

**BEFORE THE  
CANADIAN TRANSPORTATION AGENCY**

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REVIEW OF RAILWAY COST OF CAPITAL  
METHODOLOGY

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**EXPERT REPORT OF  
BRUCE E. STANGLE, Ph.D.**

**AND**

**GEORGE KOSICKI, Ph.D.**

**ANALYSIS GROUP, INC.**

**ON BEHALF OF  
CANADIAN PACIFIC RAILWAY**

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## I. INTRODUCTION

### A. Qualifications

1. This is a joint statement by Bruce E. Stangle and George Kosicki, economists at Analysis Group, Inc., a national economic consulting firm with nearly 500 professional consultants in ten offices in North America.
2. My name is Bruce E. Stangle. I am an economist with 30 years of experience with issues relating to antitrust, regulation, securities matters, and other areas of economic analysis. I am Chairman and a co-founder of Analysis Group, Inc. Over the course of my career, I have provided testimony on a number of topics including antitrust, market definition, entry conditions, competitive effects, security valuation, cost of capital, and damages. I am a member of the American Economic Association, the Board of Trustees of Bates College, and the Board of Directors of two separate money management firms: Wellington Trust Company, NA, and The Marsico Investment Fund. I have a B.A. from Bates College, and an M.S. in Management and a Ph.D. in Applied Economics from the Sloan School of Management at Massachusetts Institute of Technology. On behalf of the Association of American Railroads, I submitted six written statements and testified in person on two occasions before the United States Surface Transportation Board during its review of the methodology for determining the railroad industry's cost of capital.<sup>1</sup> My curriculum vita is included with this report as Appendix A.
3. My name is George Kosicki. I am a Vice President at Analysis Group, Inc. I have a Ph.D. in Economics from Cornell University and over 25 years of experience in economic research and teaching. Prior to joining Analysis Group,

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<sup>1</sup> Surface Transportation Board, In the Matter of Methodology to be Employed in Determining the Railroad Industry's Cost of Capital, Ex Parte 664, and Use of a Multi-Stage Discounted Cash Flow Model in Determining the Railroad Industry's Cost of Capital, Ex Parte 664, Sub-No. 1. I also submitted two written statements regarding the implementation of the multi-stage discounted cash flow model in connection with the STB's Railroad Cost of Capital 2008 Proceeding, Ex Parte 558, Sub-No. 12.

I was chair of the Economics Department at the College of the Holy Cross in Worcester, Massachusetts, where I spent 15 years on the faculty. My areas of specialization are applied microeconomics, industrial organization, competition policy, and labor economics. As an economic consultant, I have worked on a number of applied issues, including market definition, monopolization, price discrimination, the competitive impact of mergers, the cost of capital, and commercial damages. A more detailed description of my background and credentials is contained in my curriculum vitae, which is included with this report as Appendix B.

## **B. Assignment**

4. We have been asked by Canadian Pacific Railway (CP) to comment on the methodology to be used by the Canadian Transportation Agency (CTA) for determining the cost of capital rate for federally regulated railways in Canada. We were also asked to comment on the Brattle Group report “Review of Regulatory Cost of Capital Methodologies.”<sup>2</sup>
5. In commenting on the appropriate cost of capital methodology, our objective is to propose a methodology that is (i) reasonable, in that it provides federally regulated railways with a fair and reasonable return; (ii) transparent, in that it relies on well-established economic theory and replicable formulas; (iii) robust, in that it produces consistent, stable cost of capital estimates that accurately reflect underlying economic conditions; and (iv) pragmatic, in that it is based entirely on publicly available information. In an industry as capital-intensive as the railroads, we believe that the provision of a fair and reasonable return to the railroads is particularly important. If the estimated regulated cost of capital is set too low, investment will be deterred, and both the quantity and quality of rail service provided will suffer.

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<sup>2</sup> Michael J. Vilbert, Bente Villadsen, and Matthew Aharonian, “Review of Regulatory Cost of Capital Methodologies,” The Brattle Group, September 2010 (hereafter, “The Brattle Group Report”).

## II. SUMMARY OF CONCLUSIONS

6. The current methodology used by the CTA has produced cost of equity estimates that are so low they are essentially no different than the cost of debt, which is an illogical result from an economic standpoint given the additional risks associated with equity investments. Consequently, in this report we propose a specific alternative to the CTA's cost of equity methodology. This alternative is based on sound principles of economics and finance and would result in greater incentives for railroad investment and ultimately a more productive Canadian railroad industry.
7. Specifically, we believe that the CTA should rely on cost of equity estimates from multiple models when determining the cost of equity capital for CP. In addition, we recommend that the CTA rely on an average of the cost of equity estimates from the capital asset pricing model (CAPM) and the multi-stage discounted cash flow (MSDCF) model.<sup>3</sup> The CAPM and MSDCF models should be used in a systematic way (e.g., by taking a simple average of the two methods) to incorporate information from both frameworks and create a more predictable and stable outcome. A more stable estimate over time is consistent with the CTA's regulatory objectives and is more sensible from an economic perspective. In stable economic environments, the expected rates of return required by providers of equity capital typically do not change substantially from year to year.
8. The CTA's current methodology for estimating the cost of equity from the CAPM should be modified. In particular, the estimate of the market risk premium should be based on the most complete set of historical data available, and the risk-free rate used in the CAPM formula should be the long horizon risk-free rate of return.

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<sup>3</sup> Decision No. 52-R-2004 allows the CTA to combine results from up to three models (CAPM, DCF, and ERP). The decision states that, "cost of common equity calculations using all three methods are assessed by the Agency and weight is given to that model or combination of models that best reflect the state of capital markets." More recently the CTA has relied exclusively on the CAPM.

9. The CTA should use a longer historical period to calculate the equity market risk premium. CTA currently uses a moving 45-year period and computes a market risk premium over short-term (3-5 years) and long-term bonds (10+ years). The results are then averaged.<sup>4</sup> The CTA's approach should be revised for several reasons:
- i. While the CTA has expressed concern that the use of a long time series may introduce irrelevant information into the estimate of the market risk premium, it is important to recognize that many types of historical events tend to repeat themselves over time, and so even events that occurred long ago may provide relevant information about the future performance of financial markets as a whole.
  - ii. Recent financial market events in the U.S. and elsewhere suggest that risk premia incorporating information from past crises may be informative in assessing current market conditions.
  - iii. Morningstar/Ibbotson publishes an annual study titled "Canadian Risk Premia Over Time Report" which presents a long-horizon equity risk premium estimate for Canada using data from 1936.<sup>5</sup> The estimate of the market risk premium through 2009 is 5.1 percent. In contrast, for the 2010-11 crop year cost of capital determination, the CTA used the study period 1965-2009 and computed an average market risk premium of 2.66 percent.<sup>6</sup>
  - iv. Use of the annual Morningstar/Ibbotson Canadian study would significantly simplify the cost of equity determination for CTA and

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<sup>4</sup> In its Decision No. 52-R-2004, the CTA notes that: "[L]ong-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."

<sup>5</sup> This estimate of the market risk premium is calculated using data denominated in Canadian dollars. Morningstar/Ibbotson also publishes an estimate using data from 1939 denominated in U.S. dollars. Through 2009, this estimate is 5.7%.

<sup>6</sup> Correspondence from CTA to CP regarding File No. T6285/10-2, "2010/2011 Crop Year Cost of Capital Rate for the Canadian Pacific Railway Company for the Transportation of Western Grain," April 27, 2010, Appendix A, p. 2.

result in a much more reasonable cost of equity estimate for CP. There is no need to make a *de novo* calculation of the key input to the CAPM when a reputable financial data provider specializes in precisely this calculation and has performed the calculation specifically for the Canadian markets.

10. The CTA should use a risk-free rate consistent with the market risk premium calculation. The CTA currently uses the average of the return on short-term (3-5 years) and long-term (10+ years) Canadian government bonds. Morningstar/Ibbotson calculates the market risk premium with reference to Canadian long-term government bonds. If the CTA were to use the Morningstar/Ibbotson long-horizon market risk premium published in the “Canadian Risk Premia Over Time Report,” then the CTA should also update its risk-free rate to be the return on long-term Canadian government bonds used by Morningstar/Ibbotson.<sup>7</sup>
11. The CTA’s MSDCF model should be based on the Morningstar/Ibbotson multi-stage model, which allows for periods of above- or below-normal earnings growth in the short-run, but assumes that railroads’ earnings growth cannot exceed that of Canada’s nominal GDP in the long run. We note that this approach maintains the railroads in qualitatively similar positions over time.
12. The CTA should use yields-to-maturity on long-term debt instruments as an estimate of the cost of debt. Currently, the CTA relies on a methodology based on coupon rates. This methodology ignores the capital appreciation or depreciation experienced by debt holders and does not necessarily reflect a firm’s debt costs in different economic environments.
13. The CTA should use market values instead of book values when determining the equity weight in CP’s capital structure. This approach is consistent with using market values when estimating the cost of equity with the CAPM and MSDCF models. Further, the use of market values will eliminate the need to

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<sup>7</sup> In the United States, the STB uses the 20-year U.S. Treasury bond rate to be consistent with the way in which Morningstar/Ibbotson calculates the market risk premium.

use the “deferred taxes and investment tax credit” category currently in use by the CTA.<sup>8</sup> Deferred taxes arise from the accounting treatment of capital investment, specifically the ability of firms to use accelerated depreciation for tax purposes and straight line depreciation for accounting purposes. Any economic effects resulting from the investment incentives associated with deferred taxes will be reflected in market values.

### **III. BACKGROUND**

#### **A. Historical Perspective on the Cost of Equity Rates Computed for CP**

14. Figure 1 below shows that the CTA’s regulated cost of equity rates for CP have fallen significantly (by more than 50 percent) since 2001. There is no rationale in the macroeconomy or in CP’s own business conditions that would explain why its cost of equity should have declined by 50 percent over the past decade. In addition, Figure 1 shows that CP’s regulated rates are unusually low when compared with rates for Class I railroads in the U.S.<sup>9</sup> In the two most recent years, CP’s regulated rates are more than 50 percent lower than the most recent rate allowed by the STB. In comparing these rates, it is important to note that the CTA reports “pre-tax” rates, whereas the STB’s methodology determines after-tax rates. When the CTA rates are converted to an after-tax basis, as shown in Figure 1, it is more readily apparent that the CTA’s methodology is generating unusually low cost of equity estimates, which in turn push the cost of capital estimates for CP to unreasonably low levels. From an economic perspective, there is no reason to expect cost of equity rates for railroads in Canada and the U.S. to be so different given the existence of well established financial markets linking the two countries’ economies.

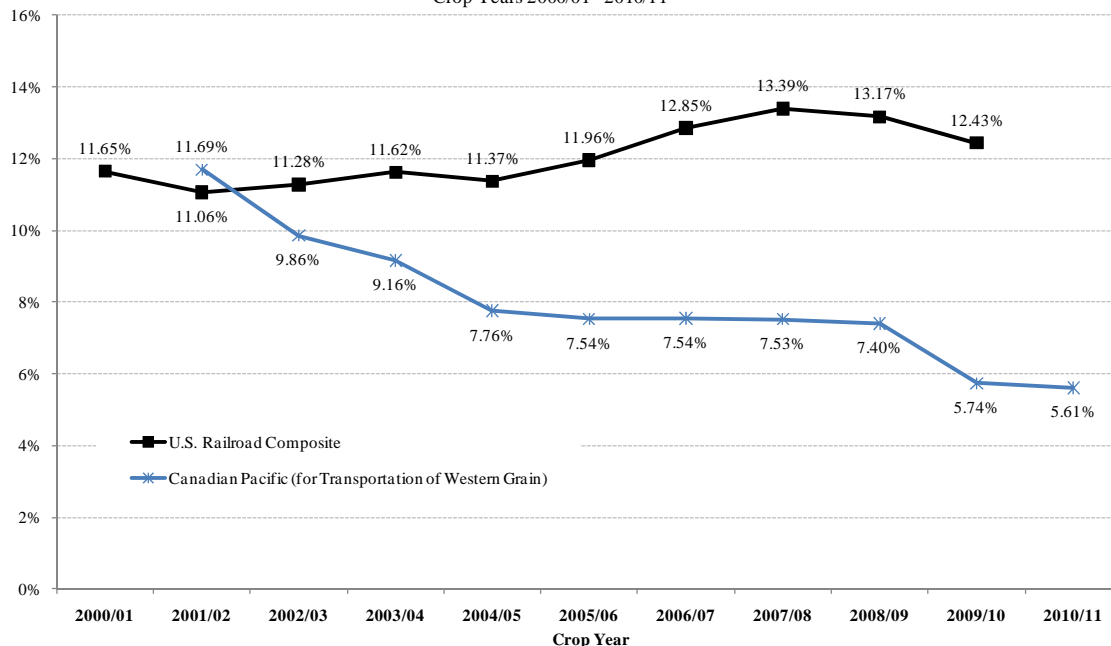
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<sup>8</sup> This portion of the capital structure is currently assigned a cost of 0%.

<sup>9</sup> One reason for the difference is that the CTA only relies on the CAPM whereas the STB’s current cost of equity methodology averages estimates from the CAPM and the Morningstar/Ibbotson MSDCF model. Ignoring this difference in methodology, STB’s CAPM estimates are still higher than CTA’s in every year since 2003-04.

15. Furthermore, the CTA’s recent after-tax cost of equity estimates are now so low that they are basically equal to the cost of debt. This result is nonsensical from an economic perspective given that the providers of equity capital generally bear significantly more risk than providers of debt capital. The result also demonstrates that the methodology used by the CTA to estimate CP’s cost of equity capital is at odds with realities of the market for investment capital. This situation reduces the incentives for Canadian railroads to invest in new plant and equipment.

**Figure 1**  
 Comparison of After-Tax Cost of Equity Rates  
 Canadian Transportation Agency and Surface Transportation Board  
 Crop Years 2000/01 - 2010/11



**Notes and Sources:**

CP data: The 2010-11 figure is from the April 27, 2010 letter from CTA to CP; figures for other crop years equal pre-tax figure x (1 - 0.3187), where 0.3187 is the tax rate used in the 2009-10 CTA determination. U.S. data: The 2009 figure is from the AAR submission in 2009 Cost of Capital proceeding, Ex Parte No. 558 (Sub-No. 13), May 17, 2010. The 2008 figure is from the STB decision in Ex Parte No. 558 (Sub-No. 12), September 24, 2009. The 2000-2007 figures are from Exhibit 1 to Stangle Reply Verified Statement, STB Ex Parte No. 558 (Sub-No. 12), June 19, 2009. Canadian data for crop year 2000-2001 and U.S. data for calendar year 2010 were not available. Canadian data for crop year 2001-2002 are lined up with U.S. data for calendar year 2001.

**B. Impact of Unreasonably Low Cost of Capital Rates on CP**

16. Inadequate cost of capital rates may adversely affect CP’s operations and investment plans. One way in which the cost of capital rate affects CP is through its maximum grain revenue entitlement (or “revenue cap”). Currently, the regulated cost of capital is a component of the volume-related composite price index (VRCPI), which is a component in the CTA’s annual calculation of

CP's revenue cap.<sup>10</sup> If the cost of capital estimate is set below an appropriate level, the revenue cap likewise will be too low. For CP, as well as other railroads, substantial net investment is needed to stay competitive with other forms of shipping. A consequence of the inadequate revenues caused by inadequate regulated cost of capital rates includes underinvestment in productive assets.

17. Economically inefficient outcomes may also occur in final offer arbitrations with CP's major customers. If the regulated cost of capital is too low, the underlying costs of the rail assets used to provide the service at issue will be underestimated. If these costs are underestimated, the arbitrator may disproportionately accept the shipper's final offer in rate disputes, resulting in insufficient revenues to CP and, eventually, insufficient net investment in productive assets.
18. Several other aspects of CP's operations and investment plans may be adversely affected to varying degrees by an unusually low regulated cost of capital. These include: interswitching rates, determination of railway (hosting) rates for passenger service providers, apportionment of cost for construction and maintenance of railway crossings, establishment of competitive line rates/joint tariffs, rates for running rights, and remedies for incidental service disputes.<sup>11</sup>

#### **IV. THE COST OF EQUITY**

19. The cost of equity is the return required by investors for bearing the risk associated with owning a firm's equity capital.<sup>12</sup> It is important to note that, while the cost of equity is an important theoretical concept in financial economics, there is no single measure that is always considered to be best. Market participants must estimate the cost of equity using models such as the

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<sup>10</sup> See CTA "Backgrounder: Revenue Caps and Costs," and "Questions and Answers on the Railway Revenue Cap," available at <http://www.otc-cta.gc.ca/>.

<sup>11</sup> QGI Consulting, "Description of Canada's Rail Based Freight Logistics System," November 2009, pp. 63-68.

<sup>12</sup> Shannon P. Pratt (2002), *Cost of Capital: Estimation and Applications*, 2<sup>nd</sup> ed., Wiley, p. 4.

Capital Asset Pricing Model (CAPM) and the Multi-Stage Discounted Cash Flow model (MSDCF). Ideally, it would be best to use a single model that outperforms all others in every situation. Unfortunately, such a scenario is unrealistic. In reality, cost of equity models each have positive and negative attributes that must be considered before relying on their results. A widely accepted method for increasing the reliability of results generated from these models is to combine individual estimates from multiple models into a single cost of equity estimate.<sup>13</sup>

### A. The Capital Asset Pricing Model

20. The CAPM is based on the idea that investors expect returns that are commensurate with the amount of non-diversifiable risk they expect to bear in holding a given asset. Investors achieve these expected returns by selling assets that they perceive to be overvalued and buying assets that they perceive to be undervalued until asset prices are such that investors can expect to earn relatively high returns for buying risky assets and low returns for buying riskless assets.<sup>14</sup> Mathematically, this relationship can be expressed as follows:

$$E[r_{CP}] = r_f + \beta_{CP} \times E[r_{Market} - r_f] \quad (\text{Equation 1})$$

where  $E[r_{CP}]$  is the return investors expect for investing in CP's equity (the cost of equity for CP),  $r_f$  is the risk-free rate of return,  $\beta_{CP}$  is a parameter that measures the sensitivity of CP's stock returns to market returns, and  $E[r_{Market} - r_f]$  denotes the market risk premium. The expectation operator "E" indicates that the cost of equity and market risk premium in the CAPM

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<sup>13</sup> The Brattle Group Report, pp. 3 and 5.

<sup>14</sup> Richard A. Brealey, Stewart C. Myers, and Franklin Allen (2006), *Principles of Corporate Finance*, 8<sup>th</sup> ed., McGraw-Hill Irwin, pp. 188-191.

reflect investor expectations. Appendix C contains a detailed summary of the data sources and methodology used in this report to implement the CAPM.<sup>15</sup>

21. The CTA currently relies on the CAPM when determining CP's cost of equity. In light of the specific methodology currently in use by the CTA, there are two inputs that merit discussion: the market risk premium and the risk-free rate of return.

i. *Market Risk Premium*

22. The CTA currently estimates the market risk premium by averaging the difference between the annual return of the Toronto Stock Exchange Index and the contemporaneous total return on Canadian Government bonds over a 45-year historical period.<sup>16</sup> This approach suffers from two major shortcomings: (i) it does not rely on all of the available data (which go back to 1936); and (ii) the risk-free rate of return used in the calculation of the market risk premium is measured using total returns, as opposed to income returns.
23. The rationale for basing the market risk premium on a long time series of historical data is well established. Conceptually, the market risk premium is the excess return over the risk-free rate that investors demand for holding a well-diversified portfolio of investments. Because the return on even a well-diversified portfolio can be extremely volatile in the short-run, a large number of observations are required to obtain a reasonably precise and stable estimate of the market risk premium.<sup>17</sup>

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<sup>15</sup> While we rely exclusively on Canadian data in constructing our proposed cost of capital estimates, we note that CP competes for capital in international capital markets, as evidenced by the fact that CP's stock is traded on both the Toronto and New York Stock Exchanges. Consequently, it would be reasonable for the CTA to incorporate data from U.S. capital markets when estimating CP's cost of capital.

<sup>16</sup> Specifically, the CTA estimates the market risk premium using two risk-free rates, the yield on 1-3 year Canadian Government bonds and the yield on 10+ year Canadian Government bonds. See The Brattle Group Report, p. 71.

<sup>17</sup> See Tim Koller, Marc Goedhart, and David Wessels (2005), *Valuation: Measuring and Managing the Value of Companies*, 4<sup>th</sup> ed., McKinsey & Company, p. 298, which advocates using "the longest period possible," and *Stocks, Bonds, Bills and Inflation, Market Results for 1926-2009, 2010 Yearbook, Valuation Edition*, Morningstar, Inc., p. 59, which notes that, "When calculated using a long data series, the historical equity risk premium is relatively stable."

24. While a large number of observations is a necessary condition for a good estimate of the market risk premium, it is not a sufficient condition. It is also important to recognize that many types of historical events tend to repeat themselves over time, and so even events that occurred long ago may tell us something about the future performance of financial markets as a whole. Morningstar/Ibbotson explains the rationale for basing the market risk premium on a very long time series of historical data as follows:

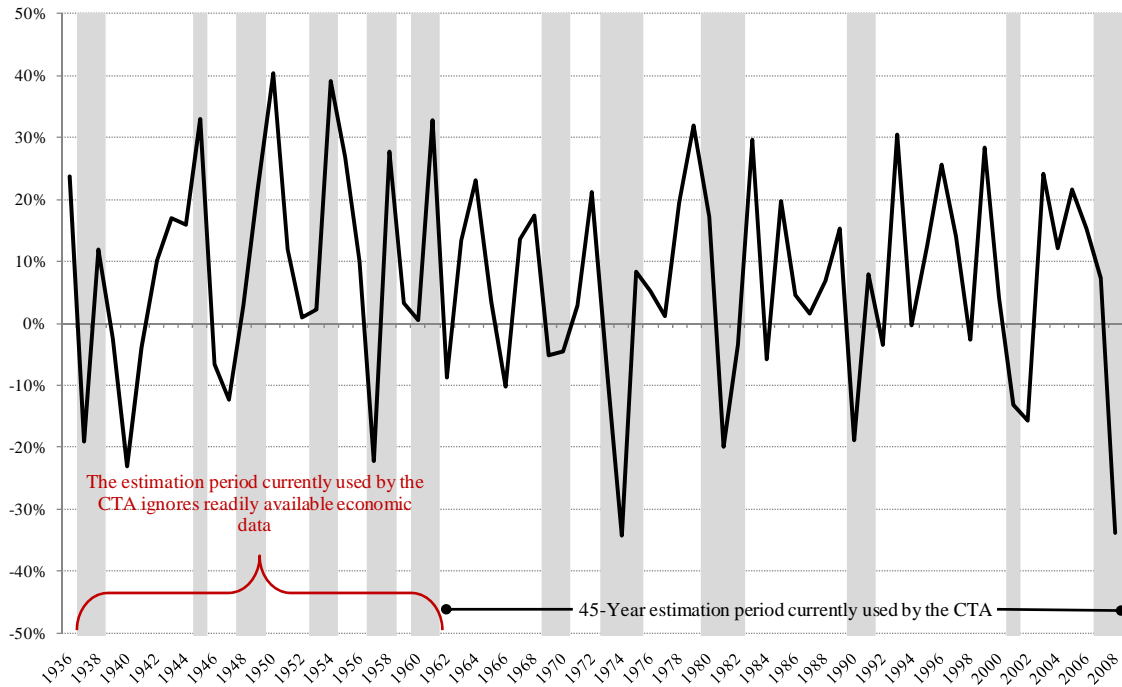
The 84-year period starting with 1926 is representative of what can happen: it includes high and low returns, volatile and quiet markets, war and peace, inflation and deflation, and prosperity and depression. Restricting attention to a shorter historical period underestimates the amount of change that could occur in a long future period. Finally, because historical event-types (not specific events) tend to repeat themselves, long-run capital market return studies can reveal a great deal about the future. Investors probably expect “unusual” events to occur from time to time, and their return expectations reflect this.<sup>18</sup>

25. Figure 2 below shows the annual return of the Canadian stock index over the period 1936-2008, as well as the timing of recessionary periods in the United States. Figure 2 shows that the CTA’s current practice of focusing on a 45-year period when calculating the market risk premium excludes several periods when the Canadian equity market generated unusually low or high returns, which were usually periods associated with the beginning or end of recessionary periods. By excluding these periods of unusually high or low equity returns from the estimation of the market risk premium, the CTA’s methodology understates the non-diversifiable risk faced by equity investors.

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<sup>18</sup> *Stocks, Bonds, Bills and Inflation, Market Results for 1926-2009, 2010 Yearbook, Valuation Edition*, Morningstar, Inc., p. 59.

**Figure 2**  
Recessions in the United States and Canadian Stock Index Returns  
1936 - 2008



**Notes and Sources:** Gray shaded areas represent years in which a recession occurred as reported by the National Bureau of Economic Research. Recession dates are from "Business Cycle Expansions and Contractions," *National Bureau of Economic Research*, <http://www.nber.org/cycles/cyclesmain.html>; Canadian Stock index returns are from the "Report on Canadian Economic Statistics, 1924-2008," *Canadian Institute of Actuaries*, June 2009.

26. In a recent review of the research on the equity risk premium, Rajnish Mehra and Nobel laureate Edward C. Prescott described the period from 1926 to the present as “the ‘Golden Age’ with regard to accurate financial data.”<sup>19</sup> Consequently there is no valid reason to limit the data series to more recent periods out of concern about data reliability. In contrast, the 45-year time period currently used by the CTA is an arbitrary period that discards relevant information available to investors in forming their expectations.
27. Further, Morningstar/Ibbotson provides an estimate of the Canadian long-horizon market risk premium that uses Toronto Stock Exchange and Canadian

<sup>19</sup> Rajnish Mehra and Edward C. Prescott (2008), “The Equity Premium: ABCs,” in Chapter 1 of *Handbook of the Equity Risk Premium*, Elsevier.

government bond income return data beginning in 1936.<sup>20</sup> The underlying data are provided to Morningstar in part by the Canadian Institute of Actuaries (CIA), a source that is currently used by the CTA. The Morningstar/Ibbotson report is publicly available and eliminates the need for the CTA to continually update the necessary data and estimate its own version of the market risk premium.<sup>21</sup>

28. An additional benefit of relying on the Morningstar/Ibbotson report is that in calculating the market risk premium, Morningstar/Ibbotson uses bond income return data (as opposed to bond total return data). In general, a portion of the historical long term total return is attributable to coupon payments (the “income return”) and another portion is attributable to changes in the price of the bond (which rises and falls throughout the bond’s life in response to general economic conditions). Morningstar/Ibbotson uses bond income return data because only that portion of the return associated with the coupon payments can be considered truly risk-free.<sup>22</sup> This distinction is important when bond prices change significantly. For example, Morningstar/Ibbotson reports that the total return on a long-term U.S. government bond in 1971 was 13.23 percent. Of this return, roughly half (6.32 percent) was attributable to the coupon payments and

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<sup>20</sup> See Morningstar (2010), “Canadian Risk Premia Over Time Report 2010.” The lead author of The Brattle Group Report, Dr. Michael J. Vilbert, has used this source in publicly available cost of capital testimony before the Ontario Energy Board and Régie De L’Énergie. See, for example, “Written Evidence of Michael J. Vilbert for Union Gas Limited,” EB-2005-0520, January 2006, Workpaper #1 to Table No. MJV-9; and “Written Evidence of Michael J. Vilbert for Gaz Métro Limited Partnership,” Régie De L’Énergie, R-3690-2009, May 4, 2009.

<sup>21</sup> The 2010 version of the Morningstar/Ibbotson “Canadian Risk Premia Over Time Report” is publicly available for a cost of US\$219. Morningstar/Ibbotson is a leading provider of investment research and financial markets data to market participants worldwide. Ibbotson Associates was established in 1977 by Roger Ibbotson, and the company became a subsidiary of Morningstar, Inc. in 2006. For its annual railroad cost of capital proceeding, the Surface Transportation Board in the U.S. uses the long-horizon equity risk premium reported by Morningstar/Ibbotson in its annual *Stocks, Bonds, Bills and Inflation Yearbook*. For the 2009 proceeding, the STB used the Morningstar/Ibbotson estimate of 6.67%. See *Stocks, Bonds, Bills and Inflation, Market Results for 1926-2009, 2010 Yearbook, Valuation Edition*, Morningstar, Inc., p. 54, and Railroad Cost of Capital -2009, STB Ex Parte 558 (Sub-No. 13), September 30, 2010.

<sup>22</sup> *Stocks, Bonds, Bills and Inflation, Market Results for 1926-2009, 2010 Yearbook, Valuation Edition*, Morningstar, Inc., pp. 55-56.

roughly half (6.61 percent) was attributable to changes in the price of the bond.<sup>23</sup>

ii. *Time Horizon of the Risk-Free Rate*

29. The risk-free rate used in the CAPM formula should have the same time horizon as the risk-free rate that is used in calculating the market risk premium.<sup>24</sup> In general, medium to long-term risk-free rates (10 years or more) are appropriate for the railroad industry because such durations are consistent with the railroad industry's long-term investment horizon.<sup>25</sup> Because the Morningstar/Ibbotson estimate of the Canadian market risk premium is measured relative to a long horizon risk-free rate, using the Morningstar/Ibbotson estimate of the market risk premium resolves any uncertainty over the appropriate risk-free rate to use in the CAPM formula.

30. Exhibit 1 shows the impact that the proposed modifications discussed above have on the CAPM cost of equity for CP. Over the period 2005-2010, the CAPM cost of equity estimates using this recommended methodology range from a low of 7.85 percent (in 2009) to a high of 10.29 percent (in 2005). The results from this recommended approach confirm that the CTA's current methodology produces estimates of the cost of equity that are far too low.<sup>26</sup>

## **B. The Multi-Stage Discounted Cash Flow Model**

31. The cost of equity in the discounted cash flow model is the discount rate that equates a firm's market value to the present value of the stream of future cash

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<sup>23</sup> *Stocks, Bonds, Bills and Inflation, Market Results for 1926-2006, 2007 Yearbook, Classic Edition*, Morningstar, Inc., pp. 239-243.

<sup>24</sup> The Brattle Group Report, pp. 22-23.

<sup>25</sup> Canadian Pacific Railway, Annual Report 2009, p. 2. ("In our industry, our investments can have a 10, 20, or 30 year horizon and we must balance near-term pressures with a long-term horizon.") In addition, see The Brattle Group Report, p. 23, which states: "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."

<sup>26</sup> The CTA pre-tax estimates have been converted to after-tax estimates using a tax rate of 31.87%, which was the tax rate used in the 2009-10 CTA cost of capital determination.

flows that accrue to equity investors. The discounted cash flow model assumes that investors will ultimately benefit from higher regular dividends, special dividends, stock buybacks, or stock price appreciation.<sup>27</sup> The CTA does not currently rely on a discounted cash flow methodology when calculating the cost of equity for CP. In light of this fact, a detailed description of the methodology is provided in the paragraphs that follow.

32. The specific financial formula used to implement the MSDCF model of the cost of equity proposed here is based on that presented in the Morningstar/Ibbotson *Cost of Capital Yearbook*. Shannon Pratt’s widely cited textbook on the cost of capital describes the *Cost of Capital Yearbook* as “a comprehensive source of industry-level financial data” that presents “[c]ost of equity, cost of capital, capital structure ratios, growth rates, industry multiples, and other useful financial data” on over 300 industries.<sup>28</sup> The formula is shown in Appendix D to this report and is consistent with the formula contained in the Surface Transportation Board’s January 28, 2009 decision in STB Ex Parte No. 664 (Sub-No. 1).
33. The financial inputs to the MSDCF model are cash flows, the expected growth of earnings, the stock market value for CP and the expected growth of earnings for Canadian National Railway (CN).<sup>29</sup> The methodology for collecting the financial inputs is described below.

i. *Cash Flows*

34. The MSDCF model defines cash flows (CF) as income before extraordinary items (IBEI) minus capital expenditures (CAPEX) plus depreciation (DEP) plus deferred taxes (DT). That is,

$$CF = IBEI - CAPEX + DEP + DT \quad (\text{Equation 2})$$

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<sup>27</sup> See, generally, Shannon P. Pratt (2002), *Cost of Capital: Estimation and Applications*, 2<sup>nd</sup> ed., Wiley, p. 112.

<sup>28</sup> Shannon P. Pratt (2002), *Cost of Capital: Estimation and Applications*, 2<sup>nd</sup> ed., Wiley, p. 128.

<sup>29</sup> For the purposes of this MSDCF model, which requires an assessment of industry-wide expected growth rates, these two railroads are assumed to constitute the entirety of the Canadian railroad industry.

35. IBEI is computed by deducting extraordinary items from net income. These financial data are then averaged over five years using the procedure described below. This averaging process requires the collection of sales revenue for each year of the relevant period.

36. For example, constructing the five-year average cash flow measure as of the end of 2009 requires the collection of data on five financial measures for each railroad for the fiscal years 2005 through 2009. These measures are:

- Net income before extraordinary items
- Capital expenditures
- Depreciation
- Deferred taxes
- Sales revenue

37. After these financial data are collected, they are combined into an average cash flow measure using the procedure illustrated in Table 1 below, which shows as an example the average cash flow calculation for CP at the end of calendar year 2009.

**Table 1**  
Average Cash Flow Calculation for Canadian Pacific Railway  
As of December 31, 2009  
(in CAD Millions)

	2005	2006	2007	2008	2009	Total
[A] Net Income Before Extraordinary Items	\$ 528	\$ 628	\$ 673	\$ 632	\$ 460	\$ 2,920
[B] Capital Expenditures	\$ (884)	\$ (794)	\$ (893)	\$ (892)	\$ (722)	\$ (4,186)
[C] Depreciation, Amortization and Accretion Charges	\$ 465	\$ 481	\$ 484	\$ 501	\$ 498	\$ 2,429
[D] Deferred Taxes	\$ 258	\$ 75	\$ 39	\$ 161	\$ 153	\$ 686
[E] Cash Flow to Equity (CF)	\$ 367	\$ 390	\$ 302	\$ 401	\$ 390	\$ <b>1,849</b>
[F] Sales	\$ 4,266	\$ 4,427	\$ 4,555	\$ 4,815	\$ <b>4,175</b>	\$ <b>22,239</b>
[G]	Ratio of CF to Sales [ $\$1,849/\$22,239$ ] =					<b>0.08316</b>
[H]	Average Cash Flow - December 31, 2009 [ $.08316 \times \$4,175$ ] =					\$ <b>347</b>

Source:

Canadian Pacific Railway, Form 40-F for years 2001, 2003- 2009.

38. The average cash flow shown in Table 1 is calculated by dividing the total cash flow over the 2005-2009 period (\$1,849 million; row E) by the total sales over the period (\$22,239 million; row F) to obtain an average cash flow to sales ratio (0.08316; row G). This cash flow to sales ratio is then multiplied by sales revenue in 2009 (\$4,175 million; row F) to obtain the 2009 average cash flow (\$347 million; row H) that is used as the starting point of the MSDCF model ( $CF_0$  in Appendix D).<sup>30</sup>
39. The financial data shown in Table 1 are reported on the consolidated financial statements contained in CP's annual Form 40-F filings with the Securities and Exchange Commission. CP typically files its 40-F form within three months after the end of the fiscal year, which is December 31. Capital expenditures, depreciation, and deferred taxes were collected from the statement of cash flows, while net income and sales revenue were collected from the income statement. Extraordinary items (if any) are reported, net of tax effects, as line items on the income statement.<sup>31</sup>

ii. *Earnings Growth Rates*

40. The first stage of the Morningstar/Ibbotson MSDCF model applies to a period that extends from one to five years in the future (the current year is considered to be year 0). In each year of the first stage, CP's annual earnings growth rate is assumed to be the average value of the "long term" (three- to five-year) earnings growth estimates made by railroad industry investment analysts during January, February, and March of each calendar year (which coincides with the release of the year-end financial statements). These analyst estimates are collected by the Institutional Brokers' Estimate System (I/B/E/S) and distributed by Thomson

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<sup>30</sup> This method of calculating average cash flows is consistent with the Morningstar/Ibbotson MSDCF model. See *Cost of Capital Yearbook*, 2010, Morningstar, Inc., p. 24.

<sup>31</sup> According to a recognized accounting textbook (Stickney et al.), extraordinary items are characterized by their "unusual nature" and "infrequency of occurrence." Extraordinary items generally fall into one or more of the following categories: (1) extraordinary gains or losses; (2) gains or losses from discontinued operations; and (3) cumulative effects of accounting changes. See Clyde P. Stickney, et al. (2010), *Financial Accounting: An Introduction to Concepts, Methods, and Uses*, 13<sup>th</sup> ed., South-Western, pp. 686-692.

Financial through its Thomson ONE Investment Management service.<sup>32</sup> Table 2 shows the average earnings growth rate estimates for CP and CN during the period 2005-2010.

**Table 2**  
I/B/E/S Average Long Term Growth Rates Estimates  
January, February, and March of Each Calendar Year  
2005-2010

Year	CP Growth Rate	CN Growth Rate
2005 (Crop Year 2005 - 2006)	12.00%	11.50%
2006 (Crop Year 2006 - 2007)	12.55%	13.75%
2007 (Crop Year 2007 - 2008)	12.00%	11.00%
2008 (Crop Year 2008 - 2009)	12.08%	11.00%
2009 (Crop Year 2009 - 2010)	10.00%	11.00%
2010 (Crop Year 2010 - 2011)	11.25%	10.75%

Notes and Sources:

- [1] Growth rates are from Thompson Financial.
- [2] February 2006 growth rate for CN of 29.3% was excluded as an outlier.

41. Research in financial economics has examined whether the actual earnings growth of firms is consistent with forecasts of earnings growth by investment analysts over the same period. Financial theory suggests possible explanations for both an upward and downward bias in analyst growth estimates, and empirical research has yielded mixed results.<sup>33</sup> Table 3 below compares CP's actual earnings growth to investment analyst growth estimates. The comparison

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<sup>32</sup> The analyst estimates used in the first stage of the model are referred to by Thomson Financial as the "Long Term Growth Forecasts." The Thomson Financial Glossary describes the estimates as follows: "[w]hile different analysts apply different methodologies, the Long Term Growth Forecast generally represents an expected annual increase in operating earnings over the company's next full business cycle. In general, these forecasts refer to a period of between three to five years." See *Thomson Financial Glossary 2004: A Guide to Understanding Thomson Financial Terms and Conventions for the First Call and I/B/E/S Estimates Databases*, p. 23. Thomson Financial also distributes I/B/E/S average growth rate estimates on a historical basis through its Thomson ONE Banker service.

<sup>33</sup> S.P. Kothari reviews major empirical research on optimism and bias in analyst forecasts, see S.P. Kothari (2001), "Capital Markets Research in Accounting," *Journal of Accounting and Economics* 31, pp. 105- 231. See also Jeffery Abarbanell and Reuven Lehavy (2003), "Biased Forecasts or Biased Earnings? The Role of Reported Earnings in Explaining Apparent Bias and Over/Underreaction in Analysts' Earnings Forecasts," *Journal of Accounting and Economics*, 36, pp. 105-146.

shows that investment analysts who track CP have not been overly optimistic regarding CP's earnings growth over time. Table 3 shows that analyst estimates underestimated CP's earnings growth in two of the four periods examined, and overestimated earnings growth in the other two periods. Note that analysts overestimated CP's growth in 2009, which was a year characterized by unusual economic activity that could not have been anticipated several years earlier when the analysts generated their growth estimates. The results in Table 3 indicate that reasonable and reliable earnings growth estimates for CP are available as inputs to the MSDCF model.

**Table 3**  
Average Cash Flow Calculation for Canadian Pacific Railway  
Comparison to Canadian Pacific Railway Actual EPS Growth  
2006-2009

Year <sup>[1]</sup>	5-Year EPS Compound Annual Growth Rate <sup>[2]</sup>	Analyst Forecast <sup>[3]</sup>
2006	16.6%	10.6%
2007	14.4%	10.2%
2008	9.9%	10.3%
2009	7.2%	12.0%

Notes and Sources:

Data are from Thomson Financial.

- [1] 2005 is not included because the first long term EPS growth estimate for Canadian Pacific is available from Thomson Financial as of December 2001, and the comparison presented here requires estimates as of March.
- [2] EPS data used in the calculation are from December 31 of each year. 5-Year EPS compound annual growth rate is calculated using:  $[\text{EPS}_n / \text{EPS}_{n-5}]^{1/5} - 1$ . For example, the value for 2006 is calculated as follows:  $[\text{EPS}_{2006} / \text{EPS}_{2001}]^{1/5} - 1$ .
- [3] EPS growth for each year is compared to the average of analyst long term growth EPS estimates made as of March 31, 4 years prior. For example, the actual 5-Year EPS growth rate as of December 31, 2006 is compared to the average long term EPS growth forecast made by investment analysts as of March 31, 2002.

42. The second stage of the MSDCF model applies to a period that extends from six to ten years in the future. During this stage, cash flows are assumed to grow at

the average of the investment analysts long term growth forecasts for the railroad industry, comprised of CP and CN.<sup>34</sup> For a given crop year, the second stage growth rate is calculated by taking the average of the relevant CP and CN growth rates shown in Table 2. For example, in 2010, the average growth estimate for CP was 11.25 percent, while the average growth rate estimate for CN was 10.75 percent.<sup>35</sup> Therefore, the second stage industry average growth rate for the 2010 MSDCF model is 11.00 percent.

43. The third stage of the MSDCF model begins 11 years in the future and continues in perpetuity. Starting in year 11, CP's growth rate is assumed to equal the long-run nominal growth rate of the Canadian economy. The long-run nominal growth rate used in the MSDCF estimate of the 2010 cost of equity is 5.74 percent, which is the sum of average historical real gross domestic product growth from 1961 to the present (3.23 percent) and the long-run inflation rate (2.51 percent).<sup>36</sup>
44. The third stage growth rate is applied to a cash flow value that is based on two additional assumptions about the long run: (i) depreciation equals capital expenditures (i.e., zero net investment); and (ii) all tax expense is treated as a cash outflow (i.e., changes in deferred taxes are zero). That is, cash flow in the third stage of the model is based only on income before extraordinary items (IBEI), whereas in stages 1 and 2 it is based on the expression in Equation 2 above. The initial value of IBEI (denoted as  $IBEI_0$  in Appendix D) is determined through the same averaging process that is illustrated in Table 1 for

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<sup>34</sup> This stage two growth rate is consistent with the Morningstar/Ibbotson MSDCF model. See *Cost of Capital Yearbook*, 2010, Morningstar, Inc., p. 24 (“ $g_2$  = Industry average of earnings growth rates”).

<sup>35</sup> Canadian National growth rate data are also collected by I/B/E/S and subsequently distributed by Thomson Financial through its Thomson ONE Investment Management service.

<sup>36</sup> The long-run inflation rate is measured by the difference between the yields of long horizon Canadian government marketable bonds and long horizon real return bonds in March of 2010. Data for historical GDP growth and long-run bond yields are from the World Bank and the Bank of Canada, respectively.

cash flows.<sup>37</sup> The third stage cash flow assumes CP has reached a steady state of operation.

iii. *Observed Market Value of Equity*

45. The final input to the MSDCF model is the stock market value of CP's equity ( $MV_0$  in Appendix D). Consistent with the practice of using stock market values that reflect the release of year-end financial statements, these data reflect the average month-end market values during the first quarter of each calendar year.<sup>38</sup>
46. Equation A1 of Appendix D gives the mathematical formula that is used to generate the MSDCF cost of equity estimates. The left side of this equation is the market value of CP in year 0. The right side of the equation is the discounted value of the cash flows from the three stages of the firm's expected future growth. The numerator of the final term in Equation A1 [specifically,  $IBEI_{10}(1+g_3)/(r-g_3)$ ] is often referred to as the terminal value of the model because it represents the value in year 10 of the perpetual stream of cash flows that begins in year 11. Equation A1 in Appendix D is solved for the cost of equity ( $r$ ) using a relatively simple but powerful numerical tool, Microsoft Excel's Solver function.<sup>39</sup>
47. Applying the methods described above, Exhibit 2 shows the MSDCF estimates for CP's cost of equity during the period 2005-2010. The estimates range from 12.86 percent (in 2008) to 16.61 percent (in 2009) during the period 2005-2010. The results from this approach are well above those generated by the CTA's CAPM approach.

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<sup>37</sup> For 2010, the value of  $IBEI_0$  is calculated as follows:  $(\$2,920 \text{ million}/\$22,239 \text{ million}) \times \$4,175 \text{ million} = 0.1313 \times \$4,175 \text{ million} = \$548 \text{ million}$ .

<sup>38</sup> See, for example, *Cost of Capital Yearbook, 2010*, Morningstar, Inc., p. 1. ("By the end of March, many companies have reported their previous year's financial results.") Market value data are collected from Thomson Financial.

<sup>39</sup> A commonly used Excel user's manual describes the Solver function as follows: "Solver is an Excel add-in that goes several steps further than goal seeking. It uses the same basic trial-and-error approach (known to scientific types as an *iterative* approach), but it's dramatically more intelligent than goal seeking." See Matthew MacDonald, *Excel 2007: The Missing Manual*, O'Reilly Media, p. 583.

### C. Average of the CAPM and MSDCF Cost of Equity Estimates

48. In theory, there is no way to predict which model (CAPM or MSDCF) will produce a higher or lower COE estimate in a given year. Were the CTA to use both the CAPM and MSDCF models to determine CP's cost of equity, it would be sensible to start the process by giving the estimates from each model equal weight.
49. Consistently averaging the cost of equity estimates from both models produces a final estimate that is more stable than estimates from either model alone for two reasons. First, in a statistical sense, the average estimate is less variable over time than estimates from the individual models. Second, consistent application of a reasonable cost of equity methodology will provide increased predictability and reduce uncertainty in the investment environment. In contrast, the CTA's current methodology has resulted in a 50 percent decline in the regulated cost of equity rate over the past decade (see, again, Figure 1). Such volatility discourages investment in long-run assets. Increased transparency in the CTA's methodology is another benefit of using a simple average of the estimates each year.
50. Exhibit 3 shows that over the period 2005-2010, the average of the MSDCF and CAPM estimates ranges from 10.77 percent (in 2007) to 12.31 percent (in 2005). Exhibit 4 provides a graphical analysis comparing the MSDCF and CAPM estimates over time with the average estimates. The average estimates produce a stable pattern for CP cost of equity over time.
51. A common statistical measure of dispersion – the coefficient of variation – confirms that taking the average creates a more stable estimate of CP's cost of equity.<sup>40</sup> Exhibit 5 shows that over the period 2005-2010 the coefficient of variation of the CAPM estimates is 0.091 and the coefficient of variation of the

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The coefficient of variation is equal to the standard deviation of a variable divided by its mean. See, for example, Ajit C. Tamhane and Dorothy D. Dunlop (2000), *Statistics and Data Analysis: From Elementary to Intermediate*, Prentice Hall, p. 116. It is important to adjust the variability by the mean in this way to account for differences in the average magnitudes of variables. Note that the coefficient of variation is independent of the unit of measurement.

MSDCF model estimates is 0.099. The average of the two estimates has a coefficient of variation of only 0.057 over this period. Thus, if the CTA were to adopt the combined methodology demonstrated above it would produce a more stable estimate of CP's cost of equity than if it were to rely on the CAPM methodology alone.

## V. THE COST OF DEBT

52. The cost of debt represents the return that compensates creditors for bearing the credit risk of the firm (i.e., the probability that the firm will fail to adhere to the terms of an agreement to repay its debts).<sup>41</sup> We recommend that the CTA compute CP's cost of debt by combining three pieces of information: (i) the weighted average time to maturity of CP's debt instruments; (ii) CP's debt rating; and (iii) the yield to maturity of an index of Canadian bonds with the same time to maturity and debt rating as CP. Exhibit 6 summarizes the results of this proposed approach.
53. For any given year, the cost of debt shown in Exhibit 6 is computed by first identifying the outstanding balance and time to maturity of each of CP's outstanding debt instruments as of December 31. Next, a weighted average time to maturity for CP's debt is calculated using each instrument's outstanding balance as the weight.<sup>42</sup> Exhibit 6 shows that CP's weighted average time to maturity ranged from 12.0 to 14.4 years over the period 2005-2010. Finally, the yield to maturity for an index of Canadian bonds is obtained from Bloomberg.<sup>43</sup> The average yield of 10- and 15-year maturity BBB-rated corporate bonds is used to be consistent with the debt rating and weighted average time to maturity

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<sup>41</sup> Shannon P. Pratt (2002), *Cost of Capital: Estimation and Applications*, 2<sup>nd</sup> ed., Wiley, p. 4.

<sup>42</sup> Reported book values of debt are used in the weighted average time to maturity calculation because market values are not available for some of the debt instruments.

<sup>43</sup> Average yields are computed from the values reported in Bloomberg's "Fair Value Curve" for 10- and 15-year BBB-rated Canadian corporate bonds. The cost of debt represents the average month-end yield to maturity for the first quarter of each year.

of CP's debt instruments.<sup>44</sup> Exhibit 6 shows that CP's cost of debt ranged from 5.44 percent (in 2007) to 7.71 percent (in 2009). These estimates represent the cost of replacing CP's portfolio of debt instruments in each year. The cost of debt estimates shown in Exhibit 6 are used in the weighted average cost of capital (WACC) calculations for CP discussed in the next section.

54. Yields to maturity are the appropriate cost of debt measure to use in the cost of capital determination because they represent a better estimate of CP's current cost of borrowing than do the coupon rates that are currently used by the CTA.<sup>45</sup> The yield to maturity reflects the market's assessment of the actual cost of debt for a given maturity at a particular point in time. Specifically, the yield to maturity is the coupon rate that the market would charge a company with CP's debt rating to issue par bonds at a particular point in time. Therefore, the yield to maturity reflects the current market cost of debt faced by the firm.<sup>46</sup> Yields not only account for returns to investors from any coupon payments, but also for any expected return from the difference between the current price of the debt instrument and its par value at maturity. Using only coupon rates as the cost of debt ignores the capital appreciation/depreciation component of the return to debt holders over the remaining life of the debt instrument.<sup>47</sup>

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<sup>44</sup> CP debt was rated BBB by Standard & Poor's over the period 2005-2010. See Form 40-F filings made by CP over this period.

<sup>45</sup> The Brattle Group Report, p. 55.

<sup>46</sup> Tim Koller, Marc Goedhart, and David Wessels (2005), *Valuation: Measuring and Managing the Value of Companies*, 4<sup>th</sup> ed., McKinsey & Company, p. 320.

<sup>47</sup> Zero coupon bonds are the simplest way to illustrate this point. Although zero coupon bonds do not offer investors any coupon payments, they are not a costless source of debt financing. Zero coupon bonds are issued at a discount and provide investors with a market rate of return, commensurate with the bond's risk, through capital appreciation between the time of issue and the bond's maturity.

## VI. WEIGHTED AVERAGE COST OF CAPITAL

### A. Market Value Weights

55. The CTA currently uses accounting book values of debt, equity and deferred taxes to determine each component's weight in CP's capital structure. Although book values of debt are generally close to the market values of debt, market values should be used for constructing the weights for the WACC calculation. CP provides an estimate of the fair market value of its outstanding debt in the notes to the financial statements contained in its annual Form 40-F filings.
56. Similarly, market values of equity are a more appropriate basis for constructing the weights for the WACC calculation than book values.<sup>48</sup> Market value weights are also consistent with the CAPM and MSDCF methods for estimating the cost of equity, both of which rely on market values for key inputs. Market values of equity are readily available for public companies such as CP and are generally used when determining the capital structure for a firm.<sup>49</sup> Consistent with the practice of using market values of equity that reflect the release of year-end financial statements, the market value of CP's equity is calculated in this report as the average of the month-end market values during the first calendar quarter of each year.
57. Using market value weights also eliminates the need to identify deferred tax liabilities as a component of CP's capital structure. Deferred tax liabilities stem from the depreciation policies used to account for capital investment, specifically the ability of firms to use accelerated depreciation for tax purposes and straight line depreciation for accounting purposes. Any economic effects associated with the depreciation policies that generate deferred tax liabilities will be captured in the market value of equity.

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<sup>48</sup> Richard A. Brealey, Stewart C. Myers, and Franklin Allen (2006), *Principles of Corporate Finance*, 8<sup>th</sup> ed., McGraw-Hill Irwin, p. 514; The Brattle Group Report, p. 64.

<sup>49</sup> CP's equity has been publicly traded since 2001.

58. The deferred tax liability is currently treated by the CTA as a separate component of the capital structure and assigned a zero cost in the CTA's calculation of the weighted average cost of capital. This treatment contributes to an unreasonably low cost of capital and counteracts the investment incentives associated with the government's accelerated depreciation policy.
59. Although using the market value of equity is the best method for determining the capital structure weighting, book values are sometimes used in regulatory settings as an alternative proxy for market values. In cases when book values are used, operating liabilities should not be considered part of the capital structure and equity equivalents, such as deferred tax liabilities, should be combined with the book value of equity.<sup>50</sup> Such an aggregation will more closely approximate market values of equity and be more in line with how the cost of equity is estimated under CAPM and MSDCF. There are no circumstances under which equity equivalents such as CP's deferred tax liabilities should be assigned a zero cost of capital and maintained as a separate category in the capital structure when determining the cost of capital for regulatory purposes.

## **B. After-Tax WACC**

60. Once a firm's capital structure has been determined and its costs of debt and equity have been estimated, the final input required for the WACC calculation is the applicable tax rate.<sup>51</sup> For purposes of this report, we used a 31.87 percent tax rate, which is the rate used in the 2010 CTA determination for CP's interswitching costs and rates.<sup>52</sup> A tax rate is required to convert the estimated

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<sup>50</sup> Tim Koller, Marc Goedhart, and David Wessels (2005), *Valuation: Measuring and Managing the Value of Companies*, 4<sup>th</sup> ed., McKinsey & Company, pp. 168, 173.

<sup>51</sup> The Brattle Group Report, p. 64.

<sup>52</sup> See CTA Staff Report, "Canadian Pacific Railway Company: Summary of Calculation for the Cost of Capital Rate for the Development of Interswitching Costs and Rates for the Year 2010," October 2009, p. 2.

cost of debt from a pre-tax rate to an after-tax rate in order to account for the tax deductibility of interest payments made by CP.<sup>53</sup>

61. Once all of the inputs to the model have been identified, the weighted average cost of capital for CP is calculated as follows:  $\text{Cost of Debt} \times (1 - 0.3187) \times (\text{Debt}/(\text{Debt} + \text{Equity})) + \text{Cost of Equity} \times (\text{Equity}/(\text{Debt} + \text{Equity}))$ . No tax adjustment is needed for the equity component because dividends are not tax deductible. As discussed previously, market values of debt and equity are used when determining the weighting.
62. CP's debt and equity weights are reported in Exhibit 7, which summarizes CP's WACC for the years 2005 through 2010. Exhibit 7 lists the relevant inputs to the calculations and compares the CTA's WACC estimates to the estimates resulting from the methodology described in this report. The WACC estimates are presented on an after-tax basis to allow the CTA flexibility to use the rates for multiple purposes. These rates can be grossed up to a pre-tax basis if needed or left on an after-tax basis depending on the regulatory application. Exhibit 7 shows that CP's after-tax WACC computed using the methodology proposed in this report is substantially higher than the CTA's estimate in every year. When converted to an after-tax basis, the CTA's WACC estimates ranged from 4.35 percent to 5.67 percent over the period 2005-2010, for an average value of 5.22 percent. In contrast, the methodology proposed in this report yields after-tax WACC estimates ranging from 8.56 percent to 9.36 percent over the period 2005-2010, for an average value of 9.1 percent.

## **VII. COMMENTS ON THE BRATTLE GROUP REPORT**

### **A. Use of Multiple Approaches for Estimating Cost of Equity**

63. Three of the regulatory authorities reviewed by The Brattle Group (Alberta Utilities Commission, Ontario Energy Board, and U.S. Surface Transportation

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<sup>53</sup> See, for example, The Brattle Group Report, footnote 105: "As this is all on an after-tax basis, the cost of debt reflects the tax value of interest deductibility."

Board) use more than one method to estimate the cost of equity.<sup>54</sup> We agree with The Brattle Group’s conclusion that “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.”<sup>55</sup> We believe the STB’s explicit use of equally weighted results from the CAPM and MSDCF models is the most transparent approach and would be a good methodology for CTA to adopt given its regulatory objectives. Using data for CP, we find that averaging the results from the CAPM and MSDCF models provides a more stable estimate of the cost of equity over time than a single model.

## **B. Risk-Free Rates Used in the CAPM**

64. We agree with The Brattle Group’s conclusion that the risk-free rate used directly in the CAPM formula should be internally consistent with the risk-free rate used to calculate the market risk premium.<sup>56</sup> In addition, we agree with The Brattle Group that regulators should use long-term risk-free rates in the CAPM because “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.”<sup>57</sup> Consequently, we believe that the CTA should modify its cost of equity methodology and implement the CAPM using a long-term risk-free rate. This change would bring the CTA’s CAPM methodology more into line with the economic reality of CP’s operations and investors’ required returns.

## **C. Market Risk Premium Measurement**

65. The Brattle Group’s discussion of the various methodologies for estimating the market risk premium (MRP) suggests that any of the approaches reviewed in the Report may be appropriate, depending of the objectives of the Agency.<sup>58</sup> We

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<sup>54</sup> The Brattle Group Report, p. 96.

<sup>55</sup> The Brattle Group Report, p. 5.

<sup>56</sup> The Brattle Group Report, p. 23.

<sup>57</sup> The Brattle Group Report, p. 23.

<sup>58</sup> The Brattle Group Report, pp. 33-34.

disagree with this The Brattle Group Report on this subject. The MRP used to determine a regulated cost of capital for Canadian railroads should be measured over a long period of time. A long-run MRP represents the best estimate of future performance because many types of historical events recur over time.<sup>59</sup> A long-run MRP also tends to be stable.<sup>60</sup> A stable cost of capital rate is essential for efficient planning and investment decisions in an industry such as the railroad industry with exceptionally long-lived physical assets. The alternative approaches to measuring the market risk premium reviewed by The Brattle Group may be appropriate for other industries or other regulatory situations, but the long-run historical average methodology represents the best choice for the Canadian railroad industry.

#### **D. Consequences for CP of Setting the Cost of Capital Too Low**

66. The Brattle Group states, and we agree, that the cost of capital represents “the expected rate of return investors require based on the risk-return alternatives available in competitive capital markets” and is “a type of opportunity cost.”<sup>61</sup> The Brattle Group goes on to describe the benefits of achieving a fair return in a regulated utility setting as follows:

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 a fair return on the invested capital.<sup>62</sup>

67. While we agree with The Brattle Group’s assessment of the regulatory process, we believe that the Report does not adequately apply the arguments to regulated

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<sup>59</sup> The Brattle Group Report, p. 31, notes that “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.”

<sup>60</sup> The Brattle Group Report, p. 34, notes that “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 models.”

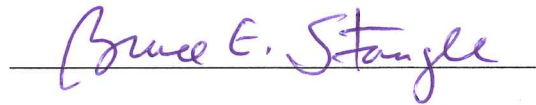
<sup>61</sup> The Brattle Group Report, p. 2.

<sup>62</sup> The Brattle Group Report, p. 3.

railroads such as CP. In order to attract the capital needed to maintain and expand CP's productive capital, investors need to earn a return that fairly compensates them for the risk of their investment in CP. If an investment in CP cannot offer a "fair return," investors will reallocate their capital to other investments that compensate them for the risk assumed. An investment in CP can only provide a "fair return" to investors if CP generates returns that meet investors' expectations. Generating sufficient returns is only possible if CP's cost of capital is appropriately determined.

68. Setting the cost of capital too low will result in capital that would otherwise be invested in CP instead being reallocated to other investments that generate returns commensurate with the risks taken. Furthermore, CP will face incentives to underinvest because it cannot earn at least its cost of capital on new investments. Although the immediate impact from underinvestment due to an inadequate regulatory cost of capital may not readily appear, in the long-run the effects of persistent underinvestment will be: (i) decreased productivity; (ii) decreased service levels; and (iii) longer shutdown periods due to inoperable infrastructure.

March 24, 2011



Bruce E. Stangle

March 24, 2011



George Kosicki

## Appendix A

### **BRUCE E. STANGLE, Ph.D.** **Chairman**

Phone: (617) 425-8110  
Fax: (617) 425-8001  
bstangle@analysisgroup.com

111 Huntington Avenue  
Tenth Floor  
Boston, MA 02199

A co-founder of Analysis Group, Inc., Dr. Stangle specializes in the fields of industrial organization, economics and finance. He has over 30 years experience directing large research projects in numerous industries on issues relating to antitrust, regulation, intellectual property and securities matters, and has consulted with Fortune 500 companies on various management, strategy and policy issues. Dr. Stangle has provided testimony on market definition, entry conditions, competitive effects, securities valuation, and damages. He is a member of the American Economic Association, the Board of Trustees of Bates College, and the Board of Directors of two separate money management firms: Wellington Trust Company, NA, and The Marsico Investment Fund. He occasionally serves on the boards of startup firms and was formerly a director of a venture capital firm.

#### **EDUCATION**

- 1978 Ph.D. in Applied Economics, MIT Sloan School of Management
- 1974 M.S. in Management, MIT Sloan School of Management Thesis: An Analysis of Computer Security in an Ambulatory Medical Care Facility
- 1970 B.A., Bates College

#### **PROFESSIONAL EXPERIENCE**

- 1981 - present Chairman and Co-founder, Analysis Group, Inc.
- 2001 - present Member, Board of Directors, Wellington Trust Company, NA
- 2010 - present Member, Board of Directors, The Marsico Investment Fund
- 1998 - present Trustee, Bates College
- 1998 - 2010 Member, Visiting Committee, Economics Department, Massachusetts Institute of Technology
- 1994 – 1998 Member, Board of Directors, Massachusetts Technology Development Corporation
- 1978 – 1981 Senior Economist, Arthur D. Little, Inc.

#### **DISSERTATION**

“Price Determination in the Markets for Beef” Committee: M.A. Adelman (Chair), Paul L. Joskow, Lester C. Thurow

## **PUBLICATIONS AND PRESENTATIONS**

“What Did Satyam Investors Lose?” with Gaurav Jetley, Guest Op-ed column, *The Economic Times*, February 25, 2009.

“Calculating Cartel Overcharges,” presented at Fordham Law School, November 2007-2010.

“An Assessment of Competition in California Title Insurance and Escrow Markets,” with Bruce A. Strombom, report prepared for First American Title Insurance Company, August 30, 2006.

“Evaluation of Proposed Regulations for the California Title Insurance and Escrow Industry,” with Bruce A. Strombom, report prepared for First American Title Insurance Company, August 30, 2006.

“Competition and Title Insurance Rates in California,” with Bruce A. Strombom, report prepared for First American Title Insurance Company, January 23, 2006.

“Market Efficiency Versus Behavioral Finance,” with Burton Malkiel and Sendhil Mullainathan, *Journal of Applied Corporate Finance*, Summer 2005;17(3):74-84.

“Is Competitive Entry Free? Bypass and Partial Deregulation in Natural Gas Markets,” with Paul W. MacAvoy and Daniel F. Spulber, *Yale Journal on Regulation*, 1989.

“Economics of U.S. and Pacific Rim Insurance Markets,” invited paper presented at the American Bar Association annual meeting, Hawaii, August 8, 1989.

“How Much Is Your Bank Worth?” with Michael F. Koehn and Laura Stiglin, *1988 Bank Performance Annual*, Edwin B. Cox, ed., Boston, MA: Warren, Gorham & Lamont, 1988.

“Market Share and Profitability,” with M.A. Adelman, *Antitrust and Regulation: Essays in Memory of John J. McGowan*, Franklin M. Fisher, ed., Cambridge, MA: M.I.T. Press, 1985.

“New Antitrust Chief and Herfindahl Index,” with William C. Pelster, *New York Law Journal*, 1981.

“The Effect of Deposit-Rate Ceilings on Bank Risk: A Comment,” with Michael F. Koehn, *Journal of Banking & Finance*, December 1980;4(5):381-386.

“The Determinants of Systematic Risk and the Cost of Capital for the Regulated Electric Utility Industry,” Cambridge, Mass: Working Paper, MIT Sloan School of Management.

“Federal Regulation of Energy, 1972-1974,” with Paul W. MacAvoy, presented at the American Association for the Advancement of Science Annual Meeting, Session on Regulation, chaired by Professor George J. Stigler, New York, January 1975. Also published in *Technology Review*.

## TESTIMONY OVER PAST FIVE YEARS

- **Flonase Antitrust Litigation**, *United States District Court, Eastern District of Pennsylvania*. Deposition testimony regarding indirect purchaser class certification in case involving alleged delay of generic entry.
- **Charters v. John Hancock Life Insurance Company**, *United States District Court, District of Massachusetts*. Deposition testimony in an ERISA case regarding fees charged to 401(k) plans.
- **AT&T Inc v. United States of America**, *United States District Court, Western District of Texas, San Antonio Division*. Deposition testimony in a tax case regarding interpretation of Universal Service Fund payments.
- **Class v. Bechtel Corporation, et al.**, *United States District Court, Northern District of California, San Francisco Division*. Deposition testimony regarding damages in an ERISA case regarding a 401(k) plan.
- **For the Association of American Railroads**, *Before The Surface Transportation Board, Ex Parte No. 664 (Sub-No.1)*. Report and testimony concerning use of a multi-stage discounted cash flow model in determining the railroad industry's cost of capital.
- **For the Association of American Railroads**, *Before The Surface Transportation Board, Ex Parte No. 664*. Reports (joint with R. Glenn Hubbard) and testimony concerning methodology to be employed in determining the railroad industry's cost of capital.
- **James L. Miller v. U.S. Foodservice, Royal Ahold, and Ahold USA**, *United States District Court, Maryland*. Deposition testimony regarding damages.
- **CIGNA Securities Litigation**, *United States District Court, Eastern District of Pennsylvania*. Deposition testimony regarding loss causation and damages.
- **CIGNA Securities Litigation**, *United States District Court, Eastern District of Pennsylvania*. Deposition testimony regarding measurement of economic loss.

## Appendix B

### GEORGE KOSICKI, Ph.D. Vice President

Phone: (617) 425-8162  
Fax: (617) 425-8001  
gkosicki@analysisgroup.com

111 Huntington Avenue  
Tenth Floor  
Boston, MA 02199

Dr. Kosicki specializes in applied microeconomics and has consulted in the areas of antitrust, mergers and acquisitions, labor economics, pharmacoeconomics, corporate finance, and commercial damages. He has also served as an expert witness on liability and damages issues. Dr. Kosicki has worked extensively on issues of cost pass through and damages in indirect purchaser litigation stemming from global price fixing conspiracies. He is experienced in market definition analyses, including those in the pharmaceutical industry.

Prior to joining Analysis Group, Dr. Kosicki served as Chair of the Economics Department at the College of the Holy Cross, where he spent 15 years on the faculty teaching principles of economics, microeconomic theory, industrial organization, and labor economics. He also wrote the book *Labor Market Problems and Applications* to accompany the best selling labor economics textbook *Modern Labor Economics* by Ehrenberg and Smith. Dr. Kosicki's research has been published in several peer-reviewed journals, including *Antitrust Bulletin*, *Southern Economic Journal*, and *Journal of Economic Education*.

#### PROFESSIONAL EXPERIENCE

College of the Holy Cross, Economics Department, Worcester, MA (Sept. 1985 – May 2001)  
Assistant Professor (Sept. 1985 – Aug. 1991)  
Associate Professor (Sept. 1991 – May 2001)  
Department Chair (June 1994 – May 1997)

The Brattle Group, Cambridge, MA (while on leave from Holy Cross)  
Associate (May 1999 – April 2000)

Analysis Group, Inc., Boston, MA (June 2001 – present)  
Senior Associate (June 2001 – Dec. 2002)  
Vice President (Jan. 2003 – present)

#### EDUCATION

Ph.D., Economics, Cornell University, 1985  
Dissertation: *A Reevaluation of the Relative Income Hypothesis*  
Committee: Robert H. Frank (chair), Ronald G. Ehrenberg, Richard E. Schuler  
M.A., Economics, Cornell University, 1984  
B.A., Economics, John Carroll University, 1981

## **SELECTED CONSULTING WORK**

### **Agrigenetics, Inc. (d/b/a Mycogen Seeds) v. Pioneer Hi-Bred International, Inc.**

*United States District Court, Southern District of Indiana, Indianapolis Division*

Supported Professor Walter Thurman in damages analysis of alleged breach of contract regarding distribution of genetically modified corn seeds.

### **Certain Underwriters at Lloyd's et al. v. Tyson Foods, Inc.**

*Superior Court of the State of Delaware in and for New Castle County*

Supported Professor Michael Wohlgenant in an analysis of the economic damages that Tyson's international leg quarter business incurred as a result of port and shipping disruptions caused by Hurricane Katrina.

### **Arvco Container Corporation v. Weyerhaeuser Company**

*United States District Court, Western District of Michigan, Case No. 1:08-cv-548*

Expert report (October 16, 2009) and deposition testimony (October 28, 2009) in rebuttal of plaintiff's allegation of a secondary-line violation of the Robinson-Patman Act. Report addressed issues of geographic market definition, cost justification, competitive injury, and damages.

### **Emigra Group, LLC v. Fragomen, Del Rey, Bernsen & Loewy, LLP, et al.**

*United States District Court, Southern District of New York, 07 Civ. 10688 (LAK)*

Submitted expert declarations (February 22, 2008 & June 27, 2008) addressing the plaintiff's market definition and monopolization claims regarding the provision of business immigration services. Judge approved defendants' motion for summary judgment on federal antitrust claims.

### **Methodology to be Employed in Determining the Railroad Industry's Cost of Capital**

*Before the Surface Transportation Board, Ex Parte No. 664 and 664 (Sub-No. 1)*

On behalf of the Association of American Railroads, supported Dr. Bruce E. Stangle and Professor R. Glenn Hubbard in an analysis of methodological issues related to the estimation of the railroad industry's cost of equity capital.

### **International Air Transportation Surcharge Antitrust Litigation**

*United States District Court, Northern District of California*

Supported Professor Robert Pindyck in analysis of the effect of fuel surcharges on the prices paid by airline passengers.

### **Executive Airlines v. Electric Boat Corporation**

*United States District Court, District of Connecticut, Civil Action No. 3:02-CV-194 (WWE)*

Expert reports (July 17, 2006 & March 12, 2007) and trial testimony (May 9-10, 2007) regarding lost profits from early termination of contract for air charter service.

**Non Participating Manufacturer (NPM) Adjustment Proceeding Under the Tobacco Master Settlement Agreement**

*Arbitration Proceeding Before Professor Daniel McFadden and the Brattle Group*

On behalf of the Settling States, supported Professors Robert Pindyck and Jonathan Gruber in an analysis of whether the disadvantages of the 1998 Master Settlement Agreement were a “significant factor” contributing to the Market Share Loss of the Participating Manufacturers in 2003 and 2004.

**HDC Medical, Inc. v. Minntech Corporation**

*United States District Court, District of Minnesota, File No. 04-CV-143 ADM/AJB*

Expert report (August 1, 2005) and deposition testimony (August 26, 2005) in rebuttal of plaintiff’s claim of attempted monopolization and anticompetitive tying; report addressed market definition, liability, and damages issues pertaining to defendant’s sales of kidney dialysis reprocessing equipment and supplies. Judge approved defendant’s motion for summary judgment, citing expert report. Decision affirmed by U.S. Court of Appeals, Eighth Circuit.

**Minnesota Vitamin Antitrust Litigation**

*State of Minnesota, District Court, County of Ramsey, Second Judicial District*

Conducted analysis of damages claims by indirect purchasers of vitamin-containing animal feed products that were allegedly inflated in price.

**Remeron Antitrust Litigation**

*United States District Court, District of New Jersey*

Supported an antitrust expert in an analysis of the market definition relevant to claims that the generic version of Remeron, an antidepressant drug, was improperly delayed.

**Verizon New England, Inc. v. D.W. White Construction Company, et al.**

*Commonwealth of Massachusetts (Suffolk County), Superior Court C.A. No. 00-0723-G*

Deposition testimony (March 14, 2003) evaluated the wage rate and total labor costs billed by Verizon New England in its attempt to recover damages from D.W. White and others for an excavation accident.

**Kellogg Company v. BASF AG, et al.**

*United States District Court, District of Columbia*

Supported Professor Robert Pindyck in an analysis of the lost profits incurred by Kellogg Company because of purchases of vitamin-containing products that were allegedly inflated in price.

**P&O Princess Cruises plc**

*Before the Federal Trade Commission*

Supported Professor Robert Pindyck in an analysis of the economic effects of a proposed merger in the cruise industry.

**EF Institute for Cultural Exchange, et al. v. Explorica, Inc., et al.**

*United States District Court, District of Massachusetts, C.A. No. 01-10645-MEL*

Expert affidavit addressed the economic effect that the electronic collection of publicly available price information by a competitor has on market competition.

### **WorldCom-Sprint Merger**

*Before the Antitrust Division of the U.S. Department of Justice*

Supported antitrust expert in analysis of the market power implications of the proposed merger; potential unilateral price increases were predicted through market simulations within a differentiated products framework.

### **PRIOR RESEARCH EXPERIENCE**

Dr. Kosicki has conducted several empirical studies of the effects of community consumption standards on individual decisions to work and save. These studies utilized large micro data sets, including the Consumer Expenditure Survey, the Current Population Survey, and the National Longitudinal Survey.

### **PUBLICATIONS**

#### **Refereed Journals - Economics**

“Economics of Cost Pass Through and Damages in Indirect Purchaser Antitrust Cases” (with M. Cahill), *Antitrust Bulletin*, Fall 2006, 599-630.

“Exploring Economic Models Using Excel” (with M. Cahill), *Southern Economic Journal*, January 2000, 770-792.

“Interpersonal Comparisons and Labor Supply: An Empirical Analysis,” *The American Economist*, Spring 1993, 20-34.

“Linking the Production Possibilities Curve, the Supply Curve, and the Competitive Norm,” *Journal of Economic Education*, Fall 1991, 307-311.

“Income Redistribution and Aggregate Consumption: Implications of the Relative Income Hypothesis,” *The American Economist*, Spring 1990, 40-44.

“A Note about Savings as a Nonpositional Good,” *Eastern Economic Journal*, July-September 1988, 271-276.

“A Test of the Relative Income Hypothesis,” *Southern Economic Journal*, October 1987, 422-434.

“The Relative Income Hypothesis: A Review of the Cross Section Evidence,” *Quarterly Journal of Business and Economics*, Autumn 1987, 65-80.

#### **Refereed Journals – Health Care**

“The Impact of Psoriasis on Health Care Costs and Patient Work Loss” (with J.F. Fowler, M.S. Duh, L. Rovba, S. Buteau, L. Pinheiro, F. Lobo, J. Sung, J.J. Doyle, A. Swensen, D.A. Mallett), *Journal of the American Academy of Dermatology*, November 2008, 772-780.

“The Direct and Indirect Cost Burden of Atopic Dermatitis: An Employer-Payer Perspective” (with J.F. Fowler, M.S. Duh, L. Rovba, S. Buteau, L. Pinheiro, F. Lobo, J. Sung, J.J. Doyle, A. Swensen, D.A. Mallett), *Managed Care Interface*, October 2007, 26-32.

“Cost-Minimization Analysis of Once-Weekly Versus Thrice-Weekly Epoetin Alfa for Chemotherapy-Related Anemia” (with P.Y. Cremieux, J.M. Fastenau, C.T. Piech, A.M. Fendrick), *Journal of Managed Care Pharmacy*, November/December 2004, 531-537.

### **Books**

*Student Learning Guide: Labor Market Problems and Applications* to accompany Ehrenberg and Smith *Modern Labor Economics*, 6th edition. Reading, MA: Addison Wesley, 1997. (5th edition published in 1994 by Harper Collins.)

### **Other Articles**

“A Framework for Developing Spreadsheet Applications in Economics” (with M. Cahill), *Social Science Computer Review*, Summer 2001, 186-200 (invited article).

“Using Spreadsheets to Explore Neoclassical Assumptions in a New Keynesian Model” (with M. Cahill), *Computers in Higher Education Economics Review*, Volume 14, No. 2, 2000.

“Antitrust Policy” and “The Relative Income Hypothesis” in *Survey of Social Science: Economics*, edited by Frank N. Magill, Pasadena: Salem Press, 1991, 55-61 and 1980-1985 (subsequently published as *International Encyclopedia of Economics*, Fitzroy Dearborn Publishers, 1997).

“The Temporary Workforce: An Economic Appraisal,” *The Margin*, September/October 1990, 27.

### **Book Reviews**

*The Antitrust Revolution*, edited by John E. Kwoka, Jr. and Lawrence J. White, *The American Economist*, Spring 1991.

*The New Unionism: Employee Involvement in the Changing Corporation* by Charles C. Heckscher, *Southern Economic Journal*, October 1989.

*Deindustrialization and Plant Closure*, edited by Paul D. Staudohar and Holly E. Brown, *Southern Economic Journal*, April 1988.

*The New Industrial Organization* by Alexis Jacquemin, *The American Economist*, Fall 1987.

### **Abstracts**

“The Impact of Psoriasis on Health Care Costs and Work Loss” and “The Direct and Indirect Cost Burden Associated with Seborrheic Dermatitis” (with J.F. Fowler et al.), *Supplement to Journal of the American Academy of Dermatology*, February 2007, AB6, AB106.

## **OTHER PROFESSIONAL ACTIVITIES**

Contributor to *Antitrust Class Actions Handbook*, American Bar Association, 2010.

Member of editorial board, *Issues in Competition Law and Policy*, American Bar Association monograph (3 volumes), Wayne Dale Collins, editor, 2008.

Referee for the *Journal of Industrial Economics*, *Journal of Economic Behavior and Organization*, *Journal of Economic Education*, *Quarterly Review of Economics and Business*, *Review of Industrial Organization*, *The American Economist*, *Journal of Occupational and Environmental Medicine*, *Defence and Peace Economics*.

Textbook reviewer for Harper Collins, McGraw Hill, Oxford University Press.

Completed “Law Institute for Economists” program, sponsored by Law & Economics Center, George Mason University School of Law (two-week intensive program held at Dartmouth College), July 1992.

Member of the American Economic Association, associate member of the American Bar Association.

## Appendix C

The cost of equity ( $E[r]$ ) in the CAPM is estimated using the following equation:

$$E[r] = r_f + \beta \times E[r_{Market} - r_f]$$

where  $E[r]$  is the cost of equity,  $r_f$  is the risk-free rate of return,  $\beta$  is a parameter that measures the sensitivity of a firm's stock returns to market returns, and  $E[r_{Market} - r_f]$  denotes the market risk premium. The expectation operator "E" indicates that the cost of equity and market risk premium in the CAPM reflect investor expectations.

Beta for each year is calculated by regressing 5 years of weekly CP adjusted excess stock returns on excess returns to the TSX Index, ending in the last week of March of the given year. Beta estimates for March 2005 and 2006 were calculated using data beginning on 8/31/2001 as this is the first date stock price data are available. Data are from Bloomberg.

Market risk premium data are from the Morningstar Canadian Risk Premia Over Time Report 2010 and are calculated relative to the long horizon risk-free rate using historical data from 1936 through the end of the most recent calendar year. The Morningstar estimate is calculated as the difference between the average market return and the income return on long-horizon Canadian Government Bonds over this period. The S&P/TSX Composite Index is used for the period 1957 - present; market return data are provided to Morningstar by the Canadian Institute of Actuaries for the period 1936 - 1956. Income return data are calculated from Canadian Long Term Government Bond yields provided by the International Monetary Fund International Financial Statistics for the period 1958 - present; year-end Long Term Government Bond yield data are provided to Morningstar by the Canadian Institute of Actuaries for the period 1936 - 1957.

The risk-free rate of return is the average daily yield of 10+ year Canadian marketable bonds during the last full week of March of the given year. Data are from the Bank of Canada.

## Appendix D

The cost of equity ( $r$ ) in the MSDCF model is the solution to the following equation:<sup>63</sup>

$$MV_0 = \sum_{t=1}^5 \frac{CF_0(1+g_1)^t}{(1+r)^t} + \sum_{t=6}^{10} \frac{CF_5(1+g_2)^t}{(1+r)^t} + \frac{IBEI_{10}(1+g_3)}{(1+r)^{10}}, \quad (\text{Equation A1})$$

where

$MV_0$  = market value of equity for CP in year 0 (i.e., the year for which the cost of equity is being estimated).

$CF_t$  = average cash flow for CP at the end of year  $t$ , expressed in Canadian dollars.

$g_j$  = earnings growth rate for CP in stage  $j$  ( $j = 1, 2$ , or  $3$ ).

$$IBEI_{10} = IBEI_0(1+g_1)^5(1+g_2)^5.$$

Note that  $IBEI_0$  is determined by the same process as  $CF_0$  (see Table 1).

Cash flows are assumed to grow in three stages, according to the following growth rates: Stage one (five years) - average analyst estimate of CP's long term EPS growth; stage two (five years) - average of long term EPS growth estimates for CP and Canadian National; stage three (terminal) - the long term nominal growth of the Canadian economy. The stage one and two growth rates are calculated as the average security analyst estimates of long term EPS growth during the first quarter of each calendar year. The terminal growth rate is the sum of average historical real GDP growth (from 1961 to the present, using World Bank WDI data) and the long term inflation rate (measured by the difference between long horizon Canadian government marketable bond and long horizon real return bonds in March of each year). Market capitalization (expressed in Canadian dollars) is calculated as the average month-end market capitalization during the first quarter of each calendar year.

Data are from Thompson Financial, the Bank of Canada, and the World Bank.

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<sup>63</sup> This methodology is based on that shown in the *Cost of Capital Yearbook*, 2010, Morningstar, Inc., p. 24.

## Exhibit 1

### Proposed Capital Asset Pricing Model Estimates of Canadian Pacific Cost of Equity Comparison to CTA Cost of Equity Estimates (After Tax) 2005 - 2010

Year <sup>[1]</sup>	Beta <sup>[2]</sup>	Market Risk Premium <sup>[3]</sup>	Risk - Free Rate <sup>[4]</sup>	Cost of Equity (Using CAPM) <sup>[5]</sup>	CTA After-Tax Cost of Equity (Using CAPM) <sup>[6]</sup>
2005 (Crop Year 2005 - 2006)	1.08	5.10%	4.79%	10.29%	7.54%
2006 (Crop Year 2006 - 2007)	0.94	5.30%	4.26%	9.27%	7.54%
2007 (Crop Year 2007 - 2008)	0.81	5.40%	4.21%	8.58%	7.53%
2008 (Crop Year 2008 - 2009)	0.94	5.40%	3.91%	9.00%	7.40%
2009 (Crop Year 2009 - 2010)	0.89	4.80%	3.56%	7.85%	5.74%
2010 (Crop Year 2010 - 2011)	0.92	5.10%	3.98%	8.68%	5.61%

Notes and Sources:

- [1] The CTA states that cost of capital rates used for the development of the composite price index are determined in March of each year (see <http://www.otc-cta.gc.ca/doc.php?did=968&lang=eng>). Therefore, the beta estimate and risk-free rate for each year are based on data through the last week of March.
- [2] Beta for each year is calculated by regressing 5 years of weekly CP adjusted excess stock returns on excess returns to the TSX Index, ending in the last week of March of the given year. Beta estimates for March 2005 and 2006 were calculated using data beginning on 8/31/2001 as this is the first date stock price data are available. Data are from Bloomberg.
- [3] Market risk premium data are from the Morningstar Canadian Risk Premia Over Time Report 2010 and are calculated relative to the long horizon risk-free rate using historical data from 1936 through the end of the most recent calendar year.
- [4] The risk-free rate is the average daily yield of 10+ year Canadian marketable bonds during the last full week of March of the given year. Data are from the Bank of Canada.
- [5] The cost of equity is calculated using  $[R_{f\text{long}} + \beta * MRP_{\text{long}}]$ , or  $[4] + [2] * [3]$ .
- [6] Pre-tax estimates are from <http://www.otc-cta.gc.ca/doc.php?did=970&lang=eng> (accessed December 15, 2010) and have been converted to after-tax estimates using a tax rate of 31.87%, which was the tax rate used in the 2009-10 CTA cost of capital determination.

## Exhibit 2

### Proposed Multi-Stage Discounted Cash Flow Model Estimates of Canadian Pacific Cost of Equity Comparison to CTA Cost of Equity Estimates (After Tax) 2005-2010

Year <sup>[1]</sup>	Growth Rates <sup>[2]</sup>			Cash Flow (CAD Millions) <sup>[3]</sup>	Market Capitalization (CAD Millions) <sup>[4]</sup>	Cost of Equity (Using MSDCF) <sup>[5]</sup>	CTA After-Tax Cost of Equity (Using CAPM) <sup>[6]</sup>
	Stage 1	Stage 2	Terminal				
2005 (Crop Year 2005 - 2006)	12.00%	11.75%	6.14%	\$ 276	\$ 6,861	14.32%	7.54%
2006 (Crop Year 2006 - 2007)	12.55%	13.15%	6.07%	\$ 306	\$ 9,043	13.62%	7.54%
2007 (Crop Year 2007 - 2008)	12.00%	11.50%	5.85%	\$ 321	\$ 9,949	12.96%	7.53%
2008 (Crop Year 2008 - 2009)	12.08%	11.54%	5.63%	\$ 310	\$ 10,461	12.86%	7.40%
2009 (Crop Year 2009 - 2010)	10.00%	10.50%	4.97%	\$ 378	\$ 6,004	16.61%	5.74%
2010 (Crop Year 2010 - 2011)	11.25%	11.00%	5.74%	\$ 347	\$ 8,903	13.67%	5.61%

#### Notes and Sources:

- [1] Growth rate and market capitalization data are from the first quarter of each calendar year. Cash flow data are from the end of the prior calendar year. The crop year is defined as the twelve month period beginning in August and ending in July of the following year.
- [2] Growth rates are calculated as the average analyst growth rate estimate during the first quarter of each calendar year. CP and CN data are from I/B/E/S (provided by Thompson Financial). Terminal growth rate equals the long-run nominal growth rate of the Canadian economy, which is the sum of average historical real gross domestic product growth since 1961 and the long-run expected inflation rate. The long-run expected inflation rate is measured by the difference between the yields of long horizon Canadian Government marketable bonds and long horizon real return bonds in March each year. Data for historical GDP growth and long-run bond yields are from the World Bank and the Bank of Canada, respectively. World Bank data are available through 2010. Note that the February 2006 growth rate for CN (29.3%) was excluded as an outlier.
- [3] Cash Flow (expressed in millions of Canadian dollars) is calculated using Net Income (Before Extraordinary Items) - Capital Expenditures + Depreciation + Deferred Taxes. Consistent with the Morningstar/Ibbotson methodology adopted by the STB, the five-year average of this value as a percent of sales is used. Data are from Canadian Pacific Railway Form 40-F for the respective years.
- [4] Market capitalization (expressed in millions of Canadian dollars) is calculated as the average month-end market capitalization during the first quarter of each calendar year.
- [5] See Section IV and Appendix D for a description of the calculation.
- [6] Pre-tax estimates are from <http://www.otc-cta.gc.ca/doc.php?did=970&lang=eng> (accessed December 15, 2010) and have been converted to after-tax estimates using a tax rate of 31.87%, which was the tax rate used in the 2009-10 CTA cost of capital determination.

### Exhibit 3

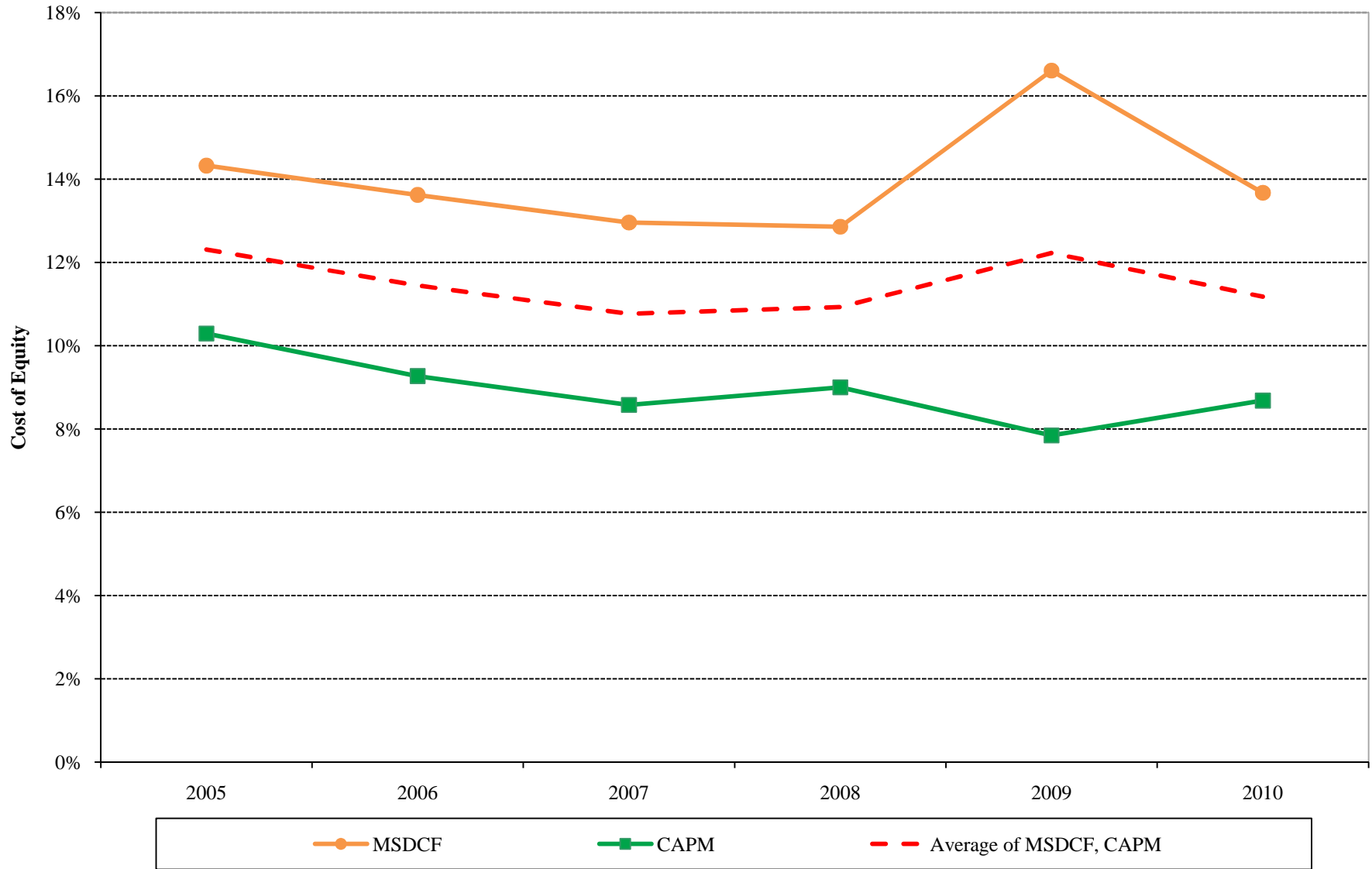
Proposed Estimates of Canadian Pacific Cost of Equity  
MSDCF Estimates, CAPM Estimates, and Average  
2005-2010

Year	Multi-Stage Discounted Cash Flow Model (MSDCF) <sup>[1]</sup>	Capital Asset Pricing Model (CAPM) <sup>[2]</sup>	Average of MSDCF, CAPM
2005 (Crop Year 2005 - 2006)	14.32%	10.29%	12.31%
2006 (Crop Year 2006 - 2007)	13.62%	9.27%	11.45%
2007 (Crop Year 2007 - 2008)	12.96%	8.58%	10.77%
2008 (Crop Year 2008 - 2009)	12.86%	9.00%	10.93%
2009 (Crop Year 2009 - 2010)	16.61%	7.85%	12.23%
2010 (Crop Year 2010 - 2011)	13.67%	8.68%	11.18%
<i>Coefficient of Variation:</i>	<i>0.099</i>	<i>0.091</i>	<i>0.057</i>

Notes and Sources:

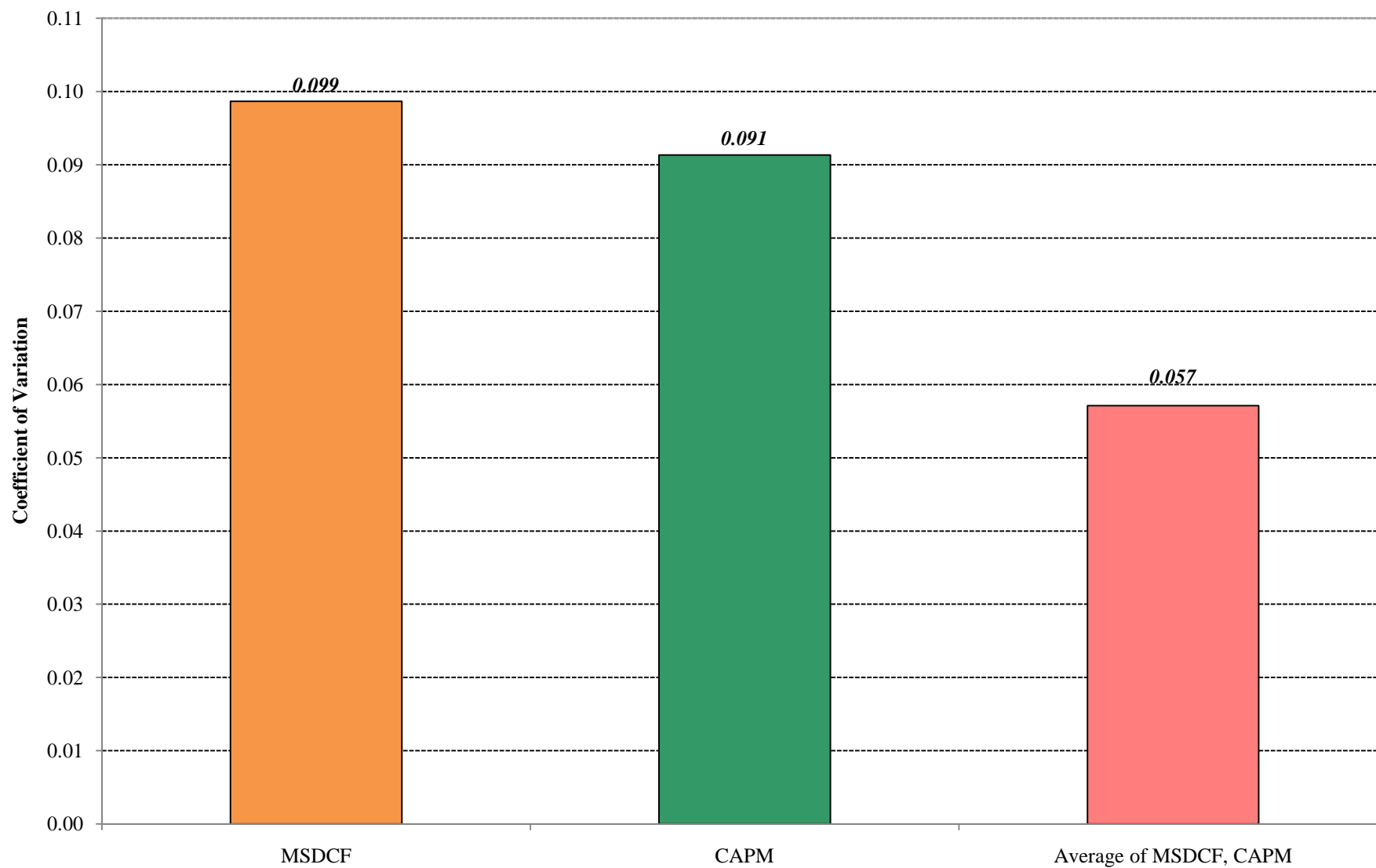
- [1] Expert Report of Bruce E. Stangle, Ph.D. and George Kosicki, Ph.D., Exhibit 2. See Section IV and Appendix D for a description of the model and the data sources.
- [2] Expert Report of Bruce E. Stangle, Ph.D. and George Kosicki, Ph.D., Exhibit 1. See Section IV and Appendix C for a description of the model and the data sources.

**Exhibit 4**  
Proposed Estimates of Canadian Pacific Cost of Equity  
MSDCF Estimates, CAPM Estimates, and Average  
2005-2010



### Exhibit 5

Coefficients of Variation of Proposed Cost of Equity Estimates  
MSDCF Estimates, CAPM Estimates, and Average  
2005-2010



## Exhibit 6

### Proposed Canadian Pacific Cost of Debt Estimates Comparison to CTA Cost of Debt Estimates 2005 - 2010

Year	Fair Value of Debt Instruments (CAD Millions) <sup>[1]</sup>	Weighted Average Time to Maturity (Years) <sup>[2]</sup>	Cost of Debt <sup>[3]</sup>	CTA Cost of Debt Estimate <sup>[4]</sup>
2005	\$3,750.20	13.1	5.62%	6.43%
2006	\$3,348.60	13.2	5.45%	5.58%
2007	\$3,272.90	12.3	5.44%	5.50%
2008	\$4,302.60	14.4	6.44%	5.40%
2009	\$4,198.90	12.0	7.71%	5.74%
2010	\$4,824.90	13.7	5.47%	5.98%

Notes and Sources:

- [1] Fair value of long term debt outstanding as of December 31 of previous fiscal year from Canadian Pacific Railway Forms 40-F, Annual Report Section: 2004 (p. 65); 2005 (p. 68); 2006 (p. 69); 2007 (p. 83); 2008 (p. 81); 2009 (p. 34). The amounts do not include the fair values of foreign exchange forward contracts, crude oil swaps/futures, and interest rate swaps/locks.
- [2] The weighted average time to maturity is calculated using data from the "Long Term Debt" section of Canadian Pacific Railway Form 40-F, 2004-2009.
- [3] Costs are calculated as average of month-end yields to maturity during the first quarter of each calendar year from the 10- and 15-year Bloomberg Fair Value Curve for BBB Canadian Corporate Bonds. Canadian Pacific debt is rated BBB by Standard & Poor's Corporation. See Canadian Pacific Railway Forms 40-F.
- [4] Data are from <http://www.otc-cta.gc.ca/doc.php?did=970&lang=eng> (accessed on December 15th, 2010).

## Exhibit 7

### Proposed Canadian Pacific Weighted Average Cost of Capital Estimates Comparison to CTA Weighted Average Cost of Capital Estimates (After Tax) 2005 - 2010

Year	Long-Term Debt <sup>[1]</sup>				Equity <sup>[2]</sup>			After-Tax WACC Estimates		
	Cost	Amount Outstanding (CAD Millions)	Weight	Tax Rate	Cost	Amount Outstanding (CAD Millions)	Weight	Proposed <sup>[3]</sup>	CTA <sup>[4]</sup>	Difference (bps) <sup>[4]</sup>
2005	5.62%	\$ 3,750	0.35	31.87%	12.31%	\$ 6,861	0.65	9.31%	5.57%	374
2006	5.45%	\$ 3,349	0.27	31.87%	11.45%	\$ 9,043	0.73	9.36%	5.50%	386
2007	5.44%	\$ 3,273	0.25	31.87%	10.77%	\$ 9,949	0.75	9.02%	5.53%	350
2008	6.44%	\$ 4,303	0.29	31.87%	10.93%	\$ 10,461	0.71	9.02%	5.67%	335
2009	7.71%	\$ 4,199	0.41	31.87%	12.23%	\$ 6,004	0.59	9.36%	4.69%	466
2010	5.47%	\$ 4,825	0.35	31.87%	11.18%	\$ 8,903	0.65	8.56%	4.35%	421
<i>Average:</i>	<i>6.02%</i>	<i>\$ 3,950</i>	<i>0.32</i>	<i>31.87%</i>	<i>11.48%</i>	<i>\$ 8,537</i>	<i>0.68</i>	<i>9.10%</i>	<i>5.22%</i>	<i>389</i>

Notes and Sources:

- [1] Yield to maturity data are from Bloomberg and amount outstanding data are from Canadian Pacific Railway Form 40-F, 2004 - 2009.
- [2] Cost of equity data represent the average of COE estimates from the CAPM and MSDCF models.
- [3] Cost of debt \* (1-t) \* debt weight + cost of equity \* equity weight, where t is assumed to be 31.87%, which is the rate used in the 2010 CTA determination for interswitching costs and rates.
- [4] Pre-tax estimates (from <http://www.otc-cta.gc.ca/doc.php?did=970&lang=eng>) are converted to after-tax estimates assuming a constant debt weight (15.74%) and a constant tax rate (31.87%), which are the values used in the 2010 CTA determination for interswitching costs and rates.