INTEREST RATE FORECAST RISK

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SUBMITTED ON BEHALF OF:

MANITOBA PUBLIC INSURANCE

August 2016

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1. INTRODUCTION

1.1 Qualifications

This evidence is prepared by Dr. Sean Cleary, CFA of Queen's University. I am currently the BMO Professor of Finance at the Smith School of Business at Queen's University. I earned my Ph.D. in Finance at the University of Toronto in 1998 and earned my CFA designation in 2001.

Most recently, I served as an expert witness for the Utilities Consumer Advocate (UCA) of Alberta in the generic cost of capital proceedings in 2015-16, preparing evidence and testifying regarding an appropriate ROE and capital structure for regulated Alberta utilities. During 2015-16, I also served as an expert witness for the Newfoundland Consumer Advocate, preparing evidence and testifying regarding capital structure issues for Newfoundland Power. Previously, I served as an expert witness on behalf of the Utilities Consumer Advocate (UCA) of Alberta in 2014, where I prepared evidence and testified regarding appropriate risk margins for commodity risk for regulated Alberta utilities, and again for the UCA of Alberta in the generic cost of capital proceedings in 2013-14, preparing evidence and testifying regarding an appropriate ROE and capital structure for regulated Alberta utilities.

In addition to this consulting work, my research has extensively involved examining corporate finance and cost of capital matters, since most of my research has dealt with empirical corporate finance and capital market issues, consisting of 28 publications. My work has been cited over 2,000 times. I have authored or co-authored 13 finance text books. I also previously worked as a commercial lender.

My CV is included in Attachment A to my report.

1.2 Purpose and Scope of Report

I have been asked by Manitoba Public Insurance (MPI) to prepare a report examining the issues with the use of standard interest rate forecasts of Canada 10-year bond yields, which is integral in pricing the "Basic" product, and to comment on the risks the current practice has posed to MPI. I have not been asked to comment on the specifics of how such forecasts are integrated into Basic pricing in this report, but rather to comment on the historical record of such interest rate forecasts, and the associated interest rate forecasting risk that has resulted for MPI.

1.3 Report Summary

My analysis demonstrates clearly that over the last eight years, the standard interest rate forecasts (SIRF) have exceeded actual 10-year Canada yields by a wide margin – 1.7% on average, representing a forecasting error percentage of -93% of the actual yields. In fact, the SIRFs were seldom "below" the actual 10-year rate over this period. This later point is of great cause for concern since it is one thing to use inaccurate forecasts, which is inevitable when trying to predict the future. However, the fact that the forecasts have been consistently *above* the actual yields in recent years has created real risks whenever such forecasts are relied upon.

As a preliminary step, I suggest at minimum that using the existing level of 10-year yields as predictors of future yields, which is commonly referred to as the naïve approach, be used as a bottom level in terms of estimating future 10-year yields to estimate Basic pricing. My analysis shows that naïve forecasts using existing 10-year Canada yields rather than survey forecasts would have improved forecasting accuracy significantly, reducing percentage forecast error by close to 60%. This result is consistent with the results of empirical studies which show that economists have fared no better on average than simple naïve forecasts of future interest rate levels.

2. A REVIEW OF HISTORICAL EVIDENCE

2.1 Standard Interest Rate Forecasts and Actual Yields

Table 1 includes historical evidence provided by MPI regarding 10-year Canada yield forecasts and the resulting actual 10-year Canada yields over the 2008-Q1/2016 period.[1] Table 2 provides the difference between the actual yields and the GRA forecasts. The results show that the forecasts have been well above actual 10-year Canada yields for most of this period. The bottom panel of this table shows that this has led to negative average "actual – forecast" values resulting from each of the GRAs since 2009, ranging from being off an average of -2.60% using the 2012 GRA forecasts, to a low of -0.36% using the 2016 GRA forecasts, and with an overall weighted average "actual – forecast" value of -1.72%.[2]

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[1] Data and calculations for Tables 1-6, as well as for the hybrid forecasting strategy described on page 16 can be found in Attachment B.

[2] The results were weighted according to the number of observations for resulting actual values available from each GRA – i.e., 20 for 2009-2012, 17 for 2013, 13 for 2014, 9 for 2015, and, 5 for 2016.

TABLE 1

GRA 10-YEAR CANADA YIELD FORECASTS AND ACTUAL YIELDS

(2008-Q1 - 2016)

Calendar Quarter		Historical Forecast 2009 GRA	2010 GRA	2011 GRA	2012 GRA	2013 GRA	2014 GRA	2015 GRA	2016 GRA	Actual
2008	Q1	3.68%								3.71%
	Q2	3.55%								3.53%
	Q3	3.78%								3.32%
	Q4	4.00%								3.13%
2009	Q1	4.12%	2.88%							3.39%
	Q2	4.22%	2.68%							3.38%
	Q3	4.30%	2.73%							3.22%
	Q4	4.45%	2.84%							3.39%
2010	Q1	5.30%	2.96%	3.58%						3.35%
	Q2	5.32%	3.05%	3.70%						2.76%
	Q3	5.35%	3.15%	3.83%						3.12%
	Q4	5.36%	3.29%	3.99%						3.30%
2011	Q1	5.37%	3.63%	4.07%	3.31%					3.07%
	Q2	5.35%	3.89%	4.11%	3.48%					2.49%
	Q3	5.35%	4.13%	4.25%	3.50%					2.15%
	Q4	5.38%	4.29%	4.45%	3.74%					1.99%
2012	Q1	5.52%	4.44%	4.54%	3.84%	2.01%				1.74%
	Q2	5.52%	4.67%	4.67%	3.94%	2.18%				1.77%
	Q3	5.52%	4.73%	4.71%	4.09%	2.33%				1.70%
	Q4	5.52%	4.73%	4.71%	4.20%	2.48%				1.84%
2013	Q1		4.73%	4.71%	4.77%	2.59%	1.87%			2.06%
	Q2		4.75%	4.71%	4.85%	2.69%	1.92%			2.62%
	Q3		4.93%	4.83%	4.85%	2.85%	2.08%			2.56%
	Q4		5.40%	5.22%	4.85%	2.95%	2.22%			2.43%
2014	Q1			5.59%	4.86%	2.98%	2.43%	2.62%		2.25%
	Q2			5.72%	4.87%	3.01%	2.62%	2.82%		2.00%
	Q3			5.72%	4.89%	3.05%	2.72%	2.99%		1.86%
	Q4			5.72%	5.12%	3.19%	2.83%	3.14%		1.30%
2015	Q1				5.61%	3.43%	2.83%	3.28%	1.47%	1.62%
	Q2				5.82%	3.55%	2.85%	3.42%	1.70%	1.62%
	Q3				5.82%	3.78%	3.15%	3.57%	1.87%	1.49%
	Q4				5.82%	4.01%	3.37%	3.71%	2.04%	1.57%
2016	Q1					4.28%	3.61%	3.70%	2.21%	1.19%

TABLE 2

ACTUAL – GRA YIELD FORECASTS

(2008-Q1 - 2016)

Calendar Quarter		**GCAN10YR** Actual	2009 GRA	2010 GRA	2011 GRA	**Actual - Forecast** 2012 GRA	2013 GRA	2014 GRA	2015 GRA	2016 GRA
2008	**Q1**	3.71%	0.03%							
	Q2	3.53%	-0.02%							
	Q3	3.32%	-0.45%							
	Q4	3.13%	-0.87%							
2009	**Q1**	3.39%	-0.74%	0.51%						
	Q2	3.38%	-0.84%	0.70%						
	Q3	3.22%	-1.08%	0.50%						
	Q4	3.39%	-1.06%	0.56%						
2010	**Q1**	3.35%	-1.95%	0.39%	-0.23%					
	Q2	2.76%	-2.56%	-0.29%	-0.94%					
	Q3	3.12%	-2.22%	-0.03%	-0.70%					
	Q4	3.30%	-2.06%	0.01%	-0.69%					
2011	**Q1**	3.07%	-2.29%	-0.56%	-1.00%	-0.23%				
	Q2	2.49%	-2.86%	-1.40%	-1.62%	-0.99%				
	Q3	2.15%	-3.20%	-1.98%	-2.10%	-1.34%				
	Q4	1.99%	-3.39%	-2.30%	-2.46%	-1.75%				
2012	**Q1**	1.74%	-3.78%	-2.70%	-2.80%	-2.10%	-0.27%			
	Q2	1.77%	-3.75%	-2.90%	-2.90%	-2.17%	-0.41%			
	Q3	1.70%	-3.82%	-3.03%	-3.01%	-2.39%	-0.63%			
	Q4	1.84%	-3.68%	-2.89%	-2.88%	-2.36%	-0.64%			
2013	**Q1**	2.06%		-2.66%	-2.65%	-2.71%	-0.52%	0.19%		
	Q2	2.62%		-2.14%	-2.10%	-2.23%	-0.07%	0.70%		
	Q3	2.56%		-2.38%	-2.27%	-2.29%	-0.29%	0.48%		
	Q4	2.43%		-2.98%	-2.80%	-2.42%	-0.53%	0.21%		
2014	**Q1**	2.25%			-3.34%	-2.61%	-0.73%	-0.18%	-0.37%	
	Q2	2.00%			-3.72%	-2.87%	-1.02%	-0.63%	-0.82%	
	Q3	1.86%			-3.86%	-3.03%	-1.19%	-0.86%	-1.13%	
	Q4	1.30%			-4.42%	-3.82%	-1.89%	-1.53%	-1.84%	
2015	**Q1**	1.62%				-3.98%	-1.81%	-1.21%	-1.66%	0.16%
	Q2	1.62%				-4.19%	-1.93%	-1.23%	-1.80%	-0.07%
	Q3	1.49%				-4.33%	-2.29%	-1.66%	-2.08%	-0.38%
	Q4	1.57%				-4.25%	-2.44%	-1.80%	-2.14%	-0.47%
2016	**Q1**	1.19%					-3.09%	-2.42%	-2.51%	-1.02%

	Actual-Forecast 2009 GRA	2010 GRA	2011 GRA	2012 GRA	2013 GRA	2014 GRA	2015 GRA	2016 GRA	WT Av
Average	-2.14%	-1.28%	-2.32%	-2.60%	-1.16%	-0.76%	-1.60%	-0.36%	**-1.72%**
Median	-2.22%	-1.69%	-2.56%	-2.41%	-0.73%	-0.86%	-1.80%	-0.38%	
Max	-0.02%	0.70%	-0.23%	-0.23%	-0.07%	0.70%	-0.37%	0.16%	
Min	-3.82%	-3.03%	-4.42%	-4.33%	-3.09%	-2.42%	-2.51%	-1.02%	
StdDev	1.27%	1.45%	1.16%	1.11%	0.90%	0.98%	0.69%	0.45%	

1Using interest rate forecasts that are too high by an average of 1.72% in absolute interest rate terms represents a significant issue from any perspective, especially when such estimates are used for product pricing purposes. However, the 1.72% difference from actual estimates represents even worse forecasting ability if we scale the error terms by the actual realized yields to obtain an idea of what percentage these estimates were off the mark. Table 3 below presents the results obtained when I express the forecast error (i.e., "actual – forecast") as a percentage of the actual rates, which is one standard way of measuring forecasting ability.[3] Table 3 shows that the average percentage forecast error resulting from the GRA forecasts ranged from -27.2% for the 2016 GRA to -144.9% for the 2012 GRA, with an overall weighted average of -92.9%. In other words, the resulting GRA forecast averages were almost double (i.e., which would correspond to a -100% percentage forecast error) the actual yields that prevailed over the period! Clearly, these forecasts were not very informative at all. In fact, it would have been much better to use the prevailing rates at the times of the GRAs and assumed no change, as I will show later.[4]

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[3] In fact, the norm would be to scale the "absolute value" of "actual – forecast" in order to weight errors above and below the actual values equally. Since my focus is on forecasts that are too high, I have chosen to simply use the actual error terms. This means that my average percentage forecast error figures actually *under estimate* the amount of actual error percentages, since I allow positive errors to be averaged with negative errors.

[4] As mentioned in Section 1.3, this forecasting approach is often referred to as the "naïve" forecasting approach (as I will call it from now on) – i.e., assume no change in yields from the existing.

TABLE 3

GRA PERCENTAGE FORECAST ERRORS

(2008-Q1 – 2016)

Forecast Error = Error/Actual (%)

Calendar Quarter		2009 GRA	2010 GRA	2011 GRA	2012 GRA	2013 GRA	2014 GRA	2015 GRA	2016 GRA
2008	Q1	0.88%							
	Q2	-0.45%							
	Q3	-13.57%							
	Q4	-27.75%							
2009	Q1	-21.71%	15.07%						
	Q2	-24.89%	20.74%						
	Q3	-33.42%	15.45%						
	Q4	-31.23%	16.40%						
2010	Q1	-58.22%	11.71%	-6.81%					
	Q2	-92.96%	-10.59%	-34.16%					
	Q3	-71.25%	-0.90%	-22.52%					
	Q4	-62.37%	0.41%	-20.91%					
2011	Q1	-74.65%	-18.08%	-32.38%	-7.51%				
	Q2	-114.84%	-56.27%	-64.95%	-39.56%				
	Q3	-148.82%	-92.16%	-97.58%	-62.48%				
	Q4	-170.79%	-115.97%	-123.96%	-87.97%				
2012	Q1	-217.27%	-155.30%	-160.77%	-120.68%	-15.52%			
	Q2	-211.89%	-163.76%	-163.93%	-122.59%	-22.88%			
	Q3	-224.73%	-178.01%	-177.32%	-140.58%	-37.06%			
	Q4	-200.51%	-157.26%	-156.64%	-128.63%	-34.73%			
2013	Q1		-128.95%	-128.41%	-131.07%	-25.24%	9.40%		
	Q2		-81.64%	-80.23%	-85.42%	-2.64%	26.61%		
	Q3		-93.02%	-88.84%	-89.72%	-11.50%	18.82%		
	Q4		-122.73%	-115.39%	-99.96%	-21.65%	8.45%		
2014	Q1			-148.90%	-116.34%	-32.68%	-7.97%	-16.53%	
	Q2			-186.55%	-144.06%	-50.88%	-31.33%	-41.12%	
	Q3			-207.86%	-163.13%	-64.16%	-46.39%	-61.05%	
	Q4			-340.00%	-294.10%	-145.38%	-117.31%	-141.35%	
2015	Q1				-245.37%	-111.21%	-74.26%	-101.99%	9.59%
	Q2				-258.09%	-118.60%	-75.49%	-110.84%	-4.37%
	Q3				-290.68%	-153.69%	-111.41%	-139.72%	-25.17%
	Q4				-270.77%	-155.41%	-114.65%	-136.48%	-30.15%
2016	Q1				-259.66%	-203.36%	-211.23%	-85.99%	

Error/Actual (%)

2009 GRA	2010 GRA	2011 GRA	2012 GRA	2013 GRA	2014 GRA	2015 GRA	2016 GRA	WT Av
-94.81%	-64.74%	-117.90%	-144.94%	-74.29%	-55.30%	-106.70%	-27.22%	**-92.95%**
-71.25%	-68.96%	-119.67%	-125.61%	-37.06%	-46.39%	-110.84%	-25.17%	
-0.45%	20.74%	-6.81%	-7.51%	-2.64%	26.61%	-16.53%	9.59%	
-224.73%	-178.01%	-340.00%	-294.10%	-259.66%	-203.36%	-211.23%	-85.99%	
77.19%	71.59%	80.42%	83.85%	71.29%	68.65%	59.85%	36.55%	

2.2 Is this Poor Forecasting Due to the Specific Standard Interest Rate Forecast Methodology?

There are several other options available to obtain interest rate forecast data, several of which have been correctly deemed as inappropriate. One alternative would be to use the Consensus Economics Inc. forecasts, which are provided quarterly. While Consensus provides a summary of forecasts from a broader number of sources that includes the big five bank forecasts plus several other sources such as the Conference Board of Canada, University of Toronto, J.P. Morgan, etc. (e.g., 17 were included in their May 2016 forecast), they are not as "timely" as the bank forecasts since they tend to wait until most of their sources have released their forecasts. In addition, they only provide forecasts for the following two years, and do not break the forecasts into quarterly forecasts. Also, the Consensus forecasts are heavily influenced by the Bank forecasts, and tend to be close to them, so it does not seem like an alternative that would add much, if any value.

In fact, most interest rate forecasts have been far too high over the past 8 years or so. For example, I noted this in my evidence provided for the Alberta Utilities Commission (AUC) in 2013 (Figure 2 on page 6 of that document) reproduced as Figure 1 below, and again in my 2016 evidence (Figure 2 on page 8 of that document) reproduced as Figure 2 below. It is worthy of note that all of the experts' forecasts depicted in these two figures were based on the use of 10-year Canada yield Consensus forecasts and adding a spread to obtain the forecast long-term Canada yield.[5] While the purpose of using bond yield forecasts was very different in these hearings, the disappointing results are all too familiar.

Figures 1 and 2 below show clearly that all experts were well above the actual prevailing long-term yields. Since these long-term forecasts were based on 10-year yield Consensus forecasts available at the time, it is clear that using other sources of interest rate forecasts is unlikely to solve interest rate forecasting issues, such as those that have been faced by MPI.

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[5] The long-term average spread between Canada 10- and 30-year yields is about 0.50%; although the spreads added by the various experts varied between 0.50% and 1%.

1 **FIGURE 1[6]**

2 **CANADIAN BOND YIELDS (2011-2013)**

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4 Data Source: Bank of Canada website at http://www.bankofcanada.ca.

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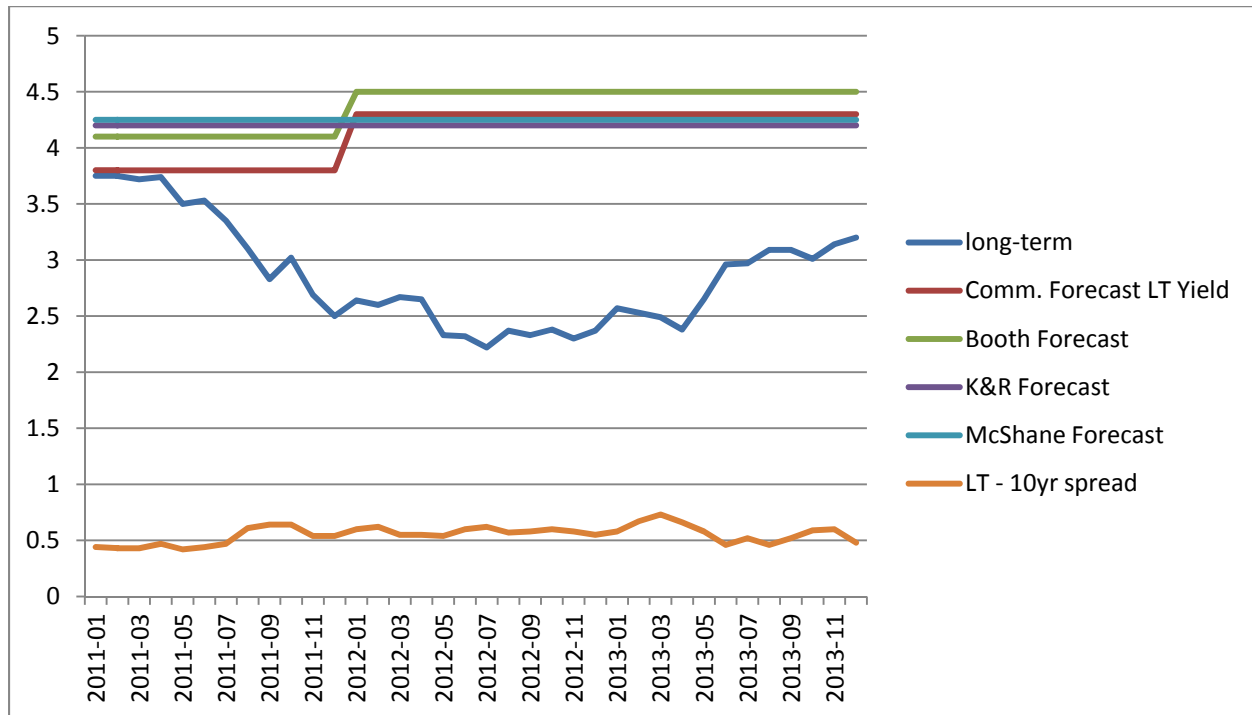
[6] Figure 2 (page 6) of Cleary 2013 evidence before the AUC.

FIGURE 2[7]

LONG-TERM CANADA BOND YIELDS VERSUS FORECASTS (2014-2015)

Data Source: Bank of Canada website at http://www.bankofcanada.ca.
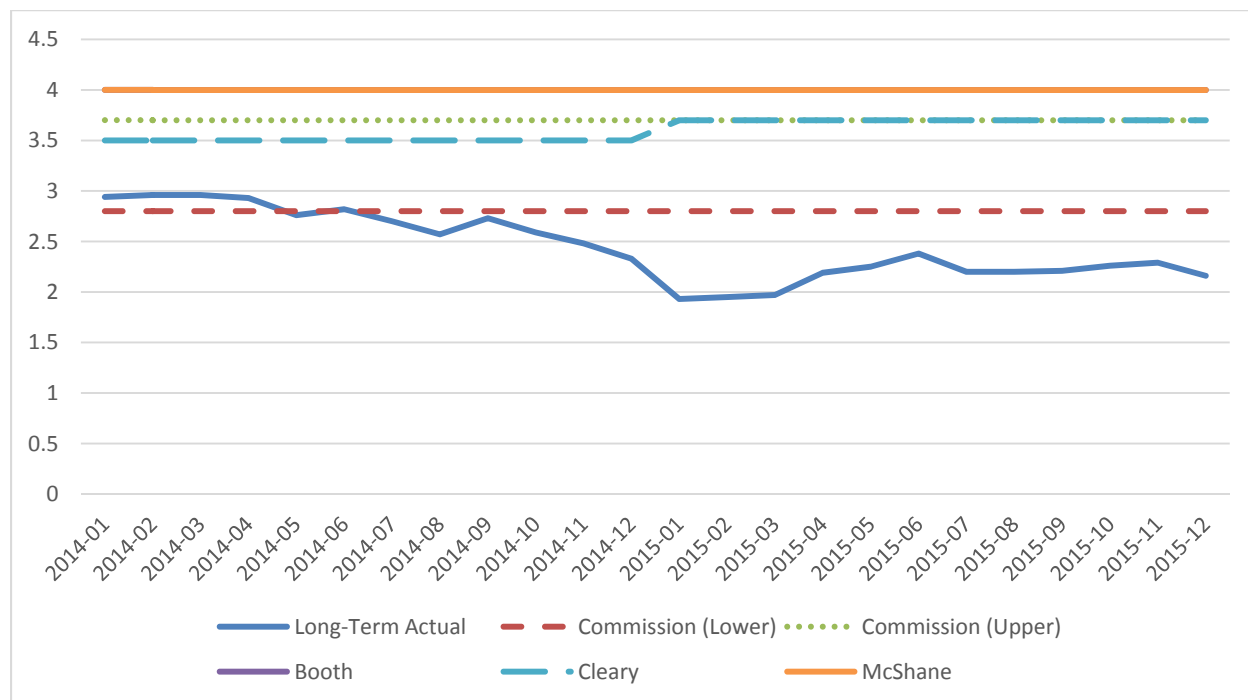
It is interesting to note from Figure 2 above that the AUC (Commission) decided in its 2013 Decision to use the existing level of interest rates as a "lower bound" in order to reflect forecasters' recent tendency to over-estimate future bond yields (i.e., based on the underlying premise that "they are so low, they *have* to go up").[8] The Commission provided the rationale for this choice on pages 15-19 of their Generic Cost of Capital Decision (2191-D01-2015 Generic Cost of Capital.pdf). I have quoted paragraphs 86 (pages 15-16) and 93 (page 19) below (with bold and italics added for emphasis):

> "86. In past GCOC decisions, the Commission considered it reasonable to rely on the Consensus Economics *Consensus Forecasts* of long-term government of Canada bond yields to estimate the risk-free rate. However, the Commission is mindful that, as the CCA pointed out, caution needs to be exercised when using the *Consensus Forecasts* outlook, because this ***forecast appears to have mostly overestimated the yields on long-term government bonds in the 2010 to 2014 period***. For example, as observed in response to Commission's IRs, the *Consensus Forecast*-based risk-free rate estimates of 3.8 per cent to 4.3 per cent accepted in

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[7] Figure 2 (page 8) of Cleary 2016 evidence before the AUC.

[8] I will discuss this issue in Section 2.5.

the 2011 GCOC proceeding proved to be much higher than actual rates experienced during that time period. The Commission also observes that, in the time period preceding the close of the evidentiary record for this proceeding on August 1, 2014, long-term government of Canada benchmark bond yields have continued to decline."

"93. Based on the foregoing, the Commission considers the actual long-term rate of 2.8 per cent in 2013 to be a reasonable lower bound estimate for the risk-free rate in its current analysis. Likewise, the latest *Consensus Forecasts* of 3.7 per cent for 2015 (as of April 2014) represents a reasonable upper bound of the risk-free rate. The Commission further notes that, ***in all likelihood, the adopted upper bound estimate may be optimistic, given that, based on recent history, the return to the long-term interest rate levels may not occur as quickly as the Consensus Forecasts predicted in April 2014***."

The approach used by the AUC was influenced by my statements regarding the importance of existing rates, as can be seen in the following passage the AUC quoted from my testimony in paragraph 83 (page 17) of the 2013 Decision:

"83. During the hearing, Dr. Cleary addressed this point as follows:
… I do acknowledge that monetary policy has played a role in this, particularly in the US. But again, I think coming from the point of investor, and if you look at the models and you look at the DCF models or the bond yield plus risk premium, or you don't even look at the models, and you think of how an investor thinks, they think about what I can earn on a bond today. The fact that it should be 4 percent isn't -- it's nice to know but it is 3 percent."

Aside from being on record in the 2013 Hearings of supporting the idea that existing rates are as, or more, important than forecast rates, I adopted the AUC approach in preparing my 2016 evidence for the AUC, using existing yields as my lower limit, and using Consensus 10-year forecasts plus 0.50% as my upper limit for 30-year Canada yields. I did so because this made intuitive sense to me, it would have reduced forecasting error, and I felt it would lead to better yield estimates.

2.3 Is this Poor Forecasting Specific to Canadian Interest Rates Since 2008?

Clearly the post-crisis period has provided many challenges to economic forecasters in Canada and elsewhere, as we have seen the introduction of quantitative easing by monetary authorities, troubles arising with the European banks, etc. So it makes sense to examine the issue of whether poor forecasts such as those in Canada in recent years are simply an "anomaly" that will eventually dissipate. A brief

review of the existing academic literature on the issue of interest rate forecasting suggests however that inaccurate interest rate forecasts are nothing new.

For example, a 2008 study by Spiwoks, Bedke and Hein evaluated 10-year US government bond yield and three-month US Treasury bill rate forecasts over the period October 1989 to December 2004.[9] They found that "not one of the forecast series proved to be unbiased," and further concluded that "the information content of most of the forecast time series is lower than that of naïve forecasts." These findings are consistent with those of Mitchell and Pearce (2005), who examined economists' six-month ahead forecasts over the 1982-2002 period.[10] They concluded that "the forecast accuracy of most of the economists is indistinguishable from that of the random walk model when forecasting the Treasury bill rate but that the forecast accuracy is significantly worse for many of the forecasters for predictions of the Treasury bond rate and the exchange rate."

Finally, anecdotal evidence provided in a 2010 "MoneyWatch" article supports the notion that economic forecasters do not add value when trying to forecast 10-year yields.[11] The article states:

> "A year ago, *The Wall Street Journal* asked 50 economic forecasters for their prediction of where the yield on the 10-year Treasury note would be in one year. Forty-three expected the 10-year U.S. Treasury note yield to move higher over the year ahead, with an average estimate of 4.13 percent. Seven expected a rate of 5 percent or higher, while only two predicted rates to fall below 3 percent. The result? The 10-year Treasury yield slumped to 2.95 percent on June 30, 2010."

The article went on to suggest that: "While the forecasts clearly turned out to be wrong, it doesn't mean the experts were incompetent. The point is that even the most talented analysts are unlikely to make reliable predictions." In other words, forecasting the future is difficult, for interest rates, as with most things.

2.4 Would the Use of Naïve Interest Rate Forecasts Improve Forecasting Performance?

Figure 2 above shows that while all of the interest rate forecasts from the 2013 AUC hearings ended up well above actual rates that prevailed, the "closest" forecast by far was the AUC's lower bound, which

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[9] Source: "Forecasting the past: the case of US interest rate forecasts," M. Spiwoks, N. Bedke, and O. Hein, Financial Markets and Portfolio Management, 2008, Volume 22, pages 37-379, (http://link.springer.com/article/10.1007/s11408-008-0087-5).

[10] Source: "Professional Forecasts of Interest Rates and Exchange Rates: Evidence from the Wall Street Journal's Panel of Economists," K. Mitchell and D. Pearce, 2005, Working Paper, North Carolina State University, (http://www4.ncsu.edu/unity/users/d/dkpearce/www/wsjpaper.pdf).

[11] Source: http://www.cbsnews.com/news/the-value-of-interest-rate-forecasts/, "The Value of Interest Rate Forecasts," L. Swedroe, MoneyWatch, July 19, 2010.

was simply the prevailing rates at the time of the 2013 hearings, or the so-called "naïve" interest rate forecast. The empirical studies cited above which are based on comprehensive samples and analysis, suggest that this should come as no surprise to us, since economic forecasters did worse than naïve forecasts on average, with few actually "beating" such forecasts. All of this suggests that it is worthwhile to examine how well such naïve forecasts would have performed over the 2008-Q1/2016 period with respect to Canada 10-year bond yields.

Table 4 replicates the results presented in Table 1, but replaces the "GRA Forecasts" for the following years with "Naïve" forecasts, based on the 10-year Canada yields prevailing in the quarter prior to the respective GRA.[12] Table 5 replicates the "actual – forecast" results presented in Table 2 which used the GRA forecasts, but now using the naïve forecasts provided in Table 4. The forecast errors are much smaller than those provided in Table 2 (which used the GRA forecasts), ranging from -1.30% for the 2009 forecasts to +0.20% using the 2016 forecasts. The overall weighted average forecast error using naïve forecasts was -0.73% - 57.6% smaller than the weighted average forecast error of -1.72% obtained when using the GRA forecasts. So clearly, simply using the naïve forecasting method would have improved the forecasting results significantly.

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[12] For example, the new "naïve forecast" in the column labelled "2009 NV" of 4.07% is the actual 10-year yield in November of 2007, while the new "naïve forecast" in the column labelled "2010 NV" of 3.13% is the actual 10-year yield in November 2008, etc.

TABLE 4

NAÏVE 10-YEAR CANADA YIELD FORECASTS AND ACTUAL YIELDS

(2008-Q1 - 2016)

Calendar Quarter		2009 NV	2010 NV	2011 NV	Naïve Annual Forecast 2012 NV	2013 NV	2014 NV	2015 NV	2016 NV	GCAN10YR Actual
2008	Q1	4.07%								3.71%
	Q2	4.07%								3.53%
	Q3	4.07%								3.32%
	Q4	4.07%								3.13%
2009	Q1	4.07%	3.13%							3.39%
	Q2	4.07%	3.13%							3.38%
	Q3	4.07%	3.13%							3.22%
	Q4	4.07%	3.13%							3.39%
2010	Q1	4.07%	3.13%	3.39%						3.35%
	Q2	4.07%	3.13%	3.39%						2.76%
	Q3	4.07%	3.13%	3.39%						3.12%
	Q4	4.07%	3.13%	3.39%						3.30%
2011	Q1	4.07%	3.13%	3.39%	3.30%					3.07%
	Q2	4.07%	3.13%	3.39%	3.30%					2.49%
	Q3	4.07%	3.13%	3.39%	3.30%					2.15%
	Q4	4.07%	3.13%	3.39%	3.30%					1.99%
2012	Q1	4.07%	3.13%	3.39%	3.30%	1.99%				1.74%
	Q2	4.07%	3.13%	3.39%	3.30%	1.99%				1.77%
	Q3	4.07%	3.13%	3.39%	3.30%	1.99%				1.70%
	Q4	4.07%	3.13%	3.39%	3.30%	1.99%				1.84%
2013	Q1		3.13%	3.39%	3.30%	1.99%	1.84%			2.06%
	Q2		3.13%	3.39%	3.30%	1.99%	1.84%			2.62%
	Q3		3.13%	3.39%	3.30%	1.99%	1.84%			2.56%
	Q4		3.13%	3.39%	3.30%	1.99%	1.84%			2.43%
2014	Q1			3.39%	3.30%	1.99%	1.84%	2.43%		2.25%
	Q2			3.39%	3.30%	1.99%	1.84%	2.43%		2.00%
	Q3			3.39%	3.30%	1.99%	1.84%	2.43%		1.86%
	Q4			3.39%	3.30%	1.99%	1.84%	2.43%		1.30%
2015	Q1				3.30%	1.99%	1.84%	2.43%	1.30%	1.62%
	Q2				3.30%	1.99%	1.84%	2.43%	1.30%	1.62%
	Q3				3.30%	1.99%	1.84%	2.43%	1.30%	1.49%
	Q4				3.30%	1.99%	1.84%	2.43%	1.30%	1.57%
2016	Q1					1.99%	1.84%	2.43%	1.30%	1.19%

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TABLE 5

ACTUAL – NAÏVE YIELD FORECASTS

(2008-Q1 - 2016)

Calendar Quarter		Naïve Actual	Actual - Forecast 2009 NV	2010 NV	2011 NV	2012 NV	2013 NV	2014 NV	2015 NV	2016 NV
2008	Q1	3.71%	-0.36%							
	Q2	3.53%	-0.54%							
	Q3	3.32%	-0.75%							
	Q4	3.13%	-0.94%							
2009	Q1	3.39%	-0.69%	0.25%						
	Q2	3.38%	-0.70%	0.24%						
	Q3	3.22%	-0.85%	0.09%						
	Q4	3.39%	-0.68%	0.26%						
2010	Q1	3.35%	-0.72%	0.22%	-0.04%					
	Q2	2.76%	-1.31%	-0.37%	-0.63%					
	Q3	3.12%	-0.95%	-0.01%	-0.27%					
	Q4	3.30%	-0.77%	0.17%	-0.09%					
2011	Q1	3.07%	-1.00%	-0.06%	-0.32%	-0.23%				
	Q2	2.49%	-1.58%	-0.64%	-0.90%	-0.81%				
	Q3	2.15%	-1.92%	-0.98%	-1.24%	-1.15%				
	Q4	1.99%	-2.08%	-1.14%	-1.40%	-1.31%				
2012	Q1	1.74%	-2.33%	-1.39%	-1.65%	-1.56%	-0.25%			
	Q2	1.77%	-2.30%	-1.36%	-1.62%	-1.53%	-0.22%			
	Q3	1.70%	-2.37%	-1.43%	-1.69%	-1.60%	-0.29%			
	Q4	1.84%	-2.23%	-1.29%	-1.55%	-1.46%	-0.15%			
2013	Q1	2.06%		-1.07%	-1.33%	-1.24%	0.08%	0.23%		
	Q2	2.62%		-0.52%	-0.78%	-0.68%	0.63%	0.78%		
	Q3	2.56%		-0.58%	-0.84%	-0.74%	0.57%	0.72%		
	Q4	2.43%		-0.71%	-0.97%	-0.87%	0.44%	0.59%		
2014	Q1	2.25%			-1.15%	-1.05%	0.26%	0.41%	-0.18%	
	Q2	2.00%			-1.40%	-1.30%	0.01%	0.16%	-0.43%	
	Q3	1.86%			-1.53%	-1.44%	-0.13%	0.02%	-0.57%	
	Q4	1.30%			-2.09%	-2.00%	-0.69%	-0.54%	-1.13%	
2015	Q1	1.62%				-1.68%	-0.36%	-0.21%	-0.80%	0.32%
	Q2	1.62%				-1.68%	-0.36%	-0.21%	-0.80%	0.32%
	Q3	1.49%				-1.81%	-0.50%	-0.35%	-0.94%	0.19%
	Q4	1.57%				-1.73%	-0.42%	-0.27%	-0.86%	0.27%
2016	Q1	1.19%				-0.80%	-0.65%	-1.24%	-0.11%	

	2009 GRA	2010 GRA	2011 GRA	2012 GRA	2013 GRA	2014 GRA	2015 GRA	2016 GRA	WT Av
Average	-1.30%	-0.52%	-1.07%	-1.29%	-0.13%	0.05%	-0.77%	0.20%	-0.73%
Median	-0.95%	-0.55%	-1.19%	-1.38%	-0.22%	0.02%	-0.80%	0.27%	
Max	-0.54%	0.26%	-0.04%	-0.23%	0.63%	0.78%	-0.18%	0.32%	
Min	-2.37%	-1.43%	-2.09%	-2.00%	-0.80%	-0.65%	-1.24%	-0.11%	
StdDev	0.68%	0.63%	0.58%	0.45%	0.41%	0.47%	0.33%	0.18%	

Similar to the results presented in Table 3 for the GRA forecasts, Table 6 below presents the percentage forecast errors obtained when using the naïve approach. These results confirm the superior forecasts generated by simply using the existing 10-year rates to forecast future 10-year yields. The average percentage forecast errors ranged from -72.1% for 2012 forecasts to +12.1% for the 2016 forecasts. The overall weighted average percentage forecast error using the naïve method was -39.5%, 57.6% less than the 93% figure obtained using the GRA forecasts – a dramatic improvement.

TABLE 6

NAÏVE PERCENTAGE FORECAST ERRORS

(2008-Q1 - 2016)

Calendar Quarter		Naïve	Forecast Error = Error/Actual (%)						
		2009 NV	2010 NV	2011 NV	2012 NV	2013 NV	2014 NV	2015 NV	2016 NV
2008	Q1	-9.67%							
	Q2	-15.17%							
	Q3	-22.44%							
	Q4	-29.99%							
2009	Q1	-20.24%	7.50%						
	Q2	-20.59%	7.23%						
	Q3	-26.28%	2.85%						
	Q4	-20.02%	7.67%						
2010	Q1	-21.60%	6.45%	-1.31%					
	Q2	-47.57%	-13.52%	-22.95%					
	Q3	-30.37%	-0.29%	-8.62%					
	Q4	-23.37%	5.09%	-2.79%					
2011	Q1	-32.40%	-1.85%	-10.31%	-7.32%				
	Q2	-63.45%	-25.74%	-36.18%	-32.49%				
	Q3	-89.21%	-45.56%	-57.65%	-53.37%				
	Q4	-104.83%	-57.57%	-70.66%	-66.03%				
2012	Q1	-133.91%	-79.94%	-94.89%	-89.60%	-14.20%			
	Q2	-129.94%	-76.89%	-91.58%	-86.38%	-12.26%			
	Q3	-139.41%	-84.18%	-99.47%	-94.06%	-16.88%			
	Q4	-121.56%	-70.44%	-84.59%	-79.59%	-8.17%			
2013	Q1		-51.70%	-64.29%	-59.84%	3.73%	11.00%		
	Q2		-19.69%	-29.63%	-26.11%	24.04%	29.78%		
	Q3		-22.50%	-32.67%	-29.07%	22.26%	28.13%		
	Q4		-29.11%	-39.84%	-36.04%	18.06%	24.25%		
2014	Q1			-50.98%	-46.88%	11.53%	18.21%	-7.97%	
	Q2			-69.97%	-65.36%	0.40%	7.92%	-21.55%	
	Q3			-82.51%	-77.56%	-6.94%	1.13%	-30.52%	
	Q4			-160.85%	-153.77%	-52.85%	-41.31%	-86.54%	
2015	Q1				-103.14%	-22.35%	-13.12%	-49.32%	19.95%
	Q2				-103.14%	-22.35%	-13.12%	-49.32%	19.95%
	Q3				-121.41%	-33.36%	-23.29%	-62.75%	12.75%
	Q4				-110.13%	-26.56%	-17.01%	-54.46%	17.20%
2016	Q1					-66.97%	-54.37%	-103.78%	-9.24%

	Error/Actual (%)							
2009 GRA	2010 GRA	2011 GRA	2012 GRA	2013 GRA	2014 GRA	2015 GRA	2016 GRA	WT Av
-57.49%	-27.11%	-55.59%	-72.06%	-11.93%	-3.21%	-51.80%	12.12%	**-39.48%**
-30.37%	-21.09%	-54.31%	-71.79%	-12.26%	1.13%	-49.32%	17.20%	
-15.17%	7.67%	-1.31%	-7.32%	24.04%	29.78%	-7.97%	19.95%	
-139.41%	-84.18%	-160.85%	-153.77%	-66.97%	-54.37%	-103.78%	-9.24%	
45.95%	32.89%	40.28%	36.85%	24.97%	26.59%	30.28%	12.30%	

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I also repeated a similar analysis for the use of a blended approach for forecasting interest rates, using 50% of the current yields (i.e., naïve forecast) and 50% of the GRA forecast yields. These results have not been reported here but are provided in Attachment B. They show, as one would expect, that this approach would have produced forecasting accuracy somewhere "between" that of using the GRA forecasts, and using the naïve approach. In particular, the weighted average forecast error would have been -1.22%, and the weighted average percentage forecasting error would have been -66.2%.

2.5 Why Should We Not Expect Canada Yields to Increase Rapidly in the Coming Months (Years)?

As discussed previously, since 2008 there has been a general tendency for interest rate forecasts to be consistently above actual rates that materialize. This has been the result of general then prevailing beliefs that interest rates had hit rock bottom, pretty much every year since 2008. Several factors have led to a decline in interest rates over this period, rather than the previously projected increases. These include but are not limited to: the Euro banking crisis and continuing struggles in the Eurozone; slower than anticipated recovery of the U.S. economy; ongoing struggles for the Japanese economy; and, various global events. As a result of these and other events, while the U.S. Federal Reserve ceased their bond buying program, they have not yet begun to "unwind" their significant bond holdings of over 3.5 trillion USD. Neither has the U.K., which holds approximately 0.5 trillion USD. In addition, Japan began purchasing approximately 660 billion USD in bonds per year in 2014, while the European Central Bank (ECB) also initiated quantitative easing at a rate of 60 billion Euros per month in January of 2015, which they increased to approximately 80 billion Euros in March 2016. The result of these policies is that somewhere in the area of $6 trillion USD in bonds held by monetary authorities at the present time. Obviously, this has kept bond yields very low, and in fact we are all aware of the massive amount of government debt presently trading at negative yields.

Given this severe overhang, it seems unlikely that interest rates on AAA-rated Canada 10-year bonds are likely to rise rapidly from the existing level of about 1%. Forecasts predicting rapid increases in 10-year yields to historical levels above 3% and even 4% are surely overly optimistic, since much has to happen before we will see such upward pressures on 10-year yields. This is unlikely to happen over the next year or two, and I would say is also very unlikely to happen over the next three years; although I would acknowledge that yields will eventually start to increase gradually.

The next issue with respect to 10-year yield forecasts is the actual level to which they will return when they do begin to increase. The Bank of Canada's 2% inflation target was introduced in 1991. After a period of transition, 30-year Canada bond yields fell below 6% in 1998. In fact, 30-year yields averaged 4.1% over the 1998-2015 period, averaging 2.35% above inflation, and have never exceeded 5% since 2004. Given the long-term average spread between 10- and 30-year Canada yields of 0.50%, it is reasonable to expect that providing an average yield over inflation of 1.85% would be a reasonable long-term target for 10-year yields. Combining this with the Bank's 2% inflation target suggests that 10-year Canada yields in the 3.85% range would be considered "normal." This implies two things when we consider current 10-year interest rate forecasts. First, forecasts for 10-year yields above 5%, and even above 4%, should be viewed with extreme caution. We can see numerous examples of such forecasts included in the 2009 through 2014 GRA forecasts that were provided in Table 1. Secondly, we are a long way from "normal" today, as discussed in the previous two paragraphs. Therefore, the idea that yields could rise so dramatically from their current level of 1% in such a short period of time, even if things become more normalized over the coming months, should be highly scrutinized to say the least.

In short, while I am not providing any interest rate forecasts of my own, there are numerous reasons to believe that Canada yields, if they increase at all, will do so at a very gradual pace over the coming months and over the next 1-3 years. Therefore, making use of existing yields in the interest rate forecasting process makes a lot of sense in today's environment. And in fact, empirical evidence suggests that this will generally be the case, even under more normalized market conditions.

This concludes my report. Please refer to Section 1.3 for my summary.

APPENDIX A

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Areas of Interest

Research: Empirical studies in corporate finance and investments.
Teaching: Investments, Business Finance and Corporate Finance. I have also taught numerous courses
    and delivered seminars in many preparatory programs designed to prepare students to write exams
    for all three levels of the CFA program and the CSC for over 10 years.

Education

University of Toronto	Ph.D., Finance, 1993 - January, 1998
Saint Mary's University	M.B.A., Finance, 1987-1989
Saint Francis Xavier University	B.Ed., Secondary, 1983-84
Acadia University	B.A., Economics, 1979-1983

Career Experience

Queen's University	BMO Professor of Finance Director of Master of Finance (July 2008 – June 2014)
Saint Mary's University	Associate Dean and Pengrowth Nova Scotia Professor in Petroleum Financial Management: (July 2007 – June 2008) Professor: (September 2006 – June 2007) Associate Professor: Finance (September 2000 - June 2001, July 2002 – August 2006) Assistant Professor: Finance (July 1998 - August 2000) Lecturer: Finance and Statistics, (1990-1993, Full Time)
York University	Assistant Professor: Finance (July 2001 – June 2002)
The University of Lethbridge	Assistant Professor: Finance (1997- 1998, Full Time)
The University of Toronto	Lecturer: Business Finance (1994-1997, Part Time)
Ryerson University	Lecturer: Investment Finance (1994-1997, Full Time)
WSC Investment Services	Instructor for CSC and CFA Seminars and Prepare Course Materials and Deliver Seminars for various professional organizations; (1996-present, Part Time)
Royal Bank of Canada	Commercial Lender; (1989-1990, Full Time)

Expert Witness Experience:

September 2015-July 2016 – Utilities Consumer Advocate (UCA) of Alberta
Prepared and testified regarding an appropriate ROE and capital structure for regulated Alberta utilities.

December 2015-June 2016 – Newfoundland Consumer Advocate
Prepared and testified regarding an appropriate capital structure for Newfoundland Power.

April-November 2014 – Utilities Consumer Advocate (UCA) of Alberta
Prepared and testified regarding appropriate risk margins for commodity risk for regulated Alberta utilities.

December 2013-August 2014 – Utilities Consumer Advocate (UCA) of Alberta
Prepared and testified regarding an appropriate ROE and capital structure for regulated Alberta utilities.

Publications:

Academic Journals:

"An Efficient and Functional Model for Predicting Bank Distress: In and Out of Sample Evidence," 2016. Co-authored with Greg Hebb, Dalhousie University. Journal of Banking and Finance, Vol. 64, March 2016, 101–111.

"Managerial Practices and Corporate Social Responsibility," 2015. Co-authored with Najah Attig, Saint Mary's University. Journal of Business Ethics, Vol. 131 (No. 1), 121-136.

"Organization Capital and Investment Cash Flow Sensitivity: The Effect of Management Quality Practices," 2014. Co-authored with Najah Attig, Saint Mary's University. Lead Article - Financial Management, Vol. 43 (No. 3), 473-504.

"Corporate Legitimacy and Investment-Cash Flow Sensitivity," 2014. Co-authored with Najah Attig, Saint Mary's University, Sadok El Ghoul, University of Alberta, and Omrane Guedhami, South Carolina University. Journal of Business Ethics, Vol. 121 (No. 2), 297-314.

"Debt Rating Initiations: Natural Evolution or Opportunistic Behavior?" 2013. Co-authored with Laurence Booth, University of Toronto, and Lynnette Purda, Queen's University. Journal of Modern Accounting and Auditing, Vol. 9 (No. 12), 1574-1595.

"Institutional Investment Horizons and the Cost of Equity Capital," 2013, Co-authored with Najah Attig, Saint Mary's University, Sadok El Ghoul, University of Alberta, and Omrane Guedhami, South Carolina University. Financial Management, Vol. 42 (No.2), 2013, 441-477.

"Institutional Investment Horizon and Investment-Cash Flow Sensitivity." Co-authored with Najah Attig, Saint Mary's University, Sadok El Ghoul, University of Alberta, and Omrane Guedhami, South Carolina University. Journal of Banking & Finance, Vol. 36, (No. 4), 2012, 1164-1180.

"Capital Market Developments in the Post-October 1987 Period: A Canadian Perspective." Co-authored with Laurence Booth from the University of Toronto. Review of Accounting and Finance, Vol. 8 (No.2), 2009, 155-175.

"Cash Flow Volatility, Financial Slack and Investment Decisions," 2008, <u>China Finance Review,</u> Number 1, Vol 2, 63-86. Co-authored with Laurence Booth from the University of Toronto.

"The Investment Nature of Income Trusts and Their Role in Diversified Portfolios," <u>Canadian Journal of Administrative Sciences</u>. Co-authored with Greg MacKinnon from Saint Mary's University, (Vol 24(4)), 2007, 314-325.

"The U-Shaped Investment Curve: Theory and Evidence." Co-authored with Paul Povel, University of Minnesota, and Michael Raith, University of Southern California, Lead article, <u>Journal of Financial and Quantitative Analysis</u>, Vol. 42 (No. 1), March 2007.

"Financial Constraints and Investment: An Alternative Empirical Framework." Co-authored with Bert D'Espallier, Hasselt University, Anales de Estudios Economicos y Empresariales, Vol. 17, 2007, 9-41.

"Dividend Smoothing and Debt Ratings." Co-authored with Laurence Booth and Varouj Aivazian, both from the University of Toronto. Lead article, <u>Journal of Financial and Quantitative Analysis</u>, Vol. 41(No. 2), June 2006, 439-452.

"International Corporate Investment and the Relationships between Financial Constraint Measures," <u>Journal of Banking and Finance</u>, Volume 30 (5), 2006, 1559-1580.

"Are U.S. Variables Good Predictors of Foreign Equity Risk Premiums?" 2006. Co-authored with John Schmitz, President, Sci-Vest Capital Management Inc., <u>The Cyprus Journal of Sciences</u>.

"Income Trusts: Past Performance and Future Prospects." Co-authored with Greg MacKinnon of Saint Mary's University. <u>Canadian Investment Review</u>, Winter 2005, 53-54.

"Dividend Policy and the Role of Contracting Environments" <u>FSR Forum</u>, December 2005, 13-20. Co-authored with Laurence Booth and Varouj Aivazian, both from the University of Toronto.

"Corporate Investment and Financial Slack: International Evidence," <u>The International Journal of Managerial Finance</u>, 2005, 140-163.

"Industry Factors Do Not Explain Momentum in Canadian Stock Returns," <u>Investment Management and Financial Innovations, 2005(2), 49-60</u>. Co-authored with John Schmitz, President, Sci-Vest Capital Management Inc., and David Doucette, Saint Mary's University.

"Do Emerging Market Firms Follow Different Dividend Policies from U.S. Firms?" <u>The Journal of Financial Research</u>, Fall 2003, 371-387. Co-authored with Laurence Booth and Varouj Aivazian, both from the University of Toronto.

"Dividend Policy and the Organization of Capital Markets." <u>Journal of Multinational Financial Management</u>, Spring 2003, 101-121. Co-authored with Laurence Booth and Varouj Aivazian, both from the University of Toronto.

"The Risk-Adjusted Performance of Closed-End Funds and the Impact of Discounts." <u>Journal of Today</u>, December 2002, 119-133. Co-authored with Greg Hebb of Dalhousie University and Greg MacKinnon from Saint Mary's University.

"Transactions Costs on the TSE," <u>Canadian Investment Review</u>, Spring 2002, 20-26. Co-authored with John Schmitz, President, Sci-Vest Capital Management Inc., and Kevin Kerr, TD Securities, Toronto.

"What Has Worked on Bay Street," <u>Canadian Investment Review,</u> Winter 2001, 25-34. Co-authored with John Schmitz, President, Sci-Vest Capital Management Inc.

"The Sensitivity of Canadian Corporate Investment to Liquidity," <u>Canadian Journal of Administrative Sciences,</u> September 2000, 217-232.

"Diversification with Canadian Stocks: How Much is Enough?" <u>Canadian Investment Review</u>, Fall 1999, 21-25. Co-authored with David Copp, Mount Allison University.

"The Relationship Between Firm Investment and Financial Status," <u>Journal of Finance</u>, April 1999, 673-692. Received at least one vote from the editorial board for the top Corporate Finance Paper Award during the year of publication.

"Momentum in Stock Returns and Time-Varying Risk," <u>Canadian Journal of Administrative Sciences,</u> September 1998, 279-291. Co-authored with Michael Inglis, University of Toronto. One of five nominations for "best 1998 CJAS paper."

Books and Book Chapters:

<u>Corporate Finance,</u> First US Edition. Co-authored with Laurence Booth from the University of Toronto and Pamela (Petersen) Drake) from Virginia Commonwealth University. John Wiley & Sons (2013).

<u>Introduction to Corporate Finance,</u> first four editions, John Wiley & Sons Canada Limited. The first three editions were co-authored with Laurence Booth from the University of Toronto (2007, 2010, 2013), and the fourth edition (2016) co-authored with Laurence Booth and Ian Rakita from Concordia University. This is an Introductory Canadian Finance text that was written from "scratch."

<u>Investments: Analysis and Management</u>, First, Second and Third Canadian Editions, co-authored with Charles P. Jones of North Carolina State University, John Wiley & Sons Canada Limited (1999, 2004, 2008). I was solely responsible for the development of all three Canadian editions, the first being based on an adaptation of the sixth U.S. edition, authored by Professor Jones.

<u>The Canadian Securities Exam Fast Track Study Guide</u>, First, Second, Third and Fourth Editions (2001, 2006, 2009, 2013) – sole author. Published by John Wiley & Sons Canada Limited.

<u>Finance in a Canadian Setting</u>, Sixth Edition, co-authored with Peter Lusztig and Bernard Schwab, both of the University of British Columbia, John Wiley & Sons Canada Limited, March, 2001. I was solely responsible for the development of this edition of the text, based on an adaptation of the fifth edition, authored by Professors Lusztig, Schwab and Randall Morck of University of Alberta.

<u>Market Efficiency</u>, a chapter in the CFA Institute Investment Series book entitled Investments: Principles of Portfolio and Equity Analysis (Wiley, 2011), which is currently used as CFA Level 1 material within the Candidate Body of Knowledge.

"Introduction to Financial Markets," (on-line course). Developed all seven modules for the Bourse de Montreal, 2002.

"Derivatives for the Retail Investor," (on-line course). Developed two modules (Forwards and Future, and Options) for the Bourse de Montreal, 2002.

"Derivatives for the Institutional Investor," (on-line course). Developed two modules (Options and Derivatives for Equity and Index Products) for the Bourse de Montreal, 2002.

"Investment Strategies and Asset Allocation," Chapter 5, <u>Investment Management Techniques</u>, The Canadian Securities Institute, 1999.

"Equity Securities," Chapter 12, <u>Investment Management Techniques</u>, The Canadian Securities Institute, 1999.

Cases:

"Time Value of Money: The Buy versus Rent Decision," with Stephen Foerster. Ivey Publishing, August 2014.

Conference Proceedings:

I have published numerous articles in conference proceedings, as summarized below:
European Financial Management Association annual conference, 2008, 2006, 2005, 2002.
Hawaii International Conference on Business, 2002.
Multinational Finance Society annual conference, 2001.
Atlantic Schools of Business annual conferences, 2000, 1998.
ASAC annual conferences, 2006, 2001, 2000.

Conference Best Paper Awards:

"The Information Content of Institutional Investment Horizon: Evidence from Firms' Implied Cost of Equity," 2012, Working Paper, Co-authored with Najah Attig, Saint Mary's University, Sadok El Ghoul, University of Alberta, and Omrane Guedhami, South Carolina University. Chosen Best Paper in Banking and Finance – 2012 European Business Research Conference.

"Income Trusts: Why All the Fuss and What About the Future?" 2006. Co-authored with Greg MacKinnon from Saint Mary's University. Chosen as the best paper in the Finance division for the 2006 ASAC Conference in Banff, Alberta.

"The U-Shaped Investment Curve: Theory and Evidence" 2004. Co-authored with Paul Povel, University of Minnesota, and Michael Raith, Rochester University. Presented at the 2004 NFA Conference and received award as the "Best Paper in Managerial Finance."

"The Sensitivity of Canadian Corporate Investment to Liquidity." Published in conference proceedings for the 1999 ASAC Conference in Saint John, New Brunswick.
Chosen as the best paper in the Finance division for this conference.

Conference Presentations:

Keynote Speaker (Finance Area) – ASAC 2012 Annual Conference.
I have presented papers at numerous conferences, as summarized below:
World Finance Conference, 2014, 2013, 2011, 2010.
Paris Financial Management Conference, 2014.
Northern Finance Association annual conferences, 2013, 2011, 2010, 2008, 2005, 2004, 2002, 2000, 1996.
Multinational Finance Society annual conferences, 2010, 2001, 1999.
European Financial Management Association annual conference, 2008, 2006, 2005, 2002.
Hawaii International Conference on Business, 2002.
Eastern Finance Association annual conferences, 2003, 2000.
Atlantic Schools of Business annual conferences, 2000, 1998, 1996.
ASAC annual conferences, 2006, 2000, 1999.
Financial Management Association annual conferences, 2013, 2011, 2010, 2008, 2005, 2004, 2001, 1999, 1996.
Southern Finance Association annual conference, 2008.

Finance Workshops (invited presentations).
Atlantic Canada CFA Society, 2006.
Melbourne Centre for Financial Studies, 2006.
Melbourne CFA Society, 2006.
Monash University (Caulfield), 2006.
University of Melbourne, 2006.
University of New South Wales, 2006.
University of Sydney, 2006.
University of Manitoba CGA Finance Conference 2005
Wilfred Laurier University, 2002.
University of Western Ontario, 2001.
York University, 2001, 2010.
Dalhousie University, 2001, 2013.
Queen's University, 2000.
Saint Mary's University, 2002, 2001, 2000, 1999.
Schulich School of Business, 2010.
Concordia University, 2013.

Research Grants

Co-investigator for a Standard Research Grant in the amount of $130,000 from the Social Sciences and Humanities Research Council of Canada (SSHRC) for the 2013 to 2017 period (Principal investigator - Najah Attig of Saint Mary's University).

Awarded three Research Grants of $90,000 each over three years from the Queen's School of Business at Queen's University (2008-11; 2011-14; 2014-17).

Principal investigator for a Standard Research Grant in the amount of $60,500 from the Social Sciences and Humanities Research Council of Canada (SSHRC) for the 2008 to 2011 period.

Co-investigator for a Standard Research Grant in the amount of $111,000 from the Social Sciences and Humanities Research Council of Canada (SSHRC) for the 2006 to 2009 period (Principal investigator - Najah Attig of Saint Mary's University).

Principal investigator for a Standard Research Grant in the amount of $70,118 from the Social Sciences and Humanities Research Council of Canada (SSHRC) for the 2003 to 2006 period.

Awarded a Research Grant of $25,000 per year for three years from the Schulich School of Business at York University (July 2001).

Principal investigator for a Standard Research Grant in the amount of $61,530 from the Social Sciences and Humanities Research Council of Canada (SSHRC) for the 1999 to 2002 period.

Awarded Research Grant for $1,500 from Saint Mary's University (2003-2004).

Awarded Research Grant for 2,500 from Saint Mary's University (2002-2003).

Awarded Research Grant for $2,500 from Saint Mary's University (2000-2001).

Awarded Research Grant for $3,030 from Saint Mary's University (1999-2000).

Awarded Research Grant for $2,000 from Saint Mary's University (1998-99).

Research Grant in the amount of $20,000 from the Intellectual Infrastructure Partnership Program (IIPP) at the University of Lethbridge (1997-98).

Research Grant from the University of Lethbridge Research Fund for $4,500 (1997-98).

Work-in Progress

"The Cash Effect and Market Reaction over Three Decades," 2015, Working Paper. Co-authored with Fatma Sonmez, Queen's University. Under review.

"Institutional Investors, Monitoring and Corporate Finance Policies," 2015, Working Paper. Co-authored with Jun Wang, The University of Western Ontario.

Professional Activities

Editorial Advisory Board – Investor Lit (2013-present)
Senior Advisor – Toronto CFA Continuing Education Committee (2014-present); Chair (2013-14); Vice-Chair (2012-13)
Chair – Awards Committee – CFA Toronto Board of Directors (2008-2011)
President - Board of Directors for the Atlantic Canada CFA Society (2007-2008). Served on the board from 2001 to 2008.
Editor (Finance area) for the *Canadian Journal of Administrative Sciences*.
Associate Editor for the *European Journal of Finance*.
Editorial Board – *Canadian Investment Review* (2008-2011).
Served as a reviewer for the *Review of Financial Studies*, the *Journal of Financial and Quantitative Analysis*, *Journal of Business, Financial Management, Journal of Money, Credit and Banking,* the *Journal of Banking and Finance,* the *European Journal of Finance*, the *Journal of Corporate Finance*, the *Journal of Applied Economics*, the *Multinational Finance Journal, Financial Review, Journal of International Financial Management,* the *International Review of Economics and Finance,* the *Canadian Journal of Administrative Sciences,* the *Review of Financial Economics, the Journal of Risk Finance,* and for the *Journal of Management and Governance*.

Reviewer for several SSHRC grant applications.
External reviewer/examiner for several tenure and renewal applications received for professors at other universities, as well as for Ph.D. dissertations.
Conference chair for 2001 Northern Finance Association Annual Meeting, held in Halifax.
Conference organizing committee and Reviewer for several conferences.
Completed the Chartered Financial Analyst (CFA) program, and awarded the CFA designation.
Completed the Professional Financial Planning Course offered by the Canadian Securities Institute, as well as the Canadian Securities Course (CSC).
Completed the Investment Funds Institute of Canada's Mutual Fund Course.
Prepared course materials for several "on-line" finance courses.
Instructor for Canadian Securities Course Seminars.
Prepared Course Materials for the Canadian Securities Institute.
Delivered Seminars for the Canadian Securities Institute on the Canadian Securities Course (CSC), Fixed Income Securities and Portfolio Management Techniques.

ATTACHMENT B - Actual versus Forecast - 10-year Canada yields

Bloomberg Ticker: GCAN10YR

Historical Forecast

Calendar Quarter	Fiscal Quarter	2009 GRA	2010 GRA	2011 GRA	2012 GRA	2013 GRA	2014 GRA	2015 GRA	2016 GRA	2017 GRA	Olympic	Fiscal Quarter Actual
2008 Q1	Feb-08	3.68%										3.71%
Q2	May-08	3.55%										3.53%
Q3	Aug-08	3.78%										3.32%
Q4	Nov-08	4.00%										3.13%
2009 Q1	Feb-09	4.12%	2.88%									3.39%
Q2	May-09	4.22%	2.68%									3.38%
Q3	Aug-09	4.30%	2.73%									3.22%
Q4	Nov-09	4.45%	2.84%									3.39%
2010 Q1	Feb-10	5.30%	2.96%	3.58%								3.35%
Q2	May-10	5.32%	3.05%	3.70%								2.76%
Q3	Aug-10	5.35%	3.15%	3.83%								3.12%
Q4	Nov-10	5.36%	3.29%	3.99%								3.30%
2011 Q1	Feb-11	5.37%	3.63%	4.07%	3.31%							3.07%
Q2	May-11	5.35%	3.89%	4.11%	3.48%							2.49%
Q3	Aug-11	5.35%	4.13%	4.25%	3.50%							2.15%
Q4	Nov-11	5.38%	4.29%	4.45%	3.74%							1.99%
2012 Q1	Feb-12	5.52%	4.44%	4.54%	3.84%	2.01%						1.74%
Q2	May-12	5.52%	4.67%	4.67%	3.94%	2.18%						1.77%
Q3	Aug-12	5.52%	4.73%	4.71%	4.09%	2.33%						1.70%
Q4	Nov-12	5.52%	4.73%	4.71%	4.20%	2.48%						1.84%
2013 Q1	Feb-13		4.73%	4.71%	4.77%	2.59%	1.87%					2.06%
Q2	May-13		4.75%	4.71%	4.85%	2.69%	1.92%					2.62%
Q3	Aug-13		4.93%	4.83%	4.85%	2.85%	2.08%					2.56%
Q4	Nov-13		5.40%	4.85%	5.22%	2.95%	2.22%					2.43%
2014 Q1	Feb-14			5.59%	4.86%	2.98%	2.43%	2.62%				2.25%
Q2	May-14			5.72%	4.87%	3.01%	2.62%	2.82%				2.00%
Q3	Aug-14			5.72%	4.89%	3.05%	2.72%	2.99%				1.86%
Q4	Nov-14			5.72%	5.12%	3.19%	2.83%	3.14%				1.30%
2015 Q1	Feb-15				5.61%	3.43%	2.83%	3.28%	1.47%			1.62%
Q2	May-15				5.82%	3.55%	2.85%	3.42%	1.70%			1.62%
Q3	Aug-15				5.82%	3.78%	3.15%	3.57%	1.87%			1.49%
Q4	Nov-15				5.82%	4.01%	3.37%	3.71%	2.04%			1.57%
2016 Q1	Feb-16					4.28%	3.61%	3.70%	2.21%	1.33%	1.27%	1.19%
Q2	May-16					4.62%	3.78%	3.83%	2.40%	1.42%	1.37%	
Q3	Aug-16					4.94%	3.98%	3.97%	2.57%	1.58%	1.52%	
Q4	Nov-16					5.03%	4.24%	4.12%	2.70%	1.76%	1.75%	
2017 Q1	Feb-17						4.43%	4.32%	3.22%	1.95%	2.05%	
Q2	May-17						4.67%	4.50%	3.41%	2.14%	2.24%	
Q3	Aug-17						4.86%	4.62%	3.52%	2.28%	2.38%	
Q4	Nov-17						4.87%	4.62%	3.55%	2.43%	2.75%	
2018 Q1	Feb-18							4.62%	3.55%	2.51%	3.17%	
Q2	May-18							4.62%	3.55%	2.68%	3.34%	
Q3	Aug-18							4.62%	3.55%	2.98%	3.56%	
Q4	Nov-18							4.62%	3.55%	3.30%	3.78%	
2019 Q1	Feb-19								3.55%	3.39%	3.85%	
Q2	May-19								3.55%	3.39%	3.87%	
Q3	Aug-19								3.55%	3.39%	3.88%	
Q4	Nov-19								3.55%	3.39%	3.89%	
2020 Q1	Feb-20									3.39%	3.89%	
Q2	May-20									3.39%	3.90%	
Q3	Aug-20									3.39%	3.90%	
Q4	Nov-20									3.39%	3.90%	

Actual - Forecast

Fiscal Quarter	2009 GRA	2010 GRA	2011 GRA	2012 GRA	2013 GRA	2014 GRA	2015 GRA	2016 GRA
Feb-08	0.03%							
May-08	-0.02%							
Aug-08	-0.45%							
Nov-08	-0.87%							
Feb-09	-0.74%	0.51%						
May-09	-0.84%	0.70%						
Aug-09	-1.08%	0.50%						
Nov-09	-1.06%	0.56%						
Feb-10	-1.95%	0.39%	-0.23%					
May-10	-2.56%	-0.29%	-0.94%					
Aug-10	-2.22%	-0.03%	-0.70%					
Nov-10	-2.06%	0.01%	-0.69%					
Feb-11	-2.29%	-0.56%	-1.00%	-0.23%				
May-11	-2.86%	-1.40%	-1.62%	-0.99%				
Aug-11	-3.20%	-1.98%	-2.10%	-1.34%				
Nov-11	-3.39%	-2.30%	-2.46%	-1.75%				
Feb-12	-3.78%	-2.70%	-2.80%	-2.10%	-0.27%			
May-12	-3.75%	-2.90%	-2.90%	-2.17%	-0.41%			
Aug-12	-3.82%	-3.03%	-3.01%	-2.39%	-0.63%			
Nov-12	-3.68%	-2.89%	-2.88%	-2.36%	-0.64%			
Feb-13		-2.66%	-2.65%	-2.71%	-0.52%	0.19%		
May-13		-2.14%	-2.10%	-2.23%	-0.07%	0.70%		
Aug-13		-2.38%	-2.27%	-2.29%	-0.29%	0.48%		
Nov-13		-2.98%						
Feb-14			-3.34%	-2.61%	-0.73%	-0.18%	-0.37%	
May-14			-3.72%	-2.87%	-1.02%	-0.63%	-0.82%	
Aug-14			-3.86%	-3.03%	-1.19%	-0.86%	-1.13%	
Nov-14			-4.42%	-3.82%	-1.89%	-1.53%	-1.84%	
Feb-15				-3.98%	-1.81%	-1.21%	-1.66%	0.16%
May-15				-4.19%	-1.93%	-1.23%	-1.80%	-0.07%
Aug-15				-4.33%	-2.29%	-1.66%	-2.08%	-0.38%
Nov-15				-4.25%	-2.44%	-1.80%	-2.14%	-0.47%
Feb-16					-3.09%	-2.42%	-2.51%	-1.02%

Actual-Forecast

	2009 GRA	2010 GRA	2011 GRA	2012 GRA	2013 GRA	2014 GRA	2015 GRA	2016 GRA	WT Av
Average	-2.14%	-1.28%	-2.32%	-2.60%	-1.16%	-0.76%	-1.60%	-0.36%	-1.72%
Median	-2.22%	-1.69%	-2.56%	-2.41%	-0.73%	-0.86%	-1.80%	-0.38%	
Max	-0.02%	0.70%	-0.23%	-0.23%	-0.07%	0.70%	-0.37%	0.16%	
Min	-3.82%	-3.03%	-4.42%	-4.33%	-3.09%	-2.42%	-2.51%	-1.02%	
StdDev	1.27%	1.45%	1.16%	1.11%	0.90%	0.98%	0.69%	0.45%	

Forecast Error = Error/Actual (%)

Fiscal Quarter	2009 GRA	2010 GRA	2011 GRA	2012 GRA	2013 GRA	2014 GRA	2015 GRA	2016 GRA
Feb-08	0.88%							
May-08	-0.45%							
Aug-08	-13.57%							
Nov-08	-27.75%							
Feb-09	-21.71%	15.07%						
May-09	-24.89%	20.74%						
Aug-09	-33.42%	15.45%						
Nov-09	-31.23%	16.40%						
Feb-10	-58.22%	11.71%	-6.81%					
May-10	-92.96%	-10.59%	-34.16%					
Aug-10	-71.25%	-0.90%	-22.52%					
Nov-10	-62.37%	0.41%	-20.91%					
Feb-11	-74.65%	-18.08%	-32.38%	-7.51%				
May-11	-114.84%	-56.27%	-64.95%	-39.56%				
Aug-11	-148.82%	-92.16%	-97.58%	-62.48%				
Nov-11	-170.79%	-115.97%	-123.96%	-87.97%				
Feb-12	-217.27%	-155.30%	-160.77%	-120.68%	-15.52%			
May-12	-211.89%	-163.76%	-163.93%	-122.59%	-22.88%			
Aug-12	-224.73%	-178.01%	-177.32%	-140.58%	-37.06%			
Nov-12	-200.51%	-157.26%	-156.64%	-128.63%	-34.73%			
Feb-13		-128.95%	-128.41%	-131.07%	-25.24%	9.40%		
May-13		-81.64%	-80.23%	-85.42%	-2.64%	26.61%		
Aug-13		-93.02%	-88.84%	-89.72%	-11.50%	18.82%		
Nov-13		-122.73%	-115.39%	-99.96%	-21.65%	8.45%		
Feb-14			-148.90%	-116.34%	-32.68%	-7.97%	-16.53%	
May-14			-186.55%	-144.06%	-50.88%	-31.33%	-41.12%	
Aug-14			-207.86%	-163.13%	-64.16%	-46.39%	-61.05%	
Nov-14			-340.00%	-294.10%	-145.38%	-117.31%	-141.35%	
Feb-15				-245.37%	-111.21%	-74.26%	-101.99%	9.59%
May-15				-258.09%	-118.60%	-75.49%	-110.84%	-4.37%
Aug-15				-290.68%	-153.69%	-111.41%	-139.72%	-25.17%
Nov-15				-270.77%	-155.41%	-114.65%	-136.48%	-30.15%
Feb-16					-259.66%	-203.36%	-211.23%	-85.99%

Error/Actual (%)

	2009 GRA	2010 GRA	2011 GRA	2012 GRA	2013 GRA	2014 GRA	2015 GRA	2016 GRA	WT Av
Average	-94.81%	-64.74%	-117.90%	-144.94%	-74.29%	-55.30%	-106.70%	-27.22%	-92.95%
Median	-71.25%	-68.96%	-119.67%	-125.61%	-37.06%	-46.39%	-110.84%	-25.17%	
Max	-0.45%	20.74%	-6.81%	-7.51%	-2.64%	26.61%	-16.53%	9.59%	
Min	-224.73%	-178.01%	-340.00%	-294.10%	-259.66%	-203.36%	-211.23%	-85.99%	
StdDev	77.19%	71.59%	80.42%	83.85%	71.29%	68.65%	59.85%	36.55%	

Government of Canada 10 Year Bond Rate

Bloomberg Ticker: 50/50

Historical Forecast

Calendar Quarter	Qtr	Fiscal Quarter	2009 GRA	2010 GRA	2011 GRA	2012 GRA	2013 GRA	2014 GRA	2015 GRA	2016 GRA	2017 GRA	Olympic
2008	Q1	Feb-08	3.68%									
	Q2	May-08	3.55%									
	Q3	Aug-08	3.78%									
	Q4	Nov-08	4.00%									
2009	Q1	Feb-09	4.12%	2.88%								
	Q2	May-09	4.22%	2.68%								
	Q3	Aug-09	4.30%	2.73%								
	Q4	Nov-09	4.45%	2.84%								
2010	Q1	Feb-10	5.30%	2.96%	3.58%							
	Q2	May-10	5.32%	3.05%	3.70%							
	Q3	Aug-10	5.35%	3.15%	3.83%							
	Q4	Nov-10	5.36%	3.29%	3.99%							
2011	Q1	Feb-11	5.37%	3.63%	4.07%	3.31%						
	Q2	May-11	5.35%	3.89%	4.11%	3.48%						
	Q3	Aug-11	5.35%	4.13%	4.25%	3.50%						
	Q4	Nov-11	5.38%	4.29%	4.45%	3.74%						
2012	Q1	Feb-12	5.52%	4.44%	4.54%	3.84%	2.01%					
	Q2	May-12	5.52%	4.67%	4.67%	3.94%	2.18%					
	Q3	Aug-12	5.52%	4.73%	4.71%	4.09%	2.33%					
	Q4	Nov-12	5.52%	4.73%	4.71%	4.20%	2.48%					
2013	Q1	Feb-13		4.73%	4.71%	4.77%	2.59%	1.87%				
	Q2	May-13		4.75%	4.71%	4.85%	2.69%	1.92%				
	Q3	Aug-13		4.93%	4.83%	4.85%	2.85%	2.08%				
	Q4	Nov-13		5.40%	5.22%	4.85%	2.95%	2.22%				
2014	Q1	Feb-14			5.59%	4.86%	2.98%	2.43%	2.62%			
	Q2	May-14			5.72%	4.87%	3.01%	2.62%	2.82%			
	Q3	Aug-14			5.72%	4.89%	3.05%	2.72%	2.99%			
	Q4	Nov-14			5.72%	5.12%	3.19%	2.83%	3.14%			
2015	Q1	Feb-15				5.61%	3.43%	2.83%	3.28%	1.47%		
	Q2	May-15				5.82%	3.55%	2.85%	3.42%	1.70%		
	Q3	Aug-15				5.82%	3.78%	3.15%	3.57%	1.87%		
	Q4	Nov-15				5.82%	4.01%	3.37%	3.71%	2.04%		
2016	Q1	Feb-16					4.28%	3.61%	3.70%	2.21%	1.33%	1.27%
	Q2	May-16					4.62%	3.78%	3.83%	2.40%	1.42%	1.37%
	Q3	Aug-16					4.94%	3.98%	3.97%	2.57%	1.58%	1.52%
	Q4	Nov-16					5.03%	4.24%	4.12%	2.70%	1.76%	1.75%
2017	Q1	Feb-17						4.43%	4.32%	3.22%	1.95%	2.05%
	Q2	May-17						4.67%	4.50%	3.41%	2.14%	2.24%
	Q3	Aug-17						4.86%	4.62%	3.52%	2.28%	2.38%
	Q4	Nov-17						4.87%	4.62%	3.55%	2.43%	2.75%
2018	Q1	Feb-18							4.62%	3.55%	2.51%	3.17%
	Q2	May-18							4.62%	3.55%	2.68%	3.34%
	Q3	Aug-18							4.62%	3.55%	2.98%	3.56%
	Q4	Nov-18							4.62%	3.55%	3.30%	3.78%
2019	Q1	Feb-19								3.55%	3.39%	3.85%
	Q2	May-19								3.55%	3.39%	3.87%
	Q3	Aug-19								3.55%	3.39%	3.88%
	Q4	Nov-19								3.55%	3.39%	3.89%
2020	Q1	Feb-20									3.39%	3.89%
	Q2	May-20									3.39%	3.90%
	Q3	Aug-20									3.39%	3.90%
	Q4	Nov-20									3.39%	3.90%

Actual - Forecast

GCAN10YR

Fiscal Quarter	Actual	2009 GRA	2010 GRA	2011 GRA	2012 GRA	2013 GRA	2014 GRA	2015 GRA	2016 GRA
Feb-08	3.71%	0.03%							
May-08	3.53%	-0.02%							
Aug-08	3.32%	-0.45%							
Nov-08	3.13%	-0.87%							
Feb-09	3.39%	-0.74%	0.51%						
May-09	3.38%	-0.84%	0.70%						
Aug-09	3.22%	-1.08%	0.50%						
Nov-09	3.39%	-1.06%	0.56%						
Feb-10	3.35%	-1.95%	0.39%	-0.23%					
May-10	2.76%	-2.56%	-0.29%	-0.94%					
Aug-10	3.12%	-2.22%	-0.03%	-0.70%					
Nov-10	3.30%	-2.06%	0.01%	-0.69%					
Feb-11	3.07%	-2.29%	-0.56%	-1.00%	-0.23%				
May-11	2.49%	-2.86%	-1.40%	-1.62%	-0.99%				
Aug-11	2.15%	-3.20%	-1.98%	-2.10%	-1.34%				
Nov-11	1.99%	-3.39%	-2.30%	-2.46%	-1.75%				
Feb-12	1.74%	-3.78%	-2.70%	-2.80%	-2.10%	-0.27%			
May-12	1.77%	-3.75%	-2.90%	-2.90%	-2.17%	-0.41%			
Aug-12	1.70%	-3.82%	-3.03%	-3.01%	-2.39%	-0.63%			
Nov-12	1.84%	-3.68%	-2.89%	-2.88%	-2.36%	-0.64%			
Feb-13	2.06%		-2.66%	-2.65%	-2.71%	-0.52%	0.19%		
May-13	2.62%		-2.14%	-2.10%	-2.23%	-0.07%	0.70%		
Aug-13	2.56%		-2.38%	-2.27%	-2.29%	-0.29%	0.48%		
Nov-13	2.43%		-2.98%		-2.42%	-0.53%	0.21%		
Feb-14	2.25%			-3.34%	-2.61%	-0.73%	-0.18%	-0.37%	
May-14	2.00%			-3.72%	-2.87%	-1.02%	-0.63%	-0.82%	
Aug-14	1.86%			-3.86%	-3.03%	-1.19%	-0.86%	-1.13%	
Nov-14	1.30%				-3.82%	-1.89%	-1.53%	-1.84%	
Feb-15	1.62%				-3.98%	-1.81%	-1.21%	-1.66%	0.16%
May-15	1.62%				-4.19%	-1.93%	-1.23%	-1.80%	-0.07%
Aug-15	1.49%				-4.33%	-2.29%	-1.66%	-2.08%	-0.38%
Nov-15	1.57%				-4.25%	-2.44%	-1.80%	-2.14%	-0.47%
Feb-16	1.19%					-3.09%	-2.42%	-2.51%	-1.02%

	2009 GRA	2010 GRA	2011 GRA	2012 GRA	2013 GRA	2014 GRA	2015 GRA	2016 GRA
Average	-2.14%	-1.28%	-2.21%	-2.60%	-1.16%	-0.76%	-1.60%	-0.36%
Median	-2.22%	-1.69%	-2.46%	-2.41%	-0.73%	-0.86%	-1.80%	-0.38%
Max	-0.02%	0.70%	-0.23%	-0.23%	-0.07%	0.70%	-0.37%	0.16%
Min	-3.82%	-3.03%	-3.86%	-4.33%	-3.09%	-2.42%	-2.51%	-1.02%
StdDev	1.27%	1.45%	1.07%	1.11%	0.90%	0.98%	0.69%	0.45%

General Forecasting of Rates

Error/Actual (%)

Calendar Quarter	Fiscal Quarter	Actual	Most Recent GRA Forecast	Actual-Forecast	Error/Actual (%)	Naïve Forecast (quarterly)*	Actual - Naïve (quarterly)	Error/Actual (%)	Naïve Forecast (annually)**	Actual - Naïve (annually)	Error/Actual (%)
2008	Q1	3.71%	3.68%	0.03%	0.88%	4.07%	-0.36%	-9.67%	4.07%	-0.36%	-9.67%
	Q2	3.53%	3.55%	-0.02%	-0.45%	3.71%	-0.18%	-5.01%	4.07%	-0.54%	-15.17%
	Q3	3.32%	3.78%	-0.45%	-13.57%	3.53%	-0.21%	-6.32%	4.07%	-0.75%	-22.44%
	Q4	3.13%	4.00%	-0.87%	-27.75%	3.32%	-0.19%	-6.16%	4.07%	-0.94%	-29.99%
2009	Q1	3.39%	2.88%	0.51%	15.07%	3.13%	0.25%	7.50%	3.13%	0.25%	7.50%
	Q2	3.38%	2.68%	0.70%	20.74%	3.39%	-0.01%	-0.30%	3.13%	0.24%	7.23%
	Q3	3.22%	2.73%	0.50%	15.45%	3.38%	-0.15%	-4.72%	3.13%	0.09%	2.85%
	Q4	3.39%	2.84%	0.56%	16.40%	3.22%	0.17%	4.95%	3.13%	0.26%	7.67%
2010	Q1	3.35%	3.58%	-0.23%	-6.81%	3.39%	-0.04%	-1.31%	3.39%	-0.04%	-1.31%
	Q2	2.76%	3.70%	-0.94%	-34.16%	3.35%	-0.59%	-21.36%	3.39%	-0.63%	-22.95%
	Q3	3.12%	3.83%	-0.70%	-22.52%	2.76%	0.36%	11.66%	3.39%	-0.27%	-8.62%
	Q4	3.30%	3.99%	-0.69%	-20.91%	3.12%	0.18%	5.37%	3.39%	-0.09%	-2.79%
2011	Q1	3.07%	3.31%	-0.23%	-7.51%	3.30%	-0.23%	-7.32%	3.30%	-0.23%	-7.32%
	Q2	2.49%	3.48%	-0.99%	-39.56%	3.07%	-0.58%	-23.45%	3.30%	-0.81%	-32.49%
	Q3	2.15%	3.50%	-1.34%	-62.48%	2.49%	-0.34%	-15.76%	3.30%	-1.15%	-53.37%
	Q4	1.99%	3.74%	-1.75%	-87.97%	2.15%	-0.16%	-8.25%	3.30%	-1.31%	-66.03%
2012	Q1	1.74%	2.01%	-0.27%	-15.52%	1.99%	-0.25%	-14.20%	1.99%	-0.25%	-14.20%
	Q2	1.77%	2.18%	-0.41%	-22.88%	1.74%	0.03%	1.69%	1.99%	-0.22%	-12.26%
	Q3	1.70%	2.33%	-0.63%	-37.06%	1.77%	-0.07%	-4.12%	1.99%	-0.29%	-16.88%
	Q4	1.84%	2.48%	-0.64%	-34.73%	1.70%	0.14%	7.46%	1.99%	-0.15%	-8.17%
2013	Q1	2.06%	1.87%	0.19%	9.40%	1.84%	0.23%	11.00%	1.84%	0.23%	11.00%
	Q2	2.62%	1.92%	0.70%	26.61%	2.06%	0.55%	21.10%	1.84%	0.78%	29.78%
	Q3	2.56%	2.08%	0.48%	18.82%	2.62%	-0.06%	-2.35%	1.84%	0.72%	28.13%
	Q4	2.43%	2.22%	0.21%	8.45%	2.56%	-0.13%	-5.40%	1.84%	0.59%	24.25%
2014	Q1	2.25%	2.62%	-0.37%	-16.53%	2.43%	-0.18%	-7.97%	2.43%	-0.18%	-7.97%
	Q2	2.00%	2.82%	-0.82%	-41.12%	2.25%	-0.25%	-12.58%	2.43%	-0.43%	-21.55%
	Q3	1.86%	2.99%	-1.13%	-61.05%	2.00%	-0.14%	-7.37%	2.43%	-0.57%	-30.52%
	Q4	1.30%	3.14%	-1.84%	-141.35%	1.86%	-0.56%	-42.92%	2.43%	-1.13%	-86.54%
2015	Q1	1.62%	1.47%	0.16%	9.59%	1.30%	0.32%	19.95%	1.30%	0.32%	19.95%
	Q2	1.62%	1.70%	-0.07%	-4.37%	1.62%	0.00%	0.00%	1.30%	0.32%	19.95%
	Q3	1.49%	1.87%	-0.38%	-25.17%	1.62%	-0.13%	-8.99%	1.30%	0.19%	12.75%
	Q4	1.57%	2.04%	-0.47%	-30.15%	1.49%	0.08%	5.10%	1.30%	0.27%	17.20%
2016	Q1	1.19%	1.33%	-0.14%	-11.62%	1.57%	-0.38%	-31.93%	1.57%	-0.38%	-31.93%
		Actual	Most Recent GRA Forecast	Actual-Forecast	Error/Actual (%)	Naïve Forecast (quarterly)*	Actual - Naïve (quarterly)	Error/Actual (%)	Naïve Forecast (annually)**	Actual - Naïve (annually)	Error/Actual (%)
	Average	2.45%	2.80%	-0.34%	-18.90%	2.54%	-0.09%	-4.60%	2.65%	-0.19%	-9.51%
	Median	2.43%	2.82%	-0.37%	-15.52%	2.49%	-0.13%	-5.01%	2.43%	-0.22%	-8.17%
	Max	3.71%	4.00%	0.70%	26.61%	4.07%	0.55%	21.10%	4.07%	0.78%	29.78%
	Min	1.19%	1.33%	-1.84%	-141.35%	1.30%	-0.59%	-42.92%	1.30%	-1.31%	-86.54%
	StdDev	0.76%	0.80%	0.66%	34.36%	0.78%	0.27%	13.31%	0.90%	0.53%	26.31%

* Naïve Forecast (quarterly) uses 10-year yield at the end of previous quarter to forecast for next quarter - so use Q4 2007 Nov07 yield of 4.07 for 10-year yield to start and update every quarter, using actuals provided.
** Naïve Forecast (annual) uses 10-year yield at the end of previous quarter to forecast for next 4 quarters - so use Q4 2007 Nov07 yield of 4.07 for 10-year yield to start and update every 4 quarters, using actuals provided.

General Forecasting of Rates   **50/50 - 50% previous 10-year actual yield + 50% of forecast**

Calendar Quarter	Fiscal Quarter Actual	Most Recent GRA Forecast	Actual-Forecast	Naïve Forecast (quarterly)*	Actual - Naïve (quarterly)	Naïve Forecast (annually)**	Actual - Naïve (annually)
2008 Q1	3.71%	3.68%	0.03%	3.87%	-0.16%	3.87%	-0.16%
Q2	3.53%	3.55%	-0.02%	3.63%	-0.10%	3.81%	-0.28%
Q3	3.32%	3.78%	-0.45%	3.65%	-0.33%	3.92%	-0.60%
Q4	3.13%	4.00%	-0.87%	3.66%	-0.53%	4.04%	-0.90%
2009 Q1	3.39%	2.88%	0.51%	3.00%	0.38%	3.00%	0.38%
Q2	3.38%	2.68%	0.70%	3.03%	0.35%	2.90%	0.47%
Q3	3.22%	2.73%	0.50%	3.05%	0.17%	2.93%	0.30%
Q4	3.39%	2.84%	0.56%	3.03%	0.36%	2.98%	0.41%
2010 Q1	3.35%	3.58%	-0.23%	3.48%	-0.14%	3.48%	-0.14%
Q2	2.76%	3.70%	-0.94%	3.52%	-0.77%	3.55%	-0.79%
Q3	3.12%	3.83%	-0.70%	3.29%	-0.17%	3.61%	-0.49%
Q4	3.30%	3.99%	-0.69%	3.56%	-0.26%	3.69%	-0.39%
2011 Q1	3.07%	3.31%	-0.23%	3.30%	-0.23%	3.30%	-0.23%
Q2	2.49%	3.48%	-0.99%	3.27%	-0.78%	3.39%	-0.90%
Q3	2.15%	3.50%	-1.34%	2.99%	-0.84%	3.40%	-1.25%
Q4	1.99%	3.74%	-1.75%	2.94%	-0.96%	3.52%	-1.53%
2012 Q1	1.74%	2.01%	-0.27%	2.00%	-0.26%	2.00%	-0.26%
Q2	1.77%	2.18%	-0.41%	1.96%	-0.19%	2.08%	-0.31%
Q3	1.70%	2.33%	-0.63%	2.05%	-0.35%	2.16%	-0.46%
Q4	1.84%	2.48%	-0.64%	2.09%	-0.25%	2.23%	-0.39%
2013 Q1	2.06%	1.87%	0.19%	1.85%	0.21%	1.85%	0.21%
Q2	2.62%	1.92%	0.70%	1.99%	0.62%	1.88%	0.74%
Q3	2.56%	2.08%	0.48%	2.35%	0.21%	1.96%	0.60%
Q4	2.43%	2.22%	0.21%	2.39%	0.04%	2.03%	0.40%
2014 Q1	2.25%	2.62%	-0.37%	2.52%	-0.28%	2.52%	-0.28%
Q2	2.00%	2.82%	-0.82%	2.53%	-0.54%	2.62%	-0.63%
Q3	1.86%	2.99%	-1.13%	2.49%	-0.64%	2.71%	-0.85%
Q4	1.30%	3.14%	-1.84%	2.50%	-1.20%	2.78%	-1.48%
2015 Q1	1.62%	1.47%	0.16%	1.38%	0.24%	1.38%	0.24%
Q2	1.62%	1.70%	-0.07%	1.66%	-0.04%	1.50%	0.13%
Q3	1.49%	1.87%	-0.38%	1.74%	-0.25%	1.58%	-0.09%
Q4	1.57%	2.04%	-0.47%	1.77%	-0.20%	1.67%	-0.10%
2016 Q1	1.19%	1.33%	-0.14%	1.45%	-0.26%	1.45%	-0.26%
	Actual	**Most Recent GRA Forecast**	**Actual-Forecast**	**Naïve Forecast (quarterly)***	**Actual - Naïve (quarterly)**	**Naïve Forecast (annually)****	**Actual - Naïve (annually)**
Average	2.45%	2.80%	-0.34%	2.67%	-0.22%	2.72%	-0.27%
Median	2.43%	2.82%	-0.37%	2.53%	-0.23%	2.78%	-0.26%
Max	3.71%	4.00%	0.70%	3.87%	0.62%	4.04%	0.74%
Min	1.19%	1.33%	-1.84%	1.38%	-1.20%	1.38%	-1.53%
StdDev	0.76%	0.80%	0.66%	0.73%	0.41%	0.83%	0.57%

* Naïve Forecast (quarterly) uses 10-year yield at the end of previous quarter to forecast for next quarter - so use Q4 2007 Nov07 yield of 4.07 for 10-year yield to start and update every quarter, using actuals provided.

** Naïve Forecast (annual) uses 10-year yield at the end of previous quarter to forecast for next 4 quarters - so use Q4 2007 Nov07 yield of 4.07 for 10-year yield to start and update every 4 quarters, using actuals provided.

For the Model Approach

			Naïve Annual Forecast										GCAN10YR	Actual - Forecast								Forecast Error = Error/Actual (%)							
Calendar Quarter		Fiscal Quarter	2009 GRA	2010 GRA	2011 GRA	2012 GRA	2013 GRA	2014 GRA	2015 GRA	2016 GRA	2017 GRA	Olympic	Fiscal Quarter Actual	2009 GRA	2010 GRA	2011 GRA	2012 GRA	2013 GRA	2014 GRA	2015 GRA	2016 GRA	2009 GRA	2010 GRA	2011 GRA	2012 GRA	2013 GRA	2014 GRA	2015 GRA	2016 GRA
2008	Q1	Feb-08	4.07%										3.71%	-0.36%								-9.67%							
	Q2	May-08	4.07%										3.53%	-0.54%								-15.17%							
	Q3	Aug-08	4.07%										3.32%	-0.75%								-22.44%							
	Q4	Nov-08	4.07%										3.13%	-0.94%								-29.99%							
2009	Q1	Feb-09	4.07%	3.13%									3.39%	-0.69%	0.25%							-20.24%	7.50%						
	Q2	May-09	4.07%	3.13%									3.38%	-0.70%	0.24%							-20.59%	7.23%						
	Q3	Aug-09	4.07%	3.13%									3.22%	-0.85%	0.09%							-26.28%	2.85%						
	Q4	Nov-09	4.07%	3.13%									3.39%	-0.68%	0.26%							-20.02%	7.67%						
2010	Q1	Feb-10	4.07%	3.13%	3.39%								3.35%	-0.72%	0.22%	-0.04%						-21.60%	6.45%	-1.31%					
	Q2	May-10	4.07%	3.13%	3.39%								2.76%	-1.31%	-0.37%	-0.63%						-47.57%	-13.52%	-22.95%					
	Q3	Aug-10	4.07%	3.13%	3.39%								3.12%	-0.95%	-0.01%	-0.27%						-30.37%	-0.29%	-8.62%					
	Q4	Nov-10	4.07%	3.13%	3.39%								3.30%	-0.77%	0.17%	-0.09%						-23.37%	5.09%	-2.79%					
2011	Q1	Feb-11	4.07%	3.13%	3.39%	3.30%							3.07%	-1.00%	-0.06%	-0.32%	-0.23%					-32.40%	-1.85%	-10.31%	-7.32%				
	Q2	May-11	4.07%	3.13%	3.39%	3.30%							2.49%	-1.58%	-0.64%	-0.90%	-0.81%					-63.45%	-25.74%	-36.18%	-32.49%				
	Q3	Aug-11	4.07%	3.13%	3.39%	3.30%							2.15%	-1.92%	-0.98%	-1.24%	-1.15%					-89.21%	-45.56%	-57.65%	-53.37%				
	Q4	Nov-11	4.07%	3.13%	3.39%	3.30%							1.99%	-2.08%	-1.14%	-1.40%	-1.31%					-104.83%	-57.57%	-70.66%	-66.03%				
2012	Q1	Feb-12	4.07%	3.13%	3.39%	3.30%	1.99%						1.74%	-2.33%	-1.39%	-1.65%	-1.56%	-0.25%				-133.91%	-79.94%	-94.89%	-89.60%	-14.20%			
	Q2	May-12	4.07%	3.13%	3.39%	3.30%	1.99%						1.77%	-2.30%	-1.36%	-1.62%	-1.53%	-0.22%				-129.94%	-76.89%	-91.58%	-86.38%	-12.26%			
	Q3	Aug-12	4.07%	3.13%	3.39%	3.30%	1.99%						1.70%	-2.37%	-1.43%	-1.69%	-1.60%	-0.29%				-139.41%	-84.18%	-99.47%	-94.06%	-16.88%			
	Q4	Nov-12	4.07%	3.13%	3.39%	3.30%	1.99%						1.84%	-2.23%	-1.29%	-1.55%	-1.46%	-0.15%				-121.56%	-70.44%	-84.59%	-79.59%	-8.17%			
2013	Q1	Feb-13		3.13%	3.39%	3.30%	1.99%	1.84%					2.06%		-1.07%	-1.33%	-1.24%	0.08%	0.23%				-51.70%	-64.29%	-59.84%	3.73%	11.00%		
	Q2	May-13		3.13%	3.39%	3.30%	1.99%	1.84%					2.62%		-0.52%	-0.78%	-0.68%	0.63%	0.78%				-19.69%	-29.63%	-26.11%	24.04%	29.78%		
	Q3	Aug-13		3.13%	3.39%	3.30%	1.99%	1.84%					2.56%		-0.58%	-0.84%	-0.74%	0.57%	0.72%				-22.50%	-32.67%	-29.07%	22.26%	28.13%		
	Q4	Nov-13		3.13%	3.39%	3.30%	1.99%	1.84%					2.43%		-0.71%	-0.97%	-0.87%	0.44%	0.59%				-29.11%	-39.84%	-36.04%	18.06%	24.25%		
2014	Q1	Feb-14			3.39%	3.30%	1.99%	1.84%	2.43%				2.25%			-1.15%	-1.05%	0.26%	0.41%	-0.18%				-50.98%	-46.88%	11.53%	18.21%	-7.97%	
	Q2	May-14			3.39%	3.30%	1.99%	1.84%	2.43%				2.00%			-1.40%	-1.30%	0.01%	0.16%	-0.43%				-69.97%	-65.36%	0.40%	7.92%	-21.55%	
	Q3	Aug-14			3.39%	3.30%	1.99%	1.84%	2.43%				1.86%			-1.53%	-1.44%	-0.13%	0.02%	-0.57%				-82.51%	-77.56%	-6.94%	1.13%	-30.52%	
	Q4	Nov-14			3.39%	3.30%	1.99%	1.84%	2.43%				1.30%			-2.09%	-2.00%	-0.69%	-0.54%	-1.13%				-160.85%	-153.77%	-52.85%	-41.31%	-86.54%	
2015	Q1	Feb-15				3.30%	1.99%	1.84%	2.43%	1.30%			1.62%				-1.68%	-0.36%	-0.21%	-0.80%	0.32%				-103.14%	-22.35%	-13.12%	-49.32%	19.95%
	Q2	May-15				3.30%	1.99%	1.84%	2.43%	1.30%			1.62%				-1.68%	-0.36%	-0.21%	-0.80%	0.32%				-103.14%	-22.35%	-13.12%	-49.32%	19.95%
	Q3	Aug-15				3.30%	1.99%	1.84%	2.43%	1.30%			1.49%				-1.81%	-0.50%	-0.35%	-0.94%	0.19%				-121.41%	-33.36%	-23.29%	-62.75%	12.75%
	Q4	Nov-15				3.30%	1.99%	1.84%	2.43%	1.30%			1.57%				-1.73%	-0.42%	-0.27%	-0.86%	0.27%				-110.13%	-26.56%	-17.01%	-54.46%	17.20%
2016	Q1	Feb-16					1.99%	1.84%	2.43%	1.30%	1.57%	1.57%	1.19%					-0.80%	-0.65%	-1.24%	-0.11%					-66.97%	-54.37%	-103.78%	-9.24%
	Q2	May-16					1.99%	1.84%	2.43%	1.30%	1.57%	1.57%																	
	Q3	Aug-16					1.99%	1.84%	2.43%	1.30%	1.57%	1.57%																	
	Q4	Nov-16					1.99%	1.84%	2.43%	1.30%	1.57%	1.57%																	
2017	Q1	Feb-17						1.84%	2.43%	1.30%	1.57%	1.57%																	
	Q2	May-17						1.84%	2.43%	1.30%	1.57%	1.57%																	
	Q3	Aug-17						1.84%	2.43%	1.30%	1.57%	1.57%																	
	Q4	Nov-17						1.84%	2.43%	1.30%	1.57%	1.57%																	
2018	Q1	Feb-18							2.43%	1.30%	1.57%	1.57%																	
	Q2	May-18							2.43%	1.30%	1.57%	1.57%																	
	Q3	Aug-18							2.43%	1.30%	1.57%	1.57%																	
	Q4	Nov-18							2.43%	1.30%	1.57%	1.57%																	
2019	Q1	Feb-19								1.30%	1.57%	1.57%																	
	Q2	May-19								1.30%	1.57%	1.57%																	
	Q3	Aug-19								1.30%	1.57%	1.57%																	
	Q4	Nov-19								1.30%	1.57%	1.57%																	
2020	Q1	Feb-20									1.57%	1.57%																	
	Q2	May-20									1.57%	1.57%																	
	Q3	Aug-20									1.57%	1.57%																	
	Q4	Nov-20									1.57%	1.57%																	

Summary statistics:

Actual - Forecast

	2009 GRA	2010 GRA	2011 GRA	2012 GRA	2013 GRA	2014 GRA	2015 GRA	2016 GRA	WT Av
Average	-1.30%	-0.52%	-1.07%	-1.29%	-0.13%	0.05%	-0.77%	0.20%	**-0.73%**
Median	-0.95%	-0.55%	-1.19%	-1.38%	-0.22%	0.02%	-0.80%	0.27%	
Max	-0.54%	0.26%	-0.04%	-0.23%	0.63%	0.78%	-0.18%	0.32%	
Min	-2.37%	-1.43%	-2.09%	-2.00%	-0.80%	-0.65%	-1.24%	-0.11%	
StdDev	0.68%	0.63%	0.58%	0.45%	0.41%	0.47%	0.33%	0.18%	

Error/Actual (%)

	2009 GRA	2010 GRA	2011 GRA	2012 GRA	2013 GRA	2014 GRA	2015 GRA	2016 GRA	WT Av
Average	-57.49%	-27.11%	-55.59%	-72.06%	-11.93%	-3.21%	-51.80%	12.12%	**-39.48%**
Median	-30.37%	-21.09%	-54.31%	-71.79%	-12.26%	1.13%	-49.32%	17.20%	
Max	-15.17%	7.67%	-1.31%	-7.32%	24.04%	29.78%	-7.97%	19.95%	
Min	-139.41%	-84.18%	-160.85%	-153.77%	-66.97%	-54.37%	-103.78%	-9.24%	
StdDev	45.95%	32.89%	40.28%	36.85%	24.97%	26.59%	30.28%	12.30%	

Calendar Quarter	Fiscal Quarter	2009 GRA	2010 GRA	2011 GRA	2012 GRA	2013 GRA	2014 GRA	2015 GRA	2016 GRA	2017 GRA	Olympic	Fiscal Quarter Actual	A-F 2009 GRA	A-F 2010 GRA	A-F 2011 GRA	A-F 2012 GRA	A-F 2013 GRA	A-F 2014 GRA	A-F 2015 GRA	A-F 2016 GRA	Err 2009 GRA	Err 2010 GRA	Err 2011 GRA	Err 2012 GRA	Err 2013 GRA	Err 2014 GRA	Err 2015 GRA	Err 2016 GRA
2008 Q1	Feb-08	3.87%										3.71%	-0.16%								-4.40%							
Q2	May-08	3.81%										3.53%	-0.28%								-7.81%							
Q3	Aug-08	3.92%										3.32%	-0.60%								-18.01%							
Q4	Nov-08	4.04%										3.13%	-0.90%								-28.87%							
2009 Q1	Feb-09	4.10%	3.00%									3.39%	-0.71%	0.38%							-20.97%	11.29%						
Q2	May-09	4.14%	2.90%									3.38%	-0.77%	0.47%							-22.74%	13.99%						
Q3	Aug-09	4.19%	2.93%									3.22%	-0.96%	0.30%							-29.85%	9.15%						
Q4	Nov-09	4.26%	2.98%									3.39%	-0.87%	0.41%							-25.63%	12.03%						
2010 Q1	Feb-10	4.68%	3.04%	3.48%								3.35%	-1.34%	0.30%	-0.14%						-39.91%	9.08%	-4.06%					
Q2	May-10	4.70%	3.09%	3.55%								2.76%	-1.94%	-0.33%	-0.79%						-70.27%	-12.06%	-28.55%					
Q3	Aug-10	4.71%	3.14%	3.61%								3.12%	-1.59%	-0.02%	-0.49%						-50.81%	-0.59%	-15.57%					
Q4	Nov-10	4.71%	3.21%	3.69%								3.30%	-1.41%	0.09%	-0.39%						-42.87%	2.75%	-11.85%					
2011 Q1	Feb-11	4.72%	3.38%	3.73%	3.30%							3.07%	-1.65%	-0.31%	-0.66%	-0.23%					-53.53%	-9.97%	-21.35%	-7.42%				
Q2	May-11	4.71%	3.51%	3.75%	3.39%							2.49%	-2.22%	-1.02%	-1.26%	-0.90%					-89.15%	-41.01%	-50.57%	-36.02%				
Q3	Aug-11	4.71%	3.63%	3.82%	3.40%							2.15%	-2.56%	-1.48%	-1.67%	-1.25%					-119.02%	-68.86%	-77.62%	-57.93%				
Q4	Nov-11	4.73%	3.71%	3.92%	3.52%							1.99%	-2.74%	-1.72%	-1.93%	-1.53%					-137.81%	-86.77%	-97.31%	-77.00%				
2012 Q1	Feb-12	4.80%	3.79%	3.96%	3.57%	2.00%						1.74%	-3.06%	-2.05%	-2.22%	-1.83%	-0.26%				-175.59%	-117.62%	-127.83%	-105.14%	-14.86%			
Q2	May-12	4.80%	3.90%	4.03%	3.62%	2.16%						1.77%	-3.03%	-2.13%	-2.26%	-1.85%	-0.31%				-170.92%	-120.32%	-127.75%	-104.49%	-17.57%			
Q3	Aug-12	4.80%	3.93%	4.05%	3.69%	2.16%						1.70%	-3.10%	-2.23%	-2.35%	-1.99%	-0.46%				-182.07%	-131.09%	-138.40%	-117.32%	-26.97%			
Q4	Nov-12	4.80%	3.93%	4.05%	3.75%	2.23%						1.84%	-2.96%	-2.09%	-2.22%	-1.91%	-0.39%				-161.03%	-113.85%	-120.62%	-104.11%	-21.45%			
2013 Q1	Feb-13		3.93%	4.05%	4.03%	2.29%	1.85%					2.06%		-1.86%	-1.99%	-1.97%	-0.22%	0.21%				-90.32%	-96.35%	-95.45%	-10.76%	10.20%		
Q2	May-13		3.94%	4.05%	4.07%	2.34%	1.88%					2.62%		-1.33%	-1.44%	-1.46%	0.28%	0.74%				-50.66%	-54.93%	-55.76%	10.70%	28.19%		
Q3	Aug-13		4.03%	4.11%	4.07%	2.42%	1.96%					2.56%		-1.48%	-1.55%	-1.52%	0.14%	0.60%				-57.76%	-60.75%	-59.39%	5.38%	23.47%		
Q4	Nov-13		4.27%	4.31%	4.07%	2.47%	2.03%					2.43%		-1.84%	-1.88%	-1.65%	-0.04%	0.40%				-75.92%	-77.61%	-68.00%	-1.79%	16.35%		
2014 Q1	Feb-14			4.49%	4.08%	2.48%	2.13%	2.52%				2.25%			-2.24%	-1.83%	-0.24%	0.12%	-0.28%				-99.94%	-81.61%	-10.57%	5.12%	-12.25%	
Q2	May-14			4.55%	4.08%	2.50%	2.23%	2.62%				2.00%			-2.56%	-2.09%	-0.50%	-0.23%	-0.63%				-128.26%	-104.71%	-25.24%	-11.70%	-31.34%	
Q3	Aug-14			4.56%	4.09%	2.52%	2.28%	2.71%				1.86%			-2.70%	-2.24%	-0.66%	-0.42%	-0.85%				-145.18%	-120.34%	-35.55%	-22.63%	-45.78%	
Q4	Nov-14			4.56%	4.21%	2.59%	2.33%	2.78%				1.30%			-3.26%	-2.91%	-1.29%	-1.03%	-1.48%				-250.42%	-223.93%	-99.12%	-79.31%	-113.94%	
2015 Q1	Feb-15				4.45%	2.71%	2.33%	2.85%	1.38%			1.62%				-2.83%	-1.08%	-0.71%	-1.23%	0.24%				-174.26%	-66.78%	-43.69%	-75.65%	14.77%
Q2	May-15				4.56%	2.77%	2.34%	2.92%	1.50%			1.62%				-2.93%	-1.14%	-0.72%	-1.30%	0.13%				-180.62%	-70.47%	-44.30%	-80.08%	7.79%
Q3	Aug-15				4.56%	2.88%	2.49%	3.00%	1.58%			1.49%				-3.07%	-1.39%	-1.00%	-1.51%	-0.09%				-206.04%	-93.52%	-67.35%	-101.23%	-6.21%
Q4	Nov-15				4.56%	3.00%	2.60%	3.07%	1.67%			1.57%				-2.99%	-1.43%	-1.03%	-1.50%	-0.10%				-190.45%	-90.99%	-65.83%	-95.47%	-6.48%
2016 Q1	Feb-16					3.13%	2.72%	3.06%	1.76%	1.45%	1.42%	1.19%					-1.94%	-1.53%	-1.87%	-0.57%					-163.32%	-128.87%	-157.51%	-47.62%
Q2	May-16					3.30%	2.81%	3.13%	1.85%	1.50%	1.47%																	
Q3	Aug-16					3.46%	2.91%	3.20%	1.94%	1.57%	1.55%																	
Q4	Nov-16					3.51%	3.04%	3.27%	2.00%	1.66%	1.66%																	
2017 Q1	Feb-17						3.13%	3.37%	2.26%	1.76%	1.81%																	
Q2	May-17						3.25%	3.46%	2.36%	1.86%	1.91%																	
Q3	Aug-17						3.35%	3.52%	2.41%	1.93%	1.98%																	
Q4	Nov-17						3.35%	3.52%	2.43%	2.00%	2.16%																	
2018 Q1	Feb-18							3.52%	2.43%	2.04%	2.37%																	
Q2	May-18							3.52%	2.43%	2.13%	2.45%																	
Q3	Aug-18							3.52%	2.43%	2.28%	2.57%																	
Q4	Nov-18							3.52%	2.43%	2.44%	2.68%																	
2019 Q1	Feb-19								2.43%	2.48%	2.71%																	
Q2	May-19								2.43%	2.48%	2.72%																	
Q3	Aug-19								2.43%	2.48%	2.72%																	
Q4	Nov-19								2.43%	2.48%	2.73%																	
2020 Q1	Feb-20									2.48%	2.73%																	
Q2	May-20									2.48%	2.73%																	
Q3	Aug-20									2.48%	2.74%																	
Q4	Nov-20									2.48%	2.74%																	

Error/Actual (%)

Actual – Forecast summary

	2009 GRA	2010 GRA	2011 GRA	2012 GRA	2013 GRA	2014 GRA	2015 GRA	2016 GRA	WT Av
Average	-1.72%	-0.90%	-1.70%	-1.95%	-0.64%	-0.36%	-1.18%	-0.08%	**-1.22%**
Median	-1.59%	-1.17%	-1.91%	-1.88%	-0.46%	-0.42%	-1.30%	-0.09%	
Max	-0.28%	0.47%	-0.14%	-0.23%	0.28%	0.74%	-0.28%	0.24%	
Min	-3.10%	-2.23%	-3.26%	-3.07%	-1.94%	-1.53%	-1.87%	-0.57%	
StdDev	0.96%	1.02%	0.85%	0.74%	0.63%	0.72%	0.50%	0.31%	

Error/Actual (%) summary

	2009 GRA	2010 GRA	2011 GRA	2012 GRA	2013 GRA	2014 GRA	2015 GRA	2016 GRA	WT Av
Average	-76.15%	-45.93%	-86.75%	-108.50%	-43.11%	-29.26%	-79.25%	-7.55%	**-66.21%**
Median	-50.81%	-45.84%	-86.98%	-104.30%	-25.24%	-22.63%	-80.08%	-6.21%	
Max	-7.81%	13.99%	-4.06%	-7.42%	10.70%	28.19%	-12.25%	14.77%	
Min	-182.07%	-131.09%	-250.42%	-223.93%	-163.32%	-128.87%	-157.51%	-47.62%	
StdDev	61.28%	51.78%	59.75%	58.99%	47.00%	47.35%	44.71%	24.20%	

Government of Canada 10 Year Bond Rate

Historical Forecast — **Actual - Forecast**

Calendar Quarter		Fiscal Quarter	2009 GRA	2010 GRA	2011 GRA	2012 GRA	2013 GRA	2014 GRA	2015 GRA	2016 GRA	2017 GRA	Olympic	Fiscal Quarter Actual	2009 GRA	2010 GRA	2011 GRA	2012 GRA	2013 GRA	2014 GRA
2008	Q1	Feb-08	3.68%										3.71%	0.03%					
	Q2	May-08	3.55%										3.53%	-0.02%					
	Q3	Aug-08	3.78%										3.32%	-0.45%					
	Q4	Nov-08	4.00%										3.13%	-0.87%					
2009	Q1	Feb-09	4.12%	2.88%									3.39%	-0.74%	0.51%				
	Q2	May-09	4.22%	2.68%									3.38%	-0.84%	0.70%				
	Q3	Aug-09	4.30%	2.73%									3.22%	-1.08%	0.50%				
	Q4	Nov-09	4.45%	2.84%									3.39%	-1.06%	0.56%				
2010	Q1	Feb-10	5.30%	2.96%	3.58%								3.35%	-1.95%	0.39%	-0.23%			
	Q2	May-10	5.32%	3.05%	3.70%								2.76%	-2.56%	-0.29%	-0.94%			
	Q3	Aug-10	5.35%	3.15%	3.83%								3.12%	-2.22%	-0.03%	-0.70%			
	Q4	Nov-10	5.36%	3.29%	3.99%								3.30%	-2.06%	0.01%	-0.69%			
2011	Q1	Feb-11	5.37%	3.63%	4.07%	3.31%							3.07%	-2.29%	-0.56%	-1.00%	-0.23%		
	Q2	May-11	5.35%	3.89%	4.11%	3.48%							2.49%	-2.86%	-1.40%	-1.62%	-0.99%		
	Q3	Aug-11	5.35%	4.13%	4.25%	3.50%							2.15%	-3.20%	-1.98%	-2.10%	-1.34%		
	Q4	Nov-11	5.38%	4.29%	4.45%	3.74%							1.99%	-3.39%	-2.30%	-2.46%	-1.75%		
2012	Q1	Feb-12	5.52%	4.44%	4.54%	3.84%	2.01%						1.74%	-3.78%	-2.70%	-2.80%	-2.10%	-0.27%	
	Q2	May-12	5.52%	4.67%	4.67%	3.94%	2.18%						1.77%	-3.75%	-2.90%	-2.90%	-2.17%	-0.41%	
	Q3	Aug-12	5.52%	4.73%	4.71%	4.09%	2.33%						1.70%	-3.82%	-3.03%	-3.01%	-2.39%	-0.63%	
	Q4	Nov-12	5.52%	4.73%	4.71%	4.20%	2.48%						1.84%	-3.68%	-2.89%	-2.88%	-2.36%	-0.64%	
2013	Q1	Feb-13		4.73%	4.71%	4.77%	2.59%	1.87%					2.06%		-2.66%	-2.65%	-2.71%	-0.52%	0.19%
	Q2	May-13		4.75%	4.71%	4.85%	2.69%	1.92%					2.62%		-2.14%	-2.10%	-2.23%	-0.07%	0.70%
	Q3	Aug-13		4.93%	4.83%	4.85%	2.85%	2.08%					2.56%		-2.38%	-2.27%	-2.29%	-0.29%	0.48%
	Q4	Nov-13		5.40%	5.22%	4.85%	2.95%	2.22%					2.43%		-2.98%	-2.80%	-2.42%	-0.53%	0.21%
2014	Q1	Feb-14			5.59%	4.86%	2.98%	2.43%	2.62%				2.25%			-3.34%	-2.61%	-0.73%	-0.18%
	Q2	May-14			5.72%	4.87%	3.01%	2.62%	2.82%				2.00%			-3.72%	-2.87%	-1.02%	-0.63%
	Q3	Aug-14			5.72%	4.89%	3.05%	2.72%	2.99%				1.86%			-3.86%	-3.03%	-1.19%	-0.86%
	Q4	Nov-14			5.72%	5.12%	3.19%	2.83%	3.14%				1.30%				-3.82%	-1.89%	-1.53%
2015	Q1	Feb-15				5.61%	3.43%	2.83%	3.28%	1.47%			1.62%				-3.98%	-1.81%	-1.21%
	Q2	May-15				5.82%	3.55%	2.85%	3.42%	1.70%			1.62%				-4.19%	-1.93%	-1.23%
	Q3	Aug-15				5.82%	3.78%	3.15%	3.57%	1.87%			1.49%				-4.33%	-2.29%	-1.66%
	Q4	Nov-15				5.82%	4.01%	3.37%	3.71%	2.04%			1.57%				-4.25%	-2.44%	-1.80%
2016	Q1	Feb-16					4.28%	3.61%	3.70%	2.21%	1.33%	1.27%	1.19%					-3.09%	-2.42%
	Q2	May-16					4.62%	3.78%	3.83%	2.40%	1.42%	1.37%							
	Q3	Aug-16					4.94%	3.98%	3.97%	2.57%	1.58%	1.52%							
	Q4	Nov-16					5.03%	4.24%	4.12%	2.70%	1.76%	1.75%							
2017	Q1	Feb-17						4.43%	4.32%	3.22%	1.95%	2.05%							
	Q2	May-17						4.67%	4.50%	3.41%	2.14%	2.24%							
	Q3	Aug-17						4.86%	4.62%	3.52%	2.28%	2.38%							
	Q4	Nov-17						4.87%	4.62%	3.55%	2.43%	2.75%							
2018	Q1	Feb-18							4.62%	3.55%	2.51%	3.17%							
	Q2	May-18							4.62%	3.55%	2.68%	3.34%							
	Q3	Aug-18							4.62%	3.55%	2.98%	3.56%							
	Q4	Nov-18							4.62%	3.55%	3.30%	3.78%							
2019	Q1	Feb-19								3.55%	3.39%	3.85%							
	Q2	May-19								3.55%	3.39%	3.87%							
	Q3	Aug-19								3.55%	3.39%	3.88%							
	Q4	Nov-19								3.55%	3.39%	3.89%							
2020	Q1	Feb-20									3.39%	3.89%							
	Q2	May-20									3.39%	3.90%							
	Q3	Aug-20									3.39%	3.90%							
	Q4	Nov-20									3.39%	3.90%							

	2009 GRA	2010 GRA	2011 GRA	2012 GRA	2013 GRA	2014 GRA
Average	-2.14%	-1.28%	-2.21%	-2.60%	-1.16%	-0.76%
Median	-2.22%	-1.69%	-2.46%	-2.41%	-0.73%	-0.86%
Max	-0.02%	0.70%	-0.23%	-0.23%	-0.07%	0.70%
Min	-3.82%	-3.03%	-3.86%	-4.33%	-3.09%	-2.42%
StdDev	1.27%	1.45%	1.07%	1.11%	0.90%	0.98%

General Forecasting of Rates

Calendar Quarter		Fiscal Quarter Actual	Most Recent GRA Forecast	Actual-Forecast	Naïve Forecast (quarterly)*	Actual - Naïve (quarterly)	Naïve Forecast (annually)**	Actual - Naïve (annually)
2008	Q1	3.71%	3.68%	0.03%	4.07%	-0.36%	4.07%	-0.36%
	Q2	3.53%	3.55%	-0.02%	3.71%	-0.18%	4.07%	-0.54%
	Q3	3.32%	3.78%	-0.45%	3.53%	-0.21%	4.07%	-0.75%
	Q4	3.13%	4.00%	-0.87%	3.32%	-0.19%	4.07%	-0.94%
2009	Q1	3.39%	2.88%	0.51%	3.13%	0.25%	3.13%	0.25%
	Q2	3.38%	2.68%	0.70%	3.39%	-0.01%	3.13%	0.24%
	Q3	3.22%	2.73%	0.50%	3.38%	-0.15%	3.13%	0.09%
	Q4	3.39%	2.84%	0.56%	3.22%	0.17%	3.13%	0.26%
2010	Q1	3.35%	3.58%	-0.23%	3.39%	-0.04%	3.39%	-0.04%
	Q2	2.76%	3.70%	-0.94%	3.35%	-0.59%	3.39%	-0.63%
	Q3	3.12%	3.83%	-0.70%	2.76%	0.36%	3.39%	-0.27%
	Q4	3.30%	3.99%	-0.69%	3.12%	0.18%	3.39%	-0.09%
2011	Q1	3.07%	3.31%	-0.23%	3.30%	-0.23%	3.30%	-0.23%
	Q2	2.49%	3.48%	-0.99%	3.07%	-0.58%	3.30%	-0.81%
	Q3	2.15%	3.50%	-1.34%	2.49%	-0.34%	3.30%	-1.15%
	Q4	1.99%	3.74%	-1.75%	2.15%	-0.16%	3.30%	-1.31%
2012	Q1	1.74%	2.01%	-0.27%	1.99%	-0.25%	1.99%	-0.25%
	Q2	1.77%	2.18%	-0.41%	1.74%	0.03%	1.99%	-0.22%
	Q3	1.70%	2.33%	-0.63%	1.77%	-0.07%	1.99%	-0.29%
	Q4	1.84%	2.48%	-0.64%	1.70%	0.14%	1.99%	-0.15%
2013	Q1	2.06%	1.87%	0.19%	1.84%	0.23%	1.84%	0.23%
	Q2	2.62%	1.92%	0.70%	2.06%	0.55%	1.84%	0.78%
	Q3	2.56%	2.08%	0.48%	2.62%	-0.06%	1.84%	0.72%
	Q4	2.43%	2.22%	0.21%	2.56%	-0.13%	1.84%	0.59%
2014	Q1	2.25%	2.62%	-0.37%	2.43%	-0.18%	2.43%	-0.18%
	Q2	2.00%	2.82%	-0.82%	2.25%	-0.25%	2.43%	-0.43%
	Q3	1.86%	2.99%	-1.13%	2.00%	-0.14%	2.43%	-0.57%
	Q4	1.30%	3.14%	-1.84%	1.86%	-0.56%	2.43%	-1.13%
2015	Q1	1.62%	1.47%	0.16%	1.30%	0.32%	1.30%	0.32%
	Q2	1.62%	1.70%	-0.07%	1.62%	0.00%	1.30%	0.32%
	Q3	1.49%	1.87%	-0.38%	1.62%	-0.13%	1.30%	0.19%
	Q4	1.57%	2.04%	-0.47%	1.49%	0.08%	1.30%	0.27%
2016	Q1	1.19%	1.33%	-0.14%	1.57%	-0.38%	1.57%	-0.38%
		Actual	Most Recent GRA Forecast	Actual-Forecast	Naïve Forecast (quarterly)*	Actual - Naïve (quarterly)	Naïve Forecast (annually)**	Actual - Naïve (annually)
	Average	2.45%	2.80%	-0.34%	2.54%	-0.09%	2.65%	-0.19%
	Median	2.43%	2.82%	-0.37%	2.49%	-0.13%	2.43%	-0.22%
	Max	3.71%	4.00%	0.70%	4.07%	0.55%	4.07%	0.78%
	Min	1.19%	1.33%	-1.84%	1.30%	-0.59%	1.30%	-1.31%
	StdDev	0.76%	0.80%	0.66%	0.78%	0.27%	0.90%	0.53%

* Naïve Forecast (quarterly) uses 10-year yield at the end of previous quarter to forecast for next quarter - so use Q4 2007 Nov07 yield of 4.07 for 10-year yield to start and update every quarter, usir

** Naïve Forecast (annual) uses 10-year yield at the end of previous quarter to forecast for next 4 quarters - so use Q4 2007 Nov07 yield of 4.07 for 10-year yield to start and update every 4 quarters,

For the Model Approach

Naïve/Forecasts Annual Forecast GCAN10YR **Actual - Forecast**

Calendar Quarter	Fiscal Quarter	Fiscal Quarter	2009 GRA	2010 GRA	2011 GRA	2012 GRA	2013 GRA	2014 GRA	2015 GRA	2016 GRA	2017 GRA	Olympic	Fiscal Quarter Actual	2009 GRA	2010 GRA	2011 GRA	2012 GRA	2013 GRA	2014 GRA
2008	Q1	Feb-08	4.07%										3.71%	-0.36%					
	Q2	May-08	4.07%										3.53%	-0.54%					
	Q3	Aug-08	4.07%										3.32%	-0.75%					
	Q4	Nov-08	4.07%										3.13%	-0.94%					
2009	Q1	Feb-09	4.07%	3.13%									3.39%	-0.69%	0.25%				
	Q2	May-09	4.07%	3.13%									3.38%	-0.70%	0.24%				
	Q3	Aug-09	4.07%	3.13%									3.22%	-0.85%	0.09%				
	Q4	Nov-09	4.07%	3.13%									3.39%	-0.68%	0.26%				
2010	Q1	Feb-10	4.07%	3.13%	3.39%								3.35%	-0.72%	0.22%	-0.04%			
	Q2	May-10	4.07%	3.13%	3.39%								2.76%	-1.31%	-0.37%	-0.63%			
	Q3	Aug-10	4.07%	3.13%	3.39%								3.12%	-0.95%	-0.01%	-0.27%			
	Q4	Nov-10	4.07%	3.13%	3.39%								3.30%	-0.77%	0.17%	-0.09%			
2011	Q1	Feb-11	4.07%	3.13%	3.39%	3.30%							3.07%	-1.00%	-0.06%	-0.32%	-0.23%		
	Q2	May-11	4.07%	3.13%	3.39%	3.30%							2.49%	-1.58%	-0.64%	-0.90%	-0.81%		
	Q3	Aug-11	4.07%	3.13%	3.39%	3.30%							2.15%	-1.92%	-0.98%	-1.24%	-1.15%		
	Q4	Nov-11	4.07%	3.13%	3.39%	3.30%							1.99%	-2.08%	-1.14%	-1.40%	-1.31%		
2012	Q1	Feb-12	4.07%	3.13%	3.39%	3.30%	1.99%						1.74%	-2.33%	-1.39%	-1.65%	-1.56%	-0.25%	
	Q2	May-12	4.07%	3.13%	3.39%	3.30%	1.99%						1.77%	-2.30%	-1.36%	-1.62%	-1.53%	-0.22%	
	Q3	Aug-12	4.07%	3.13%	3.39%	3.30%	1.99%						1.70%	-2.37%	-1.43%	-1.69%	-1.60%	-0.29%	
	Q4	Nov-12	4.07%	3.13%	3.39%	3.30%	1.99%						1.84%	-2.23%	-1.29%	-1.55%	-1.46%	-0.15%	
2013	Q1	Feb-13		3.13%	3.39%	3.30%	1.99%	1.84%					2.06%		-1.07%	-1.33%	-1.24%	0.08%	0.23%
	Q2	May-13		3.13%	3.39%	3.30%	1.99%	1.84%					2.62%		-0.52%	-0.78%	-0.68%	0.63%	0.78%
	Q3	Aug-13		3.13%	3.39%	3.30%	1.99%	1.84%					2.56%		-0.58%	-0.84%	-0.74%	0.57%	0.72%
	Q4	Nov-13		3.13%	3.39%	3.30%	1.99%	1.84%					2.43%		-0.71%	-0.97%	-0.87%	0.44%	0.59%
2014	Q1	Feb-14			3.39%	3.30%	1.99%	1.84%	2.43%				2.25%			-1.15%	-1.05%	0.26%	0.41%
	Q2	May-14			3.39%	3.30%	1.99%	1.84%	2.43%				2.00%			-1.40%	-1.30%	0.01%	0.16%
	Q3	Aug-14			3.39%	3.30%	1.99%	1.84%	2.43%				1.86%			-1.53%	-1.44%	-0.13%	0.02%
	Q4	Nov-14			3.39%	3.30%	1.99%	1.84%	2.43%				1.30%			-2.09%	-2.00%	-0.69%	-0.54%
2015	Q1	Feb-15				3.30%	1.99%	1.84%	2.43%	1.30%			1.62%				-1.68%	-0.36%	-0.21%
	Q2	May-15				3.30%	1.99%	1.84%	2.43%	1.30%			1.62%				-1.68%	-0.36%	-0.21%
	Q3	Aug-15				3.30%	1.99%	1.84%	2.43%	1.30%			1.49%				-1.81%	-0.50%	-0.35%
	Q4	Nov-15				3.30%	1.99%	1.84%	2.43%	1.30%			1.57%				-1.73%	-0.42%	-0.27%
2016	Q1	Feb-16					1.99%	1.84%	2.43%	1.30%	1.57%	1.57%	1.19%					-0.80%	-0.65%
	Q2	May-16					1.99%	1.84%	2.43%	1.30%	1.57%	1.57%							
	Q3	Aug-16					1.99%	1.84%	2.43%	1.30%	1.57%	1.57%							
	Q4	Nov-16					1.99%	1.84%	2.43%	1.30%	1.57%	1.57%							
2017	Q1	Feb-17						1.84%	2.43%	1.30%	1.57%	1.57%							
	Q2	May-17						1.84%	2.43%	1.30%	1.57%	1.57%							
	Q3	Aug-17						1.84%	2.43%	1.30%	1.57%	1.57%							
	Q4	Nov-17						1.84%	2.43%	1.30%	1.57%	1.57%							
2018	Q1	Feb-18							2.43%	1.30%	1.57%	1.57%							
using actu	Q2	May-18							2.43%	1.30%	1.57%	1.57%							
	Q3	Aug-18							2.43%	1.30%	1.57%	1.57%							
	Q4	Nov-18							2.43%	1.30%	1.57%	1.57%							
2019	Q1	Feb-19								1.30%	1.57%	1.57%							
	Q2	May-19								1.30%	1.57%	1.57%							
	Q3	Aug-19								1.30%	1.57%	1.57%							
	Q4	Nov-19								1.30%	1.57%	1.57%							
2020	Q1	Feb-20									1.57%	1.57%							
	Q2	May-20									1.57%	1.57%							
	Q3	Aug-20									1.57%	1.57%							
	Q4	Nov-20									1.57%	1.57%							

	2009 GRA	2010 GRA	2011 GRA	2012 GRA	2013 GRA	2014 GRA
Average	-1.30%	-0.52%	-1.07%	-1.29%	-0.13%	0.05%
Median	-0.95%	-0.55%	-1.19%	-1.38%	-0.22%	0.02%
Max	-0.54%	0.26%	-0.04%	-0.23%	0.63%	0.78%
Min	-2.37%	-1.43%	-2.09%	-2.00%	-0.80%	-0.65%
StdDev	0.68%	0.63%	0.58%	0.45%	0.41%	0.47%