Risk Premium Analysis by Major Sectors on Canadian Stock Market for SIAS Fund

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- Ben H.

Abstract

This thesis research examined what factors impact on the equity risk premium (ERP) of the Canadian large-cap equity market, inspired by the opportunity to receive hands-on experiences of equity valuations for the Simon Fraser University's Student Investment Advisor Service (SIAS) endowment fund. With the given investment policy statements (IPS) of the SIAS fund, this study will focus on the large-cap Canadian equity markets. The methodology of the practice was driven by the study conducted by Dimson, Marsh, and Staunton where the research identified Geometric Mean Dividend Yield, Real Dividend Growth Rate, Expansion in the P/D Ratio, and Change in Real Exchange Rate to determine general U.S. equity market return. The findings from this thesis research had determined three additional factors that can impact on the Canadian equity market return, which included Crude Oil Price Return, Global PMI Return, and US CPI Growth. In addition, similar practices were attempted for the major three sectors of the Canadian equity market, namely energy, material, and financial sectors; and the factors that impact these sectors varies. We have demonstrated an ERP of 3.57% for S&P TSX 60 Index from our own model; where we have 1.66%, 1.70%, 0.79% of ERPs for the energy sector, material sector, and financial sector, respectively.

1.1 Introduction

Understanding the factors that impact the equity risk premium (ERP) is an important analysis since the ERP is constructed with two parts – the expected return from the market and the risk free rate. As of today, there are multiple definitions of ERP as either both long term and the short term of the risk free rate can be implied in the calculations. This paper determined the usage of the Canadian 10 Year Federal Government Bond Rate to be the risk free rate. With the second half of the ERP determined, the focus then turns to understanding what the factors that drive the equity market returns are.

Inspired by the opportunity to analyze the Canadian large-cap stock market with the Student Investment Advisory Service (SIAS) fund, we would like to review and develop regression models that may assist future cohorts to identify key factors that drive historic market returns. In addition, by understanding the factors that may impact the market returns, the usage of the behaviours of the factors can further assist in tactical asset allocation as well. Literature review in the next section discuss what factors had been proven to be key value drivers or risk factors or the general equity markets.

2.1 Literature Reviews

The literature reviews focused on recent studies, as we were interested in finding studies that included data during the financial crisis of 2008. Campbell and Thompson (2007) discuss their findings regarding to historical average of the equity risk premium, modified from the Goyal and Welch (2006) forecasting exercise. The two key findings to observe from this study are first, after implementing sign restrictions on the coefficients, the authors found that most of the predictor variables perform better out-of-sample than the historical average return forecast, of which can directly benefit the investors. Second, the paper demonstrated a mathematical approach on the range of R-square of the regression driven by Sharpe ratio. The authors argue that the R-square should be compared to the squared Sharpe Ratio. If R-square is large relative the squared Sharpe Ratio, then an investor can use the information in the regression analysis to obtain a large proportional increase in the portfolio return. However, as the author stated, a large R-square in a short time horizon is too hard to believe, but believable in a longer time horizon of time series data. Hou, Karolyi, and Kho (2011) revisited Fama-French three-factor model with data constructed with over 27,000 stocks from 49 countries from 1981 to 2003. In a variation, the authors applied size, dividend yield, earnings yield, cash flow-to-price (C/P), book-to-market equity, leverage, and momentum as testing variables to replicate the multi-factor model and highlighted that the addition of the C/P ratio is statically reliable and economically important. The C/P ratio was able to capture significant return differences between industries and countries. The author concluded that the three-factor model that includes the C/P ratio and the momentum factor, in additional to the global market factor, captures a significant portion of the global equity market returns. However, this study ignored the exchange rate factor as the returns from foreign countries were denominated at prevailing exchange rates.

In addition to observing global characteristic factors that drives the market returns, we also review the papers that were conducted specifically to identify key value drivers for individual sectors. Apergis and Miller (2007) investigated the impact of the oil price shocks on the stock market returns. The research takes the sample of eight countries, which includes Canada. The authors apply a vector auto regressive model to divide risk factors into three, which are Oil-Supply Shocks, Global Aggregate Demand shocks and Global Oil-Aggregate Shocks. The proxies of each component is the Consumer Price Index (CPI), of which reflects goods prices; a global index of dry cargo single voyage freight rates, of which reflecting the global economic situation; and US price per barrel of crude oil, representing oil production. The outcomes implicate that oil-structural market shocks is important to explain the stock return adjustment. However, the magnitude of such effect is not big. In the test, it fails to explain the stock return in Australia by oil-supply change and aggregate demand change; and therefore further research is needed to modify the current model and discover the oil-structural shocks impact.

In Yang and Tsatsaronis (2012)'s review for the bank stock returns, the authors attempted to find the key value drivers for the financial institutions. The authors started with the three-factor model: $$R_t^i = \alpha + \beta_M \cdot R_{it}^m + \beta_{HML} \cdot HML_{it} + \beta_{SMB} \cdot SMB_{it} + u_{it}$$

Where R_{it} is market premium, HML is stock return difference between a portfolio of firms with a higher book-to-market ratio and the lower one, and SMB is the stock difference return between the small capital company and the large capital company. As this model could not fully explain the variation among the sample stocks, the authors decide to add 4 assuming risk factors, which are leverage, calculated by total assets over the market value of equity, earnings, book-to-market value of equity and business cycle, of which the authors used the GDP growth deviation as a proxy. The following is the modified model:

$$R_t^i = \alpha + \left(\beta_M + \beta_{LEV\_MKT} LEV_t^i + \beta_{Earning\_MKT} \cdot Earning_t^i\right) \cdot R_t^m + \beta_{HML} HML_t^i + \left(\beta_{SMB} + \beta_{CYL\_MKT} CYL_t^i\right) \cdot SMB_{it} + \varepsilon_t$$

The data included the annual stock returns of 50 actively traded global banks over 11 OECD countries. The result demonstrated all the additional risk factors are meaningful and conclude that higher leverage ratio would lead to lower stock returns. Moreover, higher capital requirements can be beneficial to stock holders.

Another studied completed by King (2009) demonstrated a CAPM approach to estimate the cost of equity for global banks. The author first highlighted the fact that after the 2008 financial crisis, the importance of the Tier 1 Capitals should be more carefully considered in the evaluation. The common equity is the first category of bank capital available to absorb losses; therefore investors would expect to be rewarded for the greater risk they bear. Hence the common equity should be the most expensive form of the bank capital.

The author then took the single factor CAPM approach to try to estimate the cost of equity for global banks headquartered in the major countries including Canada and the U.S., with data set from 1990 to 2009. The study discovered that the real cost of equity decreased steadily across all countries except Japan from 1990 to 2006 but then rose from 2006 onwards. There were clear cyclical patters for each country, which increases the cost of equity of the banking sector in around 1994 and 2000. The author discovered that approximately one-third of the portion of the decrease in the cost of equity reflects the decrease in the risk-free rates, while two-thirds of the portion of the decrease of the cost of equity was explained by the banking sector risk premium. This research also demonstrated a wide variation results across banks indicating the difficulties of estimating the expected return by single factor CAPM mode.

The following two articles are the literatures that we solely based on research on. Dimson, Marsh, and Staunton (2011) updated global estimates of historical ERP that were previously modeled by other academics. The research included 19 countries including Canada, and the dataset included equities, long term bonds, bills, inflation, exchange rates, and GDP, from 1900 to 2010. The findings indicated that equity outperformed bonds, bills, and inflation during the past 110 years, both in nominal terms and in real terms. The article then decomposes ERPs on geometric average for 19 countries, demonstrated a 4.94% and 5.26% for Canada and the U.S. respectively. This premium calculated were broken down into 5 factors, namely Geometric Mean Dividend Yield, Dividend Growth Rate, Change of Price-to-Dividend Ratio, Real Exchange Rate, and US Real Interest Rate. The article concluded that the investors should expect a long-run equity premium (relative to bills) of around 3.0-3.5% on a geometric mean basis, and an arithmetic mean premium for the World index of approximately 4.5-5.0%.

Lastly, we also examined an article by Grinold, Kroner, and Siegel (2011) to get a different perspective of how we may approach the ERP estimation problem. In this article, the authors first noted that there was no clear method on how to measure ERP historically. They highlighted Grinold and Kroner (2002) proposed an alternative model for the ERP that linked the return closely to GDP growth. The main reason behind this model was due to the fact that the authors believe any of the company cannot sustain to grow too fast or too slow compared to the GDP. The Grinold and Kroner model that the authors applied broke down the expected return of equity over a period into 3 factors, namely Income, Earnings Growth, and Re-Pricing Factors. As the authors discovered in their research, the ERP that Grinold and Kroner model suggested back in 2002, evaluated over 2002-2011, was too high. The recent update in 2011 with the existing model, the ERP estimated over the 10-year treasuries is 3.6%. The main issue came from the volatile re-pricing factor, of which was simply the change of the Price-to-Earnings ratio.

Therefore the authors concluded that they were not fully confident with their ERP forecast based on the Grinold and Kroner model, but rather they believe this model can provide a reasonable range for referencing purpose.

Analysis

As discussed in the introduction, the main focus of the ERP analysis underlies in understanding what factors that drives the market returns; since we have determined ERP as the expected market (or sector) returns minus the Canadian 10 Year Federal Government Bond Rate. In the attempt to analyze the factors that drives the historic market return, we first attempt to replicate the approach conducted by Dimson et al (2011). In Dimson model, the authors used the following factors to decompose the historical market returns:

Estimated Return of the Market = Geometric Mean Dividend Yield + Dividend Growth Rate + Change of Price-to-Dividend Ratio + Real Exchange Rate

Since this research is conducted to analyze the U.S. market, we slightly modified the data. The database construction and the result of the replication will be discussed in the section below.

3.1 Database Construction

Since we want to understand the Canadian large-cap market within the context of the SIAS IPS, we focus our research on large-cap Canadian equity markets, of which we have selected S&P TSX 60 Index as our base market return proxy. All of our data used in this research are monthly data observed from **2000/01/01** to **2012/06/30**, and therefore any returns and/or growth rates are annualized, gathered on a monthly basis. For example, the return of a single stock on 2012/06/30 is calculated by the price appreciation from 2011/06/30 to 2012/06/30 plus the dividend paid during this time period, if any. To simplify the study, we assumed there is no reinvestment of the dividends received in the same security. We chose this timer period of 150 months of data for two main reasons: first we want to observe the data that is available to us that can allow us to replicate the studies that were conducted before; and secondly we want to ensure that the data include the most current financial crisis so that we are capturing the affect of the crisis on the market as well. We believe that 150 months of data is sufficient enough to capture at least a business cycle for a cyclical company for the most cases. The sources for our database included **Bloomberg terminal**, **ThomsonOne terminal**, **Federal Reserve Economic Data (FRED)**, and **Yahoo! Finance**. The detailed database description can be found in Appendix A.

Due to the fact that the Canadian stock market in general is heavily weighted in the major three sectors (namely energy sector, material sector, and financial sector), we have decided to break down S&P TSX 60 further, and pull out the sub sector stocks in these three sectors to construct our own sector indices. We have constructed the sub-sector indices with the market-weight method for the consistency with the S&P TSX 60 Index.

Below is a summary of the indices that we will be using in this equity return analysis.

- **S&P TSX 60 Index**

With the reasoning stated above, this Index will be used as a proxy for our Canadian stock market returns.

- **Sub-Sector Indices (Energy, Material & Financial)**

These market-weight indices are constructed by pulling out the company listings as of June 30th, 2012 from S&P TSX 60, and given market weight for each of the stock listing, to compute a market weighted return index. We have encountered some listings that were not listed for the entire time period as the stock listing can vary between time periods; however this does not alter our indices since the replacement stocks' behaviours are closely correlated to the replaced stocks. Our main focus was to generate a sub-sector index that can be representative of the large-cap market for that specific index as the SIAS IPS constraints us to, and we believe the substitutions of the stock throughout the time period does not affect our focus. Therefore we have decided to keep the current TSX 60 listings as our base for the purpose of research.

- **The Key Drivers Used in the Analysis**

The Appendix A shows the variables that will be tested in our analysis. We have selected our variables in a way to represent any of the studies that we meant to replicate. For example, Dimson model highlighted Geometric Mean Dividend Yield, Dividend Growth Rate, Change of Price-to-Dividend Ratio, and Real Exchange Rate as key variables, and we classified these variables as Dimson Model factors under the "Variable Classification" section. In addition, we also want to analyze what are the other macro data that may be affecting the market's returns. As a variation of the Grinold's model, we broke down the GDP function as **GDP = C+I+G+(X-M)**. We try to find reasonable representative proxies for each and every one of the factors in the equation in our analysis. While we would like to use as many economic proxies as possible, we are also aware that we want to focus on monthly data that will be available to us. Therefore our

selection was limited but at the same time representative to key economy drivers. These variables are classified with its representative proxies of the GDP function under the "Variable Classification" section. Lastly, for the variables that we believe that a shocking factor to affect the market returns, we classify these variables as Shock factors under the "Variable Classification" section.

3.2 Methodology

Our methodology to identify key factors that drives the market returns can be separates into three stages. In stage one, the single variables listed in the Appendix A is regressed against the targeted market or sub-sector return. We apply a 95% confidence level, and therefore we expect any variable as significant when its t-test's p-value is less than or equal to 5%. In addition, we consider any variable might be significant, and may need further research on, when its t-test's p-value is between 5% - 20%.

In the second stage of the research, we pull the statistically significant variables identified from the stage one of the analysis, group them together, to run the regression against the targeted market or sub-sector return. During this stage, the variables are reviewed whether any co-linearity issue exists, as we perceived any correlation of ±50% or above of any two variables should be cautiously evaluated.

The final stage of the research is the look at the result from stage two, and trim down the non-statistically significant variables. Again here we apply a 95% confidence level. The multi-factor model will be trimmed down until all the variables are statistically significant at 95% confidence level. Depends on the multi-factor model's result, we may perceive a variable might be a significant driver should its t-test's p-value falls between 5%-20%.

3.3 The Result of Replication of Dimson Model

As discussed earlier, before we attempt to step in to identify the key factors that drive market return, we attempt to replicate the Dimson Model with the Canadian data. Again, in Dimson model, the authors used the following factors to estimate the return of the market:

Estimated Return of the Market = Geometric Mean Dividend Yield + Dividend Growth Rate + Change of Price-to-Dividend Ratio + Real Exchange Rate

We have observed the similar data based off S&P TSX 60 Index, with its respectively market-weighted dividend yield, dividend growth rate, change of trailing twelve months price-to-dividend ratios, and inflation adjusted real exchange rates between CAD and USD.

Surprisingly, the variables identified by Dimson have strong abilities to estimate the market returns, as the regression result demonstrated below:

Table 1. The Dimson Model Replication Result

R Square: 97.75%	*Coefficients*	*Standard Error*	*t Stat*	*P-value*
Geographic Mean Dividend Yield	-0.01246397	0.028630622	-0.435337047	66.40%
Real SPTSX 60 Dividend Growth	0.930277886	0.021481826	43.30534424	0.00%
Change of P/D	0.958074009	0.014757749	64.92006459	0.00%
Change in Real Exchange Rate	-0.120046678	0.024759226	-4.848563375	0.00%

Table 1 demonstrated that the four variables together explained approximately 98% of the total market return. We found this result fascinating and we were confident to implement Dimson's finding into our analysis in attempt to further identify more variables that may assist in expressing Canadian large-cap equity markets' returns.

4.1 S&P TSX 60 Return Modeling

4.1.1 Single Variable Screening

Table 2 below is a summary for the variables that we have selected as our starting point for analyzing returns of S&P TSX 60 Index. As stated earlier, each and everyone one of the variables were selected under the classification as whether the variables came from Dimson model, the GDP growth factors, or a shock factor that we believe had the potential to be influence in our multi-factor model. We ran an annualized data observed on a monthly basis regression against the historic S&P TSX 60 return with each and every one of the variables listed in Appendix A to see how significant the variable is at the 95% level of confidence level and also whether the sign of the coefficient matches our expectation. At the same time we carefully examine co-linearity issue by making sure the variables that we use in the models do not have ±50% of correlation or higher. We identify a variable that may be significant enough to be tested in our multi-factor model if the T-Test P-Value is ranged from 0%-20%, and the consistent sign of coefficients compared to our expectations.

Table 2. The Initial Screening of the Key Variables – S&P TSX 60 Returns

Variable Name	Variable Classification	R-Square	Coef	Exp Coef	T Test P-Value	Significance
Geographic Mean Dividend Yield	Dimson Model	2.29%	-	+	6.52%	Maybe
Real SPTSX 60 Dividend Growth	Dimson Model	0.13%	+	+	66.62%	No
Change of P/D	Dimson Model	63.73%	+	+	0.00%	Yes
Change in Real Exchange Rate	Dimson Model	31.70%	-	-	0.00%	Yes
Gold Price Return	Shock	0.03%	-	-	83.44%	No
Copper Price Return	Shock	2.36%	+	+	6.16%	Maybe
Oil Price Return	Shock	7.58%	+	+	0.07%	Yes
Gas Price Return	Shock	3.08%	+	+	3.22%	Yes
Canada Unemployment Rate Growth	C	0.00%	+	-	89.34%	No
Canada PMI Return	I	0.65%	-	+	32.81%	No
Global PMI Return	I	10.00%	+	+	0.01%	Yes
Dry Baltic Return	X-M	6.08%	+	+	0.24%	Yes
Canada Treasury Bill Rate Return	C	0.00%	+	-	72.05%	No
Canada 10 Year - 30 Day Bond Rate Return	C	0.11%	-	+	68.08%	No
USD/Euro Rate Growth	X-M	7.28%	+	+	0.09%	Yes
CAD/USD Rate Growth	X-M	12.83%	-	-	0.00%	Yes
JAP/USD Rate Growth	X-M	2.98%	+	+	3.54%	Yes
AA Corporate Bond Index Return	Shock	1.67%	+	+	11.62%	Maybe
BBB+ Corporate Bond Index Return	Shock	7.25%	+	+	0.09%	Yes
US Housing Starts Growth	C	0.00%	+	+	81.47%	No
US Unemployment Rate Growth	C	0.13%	-	-	66.33%	No
SP TSX 60 P/E Growth	Re-Pricing	55.34%	+	+	0.00%	Yes
SP TSX 60 P/B Growth	Re-Pricing	83.95%	+	+	0.00%	Yes
US CPI Growth	C	2.46%	+	+	5.63%	Maybe
US Import Goods From Canada Growth	X-M	0.87%	+	+	25.67%	No
US Import Goods To Canada Growth	X-M	0.72%	+	+	30.49%	No
VIX Return	Shock	39.90%	-	-	0.00%	Yes
Tier 1 Capital Return	Shock	0.00%	-	+	89.09%	No

As demonstrated, we have selected the 28 variables that we believe have the potential to drive the Canadian large-cap equity markets' returns. The detail description and the source of the variables can be found in Appendix A.

In addition to the four key variables identified by the Dimson model, we believe the commodity prices are the shock factors that can be brought to the Canadian equity market, as Apergis and Miller demonstrated regarding to oil price shocks. Three of the four variables have consistent coefficients as expected with low t-test p-value, and therefore these variables will be selected for multi-factor modeling.

We expect the Canadian unemployment rates and Treasury bill rates, as well as the US unemployment rates, housing starts, and CPI are proxies for the consumption factor of the Canadian economy; however we were only able to observe that the US CPI might be a value driver for the market return.

We also examine the Canada PMI and Global PMI as the gross investment factor of GDP proxies, since the PMIs represent productivities of a country. We would like to highlight that due to the unavailability of gathering data for China's PMI back to 2000/01/01, we use the existing 5-year data and tested the correlation between China's PMI with Global PMI. What we have discovered was the two PMIs have almost 70% of correlation. Therefore in this paper we will use Global PMI as a proxy for China's PMI. As Table 2 demonstrated, the Global PMI is statistically significant, and therefore will be tested in the multi-factor model.

We would also like to use the exchanges rates, as well as Dry Baltic Index, as proxies for the X-M factor of the GDP model, and whether these factors have any effect on the Canadian market return. In addition, we were also using the import/export data between US and Canada as other proxies for the X-M factor. As Table 2 suggested, we will put the Dry Baltic Index and the exchange rates into our multi-factor modeling.

Lastly, with a slight variation of the Grinold model's Re-Pricing factor, we have implemented two potential Re-Pricing factors as the change of the TSX 60 Index T12M P/E and T12M P/B into our analysis. We have also observed two more potential shock factors as the VIX Index, which reflects the volatility index of the US market; and the market-weighted average of the major Canadian Banks' Tier 1 Capital Ratio, which represent the leverage factor studied by both Yang and King. The addition of the AA and BBB+ Corporate Bond Index represent variables that we think that might have the surprise factor as it represent the performance of US dollar

denominated investment grade rated corporate debt publically issued in the US domestic market. We believe that by adding these Bond Indices will assist us to identify whether the Canadian market returns are correlated to the US economy factors. Table 2 shows that both of the Re-Pricing factors, both of the Bond Indices, and the VIX Index should be included into our second stage of multi-factor modeling.

4.1.2 Multi-Factor Modeling

After the initial screening process, we group the significant factors together to run the multi-factor regression. We would like to note that some of the variables such as the Gas Price Return, BBB+ Corporate Bond Index Return, and the S&P TSX 60 P/B Growth as these variables were creating co-linearity issues. The result of the first multi-factor regression model on the S&P TSX 60 ERP is demonstrated below.

Table 3. The Initial Multi-Factor Regression Testing – S&P TSX 60

First Multi-Factor Model	**R-Square: 98.19%**					
Variable Name	**Variable Classification**	**R-Square**	**Coef**	**Exp Coef**	**T Test P-Value**	**Significance**
Geographic Mean Dividend Yield	Dimson Model		-	+	4.05%	Yes
Real SPTSX 60 Dividend Growth	Dimson Model		+	+	0.00%	Yes
Change of P/D	Dimson Model		+	+	0.00%	Yes
Change in Real Exchange Rate	Dimson Model		-	-	0.01%	Yes
Copper Price Return	Shock		+	+	50.49%	No
Oil Price Return	Shock		+	+	10.13%	Maybe
Global PMI Return	I		-	+	7.97%	Maybe
Dry Baltic Return	X-M		+	+	62.54%	No
USD/Euro Rate Growth	X-M		-	+	70.88%	No
CAD/USD Rate Growth	X-M		+	-	39.44%	No
JAP/USD Rate Growth	X-M		+	+	62.50%	No
AA Corporate Bond Index Return	Shock		+	+	58.26%	No
SP TSX 60 P/E Growth	Re-Pricing		+	+	58.76%	No
US CPI Growth	C		+	+	0.08%	Yes
VIX Return	Shock		+	-	48.45%	No

As demonstrated, this 15-factor model explains approximately 98.19% of the index return. Since the four variables suggested by the Dimson model already explained 97.75%, we did not

perceive this model is significantly better than the Dimson model. For the final stage of the analysis to extend on the testing, we took out the variables that were not significant, and re-run the regression again.

Table 4. The Reduced Multi-Factor Regression Testing – S&P TSX 60

Second Multi-Factor Model	**R-Square: 98.15%**					
Variable Name	**Variable Classification**	**R-Square**	**Coef**	**Exp Coef**	**T Test P-Value**	**Significance**
Geographic Mean Dividend Yield	Dimson Model		-	+	2.02%	Yes
Real SPTSX 60 Dividend Growth	Dimson Model		+	+	0.00%	Yes
Change of P/D	Dimson Model		+	+	0.00%	Yes
Change in Real Exchange Rate	Dimson Model		-	-	0.00%	Yes
Oil Price Return	Shock		+	+	11.18%	Maybe
Global PMI Return	I		-	+	6.87%	Maybe
US CPI Growth	C		+	+	0.03%	Yes

As the result of the regression shown, by dropping the non-significant variables only decrease the R-Square by approximately 0.04%, indicating that the variables did not help to explain the model at all. To better understand the distribution, we have also used MATLAB's JBTEST (Jarque-Bera goodness-of-fit test) function to test the normality of the residuals. The result suggested that the residuals were not white noise. In addition, the inconsistency of the coefficients that differ from the expectations does raise some questions. We would expect the Geographic Mean Dividend Yield and the Global PMI Return are the two variables that can positively contributes to the Canadian market returns, however in our findings it actually lowers the market return. Due to the inconsistency of the coefficients, we argue that maybe these two variables should not be in the model. The negative coefficient from the exchange rate is expected since this data is based off USD/CAD, adjusted by Canadian inflation. Our final multi-factor model as the following:

S&P TSX 60 Returns = 0.93 * Real S&P TSX 60 Dividend Growth + 0.95 * Change of P/D - 0.10 * Change in Real Exchange Rate + 0.01 * Oil Price Return + 0.48 * US CPI Growth

With this model, we can utilize it with an expectation of Real S&P TSX 60 Dividend Growth, Change of P/D, Change in Real Exchange Rate, Oil Price Return, and US CPI Growth. As we

expect to have the number as 0.85%, -0.66%, -0.24%, 0.74%, and 0.20% respectively, we have an expected annualized S&P TSX 60 Return of 4.82%, in the month of August, 2012. This leads us to calculate the annualized ERP for the Canadian large-cap equity market as 4.82% - 1.25% = 3.57%. This result is actually extremely close compared to Dimson's model, of which the arithmetic mean premium for the world index at 4.5%-5.0% and the long-run equity premium on geometric mean basis of 3.0%-3.5%; and also match up with Grinold's model quite nicely as our 3.57% of ERP is basically right on with Grinold's 3.6% result. However, as we used the betas for each of the variables to backtrack the ERP throughout the entire time period, we have observed that the risk free rate had been outperforming the return of the market, as the historic ERP demonstrated a -2.35%, with a 4.80% of standard deviation.

In order to examine if there exist any of the co-linearity issue, we have also performed a correlation matrix to see if there exists high correlation (±50% or above) between these variables. The result of the findings is demonstrated in Table 5.

Table 5. The Correlation Matrix for the Significant Variables

	Real SPTSX 60 Dividend Growth	*Change of P/D*	*Change in Real Exchange Rate*	*Oil Price Return*	*US CPI Growth*
Real SPTSX 60 Dividend Growth	100.00%				
Change of P/D	-55.82%	100.00%			
Change in Real Exchange Rate	2.75%	-44.68%	100.00%		
Oil Price Return	-14.84%	27.84%	-22.49%	100.00%	
US CPI Growth	-7.50%	12.22%	-12.58%	58.01%	100.00%

As demonstrated, we should be concerned with a few variables as the correlations between the Real S&P TSX 60 Dividend Growth and the Change of P/D, as well as the correlation between the Oil Price Return and the US CPI Growth have relatively high correlations as these numbers surpassed our comfort threshold. We believe further analysis is needed to understand the relationships between these variables better.

4.2 Energy Sub-Sector Index Return Modeling

4.2.1 Single Variable Screening

After our attempt to determine what are the value drivers for the general large-cap market return, our focus then turns to a more specific sub-sector returns, as the Canadian equity markets are mainly consist of three major sectors. We construct the sub-sector index from the TSX 60 listed energy sector companies as of June 30th, 2012 by a market-weighted average of total appreciation to calculate the sub-sector returns; and also using the same method to calculate the dividend yields. The time periods of the data for the sub-sectors were observed from 2000/01/01 to 2012/06/30. Following are the variables for our regression testing:

Table 6. The Initial Screening of the Key Variables – Energy

Variable Name (Total Return)	Variable Classification	R-Square	Coef	Exp Coef	T Test P-Value	Significance
S&P TSX 60 Return	Dimson Model	41.44%	+	+	0.00%	Yes
Energy Sector Dividend Growth	Dimson Model	21.68%	-	-	0.00%	Yes
Gold Price Return	Shock	0.25%	-	+	54.57%	No
Copper Price Return	Shock	1.94%	+	+	9.03%	Maybe
Oil Price Return	Shock	10.27%	+	+	0.01%	Yes
Gas Price Return	Shock	3.53%	+	+	2.17%	Yes
Canada Unemployment Rate Growth	C	0.80%	-	-	27.71%	No
Canada PMI Return	I	0.00%	-	+	92.86%	No
Global PMI Return	I	4.41%	+	+	1.01%	Yes
Dry Baltic Return	X-M	3.00%	+	+	3.44%	Yes
Canada Treasury Bill Rate Return	C	0.72%	+	-	30.23%	No
Canada 10 Year - 30 Day Bond Rate Return	C	1.48%	-	+	14.01%	Maybe
USD/Euro Rate Growth	X-M	2.93%	+	+	3.67%	Yes
CAD/USD Rate Growth	X-M	7.08%	-	-	0.10%	Yes
JAP/USD Rate Growth	X-M	2.65%	+	-	4.74%	Yes
AA Corporate Bond Index Return	Shock	0.57%	+	+	36.07%	No
BBB+ Corporate Bond Index Return	Shock	2.23%	+	+	6.90%	Maybe
US Housing Starts Growth	C	0.23%	+	+	56.40%	No
US Unemployment Rate Growth	C	1.43%	-	-	14.64%	Maybe
SP TSX 60 P/E Growth	Re-Pricing	21.72%	+	+	0.00%	Yes
SP TSX 60 P/B Growth	Re-Pricing	39.25%	+	+	0.00%	Yes
US CPI Growth	C	2.04%	+	+	8.26%	Maybe
US Import Goods From Canada Growth	X-M	0.01%	+	+	88.90%	No
US Import Goods To Canada Growth	X-M	0.20%	+	+	59.11%	No
VIX Return	Shock	17.13%	-	-	0.00%	Yes
Tier 1 Capital Return	Shock	0.26%	-	+	54.01%	No

First and foremost, we assume that the return of the sub-sector index is a function of the overall market return, plus the sector-specific variables that drives the market. Therefore, our very first variable that we would like to include is the overall S&P TSX 60 Return. The rest of the variables were exactly the same variables that were tested in the earlier analysis. Note that instead of the S&P TSX 60's overall dividends, we have constructed our own sub-sector index's market-weighted dividend yield and its growth rate to replace it. Again after completing the first stage of the initial screening process to identify individual value drivers for sub-sector returns, we move on to second stage of the analysis which is multi-factor regression modeling.

4.2.2 Multi-Factor Modeling

With the same selection method as previously discussed, we have grouped the variables together to perform a multi-factor regression.

Table 7. The Initial Multi-Factor Regression Testing – Energy

First Multi-Factor Model (Total Return)	R-Square: 54.63%					
Variable Name	**Variable Classification**	**R-Square**	**Coef**	**Exp Coef**	**T Test P-Value**	**Significance**
S&P TSX 60 Return	Dimson Model		+	+	0.00%	Yes
Energy Sector Dividend Growth	Dimson Model		-	-	0.00%	Yes
Oil Price Return	Shock		+	+	62.26%	No
Gas Price Return	Shock		+	+	17.29%	Maybe
Canada Unemployment Rate Growth	Shock		+	+	70.39%	No
Canada Treasury Bill Rate Return	I		-	+	47.75%	No
Canada 10 Year - 30 Day Bond Rate Return	X-M		+	+	56.87%	No
JAP/USD Rate Growth	C		-	-	14.73%	Maybe
BBB+ Corporate Bond Index Return	X-M		+	+	81.62%	No
US Unemployment Rate Growth	X-M		-	-	87.96%	No
SP TSX 60 P/B Growth	X-M		+	+	57.64%	No
US CPI Growth	Shock		-	+	19.24%	Maybe
Tier 1 Capital Return	C		-	-	33.63%	No

As demonstrated, only 2 out of the 13 variables are significant at 95% confidence, while three variables are close to being significant. This model explains approximately 55% of the market-weighted energy sector return. By trimming the non-significant variables, we have the following:

Table 8. The Reduced Multi-Factor Regression Testing – Energy

Second Multi-Factor Model (Total Return)	**R-Square: 51.87%**					
Variable Name	**Variable Classification**	**R-Square**	**Coef**	**Exp Coef**	**T Test P-Value**	**Significance**
S&P TSX 60 Return	Dimson Model		+	+	0.00%	Yes
Energy Sector Dividend Growth	Dimson Model		-	-	0.00%	Yes
Oil Price Return	Shock		+	+	5.04%	Yes

By decreasing the number of variables down to 3, we only lost less than 3% of explanations of the model. We were quite satisfied with the result as the three factor model explained approximately 52% of the entire sub-sector returns, with all of the coefficient signs align with our expectations. In regards to the residuals, according to the result of the JBTEST from MATLAB, the residuals are not white noise. With the remaining four variables are all significant, we have concluded our multi-factor model as below:

Energy Sector Return = 0.61 * S&P TSX 60 Return – 0.13 * Energy Sector Dividend Growth + 0.07 * Oil Price Return

With our expectation of 4.82% of the S&P TSX 60 Return, 0.60% of Energy Sector Dividend Growth, and 0.74% of the Oil Price Return, we estimated the Energy Sector Return to be approximately 2.91%; of which lead us to conclude that the annualized Energy Sector ERP for the month of August is estimated at 2.91% - 1.25% = 1.66%. The regression historic Energy Sector ERP is averaged at -2.50% with a 4.12% of standard deviation. We did not find this result insulting as it demonstrated a similar behaviour with the S&P TSX 60 ERP. We have also discovered no co-linearity issue between the variables, as shown in Table 9.

Table 9. The Correlation Matrix for the Significant Variables

	SPTSX60 Return	*Energy Dividend Growth*	*Oil Price Return*
SPTSX60 Return	100.00%		
Energy Dividend Growth	-25.68%	100.00%	
Oil Price Return	27.52%	-20.53%	100.00%

4.3 Material Sub-Sector Index Return Modeling

4.3.1 Single Variable Screening

After observing the market return and the risk premium analysis, we continue our research on the sub-sector index for the material sector. We construct the material sub-sector index from the TSX 60 listed material sector companies as of June 30th, 2012 by a market-weighted average of total appreciation to calculate the sub-sector returns; and also using the same method to calculate the dividend yields. The time periods of the data for the material sub-sector were observed from 2000/01/01 to 2012/06/30. Following are the variables for our regression testing:

Table 10. The Initial Screening of the Key Variables – Material

Variable Name (Total Return)	Variable Classification	R-Square	Coef	Exp Coef	T Test P-Value	Significance
S&P TSX 60 Return	Dimson Model	27.30%	+	+	0.00%	Yes
Material Sector Dividend Growth	Dimson Model	39.53%	-	-	0.00%	Yes
Gold Price Return	Shock	9.64%	+	+	0.01%	Yes
Copper Price Return	Shock	2.97%	+	+	3.56%	Yes
Oil Price Return	Shock	7.29%	+	+	0.09%	Yes
Gas Price Return	Shock	0.91%	+	-	24.68%	No
Canada Unemployment Rate Growth	C	1.72%	+	-	11.09%	Maybe
Canada PMI Return	I	0.94%	+	+	23.95%	No
Global PMI Return	I	7.21%	+	+	0.09%	Yes
Dry Baltic Return	X-M	14.19%	+	+	0.00%	Yes
Canada Treasury Bill Rate Return	C	0.62%	-	-	33.84%	No
Canada 10 Year - 30 Day Bond Rate Return	C	1.56%	-	+	12.93%	Maybe
USD/Euro Rate Growth	X-M	5.63%	+	+	0.36%	Yes
CAD/USD Rate Growth	X-M	8.11%	-	-	0.04%	Yes
JAP/USD Rate Growth	X-M	0.75%	+	+	29.40%	No
AA Corporate Bond Index Return	Shock	9.93%	+	+	0.01%	Yes
BBB+ Corporate Bond Index Return	Shock	12.99%	+	+	0.00%	Yes
US Housing Starts Growth	C	0.32%	+	+	49.61%	No
US Unemployment Rate Growth	C	0.05%	+	-	78.00%	No
SP TSX 60 P/E Growth	Re-Pricing	13.26%	+	+	0.00%	Yes
SP TSX 60 P/B Growth	Re-Pricing	25.58%	+	+	0.00%	Yes
US CPI Growth	C	0.95%	+	+	23.77%	No
US Import Goods From Canada Growth	X-M	0.01%	+	+	88.39%	No
US Import Goods From Canada Growth	X-M	0.48%	+	+	39.91%	No
VIX Return	Shock	13.18%	-	-	0.00%	Yes
Tier 1 Capital Return	Shock	0.35%	+	+	47.27%	No

Again, we assume that the return of the material sub-sector index is a function of the overall market return, plus the material sector-specific variables that drives the market. Therefore, our very first variable that we would like to include is the overall S&P TSX 60 Return. The rest of the variables were exactly the same variables that were tested in the earlier analysis. Note that instead of the energy sub-sector dividends, we have constructed the material sub-sector index's market-weighted dividend yield and its growth rate to replace it. Again after completing the first stage of the initial screening process to identify individual value drivers for the material sub-sector returns, we move on to second stage of the analysis.

4.3.2 Multi-Factor Modeling

With the same selection method as previously discussed, we have grouped the variables together to perform a multi-factor regression.

Table 11. The Initial Multi-Factor Regression Testing – Material

First Multi-Factor Model (Total Return)	R-Square: 59.28%					
Variable Name	**Variable Classification**	**R-Square**	**Coef**	**Exp Coef**	**T Test P-Value**	**Significance**
S&P TSX 60 Return	Dimson Model		+	+	0.11%	Yes
Material Sector Dividend Growth	Dimson Model		-	-	0.00%	Yes
Gold Price Return	Shock		+	+	0.06%	Yes
Copper Price Return	Shock		+	+	70.90%	No
Oil Price Return	Shock		+	-	4.73%	Yes
Canada Unemployment Rate Growth	C		+	-	29.10%	No
Global PMI Return	I		-	+	54.60%	No
Dry Baltic Return	X-M		+	+	4.04%	Yes
Canada 10 Year - 30 Day Bond Rate Return	C		-	+	12.99%	Maybe
USD/Euro Rate Growth	X-M		-	+	13.50%	Maybe
CAD/USD Rate Growth	X-M		+	-	21.77%	No
BBB+ Corporate Bond Index Return	Shock		+	+	27.14%	No
SP TSX 60 P/E Growth	Re-Pricing		-	+	16.38%	Maybe
VIX Return	Shock		-	-	7.82%	Maybe

As demonstrated, 5 out of the 14 factors had shown to be significant at 95% confidence, while four other variables are close to be significant. The model explains approximate 59% of the material sector returns. By reducing the model, we have the following:

Table 12. The Reduced Multi-Factor Regression Testing – Material

Second Multi-Factor Model (Total Return)	R-Square: 55.63%					
Variable Name	**Variable Classification**	**R-Square**	**Coef**	**Exp Coef**	**T Test P-Value**	**Significance**
S&P TSX 60 Return	Dimson Model		+	+	0.17%	Yes
Material Sector Dividend Growth	Dimson Model		-	-	0.00%	Yes
Gold Price Return	Shock		+	+	0.01%	Yes
Dry Baltic Return	X-M		+	+	1.33%	Yes
VIX Return	Shock		-	-	9.57%	Maybe

The above five-factor model explains approximately 56% of the material sector return, which we were quite satisfied with. In regards to the residuals, according to the result of the JBTEST from MATLAB, the residuals are not white noise. All of the variables are significant in the 95% confidence level, with the expected coefficient signs equal to the results; we have concluded our multi-factor model as below:

Material Sector Return = 0.45 * S&P TSX 60 Return – 0.22 * Material Sector Dividend Growth + 0.51 * Gold Price Return + 0.06 * Dry Baltic Return – 0.06 * VIX Return

With our expectation of 4.82% of the S&P TSX 60 Return, 1.50% of the Material Sector Dividend Growth, 1.00% of the Gold Price Return, 5.00% of the Dry Baltic Return, and -5.00% of the VIX Return, we estimate the annualized Material Sector Return at 2.95%; of which lead to the annualized Material Sector ERP at 2.95% - 1.25% = 1.70%. The Material Sub-Sector's historical regression ERP was higher than the energy sector one, yet more volatile, as the historical averages out to be -1.95%, with a 6.66% of standard deviation. We have also discovered the possibility of the co-linearity issue between the VIX Index and the S&P TSX 60 Return, as the table below demonstrated that the correlation between these two variables is -63%. If needed, we will be comfortable to take the VIX Return variable out of the model as it does not meet the 95% confidence level's significance requirement; but rather it is only significant at 90% of the confidence level.

Table 13. The Correlation Matrix for the Significant Variables

	SPTSX60 Return	*Material Dividend Growth*	*Gold Price Return*	*Dry Baltic Return*	*VIX Return*
SPTSX60 Return	100.00%				
Material Dividend Growth	-40.95%	100.00%			
Gold Price Return	-1.73%	-24.65%	100.00%		
Dry Baltic Return	24.66%	-23.48%	21.21%	100.00%	
VIX Return	-63.17%	26.17%	21.99%	-17.65%	100.00%

4.4 Financial Sub-Sector Index Return Modeling

4.4.1 Single Variable Screening

Lastly, we continue to research the final sub-sector index for the financial sector. Again the financial sub-sector index was constructed from the TSX 60 listed financial sector companies as of June 30th, 2012 by a market-weighted average of total appreciation to calculate the sub-sector returns; and also using the same method to calculate the dividend yields. The time periods of the data for the financial sub-sector were observed from 2000/01/01 to 2012/06/30. Following are the variables for our regression testing:

Table 14. The Initial Screening of the Key Variables – Financial

Variable Name (Total Return)	Variable Classification	R-Square	Coef	Exp Coef	T Test P-Value	Significance
S&P TSX 60 Return	Dimson Model	38.70%	+	+	0.00%	Yes
Financial Sector Dividend Growth	Dimson Model	90.12%	-	-	0.00%	Yes
Gold Price Return	Shock	2.70%	-	-	4.51%	Yes
Copper Price Return	Shock	1.80%	+	+	10.25%	Maybe
Oil Price Return	Shock	6.20%	+	-	0.22%	Yes
Gas Price Return	Shock	3.47%	+	-	2.29%	Yes
Canada Unemployment Rate Growth	C	2.13%	-	-	7.57%	Maybe
Canada PMI Return	I	0.00%	+	+	81.46%	No
Global PMI Return	I	19.54%	+	+	0.00%	Yes
Dry Baltic Return	X-M	2.58%	+	+	5.02%	Maybe
Canada Treasury Bill Rate Return	C	0.00%	+	-	87.71%	No
Canada 10 Year - 30 Day Bond Rate Return	C	0.00%	-	+	97.16%	No
USD/Euro Rate Growth	X-M	2.23%	+	+	6.99%	Maybe
CAD/USD Rate Growth	X-M	9.07%	-	-	0.02%	Yes
JAP/USD Rate Growth	X-M	4.06%	+	+	1.37%	Yes
AA Corporate Bond Index Return	Shock	1.16%	+	+	19.03%	Maybe
BBB+ Corporate Bond Index Return	Shock	6.90%	+	+	0.12%	Yes
US Housing Starts Growth	C	0.08%	+	+	73.91%	No
US Unemployment Rate Growth	C	2.40%	-	-	5.87%	Maybe
SP TSX 60 P/E Growth	Re-Pricing	24.76%	+	+	0.00%	Yes
SP TSX 60 P/B Growth	Re-Pricing	42.69%	+	+	0.00%	Yes
US CPI Growth	C	2.61%	+	+	4.88%	Yes
US Import Goods From Canada Growth	X-M	0.69%	+	+	31.51%	No
US Import Goods From Canada Growth	X-M	0.69%	+	+	31.44%	No
VIX Return	Shock	24.37%	-	-	0.00%	Yes
Tier 1 Capital Return	Shock	1.26%	+	+	17.24%	Maybe

Similarly, we assume that the return of the financial sub-sector index is a function of the overall market return, plus the financial sector-specific variables that drives the market, of which may or may not include the leverage factor – the Tier 1 Capital Return. Therefore, our very first variable that we would like to include is the overall S&P TSX 60 Return. The rest of the variables were exactly the same variables that were tested in the earlier analysis. Note that we have constructed the financial sub-sector index's market-weighted dividend yield and its growth rate to replace the material dividend yields. Again after completing the first stage of the initial screening process to identify individual value drivers for the financial sub-sector returns, we move on to second stage of the analysis.

4.4.2 Multi-Factor Modeling

With the same selection method as previously demonstrated, we have grouped the variables together to perform a multi-factor regression.

Table 15. The Initial Multi-Factor Regression Testing – Financial

First Multi-Factor Model (Total Return)	R-Square: 92.22%					
Variable Name	**Variable Classification**	**R-Square**	**Coef**	**Exp Coef**	**T Test P-Value**	**Significance**
S&P TSX 60 Return	Dimson Model		+	+	0.37%	Yes
Financial Sector Dividend Growth	Dimson Model		-	-	0.00%	Yes
Gold Price Return	Shock		-	-	10.73%	Maybe
Copper Price Return	Shock		-	+	71.02%	No
Gas Price Return	Shock		+	-	63.06%	No
Canada Unemployment Rate Growth	C		-	-	54.87%	No
Global PMI Return	I		+	+	16.25%	Maybe
Dry Baltic Return	X-M		+	+	27.74%	No
USD/Euro Rate Growth	X-M		-	+	87.66%	No
CAD/USD Rate Growth	X-M		-	-	95.27%	No
JAP/USD Rate Growth	X-M		+	+	76.32%	No
BBB+ Corporate Bond Index Return	Shock		-	+	33.95%	No
US Unemployment Rate Growth	C		-	-	14.15%	Maybe
SP TSX 60 P/E Growth	Re-Pricing		+	+	83.26%	No
VIX Return	Shock		+	-	80.75%	No
Tier 1 Capital Return	Shock		+	+	91.52%	No

As demonstrated from Table 15, we have discovered a very interesting result. The total return of the financial sector can be largely explained by 5 variables, with an impressive R-Square of 92%. Moving forward, we reduce our multi-factor model to the significant value drivers:

Table 16. The Reduced Multi-Factor Regression Testing – Financial

Second Multi-Factor Model (Total Return)	R-Square: 92.04%					
Variable Name	**Variable Classification**	**R-Square**	**Coef**	**Exp Coef**	**T Test P-Value**	**Significance**
S&P TSX 60 Return	Dimson Model		+	+	0.00%	Yes
Financial Sector Dividend Growth	Dimson Model		-	-	0.00%	Yes
Gold Price Return	Shock		-	-	3.46%	Yes
Global PMI Return	I		+	+	6.55%	Maybe
US Unemployment Rate Growth	C		-	-	3.86%	Yes

By reducing the variables down to 5, we only lost approximately 0.2% of explanations of the model. Similar to previous tests, the JBTEST from MATLAB had demonstrated that the residuals for this regression model are not white noise. We conclude that our final multi-factor model as:

Financial Sector Return = 0.14 * S&P TSX 60 Return – 0.78 * Financial Sector Dividend Growth - 0.06 * Gold Price Return + 0.08 * Global PMI Return – 0.09 * US Unemployment Rate Growth

With our expectation of 4.82% of the S&P TSX 60 Return, 0.50% of the Financial Sector Dividend Growth, 1.00% of the Gold Price Return, 3.00% of the Global PMI Return, and 0.00% of the US Unemployment Rate Growth, we estimate the annualized Financial sub-sector return at 0.46%; of which indicated that the annualized Financial sub-sector ERP is estimated at 0.46% - 1.25% = -0.79%. The regressed historic Financial sub-sector ERP has lower average throughout the time horizon, as the averages out to -2.90% with 4.94% of standard deviation. Lastly, we have also discovered possibility of co-linearity issue between the S&P TSX 60 Return and the Financial sub-sector Dividend Growth Rate as these two variables have a correlation of -56%, demonstrated from the table below.

Table 17. The Correlation Matrix for the Significant Variables

	SPTSX60 Return	*Financial Dividend Growth*	*Gold Price Return*	*Global PMI Return*	*US Unemployment Rate Growth*
SPTSX60 Return	100.00%				
Financial Dividend Growth	-55.79%	100.00%			
Gold Price Return	-1.73%	13.81%	100.00%		
Global PMI Return	31.59%	-41.82%	11.03%	100.00%	
US Unemployment Rate Growth	-3.60%	11.54%	-0.97%	-8.54%	100.00%

5.1 Implementation of the Findings

After completing the analysis on identifying the key value driver for the general Canadian large-cap equity markets, we have implemented the result of the regression analysis on each and every one of the stock listed in the TSX 60 Index as of June 30th, 2012. The result of the regression is demonstrated in Appendix B. As the Appendix B shown, the fist column is for the listed security code; second column is the result of the regression against that stock's total annualized monthly return; third, fifth, seventh, ninth, eleventh, and thirteenth columns are the key value drivers identified from Section 4.1 The "S" right next to the variable indicates that whether this variable was significant at 95% confidence level. Note that for the stocks that has shorter time horizon of the return history, the regression was completed with only the existing total returns. Therefore for some of the stocks, such as THI, for example, only ran a regression with a sample size of 64, rather than 150.

The S&P TSX 60 Index multi-factor model has identified possible key factors or value drivers for the annualized total return. Given the IPS constraint of the SIAS fund, we were not allowed to short any of the individual security. However, assuming that we were able to do so, then we can use this Appendix B to construct portfolios with securities that can hedge out any of the exposures that we do not want to be exposed to by pairing long-short securities. For example, a portfolio manager may want to reduce the risk exposure of factor one, while increasing the risk exposure of factor two. Looking at Appendix B, we can identify the stocks with high risk exposure to risk factor one and low risk exposure to factor two to sell, while purchasing the stock with low exposure to risk factor one and high risk exposure to factor two.

6.1 Conclusion and Future Work

Inspired by the opportunity to perform equity valuation analysis for the SIAS fund, we have attempted to identify key value drivers and risk factors that may affect the equity risk premium for the Canadian large-cap equity markets. Our main focus was to develop regression models that can perform reasonable estimation of equity risk premiums for the general large-cap market, as well as the three major sectors in Canada.

Our framework was based on both of the Dimson's model, as well as the GDP growth approach developed by Grinold et al. While not all of the factors that we thought were important were proven to be significant with the time horizon of the data from our selection, we did have some success in developing multi-factor models. The results were quite satisfactory as the models are demonstrating relatively high R-Squares, as match both of the Dimson and Grinold's estimates of the equity risk premiums. We strongly believe the models can be improved upon further analysis in attempting to limit out the co-linearity issues, and this research provides a great starting point for future cohorts who may have interest in further research into this topic.

Appendix

Appendix A

Variable Name	Variable Classification	Source	Description
Geographic Mean Dividend Yield	Dimson Model	Bloomberg	The annualized mean dividend yield observed from TSX 60 Index
Real SPTSX 60 Dividend Growth	Dimson Model	Bloomberg	The annualized dividend growth rate is observed by the market-weighted average of the dividend growth rate
Change of P/D	Dimson Model	Bloomberg	The annualized monthly incremental changes of the P/D ratio of the TSX 60 Index
Change in Real Exchange Rate	Dimson Model	Bloomberg	The annualized interest rate of CAD/USD adjusted by inflation
Gold Price Return	Shock	FRED	The annualized gold price return
Copper Price Return	Shock	FRED	The annualized copper price return
Oil Price Return	Shock	FRED	The annualized oil price return
Gas Price Return	Shock	FRED	The annualized gas price return
Canada Unemployment Rate Growth	C	FRED	The annualized change of Canada Unemployment Rate
Canada PMI Return	I	Bloomberg	The annualized change of Canada PMI
Global PMI Return	I	Bloomberg	The annualized change of Global PMI
Dry Baltic Return	X-M	Bloomberg	The annualized change of the Dry Baltic Index
Canada Treasury Bill Rate Return	C	FRED	The annualized change of the Treasury Bill Rate
Canada 10 Year - 30 Day Bond Rate Return	C	FRED	The annualized change of the difference between 10 Year and 30 day Bond Rates
USD/Euro Rate Growth	X-M	FRED	The annualized change of the USD/Euro rate
CAD/USD Rate Growth	X-M	FRED	The annualized change of the CAD/USD rate
JAP/USD Rate Growth	X-M	FRED	The annualized change of the JAP/USD rate
AA Corporate Bond Index Return	Shock	FRED	The annualized AA Corporate Bond Index return
BBB+ Corporate Bond Index Return	Shock	FRED	The annualized BBB+ Corporate Bond Index return
US Housing Starts Growth	C	FRED	The annualized change of the US Housing Starts
US Unemployment Rate Growth	C	FRED	The annualized change of the US Unemployment Rate
SP TSX 60 P/E Growth	Re-Pricing	Bloomberg	The annualized change of the TSX 60 Index T12M P/E
SP TSX 60 P/B Growth	Re-Pricing	Bloomberg	The annualized change of the TSX 60 Index T12M P/B
US CPI Growth	C	FRED	The annualized change of the US CPI
US Import Goods From Canada Growth	X-M	FRED	The annualized change of the US Import Goods from Canada
US Import Goods To Canada Growth	X-M	FRED	The annualized change of the US Import Goods to Canada
VIX Return	Shock	Bloomberg	The annualized VIX Index return
Tier 1 Capital Return	Shock	Bloomberg	The annualized change of the market-weighted average of Canadian major banks' Tier 1 Capital Ratio

Appendix B

Security	R-Square	Geographic Mean Dividend Yield	S	Real SPTSX 60 Dividend Growth	S	Change of P/D	S	Change in Real Exchange Rate	S	Oil Price Return	S	Global PMI Return	S	US CPI Growth	S
ABX	24.10%	1.91	S	0.51	N	0.23	N	-0.11	N	0.37	S	-0.87	S	11.47	S
AEM	15.81%	5.75	S	2.41	S	0.31	N	0.36	N	0.32	N	-1.27	N	23.91	S
AGU	37.23%	4.58	S	1.43	S	0.19	N	-1.11	N	-0.02	N	-3.89	S	42.45	S
ARX	39.53%	6.43	S	1.2	S	0.85	S	0.51	N	-0.16	N	-3.54	S	32.96	S
BBD/B	7.11%	-1.99	N	1.62	N	0.54	N	0.69	N	0.23	N	-3.48	S	27.58	S
BAM/A	27.42%	4.69	S	0.88	N	0.1	N	-1.1	N	-0.1	N	-1.31	N	30.97	S
BCE	18.41%	2.1	N	2.45	S	1.54	S	1.42	N	0.01	N	-2.87	N	31.88	S
BMO	16.53%	4.09	S	0.02	N	0.12	N	-0.81	N	0	N	0.25	N	10.92	S
BNS	30.37%	4.22	S	0.35	N	0	N	-0.68	N	-0.02	N	-0.28	N	17.32	S
CCO	16.99%	3.71	S	2.74	S	0.79	N	-1.35	N	-0.22	N	-0.04	N	40.32	S
CM	19.20%	3.24	S	0.87	N	0.43	N	-0.59	N	0.07	N	0.21	N	14.82	S
CNQ	31.62%	4.97	S	2.29	S	1.53	S	-0.87	N	0.7	S	-4.23	S	39.35	S
CNR	34.41%	6.18	S	0.81	N	0.11	N	-0.22	N	-0.19	N	-0.12	N	11.03	S
COS	32.25%	3.53	S	3.22	S	1.27	S	0.85	N	0.06	N	-4.31	S	54.7	S
CP	26.89%	1.74	S	2.76	S	1.51	S	0.05	N	-0.03	N	-2.37	S	21.32	S
CTC/A	13.99%	3.2	S	0.39	N	0.2	N	-1.14	N	0.11	N	1.04	N	4.67	N
CVE	69.70%	2.72	N	-0.89	N	-0.17	N	-1.02	N	0.08	N	-0.05	N	54.08	S
ECA	29.19%	0.94	N	1.09	N	-0.11	N	-0.68	N	-0.15	N	-3.32	S	44.92	S
ELD	21.24%	23.9	S	-5.24	S	-0.41	N	-2.12	N	1.34	N	1.24	N	0.78	N
ENB	56.80%	6.74	S	0.01	N	-0.43	N	-0.23	N	-0.18	N	-0.74	N	13.94	S
ERF	24.51%	2.73	S	1.81	S	0.91	N	0.11	N	-0.27	N	-2.82	S	38.24	S
FM	32.46%	17.78	S	5.79	S	5.73	S	1.68	N	0.39	N	-5.49	S	94.48	S
FTS	45.27%	5.28	S	0.67	S	0.05	N	-0.45	N	-0.13	N	-0.25	N	15.37	S
G	25.96%	9.86	S	0.02	N	-0.47	N	-0.24	N	0.45	N	0.37	N	15.75	N
GIL	21.88%	4.96	S	2.55	S	2.26	S	-0.48	N	-0.2	N	-4.11	S	53.29	S
HSE	31.49%	2.01	N	4.08	S	2.31	S	0.13	N	-0.09	N	-3.51	S	44.01	S
IMG	33.01%	13.9	S	-2.45	S	-0.31	S	-1.19	N	1.06	N	5.28	S	-20.02	S
IMN	26.00%	15.49	S	1.38	N	1.11	N	-1.94	N	0.96	N	-0.11	N	31.12	S
IMO	39.03%	2.22	S	1.78	S	0.67	S	-0.28	N	0.2	N	-2.32	S	31.67	S
K	7.92%	6.37	S	-0.89	N	-1.22	N	-1.84	N	0.72	N	0.87	N	0.59	N

Appendix B – Continued

Security	R-Square	Geographic Mean Dividend Yield	S	Real SPTSX 60 Dividend Growth	S	Change of P/D	S	Change in Real Exchange Rate	S	Oil Price Return	S	Global PMI Return	S	US CPI Growth	S
L	6.18%	1.18	N	-1.22	S	-0.53	N	-0.89	N	0.03	N	0.98	S	0.75	N
MFC	15.08%	-3.24	S	0.23	N	-1.04	N	-1.84	N	-0.47	N	-2.18	S	39.93	S
MRU	35.31%	9.07	S	0.28	N	-0.33	N	-0.3	N	-0.31	N	3.53	S	-0.69	N
MG	7.29%	3.2	S	-0.25	N	-0.03	N	-0.53	N	0.1	N	1.24	N	7.58	N
NA	32.84%	5.71	S	-0.15	N	0.03	N	-0.67	N	-0.02	N	0.1	N	15.61	S
NXY	20.77%	-0.01	N	2	S	1.53	S	0.15	N	0.18	N	-3.05	S	42.32	S
POT	37.71%	6.86	S	2.8	S	0.61	N	-0.8	N	0.65	N	-6.82	S	63.75	S
POW	14.76%	1.31	N	0.1	N	-0.42	N	-1.29	S	0.12	N	-0.75	N	16.1	S
PWT	21.99%	3.22	S	2.27	S	1.78	S	0.6	N	0.09	N	-3.55	S	29.83	S
RCI/B	26.17%	2.94	S	5.08	S	3.15	S	1	N	0.14	N	-1.37	N	24.35	S
RIM	15.49%	8.13	N	9.39	S	10.46	S	6.51	N	0.99	N	-11.28	S	143.63	S
RY	25.37%	4.01	S	0.39	N	-0.04	N	-0.98	N	-0.12	N	-0.44	N	16.3	S
SAP	33.50%	6.61	S	-0.88	N	-0.62	N	-0.84	N	0.28	N	-0.58	N	15.21	S
SJR/B	21.28%	1.42	N	3.26	S	1.74	S	1	N	0.08	N	-1.65	S	21.01	S
SC	32.25%	0.75	N	1.77	S	0.86	S	0.01	N	0.14	N	-2.07	S	18.18	S
SLF	14.10%	-2.06	S	1.41	S	1.03	S	-0.54	N	-0.08	N	-0.83	N	21.27	S
SLW	9.46%	45.92	S	17.64	N	9.24	N	-7.03	N	2.64	N	-27.88	S	184.25	N
SNC	35.18%	7.38	S	1	N	-0.06	N	-0.43	N	0.01	N	-0.58	N	29.56	S
SU	27.72%	1.81	N	1.83	S	0.6	N	-0.76	N	0.33	N	-3.03	S	37.64	S
T	17.58%	3.38	S	4.49	S	2.56	S	1.07	N	-0.28	N	-0.38	N	21.62	S
TA	16.98%	-0.35	N	1.13	S	-0.34	N	-0.67	N	-0.2	N	-1.86	S	27.15	S
TCK/B	12.85%	18.39	S	-0.24	N	1.81	N	-2.25	N	0.63	N	-1.24	N	16.64	N
TD	23.79%	3.49	S	1.06	S	0.78	S	-0.06	N	0.18	N	-0.33	N	13.37	S
THI	40.93%	3.2	S	0.89	N	0.5	N	-0.51	N	0.18	N	-0.2	S	14.76	S
TLM	21.44%	1.64	N	0.75	N	0.73	N	-1	N	0.18	N	-1.96	S	31.52	S
TRI	6.04%	-1.09	S	0.15	N	0.35	N	-0.3	N	-0.03	N	-0.16	N	9.76	S
TRP	26.39%	4.4	S	-0.4	N	-1.05	S	-1.26	S	-0.23	N	-0.37	N	13.8	S
VRX	13.68%	9.25	S	0.26	N	0.55	N	0.46	N	-0.31	N	-0.08	N	32.36	S
WN	9.94%	3.17	S	-1.61	S	-1.04	S	-0.91	N	-0.09	N	1.43	S	-1.76	N
YRI	10.24%	2.74	N	3.21	S	1.34	N	-0.95	N	0.7	N	-2.2	N	19.53	N

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