ who use theoretical model to show that “the firm’s systematic risk is negatively correlated with market power in its product market.”⁸⁶

While there are papers like the Peyser 1994 paper that found an inconclusive relationship between beta and the market power of a firm or industry,⁸⁷ I have not been able to find an academic paper that shows a positive relationship and neither the AECC nor the WCTL or its experts have provided a study that contradicts the existing literature. Therefore, the increase in the industry’s beta estimate is more likely to have been caused by other factors such as the financial crisis of 2008 leading the 2008-12 betas to drop, the large capital expenditures in the industry, or the composition of the industry’s traffic mix.

⁸³ R. Charles Moyer and Robert Chatfield, “Market Power and Systematic Risk,” *Journal of Economics and Business* 35, 1983, p. 128-129.

⁸⁴ Timothy G. Sullivan, “The Cost of Capital and the Market Power of Firms,” *The Review of Economics and Statistics* 60, 1978, pp. 209-217.

⁸⁵ This paper is essentially an extension of the 1994 Peyser paper cited by the WCTL.

⁸⁶ Cheng-Few Lee, K.C. Chen and K. Thomas Liaw, “Systematic Risk, Wage Rates, and Factor Substitution,” *Journal of Economics and Business* 47, 1995, p. 277.

⁸⁷ See, for example, Kit Pong Wong, “Cournot Oligopoly and Systematic Risk,” *Journal of Economics and Business* 47, 1995 and the Peyser 1994 paper cited by the WCTL.

First, Figure 1 and Exhibit BV-1 attached to this Reply Statement shows that the railroad betas dropped at the start of the financial crisis and then recovered in 2013, when the last data pertaining to 2008 were excluded from the 5-year estimation period. Because beta is measured against the market, the beta of an individual firm or industry is affected by market developments and the composition of the market. Thus, a change could be caused by changes in the industry or by changes in the market. As Figure 1 above shows, the railroad beta dropped substantially at the start of the financial crisis in 2008 and then recovered once the data pertaining to the start of the crisis dropped out of the estimation. *I.e.*, it appears that the railroad beta in 2013 simply went back to its pre-crisis trend. This explains the increase in beta for 2013.

Second, regarding the impact of the increasing capital expenditure, Professors Berk and DeMarzo of Stanford University comment on the effect of increasing fixed costs to variable costs:

Another factor that can affect the market risk of a project is its degree of operating leverage, which is the relative proportion of fixed versus variable cost.⁸⁸

Professor Morin states:

Higher margins, due to increased fixed cost or operating leverage, magnify the effect of demand risk on beta.⁸⁹

Similarly, Professors Ross, Westerfield, and Jaffe, state:

Operating leverage magnifies the effect of the cyclicity of a firm's revenues on beta. That is, a firm with a given sales

⁸⁸ Jonathan Berk and Peter DeMarzo, *Corporate Finance: The Core*, 3rd edition, 2014, p. 420.

⁸⁹ Roger A. Morin, *New Regulatory Finance*, 2006, p. 238.

cyclicality will increase its beta if fixed costs replace variable cost in its production process.⁹⁰

Thus, to the degree that capital expenditures increase operating leverage, the cost of capital increases. Therefore, it is plausible that the large capital expenditures by the railroad industry in recent years have increased the relative share of fixed costs in the railroad industry's costs.

Third, the beta of the railroad industry depends on systematic risk of the railroad assets and the variability of the industry's returns relative to the market. Therefore, if the composition of the railroad industry's assets or the return that is generated from these assets has changed, the systematic risk has changed. So since 2007 there has been a reduction in the amount of coal, transportation equipment and mixed shipments that the Class I railroads carry, while there has been an increase in chemicals, crude and food products,⁹¹ there may have been a shift in the risk profile of the industry in recent years.

In summary, there is no evidence that the estimated railroad betas have increased due to "market power." It is much more plausible that railroad betas have simply recovered from the impact of the financial crisis. It is also possible that they have increased due to other factors such as capital expansions and / or because of a change in the risk of the railroads' cash flow caused by changing traffic mix

⁹⁰ Stephen A. Ross, Randolph W. Westerfield, and Jeffrey Jaffe, *Corporate Finance*, 10th edition, 2013, p. 410.

⁹¹ AAR, "Railroad 10-year trends 2003-2012," pp. 45-46.

D. RISK-FREE RATE AND MRP

The Levine Statement submitted in support of WCTL looks at risk-free rates of varying maturity and states that “the STB employs a relatively high risk-free rate in its CAPM calculation. ... Thus, there has been no downward pull on the CAPM results since 2008, emanating from the risk-free, interest rate component.”⁹² In its Opening Comments, the WTCL argues similarly that “... the AFP 2013 survey indicates that the 5% (or lower) MRP is typically utilized in conjunction with a [risk-free rate] that is lower than the 20-year U.S. Treasury. ... Consequently, the total market return expected by the respondents is even further below the return indicated by the Board’s CAPM.”⁹³

This commentary is both confusing and misguided. When Dr. Levine refers to a lack of “downward pull” from the risk-free rate, I believe he means to argue that using a lower risk-free rate would necessarily decrease the CAPM results. The WCTL seems to be making the same claim. However, according to fundamental finance principles, it is incorrect to consider the direct effects of a lower risk-free rate on the CAPM without also considering its impact on the MRP. The MRP must be measured over a certain risk-free rate, so if the maturity of the risk-free rate is reduced, the MRP needs to be measured over that shorter maturity risk-free rate. Because it usually is more costly to borrow long term than short term (the yield curve is increasing), the MRP measured over 10-year Treasury bonds will be higher than the MRP measured over 20-year Treasury bonds. Thus, contrary to the arguments of the WCTL and Dr. Levine, there would be two effects on the CAPM from using a shorter-maturity instrument for the

⁹² Levine Statement p. 10-11.

⁹³ WCTL, p. 36.

risk-free rate: a direct decrease due to the lower interest rate *and* an increase due to using a higher MRP.

The Ibbotson MRP relied upon by the Board is measured over long-term government bonds, which Ibbotson defines as bonds having a “maturity near 20 years.”⁹⁴ Therefore, the Board’s use of a 20-year risk-free rate and the Ibbotson long-term MRP is consistent.⁹⁵

IV. OTHER RESPONSES

A. THE COST OF CAPITAL DEPENDS ON ITS USE, NOT ITS OWNER

The Levine Statement on p. 5 states that “the actual cost of capital to the BNSF is the cost of capital to BH [Berkshire Hathaway].” The WCTL cites this statement to support its claim that “[e]xcluding BNSF...inflates the beta of the remaining railroads. This distortion is particularly significant in the case of BNSF itself because BNSF’s parent has a very low beta.”⁹⁶ However, the notion that BNSF’s cost of capital is equal to that of its corporate parent is a fundamental misconception. Standard financial economics hold that the cost of capital depends on the risk of the underlying assets and **not** on the owner of the asset. As noted by Professors Ross, Westerfield and Jaffe,

If a corporation has a number of divisions, each in a different industry, it would be a mistake to assign the same discount rate to each division.⁹⁷

⁹⁴ Morningstar, “Ibbotson SBBI 2013 Valuation Yearbook,” p. 221.

⁹⁵ For additional discussion of this point, see Exhibit BV-2, pp. 22-23.

⁹⁶ WCTL, p 42.

⁹⁷ Stephen A. Ross, Randolph W. Westerfield, and Jeffrey Jaffe, “Corporate Finance,” 10th Edition, 2013 (Ross, Westerfield & Jaffe 2013), p. 413.

Professors Brealey, Myers and Allen agree

The opportunity cost of capital depends on the use to which that capital is put.... The true cost of capital depends on project risk, not on the company undertaking the project.⁹⁸

Thus, using Berkshire Hathaway's beta as a proxy for the beta of BNSF would violate basic financial economics principles.

B. USING MORE THAN ONE METHOD TO ESTIMATE THE COST OF EQUITY IS COMMON AND BEST PRACTICE FOR REGULATORY PURPOSES.

WCTL relies on the Triantis Statement to argue that the CAPM is "vastly preferred to other COE approaches."⁹⁹ Yet, the vast majority of U.S. state regulatory commissions look to more than one method when determining utilities' cost of equity and several state tax authorities combine the CAPM and a version of the DCF to determine ad valorem taxes. Also, the Federal Energy Regulatory Commission (FERC) relies exclusively on a version of the discounted cash flow model to estimate the COE. Thus, there is ample precedent for using more than one method among regulatory entities and expert witnesses often present evidence on multiple methods. As expressed by Professor Morin, in a utility rate case in response to the question

Does the financial literature support the use of more than a single method to determine return on equity?

Dr. Morin replies:

⁹⁸ Richard A. Brealey, Stewart C. Myers, and Franklin Allen, *"Principles of Corporate Finance,"* 11th Edition, 2014 (Brealey, Myers & Allen 2014), p. 219-220.

⁹⁹ WCTL, p. 20. See also Triantis Statement, p. 5-6.

Yes. The authoritative financial literature strongly supports the use of multiple methods.¹⁰⁰

And he explains:

Each methodology has its own way of examining investor behavior, its own premises, and its own set of simplifications of reality. Investors do not necessarily subscribe to any one method, nor does the stock price reflect the application of any one single method by the price-setting investor. Absent any hard evidence as to which method outperforms the other, all relevant evidence should be used, without discounting the value of any results, in order to minimize judgmental error, measurement error, and conceptual infirmities.¹⁰¹

Similarly, many other cost of capital experts recommend using more than one method.¹⁰² A recent report by the staff of the Federal Communication Commission also endorsed the use of more than one method including the CAPM and a DCF model.¹⁰³ I wholeheartedly agree with Professor Morin and other cost of capital experts that it is important to use more than one method as discussed in my Verified Statement.¹⁰⁴

¹⁰⁰ Morin Minnesota Testimony, page 22.

¹⁰¹ *Ibid.*, page 21 – 22.

¹⁰² *Ibid.*, page 22. Some other recent examples of the reliance on multiple models for the purpose of determining the cost of equity for regulated companies are found in the Direct Testimony of Paul R. Moul on behalf of Wisconsin Public Service Corporation in Application for Authority to Adjust Electric and Natural Gas Rates, April 1, 2014 (Moul WPS Testimony) p. 5; Direct testimony of Paul R. Moul for CLECO, July 14, 2008 (Moul Cleco Testimony), p. 5; Direct Testimony of Robert B. Hevert on behalf of Union Electric Company, Ameren Missouri, July 3, 2014 (Hevert Ameren Testimony), p. 7; Direct Testimony of Roger A. Morin on behalf of Minnesota Power, May 2, 2008 (Morin Minnesota Power Testimony), p. ; Direct Testimony of James H. Vander Weide on behalf of MidAmerican Energy Company, June 25, 2014 (Vander Weide MidAmerican Testimony).

¹⁰³ FCC Staff Report at 7147-7148.

¹⁰⁴ Villadsen Statement p. 4-8 and sources referenced.

C. BNSF's FAIRNESS OPINION

In its Opening Comments, the WCTL refers to certain cost of capital estimates used in valuation analyses performed by Goldman Sachs and Evercore as part of the SEC Form S-4 for the acquisition of BNSF by Berkshire Hathaway. However, in comparing the Board's 2009 overall (or "composite") cost of capital to the weighted average cost of capital "benchmarks" calculated by Goldman Sachs and Evercore, the WCTL makes a fundamental mischaracterization, resulting in a specious comparison.

The source of the confusion lies in the different goals (and corresponding differences in methodology) of the cost of capital calculations performed by the Board and those performed by BNSF's financial advisors. The 10.43% Composite Cost-of-Capital computed by the Board for 2009 represents a required return on assets independent of financing – what corporate finance textbooks refer to as an "unlevered cost of capital"¹⁰⁵ – that is calculated as a weighted average of the *pre-tax* cost of debt and the *after-tax* cost of equity.¹⁰⁶

$$(1) \quad r_U = (\%E) \cdot r_E + (\%D) \cdot r_D$$

In contrast, when financial analysts perform valuation analyses using the Discounted Cash Flow (DCF) method, they typically employ an implicitly *after-tax*

¹⁰⁵ See, for example, Jonathan Berk and Peter DeMarzo, *Corporate Finance*, 2nd ed. (Prentice Hall, 2011), p. 391 and 398.

¹⁰⁶ Surface Transportation Board Corrected Decision, Docket No. EP 558 (Sub-No. 13) Railroad Cost of Capital – 2009, page 12. Note that the reference to "... the 2009 composite after-tax cost of capital" means that the cost of *equity* was computed based on the *levered, after-tax* cash flows of the railroads (in the DCF method) and the *levered* (implicitly after-tax) portfolio beta (in the CAPM). The STB's Composite Cost of Capital incorporates the after-tax cost of equity, but uses the *pre-tax* cost of debt.

version of the weighted average cost of capital (WACC). Indeed, when valuing a firm as the sum of its discounted *unlevered* free cash flows,¹⁰⁷ corporate finance theory *requires* that the discount rate account for the tax deductibility of interest payments. In other words, when discounting unlevered free cash flows, the correct discount rate for this kind of valuation analysis is the *after-tax* WACC.¹⁰⁸

$$(2) \quad r_{WACC} = (\%E) \cdot r_E + (\%D) \cdot r_D(1 - \tau_c)$$

Assuming Goldman Sachs and Evercore used standard finance theory, the “weighted average cost of capital” in BNSF’s Fairness Opinion must refer to the *after-tax* WACC (r_{WACC}), not the unlevered cost of capital (r_U). The description of Evercore’s DCF analysis confirms this. Evercore explicitly states that it is discounting “projected unlevered free cash flows” and a terminal value calculated as a multiple of BNSF’s “2014 projected EBITDA” (i.e., earnings *before interest, taxes, depreciation and* amortization) and thus must use a weighted average cost of capital that accounts for the tax deductibility of interest.

Evercore calculated implied per share equity reference ranges for BNSF ... based on the sum of the (i) implied present values, using discount rates ranging from 8.0% to 10.0% derived by taking into consideration, among other

¹⁰⁷ *Unlevered free cash flows* (also called *free cash flows to capital* or simply *free cash flows*) represent the cash flows that accrue to all the owners of a firm – both the equity holders and debt holders. They are *unlevered* in the sense that they neither deduct interest payments, nor account for the tax deductibility of those interest payments – they are the cash flows to capital that would occur if the firm had no debt and were 100% financed by equity. When performing DCF valuation analyses, analysts forecast unlevered free cash flows and then use a discount rate – the after tax WACC – that accounts for the actual financing and debt tax benefits of the project.

¹⁰⁸ Jonathan Berk and Peter DeMarzo, *Corporate Finance*, 2nd ed. (Prentice Hall, 2011), p. 596. See also Richard A. Brealey, Stewart C. Myers, Franklin Allen, *Principles of Corporate Finance*, 10th ed. (McGraw-Hill, 2011), p. 433.

things, a **weighted average cost of capital calculation**, of **BNSF's projected unlevered free cash flows** for calendar years 2010 through 2014 and (ii) implied present values, using discount rates ranging from 8.0% to 10.0%, of the **terminal value of BNSF's future cash flows** beyond calendar year 2014 calculated by applying a range of EBITDA terminal multiples of 6.75x to 8.25x derived from the selected peer companies as described in "Peer Group Trading Analysis" above to BNSF's calendar year **2014 projected EBITDA**.¹⁰⁹

Goldman Sachs likewise must have performed its DCF analysis using the after-tax WACC. The description of that analysis in the SEC Form S-4 indicates that "Goldman Sachs ... calculated the present value of BNSF's terminal value at December 31, 2014 by applying a range of **enterprise value/EBITDA multiples** of 5.5x to 9.5x to **BNSF's estimated 2014 EBITDA**."¹¹⁰ EBITDA is a common proxy for unlevered free cash flows, in that it also ignores the tax deductibility of interest payments. By using EBITDA to calculate terminal value on an enterprise value (i.e., the value of the entire firm independent of its financing) basis, Goldman Sachs reveals that it was projecting cash flows as they would accrue to BNSF's assets if they were 100% equity financed. Therefore, correct application of fundamental corporate finance principles would again require the analysts to discount those cash flows using the after-tax WACC.

Therefore, the weighted average cost of capital ranges used by Goldman Sachs (7-11%) and Evercore (8-10%) are clearly after-tax WACC (r_{WACC}) numbers, while the

¹⁰⁹ Amendment No. 2 to SEC Form S-4 ("SEC Form S-4"), filed December 23, 2009 by Berkshire Hathaway, Inc. with respect to its merger agreement with Burlington Northern Santa Fe Corporation, page 61. Emphasis added.

¹¹⁰ SEC Form S-4, page 49. Emphasis added.

Board's Composite Cost of Capital for the same time period (10.43%) represents the unlevered cost of capital (r_U), calculated using the *pre-tax* cost of debt and the *after-tax* cost of equity. The two are not the same and the former cannot be used directly as valid benchmarks for the latter.

It is, however, a simple matter to restate either estimate to permit a valid comparison. Indeed, the two quantities differ only by the so-called interest tax shield, which is the cost of debt times the tax rate. The after-tax WACC is simply the unlevered cost of capital, less the interest tax shield weighted by the percentage of debt in the capital structure:

$$(3) \quad r_{WACC} = r_U - (\%D) \cdot r_D \cdot \tau_C$$

$$\text{Or} \quad r_U = r_{WACC} + (\%D) \cdot r_D \cdot \tau_C$$

To allow for an true “apples-to-apples” comparison between the STB's cost of capital calculation and the weighted average cost of capital ranges used in BNSF's Fairness Opinion, I have used the parameters from the 2009 STB Cost of Capital Decision, along with a representative marginal composite corporate tax rate of 40%, to determine the equivalent unlevered cost of capital corresponding with the discount rates used by Evercore and Goldman Sachs. Table 3 below shows the conversion of several after-tax WACC (r_{WACC}) estimates within the Goldman and Evercore ranges to unlevered cost of capital (r_U) estimates by adding back the weighted value of the interest tax shield.

For example, the “median” discount rate used in both Evercore's and Goldman Sachs's DCF valuation analyses was 9%. As explained above, this is an after-tax WACC (r_{WACC}), which implicitly accounts for the tax-deductibility of interest payments by

subtracting the weighted value interest tax shield from the unlevered cost of capital (r_U). Using the STB's 2009 cost of debt ($r_D = 5.72\%$) and a 40% tax rate, I calculate that the interest tax shield equates to a 2.92% return ($0.40 \cdot 5.72\% = 2.92\%$). Applying the STB's 2009 debt percentage in the railroad capital structure ($\%D = 29.10\%$), provides an estimate of 0.67% as the weighted value of the interest tax shield ($0.2910 \cdot 2.92\% = 0.67\%$). I add this value back to the 9% after-tax WACC to get an unlevered cost of capital of 9.67%. Table 3 below shows this calculation for the full range of Goldman Sachs's estimates. The resulting unlevered cost of capital values run from 7.7% to 11.7%. The 10.43% composite cost of capital for the railroad industry for 2009 is thus well within both the 7.7% to 11.7% range estimated by Goldman Sachs and the narrower 8.7% to 10.7% range estimated by Evercore.

Table 3 – Conversion of After-tax WACC Discount Rates to Unlevered Cost of Capital

Pre-tax Cost of Debt	[a]	5.72%
Tax Rate	[b]	40.00%
Interest Tax Shield	[c] = [a]*[b]	2.29%
Debt Percentage in Capital Structure	[d]	29.10%
Weighted Interest Tax Shield	[e] = [c]*[d]	0.67%

After-tax WACC Discount Rate		Weighted Interest Tax Shield	Equivalent Unlevered Cost of Capital
[1]		[2]	[3] = [1] + [2]
7.0%	[f]	0.67%	7.7%
8.0%	[g]	0.67%	8.7%
9.0%	[h]	0.67%	9.7%
10.0%	[i]	0.67%	10.7%
11.0%	[j]	0.67%	11.7%

Sources & Notes:

[a],[d]: Surface Transportation Board Corrected Decision, Docket No. 558 (Sub-No. 13) Railroad Cost of Capital--2009.

[b]: Representative composite state and federal corporate marginal tax rate

[f]-[j]: Range of discount rates used in Goldman Sachs's DCF valuation analysis per BNSF's Fairness Opinion.

[g]-[i]: Range of discount rates used in Evercore's DCF valuation analysis per BNSF's Fairness Opinion.

The WCTL’s mischaracterization of the weighted average cost of capital ranges used by Goldman Sachs and Evercore (i.e., treating them as though they represented an unlevered cost of capital rather than a true after- tax weighted average cost of capital) renders its “benchmarking” of the Board’s 10.43% Composite Cost of Capital invalid.

Furthermore, it is possible to estimate the cost of equity implied by a given after-tax WACC. Applying Equation 4 below, I have determined that--using the parameters from the Board’s 2009 Cost of Capital Decision and a 40% representative corporate tax rate—the cost of equity consistent with an after-tax weighted average cost of capital of 10.0% is 12.7%. Similarly, the cost of equity implied by an 11.0% after-tax weighted average cost of capital is 14.1%. This means that that 12.37% Cost of Common Equity determined by the Board for 2009 (based on the CAPM and MSDCF models) is consistent with some of the “benchmark” cost of capital estimates considered by BNSF’s financial advisors and reported in the SEC Form S-4 for Berkshire Hathaway’s acquisition of BNSF.¹¹¹

$$(4) \quad r_E = \frac{r_{WACC} - (\%D)r_D(1-\tau_c)}{\%E}$$

The WCTL’s improper apples-to-oranges comparison also calls into question the its claims that “[t]he Board’s MSDCF COE for 2009 ... exceeded the highest COE value (12%) considered by either Goldman Sachs or Evercore” and that “[e]ven the CAPM [sic] COE of 11.39% falls substantially above the Goldman Sachs median COE of 10% and also exceeds the Evercore median COE of 11%.”¹¹² As demonstrated above, the

¹¹¹ The SEC Form S-4 refers to certain “cost of equity calculations” performed by Evercore and Goldman Sachs in reference to other valuation methods. However, BNSF’s financial advisors can be assumed to have considered cost of equity estimates consistent with the after-tax cost of capital discount rates they used for DCF valuation.

¹¹² WCTL, p. 12.

weighted average cost of capital ranges used by the financial advisors imply COE values as high as 14.1% (for Goldman Sachs) and 12.7% (for Evercore); furthermore, according to Equation 4, the “median” after-tax WACC used by both companies (9%), implies a COE of 11.3%. Thus the WCTL’s claims about the relationship of the Board’s 2009 cost of equity estimates to the values “considered by either Goldman Sachs or Evercore” are exaggerated at best.

Finally, it is worth noting that these claims are accompanied by a thoroughly misleading statement, namely that “the 13.34% [MSDCF COE] for 2009 was the **lowest** MSDCF COE value during 2008-2013.”¹¹³ It would seem the WCTL is implying that other years’ MSDCF COE values can meaningfully be compared to the cost of capital estimates used in BNSF’s Fairness Opinion. However, since the opinions of Goldman Sachs and Evercore were officially rendered on November 2, 2009,¹¹⁴ it is reasonable to assume that the cost of capital calculations would rely on data of similar vintage to that used by the STB in determining its 2009 cost of capital for the railroad industry. It defies logic and financial practice to suggest that the financial advisors’ 2009 calculations would represent a valid benchmark for the cost of capital in, for example, 2012.

¹¹³ WCTL, p. 12. Emphasis in original.

¹¹⁴ SEC Form S-4, pages C-1 and D-1.

VERIFICATION

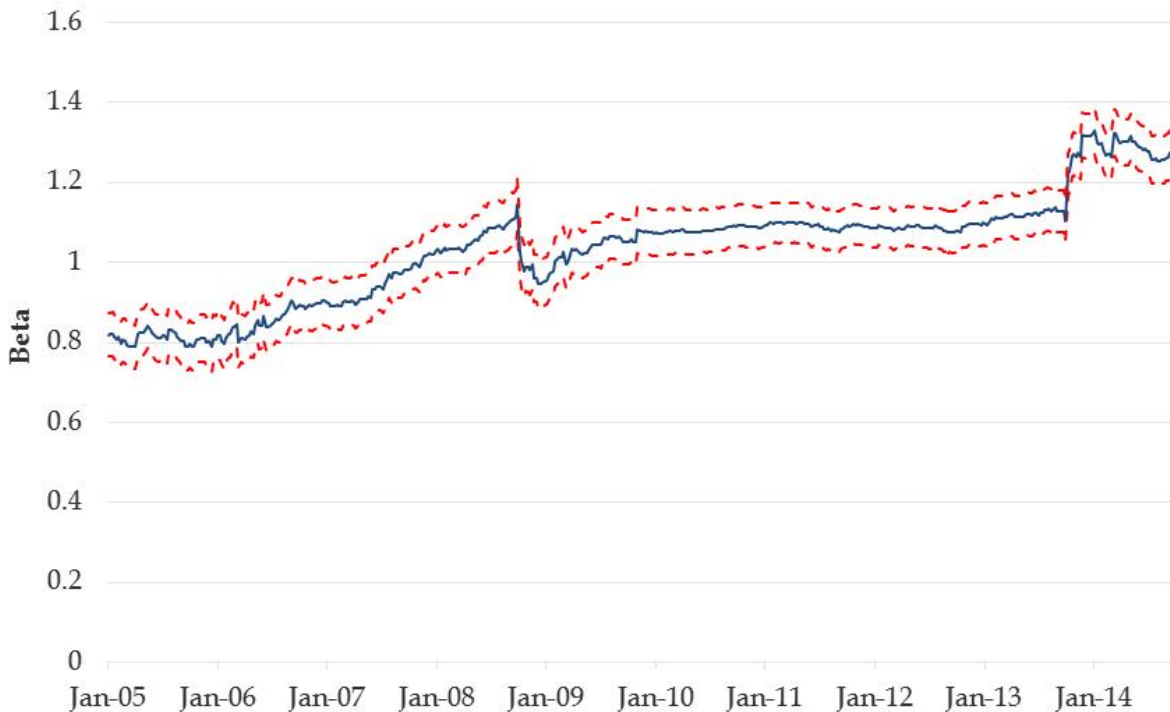
I, Bente Villadsen, declare under penalty of perjury, that the foregoing statement is true and correct to the best of my knowledge and belief and that I am qualified and authorized to file this statement.

Executed: 10-30-2014

B. Villadsen
BENTE VILLADSEN

EXHIBIT BV-1
Rolling Five-Year Betas for the Railroad Industry

Exhibit 1, Panel A
Rolling Five-year Betas for the Railroad Industry
Weekly Returns



Sources and notes: Market Capitalization and returns for railroad stocks and the S&P 500 Index from Bloomberg as of 10/10/2014. Betas are calculated from weekly rates of return on a market-value weighted portfolio of the four major US railroads: CSX, NSC, KSU, UNP, and BNI (until February 12, 2010 when BNI was bought). 3-month Treasury bill rates are subtracted from the portfolio and market returns. The Regression equation includes an intercept. Data include returns from 2000. Dashed lines show beta estimates plus and minus one standard error.

Exhibit 1, Panel B
Rolling Five-year Betas for the Railroad Industry
Monthly Returns



Sources and notes: Market Capitalization and returns for railroad stocks and the S&P 500 Index from Bloomberg as of 10/10/2014. Betas are calculated from monthly rates of return on a market-value weighted portfolio of the four major US railroads: CSX, KSU, NSC, UNP, and BNI (until February 12, 2010 when BNI was bought). 3-month Treasury bill rates are subtracted from the portfolio and market returns. The Regression equation includes an intercept. Data include returns from 2000. Dashed lines show beta estimates plus and minus one standard error.

EXHIBIT BV-2

Review of Regulatory Cost of Capital Methodologies

Prepared by: Michael J. Vilbert, Bente Villadsen and Matthew Aharonian

For

The Canadian Transportation Agency

September 2010

Review of Regulatory Cost of Capital Methodologies

Date: September 2010

Principal Investigators: Michael J. Vilbert
Bente Villadsen
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Prepared for

**Canadian
Transportation
Agency**

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I. BACKGROUND

This report is written at the request of the Canadian Transportation Agency (Agency), which has initiated a review of its cost of capital methodology. The Agency sets the cost of capital for the transportation of western grain each crop year, which begins each August, as well as for the development of interswitching costs and rates and other regulatory purposes. It reviewed its methodology most recently in 2004.

This report first reviews the cost of capital estimation models and the strengths and weaknesses of the various cost of capital estimation models relied upon in regulatory settings, with particular focus on variations in how the models are implemented. Second, the report reviews the models used by the Agency and five other regulators: The Canadian Radio-Television and Telecommunications Commission (CRTC), the Ontario Energy Board (OEB), the U.S. Surface Transportation Board (STB), the U.K. Competition Commission (CC), and the Western Australia Economic Regulation Authority (ERA). Third, the report considers the conclusions reached by several regulators, who have recently reviewed their approach to cost of capital determination. Finally, Appendix A contains technical details of the models for those who seek a more complete coverage, and Appendix B provides an introduction to the Fama-French model and its implementation.

The purpose of the report is to serve as a guide for discussion of how to estimate the cost of capital for the Canadian railways by identifying common cost of capital estimation models, best practices for their implementation, and the strengths and weaknesses of the specifications. However, the report does not provide specific recommendations for how cost of capital estimation should be performed for Canadian railways. In assessing the strengths and weaknesses of the various methodologies, we acknowledge that there are trade-offs among various goals such as accuracy, ease of implementation, robustness and consistency with respect to the regulatory goal being pursued.

II. MODELS TYPICALLY RELIED UPON FOR COST OF CAPITAL ESTIMATION

A. CONTEXT

The federal principle underlying the determination of the cost of capital for a regulated entity is the “fair return standard”, which has been articulated in several key decisions in Canada as well

as in the U.S.¹ In *Northwestern Utilities Limited*, the Supreme Court described the fair return standard as follows:

By a fair return is meant that the company will be allowed as large a return on the capital invested in its enterprise, which will be net to the company, as it would receive if it were investing the same amount in other securities possessing an attractiveness, stability and certainty equal to that of the company's enterprise.

Based on this notion as well as that of similar decisions by the U.S. Supreme Court,² cost of capital analysts typically select a group of companies that are comparable to the company being regulated and estimate the cost of capital that investors in those companies expect. However, the legal decisions, which provide the overarching principles, do not prescribe how to determine comparability, how to estimate the cost of capital for the comparable companies, or how to apply those estimates when setting allowable rates. The methods relied upon by various regulators and practitioners therefore differ substantially. For example, while some regulatory entities set rates by determining the weighted-average cost of debt and equity that the regulated company should be allowed to earn on its invested capital (as a whole), other regulatory entities determine separately the cost of equity and possibly the percentage of equity that should be allowed in the regulated company's capital structure. Both approaches are found among the regulators reviewed in this report.

1. The Cost of Capital

The cost of capital is a key parameter in regulatory settings, where it contributes to determining the return to equity investors. Defined as *the expected rate of return in capital markets on alternative investments of equivalent risk*, it is the expected rate of return investors require based on the risk-return alternatives available in competitive capital markets. Stated differently, the cost of capital is a type of opportunity cost: it represents the rate of return that investors could expect to earn elsewhere without bearing more risk.^{3,4}

¹ *Northwestern Utilities Limited v. City of Edmonton* (1929) (*Northwestern Utilities*) is the landmark Canadian decision.

² *Bluefield Waterworks & Improvement Co. v. Public Service Commission of West Virginia et al.* (1923) and *Federal Power Commission v. Hope Natural Gas* (1944) are the key U.S. decisions.

³ “Expected” is used in the statistical sense: the mean of the distribution of possible outcomes. The terms “expect” and “expected” in this report, as in the definition of the cost of capital itself, refer to the probability-weighted average over all possible outcomes.

⁴ The cost of capital is a characteristic of the investment itself, not the investor.

2. Regulation and the Cost of Capital

The most common forms of regulation found in North America are cost of service and price caps.⁵ In cost of service regulation, rates are set to recover forecast costs including the cost of capital. Price cap regulation can generally be characterized as system in which the regulated company has some freedom to set rates as long as the rates are less than a specified price cap. The Canadian Transportation Agency uses a form of revenue cap regulation. In either form of regulation, the regulator must set an allowed rate of return on capital investment that is consistent with legal standards.

It has become routine in rate regulation to accept the "cost of capital" as the right rate of return to target. Setting and achieving a fair return helps ensure that the regulated company has access to capital for maintaining and expanding utility infrastructure, as needed, yet does not charge customers more than is needed. Thus, the regulated company is entitled to receive the return of its invested capital and to expect to earn a fair return on the invested capital.

3. What should we expect from models?

It is useful to recognize explicitly at the outset that models are imperfect. All are simplifications of reality – and this is especially true of financial models. Simplification, however, is also what makes them useful. By filtering out various complexities, a model can illuminate the underlying relationships and structures that are otherwise obscured. After all, while a perfect scale model representation of the city might be highly accurate, it would make a poor road map. Nevertheless, the gap between financial models and reality can sometimes be quite significant (as was painfully demonstrated by the recent financial crisis). There is no single, widely accepted, best pricing model – just as there is still no consensus on some fundamental issues, such as the Efficient Market Hypothesis.⁶ Analysts have a dizzying array of potential models at their disposal, and it must be acknowledged that cost of capital estimation continues to be as much art as it is science. The generally recommended “best practice” is therefore to look at a totality of information from alternative methodologies. Analysts must exercise common sense as

⁵ There are other versions around the world including incentive rate making and revenue adequacy.

⁶ The Efficient Market Hypothesis (EMH) says that stocks prices very rapidly reflect available information. There are different versions of the EMH that relate to the specific definition of information considered. For example, weak form efficiency suggests that each security's price reflects the information contained in that security's price history. Semi-strong efficiency would suggest that all publicly available information is reflected in security prices.

well as expertise in interpreting the results from these models. They should try to understand why things may look unusual when they do – and be able to use that understanding to shape their interpretation of the results.

While no model is perfect, there are certain features that make models more useful from a regulatory perspective. For example, it is desirable to have models and methods that i) are consistent with the goal being pursued, ii) are transparent, iii) minimize the use of judgmental factors, iv) produce consistent results, v) are robust to small deviations or sampling error, vi) are as simple as possible (while maintaining reliability), vii) can be replicated by others (e.g., data is widely available), and viii) recognize the regulatory context and legislative requirements in which the regulatory body operates. Clearly different models will satisfy these criteria to differing degrees, and different models may be better suited to differing regulatory jurisdictions.

The Capital Asset Pricing Model (CAPM), for example, has a transparent and well-explored economic theory underlying it. Its results can be replicated easily, since the data required is widely available from many public sources. Implementing the CAPM, however, requires a number of subjective decisions – decisions which can be hotly contested and can lead to significantly different results. Conversely, the Discounted Cash Flow (DCF) model can be relatively objective to implement in its simplest form, although required data on growth rates may be difficult to cross-check in publicly available datasets. Moreover, the DCF model is highly sensitive to growth rate estimates, which can vary widely among analysts – and that variation may increase in times of greater economic uncertainty. As such, the reliability of DCF methods can be questionable in times of economic turmoil or when an industry is in transition. These reliability concerns are further exacerbated by the extent of simplification underlying the constant growth version of the DCF model. For example, assuming that cash flows will grow at a constant rate into the infinite future is a gross simplification, and makes the model highly sensitive to the growth rate assumption. If five-year growth rate forecasts are used as the constant growth rate, as is often the case, then the reliability of the model can be significantly reduced in periods of abnormally high or low growth. Moreover, the results of applying the methodology can be unstable over time, leading to rapid shifts from high cost of capital estimates to low ones. Some of this sensitivity can be mitigated in the DCF framework by adjusting the growth path more realistically, but this then opens the DCF model to some of the same subjective parameter concerns raised in implementing the CAPM. Like the CAPM and the DCF

model, the difficulties in relying on the risk premium or comparable earnings model also lie in their implementation. For example, the risk premium model requires the analyst to decide what to measure the premium over and the comparable earnings model require the analyst to select a comparable sample, determine a time horizon over which to implement the model, etc. These choices necessarily involve subjective judgment.

4. Model Stability and Robustness

Stability and robustness over time of an estimation model is desirable. Stability means that cost of capital estimates done in similar economic environments should be similar, not only period-to-period but also company-to-company within a comparable sample. Robustness is meant here as the ability of a model to reliably estimate the cost of capital across different economic conditions.

In general, all models discussed here have characteristics that make them more or less suited to one economic environment versus another. As such, all individual models can be, and often are, subject to some instability over time. For example, beta estimates for utilities were very close to zero in the aftermath of the 2001 tech collapse, suggesting a near risk-free rate of return for these securities – less than their individual costs of debt in many cases! During the early 2000s, the DCF was subject to substantial criticism as allegations of analysts' bias were prevalent. Similarly, the risk premium model has produced very different results in times of high and low inflation that did not necessarily reflect the true cost of capital. If estimates seem high or low by historic standards, the analyst needs to understand why that is. Is it the case that the cost of capital has changed significantly, or is it a problem with the models in the current environment? Many regulators review estimates from multiple models before arriving at a decision on which cost of capital to allow. Some regulators, e.g., the Surface Transportation Board, have explicitly determined which weight to assign to each model, while others use a range of estimates to guide their decision. Looking at evidence from a number of models continues to be best practice, because different models may be better at capturing different aspects of pricing. It may be the case, for example, that the traditional CAPM (a two period model) fails at times to capture fully the dynamic element of pricing, though it may capture the bulk of cross-sectional pricing (i.e., differences in the prices of assets that reflect differences in their short-term risks). The DCF model, which looks at each security on an individual basis over time, may, conversely, have a relative advantage in capturing the dynamic components of pricing (and be weaker in capturing

cross-sectional pricing). Whatever the specific reasons may be, considering evidence from all reasonable models, while recognizing their strengths and weaknesses, is clearly a good regulatory practice and will help ascertain whether cost of capital has truly shifted in a significant manner, or whether the models are having performance problems in the current economic environment.

A separate, though related, issue is how the regulator should respond, when the true underlying cost of capital enters a volatile period. We note that this is not a modeling issue, but a policy issue. The most stable and robust model will produce volatile estimates (over time) if the underlying cost of capital is itself volatile. Indeed, an approach that fails to reflect such underlying instability risks violating the fairness standard discussed earlier. Nevertheless, underlying volatility raises a legitimate concern. If the instability is generally expected to abate during the regulatory period, setting rates based on a transitory blip (up or down) in the cost of capital can lead to rates which will be expected to provide too much or too little return over most of the rate's life (before the next rate setting). As such, it is important that analysts try to understand whether those conditions giving rise to unusual estimates are expected to persist over the regulatory period. If not, and the unusual circumstances are believed to be temporary, the regulator may wish to incorporate that fact in setting rates that will be reasonable over the entire regulatory period. Although one approach might be to attempt an estimate of the future path of cost of capital as conditions normalize, this is problematic and is sure to be contentious in a regulatory setting. A better alternative might be to set rates on the current estimates and provide an efficient mechanism by which rates can be adjusted as cost of capital returns to a more normal state. For example, by having a hearing at which only the cost of capital is reset, as opposed to an entire regulatory proceeding. The Agency's approach of setting rates on a yearly basis is a good example of an approach that mitigates the concerns of volatility in the underlying true cost of capital.

B. RISK RETURN TRADEOFF

1. Asset Pricing Principles

At its most basic level, an asset (security) is a claim to a stream of future (risky) cash flows and sometimes with potential rights to exert some control over those flows.⁷ A financial market allows investors to exchange these claims, and therefore risks. Through trade, investors are able to create different packages of risks and returns than could be achieved by holding individual securities (or fixed packages of securities), and investors can change their risk exposure over time. Because investors are assumed to be risk averse, they evaluate the universe of risky investments on the basis of a risk-return trade-off. Investors can only be induced to hold a riskier investment if they expect to earn a higher rate of return on that investment.⁸

The presence of a market underlies the “opportunity cost” interpretation of cost of capital – by investing in a security A, an investor foregoes (some) investment in an alternative, “comparable risk,” investment B obtainable through the market. The risk-return tradeoff leads to the question of what makes two investments comparable in terms of risk. And once comparable risk investments have been identified, how does one measure their expected returns? These problems lie at the core of asset pricing theory. Without more structure, the potential relationships between prices, risks, expected returns, etc. can take an overwhelming number of configurations. The “no free lunch” assumption, however, provides for a simple and robust pricing framework.⁹

a) No free lunch

The most basic assumption typically made in asset pricing is that you “cannot get something for nothing – there is no free lunch.” Although there can be (and probably will be) moments where this premise is violated, such occurrences are not likely to last very long, and they cannot represent a state of equilibrium. If investors prefer more to less, they will quickly invest in such

⁷ Cost of capital estimation models are also called asset pricing models because the price of an asset reflects the discounted present value of its claim to future cash flows where the discount rate is the cost of capital.

⁸ We assume throughout that markets are frictionless and participation is not constrained. A frictionless market is one without credit constraints (i.e., everyone can borrow as much as desired at the risk-free rate), where goods and services are bought and sold without outside interference from commissions, fees, taxes, and so forth. In a frictionless market, the only factors affecting a price are the supply and the demand of the good or service. It is impossible for a completely frictionless market to exist, but it serves as the standard benchmark in economic research.

⁹ Robust in this context means that the model is not disrupted due to violations in the assumptions underlying the development of the model.

opportunities, driving prices up in the process and eradicating the free-lunch. As such, most economists are comfortable starting with the assumption that markets admit no free lunches, or in more formal terms, no arbitrage opportunities. Arbitrage is defined as the ability to purchase one security and simultaneously to sell another to gain a risk-free profit.

Assuming no-arbitrage imparts a remarkable amount of structure on asset prices and returns. In particular, it ensures the existence of the market's minimum variance frontier and the security market line that underlie the CAPM. The insight here is that when security returns are positively correlated (i.e., have a tendency to move in the same direction, to some degree), trade in capital markets allows investors to reduce their total risk exposure by holding portfolios, which serve to diversify the risk of the individual securities.¹⁰ Diversification permits investors to obtain lower variance for a given expected return or a higher expected return for a given level of variance. This essential tradeoff between the risk and the cost of capital is depicted in Figure 1 below.

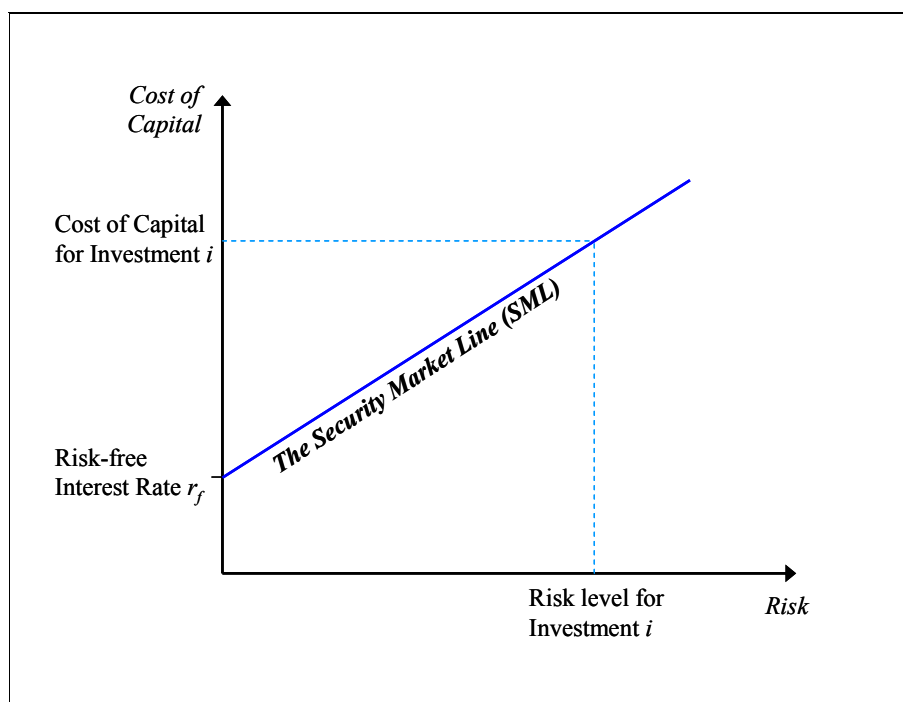


Figure 1: The Security Market Line

¹⁰ Harry Markowitz received the 1990 Nobel prize in economics for his work investigating the efficient frontier.

For a technical derivation of the security market line, please refer to *Appendix A, Section A*.

C. PRICING MODELS TRADITIONALLY USED BY REGULATORS

1. Capital Asset Pricing Model

One of the most common pricing models used in business valuation and regulatory jurisdictions is the Capital Asset Pricing Model (CAPM), which in its simplest form is depicted in Figure 2 below.

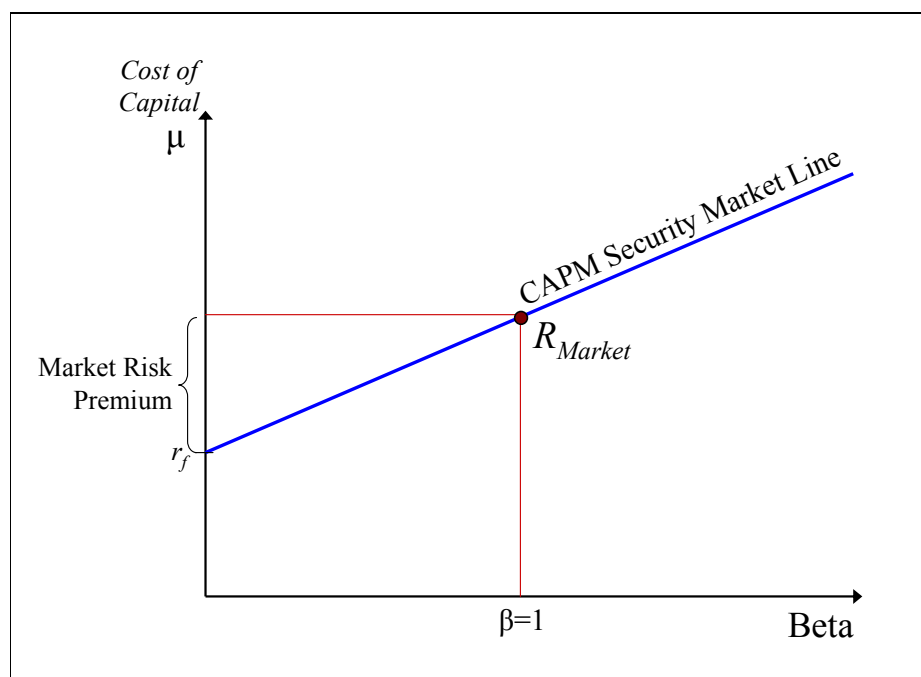


Figure 2

Thus, in the world in which the CAPM holds, the expected cost of (equity) capital for an investment is a function of the risk-free rate, a measure of systematic risk, beta, and an expected market risk premium (MRP):¹¹

$$E(r_S - r_f) = \beta_S \times E(r_M - r_f) \quad (1)$$

where r_S is the cost of capital for investment S ; r_M is the return on the market portfolio, r_f is the risk-free rate, and β_S is the measure of systematic risk for the investment S . The $(r_M - r_f)$ term is

¹¹ While the CAPM model frequently is applied to equity capital, it applies to all assets. See *Section III.G* for a discussion of the derivation of a company's unlevered (or asset) beta.

known as the market risk premium (MRP) or the equity risk premium (ERP).¹² β_S measures the response of the stock S to systematic risk. Re-arranging this equation produces the CAPM's formula for the cost of (equity) capital of a traded asset:

$$r_S = r_f + \beta_S \times MRP \quad (2)$$

The CAPM has gained much of its popularity due to its insights, its theoretical underpinnings, and its simplicity to implement. Although the specific assumptions underlying the CAPM are never met exactly in practice, it is typically viewed as a reasonable model, especially for markets that are relatively “sophisticated.” In other words, markets that are large (many buyers and sellers) and have efficient trade and clearing mechanisms (e.g., electronic), where pricing is transparent and readily available, where short-selling mechanisms are in place, where capital flows are not overly restricted, and where regulations to support the market institution and protect property rights are in place and enforced.¹³ Canada's TSX certainly satisfies these traits to a degree that makes CAPM modeling as applicable to the TSX as it is for any other market.

To implement the CAPM, it is necessary to determine the risk-free rate, r_f , and to estimate the MRP and the beta, β_S . Principles guiding the determination of these values are provided in *Section V*, which also discusses strengths and weaknesses of various approaches.

2. Discounted Cash Flow Model

Although there are several versions of the DCF model, they all determine today's stock price as a sum of discounted cash flows that are expected to accrue to shareholders. Assuming that dividends are the only type of cash payment to shareholders, the pricing formula becomes:

¹² Throughout this paper we use MRP and ERP interchangeably to refer to the same concept. To be consistent with the terminology used by the different regulators, we use MRP or ERP in various places.

¹³ Note, this is not an exhaustive list, and different financial economists may favour certain features over others.

$$P_t = \frac{E_t(D_1)}{(1+r_s)} + \frac{E_t(D_2)}{(1+r_s)^2} + \frac{E_t(D_3)}{(1+r_s)^3} + \dots \quad (3)$$

where “ P_t ” is the market price of the stock; “ D_i ” is the dividend cash flow at the end of period i ; “ r_s ” is the cost of capital of asset/security s (as before); and the sum is into the infinite future.¹⁴ The formula above says that the stock price is equal to the sum of the expected future dividends, each discounted for the time and risk between now and the time the dividend is expected to be received – with the cost of capital r_s as the appropriate discount rate.

If the dividend growth is constant, then we obtain the standard Gordon growth model or constant growth DCF:

$$P_t = \frac{D_0 \cdot (1+g)}{(1+r_s)} + \frac{D_0 \cdot (1+g)^2}{(1+r_s)^2} + \frac{D_0 \cdot (1+g)^3}{(1+r_s)^3} + \dots \quad (4)$$

which reduces to:

$$P = \frac{D_0 \times (1+g)}{(r_s - g)} \quad (5)$$

Re-arranging then gives the standard DCF formula for cost of capital:

$$r_s = \frac{D_0 \times (1+g)}{P} + g \quad (6)$$

This equation says that the cost of capital equals the expected dividend yield (dividend divided by price) plus the (perpetual) expected future growth rate of dividends. As is readily seen from Equation 6 above, an implementation of the constant growth DCF requires a determination of the current stock price, current dividends, and the applicable growth rate.

If the assumption of constant growth is not considered reasonable for several years before settling down to a constant rate, variations of the general present value formula can be used instead. For example, if there is reason to believe that investors do *not* expect a steady growth rate forever, but rather have different growth rate forecasts in the near term (e.g., over the next five or ten years) converging to a constant terminal growth, these forecasts can be used to specify the early dividends in Equation 3. Once the near-term dividends are specified, Equation 5 can be used to specify the share price value at the end of the near-term (e.g., at the end of five or ten

¹⁴ With the convention that if an asset has an expected finite life to time T , D_i is zero for periods i greater than T .

years), and the resulting cash flow stream can be solved for the cost of capital using Equation 6. A standard “multi-stage” DCF approach solves the following equation for r :

$$P = \frac{D_1}{(1+r_s)} + \frac{D_2}{(1+r_s)^2} + \dots + \frac{D_T + P_{TERM}}{(1+r_s)^T} \quad (7)$$

The terminal price, P_{TERM} is just the discounted value of all of the future dividends after constant growth is reached:

$$P_{TERM} = \frac{D_T(1+g_{LR})}{(r_s - g_{LR})} \quad (8)$$

where T is the last of the periods in which a near term dividend forecast is made, and g_{LR} is the assumed long-run growth rate. The implementation of the multi-stage growth model requires in addition to a current price and current dividend, the selection of growth rates for each stage of the model and a determination of the length of each period.

3. Risk Premium Approaches

Some regulators use a simplified version of the CAPM, the so-called risk-premium approach, which is also called the equity risk premium model, to estimate the cost of equity for regulated entities. It is sometimes used as the primary tool or as one of several methods depending on the regulator. The risk premium method is related to the CAPM in that it determines the regulated entity's cost of equity as the sum of the return on a debt instrument and a risk premium relative to that debt instrument. Like the CAPM it recognizes the risk-return tradeoff and determines the cost of equity capital as the sum of the cost of debt plus an equity risk premium. Thus, the risk premium approach calculates the cost of equity, r_s , as:

$$r_s = r_D + \text{estimated risk premium} \quad (9)$$

where r_D is the return on a selected debt instrument. There are many versions of this model depending on the choice of the debt instrument, r_D , and the estimation of the risk premium. *Section V* discusses common approaches to selecting the debt instrument and for estimating the risk premium. It also addresses the strengths and weaknesses of various implementation methods.

4. Comparable Earnings

Among the traditional approaches to cost of capital estimation is the comparable earnings method. The comparable earnings methodology does not have a financial economics foundation and while neither the Canadian nor the U.S. Supreme Court identified any specific methodology to determine a “fair return,”¹⁵ the legal decision, *Federal Power Commission v. Hope Natural Gas* (1944) is often cited in the use of comparable earnings. The decision stated that

... the return to the equity owner should be commensurate with returns on investment in other enterprises having corresponding risks.¹⁶

The steps in the comparable earnings approach include (i) selecting a group of *unregulated* companies of comparable risk, (ii) calculating the average accounting return on book equity over an appropriate time period, and (iii) adjusting the result for any differences in risk between the regulated entity and the comparable companies. These steps require the analyst to make choices regarding the following:

- Selection of a group of *unregulated* companies of comparable risk;
- Time period over which to estimate the return on equity must be selected; and
- Adjustment for any risk differences between the sample companies and the target company.

Common choices to implement the model are discussed in *Section III* below.

III. ESTIMATION IMPLEMENTATION ISSUES

A. CONTEXT AND GENERIC ISSUES

This section discusses implementation issues for the models relied upon among regulators and focus on the pros and cons of the various methods. Listed below are the criteria suggested by the Agency in Appendix A of the Contract for this project.

¹⁵ The fair return standard focuses on the allowed rate of return being “fair” (e.g., the outcome) and not the process used to arrive at the return.

¹⁶ *Federal Power Commission v Hope Natural Gas Company*, 320 U.S. 391 (1944).

a. Reasonable

1. Be consistent with the objective being pursued – namely to provide regulated railroads with a fair and reasonable return;
2. Be transparent by relying as much as possible on a formula/structured methodology and by minimizing the use of judgmental factors;

b. Reliable

3. Be based upon auditable information;
4. Produce consistent results for like conditions;
5. Be robust, and reasonably sensitive, to a broad range of economic/financial conditions;

c. Pragmatic

6. Be based upon readily available information or information that can be obtained with minimal costs;
7. Be simple to implement for both the regulator and regulated parties; and
8. Recognize the regulatory context and legislative requirements in which the Agency is exercising its responsibilities (timeframe for issuing decisions, nature of regulated parties, context in which the cost of capital is being applied).

In general, these criteria are quite reasonable; however, the methodologies discussed in this report would apply to all types of regulated companies, not just railroads in Canada. As the Agency notes, some methodologies may meet all or most of the criteria in varying degrees. Finally, a methodology may be precluded from use by the regulatory context of the company to be regulated. Such a restriction would not necessarily represent a flaw in the methodology, but rather would be recognition that legislative requirements may make it unsuitable.

The remainder of this section is organized as follow. *Section III.B* discusses a few generic principles related to cost of capital estimation, *Sections III.C* through *III.F* focus on the four most commonly used cost of capital estimation methods, *Section III.G* discusses methods that can be used to adjust for differences in financial risk and *Section III.H* summarizes.

B. COMMON ISSUES IN COST OF CAPITAL IMPLEMENTATION

Regardless of the cost of equity estimation method that a regulator relies upon, there are some key elements of the cost of capital estimation process that must be addressed. This section discusses some of these issues although the treatment is far from complete.

First, because it is common to rely on a “comparable sample” to determine the cost of equity for the regulated entity, it is important to determine what is meant by comparable.^{17,18} Although the selection of comparable companies is method and context specific, it is generally viewed as ideal to have sample companies with similar business risk to the regulated company. Similar business risk generally implies selecting companies in the same line of business. Most researchers and practitioners rely on additional criteria to exclude sample companies that have the potential to bias the cost of capital estimation methodologies. For screening, it is preferable to rely on objective information from public data sources; however, the determination of exactly which criteria to use is subject to the constraint that the sample be “large enough.” This, in turn, requires a determination of which criteria are the most important from the many possible criteria that could be considered. Among the criteria typically employed are combinations of the following:

- Include companies with similar business risks (e.g., companies in the same or similar industries);
- Exclude companies that face financial distress;
- Exclude companies that are or have recently been involved in substantial merger and acquisition activity;

¹⁷ A comparable sample can be used to assess the cost of capital for the regulated entity by (i) estimating the individual companies’ cost of capital and placing the regulated company’s cost of capital in relation to the sample using the average, median, range, or other measure to assess the cost of capital or (ii) using a portfolio approach, where the cost of capital for the portfolio of companies (rather than individual companies) is estimated to assess the cost of capital for the regulated entity. Many regulators include the regulated company in the estimation process.

¹⁸ The U.S. Federal Energy Regulatory Commission’s proceeding in Docket No. PL07-2-000 focused on this issue and especially, whether Master Limited Partnerships that engage in natural gas pipeline activities are comparable to natural gas pipeline companies. The FERC concluded that they were, but implemented a modification to the growth rate used in the DCF method it relies upon to estimate the cost of equity for natural gas pipelines. See, FERC Policy Statement on “Composition of Proxy Groups for Determining Gas and Oil Pipeline Return on Equity,” Docket No. PL07-2-000, issued April 17, 2008.

- Exclude companies with unique circumstances that may bias the cost of capital estimation (e.g., restatements of financial statements); and
- Exclude companies with insufficient data.

There is, however, controversy about how to implement the criteria above. Each element of the sample selection criteria requires some judgment. For example, what size sample is “large enough”? Should the sample include both Canadian and foreign companies? How is financial distress measured? How is “substantial merger or acquisition” activity to be defined? The selection criteria are interrelated, because selection of the sample based upon one criterion may immediately reduce the potential sample to a small number of companies. For example, if the sample is restricted to the same industry, but the number of companies in the industry is small, (e.g., there are relatively few publicly traded railways), the ability to apply other selection criteria and still have a sufficiently large sample is limited. The sample selection process is, therefore, a balancing act between selecting a sample that is “more comparable” and one that is “too small”. The analyst must decide which criteria are most important and are likely to result in as accurate an estimate of the cost of capital as possible without leaving a sample that is small.

Second, regulators must decide how the components of the cost of capital will be determined. For example, regulators can estimate (1) the cost of debt, the cost of equity and the regulatory capital structure, each separately or (2) an overall cost of capital to be applied to the rate base or (3) a combination of these. Another component of the cost of capital is the allowance for income taxes. Because the dollar amount that accrues to the regulated entity ultimately depends on not only the allowed cost of equity and rate base, but also on the relative share of equity and debt in the capital structure, it is important to consider the overall impact of the decisions on the individual components. Specifically, it is important to note that cost of equity estimation models provide estimates that reflect both the underlying business risk of the assets but also the financial risk inherent in how those assets have been financed. The equity of a company with more debt in its capital structure is more risky than the equity of an identical company with less debt in its capital structure. If the cost of equity estimates were used without consideration of differences in capital structures among the sample companies and in comparison to the regulated companies, the results can be inconsistent and not represent a reasonable estimate of the regulated company’s cost of equity.

Allowance for Income Taxes

Regardless whether companies are regulated on a cost of service basis or using a rate cap, the revenue requirement or rate cap includes an allowance for income taxes as well as other taxes such as property taxes or gross receipts taxes. Providing an appropriate allowance for income taxes is important because the return that equity holders receive and the rate that customers pay depend upon the allowance for taxes. If the allowance is set too high or too low, equity holders will expect to earn a higher or lower return on equity than authorized even if all other costs are estimated perfectly. Regulators may use an incremental tax to “gross-up” the allowed rate of return for income taxes, so that the equity holders expect to earn the allowed ROE after paying all income taxes due. Other regulators estimate the needed tax allowance. For example, in the U.K. the regulator of electric and gas distribution companies, Ofgem, models the estimated tax payment of the regulated entity and set the tax allowance accordingly. This takes the effect of tax credits and any other deductions into account. Should actual paid taxes be lower than the taxes that were estimated for regulatory purposes, the regulated entity is entitled to keep the difference unless the tax benefit was obtained by using a larger leverage than nominated by the regulator.¹⁹

There is a difference, however, between income taxes allowed by the regulator and taxes actually paid by the regulated entity. Actual taxes paid are a function of not only actual costs, as compared to estimated costs, but also of differences between regulatory depreciation and tax depreciation. Often tax depreciation is greater than regulatory (or accounting) depreciation in the early years of an asset’s life and lower in the later years even though total depreciation will be equal over the life of the asset. In North America, the difference between accounting tax and actual tax is accrued as deferred income taxes. Regulators often take this difference into account when determining the rates a regulated entity is allowed to charge.

There are two primary ways to adjust the allowance for income taxes due to differences between regulatory and tax depreciation rates. The allowance for income taxes can be based on regulatory depreciation (generally accounting depreciation) or on tax depreciation. If the income tax rate does not change, the tax shield from depreciation will be identical over the life of the asset regardless of the method used, because tax depreciation and accounting depreciation will be equal. The difference in approach really just results in a difference in timing. In both cases,

¹⁹ Ofgem, “Electric Distribution Price Control Review: Final Proposal – Allowed Revenues and Financial Issues,” December 7, 2009, Section 4.

customers receive the benefit of accelerated tax depreciation, but the allowance for taxes is different by year. To take the difference in timing into account, in normalized depreciation, the tax savings due to the difference between tax depreciation and regulatory depreciation, deferred income taxes (DIT or sometimes accumulated DIT or ADIT) is either subtracted from rate base or treated as a zero cost source of capital. As a result, the regulated rate (through revenue) is reduced because the rate base is lower, but the allowance for income taxes is higher because it does not recognize the tax actually paid due to tax depreciation. The alternative, flow-through depreciation, is to reduce the income tax allowance by the savings due to tax depreciation. Of course, there is then no need for a reduction in rate base because the income tax allowance matches the taxes paid.

The cash flows (i.e. revenue requirement) differ, but over the life of an asset, deferred income taxes accumulate to zero. In general, the tax allowance is higher in the early years and lower toward the end of the asset's life if the allowance is based on accounting depreciation. When the tax allowance is based on tax depreciation, the reverse is true. If basing the tax allowance on tax depreciation, a very large percentage of the capital requirement in the later years may be income taxes that are due. This can be a problem for an older asset if the usage of the asset declines. For example, a regulated pipeline may have difficulty paying the taxes it owes if throughput declines sufficiently. On the other hand, tax allowances based on accounting or regulatory depreciation have the effect of increasing the revenue collected, when an asset is new and therefore the capital costs for the asset are also at their highest.

In general, it is important to recognize that cost of capital estimation takes place in a regulatory context, and decisions regarding other aspects of how the regulated entity is being regulated may affect the appropriate estimation method. For example, some regulators rely on replacement cost rather than historical cost as the rate base to which the cost of capital is applied. In such circumstances, it is appropriate to use real returns rather than nominal returns as is done when historical cost is used to determine rate base.

C. CAPM IMPLEMENTATION ISSUES

Fundamentally, an analyst using the CAPM must determine three parameters to implement the model: the risk-free rate (r_f), the Market Risk Premium (MRP), and the asset's beta (β_s) as shown in the CAPM equation below.

$$r_s = r_f + \beta_s \times MRP \quad (10)$$

Through the determination (or estimation) of the parameters on the right-hand side in Equation (10), the analyst obtains an estimate of the cost of equity, r_s . Despite its theoretical elegance, implementation presents a number of challenges – primarily because the CAPM was developed as a two-period, partial equilibrium model and is not a multi-period model. Thus, the theory provides little guidance as to how it should be implemented in a multi-period world.

1. Common Practices in Canada

a) *The Risk-free rate*

Selection of the risk-free rate is generally one of the least controversial elements of the implementation process. The usual approach is to use the current yield or a forecasted yield on the home country's government debt, since government debt is generally considered to be free of risk, at least in countries such as Canada with well developed financial markets. Canadian regulatory implementations often utilize the yield on 3, 5 or 10-year government bonds (marketable or benchmark bonds), or a three months to 1 year forecast for the 10-year government bond as provided in sources such as *Consensus Forecasts*.²⁰ Data on current and historical government bond rates can be obtained from the Bank of Canada's website or from CANSIM.²¹

It is preferable to rely on bond series that are actively traded and maintaining consistency across time and regulated companies is important. For example, an often cited source for the Canadian MRP, the "Report of the Canadian Economic Statistics" relies on Bank of Canada's index of marketable bonds. Therefore, if this measure of the MRP is used, the marketable bond series would provide a consistent measure of the risk-free rate. At the same time, the benchmark yield series has the advantage of indicating the maturity of the included bonds.²²

²⁰ Consensus Forecast is provided by Consensus Economics, which surveys more than 250 economists monthly and based on their survey provides forecasts for the Canadian 3-month and 10-year government bond rate.

²¹ See, for example, Bank of Canada (<http://www.bankofcanada.ca/en/rates/index.html#interest>) and Statistics Canada (<http://cansim2.statcan.gc.ca/>). U.S. interest rates are available from the Federal Reserve St. Louis (<http://research.stlouisfed.org/fred2/>). Many commercial data providers also include government interest rates.

²² Using Bank of Canada data, the 'marketable bonds' index is based on bonds of 1-3, 3-5, 5-10 etc. years to maturity that trade in the market place. The benchmark yield is based on selected Government of Canada bond issues that mature approximately in the indicated term.

Some regulators use forecasted risk-free rates to determine the return on equity. The long-term forecast is usually for the 10-year Canadian government bonds, while the risk premium is measured over 30-year bonds. Therefore, an adjustment for the spread between 30-year and 10-year bond yields is needed. In some jurisdictions the adjustment has been based on the current yield spread.^{23,24}

b) The Canadian Market Proxy

Selection of the market proxy is usually not a controversial element of the implementation process, and is often taken to be a proxy such as the S&P/TSX composite (total return) index. Sometimes, narrower market indices that favour more liquid equity or large market cap entities are used. This is especially true in U.S. markets, where the S&P 500 is more commonly used than a broader market index such as the Wilshire 5000, or the New York Stock Exchange (NYSE). While broader indices seem more compatible with the theoretical CAPM on a technical level, lack of easy access to data or lack of regular trading activity may make such an index less desirable. For example, some stocks trade infrequently, raising questions as to whether or not the last recorded price data truly reflects the value at which a willing buyer and seller would exchange the security. Including such securities is technically closer to the market index of the CAPM, but potential measurement errors can overwhelm the benefits of using a broader index. In addition, some broader indices are not readily available to parties that do not subscribe to specific databases.

A second issue in attempting to use alternative market indices is a practical one – sometimes the data or MRP relative to an alternate market is not available, or is very expensive to obtain. In general, a best practice is to consider estimates from alternative markets when feasible. Otherwise, use of standard market indices is an accepted practice.²⁵

²³ See, for example, Ontario Energy Board, EB-2009-0084, Appendix B.

²⁴ Reliance on the current spreads between 10-year and 30-year government bond yields implicitly assumes that the spread has been constant during the time over which the MRP was determined.

²⁵ No market proxy is perfect for the CAPM. The market in the theoretical version of the CAPM includes all assets (art, real estate, bonds, etc.); not just stocks. This is an important insight from Professor Richard Roll, now often called “Roll’s Critique” (R. A. Roll, “A Critique of the Asset Pricing Theory’s Tests,” *Journal of Financial Economics*, 4, 1977, pp. 129-176.) For a discussion of this specific issue, please refer to *Appendix A.B.*

c) *The Canadian MRP*

A standard for many years was to estimate the MRP from an arithmetic average of historical realized MRPs. In Canada, the frequently used data from the Canadian Institute of Actuaries estimated the MRP by looking at the year-over-year excess of the S&P/TSX total return (TSE previously) over the corresponding treasury rate: 3-month Canadian Treasury bill (short-run CAPM) or long-term Canada bond total return (long-run CAPM). Standard practice in the academic literature and among valuation practitioners is to use the income return (i.e., bond coupon payment dividend by bond price) on long-term bonds as opposed to the total return, because the total return includes capital gains or losses which are not risk-free.²⁶ However, this was more of an established practice than a prescription by the traditional CAPM. As noted earlier, the traditional CAPM is not a multi-period model. The historical (arithmetic) average MRP of the S&P TSX Composite index over long-term government of Canada bonds was 5.3 percent over the longest period available, 5.1 percent between 1936 and 2009, and 5.3 percent between 1948 and 2009 (i.e., excluding World War II years).²⁷ The historical average of realized MRP is an unconditional version of the MRP.²⁸

Limited evidence from surveys of Canadian economists has placed the Canadian MRP in a similar range. For example, Fernandez (2008) and Fernandez and del Campo (2010) find that responding Canadian professors placed the MRP at 5.4 percent (on average) in 2008, and 5.9 percent in 2010.²⁹

d) *Beta Estimation*

Beta estimates are provided by many data services for Canadian, American and other traded companies. The most common methodology to estimate betas is to use the most recent five years of weekly or monthly return data, and then adjust the raw estimate towards one as an

²⁶See, for example, Morningstar, “*Ibbotson SBBI 2010 Valuation Yearbook*,” p. 55-56.

²⁷ The longest available period is based on E. Dimson, P. Marsh, and M. Staunton, “*Credit Suisse Global Investment Returns Sourcebook 2010*.” Estimates for 1936 and 1948 to today are based on a mixture of data from the Canadian Institute of Actuaries (CIA) (through 2007), and CANSIM, and these make use of total returns rather than income returns for the long bonds.

²⁸ Unconditional MRP means that the MRP for the coming period is estimated without regard to current economic conditions or other current factors.

²⁹ P. Fernandez, “Market Risk Premium Used By Professors In 2008: A Survey With 1,400 Answers,” IESE Working Paper WP-796, University of Navarra, May 2009, and P. Fernandez and del Campo, J., “Market Risk Premium Used in 2010 by Professors: A Survey With 1,500 Answers,” IESE Business School Working Paper, University of Navarra, May 15, 2010.

adjustment for sampling reversion that was first identified by Professor Marshal Blume (1971, 1975).³⁰

Ignoring dividends and using weekly data, the raw beta is computed as follows. First, determine the weekly return from price data on both the stock in question and the market index:

$$r_{t+1} = (p_{t+1} - p_t) / p_t \quad (11)$$

where r_{t+1} is the return in period (t+1) and p_t denotes the stock price in period t. Second, taking the difference between each of the two returns series (security and market) and the risk-free rate provides the two realized excess return series that are needed for the CAPM regression. It is common to include a constant term in the regression, so that the regression equation is

$$(r_S - r_f) = \alpha_S + \beta_{S,raw} \times (r_M - r_f) + \varepsilon_S \quad (12)$$

where r_S , r_f , and r_M are the return on the stock in question, the risk-free rate and the return on the market, respectively, α_S is a constant, β_S is the beta coefficient and ε_S is an error term. In other words, the regression allows for a non-zero constant in the equation.³¹ Third, estimate the raw beta, β_{raw} by ordinary least squares. Fourth, adjust the raw beta estimate using Blume's adjustment procedure:

$$\beta_{adjusted} = \frac{2}{3} \cdot \beta_{raw} + \frac{1}{3} \cdot 1 \quad (13)$$

Although it is common to estimate betas from a regression using the most recent five years of return data, the justification for doing so is more practical than theoretical. Some of the issues and theoretical guidance in this regard are discussed below.

2. Implementation issues

a) Long-run versus Short-run CAPM

The CAPM is typically implemented using a long-term risk-free interest rate or a short-term risk-free interest rate. Using short-term Treasury bills as the risk-free asset seems most in line with the traditional CAPM – the return on Treasury bills is the closest to a truly risk-free rate of return, and the shorter horizon is closer to the 2-period nature of the CAPM. However, it has

³⁰ M.E. Blume, "On the Assessment of Risk," *Journal of Finance* 26, 1971, pp. 1-10 and M.E. Blume, "Betas and Their Regression Tendencies," *Journal of Finance* 30, 1975, pp. 785-795.

³¹ There are multiple alternative specifications of the regression equation including versions where the constant term is forced to equal zero (as is the case in the theoretical version in Equation 1), versions where the excess return is measured using total returns (e.g., including dividends) rather than price returns, etc.

become common in many regulatory settings to implement a long-term version of the model using a long-term government bond yield as the risk-free rate and an MRP relative to the long-term bond yields. There are several justifications given by analysts and regulators for doing so. One is that regulated rates are set periodically, which means that current cost of capital estimates will determine rates for a potentially long period (potentially years). Estimates must therefore be set to be reasonable (on an expected basis) over that period. Short-term rates are a tool of monetary policy, however, and are much more affected by efforts of a country's national bank to alter economic activity other than long-term rates. As a result, short-term rates are more volatile. Cost of equity estimates based on short-rates could therefore change rapidly over the course of a few months. The recent financial crisis has demonstrated that short-rates may be significantly affected by short-run economic considerations, making their use in setting allowed rates over a five or six year horizon questionable. Another reason given for using a long rate to estimate cost of equity is that equity can be viewed as a long-term claim on the firm's assets, and therefore the relevant 'alternative risk free investment' is a long bond.³²

Whether the short-term or long-term version of the CAPM is selected, at a minimum, it is advisable to maintain consistency across the various parameters. For example, it is inappropriate to mix a MRP estimated using a long-term estimate of the risk-free rate with a short-term risk-free rate (i.e., avoid two distinct risk-free rates in the CAPM equation). Similarly, from an economic theory point of view, it is preferable to determine the CAPM using a short-term and a long-term risk-free rate rather than to average the two risk-free rates and the associated MRPs. This is because the average of two risk-free rates generally is not a risk-free rate available to investors. From a practical perspective, the calculation of both a short-term and a long-term CAPM estimate allows the analyst to examine both results, and then make a decision regarding the weight to assign to each version of the CAPM.³³

Because practical considerations sometimes necessitate compromises, the following sections discuss a number of practices and some issues to keep in mind when evaluating the results from these different approaches.

³² See, for example, Morningstar, "Ibbotson SBBI 2010 Valuation Yearbook," p. 55.

³³ Another consistency issue to be aware of and avoid is the mixing of unconditional betas with a conditional MRP. In a conditional CAPM, both beta and the MRP are adjusted based upon a set of current economic variables from the values that would be used if current economic conditions were ignored.

b) Forecast or Current Interest Rates

After deciding on whether it is more appropriate to use a short-term or long-term risk-free rate, the next decision is whether to use a current yield or a forecast yield as the interest rate. In using a current yield or a forecast yield on long-term government bills or bonds as the risk-free rate in the CAPM, it is essential to ensure that the rate used is meaningful and not unduly influenced by either a single day or forecast. For example, if a current risk-free rate is used, the analyst can use either an average over a short period (often 10-15 trading days) or check for unusual changes in the yield around the day or period of interest. If a forecast rate is used, it is important that it is a consensus of market expectations rather than a forecast developed by a single analyst or entity. In addition, if a historically developed MRP is relied upon, it is important that the security relied upon as the risk-free rate (e.g., the 10-year government bond) has a consistent series of historical data available over a relatively long period for analysis. Otherwise, it would not be feasible to develop the historical MRP that corresponds to the relied upon risk-free rate.³⁴

c) MRP Estimation Issues

Unlike the choice of risk-free rate, the choice of MRP is more varied and controversial. This is because while it has a significant impact on estimates, unlike current or forecasted bond yields, the MRP is not observable. Moreover, there is significant divergence of opinion on the MRP in both academic and practitioner circles. There is no consensus on either the magnitude of the MRP or how it should be estimated.³⁵

A number of methods for estimating the MRP exist, but the four general categories of estimates are those based on (1) averages from historical data, (2) survey data, (3) conditional estimates, and (4) a so-called “Supply Model” to derive the MRP implications of expected productivity in the real economy.

³⁴ Because the U.S. Treasury stopped issuing 30-year government bonds from 2001 to 2006, the yield on 30-year U.S. Government bonds is not consistently available while the yield on 20-year government bonds is.

³⁵ Some confusion over the MRP is due to lack of clarity as to which MRP is being discussed. It is important to specify whether the MRP is for use in the long-term or short-term version of the CAPM, whether the estimate is based upon an arithmetic or geometric average of realized returns, and whether the MRP is an unconditional estimate or a conditional estimate.

Historical Average MRP

In his presidential address to the American Finance Association in 2001, Professor Constantinides, of the University of Chicago, sought to estimate the unconditional equity premium based on average historical stock returns.³⁶ (Note that this address was based upon evidence just before the major fall in market value in that time period, the Tech Bubble period.) Professor Constantinides adjusted the average historical stock market returns downward by a fraction of the increase in the price-earnings ratio. If there is no change in valuations in an unconditional state, this adjustment will capture the unconditional return on the stock market and the difference between the adjusted return and the risk-free rate measures the MRP. His estimates of the U.S. MRP for 1926 to 2000 and 1951 to 2000 were 8.0 percent and 6.0 percent, respectively, over the 3-month T-bill rate. In another published study in 2001, Professors Harris and Marston use the DCF method to estimate the market risk premium for the U.S. stocks.³⁷ Using analysts' forecasts to proxy for investors' expectation, they conclude that over the period 1982-1998 the U.S. MRP over the long-term risk-free rate is 7.14 percent. Another line of research was pursued by Steven N. Kaplan and Richard S. Ruback (1995),³⁸ who estimated the U.S. MRP by comparing published cash flow forecasts for management buyouts and leveraged recapitalizations over the 1983 to 1989 period against the actual market values that resulted from these transactions. One of their results is an estimate of the market risk premium over the long-term Treasury bond yield that is based on careful analysis of actual major investment decisions, not realized market returns. Their median estimate is 7.78 percent and their mean estimate is 7.97 percent.³⁹

Estimation Window

The first decision to make is what period to average over. Some argue that returns over more recent periods are likely to be a better measure of investor expectations going forward, because the economy and capital markets have evolved so much over time. Alternatively, some argue that using the historical arithmetic average of this excess going back as far as possible provides

³⁶ G.M. Constantinides, "Rational Asset Prices," *Journal of Finance* 57, 2002, pp. 1567-1591.

³⁷ R. Harris and F. Marston, "The Market Risk Premium: Expectational Estimates Using Analysts' Forecasts," *Journal of Applied Finance* 11, 2001, pp. 6-16.

³⁸ S. N. Kaplan and R.S. Ruback, "The Valuation of Cash Flow Forecasts: An Empirical Analysis," *Journal of Finance*, 50, September 1995, pp. 1059-1093.

³⁹ *Ibid*, p. 1082.

data spanning many different economic environments and therefore provides the best measure on an unconditional basis (albeit not necessarily on a conditional basis). This is the approach that Ibbotson Associates take in their estimates of the historical MRP⁴⁰ and the approach adopted by the Surface Transportation Board in STB Ex. Parte 664.⁴¹

Geometric vs. Arithmetic Mean

A debate sometimes arises in regulatory settings as to whether a geometric or arithmetic historical average should be used to estimate the unconditional MRP. Since the difference can cause a one to two percentage point difference in estimates, it is important to regulators.

The arithmetic average of historical market returns is calculated by the standard formula:

$$\text{Arithmetic mean } r_M = \frac{1}{T} \sum_{t=1}^T r_{M,t} \quad (14)$$

where $r_{M,t}$ is the realized annual return on the market index, adjusted to match the return horizon of the risk-free rate being used, and T, is the number of periods used for the calculation. The geometric average is obtained as:

$$\text{Geometric mean } r_M = \left(\frac{P_{M,T}}{P_{M,0}} \right)^{\frac{1}{T}} - 1 \quad (15)$$

where $P_{M,T}$ is the value of the market index with reinvested dividends. It can be shown that the geometric mean is less than the arithmetic mean, and if returns follow a geometric Brownian process, the relationship between the two is given as:

$$\text{Arithmetic Mean} \approx \text{Geometric Mean} + \frac{1}{2} \times \text{std. deviation of returns}$$

Generally speaking, the geometric mean is a backward looking measure of performance – that is, it provides a measure for comparing past performance across different securities or portfolios.⁴² Many economists therefore find that from a forward-looking cost of capital perspective, the

⁴⁰ Morningstar, “*Ibbotson SBBI 2010 Valuation Yearbook*,” p. 57.

⁴¹ The STB in STB Ex. Parte 664 viewed the longest possible time horizon as the “superior and more standard approach” although the STB recognized the availability of other methods.

⁴² See, for example, Morningstar, “*Ibbotson SBBI 2010 Valuation Yearbook*,” p. 56; R.A. Brealey, S.C. Myers, and F. Allen, “*Principles of Corporate Finance*,” 10th edition, 2008, p. 175-176; or J. Berg and P. DeMarzo, “*Corporate Finance: The Core*,” 2009, p. 296.

arithmetic mean is more appropriate, since it reflects the expected value of future returns.⁴³ Specifically, compounding the arithmetic return over a number of periods gives the expected compound return over those periods, but compounding the geometric mean does not.

Some financial economists, however, have suggested that this line of reasoning is flawed when returns are mean reverting; *i.e.*, exhibit negative correlation between consecutive periods. When such is the case, the expected return may differ from the historical return and the arithmetic mean no longer provides an accurate measure of the expected return. The reason for this conclusion is that negative correlation introduces a degree of path dependence – above average returns one year are more likely to be followed by below average returns the following year – and vice-versa. In such situations, using a value between the geometric mean and the arithmetic mean is technically a more accurate estimate of the unconditional MRP. The amount of weight given to the geometric average will depend on both the forecast horizon and the degree of correlation, or memory, in the return series. Blume (1974) suggested a weighting of:⁴⁴

$$\left(1 - \frac{H-1}{T-1}\right) \times \text{arithmetic avg.} + \left(\frac{H-1}{T-1}\right) \times \text{geometric avg.} \quad (16)$$

where H is the return horizon (over which we are forecasting an average return) and T is the size of the sample used to estimate the arithmetic average (e.g., for 1926 to 2009, $T = 83$).⁴⁵

In regulatory scenarios, the forecast horizon for setting rates is often 3 to 5 years, which suggests a weighting of about 4/82, or 0.05, for the geometric average. Thus, if the considered period is short, the Blume weighting in (16) assigns a relatively low weight to the geometric average. In

⁴³ See, for example, Morningstar, “*Ibbotson 2010 Valuation Yearbook*,” pp 56-57.

⁴⁴ M. Blume, “Unbiased Estimates of Long-Run Expected Rates of Return,” *Journal of the American Statistical Association*, September 1974, pp. 634-638.

⁴⁵ A related justification for such a weighting is the recognition that the true average returns are not actually known, but estimated. Javier, Kane, and Marcus (2003) have shown that under fairly robust conditions, the appropriate weightings to correct for sampling error of this type are given by $\left(1 - \frac{H}{T}\right)$ and $\left(\frac{H}{T}\right)$, respectively. The result relies on stock prices being log-normally distributed, and the authors suggest that this specification is robust to statistical issues such as heteroskedasticity and serial correlation in stock market returns. (See Javier, E., A. Kane, and M.J. Marcus, “Geometric or Arithmetic Mean: A Reconsideration,” *Financial Analysts Journal*, 59, Nov/Dec 2003, pp. 46-53.) Notice, these weightings are very similar to Blume’s (1974) weights, despite the different motivation. An additional distinction is that Blume’s weights are only approximations in his framework, whereas the Javier, Kane, and Markus weights are exact for their model.

those circumstances, a simple application of the arithmetic average (i.e., 0 weight to the geometric) is often deemed acceptable.⁴⁶

Concerns with Historical Averaging

Estimating the MRP became particularly controversial as a result of the so-called Tech Bubble era the in late 1990s to 2001, because of the remarkable appreciation in the stock market, particularly the prices of technically oriented stocks. Because the realized MRP increased substantially during this period, a line of research arose that questioned the use of a historical average to estimate the forward-looking MRP. Many at the height of the stock market bubble in the U.S. and Canada claimed that the only way to justify the high stock prices would be if the MRP had declined dramatically.⁴⁷ However, this argument has been heard less frequently in recent years now that the market has declined substantially and continues to struggle.

Unexpected Productivity Gains and Survivorship Bias

Another common argument for a lower expected MRP than indicated by the past realized MRP has been that the U.S. (and Canada) experienced very remarkable growth in the 20th century that was not anticipated at the start of the century. As a result, the average realized excess return is greater than expected by investors at the time which means that relying on historical realized market returns, the standard method of estimating the MRP, would be biased upward. For example, although investors might have only demanded a MRP of 4 percent as an expected quantity, productivity was unexpectedly high and resulted in a realized MRP in that year of 10 percent. If this happened over several years, the historical average would be distorted. Of course, this raises the obvious question of “how investors have systematically and significantly underestimated expected productivity gains over the past hundred years?” “[I]f investors have overestimated the equity premium over the second half of the last century, Constantinides (2002) argues that ‘we now have a bigger puzzle on our hands’ Why have investors systematically biased their estimates over such a long horizon?”⁴⁸ For many economists, this explanation does

⁴⁶ E.g., see Morningstar, “*Ibbotson SBBI 2010 Valuation Yearbook*,” pp. 58-59. See also, S.A. Ross, R.W. Westerfield, and J. Jaffe, “*Corporate Finance*,” 8th edition, 2008, pp. 272-273.

⁴⁷ See Robert D. Arnott and Peter L. Bernstein, “What Risk Premium is ‘Normal’?” *Financial Analysts Journal* 58, 2002, pp. 64-85, for an example.

⁴⁸ R. Mehra and E.C. Prescott, “The Equity Premium in Retrospect,” in *Handbook of the Economics of Finance*, 2003, Edited by G.M. Constantinides, M. Harris and R. Stulz, Elsevier B.V, p. 926.

not suffice. Nevertheless, it is hard to deny that productivity gains were remarkable over the past 100 years, at least relative to prior history. Some argue that such gains are unlikely to continue into the future, and thus the equity premium may not be as high in the future as it has been in the past. Diermeier, Ibbotson and Siegel (1984), and Ibbotson and Chen (2003) have looked at this possibility, and it is discussed below as a Supply Model MRP estimator.⁴⁹ Of course, it is only speculation as to whether history will ultimately find this recent period as remarkable, or just the beginning of a remarkable coming of age for human civilization.

A related concern for historical average MRP estimates is the fact that data excludes failed markets and securities, by construction. That is, the data record only includes those securities and markets which have survived by being sufficiently successful. Failing to include data from securities or markets that failed introduces the possibility that averages will be upward biased, potentially overstating investor expectations of returns on an *ex ante* basis – i.e., without hindsight. However, a study by Professors Jorion and Goetzmann⁵⁰ finds, under some simplifying assumptions, that the so-called “survivorship bias” is only 29 basis points⁵¹ and in a more recent working paper, Dimson, Marsh, and Staunton find a survivorship bias of only 0.1 percent.⁵² This suggests that survivorship bias is unlikely to create problems for MRP estimation.

The strengths and weaknesses of using a historical average of realized MRPs over a pre-determined period and an explicit estimation method are discussed below. The sections below also discuss other MRP estimation methods.

⁴⁹ Diermeier, J.J., R.G. Ibbotson, and L.B. Siegel, “The Supply of Capital Market Returns,” *Financial Analysts Journal*, 40-2, Mar/Apr 1984, pp. 74-80. Ibbotson, R. and P. Chen, “Stock Market Returns in the Long Run: Participating in the Real Economy,” *Financial Analyst Journal*, 59, 2003, pp. 88-98.

⁵⁰ P. Jorion and W. Goetzmann, “Global Stock Markets in the Twentieth Century,” *Journal of Finance* 54, 1999, pp. 953-980.

⁵¹ E. Dimson, P. Marsh, and M. Staunton, “Global Evidence on the Equity Risk Premium,” *Journal of Applied Corporate Finance*, 15, 2003, pp. 27-38 make a similar point when they comment on the equity risk premia for 16 countries based on returns between 1900 and 2001: “While the United States and the United Kingdom have indeed performed well, compared to other markets there is no indication that they are hugely out of line,” p.4.

⁵² E. Dimson, P. Marsh, and M. Staunton, “The Worldwide Equity Premium: A Smaller Puzzle,” Working Paper, London Business School, April 2006, p. 22.

Survey Based MRP Estimates

Survey evidence also provides insight into the conditional MRP. Professor Ivo Welch surveyed a large group of financial economists in 1998 and 1999. The average of the estimated MRP for the U.S. was 7.1 percent in Prof. Welch's first survey⁵³ and 6.7 percent in his second survey, which was based on a smaller number of individuals. However, a more recent survey by Prof. Welch reported only a 5.5 percent MRP.⁵⁴ In characterizing these results Prof. Welch notes that "[T]he equity premium consensus forecast of finance and economics professors seems to have dropped during the last 2 to 3 years, a period with low realized equity premia."⁵⁵ More recently, Professor Welch found that a sample of about 400 finance professors estimated the geometric MRP at about 5%⁵⁶ for an arithmetic MRP of about 7% (the arithmetic mean is approximated by the geometric mean plus one half of the variance of the returns).⁵⁷ In other words, Professor Welch's more recent study shows that finance professors' view of the market risk premium as of year-end 2007 is back up to the level it was at in 1998. This demonstrates how quickly conditional expectations can occur with changing market circumstances. We are not aware of any regularly occurring surveys of the market risk premium in Canada.

Some literature has even suggested a negative or close to zero market risk premium. These, however, are best characterized as lying at an extreme end of the MRP spectrum. Despite relatively high valuation levels at the time of the studies, stock returns remained much more volatile than Treasury bond returns. Indeed, most recently the volatility of stock market returns skyrocketed during the financial crisis. It is hard to support the notion that investors would rationally hold equities and not expect to earn a positive risk premium for bearing the risk, and there is little if any literature or evidence that does.

⁵³ I. Welch, "Views of Financial Economists on the Equity Premium and on Professional Controversies," *Journal of Business*, 73(4), 2000, pp. 501-537. The cited figures are in Table 2, p. 514.

⁵⁴ I. Welch, "The Equity Premium Consensus Forecast Revisited," School of Management at Yale University working paper, 2001. The cited figure is in Table 2.

⁵⁵ *Ibid.*, p. 8.

⁵⁶ I. Welch, "The Consensus Estimate For The Equity Premium by Academic Financial Economists in December 2007: An Update to Welch (2000)," Working paper, SSRN, 2008.

⁵⁷ See, Morningstar, *Ibbotson SBBi Valuation 2010 Yearbook*, p. 66. The historical standard deviation of the return on the U.S. market has been 19.97%, so that the arithmetic market risk premium equals the geometric market risk premium of 5% plus approximately 2.12% for a premium of approximately 7%.

Conditional Estimates of the MRP

Part of the dispute about the MRP is clearly a failure to distinguish between conditional and unconditional versions of the MRP. Periods of market volatility due to possible bubbles and financial crises are not new, and the effect of market volatility is reflected in the historical record of the realized MRP. As such, the arithmetic average continues to provide an appealing estimate of the unconditional MRP. If a conditional estimate is desired, an alternative estimation methodology is needed as the conditional MRP is highly likely to deviate from the unconditional MRP.

Estimating the conditional MRP is not easy, however, because the relationship between current economic conditions and the expected MRP has not been well developed either theoretically or empirically. In addition, a time-varying MRP tends to be highly volatile. Attempts to specify the relationship are some of the most controversial and hotly debated areas of financial economics. Estimates of the U.S. conditional MRP have ranged as low as 2 percent at the peak of the so-called Tech Bubble (including some which were actually negative) to more than 8 percent during the recent financial crisis. The range of the conditional estimates illustrates the potential for controversy when attempting to use a conditional estimate of the MRP in the CAPM.

There are also a number of papers that argue that the MRP is variable and depends on a broad set of economic circumstances. For example, Mayfield (2004) estimates the MRP in a model that explicitly accounts for investment opportunities. He models the process that governs market volatility and finds that the MRP varies with investment opportunities which are linked to market volatility. Thus, the MRP varies with investment opportunities and about half of the measured MRP is related to the risk of future changes in investment opportunities. Based on this approach, Mayfield estimates the U.S. MRP to be 5.6 percent measured since 1940.⁵⁸ However, the problem with such an approach is determining when the MRP has changed and by how much.

⁵⁸ E. S. Mayfield, "Estimating the market risk premium," *Journal of Financial Economics* 73, 2004, pp. 465-496.

Another version of the conditional MRP is found in French, Schwert, and Stambaugh (1987),⁵⁹ for example, who find a positive relationship between the expected MRP and volatility of stock returns. Put differently, the conditional MRP varies with the volatility in the stock market.

To sum up the above, consider two passages from Profs. Mehra and Prescott's review of the theoretical literature on the equity premium puzzle:⁶⁰

Even if the conditional equity premium given current market conditions is small, and there appears to be general consensus that it is, this in itself does not imply that it was obvious either that the historical premium was too high or that the equity premium has diminished.

In the absence of this [knowledge of the future], and based on what we currently know, we can make the following claim: over the long horizon the equity premium is likely to be similar to what it has been in the past, and the returns to investment in equity will continue to substantially dominate that in T-bills for investors with a long planning horizon.

MRP Estimates from Supply Models

The supply-side estimate of the MRP is based upon the observation that the “supply” of market returns is generated by the productivity of businesses in the real economy. Investors should not expect to have returns much higher or much lower than those produced by businesses in the real economy. A paper by Professors Ibbotson and Chen (2003) adopts a supply-side approach to estimate the forward looking long-term sustainable equity returns and equity risk premium based upon economic fundamentals. The primary difference between the supply-side estimates and historical realized estimates of the MRP is that the supply-side model maintains that the increase in the average price-earnings ratio for stocks cannot continue. Therefore, the growth in the average price earnings ratio is subtracted from the other factors that generate returns in the market. Ibbotson and Chen's supply-side estimate of the U.S. equity risk premium over the long-term risk-free rate is updated annually and reported in the Morningstar *Ibbotson SBI 2010 Valuation Yearbook*. The estimate is currently 3.08% in geometric terms and 5.18% on an

⁵⁹ K. French, W. Schwert and R. Stambaugh, “Expected Stock Returns and Volatility,” *Journal of Financial Economics* 19, 1987.

⁶⁰ Mehra, R., and E.C. Prescott, *op cit.*, p. 926.

arithmetic basis.⁶¹ They conclude their paper by stating that their estimate of the equity risk premium is “far closer to the historical premium than being zero or negative.”⁶²

MRP Summary

It is standard to use the S&P/TSX index as a proxy for the Canadian market return in implementing the CAPM. For long-run versions of the model (using a long-run risk free rate), the historical (arithmetic) MRP has typically been in the range of 5 percent to 6 percent, but alternative MRP estimation methods using a different time horizon or methodology have resulted in lower estimates. For example, reliance on geometric rather than arithmetic averages has resulted in MRP estimates of 3.5 to 4.5 percent, while survey data have produced estimates in the range of 5 to 5.5 percent.⁶³

In evaluating the strengths and weaknesses of the various approaches to determine the MRP in relation to the criteria laid out in *Section III.A* above, we note the following regarding the historic average, survey-based, conditional and demand-side models:

Reasonable

Regardless of whether the MRP is based on a historic average, survey, conditional model, or supply-side model, the degree to which it is consistent with the objective being pursued will depend on the exact implementation and likely the economic environment at the time it is measured. However, a MRP based on a historic average or on a well-defined conditional or supply-side model will be transparent to stakeholders and with enough specificity regarding the implementation, the implementation will be formulaic and minimize the use of judgmental factors. In contrast, reliance on survey based MRP estimates is not transparent in that stakeholders cannot replicate the results and generally do not have access to the underlying data. In addition, we are not aware of any periodic and publicly available survey of the Canadian MRP.

⁶¹ Morningstar Ibbotson *SBBI 2010 Valuation Yearbook*, p. 66.

⁶² Ibbotson, R. and P. Chen, “Stock Market Returns in the Long Run: Participating in the Real Economy,” *Financial Analyst Journal*, 59, 2003, pp. 88-98.

⁶³ E.g., see E. Dimson, P. Marsh, and M. Staunton, “The Worldwide Equity Premium: A Smaller Puzzle,” Working Paper, London Business School, April 2006, for estimates of geometric MRP in Canada. The survey evidence comes from Fernandez (2008) and Fernandez and del Campo (2010) cited earlier.

Reliable

A strength of the historic average MRP is that the information generally is based on auditable information. Similarly, if a well-defined conditional or supply-side model will rely on publicly available and auditable information, but a survey based MRP will usually not be auditable, which is a weakness of the approach. While the historic average MRP is slow to react to changes in economic conditions, survey-based and conditional or supply-side models react much more timely. These characteristics can be a strength or a weakness as regulatory policy may favour stability over time or the ability to incorporate current economic conditions. For example, a conditional MRP that incorporates the volatility of financial markets would incorporate the market turmoil of 2008-09, while an MRP based on a long-horizon historical average would only minimally incorporate the development in financial markets.

Pragmatic

If the conditional or supply-side MRP model is well-specified, both models as well as a historic average MRP are pragmatic in the sense that they are based on readily available information and simple to implement. This, however, is a weakness for the survey-based MRP, where the underlying information is either unavailable or costly to obtain (through surveys). None of the MRP estimates discussed were developed specifically for regulatory purposes and hence do not explicitly address the Agency's regulatory context or legislative requirements. However, if, as a policy matter, the Agency seeks to maintain a stable rate of return over time, the historical average MRP has an advantage over the other three methods, whereas, if the Agency, as a policy matter, seeks to reflect current economic or financial conditions, the conditional or the supply-side MRP have advantages over the historical average MRP.

d) Beta Estimation Issues

There are generally four issues for beta estimation: what interval of return data to use; over how long a time period; whether to adjust the beta estimates for mean reversion; and whether to estimate the beta using the returns from a portfolio or the returns from individual securities. This section addresses these issues.

Choosing a Return Interval and Estimation Window

As noted earlier, the traditional CAPM does not address time issues well, because theoretically it is a two period model. A common practice, however, in business applications and in regulatory

proceedings is to use a long-term version of the CAPM. One argument is that this best represents the investor's horizon for a business which is a going concern.⁶⁴ In regulatory settings, the fact that capital investments are long-lived provides another justification. Still others will choose a long-run version of the CAPM because short-run interest rates are considered too volatile. In sum, the long-run version of the model is often chosen by different analysts for different reasons, but such practice is less rooted in theory than it is in established norms.

The choices for the interval for the return data and the length of the beta estimation window involve a tradeoff between obtaining more observations through the choice of a longer window and/or more frequent return data and ensuring that no structural change has occurred during the estimation window as well as that the return data are based on sufficient trading activity. For example, monthly data provides fewer observations unless a long enough estimation window is chosen (i.e., 5 years of monthly data gives only 60 data points – by contrast, a weekly horizon provides 260 observations over a 5 year period). Daily data is noisy with potentially few trades in any particular day.

Structural changes means that the risk of the asset relative to the market could change over the estimation period, so that the resulting beta estimate would be a “blend” of the risk of the asset over the historical estimation period instead of representing the forwarding-looking risk of the asset. The choice of a very long-run horizon (say, 10 years) introduces a potential problem for beta estimation. Specifically, many economic relationships shift in fundamental ways over a 10 year period.⁶⁵ Asset risk relative to the market may not be stable over such shifts, so that return data from early in the estimation period represents a risk relationship with the market that is no longer applicable. In addition, the longer the estimation period, the more likely it is that data issues arise. For example, Canadian Pacific has less than 10 years of trading data.

⁶⁴ See, for example, Morningstar, *Ibbotson SBBI's 2010 Valuation Yearbook*, p. 44.

⁶⁵ The STB rejected using a 10 year window in Ex Parte 664.

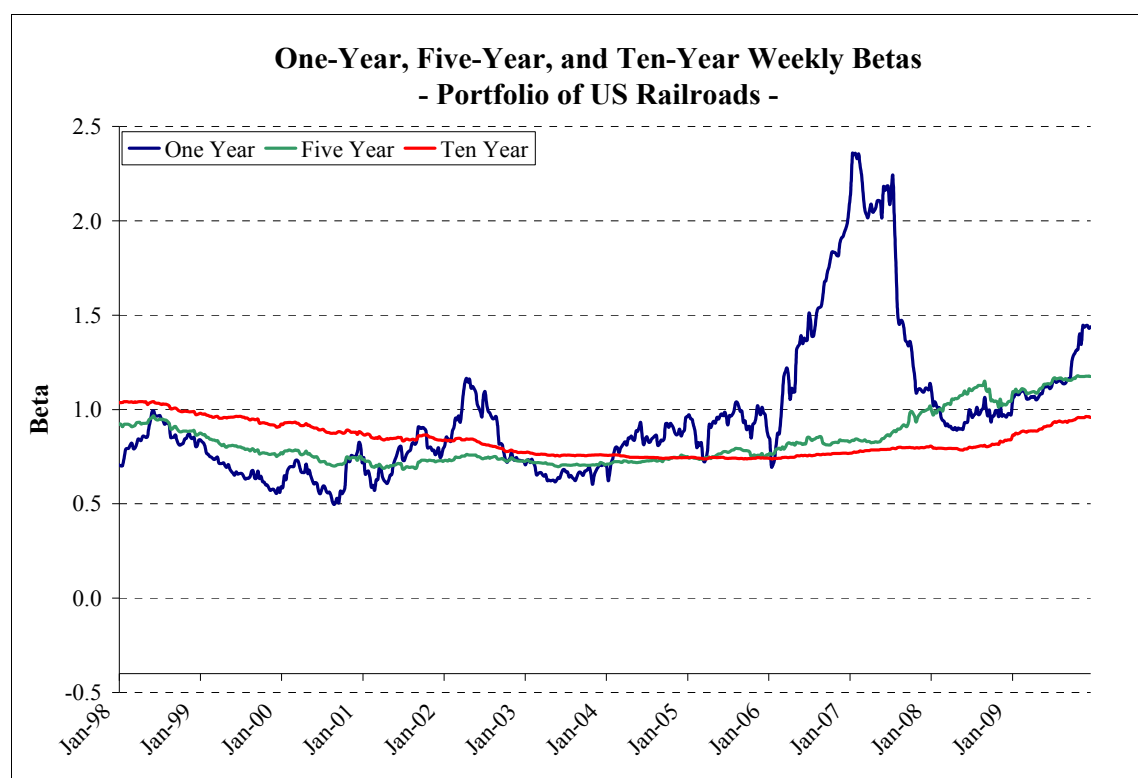


Figure 3:

Figure 3 above illustrates the relative smoothing that is achieved by using a longer estimation window. The 10 year window produces a very smooth (stable) estimate over time, but may not reflect all structural changes. The 10-year regression shows an upward trend from late 2008 onward, but the 5 year window suggests that this upward shift may have started as early as the end of 2005. Although the 5 year estimation period shows a less stable beta, it suggests a relatively distinct shift in beta over time. The 1 year window, which represents 52 data points, is relatively erratic and highly sensitive to any large movements in the underlying returns over the window. Most would likely view the 1-year weekly window as less desirable for regulatory purposes.

While there is less concern for lack of sufficient observations in daily returns, these are sometimes deemed to be too noisy to provide reliable estimates. There are also concerns that market microstructure effects can bias daily beta estimates.⁶⁶ Figure 4 below suggests that daily betas for U.S. railroads are less stable than weekly or monthly betas using a 5 year estimation window. Notice also that with a 5 year window, monthly returns are no longer the smoothest of

⁶⁶ Microstructure effects are the fact that daily prices reported can be affected by whether the price quoted is a bid price or an ask price.

the set. The additional sampling error for monthly betas (since they are based on significantly fewer data points) seems to dominate other sources of variation, and produce a less stable estimate than at the weekly horizon.

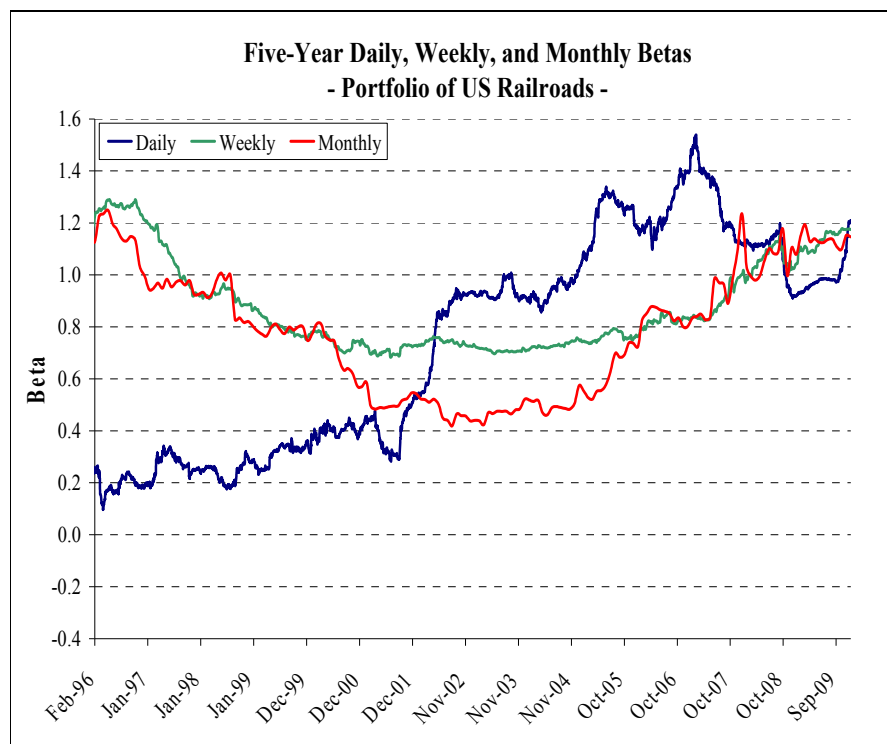


Figure 4

Balancing these considerations, economists typically recommend beta be estimated using either weekly or monthly returns over the most recent 3 to 7 year period, with weekly being the more common. For example, the STB recently decided that betas should be estimated over a 5-year window using weekly returns.⁶⁷

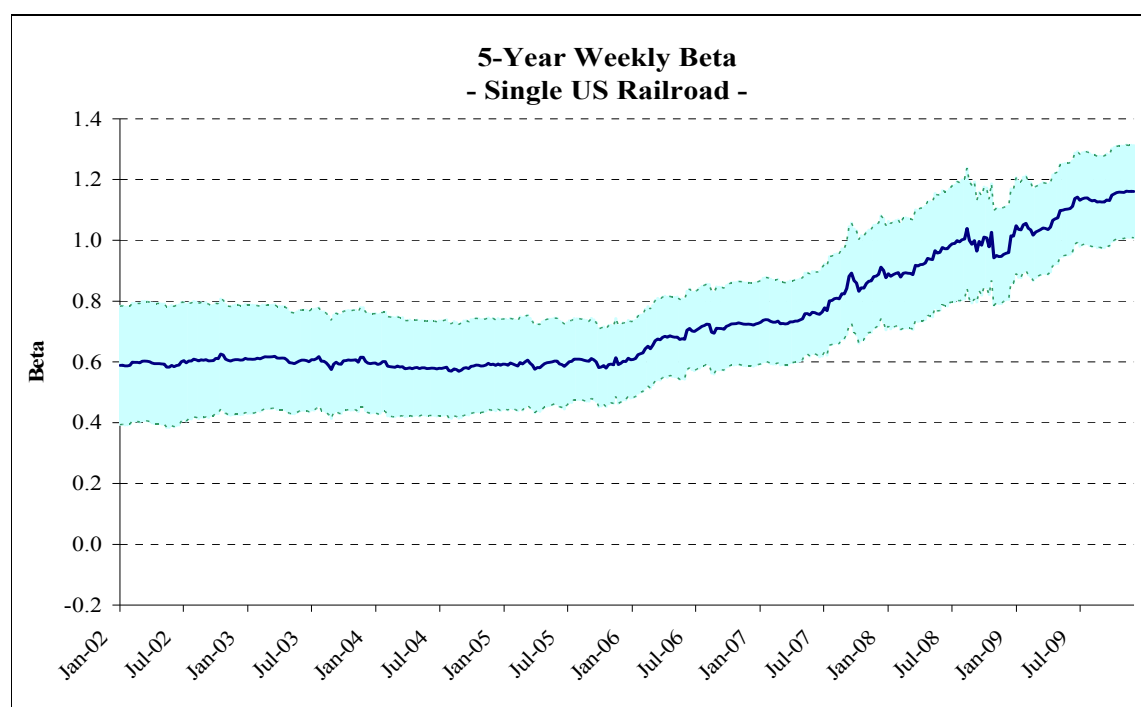
Portfolio/Industry Betas

The potential instability of the estimates of betas for individual securities is a testament to how noisy individual security data can be. In applications where the parameter of interest is a beta for the industry, it may be advisable to look at beta estimates for a portfolio of companies instead of individual betas. Much of the individual security noise can be muted by forming a portfolio, leading to more accurate/less noisy estimates of the portfolio beta.

⁶⁷ STB Ex Parte 664, pp. 9-10.

In the CAPM framework, beta pricing applies to all assets and all portfolios in the market space.⁶⁸ Therefore, the noise in the portfolio return is an average of the noise in the underlying securities. For a large, equal-weighted portfolio, the variance of the noise term will drop significantly.⁶⁹ Since the noise of a beta estimate by regression is a function of that variance (noise), the noise of the portfolio beta will also fall and therefore produce (statistically) a more reliable estimate. Moreover, it can be shown that the resulting reduction in estimation error for the portfolio beta is greater than the reduction achieved by simply averaging across individually estimated betas, making this approach better from a sampling point of view.⁷⁰

Panels A and B in Figure 5 below present rolling betas for an individual U.S. Railroad and a portfolio of U.S. Railroads, respectively. The confidence bands are presented as shaded blue areas, and represent (roughly) the area in which the true beta (at each date) is expected to be located 95 percent of the time.⁷¹



⁶⁸ For a technical derivation of this point, see *Appendix A, Section C*.

⁶⁹ This assumes that the error terms in the individual beta estimates are not correlated across securities.

⁷⁰ Deriving a confidence band for the average beta itself involves additional assumptions on the covariation in errors across the company regressions. Again, this raises an additional subjective and contestable element to the regulatory process.

⁷¹ Technically, it may not be accurate when there is correlation of the estimated bands over time.

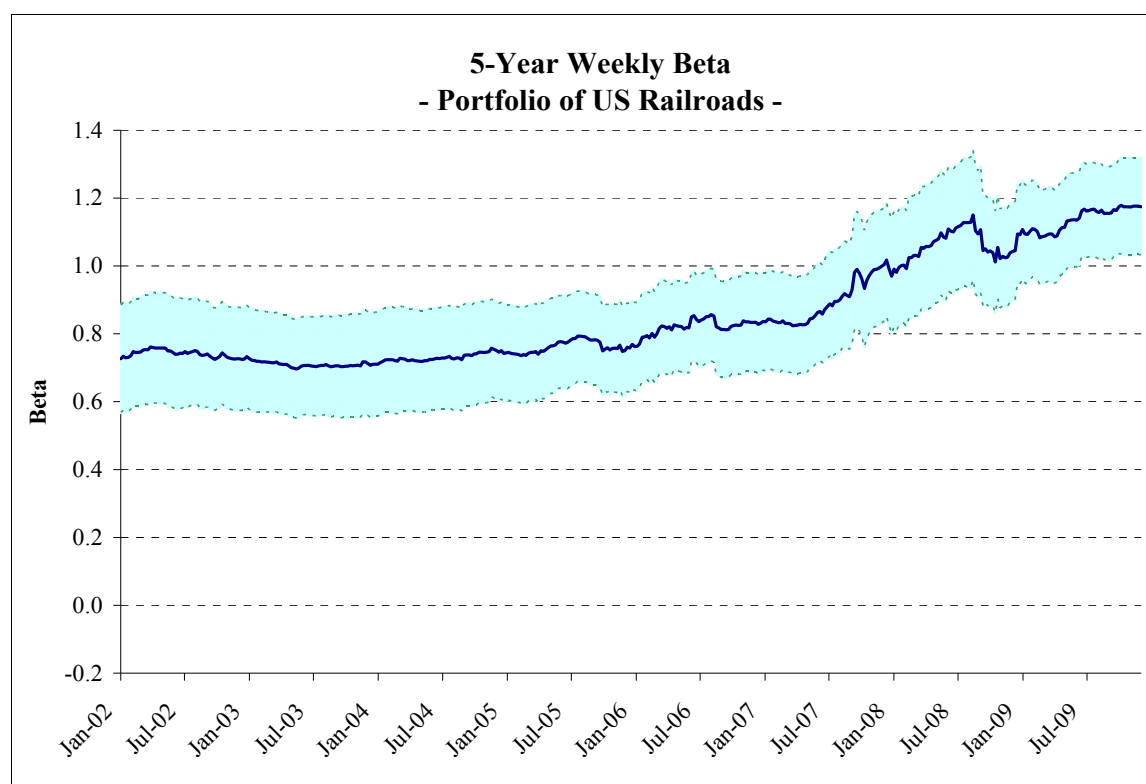


Figure 5

As will be discussed below, leverage affects the risk of equity (all else equal) and thus affects beta. Therefore, the portfolio beta will only be meaningful as a representative industry beta to the extent that industry market value capital structures are more similar to one another, and to the regulated company.

Company Beta vs Sample or Portfolio Beta

Another issue relating to the portfolio versus individual company beta question occurs when the regulated company is itself traded. In that case, a natural question is whether it is more appropriate to form an industry estimate of the cost of equity, through a sample or simply use the company's own estimated cost of capital. In the case that leverage is similar across the industry, the question can often be reduced to one of whether an industry beta (e.g., portfolio or average) or the regulated company beta should be used within the CAPM framework. It is generally favourable to work with an industry type beta over the company one for several reasons. The first reason should be clear from the discussion on portfolio betas versus averages of non-portfolio betas – reduction of sampling error. In the estimation framework, the notion is that there is a true underlying beta for the company, which is being estimated imperfectly. That is,

estimating the beta of the regulated company is exactly that – an estimate. It will not, in general, equal the true beta of that company. Thus, setting cost of capital based on that single estimate will also be prone to error, and at a minimum can lead to greater volatility in the setting of rates. If a good sample of traded companies involved in the regulated activities exists with similar leverage, then using the sample estimate of beta (either average or portfolio) will provide additional information and a more accurate/reliable estimate of the risk associated with the regulated activity. Clearly, reducing sampling error in estimation of the cost of capital is desirable under the fairness standard of most regulatory jurisdictions.

From an economic perspective, a perhaps more significant argument favouring the use of a sample beta over the company beta stems from the fact that regulated companies may be (and often are) involved in a large number of unregulated, potentially more risky activities. To the extent that this is the case, the less likely it is that the overall company beta will represent the business risk of the activities being regulated, which is the key goal. Indeed, it could be argued that such a policy gives an incentive for the company to expand its involvement in riskier, unregulated activities, knowing that this will raise its beta and expected return on the regulated portion of the company. Effectively, the company may have an incentive to manipulate such a policy so as to subsidize unregulated activities with regulated ones.

Beta Adjustment

Blume (1971, 1975) was the first to identify the sampling phenomenon that raw beta estimates tend to revert toward 1.0 in repeated sampling. Estimates of beta, especially individual company betas (vs. portfolio), are volatile due to noise in the sampling process. When a beta is estimated to be substantially above the market weighted-average beta of 1.0, it is more likely to be the result of sampling error than it is to be the result of actually having such a large beta. The converse is true for beta estimates that are very low relative to the market average of 1.0. As a result, when betas are sampled repeatedly, one should expect to see an average reversion to 1.0 in beta estimates. Under this explanation, reversion to 1.0 is attributed to measurement error. For those interested in forecasting beta (e.g., for cost of capital applications), Blume's suggested remedy was to adjust beta towards 1.0 as noted in Equation (13) above. An alternative approach was presented by Vasicek (1973), who suggested weighting the raw beta estimate and the market

beta according to the relative noise (variance) of these two estimates.⁷² Vasicek's formulation recognizes that the individual company beta is more reliable (relatively speaking), the less "noisy" it is relative to the average beta estimate. That is, when the individual company beta is relatively more informative than the average beta, it should be given more weight in estimation.

Most financial data providers, such as Bloomberg or *Value Line*, report adjusted betas using Professor Blume's methodology as their default beta. From a decision-theory point of view, this estimate is generally inferior to Vasicek's adjustment, which computes a specific weighting tailored to the information content of the data.⁷³ However, the Vasicek adjustment requires more computations and has not performed significantly better than the simplified Blume adjustment in many studies of forecasting power (e.g., see Dimson and Marsh (1983)).⁷⁴ Perhaps it is for this reason that the Vasicek adjustment is rarely employed by analysts in business and regulatory applications, and why it is not a standard reported by most data providers.⁷⁵

To summarize the relative strength of using company specific versus portfolio estimates of betas, we note that regardless of the methodology, a longer estimation window results in more robust estimates if the underlying risk of the asset does not change, but makes the estimates less sensitive to any changes in the underlying risk of the asset.

Reasonable

To be consistent with the objective being pursued, it is essential that the beta estimate captures the systematic risk associated with the regulated activities. Unless a company's activities are concentrated in the area being regulated, its estimated beta will necessarily reflect both the regulated and other activities. Most regulators determine the betas of a sample of comparable

⁷² O.A. Vasicek, "A Note on Using Cross-Sectional Information in Bayesian Estimation of Security Betas," *Journal of Finance* 28, 1973, pp. 1233-1239. See also, Morningstar, "Ibbotson SBBI 2010 Valuation Yearbook," pp. 76-77.

⁷³ More accurately, the Vasicek approach allows the analyst to incorporate any prior beliefs they might have about the value of beta into their estimates. One way of constructing reasonable prior beliefs is to look at the distribution of betas across the market, or more typically, the specific industry of interest (For a more complete discussion of the relative merits of each adjustment, see M. Lally, "An examination of Blume and Vasicek betas," *The Financial Review* 33, 1998, pp. 183-198).

⁷⁴ Dimson, E. and P. Marsh, "The stability of U.K. risk measures and the problem of thin trading," *Journal of Finance* 38, 1983, pp. 753-783.

⁷⁵ The Australian regulator, AER considered the Vasicek adjustment and the Blume adjustment but rejected both.

companies or the beta of a portfolio of comparable companies. These estimate(s) are then used to assess the systematic risk of the regulated activity. Unless the regulated entity is a pure play in the regulated activity, use of a company specific beta or beta estimates from a small sample of comparable companies may, effectively reward or punish one or another entity by allowing a higher or lower ROE than would be allowed based upon the regulated activities alone.

Regardless of whether beta estimates from a company-specific, sample, or portfolio approach are used, the beta estimates are transparent, if the relied upon methodology is identified along with the market index in the regression.

Reliable

As long as the methodology is well-specified and a common, readily available market index is chosen, all beta estimates are based on auditable information. Company-specific beta estimates are affected not only by general economic and financial conditions but also by company-specific events. The impact of company-specific factors is dampened if beta estimates from a portfolio or a sample of comparable companies is used. The portfolio approach has the further strength over a sample average in that it is easy to determine a statistical confidence interval for the estimate⁷⁶ and usually has better statistical properties. The portfolio approach to beta estimation tends to lead to more stable estimates over time.

Pragmatic

Regardless of the estimation technique, beta estimates are based on readily available information, provided the methodology relies on a publicly available market index and risk-free rate. If the estimation technique is well-defined, it is simple to implement; i.e., it should identify the time horizon over which betas are calculated, the periodicity of the underlying data, whether a 3-month government bill or another measure is used as the risk-free rate and also whether the formula used to estimate beta allows for a constant term (as in Equation (12)). In determining whether a portfolio/sample or company-specific approach should be relied upon, it is important to recognize whether the regulatory policy is to determine a cost of capital for the industry, a specific company, or a regulated activity. Regardless of the target, it is important to select the company, companies, or portfolio that resembles the target's business risk as closely as possible.

⁷⁶ It is also easy to obtain a confidence interval for company-specific betas.

3. Empirical Challenges to the CAPM

Perhaps the most fundamental challenge to the CAPM has been the consistent empirical observation that the low beta stocks have higher average returns than predicted by the CAPM, and high beta stocks lower average returns – that is, the empirical estimates seem to require a pivot of the SML around $\beta = 1$ from the traditional version of the CAPM. To the extent that this is valid, it suggests that cost of capital for regulated companies, which often have a beta less than one, will be underestimated by the traditional CAPM.⁷⁷

a) Empirical Tests of the CAPM

Papers by Black, Jensen and Scholes (1972) and Fama and MacBeth (1972) were among the first to identify this issue.⁷⁸ Although the realized market returns demonstrated a remarkable linearity in the CAPM beta, as predicted by CAPM, the empirical version of the SML was pivoted around $\beta = 1.0$, i.e., the intercept was higher and the slope less steep than predicted by theory. Several subsequent studies confirmed the robustness of this result and proposed explanations revolving around market frictions, such as different borrowing and lending rates, and the role of taxes.⁷⁹ Nevertheless, the empirical evidence suggested significant movement in the SML, often flattening, to the point that Fama and French (1992) found a zero slope in the empirical SML.⁸⁰ Fama and French suggested that factors other than the risk relative to the market, such as size and book-to-market value ratios (among others) were significant in explaining the SML. A string of papers followed the initial work that has culminated into the model now known as the Fama-French model (see later section). Although this empirical challenge has motivated important and interesting work, alternatives to using the CAPM remain hotly debated by many.

⁷⁷ Implementing a long-run version of the CAPM which uses (annualized) long-horizon returns (e.g., with long bond rates as risk-free rate) generally produces a flatter SML than obtained by using short-rates, due to the general presence of an upward sloping yield curve. While this partially compensates for the empirically observed flattening, it is not sufficient to explain all of the observed flattening of the SML. That is, even implementations that utilize a long-run risk-free interest rate require a further, albeit smaller, adjustment to match the empirical SML.

⁷⁸ F. Black, M.C. Jensen, and M. Scholes, “The Capital Asset Pricing Model: Some Empirical Tests,” *Studies in the Theory of Capital Markets*, Praeger Publishers, 1972, pp. 79-121 and E.F. Fama and J.D. MacBeth, “Risk, Returns and Equilibrium: Empirical Tests,” *Journal of Political Economy* 81 (3), 1972, pp. 607-636.

⁷⁹ Appendix A, Section E contains a list of additional articles documenting this result.

⁸⁰ E.F. Fama and K.R. French, “The Cross-Section of Expected Returns,” *Journal of Finance* 47, 1992, pp. 427-465.

Although many now concede imperfections in the CAPM, it remains the most commonly used model.⁸¹

b) The Empirical CAPM (ECAPM)

The Empirical CAPM (ECAPM) is one way of correcting for the empirical flattening of the SML. Specifically, the ECAPM directly adjusts the CAPM SML by a parameter, alpha, that can be controlled for sensitivities, etc. Formally, the ECAPM relation is given by

$$r_s = r_f + \alpha + \beta_s \times (MRP - \alpha) \quad (17)$$

where α is the “alpha” adjustment of the risk-return line, a constant, and the other symbols are as defined above. The alpha adjustment has the effect of increasing the intercept but reducing the slope of the SML, which results in a security market line that more closely matches the results of empirical tests.

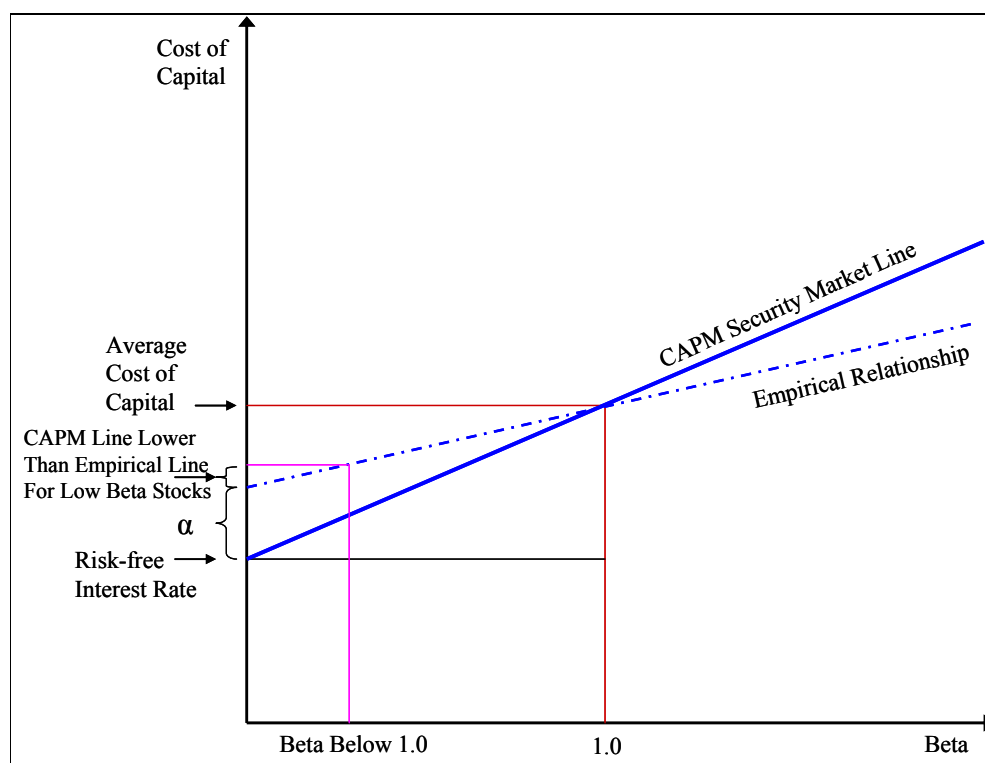


Figure 6: The Empirical Security Market Line

⁸¹ See, for example, J.R. Graham and C.R. Harvery, “The Theory and Practice of Corporate Finance: Evidence from the Field,” *Journal of Financial Economics* 60, 2001, pp. 187-243.

In general, the academic literature has estimated a fairly wide range of alpha parameters, ranging from 1 percent to as much as 7 percent.⁸² While this may seem very large, much of the variation between studies arises from differences in methodology and time periods so that the alpha estimates are not strictly comparable.

The ECAPM can be viewed from the positive school of thought as a practical adjustment that can be made when the estimation is intended for forecasting or measurement of cost of capital. It can be applied without knowing the “cause” of the increased intercept and decreased slope of the CAPM, but with the assurance that the cost of equity estimates will be closer to the empirical observed results than those from the theoretical version of the model.⁸³ There are many alternative models that attempt to account for the empirical regularity. Among them, the most commonly used model is the so-called Fama-French model, which explains stock market returns by adding explanatory risk factors to the CAPM model (see Appendix for a discussion of this model). Fama & French (1997) found that in addition to the (1) excess return on the market, (2) the return on small-firm stocks less the return on large-firm stocks (the size factor) and (3) the return on high book-to-market-ratio stocks less the return on low book-to-market-ratio stocks helped explain empirical regularities.⁸⁴ Notice that the Fama-French model is an alternative to the ECAPM – one should not employ a Fama-French model with an alpha adjustment. Indeed, one way of thinking about the Fama-French approach is as a way of explaining the estimated alpha adjustment observed in the SML.

c) The International CAPM

In the modern global economy, choosing an appropriate proxy for the market return opens a number of questions. On the one hand, capital is highly mobile across many borders, and cross-

⁸² Much of the academic literature estimating alpha dates back to the 1980s and prior to that. *Appendix A, Section E* provides an explanation of how to estimate the alpha parameter and also lists relevant academic research. Attention in this area has since turned to the Fama-French multifactor model, which attempts to explicitly capture the empirical pivot of the SML as a function of additional pricing factors (i.e., book-to-market ratios, price-to-earnings ratio, and size).

⁸³ As noted in CAPM: Summary of Implementation Issues below, the ECAPM and the Blume adjustment are attempting to correct for different empirical phenomena and therefore both may be applicable. For example, Litzenberger et al. (1980) study relied on Blume adjusted betas and estimated an alpha of 2% in a short-term version of the ECAPM. (Litzenberger, Robert H. and Krishna Ramaswamy and Howard Sosin, “On the CAPM Approach to Estimation of a Public Utility's Cost of Equity Capital,” *The Journal of Finance* 35 (2), 1980, pp. 369-387).

⁸⁴ E.F. Fama and K.R. French, “Industry Costs of Equity,” *Journal of Financial Economics* 43, 1997, pp. 153-193.

border investments are significant. This is especially true of North American markets, with Canadians making significant investments in U.S. markets, and vice versa. This raises the question of whether it is appropriate to estimate a Canadian company's cost of capital using a Canadian equity index when that company can access U.S. and international capital markets as well. Should one use a market-weighted portfolio of the Canadian, U.S. or international indices? Should something else be relied upon? This question is not trivial as there may also be home-country bias issues, suggesting that investors do not fully diversify across the two markets as though it were truly one market.⁸⁵ To the extent that investors do not treat the two markets as one, it is more appropriate to use the country's own MRP.

In terms of betas, there can be limitations estimating cost of capital for non-traded firms when there are few, if any, traded firms in the same line of business in the home market. A common remedy, when possible, is simply to adopt the betas from a market that does have a reasonably sized-sample of traded firms in the required line of business. Optimally, the chosen market would be liquid⁸⁶ (i.e., can easily find a willing buyer or seller), deep (i.e., easy to find willing buyer or sellers of large quantities or values), and roughly comparable, in structural terms, to the home country. For Canadian firms, the natural choice is the U.S. market, because the capital and trade flows between the two countries are so large and generally face minimal restrictions.

CAPM: Summary of Implementation Issues

The CAPM has a strong theoretical foundation and fits with the intuition of a risk-return tradeoff. The data necessary for its implementation are widely available at low cost, and its calculations are relatively simple. In the model, the risk-free interest rate reflects current market conditions, but the estimated beta relies on historical data, so the model is neither forward-looking nor completely backward-looking. The model is transparent and robust to violations of its underlying assumptions albeit not necessarily to changes in economic conditions.

⁸⁵ See Australian Energy Regulator, "Electricity transmission and distribution network service providers. Review of the weighted average cost of capital (WACC) parameters," May 2009, pp. 97-101 for a discussion of this issue in a regulatory context.

⁸⁶ A liquid asset has some or more of the following features. It can be sold rapidly, with minimal loss of value compared to the market price, any time within market hours. The essential characteristic of a liquid market is that there are ready and willing buyers and sellers at all times. A market may be considered deeply liquid if there are ready and willing buyers and sellers in large quantities. This is related to the concept of market depth that can be measured as the units that can be sold or bought for a given price impact.

As was revealed in the above discussion, the primary source of debate for the CAPM is estimating parameters, particularly the MRP, but the appropriate method to estimate beta and what is the appropriate measure of the risk-free interest rate are often controversial as well. It is important to recognize this lack of consensus in the academic literature and among practitioners when employing the CAPM in a regulatory setting. Although it is perhaps more well-rooted in economic theory than other methodologies, it is also more subject to technical debate and disagreement. In general, the choice of risk-free rate is not controversial and most prefer a long-rate in regulatory contexts citing, among other reasons, a lesser impact of monetary policy on the long-term rate than on the short-term rate.

The degree to which the CAPM obtains the regulatory objective being pursued depends to a large degree on the implementation of the model. For the model to provide regulated railways with a fair and reasonable return, it is important that general best practices be implemented, and that alternative adjustments be compatible with one another. For example, the choice of MRP should be consistent with the type of risk-free rate being used, and these two parameters can be chosen relatively independently of the specific methodology for estimating beta (of course, the regression needs to be consistent with the market chosen). In terms of beta estimation, there is a dearth of study as to whether Blume or Vasicek betas are more appropriate for estimation at one horizon versus another (e.g., weekly versus monthly), or over different estimation windows (e.g., 5 year versus 10 year). In principle, it is not clear that the choice of Blume or Vasicek adjustment depends on horizon or estimation window. However, the Blume adjustment is far more common, simpler to implement, and generally more widely accepted than the Vasicek adjustment. From a cost-benefit standpoint, regulators may find it more favourable to rely on the Blume weighting – especially as this decision is not likely to produce significantly different results. Note also that to the extent that the Blume weighting is viewed as a remedy for sampling error, it is also compatible with the ECAPM.⁸⁷ That is to say, both beta adjustment and alpha adjustment can be combined for cost of capital estimation. Estimates of positive alphas in the literature come from procedures that adjust for sampling error.⁸⁸ Thus, even after correcting for sampling bias, an alpha adjustment is still suggested by estimates in the literature. While the magnitude of adjustment may be debated, it is clear that some adjustment is supported by the

⁸⁷ As opposed to a way of forecasting a change in the true beta towards one.

⁸⁸ Typical approaches involve the formation of specific portfolios instead of Blume's adjustment. See *Appendix A.E* for a list of supporting literature on the alpha adjustment.

empirical research (alternatively, one may consider models such as Fama-French that try to correct for failings in the CAPM).

4. CAPM Evaluation: How Well Does the CAPM Meet the Criteria?

To summarize the strengths and weaknesses of the CAPM, it is important to realize that many aspects of the CAPM depend on its implementation. Therefore, the following refers the best practices when applicable.

First, the CAPM will provide regulated entities with a reasonable return only if it is implemented accurately, and the analyst must take any unique circumstances that may bias the estimates into account. Second, assuming that the regulator specifies the relied upon model and data sources, the model is very transparent and thus reasonable in that regard. Third, if the data sources are widely available and well-specified, the results are auditable to the regulated entity, the regulator, and other interested parties. Fourth, the model may but is not guaranteed to produce similar results for similar conditions. The model's result will be more consistent if a portfolio approach or a sample of companies is used to estimated betas. Fifth, the model is very sensitive to the estimates of the risk-free rate, beta and MRP. Short-term risk-free rates tend to change more quickly than long-term rates, so use of the long-term risk-free rate generally results in a more stable estimate. Beta estimates tend to be quite sensitive to market developments and therefore are sensitive to economic factors, but not necessarily in a manner that is easy to predict. The portfolio approach to estimating beta tends to provide more stable results than do the company specific estimation methods, but the estimates remain sensitive to market changes. Sixth, assuming that the regulator relies on standard data sources, the model is pragmatic in the sense that it is based on readily available information that is either free or relatively inexpensive to obtain. Seventh, the model is also pragmatic in that it is relatively easy to implement. Eight, because the model was developed as a generic approach to determine the cost of capital for companies, it does not specifically take the regulatory context into account. All in all, the CAPM is a well-founded and commonly used model that relies primarily on readily available information. However, it may be less stable than ideal because changes in interest rates affect the risk-free rate and market volatility affects the beta estimates. Finally, the determination of the MRP remains controversial.

D. DISCOUNTED CASH FLOW MODEL

Like the CAPM, the Discounted Cash Flow (DCF) model, takes its point of departure from the Security Market Line depicted in Figure 6. However, it works directly with the individual asset's cash flows and price. As a tool for estimating cost of capital, it derives the opportunity cost of capital determined by the market, without having to model explicitly the market risk-return tradeoff that generated the market's opportunity set.

As noted in *Section II*, the DCF model is based upon the recognition that the current stock price is the discounted sum of all future expected dividends (see Equation 3). If the growth rate in earnings and dividends is constant over time, then the cost of capital for investment S can be expressed as

$$r_s = \frac{D_0 \times (1 + g)}{P} + g \quad (18)$$

This equation says that the cost of capital equals the expected dividend yield plus the (perpetual) expected future growth rate of dividends. Thus, for implementation purposes, it is necessary to determine the dividend, the growth rate and current stock price.

1. Multi-stage DCF Models

A variation of the constant growth DCF model can be used if the assumption of constant growth is not considered reasonable for the short term, and variations of the general present value formula can instead be used to solve for r_s . For example, if there is reason to believe that investors do *not* expect a steady growth rate forever, but rather have different growth rate forecasts in the near term (e.g., over the next five or ten years) converging to a constant terminal growth rate, these forecasts can be used to specify the early dividends in Equation 3. Once the near-term dividends are specified, Equation 5 can be used to specify the share price value at the end of the near-term (e.g., at the end of five or ten years).⁸⁹ A standard “multi-stage” DCF approach solves the following equation for r :

$$P = \frac{D_1}{(1 + r_s)} + \frac{D_2}{(1 + r_s)^2} + \dots + \frac{D_T + P_{TERM}}{(1 + r_s)^T} \quad (19)$$

⁸⁹ This can be done through a numerical procedure if the growth path becomes too complicated.

The terminal price, P_{TERM} is just the discounted value of all of the future dividends after constant growth is reached:

$$P_{TERM} = \frac{D_T(1 + g_{LR})}{(r_s - g_{LR})} \quad (20)$$

where T is the last of the periods in which a near term dividend forecast is made, and g_{LR} is the assumed long-run growth rate. Equation (19) defers adoption of the very strong perpetual constant growth assumption that underlies Equation (4) — and hence the simple DCF formula, Equation (6) — for as long as possible, and instead relies on near term knowledge to improve the estimate of r_s . For example, the STB uses a three-stage DCF model.

2. DCF Implementation Issues

a) *Growth Rates*

In most cases, the choice of growth rate is the most controversial part of the DCF implementation. While some analysts rely on historic growth rates, most economists agree that the growth rates currently expected by investment analysts are more representative of investor expectations than historical growth rates, if an adequate sample of such rates is available.

Stock prices are influenced by the information available to investors and for companies in financial distress or companies involved in merger or acquisition activities, the information available to investors may be dominated by these events rather than any underlying trend in earnings or dividend growth. Therefore, the cost of capital estimation methods should not be applied to such companies. In addition, the stock prices for some companies reflect the market's perception of the value of real options available to the company. The forecast of the cash flows in the DCF approach does not include the value of the, as yet unexercised, real options, so for companies with material real option opportunities, the DCF model will underestimate the cost of equity.⁹⁰ Finally, the DCF approach requires that the stable-growth assumption must be reasonable and must be met *within the period for which forecasts are available*. That is, the expected growth rate must become and remain constant at some point.

⁹⁰ The DCF model underestimates the cost of equity for companies with real options because the market price of the stock reflects the value of the options but the forecast cash flows do not

b) Analyst Growth Forecasts

Optimism bias is related to the observed tendency for analysts to forecast earnings growth rates that are higher than are actually achieved. This tendency to over estimate growth rates is perhaps related to incentives faced by analysts that provide rewards not strictly based upon the accuracy of the forecasts. To the extent optimism bias is present in the analysts' earnings forecasts, the cost of capital estimates from the DCF model would be too high.

From a regulatory perspective, however, the effect of optimism bias is less likely to be an issue. DCF estimates are more robust for large, rate regulated companies in relatively stable segments of an industry. Furthermore, the magnitude of the optimism bias (if any) for regulated companies is not clear. This issue is addressed in a paper by Chan, Karceski, and Lakonishok (2003) who sort companies on the basis of the size of the I/B/E/S forecasts to test the level of optimism bias. Utilities constitute 25 percent of the companies in the lowest quintile, and by one measure the level of optimism bias is 4 percent. However, the 4 percent figure does not represent the complete characterization of the results in the paper. Table IX of the paper shows that the median I/B/E/S forecast for the first (lowest) quintile averages 6.0 percent. The realized "Income before Extraordinary Items" is 2.0 percent (implying a four percent upward bias in I/B/E/S forecasts), but the "Portfolio Income before Extraordinary Items" is 8.0 percent (implying a two percent downward bias in Institutional Brokers' Estimation System (I/B/E/S) forecasts).⁹¹

The difference between the "Income before Extraordinary Items" and "Portfolio Income before Extraordinary Items" is whether individual firms or a portfolio are used in estimating the realized returns. The first is a simple average of all firms in the quintile while the second is a market value weighted-average. Although both measures of bias have their own drawbacks according to the authors,⁹² the Portfolio Income measure gives more weight to the larger firms in the quintile such as regulated utilities.

There is also substantial academic evidence that analyst earnings estimates are superior to other forecasts. Specifically, Brown et al. (1987) find that analyst forecasts are better predictors of earnings numbers than time-series earnings forecasts (which look at historical earnings

⁹¹ I/B/E/S forecasts are analysts' forecasts on, for example, companies' earnings per share. The information is collected and published by Thomson Reuters.

⁹² Chan, Karceski, and Lakonishok, *op. cit.*, p. 675.

information as a gauge of future earnings). Further, fundamental analysis models rarely outperform analyst forecasts:

The ratio-based earnings prediction literature focuses on the forecasting power of financial ratios with respect to future earnings. Empirical evidence is generally consistent with the ratios' ability to predict earnings growth. These models, however, rarely outperform analysts' forecasts of earnings, especially forecasts over long horizons.⁹³

Analyst forecasts for the utilities industry are likely to be more accurate than forecasts for other industries because firms with less variability in their earnings tend to have more accurate forecasts. This suggests analyst forecasts for the utility industry are likely to be more accurate and less prone to potential bias when compared to forecasts for other industries.

c) Dividends Versus Cash in the Formula

The DCF model is based on the notion that the stock price equals the sum of the discounted cash flows that accrue to shareholders. This is usually implemented assuming that the cash flow that investors receive equals dividends. While this is true over the lifespan of the firm and in many instances also true over a shorter horizon, there may be instances where cash flow and dividends diverge for a period of time. This is the case, for example, when a company engages in share buybacks. In addition, some data providers and analysts believe that cash flows provide a better measure of the yield investors expect. This could be the case, if dividends currently are unusually low (or high) as would be the case if, for example, companies retain cash to make capital investments (or if companies pay out dividends in excess of earnings). As a result some data providers and analysts rely on the cash flow yield rather than the dividend yield in the DCF model.

In summary, the reliability of the DCF model hinges on the appropriateness of its assumptions — whether the basic present value formula works for stocks, whether option pricing effects are important for the company, whether the right variant of the basic formula has been found, and whether the true growth rate expectations have been identified.

⁹³ Kothari, S.P., “Capital Markets Research in Accounting,” *Journal of Accounting and Economics* 31, 2001, p. 186.

3. DCF Evaluation: How Well Does the DCF Model Meet the Criteria?

Most of the data necessary for its implementation is widely available at low cost. The exception is that there is no source of data on the long-term growth rate of dividends. Its calculations are relatively simple, and the logic of the model is intuitive in that the expected return on an investment is equal to the expected amount of current income (i.e., the dividend payment) and the expected amount of capital gain (i.e., the growth in the price or dividend payments).

The major source of debate for the DCF model is determining the dividend growth rate, particularly for the long-term. There is generally no publicly available data on forecast growth rates for periods longer than 5 years. Unfortunately, the forecast growth rate has a major effect on the cost of equity estimated by the DCF method.

The DCF approach is conceptually sound if its assumptions are met, but can run into difficulty in practice because those assumptions are so strong, and hence unlikely to correspond to reality. Two conditions are well-known to be necessary for the DCF approach to yield a reliable estimate of the cost of capital: (i) the variant of the present value formula, Equation (19), that is used must actually match the variations in investor expectations for the dividend growth path; and (ii) the growth rate(s) used in that formula must match current investor expectations. In practice, the stability of the DCF estimates of the cost of capital across similar companies or over a relatively short time span can be a problem. Less frequently noted conditions may also create problems, such as whether the price of the company's stock reflects the value of real options. The more stable the company and industry is, the less of a problem the issues discussed above are. To summarize the strengths and weaknesses of the DCF models, we note the following:

Reasonable

The degree to which estimates from the DCF models are consistent with the objective being pursued depends largely on (i) the reliability of the estimates as discussed below and (ii) company and economy-wide factors. Because DCF models quickly incorporate new information regarding the company's stock price, dividends, and growth rates, the ROE estimates reflect this information, which may or may not be consistent with the regulatory objective. For example, if changes in the DCF estimates were driven by factors unrelated to the required return in financial markets or the regulated activity, the impact of these factors on the ROE is not consistent with the regulatory objective. The constant growth DCF model relies heavily on a formulaic approach

and hence minimizes judgmental factors. A well-defined multi-stage model also provides a formulaic approach and avoids the use of judgmental factors.

Reliable

A strength of both the constant growth and a well-defined multi-stage DCF model is that the models rely on auditable information. A weakness of the DCF models is that they do not necessarily produce consistent results for like conditions because stock prices and growth rates can change quickly. However, the multi-stage DCF model tends to dampen the effect of changes in the basic model parameters compared to the constant growth DCF model. Finally, the cost of capital estimates from the multi-stage DCF model is more stable than the constant growth DCF model, but neither model is truly robust although both versions of the DCF model are sensitive to economic/financial conditions.

Pragmatic

As with other models, if the models relied upon are well-defined, the information needed for their implementation is readily available from public sources, and the models are simple to implement. Thus, data availability and ease of implementation is a strength for the DCF models. To determine whether a constant growth or a multi-stage DCF is appropriate for the regulatory context, it is important to recognize that the constant growth DCF model responds quickly (and sometimes dramatically) to company-specific changes, while the presence of growth rates other than those of the company in the multi-stage model, dampens the models response to company-specific changes. Therefore, the choice of model or models will necessarily involve a tradeoff between the stability of the estimates and the goal of reflecting current company-related conditions.

E. RISK PREMIUM APPROACHES

1. Equity Risk Premium Implementation

The risk premium model, sometimes called the equity risk premium model, in *Section II.C.3*, Equation (9) is frequently implemented using either a historical estimate of the risk premium or a forward-looking or expected risk premium. The historical risk premium is commonly determined as the historical spread between equity and debt returns, so the primary choices become which equity return and debt instrument to use as well as the period over which the spread is measured. It is not uncommon to see this model implemented using short-term

government bonds, long-term government bonds or utility/corporate bonds to measure the cost of debt, while the equity investments used are typically either (a) realized accounting returns of regulated entities in the same industry, (b) realized stock returns of companies in the same industry, or (c) allowed returns on equity for the industry. In choosing a debt instrument to determine r_D , it is important that it is consistent with the debt instrument used to determine the risk premium. In other words, if a 10-year government bond is used to determine the historical risk premium, then r_D must also be measured using a 10-year government bond. The realized risk premium is highly dependent on the time period over which it is estimated, so that choice is also important. The historical risk premium approach assumes that a historically realized risk premium is an appropriate measure for expected returns. However, over any given period, and especially over a short period of time, realized returns can differ substantially from expected returns. Therefore, the accuracy of the estimated risk premium will typically increase if estimated using a longer time period.⁹⁴

The forward looking model requires the analyst to determine a proper measure the cost of debt and how to *estimate* the expected risk premium. Because the yield to maturity of an investment grade bond serves as a proxy for the expected return, yield to maturity measures are natural candidates for the expected bond cost.⁹⁵ Determining the expected equity return is more difficult and requires the reliance on an estimation technique. It is common to rely on DCF models to determine the risk premium in the forward looking version. For example, the analyst may choose companies in the same industry as the regulated entity and use the DCF method to calculate the expected return on equity for the industry monthly (or quarterly) for a number of years. The analyst then determines the risk premium as the average spread between the estimated return on equity for the industry and the yield to maturity on the selected debt instrument. Again consistency requires use of the same debt instrument to measure the cost of debt (r_D) as is used to estimate the expected risk premium. One result originating from these analyses of historical or forward-looking risk-premium approaches is that empirically there is a negative relationship between the risk premium and the yield-to-maturity. Historically, a 1% decline in the yield-to-maturity of government bonds results in less than a 1% decline in the

⁹⁴ The more fair coin tosses we undertake the more likely it becomes that we realize heads close to 50% of the time and tails 50% of the time.

⁹⁵ As noted above, the cost of capital is the expected rate of return on an investment. Strictly speaking, the yield-to-maturity of debt includes a premium for default risk, so if there is no default on the bonds, the investors will earn slightly more than the cost of capital. For investment grade bonds, the default premium is likely to be small.

estimated (or realized) return on common equity.⁹⁶ The relationship between the return on equity and (government or utility) bond yields is depicted in Figure 7 below. The figure is for illustrative purposes only and does not reflect an actual analysis of the relationship.

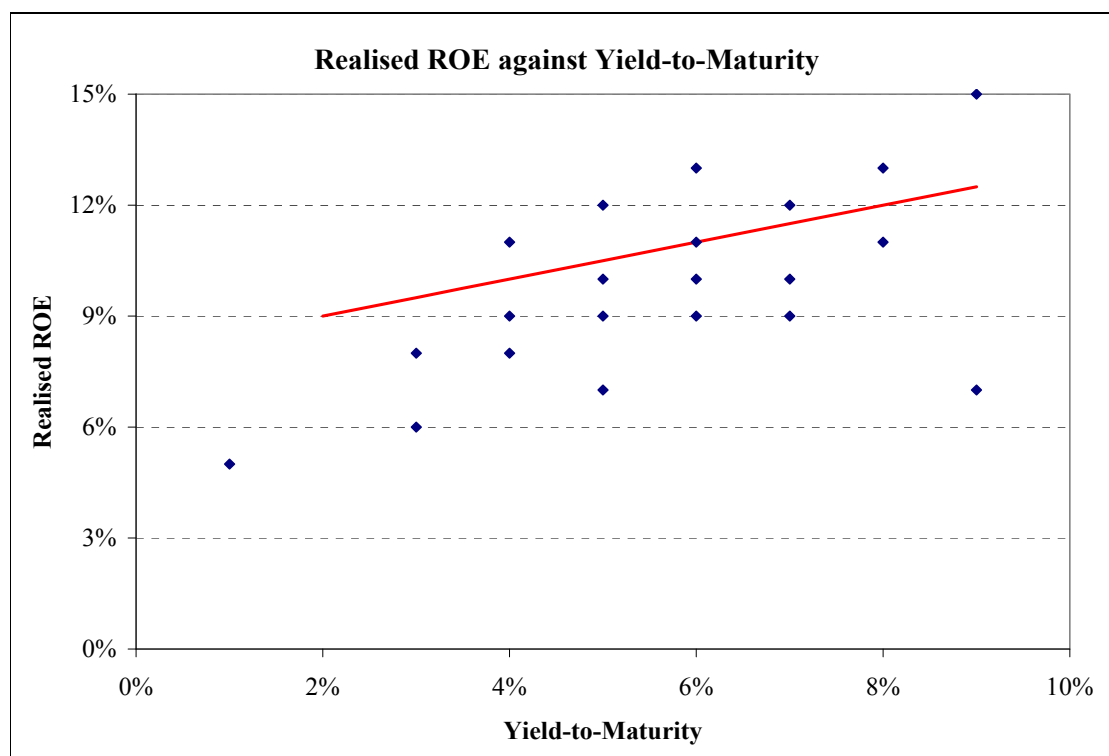


Figure 7

Among the participating regulators, the Ontario Energy Board (OEB) took evidence from the risk premium approach into consideration when determining its baseline cost of equity. The Canadian Radio-television and Telecommunications Commission (CRTC) also discusses the methodology and the Agency reviews it annually.

2. Risk Premium Model Evaluation: How Well Does the Risk Premium Model Meet the Criteria?

The risk premium model is a derivative of the CAPM so the comments that apply to the CAPM also apply to the Risk Premium Model; however, the Risk Premium Model does not have the same level of theoretical support. The tie between theory and implementation is weakened

⁹⁶ For example, Roger A. Morin, "New Regulatory Finance," Public Utilities Reports, Inc., 2004 pp. 128-129 summarizes several studies and found that the realized ROE changes approximately 50 basis points when government bond rates change 100 basis points. Regulatory agencies such as the Ontario Energy Board relied on this empirical finding as well as data submitted by experts in its recent hearing to update its annual change in the estimated cost of equity for Ontario utilities by less than the change in government bond rates.

because the interest rate in the Risk Premium Model is not necessarily equal to the risk-free rate and the risk premium is not explicitly based upon the product of the investment's beta and the MRP. However, the calculations are simple and the model is based upon the risk-return trade-off underlying the CAPM. The model is forward looking because the benchmark interest rate is a current rate, and the data necessary for the model is generally widely and cheaply available, depending upon how the risk premium is estimated.

The difficulty with the model is determining the appropriate risk premium and whether it has changed since it was last estimated. There is also an issue of whether the relationship of the risk premium to changes in the benchmark interest rate remains constant. If the interest rate increases by 1% does the risk premium stay constant or change? Because there is no underlying theory, there is no definitive answer to the question.

There are only two parameters in the Risk Premium Model so implementation only requires estimating the two parameters. The benchmark interest rate is observable so the primary controversy centers on determining the risk premium. Because there is no theory for how the risk premium should be estimated, there will always be controversy about it. However, from a regulatory consistency practice, it is important to specify whether the benchmark bond rate is the government or corporate bond rate. An argument can be made for using the corporate bond rate as regulated entities necessarily raise capital as a corporation rather than as a government entity. While the reliance on allowed rates of return provide a benchmark for whether the allowed returns are comparable to those allowed in other jurisdictions, a reliance on the allowed return of a small set of regulators or the regulator itself should be avoided to ensure there is no circularity in determining the allowed return on equity. To assess the strengths and weaknesses of the risk premium model, we note the following:

Reasonable

As with other models, the degree to which the risk premium model is consistent with the objective being pursued depends to a degree on its implementation. A strength of the model is that it explicitly considers current bond yields for the regulated entity and hence the regulated entity's cost of debt, provided the implementation relies on industry as opposed to government bond yields. Also, if the methodology is well-defined it is transparent and relies on a structured formula. Among the weaknesses of the risk premium approach is that it may be influenced by monetary policy - - especially if the implementation relies on government bond yields.

Reliable

A strength of the model is that the information on which it relies is auditable, while the weakness is that it may or may not produce consistent results for like conditions. Because inflation and other factors that are not directly related to the cost of equity capital may affect bond yields, the model will not necessarily produce like results for like conditions. The implementation of the model largely determines its ability to capture the systematic risk of companies. For example, unless a forecasted return for relevant companies is used, it will be unable to reliably estimate the cost of capital across different economic conditions. Inflation can be a problem for the risk premium model, because the historical data underlying the risk premium may not be consistent with the current level of inflation in the economy.

Pragmatic

As noted above, if the model is well-specified and uses well-defined inputs, easy access to the underlying information and easy implementation are strengths of the model. However, the estimates from the model may or may not at any given time recognize the regulatory context in which the cost of capital is being applied.

F. COMPARABLE EARNINGS**1. Comparable Earnings Implementation Issues**

As noted in *Section II.D*, the comparable earnings method requires the analyst to go through four steps. First, a group of *unregulated* companies is required because the realized accounting rate of return of a regulated company depends on its allowed return. Using regulated companies to estimate the comparable earnings cost of capital would be circular, i.e., the allowed rate of return is used to determine the allowed rate of return. However, the use of unregulated companies requires a careful consideration of the risk characteristics of the companies and the comparability to those of the target utility.

Second, a time period over which to estimate the return on equity must be selected. Because a company's achieved earnings fluctuate from year to year and depend substantially on both company-specific and economy-wide factors, it is necessary to include companies from several industries, averaged over several periods.

Third, because the comparable companies are unregulated entities, it is necessary to adjust for any risk differences between the sample companies and the target company. There are many ways to adjust for risk differences, so the following is a simplified description of some common approaches rather than an exhaustive review. Analysts often collect information on the comparable companies' and the target company's bond ratings, asset betas, DCF estimates of the cost of equity, and other measurable risk factors. In many instances this information is also collected for a sample of regulated companies in the same industry as the target company. If the sample companies are found to be consistently more (less) risky than the target company and its industry peers, then an adjustment is made to the required return on equity. This can sometimes be done formally. For example, if the sample companies' DCF estimates of cost of equity consistently are 25 basis points higher (lower) than the DCF estimates for the target company (or industry peers), then a downward (upward) adjustment of 25 basis points is made. For other measures it is more difficult to determine the exact adjustment, so it is usually made based on the analyst's experience. For example, does a two notch difference in bond rating require a specific upward or downward adjustment? Thus, while the differences are relatively easy to measure, the adjustment for such differences requires subjective judgment.

A major issue is whether realized book returns are a good proxy for the return that investors expect going forward. From a statistical perspective, the realized accounting return on book equity for any given period is the realization of a single outcome of a distribution, whereas the expected return represents the probability-weighted average of all possible outcomes of the distribution. These two figures can differ substantially. In addition, there are practical problems with the implementation because financial reporting occurs with a lag, which during times of change can mean that the results are out of date. Moreover, the procedure is inherently "backward looking" in that it considers realized returns over historical periods instead of estimating the cost of capital going forward.

The advantage of the method, if implemented correctly, is that (i) it looks directly at the return that accrues to investors in "comparable companies," (ii) it is relatively simple to implement, and (iii) data are publicly available and easily accessible. The disadvantages to the methods are that it (i) lacks an economic foundation because accounting returns and investors' expected returns are two different concepts, (ii) is backward looking, (iii) can be difficult to find a time period that accurately reflects the expected horizon of the regulated entity, and (iv) can be difficult to select

a comparable sample and to adjust for risk differences between the comparable sample and the regulated sample.

While none of the five participating regulators rely on the comparable earnings methodology, the OEB discusses it as one of four commonly used cost of equity estimation techniques even though it was not filed by experts in the OEB's most recent review of its cost of capital methodology.⁹⁷ Also, cost of equity estimates from the comparable earnings model are commonly filed in North American rate proceedings, and the model is one of three equally weighted models relied upon by the U.S. Federal Reserve to determine the imputed cost of equity that is used to price their services.⁹⁸

2. Comparable Earnings Model Evaluation: How Well Does the Comparable Earnings Model Meet the Criteria?

The primary appeal of the comparable earnings model is that it seems to be consistent with the language of the legal requirement established by the Supreme Court in both Canada and the U.S. although both courts focused on the established rate of return and not on the process by which it was established. Specifically, the decisions require that the regulated company be given a fair opportunity to earn a rate of return equal to that of comparable risk investments. The appeal is further strengthened by the fact that a comparable earnings estimate provides a rate of return on the book value of equity of a company. The allowed ROE for most regulated companies is based upon the book value of investment in the company, not the market value of the invested assets. Once a comparable sample has been selected, the data necessary for the calculations are generally readily available.

However, the comparable earnings method does not have strong theoretical basis for the estimate of the cost of capital. The cost of capital is defined as the expected rate of return of comparable risk investments. The comparable earning method fails to provide an expected rate of return, because it is a backward looking cost of equity measure. The method considers the realized rates of accounting return for the sample companies with no consideration of current market

⁹⁷ See, Ontario Energy Board, "Report of the Board on the Cost of Capital for Ontario's Regulated Utilities: EB-2009-0084," pages 26 and 35.

⁹⁸ Board of Governors of the Federal Reserve System, "Testimony Before the Surface Transportation Board, Ex Parte No. 664," February 15, 2007, p. 4. See also, E.J. Green, J.A. Lopez, Z. Wang, "The Federal Reserve Banks' Imputed Cost of Equity Capital," Federal Reserve System, Board of Governors, December 2000.

conditions. For example, if two otherwise similar companies choose different accounting conventions then the realized accounting return may differ.

The comparable earnings methodology can be implemented in many different manners, but if the best practices described above are used, the strengths and weaknesses of the method can be summarized as follows:

Reasonable

The comparable earnings methodology may or may not be consistent with the regulatory objective being pursued. Specifically, the method's strength is that it can accommodate information from non-regulated entities and hence be used to assess the required cost of capital more broadly than other methods. This is also a weakness of the model in that other industries are not necessarily comparable to the entities being regulated, so that the information may or may not be relevant. As with other models, transparency is a strength, if the relied upon methodology is well-specified.

Reliable

If the relied upon methodology is well-specified, it is clearly based on auditable information from companies' annual filings with SEDAR, for example. Because the methodology relies on accounting information, a weakness is that it does not necessarily produce consistent results for like conditions. For example, accounting changes could produce changes in estimates without any change in the underlying cost of capital. The model is not necessarily sensitive to economic or financial conditions, because it relies on backward-looking accounting information that may not reflect current economic conditions.

Pragmatic

Because the model uses accounting information that is available free of charge from SEDAR or alternatively from commercial data providers, it clearly fulfills the requirement of using readily available information. Also, it is easy to implement if a well-specified version is used. However, the estimates from the model do not come from regulated companies or activities, so it cannot be said to recognize the regulatory context in which the cost of capital is being applied.

G. FINANCIAL RISK AND THE COST OF EQUITY

A common issue in regulatory proceedings is how to apply data from a benchmark set of comparable securities when estimating a fair return on equity for the target/regulated company.⁹⁹ On the one hand, it is tempting to simply estimate the cost of equity capital for each of the sample companies (using one of the above approaches) and average them. After-all, the companies were chosen as comparable risk, so why would an investor necessarily prefer equity in one to the other (on average)? The problem with this argument is that it ignores the fact that underlying asset risk in each company is typically divided between debt and equity holders – making them derivatives of the underlying asset return. Even though the risk of the underlying assets may be comparable, a different capital structure splits that risk differently between debt and equity holders, making the equity in one firm potentially more risk than equity in another.¹⁰⁰ Stated differently, increased leverage adds financial risk to a company's equity.¹⁰¹

Figure 8 and Figure 9 below demonstrate this phenomenon by comparing equity's risk when a company uses no debt to finance its assets, and when it uses a 50-50 capital structure (i.e., it finances 50 percent of its assets with equity, 50 percent with debt). For illustrative purposes, the figures assume that the cash flows will be either \$5 or \$15 and that these two possibilities have the same chance of occurring (e.g., the chance that either occurs is $\frac{1}{2}$).

⁹⁹ This is also a common valuation problem in general business contexts.

¹⁰⁰ The difference in risk due to how the assets are financed is called financial risk. The impact of leverage on risk is conceptually no different than that faced by a homeowner who takes out a mortgage. The equity of a homeowner who finances his home with 90% debt is much riskier than the equity of one who only finances with 50% debt.

¹⁰¹ It is referred to as *financial* risk because the additional risk on equity holders stems from how the company chooses to finance its assets.

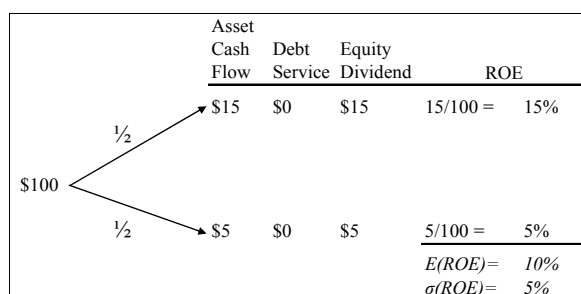


Figure 8. Firm with all equity capital structure.

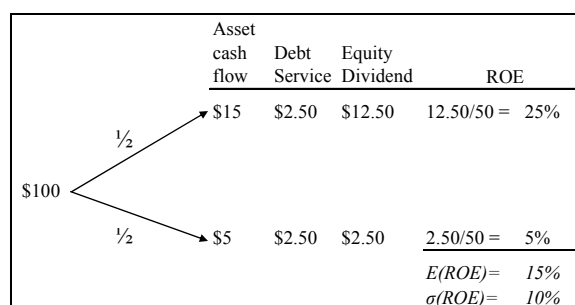


Figure 9. Firm with 50/50 capital structure.

To highlight the difference, Figure 10 below illustrates how financial risk shifts equity (when viewed as an asset in its own right) relative to the minimum variance frontier – equity in the unlevered firm is a different asset from equity in the levered firm.¹⁰² In the figure below, μ indicates the mean return and σ represents the variance.

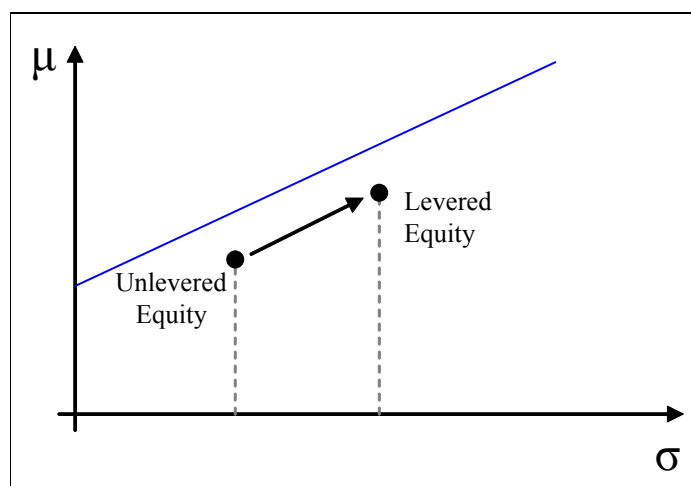


Figure 10

Therefore, to the extent that market value capital structures differ across the sample, it is not correct to treat equity as comparable without adjusting for the differences in capital structure.¹⁰³ The comparison is no longer apples-to-apples, and it is simply not clear how the sample average

¹⁰² The example assumes that the security is not on the frontier – this is the general case. If a security were on the frontier, it could replace the market as a pricing model. As drawn, the debt beta is effectively assumed to be zero (shift is parallel to frontier), but this need not be the case.

¹⁰³ Theoretical developments of this notion such as R.S. Hamada, “Portfolio Analysis, Market Equilibrium, and Corporate Finance,” *Journal of Finance* 24, 1969, pp. 13-31 rely on market value capital structures.

cost of equity relates to a fair return for the target/regulated company. On the other hand, the fact that underlying asset risks are comparable across the sample suggests that asset costs of capital may be treated on an apples-to-apples basis. Two approaches that utilize this insight to derive an implied fair return for the regulated company are i) to estimate the sample average Weighted-Average Cost of Capital (WACC) and back out the implied fair return, and ii) to estimate an asset beta from the sample and adjust it according to the leverage of the regulated company – then apply CAPM using this leveraged beta.

1. WACC implied r_E

If the companies in a sample are truly comparable in terms of the systematic risks of the underlying assets, then the weighted-average cost of capital of each company should be about the same across companies (except for sampling error), so long as they do not use extreme leverage or no leverage. The intuition here is as follows. A firm's asset value (and return) is allocated between equity and debt holders.¹⁰⁴ The expected return to the underlying asset is therefore equal to the value weighted average of the expected returns to equity and debt holders – which is the WACC.¹⁰⁵

$$WACC = r_D(1 - T_C) \cdot \frac{D}{V} + r_E \cdot \frac{E}{V} \quad (21)$$

where r_D = market cost of debt, r_E = market cost of equity, T_C = corporate income tax rate, D = market value of debt, E = market value of equity, and V is the market value of the firm (i.e., $V = D + E$). Since the WACC is the cost of capital for the underlying asset risk, and this is comparable across companies, it is reasonable to believe that the WACC of the underlying companies should also be comparable, so long as capital structures do not involve unusual leverage ratios compared to other companies in the industry.¹⁰⁶ When a company uses a high level of debt financing, for example, there is significant risk of bankruptcy and all the costs associated with it. The so called costs of financial distress when a company is over-leveraged

¹⁰⁴ Other claimants, such as preferred equity, can be added to the WACC if they exist.

¹⁰⁵ As this is all on an after-tax basis, the cost of debt reflects the tax value of interest deductibility. Also, there are a number of underlying regularity assumptions being made when the equivalence of the WACC and the asset cost of capital is asserted. For example, there is a need to assume additivity, no-arbitrage, and market efficiency, among other assumption.

¹⁰⁶ Empirically, companies within the same industry tend to have similar capital structures, so whether a leverage ratio is unusual depends upon the company's line of business.

can increase its cost of capital. A company's weighted-average cost of capital is also likely to be higher if the company does not make good use of the income tax shield available from use of debt financing.

The notion that the WACC is constant across a broad middle range of capital structures is based upon the Modigliani-Miller theorem that choice of financing does not affect the firm's value.¹⁰⁷ To the extent that it holds, this reasoning suggests that one could compute the WACC for each of the sample companies and then average to produce an estimate of the WACC associated with the underlying asset risk. Assuming that the WACC is relatively constant, one can then re-arrange the WACC formula to estimate what the implied cost of equity is at the regulated company's capital structure on a book value basis.¹⁰⁸ Alternatively, some regulators simply take the estimated WACC and use it to help determine revenue requirements, price caps, etc. (as appropriate).

2. Levered vs. Unlevered Betas

An alternative approach to account for the impact of financial risk is to examine the impact of leverage on beta. Notice that this means working within the CAPM framework, and such methodology clearly cannot be applied to estimates from DCF models. The reasoning starts by recognizing that under general conditions, the value of a firm can be decomposed as:¹⁰⁹

$$V_{Firm} = V_{Unlevered Firm} + \text{Present Value of Tax Shields on Interest} \quad (22)$$

For a company with a fixed book-value capital structure and no additional costs to leverage, it can be shown that the formula above implies:

¹⁰⁷ This is a simplified treatment of what is generally a complex debate. The role of taxes, market imperfections and constraints, etc. are areas of debate in this result.

¹⁰⁸ Market value capital structures are used in estimation – these are the market returns demanded by investors. One applies the implied market return, however, to the capital on which investors receive a return. In North America that is measured by book values.

¹⁰⁹ This follows development in Fernandez (2003). Other standard papers in this area include Hamada (1972), Miles and Ezzell (1985), Harris and Pringle (1985), Fernandez (2006). (See Fernandez, P., "Levered and Unlevered Beta," IESE Business School Working Paper WP-488, University of Navarra, Jan 2003 (rev. May 2006); Hamada, R.S., "The Effect of the Firm's Capital Structure on the Systematic Risk of Common Stock," *Journal of Finance*, 27, May 1972, pp. 435-452; Miles, J.A. and J.R. Ezzell, "Reformulating Tax Shield Valuation: A Note," *Journal of Finance*, XL5, Dec 1985, pp. 1485-1492; Harris, R.S. and J.J. Pringle, "Risk-Adjusted Discount Rates Extensions from the Average-Risk Case," *Journal of Financial Research*, Fall 1985, pp. 237-244; Fernandez, P., "The Value of Tax Shields Depends Only on the Net Increases of Debt," IESE Business School Working Paper WP-613, University of Navarra, 2006.) Additional discussion can be found in Brealey, Myers, and Allen (2008).

$$r_{\text{levered equity}} = r_{\text{unlevered equity}} + \left(\frac{D}{E}\right)(1 - T_c)(r_{\text{unlevered equity}} - r_{\text{Debt}}) \quad (23)$$

Where the returns above are expected returns and both debt D and equity E are valued at market value. T_c is the corporate tax rate. Replacing each of these returns by their CAPM beta representation and simplifying then gives the following relationship between the beta of a leveraged firm and that of an unleveraged firm.

$$\beta_L = \beta_U + (\beta_U - \beta_D)(1 - T_c)\left(\frac{D}{E}\right) \quad (24)$$

where β_D is the beta on the firm's debt. Miles and Ezzell (1985) provide the following alternative formulation when market value capital structures are kept constant instead:

$$\beta_L = \beta_U + (\beta_U - \beta_D)\left(\frac{1 - T_c \times r_D}{1 + r_D}\right)\left(\frac{D}{E}\right) \quad (25)$$

For regulated companies whose book-value capital structures are regulated (and kept stable), Equation (24) is more appropriate. Regardless of which formula is used, it is clear that either the beta of debt needs to be estimated, or an assumption made as to its value. While estimation is preferable in theory, it is not always feasible. The market for corporate debt is not generally very liquid. Debt is often issued to institutional investors or banks which simply hold it to maturity – rather than trade it. As a result, it is not clear that reliable estimates for a given company's (or industry's) debt are available. A common practice is to simply assume the beta of debt is zero, but this suggests that it is risk-free in the CAPM framework – implying that cost of debt should be the risk-free rate. This is clearly not the case, although the risk in debt instruments is not the variability of cash-flow (assuming no default) so much as it is the risk of default. Debt betas vary across time and different studies have found different parameters, but the range spanned seems to be approximately 0 to 0.25.¹¹⁰

Once a decision on debt betas is made, the cost of equity for each company in the sample can be computed on an unlevered basis (using its unlevered beta and the CAPM), and averaged to produce an estimate of the industry's unlevered beta. To estimate the cost of equity for the

¹¹⁰ For example, E.J. Elton, J. Gruber, D. Agrawal, and C. Mann, "Explaining the Rate Spread on Corporate Bonds," *The Journal of Finance*, February 2001, pp. 247-277, find a beta of 0.26 on BBB rated corporate bonds while the Australian CCC and Australian Energy Regulator uses a debt beta of zero (AER, "Final Decision: Electric Distribution and Transmission Network Service Providers. Review of the Weighted Average Cost of Capital (WACC) Parameters" 2009, p. 265, footnote 595.

regulated company, this estimate of unlevered beta can be re-levered to the regulated company's capital structure, and CAPM reapplied with this levered beta. The U.K. Competition Commission as well as other U.K regulators and the Western Australia Economic Regulation Authority rely on a delevering / relevering technique to determine the cost of equity capital for the entities they regulate.

H. SUMMARY OF STRENGTHS AND WEAKNESSES

All cost of capital estimation techniques have strengths and weaknesses. The CAPM and the DCF models are based upon a foundation of economic theory and are well documented in the academic literature, but the risk premium and comparable earnings have had less research devoted to them. However, the strengths and weaknesses of each method depend largely on how the method is implemented. It is therefore important that best practices are followed and that unique circumstances that may bias the estimation process are taken into consideration. For example, if a single company dominates the stock market index and that company discloses information that substantially alters the stock market index, beta estimation procedures should avoid using the stock market index around the time of the announcement(s). Alternatively the market index can be modified to correct for the effect of the one company.

The following briefly summarizes the strengths and weaknesses of the four methods discussed in detail above. First, none of the methods were developed specifically to be consistent with the objectives being pursued, although the comparable earnings methodology is frequently claimed to be based upon the factors referenced in the court decisions. Second, the CAPM, DCF, and risk premium models are all transparent if implemented using best practices, while the comparable earnings methodology is less transparent. Third, all models are based on auditable information if implemented using standard methods and data sources. Fourth, none of the models necessarily produce like results for like conditions. All models are to a degree sensitive to company specific and economy-wide phenomena and the effects cannot readily be measured. Fifth, none of the models are completely robust yet reasonably sensitive to a broad range of economic and finance conditions. However, the CAPM gains in robustness if a broad market index is used along with a well-defined MRP such as the historic average or if a specific supply model is used to determine it. Beta estimates that rely on a portfolio or the average of a sample enhance the stability of the CAPM. Similarly, the multi-stage DCF tends to be more stable than

is a constant growth DCF model.¹¹¹ Sixth, all four models score relatively high on being based on readily available information, if they rely on well-specified models and the CAPM avoids using survey based MRP information. Seventh, the models are all relatively easy to implement, provided a well-specified version of the model is used and the CAPM avoids using survey based MRP estimates. Finally, none of the models specifically recognizes the regulatory context or legislative environment in which Agency operates. They are developed for more generic use, but a proper choice of input parameters can greatly assist in ensuring the regulatory context is adhered to. Each methodology has its strengths and weaknesses, which we discussed above.

IV. THE AGENCY'S COST OF CAPITAL METHODOLOGY

A. APPROACH TO COST OF CAPITAL ESTIMATION FOR RAILWAYS

The Canadian Transportation Agency's (Agency) cost of capital methodology has evolved in a series of decisions since 1985.¹¹² The decisions and annual decision letters to the two largest railways, Canadian National Railway Company (Canadian National or CN) and Canadian Pacific Railway Company (Canadian Pacific or CP), outline the Agency's method for determining the applicable net rail investment, the capital structure, the cost of capital structure elements, and the weighted-average cost of capital. The discussion below is based on these decisions, letters and discussions with Agency personnel.

The Agency determines the railways' cost of capital in four steps:

1. Determination of net rail investment,
2. Determination of capital structure,
3. Determination of the cost rates applicable to components of the capital structure; e.g., cost of debt and cost of common equity, and
4. Calculation of the cost of capital rate.

¹¹¹ The stability of the risk premium and the comparable earnings models can be improved by relying on several years of data to estimate the cost of capital instead of just one year.

¹¹² Decision on the Cost of Capital Methodology (1985 Decision), Decision No. 125-R-1997 (1997 Decision), Decision No. 52-R-2004 (2004 Decision). See also, the 2004/2005, 2005/2006, 2006/2007, 2007/2008, 2008/2009, and 2009/2010 Crop Year Cost of Capital Rate for the Canadian National Railway Company for the Transportation of Western Grain and the 2004/2005, 2005/2006, 2006/2007, 2007/2008, 2008/2009, 2009/2010, 2010/2011 Crop Year Cost of Capital Rate for the Canadian Pacific Railway Company for the Transportation of Western Grain.

The determination of each step is based on submissions by the railways and is reviewed by the Agency. The four steps involve a number of considerations.

First, the net rail investment is the railways' gross book value of all railway assets less accumulated depreciation. This step identifies the portion of the regulated railway that is providing railway transportation services and falls under Agency jurisdiction. The net rail investment includes an amount for working capital. CN and CP make annual submissions regarding net rail investment, based on book values from their most recent financial statements, with certain adjustments.¹¹³

Second, the capital structure is determined using the each company's book value capital structure including long-term debt, common equity, and deferred income taxes. The latter is considered a zero-cost source of capital to the company. In its recent decision regarding the cost of capital for CN and CP, the Agency stated that it views a capital structure based on book values as more aligned to net investment and more relevant than one based on market values.¹¹⁴ Each year the railways submit capital structure figures to the Agency, which reviews and approves the figures.

Third, the Agency estimates the cost of debt and the cost of common equity.¹¹⁵ The cost of debt is based on the book-value weighted average of the interest paid on long-term debt, while the cost of common equity is estimated using primarily three economic models:

- a. Capital Asset Pricing Model (CAPM),
- b. Discounted Cash Flow Methodology (DCF), and
- c. Equity Risk Premium Model (ERP)

The railways submit estimates of their costs of debt and equity, which are reviewed and approved or modified by the Agency. Implementation issues for each of these models were discussed in *Section III.B* above.

¹¹³ Because the Canadian railways, for regulatory purposes, must follow the *Uniform Classification of Accounts and Related Railway Records* (UCA), the financial statements and the regulatory filings may treat certain items differently.

¹¹⁴ LET-R-50-2009 (CN), Appendix A, p. 3 and LET-R-52-2009 (CP), Appendix A, p. 5.

¹¹⁵ Neither CN nor CP reports any preferred equity in their most recent submission to the CTA, so determining the cost of preferred is a not an issue.

Fourth, the Agency calculates the cost of capital rate, which is grossed up for income taxes using statutory tax rates and applied to the net rail investment. Specifically, the Agency grosses the cost of equity up for taxes and calculates the cost of capital rate as:

$$\begin{aligned} \text{Cost of Capital Rate} = & \text{Before-Tax Cost of Equity} \times \text{Equity Ratio} \\ & + \text{Cost of Debt} \times \text{Long-Term Debt Ratio} \\ & + 0\% \times \text{Deferred Tax Ratio}^{116} \end{aligned}$$

The Equity, Long-Term Debt, and Deferred Tax ratios are the relative share of common equity, long-term debt, and deferred taxes in the book-value capital structure. To determine the dollar amount the railways are allowed to charge for capital for transporting western grain, interswitching and other purposes, the cost of capital rate is applied to the net rail investment.

B. IMPLEMENTATION OF COST OF CAPITAL ESTIMATION

1. Preliminaries

The Agency annually determines distinct cost of capital figures for CN and for CP with respect to the transport of western grain. The Agency also determines the cost of capital for interswitching rates and other regulatory purposes. However, except for the determination of the risk-free rate in the CAPM,¹¹⁷ all parameters are determined during the Agency's annual review of the cost of capital for CN and CP with respect to the transport of western grain. Therefore, the remainder of this section focuses on the determination of the cost of capital for the transport of western grain.

The railways submit cost estimates to the Agency annually, including cost of capital figures. Therefore, resulting figures may have been reviewed and accepted rather than estimated from scratch by the Agency. Also, as noted above, the Agency determines the cost of capital for each of the two major railways, CN and CP. To do so, the Agency follows its 2004 Decision, where it noted that “the Agency will continue to assess all three recognized models and give the

¹¹⁶ In North America, most regulators treat deferred income taxes in a manner similar to the Agency. Specifically, they (1) treat deferred income taxes as a zero cost source of capital or equivalently (2) subtract the deferred income taxes from the rate base (net investment), which has the same effect.

¹¹⁷ The key difference in risk-free rates is the date at which the rate is determined. For example, the risk-free rate used in western grain transportation rates may be determined in January while the rate used for interswitching rates may be determined in May.

appropriate weight to each model or a combination of models,”¹¹⁸ with the relevant model being the CAPM, the DCF model, and the risk premium model.

2. The Models

a) CAPM

The Agency implements the standard CAPM described in Equations (2) above. To implement the model, the Agency assesses both a short-term and a long-term risk-free rate. Specifically, the Agency has looked to the 1-3 year and the 10-year government bond rates from the *Globe and Mail* and Bank of Canada.¹¹⁹ However, in an exception to this practice, because the Agency deemed the 1-3 year bond rate to be unduly influenced by ongoing monetary policy, the Agency replaced this rate by the 3-5 year government bond rate in its most recent estimation of the cost of capital for the Canadian railways.¹²⁰ Further, the Agency relies on a historical average for the MRP using Canadian data and matches the length of the bonds over which the risk premium is measured to the time horizon for the risk-free rate, i.e., the Agency relies on an average of the market return over average total return on 1-3 year bonds and 10-year bonds. The data was historically obtained from the Canadian Institute of Actuaries, but since 2007 the Agency has estimated the MRP from data obtained from the TSX and Bank of Canada, because the data from Canadian Institute of Actuaries no longer is public. The time horizon over which to determine the MRP was discussed in the Agency’s 2004 Decision, where it stated:

The Agency acknowledges the commonly accepted principle that an average based on a long data series minimizes the distorting impact of an unusual year and incorporates a range of outcomes. The Agency further notes that long-term averages over periods of 30 years or more do tend to produce stable results. However, building on its earlier conclusions, the Agency finds that a very extended time period is inappropriate because it puts emphasis equally on recent and early historic data.¹²¹

¹¹⁸ The decision to assess these three models was made in the 1985 Decision p. 110, reaffirmed in the 1997 Decision p. 4, and again in the 2004 Decision p. 4.

¹¹⁹ See, 1997 Decision, page 4. The decision to assess both the short-term and the long-term risk-free rate originated in the 1985 Decision (Decision on the Cost of Capital Methodology, July 31, 1985, p. 109) p. and was reaffirmed in the 1997 review (Decision No. 125-R 1997 p. 4) and in the 2004 review (Decision No. 52-R-2004, issued February 2, 2004 p. 4).

¹²⁰ LET-R-71-2010, Appendix A and LET-R-73-2010, Appendix A.

¹²¹ 2004 Decision p. 7.

In recent Decision Letters to the railways, this policy have been implemented using the most recent 45 years of data.¹²²

In its 2004 Decision, the Agency considered whether reliance on U.S. data was appropriate in the determination of the market risk premium and beta estimates and determined that (i) significant differences between regulatory regimes, tax structures, monetary policy, and market climate existed; (ii) the cost of equity is applied to Canadian assets transporting Canadian grain; (iii) other regulatory bodies as well as Ibbotson Associates have examined the issue and with few exceptions relied on national data; and (iv) investors recognize that CN and CP are Canadian companies subject to Canadian regulation and tax.¹²³

To estimate the betas of the Canadian railways, the Agency relies on a Canadian market index as measured by the S&P/TSX, which is comprised of the largest stocks that trade on the Canadian Stock Exchange.¹²⁴ Betas are measured over five years using monthly and weekly data. Only if company or industry specific factors dictate it, will the Agency use less than five years of data. The 2004 decision notes that beta should be adjusted for the mean-reverting tendency.¹²⁵ The Agency implements the CAPM model using company-specific beta estimates.¹²⁶ As noted in *Section III.C*, the beta measure should ideally capture the systematic risk associated with the regulated activities.¹²⁷

b) DCF

The Agency uses the standard (single-stage) Gordon Growth DCF model to calculate the cost of equity, where

¹²² See, for example, LET-R-50-2009, Appendix A, p. 2 or LET-R-52-2009, Appendix A, pp. 2-3.

¹²³ 2004 Decision, pp. 8-9.

¹²⁴ The index consists of the largest companies listed on the Toronto Stock Exchange (TSX), where size is measured by market capitalization. As of July 16, 2010, the S&P/TSX index included 229 companies.

¹²⁵ 2004 Decision, p. 5.

¹²⁶ There are currently two publicly traded railways in Canada, CN and CP.

¹²⁷ Many regulators and practitioners select a sample of companies that are active in the same line of business as the regulated entity and use the sample companies' beta estimates or a portfolio beta to assess the systematic risk of the regulated entity. The U.S. Federal Energy Regulatory Commission (FERC) has in several decisions looked at what constitute a reasonable sample. For example, in its April 2008 Policy Statement, "Composition of Proxy Groups for Determining Gas and Oil Pipeline Return on Equity," Docket No. PL07-2-000, issued April 17, 2008, the FERC decided to include a new type of companies (Master Limited Partnerships) in its comparable samples for oil and gas pipelines. As part of the reason for the change, the FERC noted that fewer and fewer publicly traded oil and gas pipelines were available for consideration. At the time the number of gas pipelines that satisfied the FERC's historic selection criteria has been reduced to four.

$$r_s = (D_0/P_0) \times (1 + g) + g \quad (26)$$

D_0 is the most recent quarterly dividend annualized, P_0 is the current stock price, and g is the expected growth rate. Both dividends and stock price are those reflected on a single random day during the determination process.¹²⁸ The Agency obtains the earnings growth rates from the *Globe & Mail*, which provides analysts' consensus forecast from Zacks, and also reviews growth rates from Reuters, Bloomberg, and Yahoo. These sources also provide consensus earnings forecasts from security analysts.

c) Equity Risk Premium Method

Neither the 2004 Decision nor the 1985 or 1997 decisions provides detailed information on the implementation of the equity risk premium model, and recent Decision Letters to the railways regarding the cost of capital for transportation of western grain do not discuss the method.^{129,130} Thus, while the Agency does regard it as a viable method, it did not include a discussion of the method or its result in recent Decision Letters to the railways.

In the most recent determination of the cost of capital for CN and CP, the Agency relied exclusively on the CAPM model to estimate the cost of equity because “the CAPM has produced more meaningful results” and inputs to the DCF model fluctuate dramatically.¹³¹

V. FIVE SELECTED REGULATORS' COST OF CAPITAL METHODOLOGIES

A. CANADIAN RADIO-TELEVISION AND TELECOMMUNICATIONS COMMISSION

The Canadian Radio-television and Telecommunications Commission (CRTC) regulates and supervises the Canadian broadcasting and telecommunications systems. It does not regulate newspapers, magazines, cell phone rates or the quality of services and business practices. Among the CRTC's activities is the review and approval of tariffs. The cost of capital that the CRTC determines is used in regulatory economic studies, which are conducted in connection

¹²⁸ The day selected is typically during the first half of February each year.

¹²⁹ 2004 Decision, p. 4; 1997 Decision p. 4 and 1985 Decision, p. 110.

¹³⁰ LET-R-50-2009 and LET-R-52-2009.

¹³¹ LET-R-50-2009, Appendix A and LET-R-52-2009, Appendix A. See also the 2004 Decision p. 4.

with tariff determinations or revisions. The cost of capital is used to discount cash flows in order to evaluate capital investment employed to undertake the service being considered.¹³²

In 2004, the CRTC agreed with telecommunications providers that the after-tax weighted-average cost of capital (“ATWACC”) would be an acceptable measure of the companies’ cost of capital.¹³³ Specifically, the CRTC agreed that the ATWACC should be measured as:

$$\begin{aligned} \text{ATWACC} = & \text{Cost of Debt} \times \text{Debt Ratio} \times (1 - \text{Tax Rate}) \\ & + \text{Cost of Equity} \times \text{Equity Ratio} + \text{Cost of Preferred} \times \text{Preferred Ratio} \end{aligned} \quad (27)$$

The Cost of Debt is defined as the “current cost of debt financing,”¹³⁴ and company submissions indicate that this is measured as the current market cost of debt, which is estimated as the yield on 10-year Government bonds plus a company-specific risk premium (excluding issuance costs).¹³⁵ The Cost of Equity is the “deemed rate of return set by the Commission,”¹³⁶ and the Cost of Preferred is the estimate of the foreseeable rate of return required by preferred equity holders. The capital structure includes financing associated with Debt, Equity and Preferred capital. The tax rate is the corporate income tax rate, which is a composite of the federal and provincial income tax rates. If the company operates in more than one province, then the provincial income tax rate is a composite of the provincial income tax rates for all the provinces in which it operates.

In the proceeding leading to Decision CRTC 98-2,¹³⁷ experts estimated the cost of equity in a variety of manners, including the CAPM, DCF and comparable earnings methods. However, the decision only provides a detailed discussion of how the CAPM should be implemented.

The risk-free rate should be based upon a range set by using the current yield and the one-year ahead forecasted yield for Long-Term Canadian Government Bonds as the end points of the

¹³² Regulatory economic studies include prospective incremental cash flows, which are caused by the specific service being considered, but do not include cross impacts on other services.

¹³³ CRTC, “Re: Use of an after-tax weighted-average cost of capital (AT-WACC) in Phase II cost studies,” Letter: Our file 2002,86.B2.01, Ottawa, 22 October 2004. (“CRTC ATWACC Letter”)

¹³⁴ CRTC ATWACC Letter.

¹³⁵ MTS Allstream Inc., “Regulatory Economic Studies,” Appendix G.

¹³⁶ CRTC ATWACC Letter.

¹³⁷ CRTC, “Telecom Decision CRTC 98-2,” Ottawa, 5 March 1998 (“CRTC 98-2”).

range.¹³⁸ The MRP was determined using three different approaches. First, the geometric mean return for the Canadian market from the post-World War II period, 1947 to 1996 (the last year available at the time) was considered, second, the realized geometric return on Canadian telecommunications companies was determined and adjusted upward to take the price cap period into account and third, some weight was assigned to the US equity risk premium for regional telecommunications companies.¹³⁹ Although the CRTC did not specify the weight assigned to the U.S. market risk premium, it noted that it would be inappropriate to give the U.S. market equal weight to the Canadian market. Based on the data available, the Commission settled on a MRP of 5.8 to 6.0 percent (for 1998).¹⁴⁰ Finally, CTRC 98-2 found that an adjustment to beta estimates based on five years of historical data was warranted because the historical betas did not reflect “current investor risk expectations relating to changes in the fundamentals of the telephone companies' operations.”¹⁴¹ Further, the CRTC noted that individual company betas are prone to estimation errors, and therefore it assigned some weight to the beta on the Telephone Utilities sub-index on the Toronto Stock Exchange. The CRTC obtained beta estimates for the individual telecommunications companies and for the Toronto Stock Exchange's Telephone Utilities Sub-Index (regressed against the Toronto Stock Index) and settled on a beta in the range of .70 to .75.¹⁴²

The CRTC made two other adjustments to the cost of equity. First, the CRTC determined that the utility segment of the telecommunication industry was less risky than the overall industry and therefore reduced the return on common equity by 25 basis points. Second, it allowed for flotation costs.¹⁴³ The capital structure of the regulated telecommunications companies includes a maximum equity share for all companies of 55% mandated by the CRTC except for Allstream which is mandated to be 60% equity.¹⁴⁴

¹³⁸ CRTC 98-2, ¶207.

¹³⁹ CRTC 98-2, ¶227.

¹⁴⁰ This MRP estimate represents a mixture of the results for the market and for the telecommunications industry.

¹⁴¹ CRTC 98-2, ¶237. The method of adjustment was not specified in the decision.

¹⁴² CRTC 98-2, ¶237-238.

¹⁴³ CRTC 98-2, ¶242 and 280. We have not been able to determine how the amount of flotation costs to be allowed was determined.

¹⁴⁴ CRTC 98-2, ¶289 and MTS Allstream Inc., “Regulatory Economic Studies,” footnote 8.

B. ONTARIO ENERGY BOARD

The Ontario Energy Board (“OEB”) regulates electric and gas utilities in Ontario and sets rates for electric and natural gas distribution and transmission. The OEB also regulates other aspects of the electric and natural gas sector, but it does not regulate competitive electric or gas supply. In addition to determining the allowed cost of capital, the OEB also determines a deemed (allowed) capital structure for the utilities they regulate, and the allowed cost of equity is applied to the deemed equity portion of the allowed rate base, which is based on historical cost.

The OEB reviewed its approach to determining the cost of capital for Ontario utilities and in December 2009 issued a report on its estimation procedures going forward.¹⁴⁵ Prior to the review, the OEB relied on a formula-based approach using a version of the Equity Risk Premium (ERP) method to determine the return on common equity. Although a number of concerns were raised with the formula-based approach and the ERP methodology, the OEB decided to continue relying on a formula-based methodology and the ERP method, but the review led to a resetting of the equity risk premium (the premium that equity receives above the long-term Government bonds) and an adjustment to the formula used to update the ROE.

Formulaic Approach

Prior to its most recent review, the OEB determined the annual allowed cost of equity as:

$$\text{ROE} = \text{BaseROE}_{2004} + 0.75 \times (\text{LCBF} - \text{BaseLCBF}_{2004}) \quad (28)$$

Where ROE is the allowed return on equity; BaseROE₂₀₀₄ is return on equity that was allowed in the initial year, 2004; LCBF is the Long Canada Bond Forecast for the year; and BaseLCBF₂₀₀₄ is the Long Canada Bond Forecast for the initial year, 2004. The 0.75 adjustment factor was determined following a generic cost of capital proceeding.¹⁴⁶

Following the review, the OEB decided to update the BaseROE and BaseLCBF as well as to modify the formula to

¹⁴⁵ Ontario Energy Board, “EB-2009-0084, Report of the Board on the Cost of Capital for Ontario’s Regulated Utilities,” Issued December 11, 2009 (OEB Report 2009).

¹⁴⁶ The 0.75 adjustment factor originated in the Ontario Energy Board’s, “Draft Guidelines on a Formula-Based Return on Common Equity for Regulated Utilities,” March 1997, p. 31.

$$\text{ROE} = \text{BaseROE}_{2009} + 0.50 \times (\text{LCBF} - \text{BaseLCBF}_{2009}) + 0.50 \times (\text{UtilBondSpread} - \text{BaseUtilBondSpread}_{2009}) \quad (29)$$

Where ROE is the allowed return on equity; BaseROE₂₀₀₉ is return on equity that was allowed in 2009 (the new base year); LCBF is the Long Canada Bond Forecast for the year; and BaseLCBF₂₀₀₉ is the Long Canada Bond Forecast for 2009. As a result of the review process in 2009, the adjustment factor on long Canada bonds was reduced to 0.50, because the OEB agreed that the new empirical evidence indicated that the adjustment factor was closer to 0.50 than to 0.75. In addition, the OEB added a second adjustment based on the development in the spread between utility bond yields and long Canada bond yields. The inclusion of this second factor was also based on acceptance of evidence presented by experts in the 2009 review of the OEB's formula.

The OEB's approach to cost-of-capital estimation requires that the Board determine a baseline ROE and subsequently update the estimate annually using the formula in Equation (29) above. The baseline ROE was most recently determined in 2009 during the generic proceeding. The key approaches used to determine the Base ROE as well as the reasoning behind the formula are described below.

The OEB reviewed the recommendations of the submissions and determined each submission's Low, Medium, and High ERP and then selected an ERP of 5.50% based on the low end of the submitted ERP recommendations.¹⁴⁷ In determining the initial ERP, the OEB found that **“the use of multiple tests to directly and indirectly estimate the ERP is a superior approach to informing its judgment than reliance on a single methodology.”**¹⁴⁸ As a result, the OEB included all submissions, which included ERP estimates based on the CAPM, DCF, econometric ERP analyses, realized ERP analyses, the difference between awarded ROEs and realized government bond yields, and various forecasts. The OEB summarized the experts' calculations of the risk premium over the long-term government bond and found that the low-end of the recommended ERPs averaged 5.51%, the medium averaged 5.67% and the high-end averaged 5.85%.¹⁴⁹ Based on this evidence, the OEB decided to use an ERP of 5.50% and added a

¹⁴⁷ OEB 2009 p. 38.

¹⁴⁸ OEB 2009 p. 36 (emphasis in the original).

¹⁴⁹ See Table 1 p. 37 of OEB 2009.

forecasted long-term Canadian Government bond yield of 4.25% to arrive at an initial ROE of 9.75% for 2009.

Approaches to Determine the Risk Premium

To arrive at its formula and initial ERP, the OEB assessed evidence from five experts. To arrive at the formula in Equation (29), the Board's determined that the forecasted long-term government bond is an important forward looking component of the formula and also found that using the same government bond as is used to determine the initial ROE, BaseROE_{2009} , is logical.¹⁵⁰ The OEB determined that the adjustment factor on the change in the long-term government bond rate is an empirical question and relied upon statistical analyses provided by experts to assess its magnitude.¹⁵¹ The OEB included an additional factor in the formula, in Equation (29), because as the OEB concluded that **“there is a statistically significant relationship between corporate bond yields and the cost of equity, and that a corporate bond yield variable should be incorporated in the ROE formula.”**¹⁵² Three experts in the OEB proceeding provided statistical analyses of the relationship between the allowed ROE and utility bond yields or between realized returns on equity and corporate bond yields. They found that an increase (decrease) in bond yield results in an increase (decrease) in allowed ROE / realized equity return of 0.45 to 0.55.

In determining the initial risk premium, the OEB reviewed the evidence submitted by five experts and concluded that “North American gas and electric utilities provide a relevant and objective source of data for comparison.”¹⁵³ As a result, the OEB included analyses of U.S. electric and gas utilities as part of the evidence used to determine the baseline risk premium, which is added to the long-term Government bond yield to estimate the baseline ROE (for 2009). Further, the OEB included CAPM, DCF, risk premium as well as other analyses in their summary table that led to the conclusion that the baseline risk premium was 5.50%.¹⁵⁴

C. U.S. SURFACE TRANSPORTATION BOARD

The U.S. Surface Transportation Board (STB) serves as both an adjudicatory and a regulatory body with jurisdiction over railway rates and service issues and rail restructuring transactions.

¹⁵⁰ OEB 2009 p. 45.

¹⁵¹ OEB 2009 p. 46.

¹⁵² OEB 2009 p. 48 (emphasis in the original).

¹⁵³ OEB 2009 p. 23.

¹⁵⁴ See Table 1 p. 37 of OEB 2009.

The STB also regulates certain other carriers and non-energy pipelines. Regarding railway rates, the STB is charged with ensuring that rail practices and rates for captive customers are reasonable. The cost of capital is used to evaluate the adequacy of individual railway's revenues.¹⁵⁵ The cost of capital is also used in rate disputes¹⁵⁶ and specific cases such as in feeder-line applications, rail line abandonments, merger review, and in the Uniform Rail Costing System (URCS) among others.¹⁵⁷

The STB most recently reviewed the methodology used to determine the railway industry's cost of capital in 2007-09, which resulted in two decisions with detailed instructions on how to estimate the cost of capital for the railway industry.¹⁵⁸ Each year the STB calculates the cost of capital as the weighted average of the cost of debt and the cost of equity, with the weights determined by the capital structure using market values.¹⁵⁹ The cost of debt is set equal embedded cost of debt while the cost of equity is the simple average of the Capital Asset Pricing Model and Ibbotson's Multi-stage Discounted Cash Flow model.¹⁶⁰

Each year the railways, through the Association of American Railroads (AAR), submit (i) the railroads' cost of common equity, (ii) the railroads' cost of preferred equity, (iii) the railroads' cost of debt, and (iv) the capital structure mix of the railroad industry on a market value basis.

¹⁵⁵ A U.S. Class I railroad, regulated by the STB, is revenue adequate if it achieves the rate of return on net investment (ROI) equal to at least the current cost of capital for railroads. See, for example, STB, "Surface Transportation Board Calculated Rail Industry's Cost of Capital & Revenue Adequacy for 2007," September 26, 2008. Class I railroads are the larger freight railroads.

¹⁵⁶ In recent years most rate disputes have pertained to coal and chemicals (http://stb.dot.gov/stb/industry/Rate_Cases.htm). Shipments that have intermodal or intramodal competition, contract rates, and shipments below the STB's jurisdictional threshold of 180% of variable cost are outside STB jurisdiction.

¹⁵⁷ The Uniform Rail Costing System (URCS) is used to estimate variable and total unit costs for U.S. railways. The STB uses these rates in railway maximum rate reasonableness proceedings and in abandonment matters. They are also commonly used by the railway industry and shippers for costing purposes. (<http://www.stb.dot.gov/stb/industry/urcs.html>)

¹⁵⁸ Surface Transportation Board, STB Ex Parte No. 664, "Methodology to be Employed in Determining the Railroad Industry's Cost of Capital," January 17, 2008 (STB 2008) and STB Ex Parte No. 664 (Sub-No. 1), "Use of a Multi-Stage Discounted Cash Flow Model in Determining the Railroad Industry's Cost of Capital," January 28, 2009 (STB 2009).

¹⁵⁹ STB 2009, p. 2.

¹⁶⁰ STB 2009, p. 15.

Thus, the estimates are submitted by the railroads to the STB using the guidelines provided in Ex Parte 664.¹⁶¹

In adopting the simple average of the two cost of equity estimates described above, the STB found:

As the Federal Reserve Board noted in its testimony in STB Ex Parte No. 664, academic studies had demonstrated that using multiple models will improve estimation techniques when each model provides new information. In addition, there is robust economic literature confirming that, in many cases, combining forecasts from different models is more accurate than relying on a single model.¹⁶²

CAPM Estimate

To implement the CAPM, the STB specifies that the following companies should be included: Class 1 railways that have operating revenue in excess of \$250 million in 1991 dollars, have at least 50% of assets that are rail assets, and have a debt rating of no less than BBB from Standard & Poor's and Baa from Moody's. In addition, the companies must be listed on the New York Stock Exchange or the American Stock Exchange and must have paid dividends throughout the year.¹⁶³

The STB provides detailed guidelines for the estimation of the CAPM. The STB specifies that the risk-free rate in the CAPM should be set equal to the yield on 20-year U.S. constant yield-to-maturity Treasury Bonds, measured over the last 12 months. To estimate the railway beta, the STB specifies that a portfolio of stock returns for the railway industry should be used. The portfolio is created by weighting each of the sample companies by their relative market capitalization. The estimation should rely on the following equation:

$$r - r_f = \alpha + \beta \times (r_m - r_f) + \varepsilon \quad (30)$$

Where

α = constant term;

¹⁶¹ Surface Transportation Board, STB Ex Parte No. 664, "Methodology to be Employed in Determining the Railroad Industry's Cost of capital," January 17, 2008 and STB Ex Parte No. 664 (Sub-No. 1), "Use of a Multi-Stage Discounted Cash Flow Model in Determining the Railroad Industry's Cost of Capital," January 28, 2009 (STB 2009).

¹⁶² STB 2009, p. 15.

¹⁶³ STB 2008, footnote 29.

r = stock returns for the portfolio of Class I railways that meet the screening criteria set described above;

r_f = 3-month U. S. Treasury bond rate;

r_m = return on the S&P 500; and

ε = random error.

The STB has determined that a portfolio approach to the estimation of beta is appropriate, that a constant term should be included in the regression analysis, and that the estimation method should be ordinary least squares. As for data, the STB specifies five-years of weekly stock returns, reliance on the 3-month U.S. Treasury bond rate and the S&P 500 as the market index.¹⁶⁴

The MRP was among the most controversial data input issues in the STB proceeding. However, the STB settled on using the difference between the arithmetic mean of market returns and the income return on long-term Treasury bonds from 1929 to today. Therefore, the STB accepts the railroads' submission of the MRP from the most recent edition of Morningstar's "Ibbotson SBBI 20xx Valuation Yearbook."¹⁶⁵

Multi-stage DCF

The STB accepted using the Morningstar / Ibbotson multi-stage DCF model as one of its cost of equity estimation techniques. To determine this estimate, the same sample firms as identified above under CAPM are used. The Ibbotson model determines the multi-stage DCF cost of equity using a three-stage DCF model where the first five years (stage 1) rely on company specific growth rates, years 6 to 10 (stage 2) uses the railway industry's growth rate and year 11 and onward (stage 3) uses the economy-wide (GDP) growth.¹⁶⁶ The company-specific growth rate is obtained from analysts' forecast (IBES, a commercial provider of this data), while the industry-wide growth rate is the average of the individual companies' growth rates. Stage 3

¹⁶⁴ All experts in the proceeding recommended the 3-month Treasury bill be used and also that S&P 500 be relied upon as the market proxy. The 3-month Treasury bill was chosen because it is short term but not influenced as much by monetary policy as shorter term Treasury bills. The S&P 500 index was suggested because it is readily available from public online sources or commercial data providers while the New York Stock Exchange (NYSE) index, which the STB originally proposed, only is available from a few commercial data providers.

¹⁶⁵ For example, Morningstar, "Stocks, Bonds, Bills, and Inflation, 2010 Yearbook: Valuation Edition," 2010 is the most recent version.

¹⁶⁶ Note that the assumed growth rate "jumps" in the years in which a new estimate is used.

relies on Ibbotson's forecasted GDP growth rate, which Ibbotson measures as the average annual percentage change in real GDP from 1929 to the current year plus an estimated long-run inflation rate. The inflation rate is determined as the difference between the constant yield to maturity on government bonds of approximately 20 years to maturity and the yield on inflation-indexed government bonds of the same maturity. These data are publicly available from, for example, the Federal Reserve in St. Louis.

The other component of any DCF model is the initial dividend or cash flow yield on the stock in question. Ibbotson uses normalized cash flow divided by the most recent year's market equity capitalization to determine the initial (Year 0) yield. The Year 1 yield is then determined as the Year 0 yield multiplied by $(1 + \text{stage 1 growth rate})$. Annual cash flow is calculated as follows:

$$\begin{aligned}
 &\text{Income before Extraordinary Items} \\
 &+ \text{Depreciation} \\
 &- \text{Capital Expenditures} \\
 &+ \text{Deferred Taxes}^{167} \\
 &= \text{Cash Flow}
 \end{aligned}$$

The annual cash flows are then normalized over five years using sales.^{168,169} The data is obtained from the companies' 10-Ks or a commercial provider of this data (e.g., Compustat, a subscription data service). In stage 3, the model is adjusted to define cash flow as income before extraordinary items.¹⁷⁰

As noted above, the STB uses the estimated cost of capital to evaluate the adequacy of individual railways' revenue. The estimated cost of capital is also used in the assessment of specific cases,

¹⁶⁷ Both Morningstar / Ibbotson and the STB refer to Deferred Taxes in the calculation of annual cash flow. The deferred taxes referenced in the STB formula refers to the amount listed on the statement of cash flow, which reflects the current period's deferred taxes rather than the accumulated deferred taxes.

¹⁶⁸ An issue in Ibbotson's cash flow calculation is that the calculations rely on depreciation from the income statement rather than the statement of cash flow. This matters when there are impairments or other non-standard depreciation issues.

¹⁶⁹ The Ibbotson's methodology isn't as forward looking as most DCF approaches, but it is internally consistent. Because Ibbotson relies on the income statement and balance sheet information to determine the cash flow yield, a year is needed for cash flow. Consistent with that Ibbotson uses a year to determine the price.

¹⁷⁰ Morningstar, "2008 Ibbotson Cost of Capital Yearbook," 2008, p. 24. This is the edition relied upon by the STB for the decision cited above.

and sometimes rail carriers and shippers use it in negotiations. In determining whether a specific railway is revenue adequate, the STB averages the earned return on net investment over a number of years and compares the figure with what is determined using the calculated cost of capital and the Uniform Rail Costing System (URCS), which include revenue and cost accounts. When reviewing maximum rail rates, the estimated cost of capital is applied to original cost rate base to determine the appropriate return on capital.

D. UNITED KINGDOM COMPETITION COMMISSION

Introduction

The UK Competition Commission (CC) is both the “Phase two” anti-trust authority¹⁷¹ and an appellate/review body for the decisions of the specialised sector-specific economic regulators (e.g., electricity, gas, water, rail). The CC approaches each case that comes before it on its merits (within the relevant legislation governing its decisions), but we believe that in respect of the cost of capital analysis, the case we describe here is representative.

Some of the major airports in the United Kingdom (UK) are subject to economic regulation, specifically controls on the fees they may charge. As with the other regulated sectors, there is a specialized regulatory agency, the Civil Aviation Authority (CAA) which sets price controls. In most sectors, the Competition Commission is an appellate body for decisions of the sector economic regulators; however, the framework for airport regulation is unusual in that the CAA must automatically request guidance from the Competition Commission before setting prices.

This section of the report describes the cost of capital component of a recent decision¹⁷² by the CAA/Competition Commission. With regard to the cost of capital, there was very little difference between the recommendation of the Competition Commission and the final decision of the CAA. We therefore refer to either of the reports,^{173,174} according to which provides the clearest description of reasoning on a particular point.

¹⁷¹ Preliminary anti-trust investigations are carried out by the Office of Fair Trading, a separate body.

¹⁷² A decision on the price control for Heathrow and Gatwick airports for the period 2008 – 2013. See Economic Regulation of Heathrow and Gatwick Airports 2008-2013, CAA decision, CAA (March 2008) and BAA Ltd: A report on the economic regulation of the London airports companies (Heathrow Airport Ltd and Gatwick Airport Ltd), Competition Commission (September 2007).

¹⁷³ The CAA’s decision is Economic Regulation of Heathrow and Gatwick Airports 2008-2013, CAA decision, CAA (March 2008).

While there are inevitably some differences among decisions taken by different UK regulatory agencies, either because of sector-specific issues or because views of “best practice” change over time, the approach to measuring the cost of capital is very similar.¹⁷⁵ We are not aware of any legal requirement that the different regulatory bodies must follow the same approach. The legal framework seems to give regulators considerable discretion to determine the cost of capital.¹⁷⁶ We therefore ascribe the similarities of approach to two factors:

- first, there is probably a degree of consensus on best practices and, informally at least, a need to make decisions in line with this consensus; and
- second, the methodology that has emerged includes significant room for the exercise of the regulator’s judgement in reaching a final (numerical) conclusion on the cost of capital.

The UK approach is not a formulaic methodology, but we believe that the description below is representative of the UK approach.

UK Price Cap / Incentive Regulation

Gatwick and Heathrow airports are regulated under a version of “UK-style” RPI minus X incentive regulation, which is also used in regulating rail, electricity, gas, and water networks in the UK. Under this approach, the prices that the regulated firm may charge are capped.¹⁷⁷ The price cap is set for five years at a time. At each review of prices, the firm is required to submit a detailed forecast of its costs for the forthcoming five-year period. The regulator reviews the firm’s cost forecasts, including its cost of capital request, as well as realized costs from the preceding control period, and decides what price to allow. Typically, the profile of prices for the coming period is set such that the net present value of expected revenues, given the regulator’s

¹⁷⁴ The Competition Commission’s recommendation is BAA Ltd: A report on the economic regulation of the London airports companies (Heathrow Airport Ltd and Gatwick Airport Ltd), Competition Commission (September 2007).

¹⁷⁵ All of the regulators essentially use a CAPM-type approach, with a real rate of return on a regulatory asset base that increases with inflation. However, some use an ATWACC approach plus a “tax wedge” (including the CAA), while others (for example, recent decisions by the energy regulator, Ofgem), use a so-called “vanilla” cost of capital, together with a tax allowance and a claw-back or true-up if the regulated company’s actual tax bill is lower than assumed.

¹⁷⁶ In practice, however, regulators usually refer to previous decisions (their own and those of others), both in terms of the methodology and the numbers reached using it.

¹⁷⁷ More precisely, the form of the control is a hybrid revenue/price cap, with the degree of exposure to volume risk being different in different sectors. For Heathrow and Gatwick airports the control is a price cap.

volume forecast, is equal to the net present value of the regulator's view of reasonable costs. The path of prices over the five year period is set to be smooth over time. In practice the approach results in a "headline" decision with respect to an immediate change in price (a P_0 change), together with an annual change in real prices ("X"). Thus, for example, if the regulator were to determine that in order to deliver revenues equal to the cost forecast the average price over the forthcoming period should be 10% above current prices, the regulator might determine that prices should immediately rise by 8%, followed by an annual increase of 1% per year. An alternative would be a smaller immediate rise, followed by a larger annual increase.

For Gatwick and Heathrow airports, the CAA's final decision is the maximum fee that can be charged per passenger using the airport. The two airports, though at the time of the CC report commonly owned,¹⁷⁸ are separate legal entities and have been separately regulated since 2002. Both are regulated under the so-called "single till" approach, whereby a forecast of "commercial" revenue – such as leasing terminal space to retail outlets – is netted off from a forecast of total airport costs to derive a net regulated revenue requirement. The net requirement is then divided by a forecast of passenger numbers to derive a cap on the regulated price per passenger. This approach is illustrated in Figure 11 below, which shows how total revenues are composed of "building blocks" related to return of and on capital, and operating costs.

¹⁷⁸ Gatwick airport was subsequently sold.

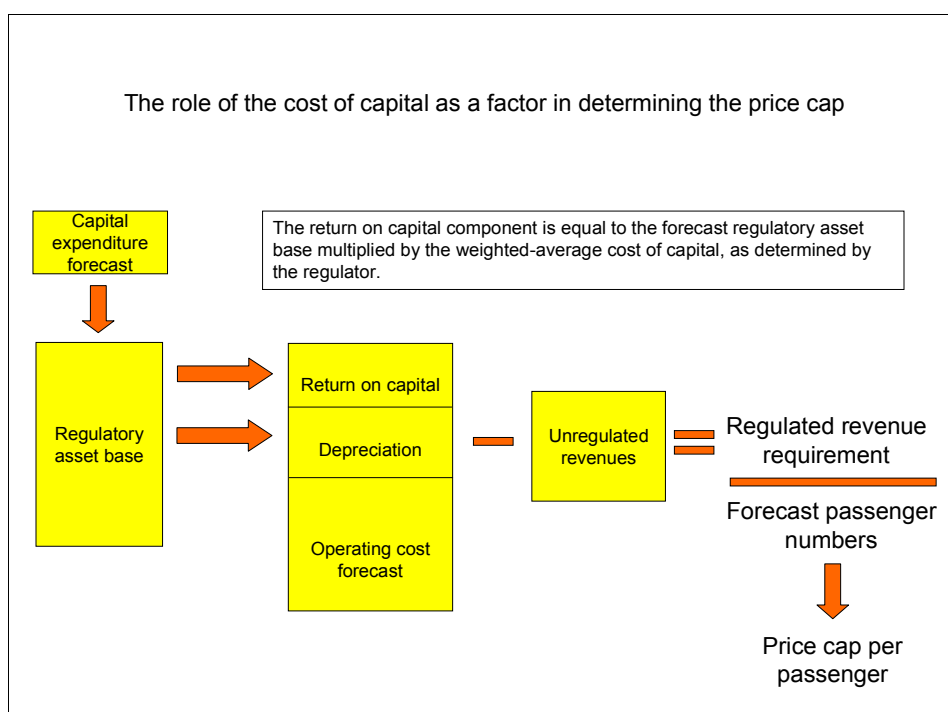


Figure 11: Illustration of the “single till” approach to regulating charges at Heathrow and Gatwick¹⁷⁹

Approach to determining return on rate base

The approach to the return on capital building block is that the historic rate base is inflated over time according to an actual inflation index (the index used is the retail price index, published by the official statistics agency). In addition, forecast capital additions, approved by the regulator as part of the price control settlement, are also added to the asset base during the five year period.¹⁸⁰ The regulator determines a real, as opposed to nominal, pre-tax cost of capital, and the price control is set so that the airport owner is forecast to earn this rate on the inflating rate base. The real pre-tax cost of capital is determined on a weighted-average basis, using a notional capital structure and an assumed tax rate. The assumed capital structure for Heathrow and Gatwick was 60% debt and the assumed tax rate was 28%, equal to the statutory marginal rate.¹⁸¹

¹⁷⁹ See Economic Regulation of Heathrow and Gatwick Airports 2008-2013, CAA decision, CAA (March 2008), p. 27.

¹⁸⁰ At the end of the five year period the asset base is “reset” to take into account any differences between actual capital expenditure and the forecast.

¹⁸¹ The Competition Commission report, p. 47, recommended using a pre-tax cost of capital approach because of insufficient data to allow reasonably accurate forecasting of actual tax requirements (and the use of the statutory tax rate for the same reason).

Estimating the Return on Equity

Both the CAA and the CC used the CAPM to estimate the cost of equity. The CAA stated that it had previously looked at other possible approaches (in an earlier decision) and had determined that its policy going forward would be to use the CAPM.¹⁸² The CC, for its part, stated:

During the course of the inquiry, most of the material that we received was presented in a CAPM framework, including the vast majority of the input from the CAA, BAA, BA and their respective cost of capital advisers, Europe Economics, Oxera and CEPA.¹⁸³ Before settling on CAPM we considered whether other models might give more accurate insights into the returns required by equity investors or otherwise provide a cross-check on the CAPM analysis. We looked in particular at the arbitrage pricing theory, Fama-French models, and the conditional CAPM, and found that:

- (a) CAPM remains the tool with the strongest theoretical underpinnings;
- (b) it is not at all clear from the academic literature that other models have better predictive power, particularly when applied to UK companies; and
- (c) none of the alternative models help to overcome the problems that CAPM has in dealing with limited market data in this case, and especially BAA's de-listing in 2006.¹⁸⁴

Taking these factors into account, we believe that although the CAPM has its limitations, it is the most robust way for a regulator to measure the returns required by shareholders. We have placed considerable weight on the CAPM in previous airport inquiries and for the above reasons we conclude that there are insufficient grounds to depart from taking the same approach in this inquiry. In terms of methodology, therefore, we have maintained consistency in our approach.¹⁸⁵

Neither Heathrow nor Gatwick are publicly traded companies. Since privatization of the British Airports Authority ("BAA") in 1987, Heathrow and Gatwick were owned by BAA plc, along with several other UK airports and other businesses. BAA plc was a publicly traded company until its takeover by Ferrovial in 2006. The regulators have traditionally applied the CAPM to Heathrow and Gatwick by reference to an estimate of the equity beta for BAA plc. For the 2008-

¹⁸² Airport price control review – CAA recommendations to the Competition Commission for Heathrow and Gatwick Airports, CAA (March 2007), paragraph 11.17.

¹⁸³ Explanatory note not part of the direct quotation: BAA is the owner of Heathrow and Gatwick, and BA is British Airways, a major customer of BAA.

¹⁸⁴ Explanatory note not part of the direct quotation: BAA was taken private shortly before this price review began.

¹⁸⁵ *Appendix F* to the Competition Commission's report, paragraphs 7 and 8.

2013 review, this approach was continued (albeit that the estimation window had to be truncated at the date that the takeover bid was announced).

Cost of equity

To estimate a notional cost of equity for Heathrow and Gatwick, the regulators took the following approach:

- estimate the beta for BAA equity (prior to the takeover announcement);
- de-lever to give an estimate for the BAA aggregate asset beta;
- “disaggregate” the asset beta into component asset betas for Heathrow, Gatwick and “the rest of BAA;”
- re-lever the Heathrow and Gatwick asset betas to give notional equity betas; and
- use these equity betas to estimate the cost of equity in a standard CAPM framework.

An explanation of the steps follows:

Beta estimation

The approach was to estimate the BAA equity beta from daily share price data, using either one or two years of data.¹⁸⁶ The CAA’s consultants compared their estimates with those published by the London Business School (“LBS”) risk measurement service, which gave similar results based on Bayesian-adjusted monthly estimates over five years. The consultants also looked at “rolling” beta estimates, whereby beta is estimated for different “windows” of data, all with the same width, but with different start and end dates.¹⁸⁷ The conclusion was that there was little evidence of beta changing significantly over time. The CC took a similar approach (daily data, one or two years), and made similar, but not identical, estimates.¹⁸⁸

Both the CAA consultants and the CC estimated standard errors in the regressions, with the latter using the standard errors to construct a confidence interval for the beta estimate. They estimated

¹⁸⁶ The estimation was of the log of BAA total returns less the log of safe returns (overnight LIBOR) against the log of total market returns. See *Supporting paper XIII: Cost of capital – estimating separate costs of capital for Heathrow and Gatwick*, Europe Economics paper for the CAA (November 2006), section 2. Data came from Thomson Financial.

¹⁸⁷ Rolling beta estimates are based upon a procedure in which a new observation is added and the oldest observation is deleted from the estimation period and then a new estimation of beta is performed.

¹⁸⁸ The estimates were different by around 0.01, but the Competition Commission did not give full details of its methodology.

the equity betas corresponding to +/- 2 standard errors, giving a high, low and mid number and then de-levered each of these three numbers to give asset betas. These values were then "disaggregated" to give regulated airport asset betas which were then re-levered to give "notional equity betas" for Heathrow and Gatwick. In the final step, the high and low equity betas were respectively combined with the high and low MRP numbers (with all other CAPM inputs as point estimates) to give high and low WACC estimates. The CC stated that this over-estimated the degree of uncertainty:

The confidence interval represented by the combined component estimates is likely to be higher than that implied by the confidence intervals for the individual components. For example, suppose the ranges for individual components are 95 per cent confidence intervals. When the values at the top and bottom of the ranges for these components respectively are added up to give a range for the overall WACC, statistically the resulting confidence interval is likely to be higher than 95 per cent.¹⁸⁹

This gave a range of 4.77% to 6.39% for Heathrow and 4.91% to 6.77% for Gatwick. The CC was concerned with the implications of setting the allowed WACC too low (underinvestment or potentially costly financial distress). Consequently, it judged the appropriate cost of capital to be near the upper end of its ranges (6.2% for Heathrow and 6.5% for Gatwick). It noted that these estimates represented numbers which were only 10 to 15 per cent below the top of its ranges and approximately two standard errors above the mid-points (after making some simplifying assumptions about the nature of the distribution around the component estimates).

De-levering

The Competition Commission produced an asset beta estimate by de-levering the equity beta estimate, using the following relationship:

$$\text{Beta}_{\text{Asset}} = \text{beta}_{\text{Equity}} \times (\text{Equity} / \text{Value}) + \text{beta}_{\text{Debt}} \times (\text{Debt} / \text{Value})^{190} \quad (31)$$

Where Value = Debt + Equity.¹⁹¹ In this relationship the debt beta represents the extent to which debt investors are exposed to systematic risk. In principle the debt beta, like the equity beta, is an estimate of the correlation between returns from holding debt with returns from the market as

¹⁸⁹ Appendix F to the Competition Commission's report, paragraph 149.

¹⁹⁰ See Annex F to the Competition Commission report, paragraph 84.

¹⁹¹ Value is measured as BAA's market capitalization and net debt as reported in BAA's annual and interim accounts.

a whole. The Competition Commission assumed a debt beta of 0.1, on the basis of a “decomposition” approach from the observed premium for corporate debt over government bonds.¹⁹² The decomposition approach views the debt premium (the spread between corporate and government bonds) as equal to the sum of a factor related to the probability of default and the recovery rate in default, a factor related to a premium for the reduced liquidity of corporate bonds, and a factor equal to the debt beta times the market risk premium. If the liquidity and default factors can be estimated (or assumed), the debt beta is the residual divided by the market risk premium.¹⁹³

As a cross-check, the Competition Commission compared the estimated asset beta for BAA with estimates for asset betas of a number of other airports and other entities and concluded that the positions of the BAA betas were reasonable.¹⁹⁴

Disaggregation

The Competition Commission disaggregated the BAA asset betas as follow: first, assume that the BAA asset beta is a weighted average of the asset betas of Heathrow, Gatwick, and the rest of BAA, where the weights are the proportions of total assets;¹⁹⁵ second, assume that Heathrow is slightly less risky than Gatwick (for example, because Heathrow is capacity constrained and has excess demand), with the difference in asset betas being 0.05; third, assume that the asset beta of Gatwick is equal to the average asset beta of BAA as a whole.

Re-levering

The notional asset beta estimates were re-levered using the formula described above, and an assumed capital structure with 60% debt.

Market Risk Premium

The Competition Commission reviewed a range of evidence on the MRP (which the Competition Commission refers to as the Equity Risk Premium (ERP)) including historic returns on equities and government bonds, forward looking estimates from the dividend growth model, and pension fund assumptions. The Competition Commission’s conclusion was that the ERP is in a range of

¹⁹² See *Annex F* to the Competition Commission report, paragraph 93.

¹⁹³ The selection of bond beta was controversial. See *CAA price control proposals: Heathrow and Gatwick Airports* (January 2008).

¹⁹⁴ For the comparable firms betas were estimated using share price data from Thomson Financial.

¹⁹⁵ The Competition Commission did not specify precisely how it calculated the asset proportions.

2.5% to 4.5%,¹⁹⁶ with the upper end of the range defined by analyses of historic returns on equity versus government bonds.¹⁹⁷ Neither the Competition Commission nor the CAA explicitly chose a point estimate for the ERP, but the final decision on the cost of equity is consistent with an ERP in the range 4.2%–4.5%.¹⁹⁸

Risk-free Rate

The Competition Commission based its estimate of the risk-free rate on index-linked government bond yields. No weight was placed on yields of bonds with maturities greater than 10 years, because it was felt that unusual conditions (for example, relating to the rules on funding requirements for pension funds) were depressing longer-dated yields. The Competition Commission examined both spot estimates of yields and historical data in coming to its view.

E. WESTERN AUSTRALIA ECONOMIC REGULATION AUTHORITY

Introduction

The Economic Regulation Authority (ERA) is responsible for regulating the monopoly aspects of the rail, gas and electricity sectors in Western Australia, among other duties. The ERA makes cost of capital determinations in the context of regulating all three of these sectors. In this report we describe its approach to determining the cost of capital in the rail sector.

Western Australia has a regime of third-party access to rail infrastructure, under which third parties negotiate with the track operator for access to certain rail routes. The ERA is required to make cost of capital determinations for the track operators which are used to calculate “floor and ceiling” rates. These rates bound negotiations for access, with the floor price being a measure of the incremental or avoidable costs associated with providing access to a particular route and ceiling price being the total cost of providing the relevant service. The same floor and ceiling rates apply to all parties having access to the track on a particular route. The cost of capital figure, together with an approved economic lifetime assumption, is applied to a measure of the railway’s asset base in order to determine the capital cost component of the floor and ceiling

¹⁹⁶ The selection of the ERP was controversial. See *CAA price control proposals: Heathrow and Gatwick Airports* (January 2008).

¹⁹⁷ The historic equity and debt returns came from the dataset maintained by Dimson, Marsh and Staunton. It is published annually as the *Credit Suisse Global Investment Returns Sourcebook*.

¹⁹⁸ This range was not published in the report but was estimated by *The Brattle Group* based upon other information in the decision.

rates. The asset base is determined on a gross replacement value basis (for assets required to meet actual and reasonably forecasted demand). Where appropriate, the replacement costs are determined on a modern equivalent asset basis.¹⁹⁹

The ERA is required to determine the cost of capital for each designated rail operator every year and to undertake a public consultation on its decision every five years. The last such consultation was in 2008, and included a review of the ERA's methodology.²⁰⁰

Approach to determining the cost of capital

The ERA is required by the relevant legislation to determine a weighted-average cost of capital. The CAPM is widely used by economic regulators in Australia, although it is not required to be used by the relevant legislation. The ERA estimates a pre-tax, real cost of capital, which is then applied to a gross replacement value asset base. The cost of capital figure is used to set floor and ceiling prices in real terms, which are subsequently updated for actual inflation.

Estimating the Return on Equity

The various components of the ERA's cost of equity determination are explained below.

Beta estimation

The component of the ERA's cost of capital decision attracting the most comment and debate was its beta assumptions. The ERA made separate assumptions on the appropriate asset beta for rail freight and passenger rail systems, in each case based on analysis of publicly-traded comparable firms. Asset beta estimates for comparable firms were derived by de-levering Bloomberg "raw" (unadjusted) equity betas (based on 5 years of monthly data).

For rail freight, the ERA's advisors estimated asset betas for a range of comparable firms including North American rail operators. From these estimates, the ERA chose a range of 0.65 to 0.75 for the asset beta. (It was not clear how the ERA or its advisors derived this range, since some of the comparable firms had asset betas outside this range.) Asset beta estimates for comparable firms were derived by de-levering Bloomberg "raw" (unadjusted) equity betas (based on 5 years of monthly data). For the passenger rail business, in the absence of publicly-

¹⁹⁹ See, for example, "Final Determination on the Proposed 2009-10 Floor and Ceiling Costs for: Mainlines Worsley Line, Terminal Ends, Kwinana to Soundcem, Grain Lines," ERA (June 2009).

²⁰⁰ See, for example, "Final Determination: 2008 Weighted Average Cost of Capital for the Freight (WestNet Rail) and Urban (Public Transport Authority) Railway Networks," ERA (June 2008).

traded comparable rail firms, the ERA and its advisors looked at other infrastructure businesses, such as toll roads. This evidence suggested a range for asset beta of 0.25 – 0.30.

The ERA considered, but ultimately rejected, the suggestion that the beta estimate for the rail freight business should be adjusted downwards because the comparable rail firms have a greater proportion of intermodal container traffic than WestNet,²⁰¹ which has a higher proportion of bulk grain and minerals business, judged to be lower risk. However, the ERA ultimately decided that there was limited justification for moving outside the range established by looking at market evidence from comparable businesses. It therefore chose the beta for the rail freight business at the low end of the comparable range (0.65 for asset beta, corresponding to an equity beta of 1.0).

For the passenger rail business, the ERA selected an asset beta of 0.30 (the top end of the range, corresponding to an equity beta of 0.46), in part because this was the figure it had used in its 2003 cost of capital determinations. The asset beta range was re-levered using the ERA's leverage assumption (see below).

De-levering

To convert between asset and equity betas, the ERA used a simple de-levering and re-levering formula: $\text{beta (equity)} = (1 - \text{leverage ratio}) \times \text{beta assets}$. It thus assumed a debt beta of zero,²⁰² although it observed that its results were not very sensitive to this assumption, since the comparable firms had gearing (e.g., leverage) levels that were not very different from its capital structure assumption.

Re-levering

The ERA assumed a notional capital structure with 35% debt based upon evidence on the actual capital structures of various comparable businesses (including rail infrastructure groups in North America, transport infrastructure and services firms in Australia and New Zealand, and global toll-road operators).

Equity Risk Premium

The ERA used a value of 6% for the equity risk premium. The ERA acknowledged that historical capital market evidence in Australia (observed returns on holding equity and debt over

²⁰¹ WestNet is the freight network in the south west part of Western Australia, consisting of around 5,000 km of track.

²⁰² See *Section V.G.2* for a discussion of de-levering.

long periods) is consistent with a figure between 5% and 8%, suggesting a mid-point higher than 6%. However, surveys and other studies imputing a figure for the ERP from market behaviour suggested lower figures. Considering all of the evidence, the ERA chose a figure of 6%, consistent with regulatory precedents in Australia.²⁰³

Risk-free Rate

In earlier determinations, the ERA (along with other Australian regulators) had used the yields on index-linked government bonds to obtain a real risk-free rate directly.²⁰⁴ However, evidence emerged that these yields may have been depressed by unusual capital market conditions. Market participants argued that a downwards bias in yields existed due to “excess demand” for these securities,²⁰⁵ and yields on real and nominal government bonds implied an inflation expectation that was not consistent with survey evidence.²⁰⁶ As a result, the ERA decided to estimate a real risk-free rate from yields on nominal government debt by subtracting an inflation forecast.

In its 2008 determination for WestNet, the ERA settled on a long-term inflation forecast of 2.75%, the same as a recently-published long-term forecast from the Western Australian Treasury.²⁰⁷ In the same determination the ERA estimated the nominal risk-free rate as the average yield over the preceding 20 trading days on the 10-year government bond. This figure was 6.37%, implying a real risk-free rate of 3.52%.²⁰⁸

²⁰³ See section 5 of “Railways (Access) Code 2000: Weighted Average Cost of Capital 2008 WACC Determinations Report to the Economic Regulation Authority,” The Allen Consulting Group (October 2007) and sources cited therein.

²⁰⁴ “Australian economic regulators have, in the past, almost invariably determined values of risk free rates as observed or imputed yields on long-term nominal and real government bonds.” (Allen Consulting Group report, p. 14).

²⁰⁵ See, for example, “Bias in Indexed CGS Yields as a Proxy for the CAPM Risk Free Rate, A report for the ENA,” NERA Economic Consulting (March 2007).

²⁰⁶ Furthermore, the Australian Office of Financial Management ceased issuing index-linked debt in 2003 (it did not resume index-linked issuance until 2009). See Australian Office of Financial Management Operations Notice, August 7th 2009 (<http://www.aofm.gov.au/content/notices.asp>).

²⁰⁷ Final Determination: 2008 Weighted Average Cost of Capital for the Freight (WestNet Rail) and Urban (Public Transport Authority) Railway Networks, ERA (June 2008), p. 15.

²⁰⁸ $(1 + 6.37\%) / (1 + 2.75\%) - 1 = 3.52\%$.

VI. FINDINGS OF OTHER REGULATORY REVIEWS

Two of the regulators included in the review of selected regulators' approach to cost of capital determination, the Ontario Energy Board and the Surface Transportation Board, have recently reviewed their cost of capital methodology, so their conclusions are largely included in the review of their current practices. In addition, the Alberta Utilities Commission²⁰⁹ and the Australian Energy Regulator (part of the Australian Competition and Consumer Commission)²¹⁰ recently reviewed their approach to cost of capital determination, while the New Zealand Commerce Commission is in the process of reviewing their methodology.²¹¹ For background on those regulators that have not been included in the review in *Section V*, the Alberta Utilities Commission regulated electric and gas utilities in Alberta using essentially a cost of service approach, the Australian Energy Regulator (AER) sets price caps for electric transmission and distribution, and the New Zealand Commerce Commission's project applies primarily to electric distribution and transmission plus gas pipelines. Because prior sections already have discussed pros and cons of various methodologies and summarized the methodology of two regulators, who recently reviewed their approach to cost of capital determination, the section, where possible, references prior sections. The remainder of the Section is organized as follows. First, we discuss the regulators choice of approach and second, we discuss the implementation of the chosen approaches. In the implementation section, we discuss the regulators choices by method and also include the Agency and the five reviewed regulators' methodologies for ease of comparison. Therefore, the review is based on the most recent decisions for those regulators who have not recently reviewed their cost of capital methodology and for NZ CC, which is in the process of reviewing its cost of capital methodology.

²⁰⁹ Alberta Utilities Commission (AUC), Decision 2009-216: 2009 Generic Cost of Capital, November 12, 2009. (AUC 2009 Decision)

²¹⁰ Australian Energy Regulator (AER), "Electric transmission and distribution network service providers: Review of the weighted average cost of capital (WACC) parameters," May 2009. (AER 2009 Decision)

²¹¹ The New Zealand Commerce Commission (NZ CC) has commissioned an independent expert report, received constituent comments, held a cost of capital workshop in December 2009 and expects to issue a final report later this year (<http://www.comcom.govt.nz/cost-of-capital/>). (NZ CC Expert Report) The NZ CC's most recent decision regarding cost of capital is: New Zealand Commerce Commission, "Revised Draft Guidelines: The Commerce Commission's Approach to Estimating the Capital," June 2009.

A. CHOICE OF METHODOLOGY

The AUC's, OEB's, and STB's reviews included a review of which methodology or methodologies to rely on in estimating the cost of capital, while the AER and NZ CC only reviewed the implementation of its CAPM; *i.e.*, these two regulators did not consider other methodologies.

The three regulators, who reviewed which methodology or methodologies to use, decided to rely on more than one method to estimate the cost of equity. These three regulators noted that each methodology has its own strengths and weaknesses.²¹² However, the degree to which each regulator relied on a specific method differs. While the STB decided to assign equal weight to the CAPM and the multi-stage DCF model, the AUC noted that it looked to the CAPM, the DCF model, and other evidence, and the OEB assigned equal weight to the methods submitted for its review.

Prior to its Ex Parte 664 proceedings, the STB established the cost of equity for the railroads it regulates using the single-stage DCF methodology. Based on a review of the methodology and input from stakeholders, the STB in January 2008 decided to switch to using the CAPM model. However, the STB also decided to review DCF methodologies and whether both a CAPM and a DCF should be used. In doing so, the STB noted

[w]hile CAPM is a widely accepted tool for estimating the cost of equity, it has certain strengths and weaknesses, and it may be complemented by a DCF model. In theory, both approaches seek to estimate the true cost of equity for a firm, and if applied correctly should produce the same expected result. The two approaches simply take different paths towards the same objective. Therefore, by taking an average of the results from the two approaches, we might be able to obtain a more reliable, less volatile, and ultimately superior estimate than by relying on either model standing alone.²¹³

Ultimately, the STB decided to put equal weight on the standard CAPM and on Ibbotson Associates' version of a multi-stage DCF results for the railroad industry.

The OEB, in its most recent review of its formulaic approach, decided to assign some weight to all methods presented for the determination of the risk premium of equity over long-term debt. It

²¹² OEB p. 26; STB 2009 p. 3 and 5; AUC p. 86-87 express weaknesses with DCF and CAPM.

²¹³ Ex Parte No. 664, p. 13.

noted that each of the four cost of equity methods introduced in *Section II* have strengths and weaknesses and concluded “**the use of multiple tests to directly and indirectly estimate the ERP is a superior approach to informing its judgment than reliance on a single methodology.**”²¹⁴ Having reviewed a multiplicity of empirical approaches to determine the risk premium and the initial ROE, the OEB assigned equal weight to the methods for the purpose of determining the risk premium and initial ROE. In the second step of its procedure, the OEB decided to rely on a formulaic approach based on the risk premium approach to *update* the cost of equity annually.

The AUC, in its 5-year review of its formulaic approach, decided to rely primarily on the CAPM but also looked to the DCF and especially the multi-stage DCF as well as other evidence. The AUC rejected the comparable earnings methodology.²¹⁵ Thus, the STB explicitly decided to weigh the CAPM and a multi-stage DCF equally, while the AUC and OEB recognized the merits of using more than one methodology to estimate the risk premium required by investors; with the OEB assigning equal weight to the presented methodologies for its initial ROE and risk premium.²¹⁶

B. IMPLEMENTATION

In their recent review of cost of capital methodology, the OEB emphasized its legal obligation that approved rates must produce a fair return and rather than selecting a specific methodology or methodologies and the implementation hereof, the OEB’s determination was based on the submissions it received. Therefore, the following focuses on the STB, AER, AUC and NZ CC, whose decisions included determinations regarding estimation technique, inputs, etc.²¹⁷

²¹⁴ OEB 2009 p. 36 (emphasis in the original).

²¹⁵ AUC 2009 ¶281.

²¹⁶ AUC 2009 Decision ¶323 and OEB 2009 Decision p. 38.

²¹⁷ The New Zealand Competition Commission has an ongoing review of its cost of capital methodology. The review pertains to the implementation of the CAPM. At the date of this report, a decision had not been rendered.

CAPM Implementation

The AER, NZ CC and the STB all note the importance of matching the horizon of the risk-free rate and the MRP. The AER 2009 Decision maintained its use of a 10-year risk-free rate and specified that the risk-free rate should be measured as the average over the 10-40 day period ending as close as practical to the commencing of the regulatory period.²¹⁸ The AER based its decision on submitted evidence and none of the parties suggested a risk-free rate other than the 10-year rate. The NZ CC intended for the risk-free rates horizon to match the regulatory life of the asset being regulated and in practice looked to a series of government bonds ranging from 1 to 10 years to maturity. Experts involved in the STB's review agreed that the use of the 20-year Treasury bond as the risk-free rate was preferable to the 30-year rate in the U.S. because no continual series of 30-year data existed. Similarly, the experts also agreed that the 20-year series was preferable to the 10-year series, because consistent data on the 10-year series are more difficult to obtain. The STB agreed.²¹⁹ The AUC looked to the forecasted yield on the 10-year Canada bond as the risk-free rate but acknowledged that the volatility in the market "made it difficult to establish a consistent forecast."²²⁰ This was not an issue of contention in the AUC review.

Having determined that the horizon of the risk-free rate and the MRP should match, the discussion at the STB cost of capital review focused on the number of years over which the MRP should be estimated. The STB ultimately concluded that the longest available period of time in the most recent version of Ibbotson's 20xx Valuation Yearbook should be used to determine the MRP because it was convinced it is the most common approach. Thus, the STB measures the MRP as the total return on the S&P 500 index over the long-term government bond income returns using a period as long as possible.²²¹ Neither the AUC nor the AER recommended a formulaic approach to determine the MRP. The AUC rejected using an average of the realized Canadian and U.S. market risk premium and acknowledged that the financial crisis may have increased the MRP. Based on the evidence in the record, the AUC settled on an MRP in the range of

²¹⁸ AER 2009 Decision p. xiii.

²¹⁹ STB Ex. Parte 664, p. 7.

²²⁰ AUC 2009 Decision, ¶233.

²²¹ STB Ex. Parte 664, pp. 8-9. See also Morningstar, "Ibbotson SBBI 2010 Valuation Edition," Appendix A.

5.00 to 5.75% for Canada.²²² The AER reviewed long-term historical estimates for the periods 1883-2008, 1937-2008, and 1958-2008, as well as survey results and forecasted MRPs, before settling on an MRP of 6.5% for Australia for 2009. This figure was within the range of the estimates and recognizes that the financial crisis may have increased the MRP.²²³ The NZ CC looked to the realized MRP in New Zealand as well as in other jurisdictions and also considered other estimates. The NZ CC found that the increase in the price-dividend ratio likely was unsustainable and therefore considered whether to the increase from the MRP. However, having considered all evidence, the NZ CC settled on an MRP of 7% for New Zealand for 2009.²²⁴

In conclusion, the reviewed regulators rely primarily on a long-horizon MRP, but the method used to measure it differs. While the STB relies on a formulaic approach using a pre-determined source for data, the AUC, AER, NZ CC reviewed multiple estimates before settling on a range or final number that was not the result of a specific methodology or source. Instead the final decision was made as a result of the regulatory context and regulatory judgment.

The last component of the CAPM model is the beta estimate. Again, the STB was very specific in its determination of the estimation process. First, all parties in the proceeding recommended using the S&P 500 (instead of, for example, the New York Stock Index) as the market index due to its common availability, so the STB adopted that recommendation to enhance the access to data. Second, all parties also recommended using Equation (12) to estimate the beta estimate, which has statistically better properties than an equation without the constant term, so again the STB adopted this implementation. Third, the STB adopted a portfolio based estimation methodology as most parties agreed it reduces the noise in the estimation process. Fourth, the time horizon over which to estimate betas was more controversial, but ultimately the STB rejected a 10-year period as too long and adopted the 5-year horizon, which is common among commercial providers of beta estimates. Fifth, the STB agreed with several experts that betas based on weekly returns were more stable than betas based on monthly returns and thus adopted the weekly return methodology.²²⁵ The NZ CC decided to rely on a sample of both New Zealand and foreign companies to determine the industry beta. The regulator estimates the companies' beta against the index in the country, where the

²²² AUC 2009 Decision, ¶239-240.

²²³ AER 2009 Decision, p. xiv and pp. 46-47.

²²⁴ NZ CC 2009, ¶159-and 163.

²²⁵ See *Section IV.C*.

company trades and primarily relies on 5 years of monthly data although the NZ CC checks other measures. The industry measure of beta is a weighted average of the sample companies' beta.

While the AUC did not provide a specific CAPM implementation guide, the AUC did provide indications of its preferences for certain beta characteristics. First, all experts submitted evidence using a long-term version of the CAPM, and the AUC looked to those results. Second, the AUC found insufficient evidence that a beta adjustment based on reversion towards one was needed for Canadian utilities.²²⁶ However, the AUC settled on a range of beta estimates of which the upper bound was obtained through an adjustment to beta estimates for Canadian utilities.

The AER looked to many different specifications of the beta estimates using both Australian and foreign data. Based on the numerous regressions and comments from stakeholders, the AER concluded the following regarding beta estimation. Both local and U.S. markets provide evidence on the systematic risk of regulated entities, but the largest weight should be assigned to the locally measured beta. Similarly, the AER considered both portfolio betas and the average of individual company betas. The AER found that an advantage of the portfolio approach was that the statistical confidence interval for the beta estimate is readily available, while a disadvantage is that there was controversy about how to weight companies in the portfolio. As a result, the AER assigned weight to both the portfolio beta and to the average of the sample companies' betas with the larger weight assigned to the average. The AER looked to both weekly and monthly betas using a five year estimation horizon.

²²⁶ AUC 2009 Decision, ¶251.

Table 1 below summarizes the preferences by the Agency, AUC, OEB, AER, STB, CRTC, ERA, UK CC and NZ CC regarding the CAPM implementation.

Table 1

	Agency	AUC	OEB ²	AER	STB	CRTC ³	UK CC ³	W. Australian ERA ³	NZ CC ³
Risk-free Rate	Short and Long-term	Long-term	-	Long-term	Long-term	Long-term	Several	Long-term	Matched to length of asset
MRP	Short and Long-term	Long-term	-	Long-term	Long-term	Long-term	Several	Long-term	Matched to length of asset
Term	Historic	All	-	All	Historic	Historic	Combination	Combination	Combination
Historic / Forecast / Other	45 years	Several	-	Several	Longest possible	Several	Combination	Combination	Combination
If historic, period									na
Beta									
Index	Local	Local		Local & US	Local	Local and US	Local	Local and US	Local to sample companies
Horizon	5 years ¹	*	-	5 years, longer / shorter	5 years	5 years	1, 2, 5 years	5 years	5 years
Periodicity	Weekly or Monthly	*	-	Weekly & Monthly	Weekly	*	Daily, Monthly	Monthly	Monthly
Portfolio / Average of Sample / Other	Company-specific	*	-	Portfolio & Average	Portfolio	Average & Portfolio ⁴	Company-specific	Portfolio and Average	Average
Blume adjustment	Yes	Mixed	-	No	No	*	(5)	*	*

* The decision does not indicate a preference.

¹ In limited circumstances the Agency will consider a shorter time horizon.

² The OEB considered all submitted evidence.

³ The classification is based on the regulator's recent decision(s).

⁴ The CRTC estimated company specific betas and betas for a telecommunication index.

⁵ The UK CC reviewed Bayesian adjustments to beta estimates

Bold indicates that the regulator put a larger emphasis on this methodology.

DCF Implementation

Of the regulators discussed in this section, only the STB has provided a detailed specification on the implementation of the DCF model as discussed in *Section IV.C*. The choice of DCF model and its implementation was controversial in the STB's Ex. Parte 664 proceeding, where the railways found a single-stage DCF appropriate, while shippers found that no DCF or different multi-stage DCF was appropriate. The STB noted in its decision that Ibbotson Associates is a well-recognized source that takes cash flow other than dividends into account and also incorporates the long-term growth of the economy for which reason, the STB decided to use Ibbotson's Three-stage DCF model to estimate the cost of equity for railways.²²⁷

While neither the AUC nor the OEB made detailed comments on the implementation of DCF models, both regulators relied in part on results from the DCF model to determine the allowed

²²⁷ See STB Ex. Parte 664, Sub-No. 1. The method is applied to those companies that fulfill the STB's sample criteria as discussed in *Section V.C*.

ROE or risk premium and also provided insights into what they considered. For example, the AUC in its recent review of cost of capital methodologies concluded that

the Commission [AUC] considers that a multi-stage DCF analysis that adjusts the long run growth expectations to a reasonable level can provide some guidance to the Commission [AUC].²²⁸

Further, the AUC noted some concerns about applying the constant growth DCF to holding companies with substantial unregulated assets and about analysts' forecasts being biased. As a result, the AUC limited the number of companies it considered in the DCF analysis to Canadian companies with close to 100% regulated assets.²²⁹

Table 2 below summarizes the regulators views on how to implement the DCF model.

Table 2

	Agency	AUC	OEB	AER	STB	CRTC ¹	UK CC W. Australian ERA NZ CC ¹
Constant Growth DCF	Yes	Limited	Yes	No	No	*	No
Dividend Yield	Current	*	*	-	-	-	-
Growth Rate	Forecast	*	*	-	-	-	-
Multi-Stage DCF	No	Yes	Yes	No	Yes	*	No
Dividend Yield / Cash Flow Yield	-	*	*	-	Cash Flow	-	-
Growth Rate	-	-	-	-	-	-	-
Stage 1	-	*	*	-	Analyst Forecast, Company	-	-
Stage 2	-	*	*	-	Analyst Forecast, Industry	-	-
Stage 3	-	*	*	-	GDP	-	-

* The decision does not indicate a preference.

¹ The classification is based on the regulator's recent decision(s).

Other Implementation Issues

Among the regulators considered in this section, only the OEB specifically relied on a risk premium approach as described in *Section IV.B* and none of the regulators made specific recommendations regarding the implementation of the comparable earnings methodology. Therefore, we can summarize the four regulators relied upon methodologies as follows:

²²⁸ AUC 2009 Decision ¶269.

²²⁹ AUC 2009 Decision ¶327.

Table 3

	Agency ¹	AUC	OEB	AER	STB	CRTC ²	UK CC W. Australian ERA NZ CC ²
CAPM	Favoured	Partly	Partly	Yes	Half weight	Yes	Yes
DCF							
Constant Growth	Yes, reviewed	Minimal	Partly	No	No	No	No
Multi-Stage	No	Partly	Partly	No	Half weight	No	No
Risk Premium	Yes, reviewed	No	Yes	No	No	No	No
Comparable Earnings	No	No	Partly	No	No	No	No

¹ The Agency reviews results from the CAPM, DCF, and Risk Premium models. It has in recent years favoured the CAPM.

² The classification is based on the regulator's recent decision(s).

Thus, among the regulators who have recently reviewed their cost of capital methodology, all rely to a degree on the CAPM model and several put some weight on the DCF model.²³⁰

Finally, the AUC, OEB, and AER all considered whether reliance on information from foreign markets was appropriate. All three regulators choose to look to beta estimates for foreign companies that were deemed comparable. For example, the AUC and the OEB assigned some weight to estimation results from U.S. utility samples when determining the return on equity and the initial risk premium, respectively.²³¹ The AER looked to U.S. beta estimates to determine the reasonableness of Australian betas estimates, but rejected reliance on a foreign MRP or risk-free rate.²³² The NZ CC also looked to foreign estimated, but did not specify what weight it assigned to foreign estimates of beta or the MRP. Thus, none of the regulators assigned a specific weight to foreign estimates. The STB did not look to foreign countries for data.

Some of the decisions regarding cost of capital may be better understood in the context of other decisions made by those regulators. For example, it is important to understand that the U.K. CC, the Western Australian ERA, the NZ CC and the STB calculate the overall or weighted-average cost of capital using market values to assign weight to the cost of equity and debt. The determination of the weighted-average cost of capital using market values to weight debt and equity costs is consistent with standard practice in non-regulated industries and does not affect the size of the rate base. However, in the U.K. as well as in Australia and New Zealand (and in some other jurisdictions), the rate base of the regulated entities is based on replacement cost or a similar notion rather original cost, so the rate base generally increases over time. In return, these

²³⁰ The ongoing review of cost of capital methodology by the NZ CC pertains exclusively to the CAPM.

²³¹ AUC 2009 Decision ¶203 and OEB 2009 Decision p. 38.

²³² ERA 2009 Decision p. 108 p. 100, respectively.

regulators tend to use real rather than nominal cost of capital, so inflation is removed from the allowed rate of return. I.e., the rate base is adjusted (upward) for inflation, while the allowed rate of return is adjusted (downward) for inflation.

Some regulators, e.g., the OEB and the AUC, deem a capital structure for the entities they regulate. This has to be seen in the context of these regulators determining an allowed return on equity which is the same (or at least similar) for all entities in a given industry, while the deemed capital structure is used to differentiate the risk across those entities. In other words, this practice is tied to the regulatory context and history of the jurisdictions.

Finally, it is important to recognize that the reviewed regulators cover a broad range of industries: railways, airports, electric and gas utilities, pipelines, etc. Further, each regulator faces a unique regulatory history, legislative environment, and in some instances unique economic environments. Therefore, the choices made by the regulators regarding cost of capital estimation cannot be viewed in isolation - - other regulatory issues necessarily impact the decision process and outcome.

APPENDIX A: TECHNICAL DERIVATIONS

A. THE MINIMUM VARIANCE FRONTIER

The minimum variance frontier (“MVF”) is a convenient framework for thinking about the cost of capital.²³³ For any given time period and return horizon, marketed assets/securities can be plotted in expected return and standard deviation of return space ($E(r), \sigma$). Figure A.1 below illustrates this mapping for a sample of market securities.²³⁴

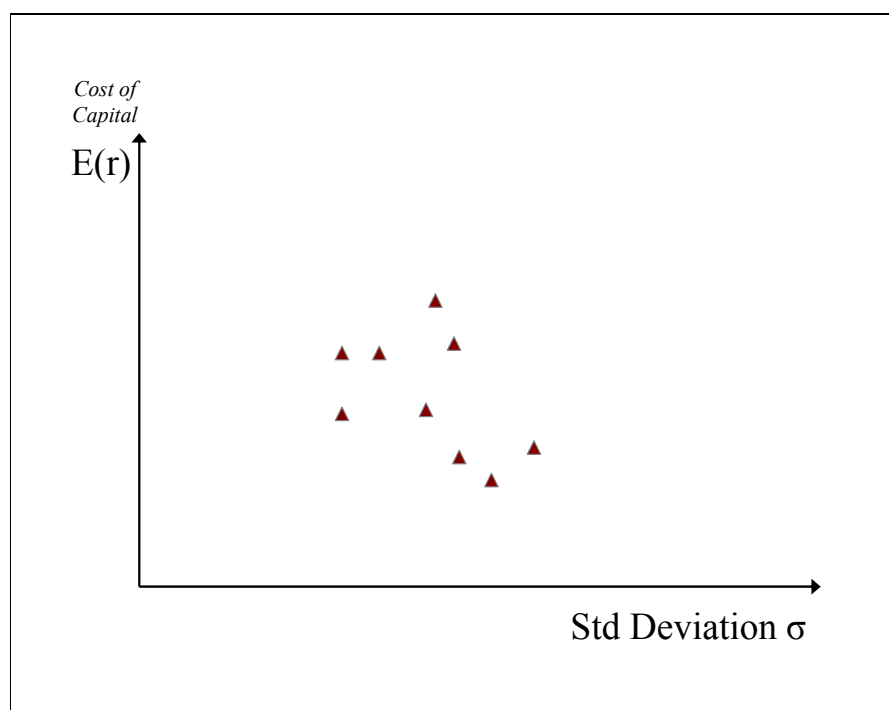


Figure A.1

The minimum variance frontier (“MVF”) represents the boundary of the investments available in the market in this space (see Figure A.2 below). That is, the MVF is a graph of the minimum standard deviation any portfolio in the market can achieve for a given expected return.²³⁵ The insight here is that when security returns are positively correlated (i.e., have a tendency to move in the same direction, to some degree), trade in capital markets allows for a reduction of total risk

²³³ Moreover, thinking in terms of the frontier has the added benefit of working directly with the cost of capital.

²³⁴ As typically drawn, the correspondence is done in terms of standard deviation.

²³⁵ Harry Markowitz received the 1990 Nobel prize in economics for his work investigating the frontier.

through portfolios which can diversify individual security risks. As a result, portfolios with lower variance can be formed for a given level of expected return (cost of capital).²³⁶ Diversification permits investors to obtain lower variance at a given expected return or a higher expected return for a given level of variance. The smallest number of different investments necessary to produce a fully diversified portfolio is obtained by selecting securities whose correlation is low.²³⁷ The implication of the MVF is that there is no set of securities which have a higher expected return with lower risk, (i.e., variance).

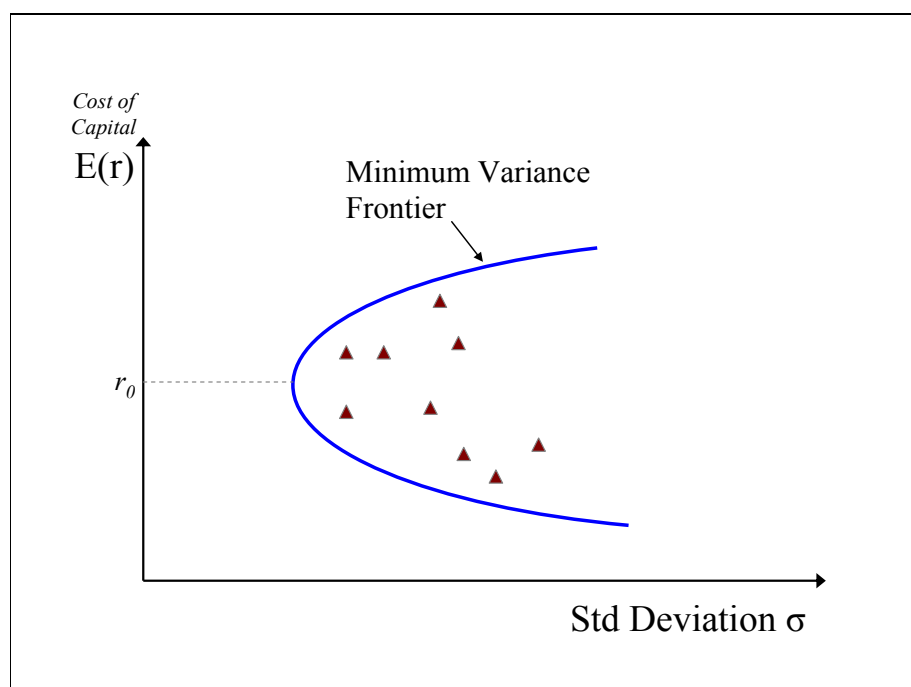


Figure A.2

Two important properties of the minimum variance frontier are: any portfolio of individual assets lying on the MVF will also fall on the MVF; and the return of any security satisfies a beta representation of the form:

²³⁶ This issue was explored in H. Markowitz, "Portfolio Selection," *The Journal of Finance* 7, 1952, pp. 77-91.

²³⁷ The greatest diversification (i.e., most total risk reduction) results from securities whose returns have a low or negative correlation with the returns of the other assets in the portfolio. Large capital markets generally offer the best opportunities for reducing company specific risks through diversification.

$$E(r_S - r_0) = \beta_S \times E(r_m - r_0) \quad (32)$$

Where r_S is the security return, r_m is the return of any minimum-variance portfolio, β_S is the coefficient from a least-squares regression of r_S against r_m , and r_0 is the return of a security with a beta of zero. Securities with a beta of zero are commonly referred to as “zero-beta” assets. If there is a risk-free asset, it has a constant return and therefore zero correlation with any risky portfolio. Thus, when a risk-free asset exists, it is the zero-beta security. Moreover, since it has zero variance, the presence of a risk-free asset pulls the MVF to the vertical axis, producing a MVF as seen in Figure A.3 below. The linearity of the MVF illustrated in Figure A.3 is a consequence of property 1 above. A risk-free asset is minimum variance at the risk-free rate by definition, so it must be on the MFV. Combining it with any other MVF security, r_M , in a portfolio results in a portfolio that is also on the MFV (by property 1 above). But any such portfolio r_p with p percent of the portfolio invested in the risky asset satisfies:

$$r_p = r_f + (p) \times (r_M - r_f) \quad (33)$$

which means that

$$\begin{aligned} E(r_p) &= r_f + (p) \times E(r_M - r_f) \\ \text{and } \sigma(r_p) &= (p) \times \sigma(r_M) \end{aligned} \quad (34)$$

Allowing p to vary therefore traces a straight line in the graph.²³⁸

²³⁸ Notice that as p changes, $E(r_p)$ changes by $\Delta p \times E(r_M - r_f)$ and the standard deviation of r_p , $\sigma(r_p)$ changes by $\Delta p \times \sigma(r_M)$. The ratio of these is independent of p , which is to say that the slope of the MVF is constant (i.e., MFV is a straight line).

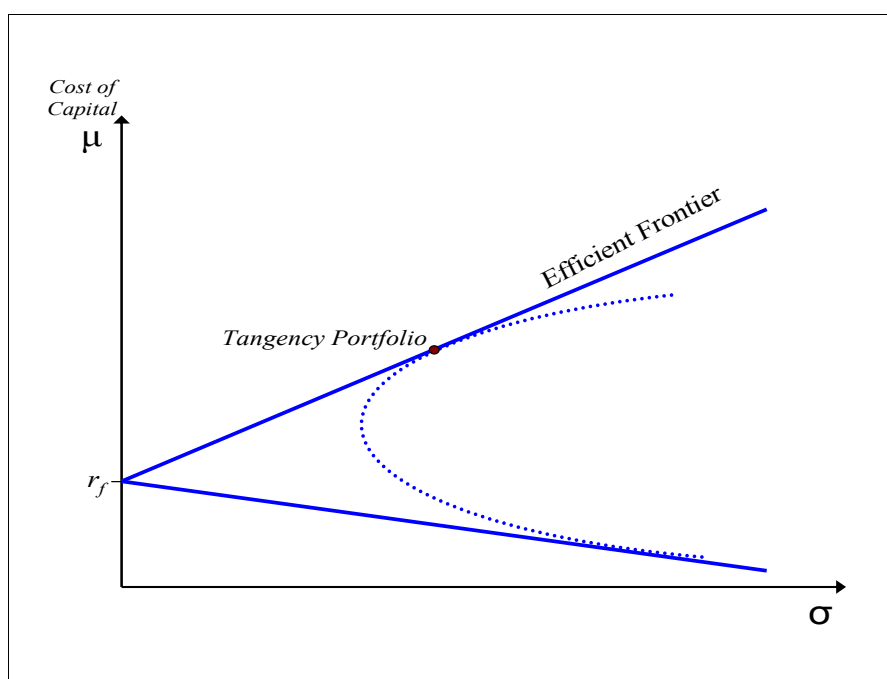


Figure A.3

Beta representation highlights that the cost of capital for any security (or asset) is determined by the risk-free rate r_f , a risk premium common to all assets, $(r_m - r_f)$, and the amount of this common (or systematic) risk that is “held” by the security, as measured by its beta. It is important to stress here that although the MVF and this beta representation are often associated with the Capital Asset Pricing Model (“CAPM”) (Sharpe 1964, Lintner 1965),²³⁹ these results are not part of the CAPM model. The results exist in any market that satisfies the no-arbitrage assumption. The CAPM is just a special case which puts the market portfolio on the frontier. In general, one can think of most asset pricing models as competing models of the MVF.

Using Equation (32), the MVF can be plotted in risk-return space instead, where “risk” is measured by beta and return is measured as the cost of capital. This produces the Security Market Line (“SML”). The SML depicts the risk-return tradeoff discussed above. A higher level of risk as denoted by beta results in a higher expected return.

²³⁹ W.F. Sharpe, “Capital Asset Prices: A Theory of Market Equilibrium Under Conditions of Risk,” *Journal of Finance* 19, 1964, pp. 425-442 and J. Lintner, “The Valuation of Risk Assets and Selection of Risky Investments in Stock Portfolios and Capital Budgets,” *Review of Economics and Statistics* 47, 1965, pp. 13-37.

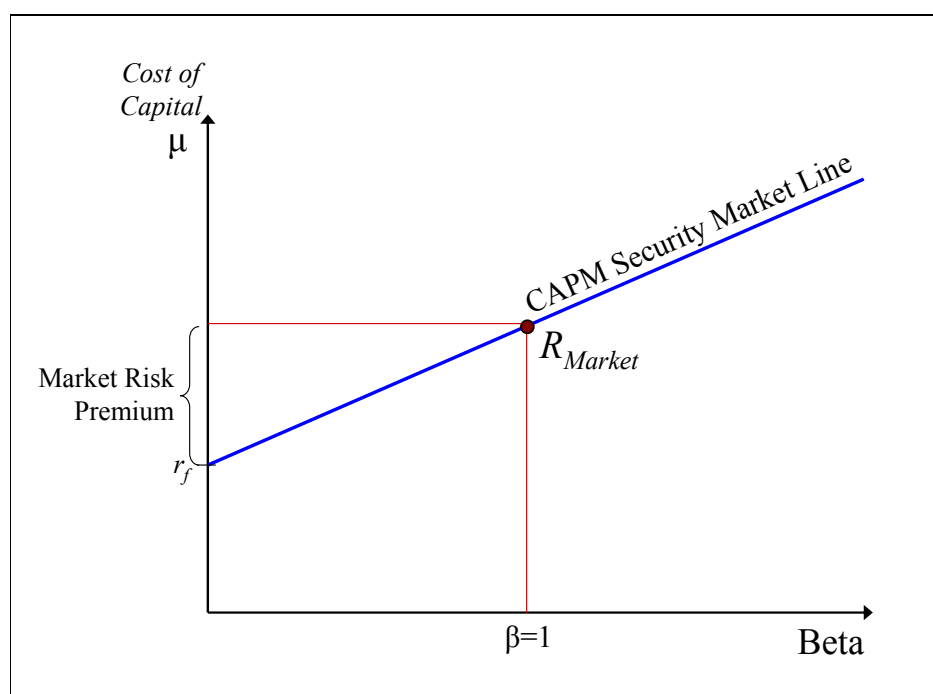


Figure A.4

Again, a key insight here is that the cost of capital (vertical axis) is a function of an asset's systematic risk, as measured by beta. Thus, not all risk is priced; only systematic risk affects an asset's expected return. Simply because an asset has a higher variance does not mean that investors will demand a higher return. Investors expect a return premium only for that component of variation which cannot be diversified or traded away in the market. In a regulatory context, this means that mechanisms which reduce the variance of cash flows do not necessarily reduce the cost of capital. Only mechanisms which reduce systematic risk reduce the cost of capital.

The beta representation also provides a quantitative answer to evaluate what comparable risk investments are – specifically, investments with equal betas have comparable risk from a cost of capital perspective. Opportunity cost is really about comparable “priced” risk.²⁴⁰

²⁴⁰ Note, this is not to say that two companies which have the same equity betas are of comparable business risk. The underlying business risk (or asset risk) of a company is not generally the same as its equity risk. Equity is a derivative claim on the underlying assets, which is affected by the amount of debt used to finance assets (among other factors). Therefore, two companies with the same equity betas may not be of comparable underlying risk, and two companies with comparable underlying risk may have very different equity betas – depending on the leverage of the firm. This is discussed in more detail below.

B. “THE MARKET” AND ROLL’S (1977) CRITIQUE

This technical note discusses how to identify the CAPM market return. As Roll (1977)²⁴¹ pointed out, the CAPM specifies a relationship between all assets in the economy – including human capital, precious metals, stamps, jewelry, etc. The market return contemplated in the theoretical CAPM, therefore, is simply not observable.²⁴² From an implementation point of view, this means that one is never really utilizing the CAPM, per se. It is more correct to label common implementations of the CAPM, which utilize an equity index such as the S&P TSX, as market models. Does the distinction make a difference? Or stated differently: “does a submarket approximate the CAPM when the larger market satisfies the CAPM?” In general, the answer is no, and deviations from the CAPM may be both significant and changing over time – depending on whether (and how) pricing of the non-included assets is changing. Despite this negative fundamental result, equity market indices are generally a significant and important determinant of cost of capital. As such, most economists and practitioners understand the significance of Roll’s critique, but nevertheless take it with a grain of salt. The critique may, in part, explain some of the empirical criticisms faced by the CAPM over the years. These criticisms have in turn motivated a significant research effort producing alternative factor models such as that of Fama & French.

In light of Roll’s critique, the challenge to analysts implementing the CAPM is to select a proxy for the market that comes closest to the true market return, while at the same time mitigating potential data problems. For example, a natural equity index in Canada would be the entire TSX. However, many TSX securities may trade infrequently or have little market depth – which is to say it would be hard for someone to buy or sell the security on demand. Is the price of these securities really the price that one could expect to receive in trade? Such problems reduce the reliability of total market indices. An index like the S&P/TSX, however, attempts to provide a broad representation of securities while minimizing the impact of such liquidity problems. For this reason, it tends to be used frequently by analysts. Nevertheless, in instances where markets become more volatile, at least examining the results of a broader index may be advisable for providing a more complete picture.

²⁴¹ R. A. Roll, “A Critique of the Asset Pricing Theory’s Tests,” *Journal of Financial Economics*, 4, 1977, pp. 129-176.

²⁴² Roll’s Critique was more specifically that the CAPM is not testable because the market is unobservable.

Additionally, because capital markets in the U.S. and Canada may be becoming increasingly integrated there is a question as to whether a strictly Canadian market index is the appropriate market choice, or whether a portfolio of Canadian and U.S. indices is more appropriate. There is no single best answer to this question. In some cases, the beta of a Canadian security against the U.S. market can be very low, and a CAPM using the CAN-US merged market may actually produce inferior forecasting power for the model. However, for companies that have significant cross-border operations and which raise capital in both markets, it may be preferable to use the merged market return as opposed to domestic market only. Indeed, it is generally recognized that the MRP in Canada will be affected by the investment opportunities in the U.S. and the rest of the world. For example, in a study of Canadian utilities Standard & Poor's noted that "[b]oth utilities and power income funds are focused on opportunities south of the Canada-U.S. border."²⁴³ Many Canadian companies routinely access the capital markets in the U.S. – a reason that some analysts consider an international analysis as part of the estimation process.

C. DERIVATION OF THE PROPOSITION THAT THE BETA OF A PORTFOLIO IS THE MARKET-WEIGHTED AVERAGE OF THE UNDERLYING BETAS

In this section, we show that the beta of a portfolio should be the market-weighted average of the underlying betas. For simplicity, consider two security returns r^1 and r^2 , along with the portfolio return r^P defined as:

$$r^P = p \cdot r^1 + (1-p) \cdot r^2 \quad ; 0 \leq p \leq 1 \quad (35)$$

from which we can subtract the risk-free rate r_f on both sides to give

$$r^P - r_f = p \cdot (r^1 - r_f) + (1-p) \cdot (r^2 - r_f) \quad (36)$$

Taking expectations gives:

$$(\bar{r}^P - r_f) = p \cdot (\bar{r}^1 - r_f) + (1-p) \cdot (\bar{r}^2 - r_f) \quad ; \text{ where } \bar{r} = E(r) \quad (37)$$

Under the CAPM, each of these terms can be re-written in terms of each security's beta and the MRP, which shows that the beta of the portfolio is the portfolio of the underlying betas.

²⁴³ Standard & Poor's Ratings Direct, "Industry Report Card: Top Seven Canadian Utilities Reflect Ongoing Sector Stability," October 27, 2006.

$$\begin{aligned}\beta^p \cdot MRP &= p \cdot \beta^1 \cdot MRP + (1-p) \cdot \beta^2 \cdot MRP \\ \Rightarrow \beta^p &= p \cdot \beta^1 + (1-p) \cdot \beta^2\end{aligned}\tag{38}$$

The benefits of forming a series of (constant) portfolio returns first and computing beta arise from the potential reduction of noise when forming portfolios – assuming noise is not correlated across the underlying securities. For return r^i under the CAPM, we have:

$$r^i - r_f = \beta^i \cdot (r_M - r_f) + noise_i\tag{39}$$

Which implies

$$r^p - r_f = p \cdot [\beta^1 \cdot (r_M - r_f) + noise_1] + (1-p) \cdot [\beta^2 \cdot (r_M - r_f) + noise_2]\tag{40}$$

for the portfolio p , or

$$\begin{aligned}r^p - r_f &= [p \cdot \beta^1 + (1-p) \cdot \beta^2] \cdot (r_M - r_f) + [p \cdot noise_1 + (1-p) \cdot noise_2] \\ &= \beta^p \cdot (r_M - r_f) + [p \cdot noise_1 + (1-p) \cdot noise_2]\end{aligned}\tag{41}$$

This result tells us that the noise in the portfolio return is an average of the noise in the underlying securities. For a large, equal weighted portfolio, the variance of the noise term will drop significantly.²⁴⁴ Since the noise of a beta estimate by regression is a function of that variance, the variance of the portfolio beta will also fall, producing a more reliable estimate. Moreover, it can be shown that the resulting reduction in estimation error for the portfolio beta is greater than the reduction achieved by simply averaging across individually estimated betas, making this approach better from a sampling point of view.

D. THE GORDON GROWTH MODEL

To start, notice that Equation (3) can be re-written in terms of the expected *growth path* of dividends instead. That is:

$$P_t = \frac{E_t[D_0(1+g_1)]}{(1+r_s)} + \frac{E_t[D_1(1+g_2)]}{(1+r_s)^2} + \frac{E_t[D_{T-1}(1+g_3)]}{(1+r_s)^3} + \dots\tag{42}$$

²⁴⁴ This assumes that the error terms in the individual beta estimates are not correlated across securities.

Or

$$P_t = \frac{D_0 \cdot E_t(1+g_1)}{(1+r_s)} + \frac{D_0 \cdot E_t[(1+g_1)(1+g_2)]}{(1+r_s)^2} + \frac{D_0 \cdot E_t[(1+g_1)(1+g_2)(1+g_3)]}{(1+r_s)^3} + \dots \quad (43)$$

The easiest, though perhaps least justifiable, way to simplify this equation is to assume that growth is constant (g) over all future periods, producing Gordon's (1959)²⁴⁵ DCF model. Substituting back into Equation (42) gives:

$$P_t = \frac{D_0 \cdot (1+g)}{(1+r_s)} + \frac{D_0 \cdot (1+g)^2}{(1+r_s)^2} + \frac{D_0 \cdot (1+g)^3}{(1+r_s)^3} + \dots \quad (44)$$

which, when we re-arrange the terms, reduces to:

$$P = \frac{D_0 \times (1+g)}{(r_s - g)} \quad (45)$$

Equation (45) is the standard formula used in the constant growth model.

E. ARTICLES ON THE MAGNITUDE OF THE ALPHA COEFFICIENT IN THE ECAPM

Soon after the development of the CAPM in the 1960s, researchers began testing the empirical predictions of the CAPM. These tests utilized a variety of CAPM implementations, and sometimes alternative model structures were used to quantify deviations from CAPM predictions. For example, Litzenberger and Ramaswamy (1979) considered the model:

$$R_{it} - r_{ft} = \gamma_0 + \gamma_1 \beta_{it} + \mu_{it}$$

where μ_{it} is an error term with a mean of zero and finite variance, γ_1 is the market risk premium (parameter to be estimated), and γ_0 represents an extra component for the cost of capital not captured by this implementation of the CAPM. The security returns R_{it} are computed on a monthly basis, and 30-day treasuries are used as a proxy for the risk-free rate r_{ft} . Within this specification, a statistically significant (non-zero) γ_0 is an estimate of the alpha shift parameter that is found in the ECAPM ("short run" implementation). As noted in Table A.1 below, the

²⁴⁵ M.J. Gordon, "Dividends, Earnings and Stock Prices", *Review of Economics and Statistics* 41, 1959, pp. 99–105.

Litzenberger and Ramaswamy (1979) results suggest an alpha adjustment of 5.32 percent (on an annualized basis) between 1936 and 1977.

More comparable to the ECAPM formulation, Litzenberger, Ramaswamy and Sosin (1980) estimate the following model on a monthly basis:

$$r_{it} = r_{ft} + \alpha + \beta_i(r_{mt} - r_{ft} - \alpha) + \mu_{it}$$

Interestingly, the model is run using three variants of beta: raw betas, Blume adjusted betas, and a Bayesian adjusted beta similar to the Vasicek beta. In all cases, there is evidence of a positive alpha adjustment: 3.92%, 1.932%, and 1.632%, respectively. As noted in the report, this supports the use of a Blume adjusted beta in combination with the ECAPM framework, using an alpha of about 2 percent. Table A.1 summarizes additional study results.²⁴⁶

²⁴⁶ Due to the variety of methodologies employed, the numbers presented in the table have been adjusted and annualized to provide an apples-to-apples comparison across the various studies.

Table A-1

EMPIRICAL EVIDENCE ON THE ALPHA FACTOR IN ECAPM*		
AUTHOR	RANGE OF ALPHA	PERIOD RELIED UPON
Black (1993) ¹	1% for betas 0 to 0.80	1931-1991
Black, Jensen and Scholes (1972) ²	4.31%	1931-1965
Fama and McBeth (1972)	5.76%	1935-1968
Fama and French (1992) ³	7.32%	1941-1990
Fama and French (2004) ⁴	N/A	
Litzenberger and Ramaswamy (1979) ⁵	5.32%	1936-1977
Litzenberger, Ramaswamy and Sosin (1980)	1.63% to 3.91%	1926-1978
Pettengill, Sundaram and Mathur (1995) ⁶	4.6%	1936-1990

*The figures reported in this table are for the longest estimation period available and, when applicable, use the authors' recommended estimation technique. Many of the articles cited also estimate alpha for sub-periods and those alphas may vary.

¹Black estimates alpha in a one step procedure rather than in an un-biased two-step procedure.

²Estimate a negative alpha for the subperiod 1931-39 which contain the depression years 1931-33 and 1937-39.

³Calculated using Ibbotson's data for the 30-day treasury yield.

⁴The article does not provide a specific estimate of alpha; however, it supports the general finding that the CAPM underestimates returns for low-beta stocks and overestimates returns for high-beta stocks.

⁵Relies on Lizenberger and Ramaswamy's before-tax estimation results. Comparable after-tax alpha estimate is 4.4%.

⁶Pettengill, Sundaram and Mathur rely on total returns for the period 1936 through 1990 and use 90-day treasuries. The 4.6% figure is calculated using auction averages 90-day treasuries back to 1941 as no other series were found this far back.

Sources:

Black, Fischer. 1993. Beta and Return. *The Journal of Portfolio Management* 20 (Fall): 8-18.

- Black, F., Michael C. Jensen, and Myron Scholes. 1972. The Capital Asset Pricing Model: Some Empirical Tests, from *Studies in the theory of Capital Markets*, edited by Michael C. Jensen, 79-121. New York: Praeger.
- Fama, Eugene F. and James D. MacBeth. 1972. Risk, Returns and Equilibrium: Empirical Tests. *Journal of Political Economy* 81 (3): 607-636.
- Fama, Eugene F. and Kenneth R. French. 1992. The Cross-Section of Expected Stock Returns. *Journal of Finance* 47 (June): 427-465.
- Fama, Eugene F. and Kenneth R. French. 2004. The Capital Asset Pricing Model: Theory and Evidence. *Journal of Economic Perspectives* 18 (3): 25-46.
- Litzenberger, Robert H. and Krishna Ramaswamy. 1979. The Effect of Personal Taxes and Dividends on Capital Asset Prices, Theory and Empirical Evidence. *Journal of Financial Economics* XX (June): 163-195.
- Litzenberger, Robert H. and Krishna Ramaswamy and Howard Sosin. 1980. On the CAPM Approach to Estimation of a Public Utility's Cost of Equity Capital. *The Journal of Finance* 35 (2): 369-387.
- Pettengill, Glenn N., Sridhar Sundaram and Ike Mathur. 1995. The Conditional Relation between Beta and Returns. *Journal of Financial and Quantitative Analysis* 30 (1): 101-116.

APPENDIX B: THE FAMA-FRENCH FACTOR MODEL

Fama & French (1992) was essentially the last in a series of academic research into the placement “pivot” of the empirical SML relative to the theoretical CAPM (see Appendix A and the section on the Empirical CAPM above).²⁴⁷ Specifically, Fama & French found that the graph between market beta and expected return, after controlling for firm size (market capitalization), was essentially flat (i.e., had zero slope). Stated differently, any explanatory power that beta in the CAPM might have is absorbed by using size to explain the cross-sectional variation in returns. Fama & French interpreted this to mean that market beta (and by extension the CAPM) had zero explanatory power for expected returns. Moreover, they found that all of the variation in returns that were (in other research) associated with size, earnings/price ratios, book-to-market equity ratio, and leverage, could be captured by size and the book-to-market equity ratio alone.

The interpretation of these findings came under harsh criticism by some financial economists, with Black (1993) providing particularly strong recrimination. Among Black’s criticisms was the fact that there was no economic foundation for the Fama-French factors of size and book-to-market equity, and that the Fama-French analysis was susceptible to serious data mining concerns.²⁴⁸ Fama and French (1993) ultimately settled on a three factor model that brought the market return back into the model (size, book-to-market ratio, and market return).²⁴⁹ Their 1993 paper found that this model explained 90 percent of the variations in the cross-section of returns, and it has since become known as the Fama-French three-factor model.

The Model:

The Fama-French model holds that the expected return of a security is described by an augmented CAPM relationship:

$$E(r_S - r_f) = \beta_S \cdot E(r_M - r_f) + s_S \cdot E(SMB) + h_S \cdot E(HML) \quad (46)$$

where $E(r_M - r_f)$ is the market risk premium (MRP) discussed above, SMB is the difference in returns between small companies and big companies (“*Small Minus Big*”), and HML is the

²⁴⁷ Fama, E., and K.R. French, “The cross-section of expected stock returns.” *Journal of Finance* 47, 1992, pp. 427-465.

²⁴⁸ Black, F., “Beta and return.” *Journal of Portfolio Management* 20, 1993, pp. 8-18.

²⁴⁹ Fama, E., and K.R. French, “Common risk factors in the returns on stocks and bonds.” *Journal of Financial Economics* 33, 1993, pp. 3-56.

difference in returns between securities of firms with a high book-to-market equity ratio and a low one (“*High Minus Low*”). The factor loadings s_S and h_S represent security S ’s “holding” of each of these risk factors, which is to say they are the regression coefficients of r_S on each of the factors. The standard approach for creating a time-series of SMB and HML are detailed below.

Standard Implementation:

The SMB factor and HML factor are typically created following Fama & French’s (1993) approach. Specifically, at each point in time one allocates each firm into the small or big category, according to whether its market cap is in the top or bottom half of all firms considered. The firms in each half are then value weighted to form two portfolios: small firms and big firms. The difference in realized returns between each of these portfolios is then taken as the SMB realization of that period. Creation of the HML series is similar, but firms are allocated to the “high” category if their book-to-market ratio is in the top 30th percentile and to the “low” category if their book-to-market ratio is in the 70th percentile (bottom 30th percentile). These two time series can then be used to estimate the average SML and HML, as well as the factor loadings for a given security. Specifically, β_S , s_S , and h_S are estimated using the time-series regression:

$$r_{S,t} - r_{f,t} = \alpha_S + \beta_S \cdot (r_{M,t} - r_{f,t}) + s_S \cdot (SMB_t) + h_S \cdot (HML_t) + \varepsilon_{S,t} \quad (47)$$

As a practical matter, the SMB and HML factors can be obtained free of charge from Professor Kenneth French’s website,²⁵⁰ where he maintains a database of the factors for Canada, U.S. markets and specific other international markets. The $E(r_M - r_f)$ or MRP factor is subject to the same issues as in CAPM implementation. In implementing the Fama-French model, the coefficients in Equation (47) are necessarily estimated over the same time horizon; e.g., 5 years. However, it is possible that the time horizon over which the three factors (MRP, SMB, and HML) are estimated differ.

Issues:

The strongest criticism of the Fama-French model is its lack of a clear economic foundation. Some, including Fama and French themselves, have suggested that the SMB and HML factors

²⁵⁰ The website is located at http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html.

may proxy for the hedging variables (e.g., see Fama & French (1993, 1995, 1997)).²⁵¹ Alternatively, some have suggested that the explanatory power of SMB and HML is largely due to survivorship bias (e.g., see Kothari, Shanken, and Sloan (1995)), data mining (Black (1993), MacKinlay (1995)), or market over-reaction (irrationality), whereby distressed stocks are underpriced and growth stocks overpriced (Lakonishok, Shleifer, and Vishny 1994)).²⁵²

Regulatory Use

The Fama-French model is not commonly relied upon in North American rate regulation, although it has been submitted for consideration in some instances. For example, in 2007, the Régie de l'énergie in Québec considered the Fama-French approach and found that the model had not been sufficiently examined to date to be used as a basis for setting the rate of return for a gas distributor.²⁵³ Similarly, Fama-French evidence has been presented at times for U.S.²⁵⁴ and U.K. regulatory proceedings. However, we are not aware of a U.S. decision that primarily relied on the Fama-French model although the U.K. Competition Commission used the model to determine whether a small company premium should be included in the cost of capital.²⁵⁵

The risk premia estimates for the SMB and HML part of the FF model can vary substantially over time. In addition, the standard source for the SMB and HML parameters is Professor French's website rather than a commercial vendor. Recreating these parameters would be time consuming should an analyst seek to do so, even though they are freely available from Professor French's website. In other words, the transparency of the method is arguably less than that of other models discussed in this report.

²⁵¹ Fama, E., and K.R. French, "Size and book-to-market factors in earnings and returns." *Journal of Finance* 50, 1995, pp. 131-155; and Fama, E., and K.R. French, "Industry costs of equity." *Journal of Financial Economics* 43(2), 1997, pp. 153-193.

²⁵² Kothari, S.P., J. Shanken, and R.G. Sloan, "Another look at the cross-section of expected stock returns." *Journal of Finance* 50, 1995, pp. 185-224; MacKinlay, A. Craig, "Multifactor models do not explain deviations from the CAPM." *Journal of Financial Economics* 38, 1995, pp. 3-28; and Lakonishok, J., Andrei Shleifer, and R.W. Vishny, "Contrarian investment, extrapolation, and risk." *Journal of Finance* 49, 1994, pp. 1541-1578.

²⁵³ Régie de l'énergie, Décision D-2007-116, Gaz Métropolitain, pp. 23-24.

²⁵⁴ At least in California, Massachusetts, and Nevada, See California Public Utilities Commission, "Decision 07-12-049," December 20, 2007.

²⁵⁵ See, for example, U.K. Competition Commission, "Market Investigation into Supply of Bulk Liquefied Petroleum Gas for Domestic Use: Provisional Findings Report," August 2005, Appendix K.

EXHIBIT BV-3
Figure 1 from Duarte & Rosa 2014



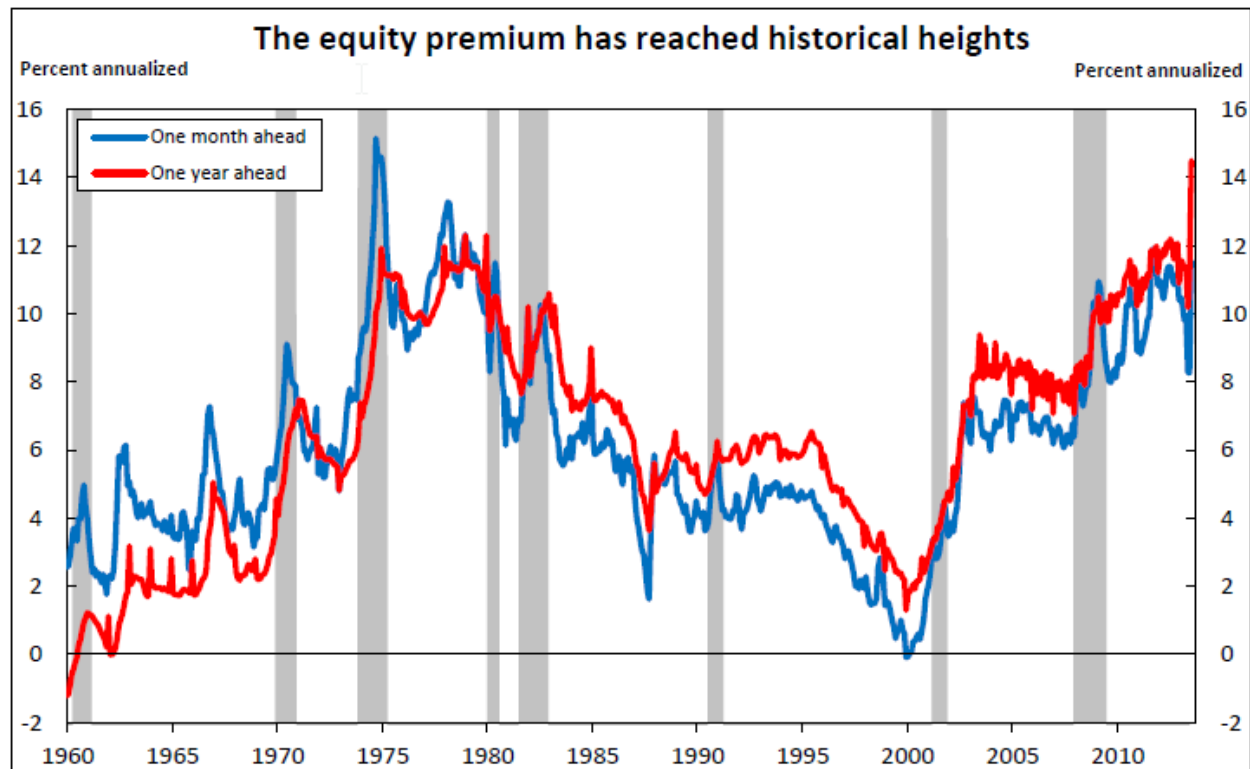


Figure 1 The equity risk premium (expected excess returns) over a one year ahead and one month ahead horizons are the first principal components of 20 models of the equity premium. The models include time-series and cross-sectional regressions, dividend discount models and surveys. Shaded bars are NBER recessions.

Source: Fernando Duarte and Carlo Rosa, "The Equity Risk Premium: A Consensus of Models," Federal Reserve Bank of New York, 2014, Figure 1.

EXHIBIT BV-4
Derivation of the Value Line Forecasted MRP

Ex-Ante Market Risk Premium 2012
Market DCF Method Based - Value Line

		S&P 500 DCF- derived return	10-year Treasury bond yield as of year end 2012 (30 day average)	Implied MRP			
		[1]	[2]	[3]			
		14.21%	1.69%	12.52%			
Company	Ticker	Market Cap	Weight in Index	Estimated Dividend Yield	Long-term Growth Est.	DCF Result	Weighted DCF Result
		(\$ mil)	(%)	(%)	(%)	(%)	(%)
		[4]	[5]	[6]	[7]	[8]	[9]
3M Company	MMM	64,101	0.59%	2.55%	9.50%	12.29%	0.07%
Abbott Labs.	ABT	102,822	0.94%	3.14%	7.50%	10.88%	0.10%
Abercrombie & Fitch	ANF	3,672	0.03%	1.52%	24.00%	25.88%	0.01%
Accenture Plc	ACN	42,450	0.39%	2.45%	12.00%	14.74%	0.06%
ACE Limited	ACE	27,050	0.25%	2.46%	4.00%	6.56%	0.02%
Adobe Systems	ADBE	18,454	0.00%	0.00%	13.00%	13.00%	0.00%
ADT Corp. (The)	ADT	10,684	0.00%	1.08%	0.00%	1.08%	0.00%
Advanced Micro Dev.	AMD	1,702	0.00%	0.00%	0.00%	0.00%	0.00%
AES Corp.	AES	7,915	0.07%	1.50%	23.00%	24.85%	0.02%
Aetna Inc.	AET	15,467	0.14%	1.73%	9.50%	11.39%	0.02%
Aflac Inc.	AFL	24,847	0.23%	2.64%	12.00%	14.96%	0.03%
Agilent Technologies	A	14,161	0.13%	0.98%	16.50%	17.64%	0.02%
AGL Resources	GAS	4,702	0.04%	4.61%	6.00%	10.89%	0.00%
Air Products & Chem.	APD	17,953	0.16%	3.02%	8.50%	11.78%	0.02%
Airgas Inc.	ARG	7,063	0.06%	1.95%	16.00%	18.26%	0.01%
Akamai Technologies	AKAM	7,276	0.00%	0.00%	14.50%	14.50%	0.00%
Alcoa Inc.	AA	9,199	0.00%	1.39%	0.00%	1.39%	0.00%
Alexion Pharmac.	ALXN	18,189	0.00%	0.00%	30.50%	30.50%	0.00%
Allegheny Techn.	ATI	3,186	0.03%	2.42%	33.00%	36.22%	0.01%
Allergan Inc.	AGN	27,389	0.25%	0.22%	10.50%	10.74%	0.03%
Allstate Corp.	ALL	19,383	0.18%	2.19%	15.00%	17.52%	0.03%
Altera Corp.	ALTR	11,008	0.10%	1.16%	9.50%	10.77%	0.01%
Altria Group	MO	63,554	0.58%	5.61%	10.00%	16.17%	0.09%
Amazon.com	AMZN	112,484	0.00%	0.00%	32.00%	32.00%	0.00%
Amer. Elec. Power	AEP	20,680	0.19%	4.41%	3.00%	7.54%	0.01%
Amer. Express	AXP	63,606	0.58%	1.41%	12.50%	14.09%	0.08%
Amer. Int'l Group	AIG	51,626	0.00%	0.00%	0.00%	0.00%	0.00%
Amer. Tower 'A'	AMT	30,162	0.28%	1.44%	26.00%	27.81%	0.08%
Ameren Corp.	AEE	7,421	0.07%	5.23%	-1.00%	4.18%	0.00%
Ameriprise Fin'l	AMP	12,979	0.12%	2.88%	12.00%	15.23%	0.02%
AmerisourceBergen	ABC	10,859	0.10%	1.94%	12.00%	14.17%	0.01%
Amgen	AMGN	66,172	0.61%	2.18%	8.00%	10.35%	0.06%
Amphenol Corp.	APH	10,465	0.10%	0.65%	10.50%	11.22%	0.01%
Anadarko Petroleum	APC	36,867	0.00%	0.49%	0.00%	0.49%	0.00%
Analog Devices	ADI	12,625	0.12%	2.87%	9.50%	12.64%	0.01%
Aon plc	AON	17,903	0.16%	1.12%	12.50%	13.76%	0.02%
Apache Corp.	APA	30,613	0.28%	0.87%	11.00%	11.97%	0.03%
Apartment Investment	AIV	-	0.00%	3.11%	0.00%	3.11%	0.00%
Apollo Group `A'	APOL	2,309	0.00%	0.00%	-0.50%	-0.50%	0.00%
Apple Inc.	AAPL	483,749	4.45%	2.06%	22.50%	25.02%	1.11%
Applied Materials	AMAT	13,586	0.12%	3.17%	9.50%	12.97%	0.02%
Archer Daniels Midl'd	ADM	18,116	0.17%	2.55%	6.50%	9.22%	0.02%
Assurant Inc.	AIZ	2,742	0.03%	2.43%	9.00%	11.65%	0.00%

Ex-Ante Market Risk Premium 2012
Market DCF Method Based - Value Line

AT&T Inc.	T	192,100	1.77%	5.35%	7.00%	12.72%	0.22%
Autodesk Inc.	ADSK	7,892	0.00%	0.00%	18.50%	18.50%	0.00%
Automatic Data Proc.	ADP	27,546	0.25%	3.06%	8.00%	11.30%	0.03%
AutoNation Inc.	AN	4,769	0.00%	0.00%	21.00%	21.00%	0.00%
AutoZone Inc.	AZO	12,879	0.00%	0.00%	18.00%	18.00%	0.00%
AvalonBay Communities	AVB	-	0.00%	3.06%	0.00%	3.06%	0.00%
Avery Dennison	AVY	3,480	0.03%	3.10%	3.50%	6.71%	0.00%
Avon Products	AVP	6,111	0.06%	1.70%	5.00%	6.79%	0.00%
Baker Hughes	BHI	17,617	0.16%	1.50%	17.50%	19.26%	0.03%
Ball Corp.	BLI	6,861	0.06%	0.90%	11.50%	12.50%	0.01%
Bank of America	BAC	123,615	0.00%	0.35%	0.00%	0.35%	0.00%
Bank of New York Mellon	BK	29,975	0.28%	2.03%	23.00%	25.50%	0.07%
Bard (C.R.)	BCR	7,996	0.07%	0.82%	7.50%	8.38%	0.01%
Baxter Int'l Inc.	BAX	36,499	0.34%	2.71%	8.50%	11.44%	0.04%
BB&T Corp.	BBT	20,329	0.19%	2.96%	16.00%	19.43%	0.04%
Beam Inc.	BEAM	9,683	0.09%	1.35%	9.00%	10.47%	0.01%
Becton Dickinson	BDX	15,621	0.14%	2.53%	8.50%	11.25%	0.02%
Bed Bath & Beyond	BBBY	12,467	0.00%	0.00%	14.50%	14.50%	0.00%
Bemis Co.	BMS	3,454	0.03%	2.99%	11.00%	14.32%	0.00%
Berkshire Hathaway 'B'	BRK/B	-	0.00%	0.00%	0.00%	0.00%	0.00%
Best Buy Co.	BBY	3,890	0.04%	5.91%	0.50%	6.44%	0.00%
Big Lots Inc.	BIG	1,596	0.00%	0.00%	10.50%	10.50%	0.00%
Biogen Idec Inc.	BIIB	34,959	0.00%	0.00%	11.50%	11.50%	0.00%
BlackRock Inc.	BLK	35,452	0.33%	2.91%	12.00%	15.26%	0.05%
Block (H&R)	HRB	5,011	0.05%	4.33%	8.50%	13.20%	0.01%
BMC Software	BMC	6,205	0.00%	0.00%	13.00%	13.00%	0.00%
Boeing	BA	57,155	0.53%	2.56%	12.00%	14.87%	0.08%
BorgWarner	BWA	8,248	0.00%	0.00%	19.50%	19.50%	0.00%
Boston Properties	BXP	-	0.00%	2.46%	0.00%	2.46%	0.00%
Boston Scientific	BSX	7,825	0.00%	0.00%	6.00%	6.00%	0.00%
Bristol-Myers Squibb	BMJ	53,053	0.49%	4.36%	8.00%	12.71%	0.06%
Broadcom Corp. 'A'	BRCM	18,443	0.17%	1.22%	14.00%	15.39%	0.03%
Brown-Forman 'B'	BF/B	13,438	0.12%	1.62%	9.00%	10.77%	0.01%
C.H. Robinson	CHRW	10,124	0.09%	2.23%	10.50%	12.96%	0.01%
CA Inc.	CA	9,954	0.09%	4.56%	8.00%	12.92%	0.01%
Cablevision Sys. 'A'	CVC	3,899	0.04%	4.05%	5.00%	9.25%	0.00%
Cabot Oil & Gas 'A'	COG	10,439	0.10%	0.16%	22.50%	22.70%	0.02%
Cameron Int'l Corp.	CAM	13,519	0.00%	0.00%	14.00%	14.00%	0.00%
Campbell Soup	CPB	10,914	0.10%	3.33%	6.00%	9.53%	0.01%
Capital One Fin'l	COF	33,166	0.30%	0.35%	8.50%	8.88%	0.03%
Cardinal Health	CAH	14,059	0.13%	2.66%	11.00%	13.95%	0.02%
CareFusion Corp.	CFN	6,296	0.00%	0.00%	0.00%	0.00%	0.00%
CarMax Inc.	KMX	8,519	0.00%	0.00%	9.00%	9.00%	0.00%
Carnival Corp.	CCL	28,516	0.26%	2.72%	6.50%	9.40%	0.02%
Caterpillar Inc.	CAT	57,324	0.53%	2.37%	20.00%	22.84%	0.12%
CBRE Group	CBG	6,315	0.00%	0.00%	15.50%	15.50%	0.00%
CBS Corp. 'B'	CBS	23,747	0.22%	1.29%	21.00%	22.56%	0.05%
Celgene Corp.	CELG	33,316	0.00%	0.00%	15.50%	15.50%	0.00%
CenterPoint Energy	CNP	8,143	0.07%	4.36%	5.00%	9.58%	0.01%
CenturyLink Inc.	CTL	24,278	0.22%	7.44%	1.50%	9.05%	0.02%
Cerner Corp.	CERN	13,159	0.00%	0.00%	18.50%	18.50%	0.00%
CF Industries	CF	12,662	0.12%	0.87%	14.50%	15.50%	0.02%
Chesapeake Energy	CHK	10,867	0.10%	2.08%	2.00%	4.12%	0.00%
Chevron Corp.	CVX	212,393	1.95%	3.32%	10.50%	14.17%	0.28%
Chipotle Mex. Grill	CMG	9,320	0.00%	0.00%	20.00%	20.00%	0.00%
Chubb Corp.	CB	19,578	0.18%	2.19%	7.00%	9.34%	0.02%
CIGNA Corp.	CI	15,377	0.14%	0.08%	14.00%	14.09%	0.02%
Cincinnati Financial	CINF	6,372	0.06%	4.17%	14.50%	19.27%	0.01%
Cintas Corp.	CTAS	5,092	0.05%	1.57%	12.50%	14.27%	0.01%
Cisco Systems	CSCO	104,361	0.96%	2.85%	8.50%	11.59%	0.11%

Ex-Ante Market Risk Premium 2012
Market DCF Method Based - Value Line

Citigroup Inc.	C	115,101	0.00%	0.10%	0.00%	0.10%	0.00%
Citrix Sys.	CTXS	12,177	0.00%	0.00%	15.50%	15.50%	0.00%
Cliffs Natural Res.	CLF	5,135	0.05%	6.94%	9.50%	17.10%	0.01%
Clorox Co.	CLX	9,525	0.09%	3.64%	11.50%	15.56%	0.01%
CME Group	CME	16,701	0.15%	3.58%	7.50%	11.35%	0.02%
CMS Energy Corp.	CMS	6,397	0.06%	4.21%	7.00%	11.50%	0.01%
Coach Inc.	COH	15,561	0.14%	2.19%	15.00%	17.52%	0.03%
Coca-Cola	KO	163,380	1.50%	2.96%	9.00%	12.23%	0.18%
Coca-Cola Enterprises	CCE	9,071	0.00%	2.12%	0.00%	2.12%	0.00%
Cognizant Technology	CTSH	21,896	0.00%	0.00%	20.50%	20.50%	0.00%
Colgate-Palmolive	CL	49,738	0.46%	2.50%	9.50%	12.24%	0.06%
Comcast Corp.	CMCSA	98,292	0.90%	1.76%	14.50%	16.52%	0.15%
Comerica Inc.	CMA	5,775	0.05%	1.99%	32.50%	35.14%	0.02%
Computer Sciences	CSC	6,096	0.06%	2.04%	4.00%	6.12%	0.00%
ConAgra Foods	CAG	11,927	0.11%	3.40%	9.00%	12.71%	0.01%
ConocoPhillips	COP	70,285	0.65%	4.56%	5.50%	10.31%	0.07%
CONSOL Energy	CNX	7,334	0.07%	1.55%	7.50%	9.17%	0.01%
Consol. Edison	ED	16,231	0.15%	4.40%	4.00%	8.58%	0.01%
Constellation Brands	STZ	6,357	0.00%	0.00%	12.00%	12.00%	0.00%
Corning Inc.	GLW	18,593	0.17%	2.86%	3.50%	6.46%	0.01%
Costco Wholesale	COST	42,578	0.39%	1.12%	12.50%	13.76%	0.05%
Coventry Health Care	CVH	6,004	0.06%	1.12%	7.50%	8.70%	0.00%
Covidien Plc	COV	27,485	0.25%	1.87%	8.50%	10.53%	0.03%
Crown Castle Int'l	CCI	20,680	0.00%	0.00%	30.00%	30.00%	0.00%
CSX Corp.	CSX	20,236	0.19%	2.85%	14.00%	17.25%	0.03%
Cummins Inc.	CMI	20,132	0.18%	1.87%	16.50%	18.68%	0.03%
CVS Caremark Corp.	CVS	60,306	0.55%	1.86%	11.00%	13.06%	0.07%
Danaher Corp.	DHR	38,638	0.36%	0.18%	15.00%	15.21%	0.05%
Darden Restaurants	DRI	5,742	0.05%	4.48%	10.50%	15.45%	0.01%
DaVita Inc.	DVA	10,481	0.00%	0.00%	14.50%	14.50%	0.00%
Dean Foods	DF	2,985	0.00%	0.00%	9.00%	9.00%	0.00%
Deere & Co.	DE	33,660	0.31%	2.14%	13.00%	15.42%	0.05%
Dell Inc.	DELL	17,690	0.16%	3.14%	5.00%	8.30%	0.01%
Denbury Resources	DNR	6,169	0.00%	0.00%	16.00%	16.00%	0.00%
Dentsply Int'l	XRAY	5,592	0.05%	0.61%	9.50%	10.17%	0.01%
Devon Energy	DVN	21,165	0.19%	1.53%	8.00%	9.65%	0.02%
Diamond Offshore	DO	9,403	0.09%	5.18%	3.00%	8.34%	0.01%
DIRECTV	DTV	30,410	0.00%	0.00%	23.50%	23.50%	0.00%
Discover Fin'l Svcs.	DFS	19,264	0.18%	1.48%	18.50%	20.25%	0.04%
Discovery Communic.	DISCA	23,205	0.00%	0.00%	16.00%	16.00%	0.00%
Disney (Walt)	DIS	89,595	0.82%	1.51%	13.00%	14.71%	0.12%
Dollar Tree Inc.	DLTR	9,027	0.00%	0.00%	18.50%	18.50%	0.00%
Dominion Resources	D	29,661	0.27%	4.34%	5.00%	9.56%	0.03%
Donnelley (R.R) & Sons	RDR	1,579	0.01%	11.89%	8.50%	21.40%	0.00%
Dover Corp.	DOV	11,661	0.11%	2.15%	12.50%	14.92%	0.02%
Dow Chemical	DOW	38,519	0.35%	4.17%	18.00%	22.92%	0.08%
Dr Pepper Snapple	DPS	9,213	0.08%	3.17%	9.00%	12.46%	0.01%
DTE Energy	DTE	10,338	0.09%	4.19%	5.00%	9.40%	0.01%
Du Pont	DD	42,022	0.39%	3.86%	11.50%	15.80%	0.06%
Duke Energy	DUK	44,852	0.41%	4.85%	4.50%	9.57%	0.04%
Dun & Bradstreet	DNB	3,526	0.03%	1.92%	7.50%	9.56%	0.00%
E*Trade Fin'l	ETFC	2,497	0.00%	0.00%	0.00%	0.00%	0.00%
Eastman Chemical	EMN	10,233	0.09%	1.80%	17.00%	19.11%	0.02%
Eaton Corp. plc	ETN	18,122	0.17%	2.83%	15.50%	18.77%	0.03%
eBay Inc.	EBAY	65,075	0.00%	0.00%	16.00%	16.00%	0.00%
Ecolab Inc.	ECL	21,031	0.19%	1.28%	14.50%	15.97%	0.03%
Edison Int'l	EIX	14,655	0.00%	3.00%	0.00%	3.00%	0.00%
Edwards Lifesciences	EW	10,562	0.00%	0.00%	18.50%	18.50%	0.00%
Electronic Arts	EA	4,374	0.00%	0.00%	17.50%	17.50%	0.00%
EMC Corp.	EMC	53,277	0.00%	0.00%	14.50%	14.50%	0.00%

Ex-Ante Market Risk Premium 2012
Market DCF Method Based - Value Line

Emerson Electric	EMR	38,415	0.35%	3.11%	9.00%	12.39%	0.04%
Ensco plc	ESV	13,556	0.12%	2.57%	16.00%	18.98%	0.02%
Entergy Corp.	ETR	11,273	0.10%	5.23%	-4.50%	0.49%	0.00%
EOG Resources	EOG	32,943	0.30%	0.58%	26.50%	27.23%	0.08%
EQT Corp.	EQT	8,770	0.08%	0.20%	14.50%	14.73%	0.01%
Equifax Inc.	EFX	6,412	0.06%	1.34%	10.50%	11.98%	0.01%
Equity Residential	EQR	-	0.00%	2.98%	0.00%	2.98%	0.00%
Exelon Corp.	EXC	25,150	0.23%	7.13%	-2.00%	4.99%	0.01%
Expedia Inc.	EXPE	8,164	0.08%	0.86%	14.50%	15.48%	0.01%
Expeditors Int'l	EXPD	8,206	0.08%	1.43%	8.50%	10.05%	0.01%
Express Scripts	ESRX	43,200	0.00%	0.00%	20.00%	20.00%	0.00%
Exxon Mobil Corp.	XOM	396,024	3.64%	2.63%	10.00%	12.89%	0.47%
F5 Networks	FFIV	7,675	0.00%	0.00%	21.00%	21.00%	0.00%
Family Dollar Stores	FDO	7,303	0.07%	1.34%	14.50%	16.03%	0.01%
Fastenal Co.	FAST	13,725	0.13%	1.81%	18.00%	20.14%	0.03%
Federated Investors	FII	2,072	0.02%	4.81%	8.50%	13.72%	0.00%
FedEx Corp.	FDX	28,773	0.26%	0.61%	14.00%	14.70%	0.04%
Fidelity National Information	FIS	10,118	0.09%	2.31%	12.67%	15.27%	0.01%
Fifth Third Bancorp	FITB	13,534	0.12%	2.65%	15.00%	18.05%	0.02%
First Horizon National	FHN	2,427	0.00%	0.41%	0.00%	0.41%	0.00%
First Solar Inc.	FSLR	2,612	0.00%	0.00%	-10.50%	-10.50%	0.00%
FirstEnergy Corp.	FE	17,419	0.16%	5.28%	5.00%	10.54%	0.02%
Fiserv Inc.	FISV	10,588	0.00%	0.00%	10.50%	10.50%	0.00%
FLIR Systems	FLIR	3,331	0.03%	1.44%	7.00%	8.54%	0.00%
Flowserve Corp.	FLS	7,259	0.07%	0.99%	8.50%	9.57%	0.01%
Fluor Corp.	FLR	9,691	0.09%	1.10%	11.50%	12.73%	0.01%
FMC Corp.	FMC	7,961	0.07%	0.93%	13.50%	14.56%	0.01%
FMC Technologies	FTI	9,797	0.00%	0.00%	19.50%	19.50%	0.00%
Ford Motor	F	48,650	0.45%	1.57%	14.00%	15.79%	0.07%
Forest Labs.	FRX	9,261	0.00%	0.00%	-12.50%	-12.50%	0.00%
Fossil Inc.	FOSL	5,475	0.00%	0.00%	19.00%	19.00%	0.00%
Franklin Resources	BEN	26,850	0.25%	0.92%	12.50%	13.54%	0.03%
Freeport-McMoRan C&G	FCX	31,973	0.29%	3.89%	8.50%	12.72%	0.04%
Frontier Communic.	FTR	4,184	0.04%	9.55%	6.00%	16.12%	0.01%
GameStop Corp.	GME	2,983	0.03%	4.05%	9.50%	13.93%	0.00%
Gannett Co.	GCI	4,116	0.04%	4.47%	5.50%	10.22%	0.00%
Gap (The) Inc.	GPS	14,731	0.14%	1.73%	11.00%	12.92%	0.02%
Gen'l Dynamics	GD	24,369	0.22%	2.96%	3.00%	6.05%	0.01%
Gen'l Electric	GE	216,962	1.99%	3.67%	13.50%	17.67%	0.35%
Gen'l Mills	GIS	26,211	0.24%	3.25%	7.00%	10.48%	0.03%
Genuine Parts	GPC	9,860	0.09%	3.12%	11.50%	14.98%	0.01%
Genworth Fin'l	GNW	3,567	0.00%	0.00%	34.50%	34.50%	0.00%
Gilead Sciences	GILD	55,026	0.00%	0.00%	7.50%	7.50%	0.00%
Goldman Sachs	GS	61,574	0.57%	1.58%	6.50%	8.18%	0.05%
Goodyear Tire	GT	3,288	0.00%	0.00%	35.00%	35.00%	0.00%
Google Inc.	GOOG	232,053	0.00%	0.00%	15.50%	15.50%	0.00%
Grainger (W.W.)	GWV	13,935	0.13%	1.72%	15.50%	17.49%	0.02%
Halliburton Co.	HAL	32,109	0.30%	1.04%	15.00%	16.20%	0.05%
Harley-Davidson	HOG	10,822	0.10%	1.29%	26.00%	27.63%	0.03%
Harman Int'l	HAR	2,951	0.03%	1.38%	18.00%	19.63%	0.01%
Harris Corp.	HRS	5,548	0.05%	3.01%	5.50%	8.68%	0.00%
Hartford Fin'l Svcs.	HIG	9,816	0.09%	1.78%	19.00%	21.12%	0.02%
Hasbro Inc.	HAS	4,637	0.04%	4.05%	6.50%	10.81%	0.00%
HCP Inc.	HCP	-	0.00%	4.43%	0.00%	4.43%	0.00%
Health Care REIT	HCN	-	0.00%	5.17%	0.00%	5.17%	0.00%
Heinz (H.J.)	HNZ	18,553	0.17%	3.56%	6.50%	10.29%	0.02%
Helmerich & Payne	HP	5,853	0.05%	1.08%	18.50%	19.78%	0.01%
Hershey Co.	HSY	16,083	0.15%	2.33%	12.50%	15.12%	0.02%
Hess Corp.	HES	17,758	0.16%	0.76%	10.50%	11.34%	0.02%
Hewlett-Packard	HPQ	27,617	0.25%	3.78%	-2.00%	1.70%	0.00%

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Home Depot	HD	91,361	0.84%	1.90%	13.50%	15.66%	0.13%
Honeywell Int'l	HON	49,932	0.46%	2.57%	12.00%	14.88%	0.07%
Hormel Foods	HRL	8,087	0.07%	2.21%	10.00%	12.43%	0.01%
Horton D.R.	DHI	6,251	0.06%	0.77%	30.00%	31.00%	0.02%
Hospira Inc.	HSP	5,148	0.00%	0.00%	5.50%	5.50%	0.00%
Host Hotels & Resorts	HST	-	0.00%	2.31%	0.00%	2.31%	0.00%
Hudson City Bancorp	HCBK	4,009	0.04%	3.96%	25.00%	29.95%	0.01%
Humana Inc.	HUM	10,759	0.10%	1.53%	7.50%	9.14%	0.01%
Huntington Bancshs.	HBAN	5,424	0.00%	2.52%	0.00%	2.52%	0.00%
Illinois Tool Works	ITW	28,127	0.26%	2.51%	13.00%	15.84%	0.04%
Ingersoll-Rand	IR	14,246	0.13%	1.36%	17.00%	18.59%	0.02%
Int'l Business Mach.	IBM	217,749	2.00%	1.84%	9.50%	11.51%	0.23%
Int'l Flavors & Frag.	IFF	5,469	0.05%	2.03%	8.50%	10.70%	0.01%
Int'l Game Tech.	IGT	3,654	0.03%	2.04%	13.00%	15.31%	0.01%
Int'l Paper	IP	17,377	0.16%	3.03%	12.50%	15.91%	0.03%
Integrus Energy	TEG	4,069	0.04%	5.21%	6.00%	11.52%	0.00%
Intel Corp.	INTC	102,181	0.94%	4.39%	12.00%	16.92%	0.16%
IntercontinentalExch.	ICE	9,046	0.00%	0.00%	11.50%	11.50%	0.00%
Interpublic Group	IPG	4,672	0.04%	2.22%	18.50%	21.13%	0.01%
Intuit Inc.	INTU	18,018	0.17%	1.13%	13.00%	14.28%	0.02%
Intuitive Surgical	ISRG	19,389	0.00%	0.00%	16.50%	16.50%	0.00%
Invesco Ltd.	IVZ	11,532	0.11%	2.81%	17.50%	20.80%	0.02%
Iron Mountain	IRM	5,797	0.05%	3.49%	12.00%	15.91%	0.01%
Jabil Circuit	JBL	3,950	0.04%	1.77%	16.50%	18.56%	0.01%
Jacobs Engineering	JEC	5,503	0.00%	0.00%	12.00%	12.00%	0.00%
JDS Uniphase	JDSU	3,110	0.00%	0.00%	12.00%	12.00%	0.00%
Johnson & Johnson	JNJ	193,628	1.78%	3.48%	6.00%	9.69%	0.17%
Johnson Controls	JCI	20,777	0.19%	2.50%	13.00%	15.83%	0.03%
Joy Global	JOY	6,586	0.06%	1.13%	10.50%	11.75%	0.01%
JPMorgan Chase	JPM	165,738	1.52%	3.09%	9.00%	12.37%	0.19%
Juniper Networks	JNPR	10,198	0.00%	0.00%	10.50%	10.50%	0.00%
Kellogg	K	19,955	0.18%	3.16%	7.50%	10.90%	0.02%
KeyCorp	KEY	7,883	0.00%	2.38%	0.00%	2.38%	0.00%
Kimberly-Clark	KMB	32,926	0.30%	3.53%	9.00%	12.85%	0.04%
Kimco Realty	KIM	-	0.00%	4.32%	0.00%	4.32%	0.00%
Kinder Morgan Inc.	KMI	36,061	0.00%	4.17%	0.00%	4.17%	0.00%
KLA-Tencor	KLAC	7,898	0.07%	3.37%	17.50%	21.46%	0.02%
Kohl's Corp.	KSS	9,827	0.09%	3.22%	11.00%	14.57%	0.01%
Kraft Foods Group	KRFT	26,298	0.00%	4.51%	0.00%	4.51%	0.00%
Kroger Co.	KR	13,343	0.12%	2.31%	10.00%	12.54%	0.02%
L-3 Communic.	LLL	7,277	0.07%	2.67%	4.00%	6.78%	0.00%
Laboratory Corp.	LH	8,230	0.00%	0.00%	10.00%	10.00%	0.00%
Lam Research	LRCX	6,309	0.00%	0.00%	10.50%	10.50%	0.00%
Lauder (Estee)	EL	22,632	0.21%	1.23%	18.50%	19.96%	0.04%
Legg Mason	LM	3,388	0.03%	1.71%	14.00%	15.95%	0.00%
Leggett & Platt	LEG	3,776	0.03%	4.34%	16.00%	21.03%	0.01%
Lennar Corp.	LEN	7,266	0.00%	0.42%	0.00%	0.42%	0.00%
Leucadia National	LUK	5,804	0.00%	1.05%	0.00%	1.05%	0.00%
Life Technologies	LIFE	8,413	0.00%	0.00%	9.50%	9.50%	0.00%
Lilly (Eli)	LLY	54,827	0.50%	4.00%	-6.50%	-2.76%	-0.01%
Limited Brands	LTD	13,366	0.12%	2.15%	10.50%	12.88%	0.02%
Lincoln Nat'l Corp.	LNC	6,998	0.06%	1.89%	7.00%	9.02%	0.01%
Linear Technology	LLTC	7,838	0.07%	3.06%	6.50%	9.76%	0.01%
Lockheed Martin	LMT	30,039	0.28%	5.06%	3.00%	8.21%	0.02%
Loews Corp.	L	15,936	0.15%	0.62%	10.50%	11.19%	0.02%
Lorillard Inc.	LO	14,899	0.14%	5.41%	13.50%	19.64%	0.03%
Lowe's Cos.	LOW	39,451	0.36%	1.82%	13.50%	15.57%	0.06%
LSI Corp.	LSI	3,822	0.00%	0.00%	37.00%	37.00%	0.00%
LyondellBasell Inds NV	LYB	-	0.00%	0.00%	8.92%	8.92%	0.00%
M&T Bank Corp.	MTB	12,524	0.12%	2.85%	10.50%	13.65%	0.02%

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Macy's Inc.	M	14,657	0.13%	2.56%	16.50%	19.48%	0.03%
Marathon Oil Corp.	MRO	21,406	0.00%	2.24%	0.00%	2.24%	0.00%
Marathon Petroleum	MPC	21,025	0.00%	2.26%	0.00%	2.26%	0.00%
Marriott Int'l	MAR	11,580	0.11%	1.41%	17.00%	18.65%	0.02%
Marsh & McLennan	MMC	18,790	0.17%	2.66%	15.00%	18.06%	0.03%
Masco Corp.	MAS	5,684	0.05%	1.84%	54.00%	56.83%	0.03%
MasterCard Inc.	MA	60,747	0.56%	0.25%	15.00%	15.29%	0.09%
Mattel Inc.	MAT	12,389	0.11%	3.43%	9.50%	13.26%	0.02%
McCormick & Co.	MKC	8,363	0.08%	2.15%	9.00%	11.34%	0.01%
McDonald's Corp.	MCD	89,073	0.82%	3.47%	8.50%	12.26%	0.10%
McGraw-Hill	MHP	14,888	0.00%	1.90%	0.00%	1.90%	0.00%
McKesson Corp.	MCK	22,759	0.21%	0.91%	11.00%	12.01%	0.03%
Mead Johnson Nutrition	MJN	13,324	0.12%	1.83%	12.50%	14.56%	0.02%
MeadWestvaco	MWV	5,536	0.05%	3.41%	10.50%	14.27%	0.01%
Medtronic Inc.	MDT	41,810	0.38%	2.61%	5.50%	8.25%	0.03%
Merck & Co.	MRK	125,429	1.15%	4.18%	1.00%	5.22%	0.06%
MetLife Inc.	MET	34,940	0.32%	2.25%	12.00%	14.52%	0.05%
Metro PCS Communic.	PCS	3,586	0.00%	0.00%	8.00%	8.00%	0.00%
Microchip Technology	MCHP	6,286	0.06%	4.36%	11.00%	15.84%	0.01%
Micron Technology	MU	6,329	0.00%	0.00%	21.00%	21.00%	0.00%
Microsoft Corp.	MSFT	227,057	2.09%	3.41%	11.00%	14.79%	0.31%
Molex Inc.	MOLX	4,795	0.04%	3.25%	7.00%	10.48%	0.00%
Molson Coors Brewing	TAP	7,821	0.07%	2.97%	4.50%	7.60%	0.01%
Mondelez Int'l	MDLZ	45,067	0.41%	2.05%	1.00%	3.07%	0.01%
Monsanto Co.	MON	50,247	0.46%	1.60%	10.50%	12.27%	0.06%
Monster Beverage	MNST	8,948	0.00%	0.00%	19.50%	19.50%	0.00%
Moody's Corp.	MCO	11,114	0.10%	1.60%	10.50%	12.27%	0.01%
Morgan Stanley	MS	37,072	0.34%	1.07%	23.50%	24.82%	0.08%
Mosaic Company	MOS	23,900	0.22%	1.78%	15.50%	17.56%	0.04%
Motorola Solutions	MSI	15,394	0.00%	1.89%	0.00%	1.89%	0.00%
Murphy Oil Corp.	MUR	11,557	0.11%	2.10%	17.00%	19.46%	0.02%
Mylan Inc.	MYL	11,141	0.00%	0.00%	12.00%	12.00%	0.00%
Nabors Inds.	NBR	4,123	0.00%	0.00%	17.50%	17.50%	0.00%
Nasdaq OMX Group	NDAQ	4,138	0.04%	2.08%	8.00%	10.25%	0.00%
National Oilwell Varco	NOV	28,588	0.26%	0.84%	15.00%	15.97%	0.04%
NetApp Inc.	NTAP	11,968	0.00%	0.00%	4.50%	4.50%	0.00%
Netflix Inc.	NFLX	5,027	0.00%	0.00%	7.00%	7.00%	0.00%
Newell Rubbermaid	NWL	6,319	0.06%	2.73%	14.00%	17.11%	0.01%
Newfield Exploration	NFX	3,488	0.00%	0.00%	0.00%	0.00%	0.00%
Newmont Mining	NEM	22,573	0.21%	3.08%	-8.00%	-5.17%	-0.01%
News Corp.	NWS	59,973	0.55%	0.67%	13.50%	14.26%	0.08%
NextEra Energy	NEE	29,290	0.27%	3.68%	4.00%	7.83%	0.02%
NIKE Inc. 'B'	NKE	46,641	0.43%	1.62%	11.50%	13.31%	0.06%
NiSource Inc.	NI	7,653	0.07%	3.88%	10.50%	14.79%	0.01%
Noble Corp.	NE	8,764	0.00%	0.00%	13.00%	13.00%	0.00%
Noble Energy	NBL	17,923	0.16%	0.99%	17.00%	18.16%	0.03%
Nordstrom Inc.	JWN	10,392	0.10%	2.26%	14.00%	16.58%	0.02%
Norfolk Southern	NSC	19,348	0.18%	3.27%	11.50%	15.15%	0.03%
Northeast Utilities	NU	12,173	0.11%	3.66%	8.00%	11.95%	0.01%
Northern Trust Corp.	NTRS	11,976	0.11%	2.40%	6.50%	9.06%	0.01%
Northrop Grumman	NOC	16,643	0.15%	3.37%	4.00%	7.50%	0.01%
NRG Energy	NRG	5,235	0.00%	1.57%	0.00%	1.57%	0.00%
Nucor Corp.	NUE	13,706	0.13%	3.48%	45.00%	50.05%	0.06%
NVIDIA Corp.	NVDA	7,598	0.07%	2.47%	12.50%	15.28%	0.01%
NYSE Euronext	NYX	7,732	0.07%	3.79%	7.00%	11.06%	0.01%
O'Reilly Automotive	ORLY	10,295	0.00%	0.00%	13.50%	13.50%	0.00%
Occidental Petroleum	OXY	62,336	0.57%	2.92%	10.00%	13.21%	0.08%
Omnicom Group	OMC	13,053	0.12%	2.43%	12.50%	15.23%	0.02%
ONEOK Inc.	OKE	8,626	0.08%	3.23%	11.50%	15.10%	0.01%
Oracle Corp.	ORCL	157,966	1.45%	0.72%	9.00%	9.78%	0.14%

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Owens-Illinois	OI	3,454	0.00%	0.00%	7.50%	7.50%	0.00%
PACCAR Inc.	PCAR	15,751	0.14%	1.79%	24.00%	26.22%	0.04%
Pall Corp.	PLL	6,691	0.06%	1.66%	8.00%	9.79%	0.01%
Parker-Hannifin	PH	12,604	0.12%	1.94%	16.50%	18.76%	0.02%
Patterson Cos.	PDCO	3,517	0.03%	1.65%	10.00%	11.82%	0.00%
Paychex Inc.	PAYX	11,315	0.10%	4.28%	7.50%	12.10%	0.01%
Peabody Energy	BTU	6,970	0.06%	1.31%	1.50%	2.83%	0.00%
Penney (J.C.)	JCP	4,279	0.00%	0.00%	11.50%	11.50%	0.00%
Pentair Ltd.	PNR	10,132	0.09%	1.83%	18.00%	20.16%	0.02%
People's United Fin'l	PBCT	4,055	0.04%	5.30%	23.50%	30.05%	0.01%
Pepco Holdings	POM	4,435	0.04%	5.59%	7.00%	12.98%	0.01%
PepsiCo Inc.	PEP	106,507	0.98%	3.22%	8.00%	11.48%	0.11%
PerkinElmer Inc.	PKI	3,598	0.03%	0.89%	12.50%	13.50%	0.00%
Perrigo Co.	PRGO	9,701	0.09%	0.35%	18.00%	18.41%	0.02%
PetSmart Inc.	PETM	7,325	0.07%	1.01%	15.50%	16.67%	0.01%
Pfizer Inc.	PFE	185,095	1.70%	3.82%	12.00%	16.28%	0.28%
PG&E Corp.	PCG	17,129	0.16%	4.55%	3.50%	8.21%	0.01%
Philip Morris Int'l	PM	140,393	1.29%	4.06%	11.00%	15.51%	0.20%
Phillips 66	PSX	32,267	0.00%	1.94%	0.00%	1.94%	0.00%
Pinnacle West Capital	PNW	5,598	0.05%	4.31%	5.00%	9.53%	0.00%
Pioneer Natural Res.	PXD	12,933	0.12%	0.08%	31.00%	31.10%	0.04%
Pitney Bowes	PBI	2,112	0.02%	12.83%	-5.00%	7.19%	0.00%
Plum Creek Timber	PCL	7,173	0.07%	3.79%	7.50%	11.57%	0.01%
PNC Financial Serv.	PNC	30,656	0.28%	2.76%	7.50%	10.47%	0.03%
PPG Inds.	PPG	20,414	0.19%	1.77%	12.50%	14.49%	0.03%
PPL Corp.	PPL	16,569	0.15%	5.15%	6.50%	11.98%	0.02%
Praxair Inc.	PX	32,559	0.30%	2.26%	13.00%	15.55%	0.05%
Precision Castparts	PCP	27,351	0.25%	0.06%	12.00%	12.07%	0.03%
Price (T. Rowe) Group	TROW	16,577	0.15%	2.23%	13.50%	16.03%	0.02%
priceline.com	PCLN	30,419	0.00%	0.00%	25.00%	25.00%	0.00%
Principal Fin'l Group	PFG	8,253	0.08%	2.99%	8.00%	11.23%	0.01%
Procter & Gamble	PG	185,846	1.71%	3.31%	9.50%	13.12%	0.22%
Progressive (Ohio)	PGR	12,682	0.12%	2.10%	10.50%	12.82%	0.01%
Prologis	PLD	-	0.00%	3.25%	0.00%	3.25%	0.00%
Prudential Fin'l	PRU	24,615	0.23%	3.11%	9.00%	12.39%	0.03%
Public Serv. Enterprise	PEG	15,318	0.14%	4.79%	-2.00%	2.69%	0.00%
Public Storage	PSA	-	0.00%	3.17%	0.00%	3.17%	0.00%
PulteGroup Inc.	PHM	6,859	0.00%	0.00%	0.00%	0.00%	0.00%
QEP Resources	QEP	5,368	0.00%	0.37%	0.00%	0.37%	0.00%
Qualcomm Inc.	QCOM	104,936	0.96%	1.63%	12.00%	13.83%	0.13%
Quanta Services	PWR	5,753	0.00%	0.00%	22.50%	22.50%	0.00%
Quest Diagnostics	DGX	9,337	0.09%	2.04%	7.00%	9.18%	0.01%
Ralph Lauren	RL	13,573	0.12%	1.08%	11.50%	12.70%	0.02%
Range Resources Corp.	RRC	10,020	0.09%	0.25%	28.50%	28.82%	0.03%
Raytheon Co.	RTN	19,062	0.18%	3.56%	5.00%	8.74%	0.02%
Red Hat Inc.	RHT	10,198	0.00%	0.00%	18.50%	18.50%	0.00%
Regions Financial	RF	9,877	0.00%	0.57%	0.00%	0.57%	0.00%
Republic Services	RSG	10,759	0.10%	3.25%	11.00%	14.61%	0.01%
Reynolds American	RAI	23,034	0.21%	5.73%	9.00%	15.25%	0.03%
Robert Half Int'l	RHI	4,368	0.04%	1.99%	28.00%	30.55%	0.01%
Rockwell Automation	ROK	11,567	0.11%	2.27%	10.00%	12.50%	0.01%
Rockwell Collins	COL	8,268	0.08%	2.06%	8.50%	10.74%	0.01%
Roper Inds.	ROP	10,826	0.10%	0.60%	13.50%	14.18%	0.01%
Ross Stores	ROST	11,817	0.11%	1.05%	17.00%	18.23%	0.02%
Rowan Cos. plc	RDC	3,841	0.00%	0.00%	12.00%	12.00%	0.00%
Ryder System	R	2,511	0.02%	2.52%	18.00%	20.97%	0.00%
Safeway Inc.	SWY	4,246	0.04%	4.23%	7.50%	12.05%	0.00%
SAIC Inc.	SAI	3,796	0.03%	4.32%	6.00%	10.58%	0.00%
salesforce.com	CRM	23,606	0.00%	0.00%	38.50%	38.50%	0.00%
SanDisk Corp.	SNDK	10,450	0.00%	0.00%	9.50%	9.50%	0.00%

Ex-Ante Market Risk Premium 2012
Market DCF Method Based - Value Line

SCANA Corp.	SCG	5,999	0.06%	4.43%	4.00%	8.61%	0.00%
Schlumberger Ltd.	SLB	91,828	0.84%	1.59%	16.50%	18.35%	0.15%
Schwab (Charles)	SCHW	18,118	0.17%	1.69%	10.00%	11.86%	0.02%
Scripps Networks	SNI	8,539	0.08%	0.84%	14.50%	15.46%	0.01%
Seagate Technology	STX	11,660	0.11%	5.13%	13.50%	19.32%	0.02%
Sealed Air	SEE	3,377	0.03%	2.99%	11.50%	14.83%	0.00%
Sempra Energy	SRE	17,097	0.16%	3.51%	4.50%	8.17%	0.01%
Sherwin-Williams	SHW	15,506	0.14%	1.26%	16.50%	17.97%	0.03%
Sigma-Aldrich	SIAL	8,866	0.08%	1.09%	7.50%	8.67%	0.01%
Simon Property Group	SPG	-	0.00%	2.79%	0.00%	2.79%	0.00%
SLM Corporation	SLM	8,536	0.08%	2.98%	7.50%	10.70%	0.01%
Smucker (J.M.)	SJM	9,276	0.09%	2.43%	8.00%	10.62%	0.01%
Snap-on Inc.	SNA	4,550	0.04%	1.95%	12.00%	14.18%	0.01%
Southern Co.	SO	37,307	0.34%	4.73%	5.00%	9.97%	0.03%
Southwest Airlines	LUV	7,572	0.07%	0.39%	20.00%	20.47%	0.01%
Southwestern Energy	SWN	11,577	0.00%	0.00%	8.50%	8.50%	0.00%
Spectra Energy	SE	17,553	0.16%	4.61%	7.50%	12.46%	0.02%
Sprint Nextel Corp.	S	16,877	0.00%	0.00%	0.00%	0.00%	0.00%
St. Jude Medical	STJ	11,319	0.10%	2.57%	10.50%	13.34%	0.01%
Stanley Black & Decker	SWK	12,266	0.11%	2.70%	13.00%	16.05%	0.02%
Staples Inc.	SPLS	7,564	0.07%	3.92%	11.00%	15.35%	0.01%
Starbucks Corp.	SBUX	40,452	0.37%	1.58%	21.00%	22.91%	0.09%
Starwood Hotels	HOT	11,155	0.10%	2.20%	19.00%	21.62%	0.02%
State Street Corp.	STT	21,716	0.20%	2.16%	7.50%	9.82%	0.02%
Stericycle Inc.	SRCL	7,921	0.00%	0.00%	12.00%	12.00%	0.00%
Stryker Corp.	SYK	20,972	0.19%	1.92%	7.50%	9.56%	0.02%
SunTrust Banks	STI	14,961	0.00%	1.25%	0.00%	1.25%	0.00%
Symantec Corp.	SYMC	12,643	0.00%	0.00%	13.50%	13.50%	0.00%
Sysco Corp.	SYT	18,622	0.17%	3.53%	10.00%	13.88%	0.02%
Target Corp.	TGT	38,570	0.35%	2.49%	10.50%	13.25%	0.05%
TE Connectivity	TEL	15,798	0.15%	2.28%	11.50%	14.04%	0.02%
TECO Energy	TE	3,622	0.03%	5.26%	5.50%	11.05%	0.00%
Tenet Healthcare	THC	3,339	0.00%	0.00%	31.50%	31.50%	0.00%
Teradata Corp.	TDC	10,359	0.00%	0.00%	17.50%	17.50%	0.00%
Teradyne Inc.	TER	3,108	0.00%	0.00%	9.00%	9.00%	0.00%
Tesoro Corp.	TSO	6,074	0.06%	1.38%	40.00%	41.93%	0.02%
Texas Instruments	TXN	34,454	0.32%	2.73%	4.50%	7.35%	0.02%
Textron Inc.	TXT	6,846	0.06%	0.33%	25.00%	25.41%	0.02%
Thermo Fisher Sci.	TMO	22,845	0.21%	0.95%	10.50%	11.55%	0.02%
Tiffany & Co.	TIF	7,230	0.07%	2.24%	13.50%	16.04%	0.01%
Time Warner	TWX	45,049	0.41%	2.19%	13.50%	15.99%	0.07%
Time Warner Cable	TWC	29,184	0.27%	2.33%	17.00%	19.73%	0.05%
TJX Companies	TJX	30,286	0.28%	1.11%	13.00%	14.25%	0.04%
Torchmark Corp.	TMK	4,852	0.04%	1.17%	6.50%	7.75%	0.00%
Total System Svcs.	TSS	4,026	0.04%	1.86%	8.00%	10.01%	0.00%
Travelers Cos.	TRV	27,435	0.25%	2.56%	9.00%	11.79%	0.03%
TripAdvisor Inc.	TRIP	5,969	0.00%	0.00%	15.70%	15.70%	0.00%
Tyco Int'l	TYC	13,299	0.00%	0.00%	0.00%	0.00%	0.00%
Tyson Foods 'A'	TSN	7,011	0.06%	1.03%	12.50%	13.66%	0.01%
U.S. Bancorp	USB	60,198	0.55%	2.69%	13.50%	16.55%	0.09%
U.S. Steel Corp.	X	3,411	0.00%	0.85%	0.00%	0.85%	0.00%
Union Pacific	UNP	58,712	0.54%	2.21%	15.50%	18.05%	0.10%
United Parcel Serv.	UPS	70,510	0.65%	3.09%	11.50%	14.95%	0.10%
United Technologies	UTX	75,221	0.69%	2.61%	10.00%	12.87%	0.09%
UnitedHealth Group	UNH	55,093	0.51%	1.56%	12.50%	14.26%	0.07%
Unum Group	UNM	5,697	0.05%	2.51%	6.00%	8.66%	0.00%
Urban Outfitters	URBN	5,632	0.00%	0.00%	14.00%	14.00%	0.00%
V.F. Corp.	VFC	16,507	0.15%	2.32%	15.00%	17.67%	0.03%
Valero Energy	VLO	18,724	0.17%	2.07%	26.00%	28.61%	0.05%
Varian Medical Sys.	VAR	7,774	0.00%	0.00%	11.50%	11.50%	0.00%

Ex-Ante Market Risk Premium 2012
Market DCF Method Based - Value Line

Ventas Inc.	VTR	-	0.00%	4.05%	0.00%	4.05%	0.00%
VeriSign Inc.	VRSN	5,929	0.00%	0.00%	23.00%	23.00%	0.00%
Verizon Communic.	VZ	124,088	1.14%	4.74%	8.50%	13.64%	0.16%
Viacom Inc. 'B'	VIAB	27,199	0.25%	2.09%	17.00%	19.45%	0.05%
Visa Inc.	V	121,014	1.11%	0.88%	19.50%	20.55%	0.23%
Vornado R'lty Trust	VNO	14,806	0.14%	3.47%	13.00%	16.92%	0.02%
Vulcan Materials	VMC	6,700	0.00%	0.08%	0.00%	0.08%	0.00%
Wal-Mart Stores	WMT	228,982	2.10%	2.33%	9.50%	12.05%	0.25%
Walgreen Co.	WAG	31,360	0.29%	3.01%	8.50%	11.77%	0.03%
Washington Post	WPO	2,668	0.02%	2.71%	6.50%	9.39%	0.00%
Waste Management	WM	15,638	0.14%	4.36%	5.50%	10.10%	0.01%
Waters Corp.	WAT	7,609	0.00%	0.00%	10.50%	10.50%	0.00%
Watson Pharmac.	WPI	11,401	0.00%	0.00%	17.00%	17.00%	0.00%
WellPoint Inc.	WLP	18,991	0.17%	1.90%	8.00%	10.05%	0.02%
Wells Fargo	WFC	180,799	1.66%	2.58%	11.50%	14.38%	0.24%
Western Digital	WDC	10,223	0.09%	2.38%	5.50%	8.01%	0.01%
Western Union	WU	8,201	0.08%	3.65%	6.50%	10.39%	0.01%
Weyerhaeuser Co.	WY	15,139	0.00%	2.43%	0.00%	2.43%	0.00%
Whirlpool Corp.	WHR	7,891	0.07%	1.98%	6.00%	8.10%	0.01%
Whole Foods Market	WFM	16,627	0.15%	0.89%	22.50%	23.59%	0.04%
Williams Cos.	WMB	20,077	0.18%	4.37%	9.00%	13.76%	0.03%
Windstream Corp.	WIN	4,946	0.05%	11.89%	9.50%	22.52%	0.01%
Wisconsin Energy	WEC	8,474	0.08%	3.69%	6.50%	10.43%	0.01%
WPX Energy	WPX	2,949	0.00%	0.00%	0.00%	0.00%	0.00%
Wyndham Worldwide	WYN	7,414	0.07%	1.74%	12.50%	14.46%	0.01%
Wynn Resorts	WYNN	11,161	0.10%	3.60%	22.50%	26.91%	0.03%
Xcel Energy Inc.	XEL	12,951	0.12%	4.14%	6.00%	10.39%	0.01%
Xerox Corp.	XRX	8,641	0.08%	2.50%	9.50%	12.24%	0.01%
Xilinx Inc.	XLNX	9,331	0.09%	2.46%	7.50%	10.14%	0.01%
XL Group plc	XL	7,825	0.07%	1.77%	12.00%	13.98%	0.01%
Xylem Inc.	XYL	4,989	0.00%	0.00%	5.03%	5.03%	0.00%
Yahoo! Inc.	YHOO	23,245	0.00%	0.00%	12.00%	12.00%	0.00%
Yum! Brands	YUM	29,588	0.27%	2.09%	11.50%	13.83%	0.04%
Zimmer Holdings	ZMH	11,578	0.11%	1.20%	9.50%	10.81%	0.01%
Zions Bancorp.	ZION	3,915	0.00%	0.19%	0.00%	0.19%	0.00%

S&P 500 DCF-derived return:

14.21%

Sources and Notes:

[2]: Bloomberg as of 10/22/14.

[4], [6], [7]: Valueline as of 10/22/14.

Ex-Ante Market Risk Premium 2013
Market DCF Method Based - Value Line

		S&P 500 DCF- derived return	10-year Treasury bond yield as of year end 2013 (30 day average)	Implied MRP			
		[1]	[2]	[3]			
		12.83%	2.86%	9.97%			
Company	Ticker	Market Cap	Weight in Index	Estimated Dividend Yield	Long-term Growth Est.	DCF Result	Weighted DCF Result
		(\$ mil)	(%)	(%)	(%)	(%)	(%)
		[4]	[5]	[6]	[7]	[8]	[9]
3M Company	MMM	93,106	0.65%	2.47%	7.50%	10.16%	0.07%
Abbott Labs.	ABT	59,296	0.42%	2.30%	-5.50%	-3.33%	-0.01%
AbbVie Inc.	ABBV	84,148	0.00%	3.02%	0.00%	3.02%	0.00%
Abercrombie & Fitch	ANF	2,566	0.02%	2.38%	15.50%	18.25%	0.00%
Accenture Plc	ACN	52,054	0.36%	2.26%	8.00%	10.44%	0.04%
ACE Limited	ACE	34,922	0.24%	2.45%	9.50%	12.18%	0.03%
Actavis plc	ACT	22,128	0.00%	0.00%	14.00%	14.00%	0.00%
Adobe Systems	ADBE	29,898	0.00%	0.00%	6.00%	6.00%	0.00%
ADT Corp. (The)	ADT	8,556	0.00%	1.22%	0.00%	1.22%	0.00%
AES Corp.	AES	10,733	0.08%	1.38%	22.00%	23.68%	0.02%
Aetna Inc.	AET	25,104	0.18%	1.32%	11.00%	12.47%	0.02%
Aflac Inc.	AFL	31,254	0.22%	2.20%	8.50%	10.89%	0.02%
Agilent Technologies	A	19,007	0.13%	0.92%	7.00%	7.98%	0.01%
AGL Resources	GAS	5,598	0.04%	3.99%	8.00%	12.31%	0.00%
Air Products & Chem.	APD	23,828	0.17%	2.50%	9.00%	11.73%	0.02%
Airgas Inc.	ARG	8,169	0.06%	1.92%	14.00%	16.19%	0.01%
Akamai Technologies	AKAM	8,453	0.00%	0.00%	14.50%	14.50%	0.00%
Alcoa Inc.	AA	11,156	0.08%	1.15%	16.00%	17.33%	0.01%
Alexion Pharmac.	ALXN	26,055	0.00%	0.00%	26.50%	26.50%	0.00%
Allegheny Techn.	ATI	3,784	0.03%	2.06%	14.50%	16.86%	0.00%
Allergan Inc.	AGN	32,656	0.23%	0.18%	12.50%	12.70%	0.03%
Allstate Corp.	ALL	24,519	0.17%	1.86%	15.50%	17.65%	0.03%
Altera Corp.	ALTR	10,333	0.07%	1.87%	3.00%	4.93%	0.00%
Altria Group	MO	76,424	0.53%	5.02%	11.00%	16.57%	0.09%
Amazon.com	AMZN	185,211	0.00%	0.00%	48.00%	48.00%	0.00%
Amer. Elec. Power	AEP	22,619	0.16%	4.35%	5.50%	10.09%	0.02%
Amer. Express	AXP	95,586	0.67%	1.10%	9.00%	10.20%	0.07%
Amer. Int'l Group	AIG	75,090	0.00%	0.78%	0.00%	0.78%	0.00%
Amer. Tower 'A'	AMT	31,105	0.22%	1.62%	20.50%	22.45%	0.05%
Ameren Corp.	AEE	8,722	0.06%	4.45%	-0.50%	3.93%	0.00%
Ameriprise Fin'l	AMP	22,220	0.16%	1.83%	13.00%	15.07%	0.02%
AmerisourceBergen	ABC	16,225	0.11%	1.34%	13.50%	15.02%	0.02%
Ametek Inc.	AME	12,867	0.09%	0.46%	10.50%	11.01%	0.01%
Amgen	AMGN	86,239	0.60%	2.13%	10.00%	12.34%	0.07%
Amphenol Corp.	APH	13,972	0.10%	0.90%	8.50%	9.48%	0.01%
Anadarko Petroleum	APC	39,360	0.28%	0.92%	74.50%	76.11%	0.21%
Analog Devices	ADI	15,782	0.11%	2.68%	11.50%	14.49%	0.02%
Aon plc	AON	25,129	0.18%	0.84%	15.50%	16.47%	0.03%
Apache Corp.	APA	34,862	0.24%	0.93%	8.00%	9.00%	0.02%
Apartment Investment	AIV	-	0.00%	3.70%	0.00%	3.70%	0.00%
Apple Inc.	AAPL	512,271	3.59%	2.16%	14.50%	16.97%	0.61%
Applied Materials	AMAT	20,998	0.15%	2.47%	19.00%	21.94%	0.03%
Archer Daniels Midl'd	ADM	28,720	0.20%	2.20%	6.00%	8.33%	0.02%
Assurant Inc.	AIZ	4,860	0.03%	1.51%	7.50%	9.12%	0.00%
AT&T Inc.	T	185,653	1.30%	5.23%	7.00%	12.60%	0.16%
Autodesk Inc.	ADSK	11,142	0.00%	0.00%	8.00%	8.00%	0.00%
Automatic Data Proc.	ADP	38,905	0.27%	2.38%	9.00%	11.59%	0.03%

Ex-Ante Market Risk Premium 2013
Market DCF Method Based - Value Line

AutoNation Inc.	AN	6,177	0.00%	0.00%	16.00%	16.00%	0.00%
AutoZone Inc.	AZO	16,070	0.00%	0.00%	15.00%	15.00%	0.00%
AvalonBay Communities	AVB	-	0.00%	3.78%	0.00%	3.78%	0.00%
Avery Dennison	AVY	4,924	0.03%	2.35%	10.00%	12.59%	0.00%
Avon Products	AVP	7,530	0.05%	1.38%	16.00%	17.60%	0.01%
Baker Hughes	BHI	24,191	0.17%	1.10%	13.00%	14.24%	0.02%
Ball Corp.	BLL	7,449	0.05%	1.01%	8.50%	9.60%	0.01%
Bank of America	BAC	167,193	0.00%	0.26%	0.00%	0.26%	0.00%
Bank of New York Mellon	BK	39,693	0.28%	1.74%	10.00%	11.91%	0.03%
Bard (C.R.)	BCR	10,417	0.07%	0.63%	8.50%	9.18%	0.01%
Baxter Int'l Inc.	BAX	37,644	0.26%	2.83%	8.50%	11.57%	0.03%
BB&T Corp.	BBT	26,195	0.18%	2.69%	11.00%	13.99%	0.03%
Beam Inc.	BEAM	10,955	0.08%	1.34%	11.50%	12.99%	0.01%
Becton Dickinson	BDX	21,383	0.15%	1.98%	8.50%	10.65%	0.02%
Bed Bath & Beyond	BBBY	16,761	0.00%	0.00%	10.50%	10.50%	0.00%
Bemis Co.	BMS	4,179	0.03%	2.66%	8.00%	10.87%	0.00%
Berkshire Hathaway 'B'	BRK/B	-	0.00%	0.00%	0.00%	0.00%	0.00%
Best Buy Co.	BBY	14,182	0.10%	1.73%	2.50%	4.27%	0.00%
Biogen Idec Inc.	BIIB	66,456	0.00%	0.00%	12.50%	12.50%	0.00%
BlackRock Inc.	BLK	53,431	0.37%	2.13%	8.00%	10.30%	0.04%
Block (H&R)	HRB	7,931	0.06%	3.11%	9.00%	12.39%	0.01%
Boeing	BA	103,967	0.73%	2.11%	11.00%	13.34%	0.10%
BorgWarner	BWA	12,686	0.09%	0.90%	14.00%	15.03%	0.01%
Boston Properties	BXP	-	0.00%	2.58%	0.00%	2.58%	0.00%
Boston Scientific	BSX	16,294	0.00%	0.00%	11.00%	11.00%	0.00%
Bristol-Myers Squibb	BMJ	88,255	0.62%	2.69%	10.00%	12.96%	0.08%
Broadcom Corp. 'A'	BRCM	16,574	0.12%	1.64%	3.00%	4.69%	0.01%
Brown-Forman 'B'	BF/B	16,030	0.11%	1.55%	8.50%	10.18%	0.01%
C.H. Robinson	CHRW	8,713	0.06%	2.45%	8.00%	10.65%	0.01%
CA Inc.	CA	14,949	0.10%	2.99%	5.50%	8.65%	0.01%
Cablevision Sys. 'A'	CVC	4,743	0.03%	3.39%	11.00%	14.76%	0.00%
Cabot Oil & Gas 'A'	COG	16,240	0.11%	0.21%	29.50%	29.77%	0.03%
Cameron Int'l Corp.	CAM	14,183	0.00%	0.00%	16.00%	16.00%	0.00%
Campbell Soup	CPB	13,446	0.09%	2.92%	6.00%	9.10%	0.01%
Capital One Fin'l	COF	44,185	0.31%	1.58%	4.00%	5.64%	0.02%
Cardinal Health	CAH	23,011	0.16%	1.88%	12.00%	14.11%	0.02%
CareFusion Corp.	CFN	8,430	0.00%	0.00%	13.50%	13.50%	0.00%
CarMax Inc.	KMX	10,601	0.00%	0.00%	9.50%	9.50%	0.00%
Carnival Corp.	CCL	30,683	0.21%	2.53%	5.00%	7.66%	0.02%
Caterpillar Inc.	CAT	58,004	0.41%	2.63%	6.00%	8.79%	0.04%
CBRE Group	CBG	8,621	0.00%	0.00%	10.50%	10.50%	0.00%
CBS Corp. 'B'	CBS	37,863	0.27%	0.76%	13.00%	13.86%	0.04%
Celgene Corp.	CELG	69,787	0.00%	0.00%	13.50%	13.50%	0.00%
CenterPoint Energy	CNP	9,889	0.07%	3.68%	6.00%	9.90%	0.01%
CenturyLink Inc.	CTL	18,903	0.13%	6.78%	8.00%	15.32%	0.02%
Cerner Corp.	CERN	19,104	0.00%	0.00%	15.50%	15.50%	0.00%
CF Industries	CF	13,333	0.09%	1.72%	9.50%	11.38%	0.01%
Chesapeake Energy	CHK	17,968	0.13%	1.26%	7.00%	8.35%	0.01%
Chevron Corp.	CVX	240,031	1.68%	3.20%	5.50%	8.88%	0.15%
Chipotle Mex. Grill	CMG	16,564	0.00%	0.00%	18.00%	18.00%	0.00%
Chubb Corp.	CB	24,124	0.17%	1.84%	8.00%	9.99%	0.02%
Cigna Corp.	CI	24,041	0.17%	0.05%	10.50%	10.56%	0.02%
Cincinnati Financial	CINF	8,590	0.06%	3.21%	13.50%	17.14%	0.01%
Cintas Corp.	CTAS	7,175	0.05%	1.30%	9.50%	10.92%	0.01%
Cisco Systems	CSCO	116,652	0.82%	3.12%	7.50%	10.85%	0.09%
Citigroup Inc.	C	158,778	1.11%	1.05%	14.00%	15.20%	0.17%
Citrix Sys.	CTXS	11,466	0.00%	0.00%	13.50%	13.50%	0.00%
Cliffs Natural Res.	CLF	3,830	0.03%	2.40%	-4.00%	-1.70%	0.00%
Clorox Co.	CLX	11,957	0.08%	3.24%	12.50%	16.15%	0.01%
CME Group	CME	26,635	0.19%	2.25%	7.00%	9.41%	0.02%

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CMS Energy Corp.	CMS	7,092	0.05%	4.05%	5.50%	9.77%	0.00%
Coach Inc.	COH	158,635	1.11%	2.39%	8.50%	11.09%	0.12%
Coca-Cola	KO	178,804	1.25%	2.99%	8.00%	11.23%	0.14%
Coca-Cola Enterprises	CCE	11,305	0.08%	1.98%	9.50%	11.67%	0.01%
Cognizant Technology	CTSH	30,068	0.00%	0.00%	20.00%	20.00%	0.00%
Colgate-Palmolive	CL	59,981	0.42%	2.24%	10.00%	12.46%	0.05%
Comcast Corp.	CMCSA	134,721	0.94%	1.51%	11.00%	12.68%	0.12%
Comerica Inc.	CMA	8,728	0.06%	1.43%	12.50%	14.11%	0.01%
Computer Sciences	CSC	8,201	0.06%	1.44%	7.00%	8.54%	0.00%
ConAgra Foods	CAG	14,099	0.10%	2.99%	11.00%	14.32%	0.01%
ConocoPhillips	COP	85,990	0.60%	3.93%	3.50%	7.57%	0.05%
CONSOL Energy	CNX	8,665	0.06%	1.32%	9.00%	10.44%	0.01%
Consol. Edison	ED	16,108	0.11%	4.55%	2.50%	7.16%	0.01%
Constellation Brands	STZ	13,272	0.00%	0.00%	16.00%	16.00%	0.00%
Corning Inc.	GLW	25,655	0.18%	2.26%	2.50%	4.82%	0.01%
Costco Wholesale	COST	52,164	0.37%	1.04%	11.50%	12.66%	0.05%
Covidien Plc	COV	31,151	0.22%	1.90%	6.00%	8.01%	0.02%
Crown Castle Int'l	CCI	21,069	0.15%	1.93%	27.00%	29.45%	0.04%
CSX Corp.	CSX	28,819	0.20%	2.11%	10.00%	12.32%	0.02%
Cummins Inc.	CMI	26,026	0.18%	1.79%	10.50%	12.48%	0.02%
CVS Caremark Corp.	CVS	85,821	0.60%	1.54%	11.50%	13.22%	0.08%
Danaher Corp.	DHR	53,629	0.38%	0.13%	12.00%	12.15%	0.05%
Darden Restaurants	DRI	7,093	0.05%	4.05%	11.00%	15.50%	0.01%
DaVita HealthCare	DVA	13,481	0.00%	0.00%	14.00%	14.00%	0.00%
Deere & Co.	DE	34,885	0.24%	2.24%	7.50%	9.91%	0.02%
Delphi Automotive PLC	DLPH	18,500	0.00%	1.13%	0.00%	1.13%	0.00%
Delta Air Lines	DAL	23,726	0.17%	0.86%	12.50%	13.47%	0.02%
Denbury Resources	DNR	5,993	0.00%	0.00%	13.50%	13.50%	0.00%
Dentsply Int'l	XRAY	6,904	0.05%	0.51%	9.00%	9.56%	0.00%
Devon Energy	DVN	24,815	0.17%	1.44%	7.50%	9.05%	0.02%
Diamond Offshore	DO	7,776	0.05%	6.26%	6.50%	13.17%	0.01%
DIRECTV	DTV	35,774	0.00%	0.00%	16.50%	16.50%	0.00%
Discover Fin'l Svcs.	DFS	26,142	0.18%	1.47%	8.50%	10.09%	0.02%
Discovery Communic.	DISCA	21,752	0.00%	0.00%	15.00%	15.00%	0.00%
Disney (Walt)	DIS	134,316	0.94%	1.15%	11.50%	12.78%	0.12%
Dollar General	DG	19,513	0.00%	0.00%	16.00%	16.00%	0.00%
Dollar Tree Inc.	DLTR	11,774	0.00%	0.00%	15.50%	15.50%	0.00%
Dominion Resources	D	37,397	0.26%	3.68%	5.00%	8.86%	0.02%
Dover Corp.	DOV	16,376	0.11%	1.56%	11.00%	12.73%	0.01%
Dow Chemical	DOW	54,240	0.38%	3.12%	13.00%	16.53%	0.06%
Dr Pepper Snapple	DPS	9,781	0.07%	3.21%	7.50%	10.95%	0.01%
DTE Energy	DTE	11,697	0.08%	4.07%	5.00%	9.27%	0.01%
Du Pont	DD	59,500	0.42%	2.86%	8.00%	11.09%	0.05%
Duke Energy	DUK	48,552	0.34%	4.58%	4.00%	8.76%	0.03%
Dun & Bradstreet	DNB	4,706	0.03%	1.30%	9.00%	10.42%	0.00%
E*Trade Fin'l	ETFC	5,587	0.00%	0.00%	0.00%	0.00%	0.00%
Eastman Chemical	EMN	12,151	0.09%	1.77%	13.00%	15.00%	0.01%
Eaton Corp. plc	ETN	36,337	0.25%	2.19%	9.50%	11.90%	0.03%
eBay Inc.	EBAY	69,954	0.00%	0.00%	14.50%	14.50%	0.00%
Ecolab Inc.	ECL	31,546	0.22%	1.05%	13.00%	14.19%	0.03%
Edison Int'l	EIX	15,039	0.11%	3.08%	1.50%	4.63%	0.00%
Edwards Lifesciences	EW	7,154	0.00%	0.00%	15.50%	15.50%	0.00%
Electronic Arts	EA	7,314	0.00%	0.00%	15.50%	15.50%	0.00%
EMC Corp.	EMC	51,487	0.36%	1.60%	11.50%	13.28%	0.05%
Emerson Electric	EMR	50,180	0.35%	2.45%	8.00%	10.65%	0.04%
Ensco plc	ESV	13,065	0.09%	5.36%	17.00%	23.27%	0.02%
Entergy Corp.	ETR	11,121	0.08%	5.32%	-3.50%	1.63%	0.00%
EOG Resources	EOG	45,856	0.32%	0.46%	24.00%	24.57%	0.08%
EQT Corp.	EQT	13,608	0.10%	0.13%	17.00%	17.15%	0.02%
Equifax Inc.	EFX	8,404	0.06%	1.27%	11.00%	12.41%	0.01%

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Equity Residential	EQR	-	0.00%	5.02%	0.00%	5.02%	0.00%
Exelon Corp.	EXC	23,299	0.16%	4.56%	-5.50%	-1.19%	0.00%
Expedia Inc.	EXPE	9,109	0.06%	0.87%	7.00%	7.93%	0.01%
Expeditors Int'l	EXPD	8,964	0.06%	1.38%	7.00%	8.48%	0.01%
Express Scripts	ESRX	56,511	0.00%	0.00%	13.50%	13.50%	0.00%
Exxon Mobil Corp.	XOM	440,783	3.09%	2.56%	6.50%	9.23%	0.28%
F5 Networks	FFIV	6,991	0.00%	0.00%	13.50%	13.50%	0.00%
Family Dollar Stores	FDO	7,469	0.05%	1.60%	10.00%	11.76%	0.01%
Fastenal Co.	FAST	13,986	0.10%	2.12%	15.00%	17.44%	0.02%
FedEx Corp.	FDX	44,742	0.31%	0.42%	9.00%	9.46%	0.03%
Fidelity National	FIS	15,329	0.11%	1.67%	10.00%	11.84%	0.01%
Fifth Third Bancorp	FITB	18,663	0.13%	2.42%	11.00%	13.69%	0.02%
First Solar Inc.	FSLR	5,537	0.00%	0.00%	-3.50%	-3.50%	0.00%
FirstEnergy Corp.	FE	13,412	0.09%	6.86%	3.50%	10.60%	0.01%
Fiserv Inc.	FISV	15,226	0.00%	0.00%	10.00%	10.00%	0.00%
FLIR Systems	FLIR	4,202	0.03%	1.35%	6.50%	7.94%	0.00%
Flowserve Corp.	FLS	10,653	0.07%	0.73%	11.50%	12.31%	0.01%
Fluor Corp.	FLR	13,058	0.09%	0.80%	12.00%	12.90%	0.01%
FMC Corp.	FMC	10,049	0.07%	0.82%	12.50%	13.42%	0.01%
FMC Technologies	FTI	12,372	0.00%	0.00%	20.50%	20.50%	0.00%
Ford Motor	F	60,468	0.42%	2.61%	10.00%	12.87%	0.05%
Forest Labs.	FRX	15,910	0.00%	0.00%	-5.00%	-5.00%	0.00%
Fossil Group	FOSL	6,766	0.00%	0.00%	14.50%	14.50%	0.00%
Franklin Resources	BEN	36,350	0.25%	0.84%	10.50%	11.43%	0.03%
Freep't-McMoRan C&G	FCX	38,370	0.27%	3.54%	7.50%	11.31%	0.03%
Frontier Commun.	FTR	4,698	0.03%	8.51%	9.50%	18.82%	0.01%
GameStop Corp.	GME	5,852	0.04%	2.42%	10.00%	12.66%	0.01%
Gannett Co.	GCI	6,680	0.05%	2.76%	4.00%	6.87%	0.00%
Gap (The) Inc.	GPS	17,498	0.12%	2.05%	12.50%	14.81%	0.02%
Garmin Ltd.	GRMN	9,000	0.06%	4.23%	1.50%	5.79%	0.00%
Gen'l Dynamics	GD	33,131	0.23%	2.36%	3.50%	5.94%	0.01%
Gen'l Electric	GE	281,566	1.97%	3.16%	12.00%	15.54%	0.31%
Gen'l Mills	GIS	31,132	0.22%	3.08%	7.00%	10.30%	0.02%
General Motors	GM	58,128	0.00%	0.00%	11.00%	11.00%	0.00%
Genuine Parts	GPC	12,816	0.09%	2.59%	10.00%	12.85%	0.01%
Genworth Fin'l	GNW	7,692	0.00%	0.00%	28.00%	28.00%	0.00%
Gilead Sciences	GILD	115,359	0.00%	0.00%	9.50%	9.50%	0.00%
Goldman Sachs	GS	80,902	0.57%	1.25%	13.00%	14.41%	0.08%
Goodyear Tire	GT	5,795	0.04%	0.85%	19.00%	20.01%	0.01%
Google Inc.	GOOG	373,407	0.00%	0.00%	13.50%	13.50%	0.00%
Graham Hldgs.	GHC	4,873	0.03%	1.49%	5.00%	6.56%	0.00%
Grainger (W.W.)	GWW	17,729	0.12%	1.46%	15.00%	16.68%	0.02%
Halliburton Co.	HAL	43,375	0.30%	1.17%	11.50%	12.80%	0.04%
Harley-Davidson	HOG	15,371	0.11%	1.21%	16.00%	17.40%	0.02%
Harman Int'l	HAR	5,778	0.04%	1.42%	15.50%	17.14%	0.01%
Harris Corp.	HRS	7,438	0.05%	2.50%	1.00%	3.53%	0.00%
Hartford Fin'l Svcs.	HIG	16,401	0.11%	1.64%	13.50%	15.36%	0.02%
Hasbro Inc.	HAS	7,032	0.05%	2.95%	7.00%	10.16%	0.00%
HCP Inc.	HCP	-	0.00%	5.98%	0.00%	5.98%	0.00%
Health Care REIT	HCN	-	0.00%	5.99%	94.50%	106.15%	0.00%
Helmerich & Payne	HP	8,851	0.06%	3.01%	12.50%	15.89%	0.01%
Hershey Co.	HSY	21,567	0.15%	2.01%	12.00%	14.25%	0.02%
Hess Corp.	HES	28,001	0.20%	1.21%	3.50%	4.75%	0.01%
Hewlett-Packard	HPQ	54,610	0.38%	2.15%	58.50%	61.91%	0.24%
Home Depot	HD	114,822	0.80%	1.91%	15.00%	17.20%	0.14%
Honeywell Int'l	HON	71,484	0.50%	1.98%	11.00%	13.20%	0.07%
Hormel Foods	HRL	11,838	0.08%	1.78%	10.00%	11.96%	0.01%
Horton D.R.	DHI	6,901	0.05%	0.70%	29.00%	29.90%	0.01%
Hospira Inc.	HSP	6,840	0.00%	0.00%	4.50%	4.50%	0.00%
Host Hotels & Resorts	HST	-	0.00%	2.68%	0.00%	2.68%	0.00%

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Hudson City Bancorp	HCBK	4,661	0.03%	1.71%	68.00%	70.87%	0.02%
Humana Inc.	HUM	16,142	0.11%	1.04%	9.00%	10.13%	0.01%
Huntington Bancshs.	HBAN	8,011	0.06%	2.07%	10.50%	12.79%	0.01%
Illinois Tool Works	ITW	37,154	0.26%	2.01%	10.50%	12.72%	0.03%
Ingersoll-Rand	IR	17,657	0.12%	1.37%	12.50%	14.04%	0.02%
Int'l Business Mach.	IBM	201,263	1.41%	2.13%	7.50%	9.79%	0.14%
Int'l Flavors & Frag.	IFF	7,027	0.05%	1.85%	9.00%	11.02%	0.01%
Int'l Game Tech.	IGT	4,527	0.03%	2.49%	13.50%	16.33%	0.01%
Int'l Paper	IP	21,956	0.15%	2.84%	12.00%	15.18%	0.02%
Integrus Energy	TEG	4,316	0.03%	5.00%	4.50%	9.73%	0.00%
Intel Corp.	INTC	127,806	0.89%	3.50%	7.50%	11.26%	0.10%
IntercontinentalExch.	ICE	16,389	0.00%	0.00%	9.00%	9.00%	0.00%
Interpublic Group	IPG	7,214	0.05%	1.79%	13.50%	15.53%	0.01%
Intuit Inc.	INTU	21,737	0.15%	1.00%	11.00%	12.11%	0.02%
Intuitive Surgical	ISRG	14,279	0.00%	0.00%	10.50%	10.50%	0.00%
Invesco Ltd.	IVZ	16,199	0.11%	2.46%	17.00%	19.88%	0.02%
Iron Mountain	IRM	5,849	0.04%	3.53%	3.50%	7.15%	0.00%
Jabil Circuit	JBL	3,403	0.02%	1.91%	-1.00%	0.89%	0.00%
Jacobs Engineering	JEC	8,139	0.00%	0.00%	13.00%	13.00%	0.00%
JDS Uniphase	JDSU	2,975	0.00%	0.00%	6.50%	6.50%	0.00%
Johnson & Johnson	JNJ	261,024	1.83%	2.85%	7.00%	10.05%	0.18%
Johnson Controls	JCI	34,933	0.24%	1.72%	10.50%	12.40%	0.03%
Joy Global	JOY	6,030	0.04%	1.23%	3.50%	4.77%	0.00%
JPMorgan Chase	JPM	218,757	1.53%	2.71%	8.00%	10.93%	0.17%
Juniper Networks	JNPR	11,056	0.00%	0.00%	12.50%	12.50%	0.00%
Kansas City South'n	KSU	13,629	0.10%	0.69%	16.50%	17.30%	0.02%
Kellogg	K	21,981	0.15%	3.03%	7.50%	10.76%	0.02%
KeyCorp	KEY	12,067	0.08%	1.79%	8.50%	10.44%	0.01%
Kimberly-Clark	KMB	40,117	0.28%	3.09%	9.50%	12.88%	0.04%
Kimco Realty	KIM	-	0.00%	4.44%	0.00%	4.44%	0.00%
Kinder Morgan Inc.	KMI	36,990	0.00%	4.59%	0.00%	4.59%	0.00%
KLA-Tencor	KLAC	10,686	0.07%	2.81%	7.50%	10.52%	0.01%
Kohl's Corp.	KSS	11,918	0.08%	2.68%	8.00%	10.89%	0.01%
Kraft Foods Group	KRFT	31,957	0.00%	3.92%	0.00%	3.92%	0.00%
Kroger Co.	KR	20,483	0.14%	1.71%	10.50%	12.39%	0.02%
L Brands	LB	17,945	0.13%	1.94%	9.50%	11.62%	0.01%
L-3 Communic.	LLL	9,540	0.07%	2.05%	3.50%	5.62%	0.00%
Laboratory Corp.	LH	7,964	0.00%	0.00%	7.00%	7.00%	0.00%
Lam Research	LRCX	8,812	0.00%	0.00%	15.50%	15.50%	0.00%
Lauder (Estee)	EL	28,595	0.20%	1.07%	12.00%	13.20%	0.03%
Legg Mason	LM	5,303	0.04%	1.19%	14.00%	15.36%	0.01%
Leggett & Platt	LEG	4,378	0.03%	3.87%	14.50%	18.93%	0.01%
Lennar Corp.	LEN	7,633	0.05%	0.41%	38.50%	39.07%	0.02%
Leucadia National	LUK	10,350	0.00%	0.88%	0.00%	0.88%	0.00%
Life Technologies	LIFE	13,086	0.00%	0.00%	8.50%	8.50%	0.00%
Lilly (Eli)	LLY	55,079	0.39%	3.84%	-4.50%	-0.83%	0.00%
Lincoln Nat'l Corp.	LNC	13,629	0.10%	1.23%	7.50%	8.82%	0.01%
Linear Technology	LLTC	10,600	0.07%	2.34%	7.00%	9.50%	0.01%
Lockheed Martin	LMT	47,822	0.33%	3.65%	5.00%	8.83%	0.03%
Loews Corp.	L	18,595	0.13%	0.52%	13.00%	13.59%	0.02%
Lorillard Inc.	LO	18,605	0.13%	4.36%	12.00%	16.88%	0.02%
Lowe's Cos.	LOW	51,482	0.36%	1.47%	15.50%	17.20%	0.06%
LSI Corp.	LSI	5,969	0.04%	1.09%	31.00%	32.43%	0.01%
LyondellBasell Inds.	LYB	44,190	0.31%	2.52%	11.50%	14.31%	0.04%
M&T Bank Corp.	MTB	15,098	0.11%	2.41%	7.00%	9.58%	0.01%
Macerich Comp. (The)	MAC	-	0.00%	4.17%	0.00%	4.17%	0.00%
Macy's Inc.	M	19,467	0.14%	1.99%	12.50%	14.74%	0.02%
Marathon Oil Corp.	MRO	24,555	0.00%	2.15%	0.00%	2.15%	0.00%
Marathon Petroleum	MPC	27,131	0.00%	1.90%	0.00%	1.90%	0.00%
Marriott Int'l	MAR	14,693	0.10%	1.39%	14.00%	15.58%	0.02%

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Market DCF Method Based - Value Line

Marsh & McLennan	MMC	26,437	0.19%	2.07%	13.00%	15.34%	0.03%
Masco Corp.	MAS	7,896	0.06%	1.33%	53.00%	55.03%	0.03%
MasterCard Inc.	MA	98,935	0.69%	0.54%	15.00%	15.62%	0.11%
Mattel Inc.	MAT	15,766	0.11%	3.11%	9.50%	12.91%	0.01%
McCormick & Co.	MKC	9,105	0.06%	2.15%	9.00%	11.34%	0.01%
McDonald's Corp.	MCD	96,359	0.67%	3.35%	8.00%	11.62%	0.08%
McGraw Hill Fin'l	MHFI	20,903	0.00%	1.45%	0.00%	1.45%	0.00%
McKesson Corp.	MCK	37,068	0.26%	0.60%	14.00%	14.68%	0.04%
Mead Johnson Nutrition	MJN	16,837	0.12%	1.63%	11.00%	12.81%	0.02%
MeadWestvaco	MWV	6,523	0.05%	2.73%	10.00%	13.00%	0.01%
Medtronic Inc.	MDT	57,375	0.40%	2.02%	6.00%	8.14%	0.03%
Merck & Co.	MRK	145,511	1.02%	3.54%	2.00%	5.61%	0.06%
MetLife Inc.	MET	60,548	0.42%	2.07%	8.00%	10.24%	0.04%
Michael Kors Hldgs.	KORS	16,446	0.00%	0.00%	29.00%	29.00%	0.00%
Microchip Technology	MCHP	8,797	0.06%	3.20%	9.00%	12.49%	0.01%
Micron Technology	MU	22,867	0.00%	0.00%	94.00%	94.00%	0.00%
Microsoft Corp.	MSFT	312,474	2.19%	2.99%	8.50%	11.74%	0.26%
Molson Coors Brewing	TAP	10,181	0.07%	2.31%	7.50%	9.98%	0.01%
Mondelez Int'l	MDLZ	61,225	0.43%	1.60%	4.50%	6.17%	0.03%
Monsanto Co.	MON	61,002	0.43%	1.49%	12.00%	13.67%	0.06%
Monster Beverage	MNST	11,310	0.00%	0.00%	13.50%	13.50%	0.00%
Moody's Corp.	MCO	16,709	0.12%	1.44%	12.50%	14.12%	0.02%
Morgan Stanley	MS	60,749	0.43%	0.64%	23.50%	24.29%	0.10%
Mosaic Company	MOS	19,995	0.14%	2.45%	11.00%	13.72%	0.02%
Motorola Solutions	MSI	17,380	0.12%	1.85%	12.00%	14.07%	0.02%
Murphy Oil Corp.	MUR	11,989	0.08%	1.95%	12.50%	14.69%	0.01%
Mylan Inc.	MYL	16,388	0.00%	0.00%	12.00%	12.00%	0.00%
Nabors Inds.	NBR	4,837	0.03%	0.98%	16.50%	17.64%	0.01%
Nasdaq OMX Group	NDAQ	6,693	0.05%	1.30%	7.50%	8.90%	0.00%
National Oilwell Varco	NOV	33,691	0.24%	1.32%	11.50%	12.97%	0.03%
NetApp Inc.	NTAP	13,778	0.10%	1.49%	11.00%	12.65%	0.01%
Netflix Inc.	NFLX	22,336	0.00%	0.00%	19.00%	19.00%	0.00%
Newell Rubbermaid	NWL	9,262	0.06%	1.86%	13.50%	15.61%	0.01%
Newfield Exploration	NFX	3,204	0.00%	0.00%	-1.50%	-1.50%	0.00%
Newmont Mining	NEM	11,615	0.08%	3.43%	-16.50%	-13.64%	-0.01%
NextEra Energy	NEE	36,431	0.25%	3.33%	5.50%	9.01%	0.02%
Nielsen Holdings N.V.	NLSN	17,347	0.00%	1.74%	0.00%	1.74%	0.00%
NIKE Inc. 'B'	NKE	69,511	0.49%	1.23%	13.50%	14.90%	0.07%
NiSource Inc.	NI	10,168	0.07%	3.08%	10.50%	13.90%	0.01%
Noble Corp. plc	NE	9,259	0.06%	2.74%	19.50%	22.77%	0.01%
Noble Energy	NBL	24,430	0.17%	0.82%	17.00%	17.96%	0.03%
Nordstrom Inc.	JWN	11,903	0.08%	2.05%	10.00%	12.26%	0.01%
Norfolk Southern	NSC	28,689	0.20%	2.24%	9.50%	11.95%	0.02%
Northeast Utilities	NU	13,301	0.09%	3.65%	8.00%	11.94%	0.01%
Northern Trust Corp.	NTRS	14,748	0.10%	2.01%	8.00%	10.17%	0.01%
Northrop Grumman	NOC	25,806	0.18%	2.12%	4.50%	6.72%	0.01%
NRG Energy	NRG	9,208	0.06%	1.68%	5.00%	6.76%	0.00%
Nucor Corp.	NUE	17,072	0.12%	2.80%	26.00%	29.53%	0.04%
NVIDIA Corp.	NVDA	8,909	0.06%	2.17%	7.00%	9.32%	0.01%
O'Reilly Automotive	ORLY	13,958	0.00%	0.00%	13.50%	13.50%	0.00%
Occidental Petroleum	OXY	75,794	0.53%	2.98%	7.00%	10.19%	0.05%
Omnicom Group	OMC	18,720	0.13%	2.20%	11.50%	13.95%	0.02%
ONEOK Inc.	OKE	12,397	0.09%	2.83%	12.00%	15.17%	0.01%
Oracle Corp.	ORCL	169,831	1.19%	1.27%	9.00%	10.38%	0.12%
Owens-Illinois	OI	5,841	0.00%	0.00%	8.50%	8.50%	0.00%
PACCAR Inc.	PCAR	20,793	0.15%	1.36%	13.50%	15.04%	0.02%
Pall Corp.	PLL	9,471	0.07%	1.29%	10.50%	11.93%	0.01%
Parker-Hannifin	PH	19,084	0.13%	1.41%	8.50%	10.03%	0.01%
Patterson Cos.	PDCO	4,133	0.03%	1.71%	11.00%	12.90%	0.00%
Paychex Inc.	PAYX	16,623	0.12%	3.18%	7.50%	10.92%	0.01%

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Peabody Energy	BTU	5,029	0.04%	1.82%	9.00%	10.98%	0.00%
Penney (J.C.)	JCP	2,732	0.00%	0.00%	0.00%	0.00%	0.00%
Pentair Ltd.	PNR	15,426	0.11%	1.29%	17.50%	19.02%	0.02%
People's United Fin'l	PBCT	4,600	0.03%	4.35%	17.50%	22.61%	0.01%
Pepco Holdings	POM	4,732	0.03%	5.70%	6.00%	12.04%	0.00%
PepsiCo Inc.	PEP	126,726	0.89%	2.78%	8.50%	11.52%	0.10%
PerkinElmer Inc.	PKI	4,617	0.03%	0.68%	10.00%	10.75%	0.00%
Perrigo Co. plc	PRGO	14,350	0.10%	0.24%	12.50%	12.77%	0.01%
PetSmart Inc.	PETM	7,600	0.05%	1.08%	14.00%	15.23%	0.01%
Pfizer Inc.	PFE	197,997	1.39%	3.40%	12.00%	15.81%	0.22%
PG&E Corp.	PCG	18,195	0.13%	4.49%	2.50%	7.10%	0.01%
Philip Morris Int'l	PM	138,139	0.97%	4.37%	9.00%	13.76%	0.13%
Phillips 66	PSX	45,037	0.00%	2.08%	0.00%	2.08%	0.00%
Pinnacle West Capital	PNW	5,832	0.04%	4.28%	5.00%	9.49%	0.00%
Pioneer Natural Res.	PXD	25,836	0.18%	0.04%	23.00%	23.05%	0.04%
Pitney Bowes	PBI	4,799	0.03%	3.15%	-0.50%	2.63%	0.00%
Plum Creek Timber	PCL	7,537	0.05%	3.81%	11.50%	15.75%	0.01%
PNC Financial Serv.	PNC	41,102	0.29%	2.28%	7.00%	9.44%	0.03%
PPG Inds.	PPG	26,712	0.19%	1.30%	11.00%	12.44%	0.02%
PPL Corp.	PPL	18,750	0.00%	5.01%	0.00%	5.01%	0.00%
Praxair Inc.	PX	38,141	0.27%	2.07%	11.00%	13.30%	0.04%
Precision Castparts	PCP	39,331	0.28%	0.04%	13.50%	13.55%	0.04%
Price (T. Rowe) Group	TROW	21,806	0.15%	1.93%	12.50%	14.67%	0.02%
priceline.com	PCLN	60,754	0.00%	0.00%	24.00%	24.00%	0.00%
Principal Fin'l Group	PFG	14,566	0.10%	2.10%	9.50%	11.80%	0.01%
Procter & Gamble	PG	222,243	1.56%	2.95%	9.00%	12.22%	0.19%
Progressive (Ohio)	PGR	16,242	0.11%	1.03%	15.50%	16.69%	0.02%
Prologis	PLD	-	0.00%	3.26%	0.00%	3.26%	0.00%
Prudential Fin'l	PRU	42,878	0.30%	2.29%	10.50%	13.03%	0.04%
Public Serv. Enterprise	PEG	16,107	0.11%	4.59%	-0.50%	4.07%	0.00%
Public Storage	PSA	-	0.00%	3.70%	0.00%	3.70%	0.00%
PulteGroup Inc.	PHM	7,654	0.00%	1.00%	0.00%	1.00%	0.00%
PVH Corp.	PVH	11,012	0.08%	0.11%	13.50%	13.62%	0.01%
QEP Resources	QEP	5,463	0.04%	0.39%	12.00%	12.44%	0.00%
Qualcomm Inc.	QCOM	126,533	0.89%	1.90%	11.50%	13.62%	0.12%
Quanta Services	PWR	6,688	0.00%	0.00%	20.50%	20.50%	0.00%
Quest Diagnostics	DGX	7,832	0.05%	2.23%	7.00%	9.39%	0.01%
Ralph Lauren	RL	15,908	0.11%	1.02%	9.50%	10.62%	0.01%
Range Resources Corp.	RRC	13,361	0.09%	0.19%	36.00%	36.26%	0.03%
Raytheon Co.	RTN	29,078	0.20%	2.42%	4.50%	7.03%	0.01%
Red Hat Inc.	RHT	10,587	0.00%	0.00%	13.00%	13.00%	0.00%
Regeneron Pharmac.	REGN	27,370	0.00%	0.00%	0.00%	0.00%	0.00%
Regions Financial	RF	13,615	0.10%	1.22%	71.00%	73.09%	0.07%
Republic Services	RSG	12,121	0.08%	3.15%	10.00%	13.47%	0.01%
Reynolds American	RAI	26,770	0.19%	5.09%	9.50%	15.07%	0.03%
Robert Half Int'l	RHI	5,714	0.04%	1.57%	19.50%	21.38%	0.01%
Rockwell Automation	ROK	16,364	0.11%	1.97%	6.50%	8.60%	0.01%
Rockwell Collins	COL	10,003	0.07%	1.62%	7.50%	9.24%	0.01%
Roper Inds.	ROP	13,715	0.10%	0.58%	14.00%	14.66%	0.01%
Ross Stores	ROST	16,011	0.11%	1.03%	12.00%	13.15%	0.01%
Rowan Cos. plc	RDC	4,245	0.00%	0.00%	23.00%	23.00%	0.00%
Ryder System	R	3,855	0.03%	1.86%	14.50%	16.63%	0.00%
Safeway Inc.	SWY	7,826	0.05%	2.69%	6.50%	9.36%	0.01%
salesforce.com	CRM	33,075	0.00%	0.00%	0.00%	0.00%	0.00%
SanDisk Corp.	SNDK	15,923	0.11%	1.28%	9.50%	10.90%	0.01%
SCANA Corp.	SCG	6,596	0.05%	4.42%	4.50%	9.12%	0.00%
Schlumberger Ltd.	SLB	117,723	0.82%	1.49%	15.00%	16.71%	0.14%
Schwab (Charles)	SCHW	33,146	0.23%	0.93%	11.50%	12.54%	0.03%
Scripps Networks	SNI	12,403	0.09%	0.71%	9.00%	9.77%	0.01%
Seagate Technology	STX	20,098	0.14%	3.07%	7.00%	10.28%	0.01%

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Sealed Air	SEE	6,661	0.05%	1.53%	15.00%	16.76%	0.01%
Sempra Energy	SRE	21,838	0.15%	2.92%	4.50%	7.55%	0.01%
Sherwin-Williams	SHW	18,366	0.13%	1.26%	16.50%	17.97%	0.02%
Sigma-Aldrich	SIAL	11,030	0.08%	0.93%	8.50%	9.51%	0.01%
Simon Property Group	SPG	-	0.00%	3.24%	0.00%	3.24%	0.00%
SLM Corporation	SLM	11,801	0.08%	2.61%	8.50%	11.33%	0.01%
Smucker (J.M.)	SJM	10,828	0.08%	2.28%	8.50%	10.97%	0.01%
Snap-on Inc.	SNA	6,331	0.04%	1.62%	9.50%	11.27%	0.00%
Southern Co.	SO	35,931	0.25%	5.10%	3.00%	8.25%	0.02%
Southwest Airlines	LUV	13,189	0.09%	0.85%	15.50%	16.48%	0.02%
Southwestern Energy	SWN	13,916	0.00%	0.00%	11.50%	11.50%	0.00%
Spectra Energy	SE	23,338	0.16%	3.90%	4.50%	8.58%	0.01%
St. Jude Medical	STJ	18,130	0.13%	1.59%	9.50%	11.24%	0.01%
Stanley Black & Decker	SWK	12,579	0.09%	2.47%	11.50%	14.25%	0.01%
Staples Inc.	SPLS	10,393	0.07%	3.02%	3.00%	6.11%	0.00%
Starbucks Corp.	SBUX	59,247	0.41%	1.32%	19.50%	21.08%	0.09%
Starwood Hotels	HOT	15,272	0.11%	1.70%	14.00%	15.94%	0.02%
State Street Corp.	STT	32,096	0.22%	1.54%	10.50%	12.20%	0.03%
Stericycle Inc.	SRCL	9,881	0.00%	0.00%	12.00%	12.00%	0.00%
Stryker Corp.	SYK	28,529	0.20%	1.62%	7.00%	8.73%	0.02%
SunTrust Banks	STI	19,597	0.14%	1.09%	26.00%	27.37%	0.04%
Symantec Corp.	SYMC	15,974	0.11%	2.61%	15.00%	18.00%	0.02%
Sysco Corp.	SYT	21,232	0.15%	3.17%	10.50%	14.00%	0.02%
Target Corp.	TGT	39,472	0.28%	2.82%	9.50%	12.59%	0.03%
TE Connectivity	TEL	22,595	0.16%	1.83%	8.00%	9.98%	0.02%
TECO Energy	TE	3,707	0.03%	5.16%	3.00%	8.31%	0.00%
Tenet Healthcare	THC	4,050	0.00%	0.00%	29.00%	29.00%	0.00%
Teradata Corp.	TDC	7,302	0.00%	0.00%	13.00%	13.00%	0.00%
Teradyne Inc.	TER	3,309	0.00%	0.00%	3.00%	3.00%	0.00%
Tesoro Corp.	TSO	7,871	0.06%	1.71%	18.00%	20.02%	0.01%
Texas Instruments	TXN	47,712	0.33%	2.75%	4.00%	6.86%	0.02%
Textron Inc.	TXT	10,175	0.07%	0.33%	16.00%	16.38%	0.01%
Thermo Fisher Sci.	TMO	39,848	0.28%	0.54%	10.50%	11.10%	0.03%
Tiffany & Co.	TIF	11,649	0.08%	1.54%	11.50%	13.22%	0.01%
Time Warner	TWX	63,630	0.45%	1.64%	12.00%	13.84%	0.06%
Time Warner Cable	TWC	37,719	0.26%	2.03%	11.50%	13.76%	0.04%
TJX Companies	TJX	45,268	0.32%	0.91%	13.50%	14.53%	0.05%
Torchmark Corp.	TMK	7,127	0.05%	0.87%	7.50%	8.44%	0.00%
Total System Svcs.	TSS	6,336	0.04%	1.20%	8.00%	9.30%	0.00%
Transocean Ltd.	RIG	17,368	0.12%	4.65%	13.50%	18.78%	0.02%
Travelers Cos.	TRV	32,773	0.23%	2.22%	9.50%	11.93%	0.03%
TripAdvisor Inc.	TRIP	11,860	0.00%	0.00%	0.00%	0.00%	0.00%
Twenty-First Century Fox	FOXA	80,194	0.56%	0.77%	11.00%	11.85%	0.07%
Tyco Int'l	TYC	18,766	0.00%	1.77%	0.00%	1.77%	0.00%
Tyson Foods 'A'	TSN	11,729	0.08%	0.90%	9.50%	10.49%	0.01%
U.S. Bancorp	USB	74,233	0.52%	2.32%	8.00%	10.51%	0.05%
U.S. Steel Corp.	X	4,257	0.00%	0.68%	0.00%	0.68%	0.00%
Union Pacific	UNP	76,685	0.54%	1.90%	12.00%	14.13%	0.08%
United Parcel Serv.	UPS	97,343	0.68%	2.37%	7.50%	10.05%	0.07%
United Technologies	UTX	103,402	0.72%	2.09%	10.50%	12.81%	0.09%
UnitedHealth Group	UNH	74,700	0.52%	1.50%	10.00%	11.65%	0.06%
Unum Group	UNM	9,182	0.06%	1.65%	6.50%	8.26%	0.01%
Urban Outfitters	URBN	5,530	0.00%	0.00%	14.50%	14.50%	0.00%
V.F. Corp.	VFC	27,267	0.19%	1.69%	13.00%	14.91%	0.03%
Valero Energy	VLO	26,410	0.18%	1.85%	17.00%	19.16%	0.04%
Varian Medical Sys.	VAR	8,270	0.00%	0.00%	7.00%	7.00%	0.00%
Ventas Inc.	VTR	-	0.00%	5.07%	0.00%	5.07%	0.00%
VeriSign Inc.	VRSN	8,215	0.00%	0.00%	20.50%	20.50%	0.00%
Verizon Communic.	VZ	140,741	0.99%	4.31%	9.50%	14.22%	0.14%
Vertex Pharmac.	VRTX	17,241	0.00%	0.00%	0.00%	0.00%	0.00%

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Viacom Inc. 'B'	VIAB	41,049	0.29%	1.40%	13.50%	15.09%	0.04%
Visa Inc.	V	173,297	1.21%	0.73%	18.50%	19.37%	0.23%
Vornado R'lty Trust	VNO	16,687	0.12%	3.27%	7.00%	10.50%	0.01%
Vulcan Materials	VMC	7,575	0.00%	0.07%	0.00%	0.07%	0.00%
Wal-Mart Stores	WMT	254,140	1.78%	2.55%	7.50%	10.24%	0.18%
Walgreen Co.	WAG	54,498	0.38%	2.18%	9.50%	11.89%	0.05%
Waste Management	WM	21,105	0.15%	3.36%	6.50%	10.08%	0.01%
Waters Corp.	WAT	8,459	0.00%	0.00%	7.50%	7.50%	0.00%
WellPoint Inc.	WLP	27,294	0.19%	1.63%	7.50%	9.25%	0.02%
Wells Fargo	WFC	240,166	1.68%	2.63%	8.00%	10.84%	0.18%
Western Digital	WDC	19,607	0.14%	1.44%	8.00%	9.56%	0.01%
Western Union	WU	9,513	0.07%	2.90%	5.00%	8.05%	0.01%
Weyerhaeuser Co.	WY	18,252	0.13%	2.81%	22.00%	25.43%	0.03%
Whirlpool Corp.	WHR	12,466	0.09%	1.58%	9.00%	10.72%	0.01%
Whole Foods Market	WFM	21,474	0.15%	0.83%	19.00%	19.99%	0.03%
Williams Cos.	WMB	26,111	0.18%	4.58%	7.00%	11.90%	0.02%
Windstream Hldgs.	WIN	5,019	0.04%	11.88%	8.50%	21.39%	0.01%
Wisconsin Energy	WEC	9,337	0.07%	3.79%	7.00%	11.06%	0.01%
WPX Energy	WPX	4,074	0.00%	0.00%	0.00%	0.00%	0.00%
Wyndham Worldwide	WYN	9,516	0.07%	1.59%	13.50%	15.30%	0.01%
Wynn Resorts	WYNN	19,235	0.13%	2.09%	14.00%	16.38%	0.02%
Xcel Energy Inc.	XEL	13,849	0.10%	4.10%	4.50%	8.78%	0.01%
Xerox Corp.	XRX	15,057	0.11%	2.04%	6.00%	8.16%	0.01%
Xilinx Inc.	XLNX	12,123	0.08%	2.21%	8.00%	10.39%	0.01%
XL Group plc	XL	9,468	0.07%	1.77%	17.00%	19.07%	0.01%
Xylem Inc.	XYL	6,400	0.00%	1.36%	0.00%	1.36%	0.00%
Yahoo! Inc.	YHOO	41,181	0.00%	0.00%	10.00%	10.00%	0.00%
Yum! Brands	YUM	32,979	0.23%	2.00%	9.50%	11.69%	0.03%
Zimmer Holdings	ZMH	15,930	0.11%	0.92%	10.00%	11.01%	0.01%
Zions Bancorp.	ZION	5,509	0.00%	0.54%	0.00%	0.54%	0.00%
Zoetis Inc.	ZTS	16,295	0.00%	0.89%	0.00%	0.89%	0.00%
S&P 500 DCF-derived return:							12.83%

Sources and Notes:

[2]: Bloomberg as of 10/22/14.

[4], [6], [7]: Valueline as of 10/22/14.