PUB ORDER NO. 150/08

DIRECTIVE NO. 4

INDEPENDENT ASSESSMENT OF FIXED VS. FLOATING RATE DEBT

Manitoba Hydro

July 24, 2009

Manitoba Hydro
Independent Assessment of Fixed Vs. Floating Rate Debt

Introduction

Order 150/08, Directive No. 4 directed MH to undertake the following:

> MH to provide the Board an independent assessment of the Corporation's relative weighting of fixed vs. floating debt and file a report with the Board on or before June 30, 2009.

Manitoba Hydro response

A Request for Tender was sent to six financial institutions. The low bid was received from National Bank Financial (NBF) in the amount of $200 000.

In summary, NBF concluded that, "Manitoba Hydro's fixed vs. floating rate debt policy of 15% to 25% floating rate debt is inside of the identified optimal range of 14% to 27% floating rate debt, and is therefore both reasonable and appropriate in the context of an asset/liability management framework."

A copy of the NBF Report entitled, "Independent Assessment of Corporate Policy Fixed vs. Floating Rate Debt" is attached.

Attachment
2009 07 24

Independent Assessment of Corporate Policy
Fixed vs. Floating Rate Debt

National Bank Financial

July 16, 2009

Table of Contents

1. EXECUTIVE SUMMARY 1
2. PORTFOLIO THEORY OVERVIEW 8
 2.1. MODERN PORTFOLIO THEORY 8
  2.1.1. Diversification Risk 9
  2.1.2. The Efficient Frontier – Theory 9
  2.1.3. The Efficient Frontier – Application 10
  2.1.4. Advantages 11
  2.1.5. Limitations 12
 2.2. ALTERNATIVE THEORIES 13
  2.2.1. Post Modern Portfolio Theory 13
  2.2.2. Market Timing Theory 14
  2.2.3. Asset/Liability Management 15
 2.3. CONCLUSION 17
3. IDENTIFICATION OF KEY FACTORS 18
 3.1. ASSETS 18
  3.1.1. Domestic Utility Rates 18
  3.1.2. Extraprovincial Revenues 19
  3.1.3. Potential Hydraulic Generation/Reserves 20
 3.2. LIABILITIES 20
  3.2.1. Purchased Power 20
  3.2.2. Operation and Maintenance Expenses 21
  3.2.3. Water Rental Fees 21
  3.2.4. Debt and Interest Expenses 21
 3.3. HYDROLOGY RISK 21
 3.4. CONCLUSION 22
4. PEER GROUP ANALYSIS 23
 4.1. MARKET TIMING EVIDENCE 23
 4.2. ASSET/LIABILITY MANAGEMENT EVIDENCE 25
  4.2.1. Assets 25
  4.2.2. Liabilities 27
  4.2.3. Asset/Liability Management Evidence 27
 4.3. CONCLUSION 28
5. TECHNICAL ANALYSIS 30
 5.1. ASSUMPTIONS 30
  5.1.1. US Assets and Liabilities 30
  5.1.2. Debt Maturity Schedule 31
 5.2. VOLATILITY AND CORRELATION ANALYSIS 31
6. SCENARIO ANALYSIS 34
 6.1. EFFICIENT FRONTIER 34
7. SOLUTION FORMULATION 36
 7.1. ASSET/LIABILITY MANAGEMENT FRAMEWORK 36
 7.2. MARKET TIMING 36
8. IMPACT ANALYSIS 39
 8.1. IMPACT ON MANITOBA HYDRO 39
 8.2. CONCLUSION 39
9. CONCLUSIONS 40
10. APPENDICES A-1

List of Figures and Tables

Figures

Figure 1: Volatility Impact Model Efficient Frontier 6
Figure 2: MPT Efficient Frontier, 1999-2009..... 11
Figure 3: Historical Interest Rates 13
Figure 4: Term Spread – 3 Month BA vs. 15 Year Province of Manitoba..... 15
Figure 5: Term Spread vs. Average Peer Group Floating Rate Debt % 24
Figure 6: 20 Year Government of Canada vs. Average Peer Group Floating Rate Debt %..... 25
Figure 7: Historical ISO Electricity Spot Prices 26
Figure 8: Peer Group Floating Rate Debt % (2008) vs. Export Revenue % (Crown Utilities)..... 28
Figure 9: Correlation Impact on Net Income 33
Figure 10: Volatility Impact Model Efficient Frontier 35
Figure 11: Bank of Canada Overnight Rate..... 37
Figure 12: 20 Year Government of Canada Interest Rates 37
Figure 13: Canadian Swap Curve and Forward Curves..... 38
Figure 14: MPT Efficient Frontier, 1999-2003..... A-1
Figure 15: MPT Efficient Frontier, 2004-2009..... A-2

Tables

Table 1: Key Factor Volatility Metrics..... 4
Table 2: Portfolio Risk/Return Matrix..... 6
Table 3: Yield Correlation, 1999-2009 10
Table 4: Yield Correlation, 1999-2003 vs. 2004-2009 12
Table 5: Domestic vs. Extraprovincial Electric Revenues and Volumes 19
Table 6: Domestic vs. Extraprovincial Revenues..... 20
Table 7: Hydrology Risk Analysis..... 22
Table 8: Peer Group List..... 23
Table 9: Historical Proportion of US Dollar Denominated Debt 31
Table 10: Historical Average Maturity Terms..... 31
Table 11: Variable Volatilities, 2005-2009 32
Table 12: Variable Correlation Matrix, 2005-2009 32
Table 13: Portfolio Risk/Return Matrix..... 34
Table 14: Impact of changes in Floating Rate Debt Mix..... 39
Table 15: Peer Group – Crown Utility Corporations..... A-3
Table 16: Peer Group – Publicly Traded Corporations A-4
Table 17: Peer Group – Historical Floating Rate Debt..... A-5

1. EXECUTIVE SUMMARY

1.1. INTRODUCTION

It is National Bank Financial Inc.'s ("NBF") understanding that Manitoba Hydro was instructed by the Public Utilities Board of Manitoba ("Board") to obtain an independent assessment of its fixed vs. floating rate debt policy as a result of arguments put forward by a coalition of intervenors in the 2008/09 General Rate Application hearings.

Following a submission in response to a Request for Tender ("RFT") dated January 16, 2009, Manitoba Hydro engaged NBF to provide this independent assessment of its fixed vs. floating rate debt policy.

Although a substantial portion of the data required to complete the assessment was sourced from Manitoba Hydro, NBF worked independently of management and derived its conclusions by way of interpretation of analysis conducted and its institutional knowledge base.

1.2. OBJECTIVE

In order to address the specific requirements outlined in the RFT and complete its independent assessment of Manitoba Hydro's fixed vs. floating rate debt policy, NBF's objective was to provide the following:

1. A body of knowledge regarding the theory of portfolio optimization and advantages and disadvantages of each portfolio optimization methodology;

2. Identification of key factors associated with achieving an optimal weighting of fixed vs. floating rate debt;

3. An in-depth analysis of the fixed vs. floating rate debt policies of Manitoba Hydro's peers;

4. The definition of an optimal floating rate debt range through a variety of scenarios based on different yield curves, interest rate expectations and other factors, that can be supported by historical analysis;

5. An implementation plan to assist Manitoba Hydro on an ongoing basis to ensure its portfolio mix is at an optimal level given different possible economic scenarios; and

6. A financial impact analysis, comparing the optimal fixed vs. floating rate debt mix against Manitoba Hydro's current policy.

NBF has considered and assessed the specific requirements outlined in the RFT and provided an overall recommendation with respect to an optimal fixed vs. floating rate debt policy for Manitoba Hydro, as well as supporting analysis herein.

1.3. Assumptions and Limitations

NBF's mandate is to provide an independent assessment of Manitoba Hydro's fixed vs. floating rate debt mix. In order to strictly adhere to this mandate, NBF did not evaluate other aspects of Manitoba Hydro's debt policy that may have impacted the result of this assessment. Specifically, NBF's analysis did not include an assessment of Manitoba Hydro's choice of debt maturities and the proportion of US Dollar denominated debt in its debt portfolio, as these issues were deemed to be outside of the scope of this assignment.

In addition, given that Manitoba Hydro's debt is issued and guaranteed by the Province of Manitoba, Manitoba Hydro's cost of debt is dependent on the Province of Manitoba's credit rating. NBF's assessment is therefore premised on the maintenance of the current credit rating of the Province of Manitoba.

1.4. The NBF Approach

In order to assess the situation and recommend an optimal debt policy for Manitoba Hydro, NBF formulated its approach based on a comprehensive analysis of the issues relevant to this assignment. Specifically, the components of the approach were:

1.4.1. Portfolio Theory Overview

NBF began with a comprehensive review of the available academic literature on alternative approaches to fixed vs. floating rate debt management. The review included modern portfolio theory, post modern portfolio theory, market timing and asset/liability management, and their respective advantages and limitations.

In the debt management context, both modern portfolio theory and post modern portfolio theory only seek to minimize a company's cost of debt and its volatility. As a result, these approaches ignore operational cash flow volatility, which may be correlated with movements in interest rates and therefore affect net income. Given that profit is the measure of financial performance, these methods result in incomplete analyses.

The market timing theory also ignores the asset volatility factors of the business and relies on a view on the future direction of interest rates. Furthermore, the framework is unable to quantify the risks associated with issuing floating rate debt; analysis suggests that a debt portfolio with a high proportion of floating rate debt will result in higher interest expense volatility.

The asset/liability approach examines both revenues and expenses simultaneously and formulates an optimal mix of fixed and floating rate debt based on reducing the volatility factors affecting the company. Given that the asset/liability management approach is the only approach that matches a company's assets and liabilities, thereby allowing for optimization of net income, NBF decided that this was the appropriate framework to determine the optimal fixed vs. floating rate debt policy for Manitoba Hydro.

1.4.2. Identification of Key Factors

As the first step in the asset/liability management approach, NBF identified the sources of Manitoba Hydro's cash inflow and outflow volatility. This qualitative process of identifying key factors provided the basis for the quantitative historical analysis of the volatility and correlation of these factors conducted by NBF in its technical analysis.

NBF found that key factors affecting assets were domestic utility rates (subject to Canadian inflation risk) and extraprovincial revenues (primarily subject to US inflation risk for long-term contracts, and fluctuations in spot electricity prices in the MISO grid for short-term contracts and spot transactions).

The key factors affecting liabilities were purchased power (subject to spot electricity prices in the MISO grid), operation and maintenance expenses (subject to Canadian inflation risk), and interest expenses (subject to interest rate fluctuations).

While hydrology is a source of Manitoba Hydro's cash flow volatility, there is no causal relationship between weather patterns and macroeconomic indicators. As a result, it is not possible to lower exposure to hydrology risk through determining a debt policy, and therefore hydrology was not considered a key factor in the asset/liability management framework.

Another source of cash flow volatility excluded from the asset/liability management framework was foreign currency exchange rate fluctuation, which impacts extraprovincial power sales and purchases. Given that Manitoba Hydro already has an Exposure Management Program in place to effectively manage currency risk, evaluation of this risk factor was considered to be outside the scope of this assessment.

1.4.3. Peer Group Analysis

NBF examined the fixed vs. floating rate debt policies of Manitoba Hydro's peer group, which consisted of both crown utility and publicly-traded corporations considered to be vertically integrated electric utilities (i.e. owning energy generation, transmission and distribution infrastructure). The purpose of this analysis was not to provide an assessment of the peer group's fixed vs. floating rate debt policies, but rather to attain insight into a relevant peer group's choice of floating rate debt mix.

The first component of this analysis examined the historical floating rate debt proportions of each of the peers over the past 10 years. When combined with historical yield curves and interest level analyses, NBF found evidence that those peers with a floating rate debt component utilized market timing strategies. In particular, peers tended to increase their portion of floating rate debt during periods of rising term spreads (indicating higher discrepancies between short and long-term interest rates), and lowered the proportion during contracting term spread periods. Moreover, in low interest rate environments this analysis provided evidence that these companies fixed a higher portion of their debt in order to lower their risk at a cheaper cost.

NBF then extended the key factor identification process to the peer group, qualitatively assessing the sources of volatility present in each of the peer group's business models. This analysis yielded a statistically significant correlation between the crown utility peers' proportion of export revenues and their levels of floating rate debt. The analysis demonstrated that Manitoba Hydro's fixed vs. floating rate debt policy was consistent with that of its peer group.

1.4.4. Technical Analysis

A historical analysis was conducted for each of the identified key volatility factors. These factors and their respective volatility metrics were:

Table 1: Key Factor Volatility Metrics

Asset Variables		Volatility Metric
A	**Domestic Utility Rates**	**Change in Canadian CPI**
B	**Extraprovincial Power (Short-Term Contracts and Spot)**	**MISO Power Price**
C	**Extraprovincial Power (Long-Term Contracts)**	**Change in US CPI**

Liability Variables		Volatility Metric
D	**Canadian Short-Term Interest Rates**	**3 Month BA**
E	**US Short Term-Interest Rates**	**3 Month LIBOR**

Each factor's volatility, as measured by the standard deviation from the mean, and its correlation with the other factors, were calculated from historical data.

This analysis proved that short-term export power contracts and spot market sales were the most volatile factors, being driven by power prices in the MISO grid. Also, these factors exhibited higher correlation with short-term interest rates compared to domestic utility rates or long-term export contracts.

As a result, this analysis indicated that Manitoba Hydro's fixed vs. floating rate debt policy should incorporate an element of floating rate debt in order to lower net income volatility under the asset/liability management framework.

1.4.5. Scenario Analysis

Following the results of the technical analysis, a scenario analysis was conducted in order to identify the range of floating rate debt mixes that would lower net income volatility.

NBF's volatility impact model generated 10,000 scenarios, reflecting volatility and correlation metrics derived from the aforementioned technical analysis. Each scenario was then applied to a set of 100 portfolios of varying fixed vs. floating rate debt mixes. The mean net income impact and its volatility, as measured by standard deviation from the mean, were calculated for each one of these 100 different portfolios.

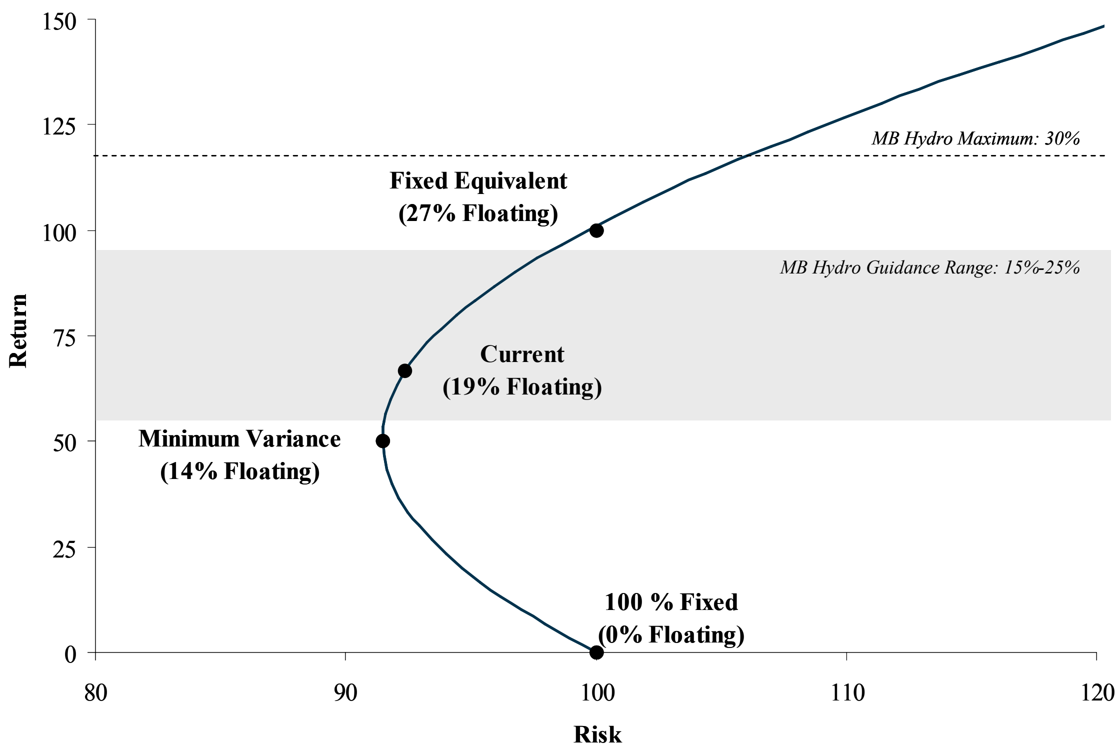
This analysis resulted in the identification of two key metrics: the fixed equivalent and the minimum variance portfolios. The fixed equivalent portfolio, defined as the mix that results in the same amount of volatility as a portfolio comprised of 100% fixed debt, was determined to have a 27% floating rate debt component.

The minimum variance portfolio was defined as the fixed vs. floating rate mix that yielded the lowest variance in net income, and was achieved by incorporating 14% floating rate debt into the debt portfolio. Increasing the proportion of floating rate debt can lead to lower risk because the analysis shows that interest expense and revenues are somewhat correlated. The analysis implied that risk could be lowered by 7% by increasing the floating rate debt mix to 14% (from a 100% fixed portfolio) while making positive gains in net income since floating interest rates tend to be lower than fixed interest rates.

Table 2: Portfolio Risk/Return Matrix

	Floating (%)	Adjusted Risk	Adjusted Return
1. Fixed	0%	100	0
2. Minimum Variance	14%	93	50
3. Current (March 31, 2008)	19%	94	69
4. Fixed Equivalent	27%	100	100
5. Floating	100%	253	370

Figure 1: Volatility Impact Model Efficient Frontier



The range between the minimum variance and the fixed equivalent portfolios represents an optimal range of mixes that allow Manitoba Hydro to minimize its interest rate volatility (Risk) and maximize its net income (Return) through lower interest rates, by way of a floating rate component in its debt portfolio.

1.5. SOLUTION FORMULATION

NBF's scenario analysis demonstrated that Manitoba Hydro's guidance range of 15% to 25% floating rate debt was inside of this optimal floating rate debt range of 14% to 27%.

Having also analyzed the risk profile of Manitoba Hydro's business, namely the high exposure to hydrology risk, NBF believes that Manitoba Hydro's current guidance range is reasonable in the context of an asset/liability management framework, as it seeks to lower risk in an efficient, return maximizing manner.

Furthermore, NBF recommends that Manitoba Hydro complement this asset/liability management framework with a market timing component that allows the company to adjust its floating rate debt proportion within the identified optimal range in order to take advantage of the prevailing interest rate environment. This adjustment should take into account both the level and the slope of the yield curve.

Steeper yield curves generally allow for greater cost savings by switching to floating rate debt, but also result in higher net income volatility. Given that interest rates are currently at historical lows, there exists an opportunity to lower risk at relatively inexpensive levels by increasing the proportion of fixed rate debt.

1.6. Impact Analysis

Having established an optimal range of fixed vs. floating rate debt mixes as prescribed by the asset/liability management framework, NBF analyzed the impact of this range of portfolios on Manitoba Hydro's historical financial results. This analysis demonstrated that historically, Manitoba Hydro has kept its floating rate debt mix within the optimal risk reduction range of 14% to 27%.

1.7. Conclusions

NBF's independent assessment of Manitoba Hydro's fixed vs. floating rate debt policy concludes that its current policy of 15% to 25% floating rate debt is inside of the identified optimal range of 14% to 27% floating rate debt, and is therefore both reasonable and appropriate in the context of an asset/liability management framework.

2. PORTFOLIO THEORY OVERVIEW

In order to determine the appropriate framework for an optimal fixed vs. floating rate policy, NBF conducted a comprehensive review of portfolio theory alternatives, and the advantages and limitations of each alternative.

While asset allocation decisions have been thoroughly debated and explored in academic literature, research on liability management has been more sparse, and was generally limited to high level capital structure decisions such as equity versus debt allocations.

Early capital structure literature has stated that the choice of liability structure is irrelevant in the absence of contracting costs and taxes.[1] The introduction of frictions, such as taxes and bankruptcy costs, provides one possible justification for a non-trivial capital structure choice that is based on the trade-off between the tax benefit of debt and the bankruptcy costs of debt. The first quantitative analysis of this trade-off theory was provided by Leland[2] and subsequently by Leland and Toft.[3]

This section provides an overview of the different theories of debt management as they apply to fixed vs. floating rate debt, and their respective advantages and limitations.

2.1. MODERN PORTFOLIO THEORY

Modern portfolio theory (MPT) describes how rational, risk averse entities optimize their portfolio of securities through diversification. It measures the risk/return profiles of portfolios comprised of different individual securities, and plots a set of efficient investment portfolios (the efficient frontier) that maximize return for a given level of risk.

This approach was first formulated by Markowitz in 1952, who proposed that simply picking assets that yield the highest net present value leads to an inefficient portfolio. Instead, a more efficient mix of assets can lower risk for any given level of return.[4] MPT has traditionally been used as a framework to examine portfolio returns and risks, and its application was limited in the context of analyzing liabilities.

---

[1] Modigliani, F., Miller, M., 1958, The Cost of Capital, Corporation Finance and the Theory of Investment, American Economic Review, 48 (3), 261–297.
[2] Leland, H., 1994. Corporate Debt Value, Bond Covenants, and Optimal Capital Structure, Journal of Finance, American Finance Association, 49 (4), 1213-1252.
[3] Leland, H., Toft, K., 1996, Optimal Capital Structure, Endogenous Bankruptcy, and the Term Structure of Credit Spreads, Journal of Finance, 51 (3), 987-1019.
[4] Markowitz, H., 1952, Portfolio Selection, The Journal of Finance, 7 (1), 77-91.

While this concept provides a useful framework to underline the benefits of holding a diversified portfolio of securities, it is an incomplete analytical tool for a precise formulation of risk management for several reasons.

2.1.1. Diversification Risk

There are two types of risks associated with securities: systematic and non-systematic risk. The former is driven by the market-wide risk that affects all securities to varying degrees, such as a global recession. As a result, this type of risk cannot be reduced through portfolio diversification.

Conversely, non-systematic risk is specific to each security, and therefore can be reduced with appropriate diversification by adding uncorrelated securities to the portfolio. Empirical studies have shown that the average portfolio standard deviation could be reduced to less than 20% by incrementally increasing the number of securities in a portfolio.[5]

The limitation of this approach is that it is based on simplistic diversification, where each security in the portfolio is weighted equally. Theoretically, it is possible to construct a more efficient set of portfolios through a more judicious diversification procedure that leads to an efficient portfolio, one that maximizes return for a given level of risk. Furthermore, this analysis seems to imply that the best results are attained with an infinite number of securities in the portfolio to minimize risk. However, diversification and constant portfolio adjustments can be a costly process. Therefore, marginal returns resulting from diversification decrease eventually, implying that there is an optimal level of diversification to be attained.[6]

2.1.2. The Efficient Frontier – Theory

In constructing an efficient portfolio, the first step is to derive the total return of the portfolio, which is simply the arithmetic mean of the returns of each of the securities comprising the portfolio. Mathematically, the portfolio return can be expressed as follows:

$$\mathrm{E}(R_p) = \sum_i^n w_i \mathrm{E}(R_i) \qquad (1)$$

Where $\mathrm{E}(R_p)$ and $\mathrm{E}(R_i)$ denote the expected return of the portfolio and the individual securities, respectively, and w_i the relative weighting of each security in the portfolio. As a result, an

[5] Statman, M., 1987, How Many Stocks Make a Diversified Portfolio, Journal of Financial and Quantitative Analysis, 22, 353-363.
[6] Lubatkin, M., Chatterjee, S., 1994, Extending Modern Portfolio Theory into the Domain of Corporate Diversification: Does It Apply?, Academy of Management Journal, 37 (1), 109-136.

investor can achieve any level of return that lies in the range of the portfolio simply by changing the relative weighting of the individual securities.

The second step is to determine the risk level of the overall portfolio. Under MPT, risk is defined as the standard deviation (σ) from the mean. At this point, the concept of correlation among the securities (denoted by ρ_{ij}, which represents the correlation factor between security i and j) is introduced. Mathematically, portfolio risk can be represented as follows:

$$\sigma_p^2 = \sum_i^n w_i^2 \sigma_i^2 + \sum_i^n \sum_{j,j \neq i}^n w_i w_j \sigma_i \sigma_j \rho_{ij} \qquad (2)$$

For any given set of two distinct securities, the correlation between the two is likely to be less than perfect and hence ρ_{ij} will be less than 1. As a result, it is conceivable that a mix of relative weighting options exist that would lead to risk levels that are below those of the lowest risk asset in the portfolio.

2.1.3. The Efficient Frontier – Application

In theory, the construction of an efficient frontier can be easily formulated with equations (1) and (2) above. However, the application of theory to real market data presents several challenges, such as transaction costs, changing risk/return profiles, limitations to active portfolio management, and, in the case of debt portfolios, refinancing risk.[7]

For illustration purposes, this section of the analysis will focus on a simple two liability portfolio with constant risk/reward relationships as a base case. Under the base case scenario, it is assumed that a debt portfolio consists of just two elements: a fixed rate debt component and a floating rate component. As a proxy for returns and volatility, 3 month Banker's Acceptance ("BA") and 15 year Province of Manitoba debt yields were analyzed.

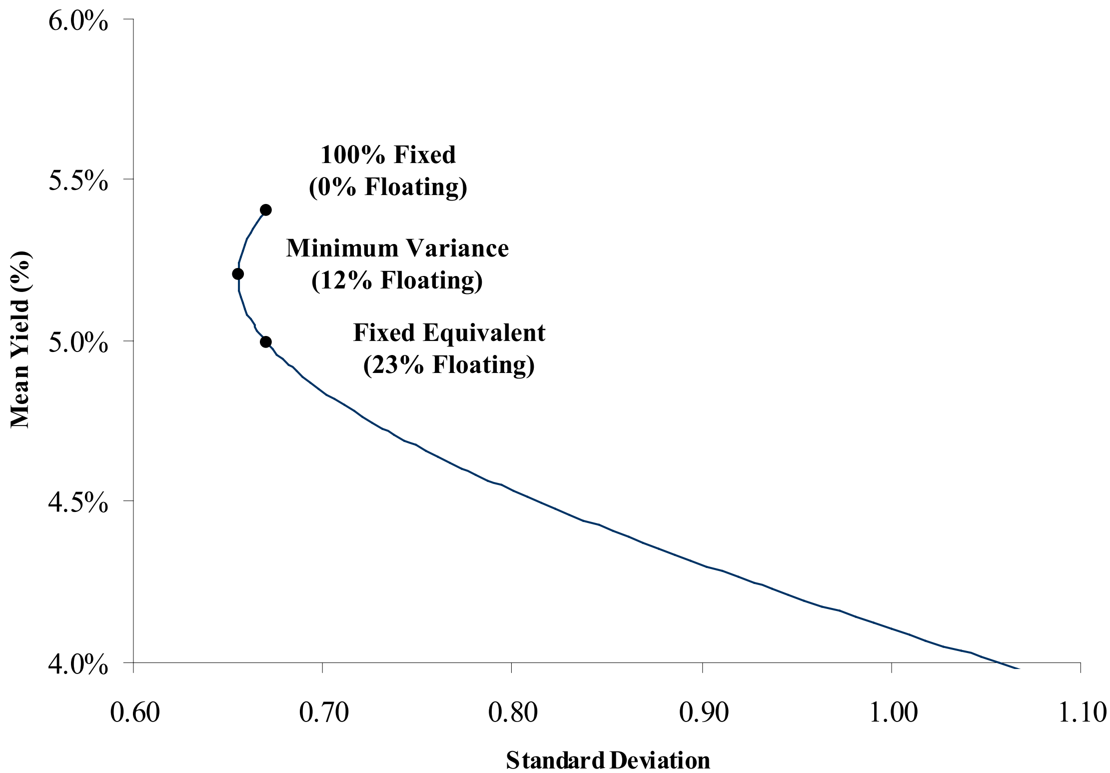
Table 3: Yield Correlation, 1999-2009[8]

	3 Month BA	15 Year Prov. of Man.
Mean Yield (%)	3.63%	5.40%
Standard Deviation (%)	1.27%	0.67%
Correlation	0.33	

[7] Fisher, L., 1975, Using Modern Portfolio Theory to Maintain an Efficiently Diversified Portfolio, Financial Analysts Journal, 31 (3), 73-85.
[8] Historical interest rate data as per Bloomberg.

An analysis using historical 10 year data yields the following efficiency frontier:

Figure 2: MPT Efficient Frontier, 1999-2009



According to this analysis, minimum volatility is achieved with a 12% floating rate debt component. With a 23% floating rate debt component, the same volatility can be achieved as 100% fixed, but at a lower cost of debt.

A company's appropriate mix of fixed and floating rate debt is ultimately a function of its risk appetite. However, this analysis demonstrates that regardless of a company's risk profile, a more efficient risk/cost equilibrium can be attained by introducing a floating rate element to the company's debt portfolio.

2.1.4. Advantages

MPT is a simple, straight-forward analysis that provides a broad context for understanding the interactions of systematic risk and reward. The theory concludes that an appropriate diversification of debt instruments may help lower the cost of debt.

2.1.5. Limitations

MPT relies on the assumption that the correlation between short and long-term interest rates stays constant over time. Historically there has been no evidence to support this assumption, given that yield curve slopes have shown high levels of volatility over the past ten years.

While on average, over the past decade, there has been a positive relationship between short and long-term rates, it is apparent that correlation factors change depending on the specific timeframe chosen.

Table 4: Yield Correlation, 1999-2003 vs. 2004-2009[9]

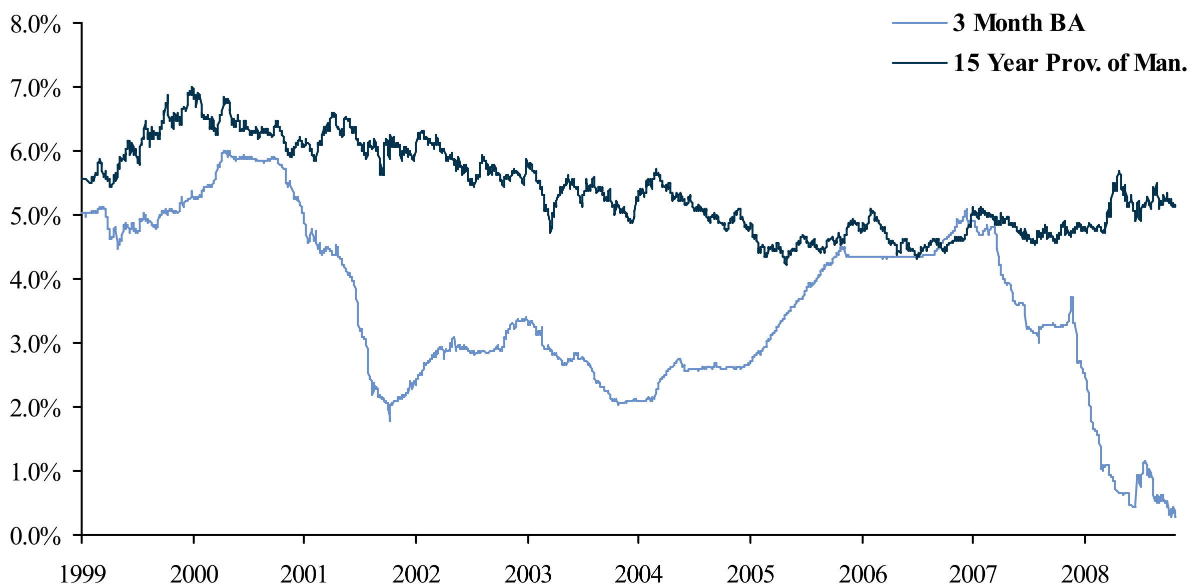
1999-2003	3 Month BA	15 Year Prov. of Man.
Mean Yield (%)	4.05%	5.99%
Standard Deviation (%)	1.27%	0.42%
Correlation	0.58	

2004-2009	3 Month BA	15 Year Prov. of Man.
Mean (%)	3.23%	4.87%
Standard Deviation (%)	1.14%	0.31%
Correlation	-0.56	

Figure 3 illustrates this point graphically. It is apparent that during the first five years, both rates move together, leading to a strong positive correlation of 0.58. However, from 2004 onwards, interest rates move in opposite directions, leading to a negative correlation of -0.56.

[9] Historical interest rate data as per Bloomberg.

Figure 3: Historical Interest Rates[10]



As a result, MPT yields two separate efficiency frontiers for the two time periods. In the 1999-2003 timeframe, minimum variance is achieved at a 100% fixed portfolio, whereas for 2004-2009, a 16% floating mix yields the lowest volatility.

Furthermore, in the debt management context, MPT's only objective is to minimize a company's cost of debt and its volatility. However, this is an incomplete analysis because it ignores operational cash flow volatility, which may be correlated with movements in interest costs. Given that profit is the measure of financial performance, MPT results in an incomplete analysis.

Despite these limitations, MPT does present itself as a useful tool to evaluate the appropriate mix of fixed and floating rate debt. One generic conclusion that can be derived from this exercise is that depending on the correlation of fixed and floating rates, an appropriate diversification of different debt instruments may help lower the cost of debt for a given level of risk.

2.2. Alternative Theories

2.2.1. Post Modern Portfolio Theory

The Post Modern Portfolio Theory (PMPT) was developed to address some of the limitations of the MPT, namely the symmetrical distribution of returns. To address this, Rom and Ferguson introduced the concept of volatility skewness, which denotes the ratio of a distribution's

[10] Historical interest rate data as per Bloomberg.

percentage of total variance from returns above the mean, to the percentage of the distribution's total variance from returns below the mean.[11]

One way to address some of the major shortcomings of MPT, namely the symmetrical distribution of returns, is to introduce a three-parameter lognormal distribution of returns to account for the skew in the volatility of returns. The lognormal distribution assumes that the natural logarithm of the returns follow a normal distribution.

PMPT refines the MPT model to account for asymmetric expected returns, and reduces skewed volatility. However one of the limitations of PMPT is that it ignores the asset-side volatility factors of the business, and while it is considered a useful academic tool to analyze portfolio performance, it is an incomplete approach to corporate risk management decisions.

2.2.2. Market Timing Theory

The market timing approach dictates that companies should determine their fixed vs. floating rate debt policy according to the expectations of changes in future interest rates.

Steeper yield curves imply greater difference between short and long-term interest rates, and would entail a higher proportion of floating rate debt in the short term to lower interest expense. If companies believe they can effectively time the market, thereby reducing their cost of capital, then the interest rate exposure selection should be driven by movements in interest rates.[12]

The concern associated with this approach is that market timing is macroeconomic focused and may be considered speculative in nature. Market timing seeks to adjust the cost of debt based on current and expected yields, but does not aim to reduce other volatility factors correlated with interest rate movements. The cost of debt is only one component of financial performance.

Figure 4 depicts the term spread of the 3 month and 15 year Province of Manitoba bonds, illustrating the current steepness of the yield curve, implying that practicing a higher proportion of floating rate debt would result in a lower interest expense.

---

[11] Rom, B., Ferguson, K.. Post-Modern Portfolio Theory Comes of Age, 1993, Journal of Investing, 1, 349-364.
[12] Faulkender, M., 2005, Hedging or Market Timing, Journal of Finance, 60 (2), 931-962.

Figure 4: Term Spread – 3 Month BA vs. 15 Year Province of Manitoba[13]

The market timing approach seeks to take advantage of a steep yield curve. This strategy is particularly relevant in the current economic environment where interest rates, especially short-term ones, are at historical lows. The market timing approach reflects economic factors that management should take into account when seeking to minimize interest expense, which has a direct impact on the profitability of the company. However, this approach has traditionally focused on yield curve slopes, without taking into account the overall level of interest rates, which should be reflected in debt structuring decisions.

Other pitfalls associated with market timing theory are that it ignores the asset volatility factors of the business and relies on a view on the future direction of interest rates, which could be interpreted as speculation. Also, the framework is unable to quantify the risks associated with issuing floating rate debt; analysis suggests that a debt portfolio with a high proportion of floating rate debt will result in higher interest expense volatility.

2.2.3. Asset/Liability Management

The asset/liability approach examines both revenues and expenses simultaneously and formulates an optimal mix of fixed and floating rate debt based on reducing the volatility factors affecting the company. Taking an asset/liability management approach considers interest expense management in the context of the overall business, not as a standalone item. The approach seeks

[13] Historical interest rate data from Bloomberg.

to optimize net income, which is the key metric of relevance for Manitoba Hydro. Carrying more floating rate debt can have a volatility-decreasing effect by offsetting changes in interest rates.[14] Hedging strategy impacts a company's ability to pay interest, and meet its debt costs on a regular basis.[15] High variability in cash flows negatively impacts capital expenditure plans because debt cannot be used as a supplement to internally generated cash flows to fund capital requirements.[16]

In Hackbarth et al., the authors examine the optimal mixture of bank and market debt to explore dynamic capital structures in the context of realistic macroeconomic settings with interest rate and inflation risks. However, all market debt is assumed to be in the form of fixed rate bonds.[17]

In most academic research papers, corporate debt is only represented by fixed coupon bonds and does not take into consideration interest rate movements and inflation risks. Hence, limited analytical results relevant to the scope of this assessment are available.

Other hedging theories stipulate that by matching the interest rate exposure of the liabilities to that of their assets, firms can reduce variability of their cash flows and, as a result, lower their expected cost of financial distress and capture greater tax shield benefits.[18] Hedging also allows firms to minimize how often they have to raise external capital.[19] These academic papers have not provided any quantitative estimate of the optimal breakdown between various types of debt instruments.

Martellini and Milhau tie together these two separated strands of the corporate finance literature by providing the first quantitative analysis of capital structure and debt management choices in a unified framework. This research shows that risk management motives can be quantitatively analyzed in the context of a formal capital structure model. To do that, it considers the optimal allocation to various competing forms of liabilities in a more realistic stochastic environment. In the presence of interest rate and inflation risks, they obtain analytical expressions for the price of, and optimal allocation to, various forms of liabilities classes (fixed rate bonds, floating rate bonds and inflation indexed bonds, in addition to equity).[20]

---

[14] Chava, S., Purnanandam, A., 2007, Determinants of the Floating-to-Fixed Rate Debt Structure of Firms, Journal of Finance, 50 (3), 789-819.
[15] Smith, C., Stulz, R., 1985, The Determinants of Firms' Hedging Policies, Journal of Financial and Quantitative Analysis, 20 (4), 391-405.
[16] Froot, K., Scharfstein, D., Stein, J., 1993, Risk Management: Coordinating Corporate Investment and Financing Policies, Journal of Finance, 48 (5), 1629-1658.
[17] Hackbarth, D., Hennessy, C., Leland, H., 2007, Can the Trade-off Theory Explain Debt Structure?, Review of Financial Studies, 20 (5), 1389-1428.
[18] Smith, C., Stulz, R., 1985, The Determinants of Firms' Hedging Policies, Journal of Financial and Quantitative Analysis, 20 (4), 391-405.
[19] Froot, K., Scharfstein, D., Stein, J., 1993, Risk Management: Coordinating Corporate Investment and Financing Policies, Journal of Finance, 48 (5), 1629-1658.
[20] Martellini, L., Milhau, V., 2008, Capital Structure Choices and the Optimal Design of Corporate Market Debt Programs, Second Singapore International Conference on Finance 2008.

This analysis shows that debt management decisions have an impact on capital structure decisions. The optimal allocation depends on the correlation between interest rates and the firm's asset value. The volatility of the interest rate and the speed of mean reversions also play an important role in the determination of the debt structure.

The limitation associated with taking an asset/liability management approach to formulating an optimal debt mix is that it is often difficult to segregate both the factors that impact operating cash flow and analyze their correlation with interest rates.

2.3. CONCLUSION

NBF's comprehensive review of academic literature on alternative debt portfolio frameworks and their respective advantages and limitations established that the asset/liability management approach is the most appropriate framework for assessing Manitoba Hydro's fixed vs. floating rate debt policy.

In NBF's opinion, the asset/liability model is the only alternative that allows for the optimization of net income as it seeks to match the assets and liabilities of a company.

3. IDENTIFICATION OF KEY FACTORS

Having identified the asset/liability management framework as the appropriate approach for this analysis, NBF examined the sources of volatility of the assets and liabilities affecting the historical financial performance of Manitoba Hydro.

The asset analysis identified the volatility factors affecting the drivers of Manitoba Hydro's revenue, and likewise, the liabilities analysis identified the volatility factors affecting Manitoba Hydro's costs. The key factors identified in this analysis were used as the drivers of the technical analysis and scenario testing.

3.1. ASSETS

Assets are defined as the stream of cash inflows that result from operational assets. These include both domestic and extraprovincial electricity sales revenue.

3.1.1. Domestic Utility Rates

The prices charged for the sale of electricity and natural gas within Manitoba are subject to review and approval by the Public Utilities Board of Manitoba ("Board"). The Board is the provincial government's regulatory body through which all of Manitoba Hydro's electricity and natural gas rate applications must be approved before rate increases or decreases can become effective.

Table 5: Domestic vs. Extraprovincial Electric Revenues and Volumes[21]

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Electric Revenue ($mm)	$1,122	$1,212	$1,362	$1,243	$1,218	$1,458	$1,753	$1,558	$1,633	$1,675
Domestic Revenue ($mm)	$748	$737	$781	$786	$875	$918	$939	$984	$1,024	$1,074
GWh	16,331	15,820	16,698	16,958	18,953	19,323	19,781	19,976	20,555	21,109
$/MWh	$34.26	$39.09	$47.24	$46.97	$49.22	$50.03	$53.00	$50.75	$49.33	$51.29
Export Revenue ($mm)	$374	$475	$581	$457	$343	$540	$814	$574	$609	$601
Import Costs ($mm)	$19	$30	$56	$126	$506	$101	$86	$186	$99	$136
Net Export Rev. ($mm)	$355	$445	$525	$331	($163)	$439	$728	$387	$510	$465
Export GWh	10,911	12,154	12,298	9,735	6,976	10,789	15,360	11,305	12,348	11,720
Export $/MWh	$34.26	$39.09	$47.24	$46.97	$49.22	$50.03	$53.00	$50.75	$49.33	$51.29
Import GWh	978	916	1,458	3,043	9,627	2,278	1,787	3,454	2,098	2,579
Import $/MWh	$18.97	$32.43	$38.36	$41.41	$52.58	$44.19	$48.28	$53.94	$47.09	$52.91

3.1.2. Extraprovincial Revenues

Extraprovincial revenues are subject to two main macroeconomic volatility factors: spot/forward rate risk in the Mid-West Independent Operating (MISO) system and foreign currency exchange exposure. MISO is an open-market, US electrical grid. Manitoba Hydro sells excess electricity to this grid through contracts or at the prevailing spot price. Constant fluctuations in spot prices affect forward contract prices and total extraprovincial revenue. Due to extraprovincial revenues generated from sales into the MISO grid, Manitoba Hydro is exposed to fluctuations in foreign currency exchange rates.

Manitoba Hydro engages in two types of export sales: contracted export sales and spot price export sales. Export contracts account for most of Manitoba Hydro's exported electricity being sold on-peak capacity. Current long-term export contracts produce export sales of about 2,500 GWh/year at prices above $50.00/MWh (average of $55.00/MWh for fiscal 2007/08). Other contracts are short-term market based agreements, and pricing is below $40.00/MWh for sales volumes of 1,500 GWh/year.

Opportunity export sales are spot price sales that attempt to capture the remainder of on-peak availability, and rely on shoulder and off-peak periods to maximize total electrical sales. These

[21] Data as per Manitoba Hydro.

off-peak sales in fiscal 2007/08 accounted for an additional 8,000 GWh in 2007/08, however brought the export average price below $50.00/MWh.

Historically, export revenues have accounted for a significant proportion of total revenues, accounting for an average of 37% over the past 10 years with a standard deviation of 4.9% over the same period.

Table 6: Domestic vs. Extraprovincial Revenues[22]

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Domestic Rev. ($mm)	$748	$737	$781	$786	$875	$918	$939	$984	$1,024	$1,074
Extraprov. Rev. ($mm)	$374	$475	$581	$457	$343	$540	$814	$574	$609	$601
Total Electric Revenue	**$1,122**	**$1,212**	**$1,362**	**$1,243**	**$1,218**	**$1,458**	**$1,753**	**$1,558**	**$1,633**	**$1,675**
Extraprovincial (%)	33%	39%	43%	37%	28%	37%	46%	37%	37%	36%
									Standard Deviation of Proportion of Extraprovincial Revenue:	*4.9%*

3.1.3. Potential Hydraulic Generation/Reserves

Reservoirs within the Nelson-Churchill drainage basins allow Manitoba Hydro to store water for future electrical generation. These reserves are held at virtually no economic cost and it allows Manitoba Hydro to reserve power generation for future seasons in order to meet variable domestic demand and to optimize export sales during peak load demand in the MISO grid.

3.2. Liabilities

Liabilities are defined as the stream of cash outflows that result from both operating and financial activities. These include cost of power purchased from extraprovincial sources, as well as interest payments on issued debt.

3.2.1. Purchased Power

Purchased power costs are subject to spot rate risk in the MISO system given that Manitoba Hydro purchases electricity from the MISO grid at the prevailing spot price. Constant movement in spot prices affects the cost of purchased power.

[22] Data as per Manitoba Hydro.

3.2.2. Operation and Maintenance Expenses

Costs and operating programs have increased due to: increased maintenance requirements (due to an aging infrastructure); wage and benefit settlements that exceed projected inflation; additional overtime and increased staffing levels (to meet extraprovincial requirements); the expansion of programs (to meet higher than expected domestic customer numbers and needs); and the meeting of environmental and other stakeholder expectations. These costs have been compounded by the recent shortage of skilled labour in Manitoba, which results in higher training and labour costs.

3.2.3. Water Rental Fees

Water rentals relate to the use of provincial water resources. Water rentals and assessment fees are determined by the amount of annual water-flow used during the year.

3.2.4. Debt and Interest Expenses

Manitoba Hydro maintains a proportion of floating rate debt in its debt portfolio, which is subject to the volatility of the underlying rate drivers (3 month BA in Canada, 3 month LIBOR in the US). Their respective correlations with other key factors are analyzed in detail in the technical analysis portion of this assessment, and form the basis for the scenario analysis.

The portion of total debt denominated in US Dollars is in place as part of Manitoba Hydro's Exposure Management Program ("EMP") to manage the currency risk associated with extraprovincial power sales. This portion of total debt establishes a natural hedge against US Dollar denominated extraprovincial revenues. This assumption is discussed further in section 5.1.1.

3.3. HYDROLOGY RISK

Based on a study published in Manitoba Hydro's 2008/09 General Rate Application, 94 years of river flow history revealed that Manitoba has faced drought conditions in 23 of the 94 years (approximately 1 year in every 4). Consecutive years of drought conditions occurred from 1929 to 1932, 1936 to 1942, 1976 to 1977, 1980 to 1981, and 1987 to 1991. The most recent drought was in 2003-04. In Table 7, Manitoba Hydro has forecasted the impact of a drought on retained earnings.

Table 7: Hydrology Risk Analysis[23]

Event in Forecast Period	Frequency	Cumulative Retained Earnings Reductions ($mm)
One Year Drought (50% of 2003/04 loss)	1 in 10	($490)
2003/04 Drought	1 in 15	($891)
Five-Year Drought (1987-91)	1 in 50	($2,800)
Seven-Year Drought (1936-42)	1 in 100	($3,500)

Hydrology is considered a key volatility factor affecting the financial performance of Manitoba Hydro. Although hydrology risk can affect the volatility of regulated electricity rates and extraprovincial generation, there is no causal effect between hydrology and macroeconomic factors and therefore cannot, in the context of this assessment, be deemed a key variable in determining the optimal fixed versus floating rate debt policy.

3.4. Conclusion

The foregoing analysis demonstrates that Manitoba Hydro's business model is subject to several volatility factors that affect its assets and liabilities. In formulating an optimal fixed vs. floating rate debt policy, the relationship between these factors justifies the use of an asset/liability management framework. Such an approach will allow Manitoba Hydro to lower net income volatility risk while attaining an optimal level of return.

[23] Data as per Manitoba Hydro.

4. PEER GROUP ANALYSIS

As part of this assessment, NBF examined Manitoba Hydro's peer group's fixed vs. floating rate debt policies. The peer group consisted of vertically integrated electric utilities, and was segmented into two separate types of peers: crown utility corporations and publicly-traded corporations.

Table 8: Peer Group List

Crown Utility Corporations	Publicly Traded Corporations
BC Hydro	Emera Inc.
SaskPower	Fortis Inc.
Hydro Québec	Canadian Utilities Limited
New Brunswick Power	
Newfoundland & Labrador Hydro (Nalcor Energy)	

First, NBF tracked each of the peer's historical floating rate debt mix over a 10 year period and found evidence that Manitoba Hydro's peers utilized market timing to adjust their fixed vs. floating rate debt mix to account for prevailing interest conditions.

Second, NBF extended the key factor identification process to the peer group to identify the sources of volatility affecting their assets and liabilities, and found evidence of asset/liability management.

The purpose of the peer group analysis was not to provide an evaluation of the peer group's fixed vs. floating rate debt policy. Rather, this analysis simply compared Manitoba Hydro's policy to its peers and found that it was consistent with industry practice from an asset/liability management perspective.

4.1. MARKET TIMING EVIDENCE

Market timing provides context as to the macroeconomic reasoning for changes in floating rate debt proportions over time. Companies use this strategy to take advantage of a steep yield curve by increasing floating rate debt, or by fixing their floating rate debt during low interest rate timeframes.

The market timing component of this analysis first examined the relationship between the floating rate debt mix and the slope of the yield curve. Figure 5 depicts the relationship between the peer group's floating rate debt proportion and term spreads in the past 10 years:

Figure 5: Term Spread vs. Average Peer Group Floating Rate Debt %[24]

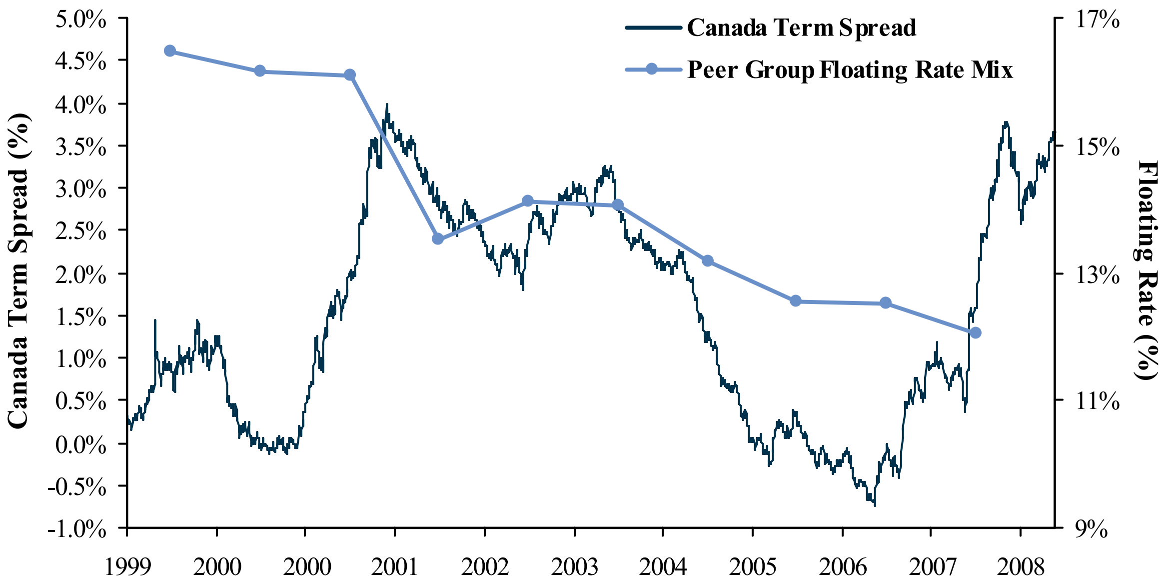


Figure 5 proves that while the peer group's floating rate debt proportion has followed the term spread between 2000 and 2006, these companies have not increased their proportion of floating rate debt in the context of the recent spike in term spreads that has taken place over the last two years.

One reason for this divergence could involve a lag effect between the term spread change and its reflection in company policy. However, another explanation could be the fact that the current low-interest economic environment provides an opportunity for companies to fix their long-term debt at cheaper prices than historical levels.

Figure 6 tests this latter hypothesis by examining the relationship between the peer group's average floating rate debt proportion and long-term interest rates:

[24] Historical interest rate data as per Bloomberg, peer group floating rate mix as per peer group company reports.

Figure 6: 20 Year Government of Canada vs. Average Peer Group Floating Rate Debt %[25]

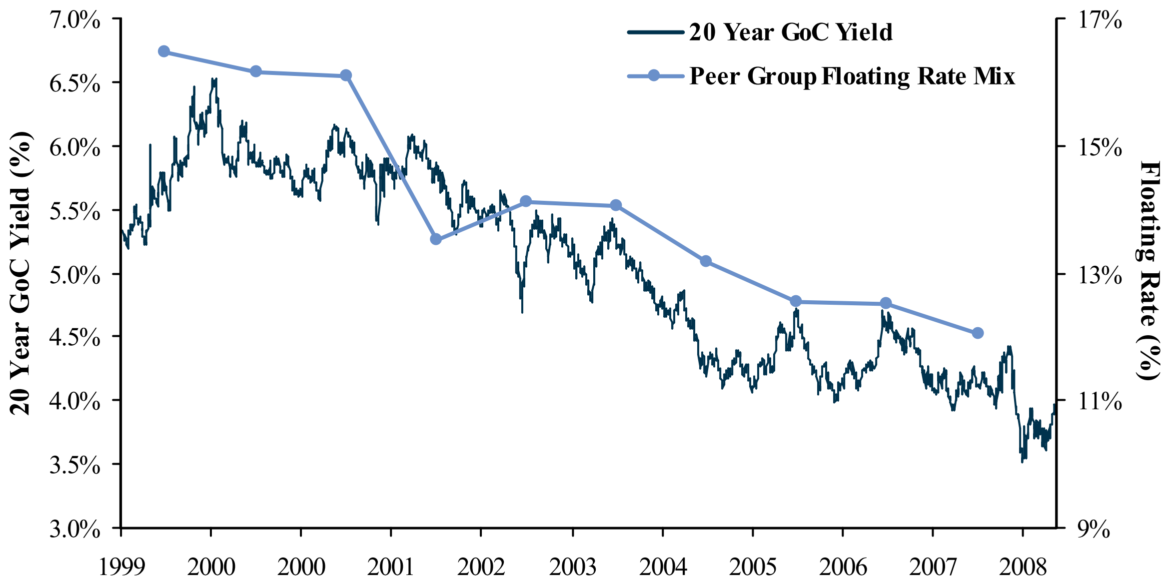


Figure 6 provides evidence that given the unique interest rate environment today, these companies are choosing to engage in market timing not by taking advantage of the increasing term spread, but rather by taking the opportunity to lower their interest rate volatility by fixing more of their debt at historically lower levels.

4.2. Asset/Liability Management Evidence

The asset/liability management approach is a more fulsome and detailed methodology of determining the reasons behind implementing certain individual debt management policies. The sources of revenue and costs were both examined, and the analysis assessed volatility factors associated with changes to each company's net income.

4.2.1. Assets

4.2.1.1. Domestic Utility Rates

The prices charged for the sale of electricity and natural gas within the respective operating provinces of the peer group is subject to review and approval by each public utilities board/commission, with the exception of companies that operate in merchant markets such as Alberta. The public utilities board/commission is the respective provincial government's regulatory body through which all electricity and natural gas rate applications must be approved before rate increases or decreases can become effective.

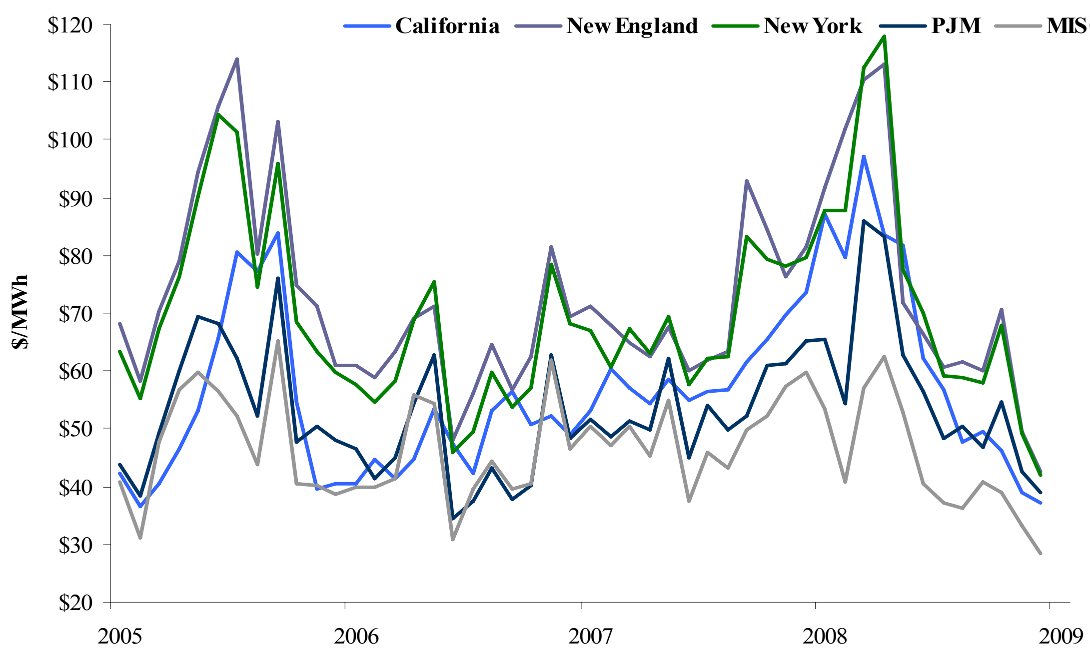
[25] Historical interest rate data as per Bloomberg, peer group floating rate mix as per peer group company reports.

Regulated electricity rates are determined by a host of factors including, but not limited to, inflation risk, electricity demand risk and fuel price risk.

4.2.1.2. Export Revenue

Export revenues are subject to two main macroeconomic volatility factors; spot/forward prices associated with selling excess electricity to open-market grids and foreign currency exchange exposure. Open-market grids that the peer group sells excess electricity into include; California ISO (CISO), ISO New England, MISO, New York Independent System Operator (NYISO), PJM Interconnection and Alberta ISO. The peer group sells excess electricity to these open-market grids at the prevailing respective spot/forward prices. Constant changes in spot prices affect total export revenue. Secondly, due to export revenues generated from sales into the previously mentioned open-market grids, export revenues are exposed to fluctuations in foreign currency exchange rates.

Figure 7: Historical ISO Electricity Spot Prices[26]



4.2.1.3. Generation Risk

Natural weather conditions such as hydrology and wind levels impact generation and its volatility increases dependency on import power. The unpredictability of these sources of generation affect the volatility of regulated electricity rates, however it is not a risk that is correlated with macroeconomic metrics such as interest rates and cannot be used in forecasting

[26] Historical ISO electricity spot prices as per Bloomberg.

future impacts on financial performance, specifically through determining an optimal debt policy.

4.2.2. Liabilities

4.2.2.1. Operation and Maintenance Expenses

Unexpected inflation risk is the key metric affecting volatility in operation and maintenance expenses of the peer group. Items such as unforeseen changes in staffing levels/costs are responsible for this volatility.

4.2.2.2. Purchased Power

Purchased power costs are subject to two main volatility factors: spot rate risk associated with purchasing electricity due to domestic generation shortfall on open-market grids and foreign currency exchange exposure. The open-market grids that the peer group purchases electricity from include: ISO New England, MISO, New York Independent System Operator (NYISO), and PJM Interconnection. Secondly, due to purchased power from electricity in the previously mentioned open-market grids, purchased power is exposed to fluctuations in foreign currency exchange rates.

The cost of producing power from certain additional sources of generation is an additional volatility factor affecting the peer group. Input fuel prices for power generation from natural gas, coal and oil are all examples of fuel costs that are subject to external pricing.

4.2.2.3. Debt and Interest Costs

Peers that maintain a floating portion of their total debt are subject to volatilities in rate drivers (BA and LIBOR). NBF's peer group analysis demonstrated that among the peers, only SaskPower fixed all of its debt and hence was not affected by fluctuations in short-term interest rates.

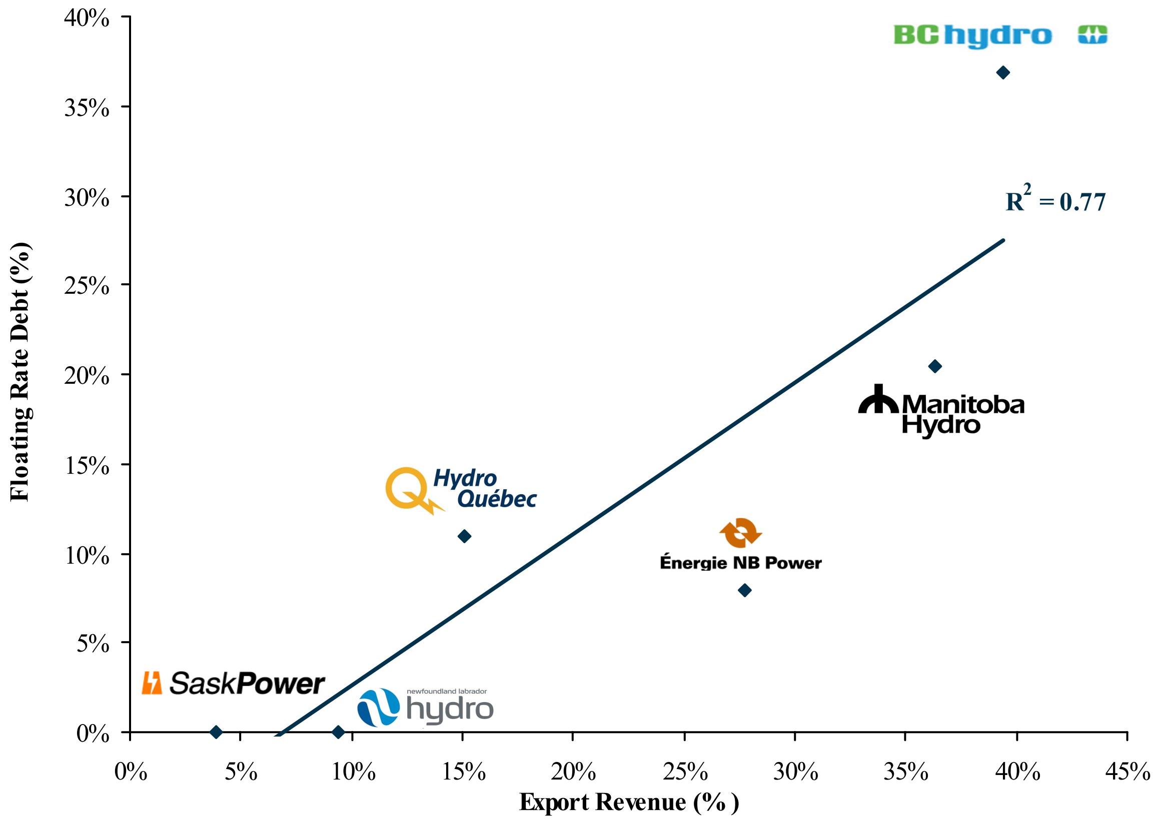
Furthermore, the analysis also demonstrates that peer group members issue a portion of their debt in foreign currencies to mitigate foreign revenue exposures.

4.2.3. Asset/Liability Management Evidence

The foregoing key factor identification process demonstrated that Manitoba Hydro's peers are subject to volatility factors that warrant an asset/liability management approach to their fixed vs. floating rate debt policy.

In Figure 8, an evaluation of the crown utility peer group's operations indicates that there is a positive relationship (as evidenced by an R^2 of 0.77) between the exposure to exported power revenue, which is subject to spot/forward electricity price volatility, and the proportion of floating rate debt on the company's balance sheet. Figure 8 suggests that as revenues become more dependent on exports, the floating rate debt component becomes more prevalent.

Figure 8: Peer Group Floating Rate Debt % (2008) vs. Export Revenue % (Crown Utilities)[27]



Manitoba Hydro, BC Hydro, NB Power and Hydro Québec all export material amounts of power to various markets in the United States. To hedge part of the volatility of spot/forward prices, each respective peer carries a floating rate debt component in their debt portfolio.

4.3. Conclusion

The peer group analysis provided evidence of market timing among Manitoba Hydro's peer group. The historical analysis suggests that the peers adjusted their floating rate debt proportion to take advantage of the prevailing interest rate environment.

[27] Data as per Manitoba Hydro and peer group company reports.

The asset/liability portion of the analysis yielded evidence that Manitoba Hydro's fixed vs. floating rate debt policy is consistent with that of its crown utility peers from an asset/liability management perspective.

5. TECHNICAL ANALYSIS

The purpose of NBF's technical analysis was to quantify the volatility and correlation of the key factors identified in Section 3, namely domestic utility rates, export power prices (short-term contracts/spot transactions and long-term contracts) and Canadian and US short-term interest rates. NBF found that the difference in volatilities between regulated and spot electricity prices and their correlation to short-term interest rates were the key elements of this analysis. The results were then used as inputs for the scenario analysis in Section 6.

5.1. ASSUMPTIONS

In order to strictly adhere to the scope of this mandate and issue in question, namely the optimal mix of fixed vs. floating rate debt, NBF has made the following assumptions in its technical analysis.

5.1.1. US Assets and Liabilities

The NBF methodology assumed Manitoba Hydro's current mix of Canadian and US Dollar ("USD") denominated debt as given, and then analyzed the optimal mix of fixed vs. floating rate debt for its entire debt portfolio.

Manitoba Hydro currently has an EMP to manage its currency risk. The EMP uses USD denominated debt to establish a natural hedge between USD cash inflows and outflows. Any discussion regarding the appropriate mix of Canadian vs. USD denominated debt instruments would entail an evaluation of Manitoba Hydro's currency risk hedging practices, which is outside the scope of this assignment.

For the purposes of the technical analysis, NBF assumed that USD denominated debt accounted for 37% of the total debt portfolio in the base case year, calculated as the average proportion of total debt over the last three years. This proportion is comparable to the 37% in extraprovincial revenues as a percentage of Manitoba Hydro's total electric revenue as identified in Table 6.

Table 9: Historical Proportion of US Dollar Denominated Debt[28]

	2000	2001	2002	2003	2004	2005	2006	2007	2008
Exchange Rate (C$/US$)	$1.172	$1.174	$1.594	$1.469	$1.311	$1.210	$1.167	$1.153	$1.028
Fixed Debt (C$mm)	$3,367	$2,758	$4,033	$3,425	$2,793	$2,578	$2,488	$2,458	$2,191
Floating Rate Debt (C$mm)	$206	$176	$478	$441	$393	$363	$350	$346	$514
Total US Debt (C$mm)	$3,573	$2,934	$4,511	$3,866	$3,186	$2,940	$2,838	$2,804	$2,705
(%) of Total Debt	50.1%	45.5%	58.9%	53.2%	43.1%	40.8%	39.6%	38.8%	35.6%

5.1.2. Debt Maturity Schedule

Discussion regarding the maturity schedule of debt instruments is outside the scope of this assignment. Hence, current and historical maturities will form the basis for the technical analysis.

As Manitoba Hydro's weighted average fixed term to maturity in 2008 was 14.7 years, throughout its technical analysis, NBF assumes a fixed term to maturity of 15 years for fixed debt instruments.

Table 10: Historical Average Maturity Terms[29]

Term to Maturity	2000	2001	2002	2003	2004	2005	2006	2007	2008
Total Canada	23.2	21.9	21.1	20.7	19.4	18.9	18.8	18.1	19.4
Total US	18.2	15.6	13.5	12.4	12.3	11.3	10.3	10.3	8.8
Total Fixed	18.7	17.3	15.9	15.6	14.9	14.6	14.4	13.7	14.7
Total Floating	13.0	12.7	9.4	8.3	7.8	8.0	7.1	7.8	6.4

5.2. VOLATILITY AND CORRELATION ANALYSIS

As previously discussed, Manitoba Hydro's financial results are subject to several volatility factors, most notably variances in export electricity prices, exchange rates and hydrology. The primary source of net income variability relates to the substantial level of hydrology risk that is present in Manitoba Hydro's operations. Given that in principle there is no causal relationship between weather patterns and macroeconomic indicators, it is not possible to lower exposure to this hydrology risk through determining a debt policy.

However, it is important to note that the added volatility introduced by fluctuations in hydrology does highlight the need for the stabilization of income, to the extent that it can be managed through financial instruments.

[28] Data as per Manitoba Hydro.
[29] Data as per Manitoba Hydro.

Given that hydrology and currency risks are non-factors in the technical component of the analysis, NBF's methodology focuses on power prices in both the domestic and extraprovincial markets as value drivers for the assets, and compares them to the liability portion driven by short-term interest rates. As a proxy for volatility in domestic rates and long-term export contracts, NBF's technical analysis utilizes the volatility in the Canadian Consumer Price Index ("Canadian CPI") and US Consumer Price Index ("US CPI"), respectively.

The historical results, based on a 2005-2009 period, are summarized as follows:

Table 11: Variable Volatilities, 2005-2009[30]

	Asset Variables	Volatility Metric	Mean	Standard Deviation
A	**Domestic Utility Rates**	Change in Canadian CPI	1.68%	1.45%
B	**Extraprovincial Power (Short-Term Contracts and Spot)**	MISO Power Price	US$42.37	US$11.96
C	**Extraprovincial Power (Long-Term Contracts)**	Change in US CPI	2.32%	1.66%

	Liability Variables	Volatility Metric	Mean	Standard Deviation
D	**Canadian Short-Term Interest Rates**	3 Month BA	3.49%	1.18%
E	**US Short Term-Interest Rates**	3 Month LIBOR	4.02%	1.43%

Changes in Canadian CPI and US CPI levels were measured using a lognormal distribution. The mean reflects annualized increases, whereas the standard deviation represents the proportion of the mean that is subject to volatility on an annualized basis.

Table 12: Variable Correlation Matrix, 2005-2009

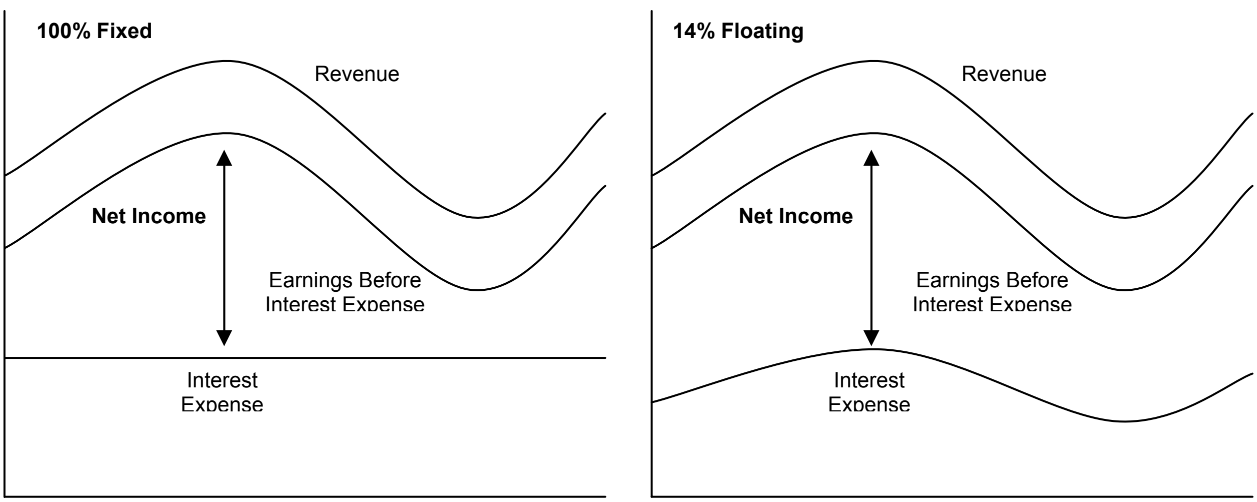
Correlations	Domestic Utility Rates	Export Power (ST and Spot)	Export Power (LT Contracts)	Canadian ST Interest Rates	US ST Interest Rates
Domestic Utility Rates	-	0.17	0.66	0.06	0.00
Extraprovincial Power (ST and Spot)	0.17	-	0.23	0.46	0.37
Extraprovincial Power (LT Contracts)	0.66	0.23	-	0.22	0.00
Canadian ST Interest Rates	0.06	0.46	0.22	-	0.91
US ST Interest Rates	0.00	0.37	0.19	0.91	-

30 Historical interest rate data as per Bloomberg.

The technical analysis demonstrates that short-term export power contract prices have higher correlation with short-term interest rates than domestic rates and long-term export contracts. The results suggest that the volatility in the pricing of these contracts could be better mitigated by increasing the proportion of floating rate debt.

Increasing the proportion of floating rate debt can lead to lower risk because our analysis shows that interest expense and revenues are correlated. Because short term interest expense and revenues move together to a certain extent, net income can be stabilized by adding a floating element to the overall debt portfolio. A 100% fixed portfolio would keep interest expense flat, and hence revenue fluctuations will be reflected in net income. However, by allowing interest expense to move together with revenue, Manitoba Hydro can achieve more net income stability, as shown in figure 9.

Figure 9: Correlation Impact on Net Income



This conclusion was incorporated in the scenario analysis portion of NBF's assessment.

6. SCENARIO ANALYSIS

Based on the aforementioned technical analysis, NBF's scenario analysis generated a set of 10,000 scenarios for each of the identified key factors. These scenarios reflected the volatility and correlation metrics previously quantified in the technical analysis.

This set of scenarios was then applied to 100 portfolios of different fixed vs. floating rate debt mixes. Under each scenario, the net impact on Manitoba Hydro's net income was calculated for each portfolio mix. The inherent volatility in a given portfolio selection was then derived from the variance that each fixed vs. floating rate debt mix caused under each one of the 10,000 generated scenarios.

The product of this scenario generation process was an average return (defined as net income impact) and risk (the level of volatility of this net income impact) that resulted from each one of the 100 different portfolio mixes.

6.1. EFFICIENT FRONTIER

Each portfolio was plotted according to its risk and reward profile, yielding a curve of possible outcomes. Due to the positive correlation between power prices (especially short-term and spot export prices) and floating interest rates, the result suggested that risk could actually be lowered by increasing the proportion of floating rate debt.

The fixed equivalent, defined as the portfolio that yields the same level of risk as the 100% fixed portfolio, consisted of 27% floating rate debt. For illustration purposes, this was established as the base case level of risk and return, and each portfolio's net income impact and volatility were calculated relative to this base case.

Table 13 summarizes these findings:

Table 13: Portfolio Risk/Return Matrix

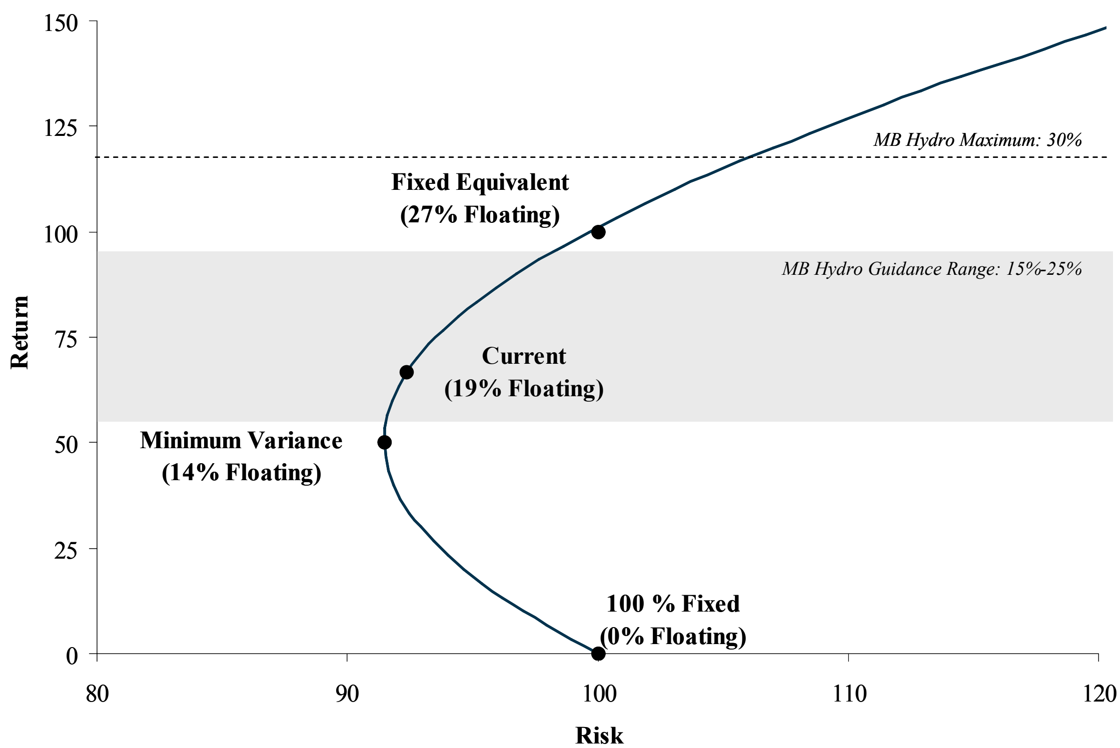
	Floating (%)	Adjusted Risk	Adjusted Return
1. Fixed	0%	100	0
2. Minimum Variance	14%	93	50
3. Current (March 31, 2008)	19%	94	69
4. Fixed Equivalent	27%	100	100
5. Floating	100%	253	370

The minimum variance portfolio was defined as the fixed vs. floating rate mix that yielded the lowest variance in net income, and was achieved by incorporating 14% floating rate debt into the debt portfolio. The above analysis implied that risk could be lowered by 7% by increasing the floating rate debt mix to 14% (from a 100% fixed portfolio) while making positive gains in net income since floating interest rates tend to be lower than fixed interest rates.

Furthermore, this analysis demonstrated that in order to maximize returns for a given level of risk, the portfolio must contain more than 14% floating rate debt. This minimum variance point therefore determined the beginning of the efficient frontier, which was defined as the set of portfolios that maximize return for a given level of risk.

The efficient frontier resulting from this scenario analysis is illustrated as follows:

Figure 10: Volatility Impact Model Efficient Frontier



This analysis proves that Manitoba Hydro's guidance range of 15% to 25% floating rate debt mix is efficient from a risk/return perspective as it is above the minimum variance portfolio. In addition, this range is below the fixed equivalent mix of 27% floating rate debt. As a result, Manitoba Hydro's current floating rate debt policy has the effect of lowering net income volatility in relation to a 100% fixed debt portfolio, while increasing returns through interest cost savings.

7. SOLUTION FORMULATION

Based on the analysis conducted, NBF formulated a set of recommendations for Manitoba Hydro to consider in determining the appropriate policy for fixed vs. floating rate debt mix. Such a policy needs to take into account the results of the asset/liability management framework, which allows the company to achieve an efficient level of risk. Moreover, the policy should also take into consideration the prevailing interest rate environment in order to take advantage of potential market timing opportunities.

7.1. ASSET/LIABILITY MANAGEMENT FRAMEWORK

The scenario analysis demonstrates that Manitoba Hydro's current guidance range of 15% to 25% is on the efficient frontier given that it falls inside the optimal risk reduction range of 14% to 27%. As a result, Manitoba Hydro's range has the effect of lowering risk from a 100% fixed rate debt portfolio while increasing net income through the introduction of lower interest costs.

Having analyzed the risk profile of the business, NBF believes that Manitoba Hydro's current guidance range is close to optimal, given that it seeks to lower risk in an efficient manner as prescribed by the asset/liability framework. This risk lowering approach is consistent with the risk profile of Manitoba Hydro's business, since the substantial hydrology risk highlights the need for stable underlying net income levels.

Given that the asset/liability framework adopts a consolidated approach, it also takes into account Centra Gas' risk profile and its respective impact on net income volatility. Accordingly, the results of our analysis are applicable to Manitoba Hydro's consolidated financials, which include Centra Gas.

While the current guidance range lies on the efficient frontier, NBF suggests that Manitoba Hydro should constantly monitor the performance of asset and liability variables to ensure that they reflect the prevailing economic environment.

7.2. MARKET TIMING

While the minimum variance portfolio yields the most stability, there are opportunities to lower the cost of interest (hence increase net income) by taking advantage of the prevailing interest rates at any given time. This approach should complement the asset/liability approach, which prescribes a range of optimal mixes.

One of the outcomes of the current recession has been a substantial drop in interest rates across the yield curve. Interest rates are currently at historically low levels because of a low inflation environment. The Bank of Canada and Federal Reserve have reduced key interest rates (currently 0.25% in Canada and between 0% and 0.25% in the US) and the equities sell-off and 'flight-to-quality' has generated high demand for government bonds in Canada.

Figures 11 and 12 demonstrate that Canadian interest rates are at historical lows, further promoting an opportune time to consider market timing as a viable strategy in determining an optimal debt mix.

Figure 11: Bank of Canada Overnight Rate[31]

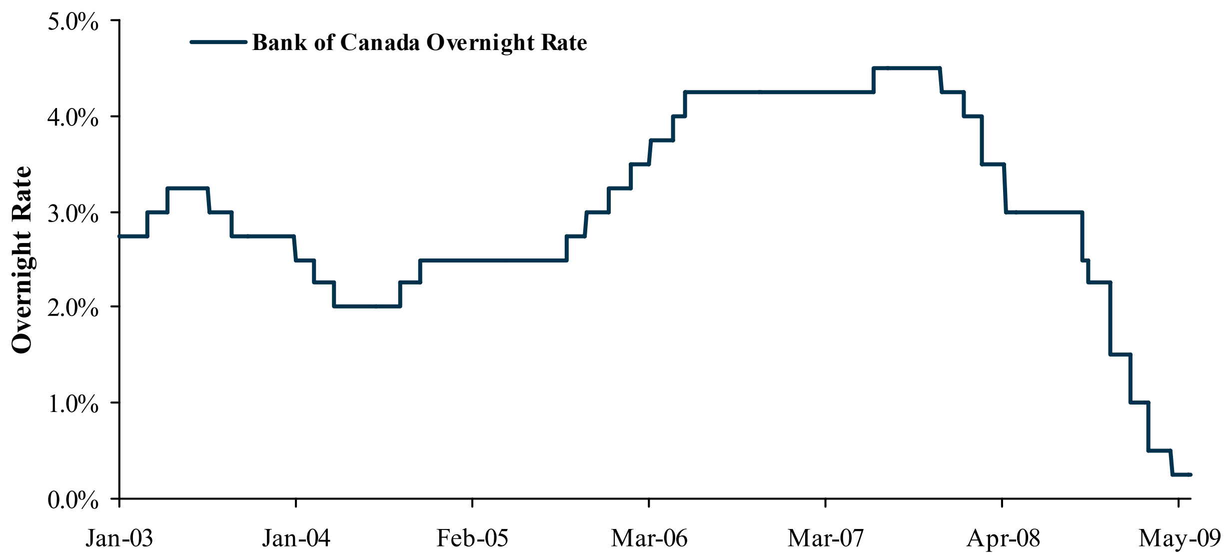
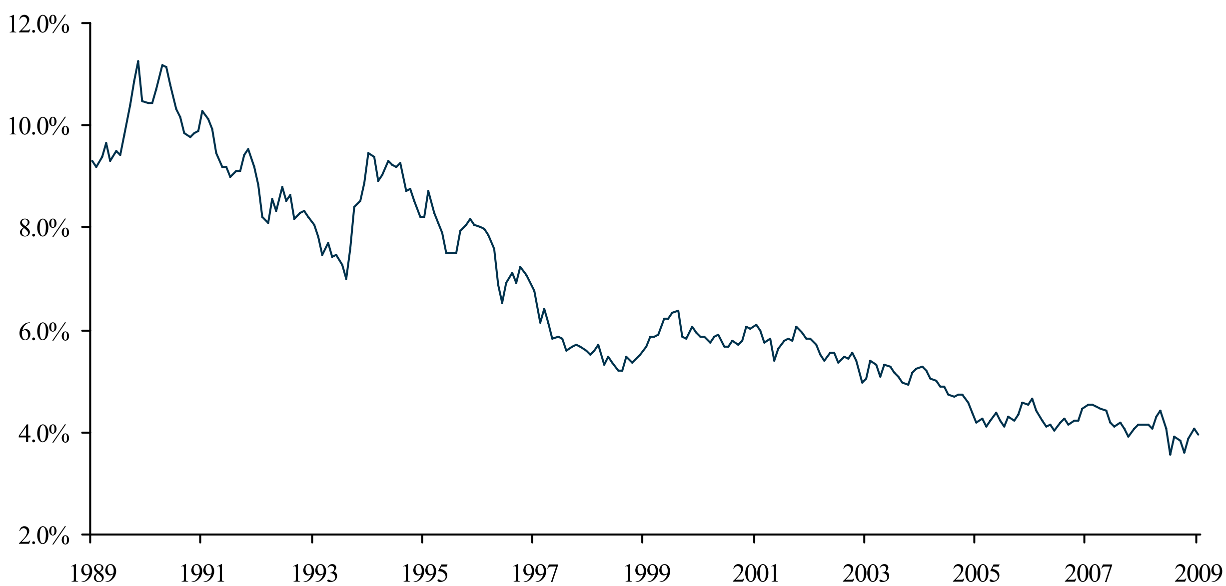


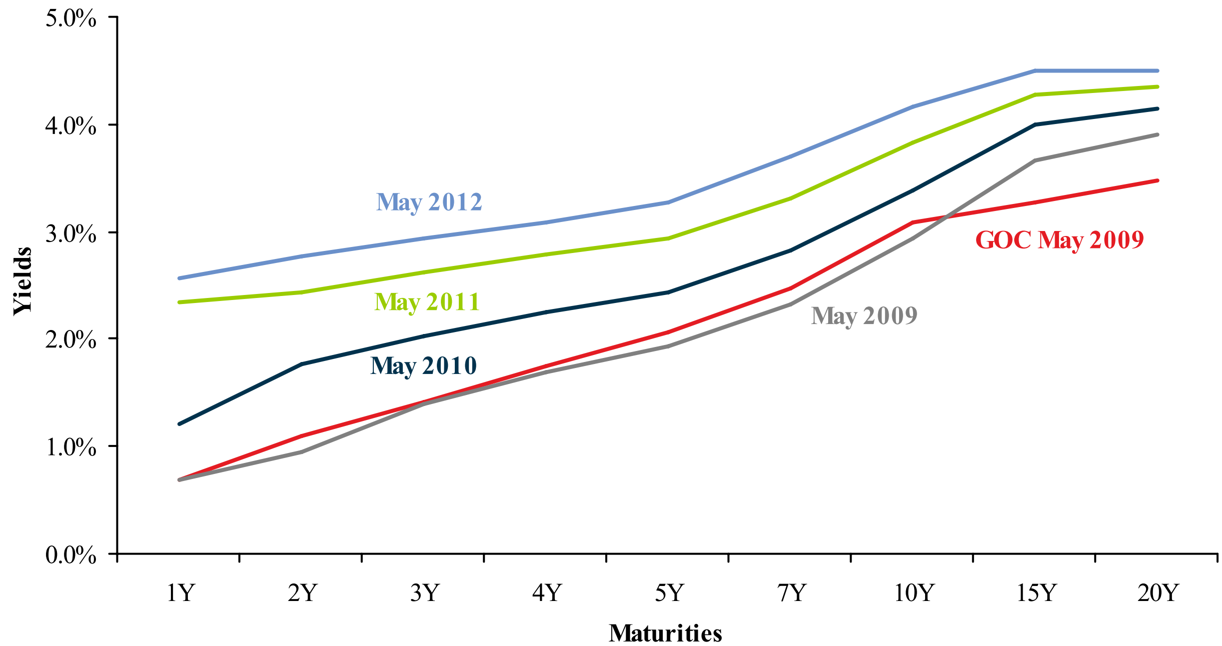
Figure 12: 20 Year Government of Canada Interest Rates[31]



[31] Historical interest rate data as per Bloomberg.

It is important to note that incremental increases in floating rate debt leads to higher interest rate risk. By examining the forward curves for different maturities outlined in Figure 13, it is evident that market participants believe interest rates will move significantly higher, hence the steepness of the yield curve.

Figure 13: Canadian Swap Curve and Forward Curves[32]



Figures 11, 12 and 13 provide evidence that the prevailing interest rate environment and yield curve slopes need to be taken into consideration in order to determine the optimal fixed vs. floating rate debt portfolio. Traditional market timing theory would normally prescribe a higher proportion of floating rate debt during periods of steep yield curves. However, it is important to note that these historically low interest rate levels provide an opportunity to lower interest rate risk at relatively inexpensive levels by increasing the proportion of fixed rate debt.

[32] Interest rate data as per Bloomberg.

8. IMPACT ANALYSIS

Having established an optimal range of fixed vs. floating rate debt mix, as prescribed by the asset/liability framework, NBF analyzed the retroactive impact of this range on Manitoba Hydro's historical financial results.

8.1. IMPACT ON MANITOBA HYDRO

For each year, NBF calculated the impact on interest expense resulting from both the minimum variance (14% floating rate debt) and fixed equivalent (27% floating rate debt) portfolios. This allowed for an adjustment to the actual net income and coverage ratios. These impacts are summarized as follows:

Table 14: Impact of changes in Floating Rate Debt Mix[33]

all figures in ($mm)	2000	2001	2002	2003	2004	2005	2006	2007	2008
Total Debt	**$7,134**	**$6,442**	**$7,661**	**$7,268**	**$7,390**	**$7,204**	**$7,169**	**$7,227**	**$7,599**
Historical Debt Mix									
Floating Rate	15%	14%	14%	16%	17%	22%	19%	19%	19%
Net Income									
Minimum Variance	$152	$267	$206	$61	($453)	$129	$410	$116	$326
Actual	$152	$269	$214	$71	($436)	$136	$415	$122	$346
Fixed Equivalent	$171	$301	$229	$93	($424)	$149	$424	$133	$363
Interest Coverage									
Minimum Variance	1.35	1.62	1.41	1.12	0.14	1.24	1.76	1.22	1.67
Actual	1.35	1.62	1.42	1.14	0.17	1.25	1.77	1.23	1.71
Fixed Equivalent	1.39	1.69	1.45	1.18	0.19	1.27	1.79	1.25	1.75

8.2. CONCLUSION

The impact analysis demonstrates that since Manitoba Hydro's historical floating rate debt mix had stayed within the optimal range as prescribed by the asset/liability framework, the actual financial results were also within the optimal range.

[33] Historical financial data as per Manitoba Hydro.

9. CONCLUSIONS

An assessment of Manitoba Hydro's fixed vs. floating rate debt policy suggests that its current guidance range of 15% to 25% floating rate debt represents a range that is close to optimal under the asset/liability management framework. Furthermore, NBF recommends that Manitoba Hydro adjust its floating rate debt proportion accordingly within its current guidance range in order to take advantage of market timing opportunities presented by the prevailing interest rate environment by taking into account both the slope of the yield curve and the level of interest rates.

9.1. THE NBF APPROACH

NBF's assessment of Manitoba Hydro's fixed vs. floating rate debt policy was based on a comprehensive analysis of the issues relevant to this policy. The components of this approach were:

9.1.1. Portfolio Theory Overview

The approach began with a comprehensive review of academic literature on portfolio theory and the alternative approaches to managing fixed vs. floating rate debt. Based on this review process, NBF concluded that the asset/liability management approach was the appropriate framework for this analysis given its ability to optimize net income by matching assets and liabilities.

9.1.2. Identification of Key Factors

The asset/liability management framework involved an identification of the sources of volatility affecting the net income of the business. NBF found that the key asset factors were domestic utility rates and extraprovincial revenues, and key liability factors were purchased power prices, operation and maintenance expenses and interest expenses. These factors were the key drivers of the technical and scenario analysis portion of the assessment.

9.1.3. Peer Group Analysis

A comprehensive review of the fixed vs. floating rate debt policies of Manitoba Hydro's peer group provided evidence of market timing and asset/liability management. This analysis demonstrated that Manitoba Hydro's fixed vs. floating rate debt policy was consistent with that of its peer group.

9.1.4. Technical Analysis

A historical analysis involving volatility and correlation analysis was conducted on the key asset and liability factors identified in Section 3. This analysis demonstrated that short-term export contracts and spot price transactions for excess power exhibited higher volatility and correlation with short-term interest rates compared to both the domestic utility and long-term export contract rates. Such a result suggests that the volatility in short-term contract and spot prices could be mitigated by introducing a floating rate debt portion to the total debt portfolio.

9.1.5. Scenario Analysis

Based on the historical volatility and correlation metrics calculated in the technical analysis, the scenario analysis generated 10,000 scenarios for each of the identified key factors and calculated the net income impact and volatility of a set of 100 fixed vs. floating rate debt portfolios. This analysis demonstrated that the minimum variance portfolio comprised 14% floating rate debt, while the fixed equivalent portfolio, a mix that yielded the same risk as a 100% fixed portfolio, comprised 27% floating rate debt. These results implied that Manitoba Hydro could lower its net income volatility while improving its returns by keeping floating rate debt mix between 14% and 27% of the total debt portfolio.

The analysis also takes into account Centra Gas' risk profile and its respective impact on net income volatility. Accordingly, the results of our analysis are applicable to Manitoba Hydro's consolidated financials, which include Centra Gas.

9.2. Solution Formulation

The scenario analysis demonstrated that Manitoba Hydro's current guidance range of 15% to 25% was inside the optimal risk reduction range of 14% and 27%. NBF recommends that Manitoba Hydro should maintain this guidance range given that this risk reduction approach appears appropriate in the context of its overall business risk. In particular, Manitoba Hydro is exposed to substantial levels of hydrology risk, supporting the view that net income volatility should be minimized through an asset/liability management framework.

Furthermore, NBF recommends that Manitoba Hydro adjust its floating proportion of total debt within this guidance range in order to take advantage of any market timing opportunities.

9.3. Impact Analysis

An impact analysis of the effect of an optimal risk reduction range on Manitoba Hydro's financials demonstrated that there was negligible financial impact as Manitoba Hydro's historical floating rate debt proportion had stayed within this optimal range.

9.4. Assumptions and Limitations

Given that Manitoba Hydro's debt is issued and guaranteed by the Province of Manitoba, Manitoba Hydro's cost of debt is dependent on the Province of Manitoba's credit rating. NBF's assessment is therefore premised on the maintenance of the current credit rating of the Province of Manitoba. In addition, in order to strictly adhere to the mandate of providing an independent assessment of Manitoba Hydro's fixed vs. floating rate debt mix, NBF's assessment has not included an evaluation of Manitoba Hydro's choice of debt maturities or the proportion of US Dollar denominated debt. It is important to note that these factors can impact the results of an optimal debt policy.

10. APPENDICES

Figure 14: MPT Efficient Frontier, 1999-2003

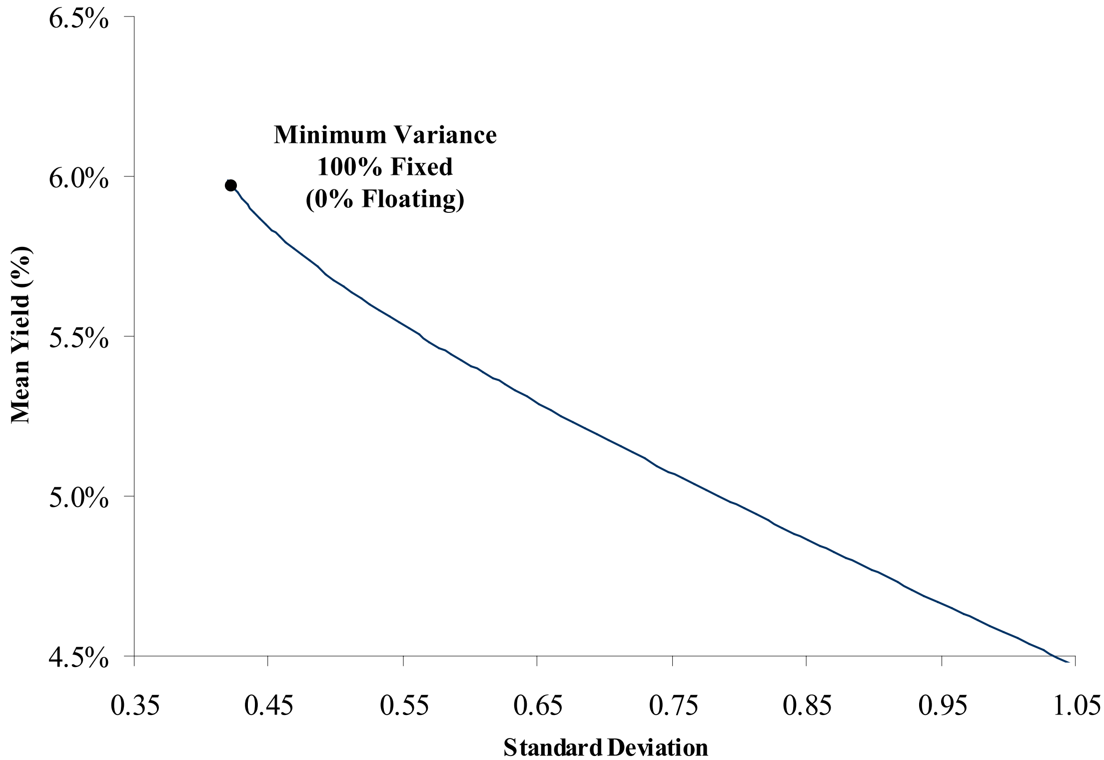


Figure 15: MPT Efficient Frontier, 2004-2009

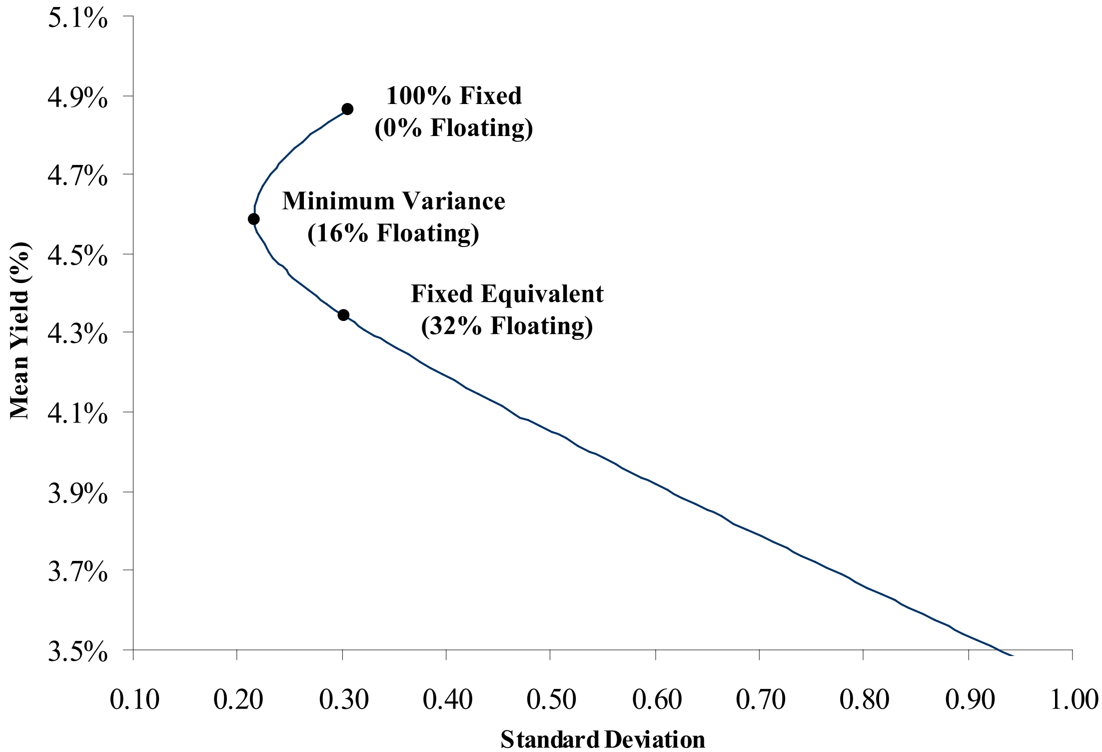


Table 15: Peer Group – Crown Utility Corporations[34]

	Manitoba Hydro	BC Hydro	SaskPower	Hydro Québec	NB Power	Nfld. & Labrador Hydro
Revenue	$2,250	$4,855	$1,469	$12,717	$1,712	$573
EBITDA	$1,215	$1,211	$589	$8,814	$645	$233
Net Income	$346	$369	$138	$3,141	$89	$82
% of Floating Rate Debt	19.4%	36.9%	0.0%	11.0%	7.9%	1.2%
Capital Expenditures	$827	$1,072	$280	$3,756	$409	$87
Exports as a % of Revenue	36.3%	39.4%	3.9%	15.1%	27.7%	9.4%
Return on Equity	12.2%	11.3%	9.3%	15.4%	9.5%	13.0%
Peak Demand (MW)	4,273	9,548	2,969	37,230	3,447	6,898
Generation Capacity (MW)	5,465	11,326	3,668	36,429	3,959	7,307

[34] Historical financial data as per company reports.

Table 16: Peer Group – Publicly Traded Corporations[35]

	Manitoba Hydro	Emera	Fortis	Canadian Utilities
Revenue	$2,250	$1,332	$3,903	$2,779
EBITDA	$1,215	$562	$1,048	$1,319
Net Income	$346	$145	$235	$580
% of Floating Rate Debt	19.4%	6.4%	11.9%	2.9%
Capital Expenditures	$827	$546	$890	$1,011
Exports as a % of Revenue	36.3%	15.4%	10.5%	13.8%
Return on Equity	12.2%	9.4%	8.7%	15.7%
Peak Demand (MW)	4,273	2,560	5,724	n/a
Generation Capacity (MW)	5,465	3,038	927	2,503

35 Historical financial data as per company reports.

Table 17: Peer Group – Historical Floating Rate Debt[36]

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Manitoba Hydro		15%	14%	14%	16%	17%	22%	19%	19%	19%
BC Hydro	38%	30%	19%	26%	38%	29%	29%	36%	38%	37%
SaskPower	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Hydro Québec	26%	26%	26%	24%	25%	26%	20%	8%	8%	11%
NB Power	3%	5%	3%	0%	10%	14%	11%	8%	0%	8%
Nfld. Hydro		20%	17%	13%	11%	11%	10%	4%	1%	n/a
Emera Inc.	20%	18%	27%	16%	7%	8%	5%	7%	2%	6%
Fortis Inc.	14%	4%	14%	14%	9%	9%	6%	13%	18%	12%
Canadian Utilities Limited	4%	7%	7%	2%	1%	1%	1%	2%	2%	3%

[36] Historical financial data as per company reports.