Common Risk Factors in Explaining Canadian Equity Returns

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Abstract

This paper adopts the Fama and French (1993) methodology for determining the common risk factors in the returns of Canadian stocks. Our results suggest that the three stock market factors, the excess stock market returns, a size factor, and a book-to-market equity factor, explain most of the variation in Canadian equity returns over time. Unlike in the U.S. equity market, the addition of bond market variables provide little explanatory power for the average Canadian equity, suggesting that the underlying factors influencing stocks and bonds are more distinct in Canada.

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1. *Introduction*

Considerable evidence now exists that the cross-sectional pattern of stock returns can be explained by characteristics such as size, leverage, earnings-to-price ratios, and book-to-market ratios.[1] Fama and French (1992) found that two easily measured variables, size and the book-to-market ratio, provided a simple and powerful explanation of the cross-section of average returns for U.S. stocks.

In a second paper, Fama and French (1993) argued that size and book-to-market are proxies for distress and that distressed firms may be more sensitive to changes in certain business cycle factors, like changes in credit conditions, than are firms that are less financially vulnerable. The authors also introduced term structure risk factors as variables to examine the integration between the stock and bond market; the notion being that if markets are integrated, there is likely some overlap between the return processes for bonds and stocks. Fama and French provided a number of tests which suggest that a firm's book-to-market ratio and size are proxies for the firm's loadings on priced risk factors. First, they show that the prices of high book-to-market and small size stocks tend to move in a way that suggests a common risk factor. Secondly, they find that the loadings on zero cost factor portfolios formed on the basis of size and book-to-market ratios along with the market portfolio explain the excess returns of a full set of portfolios sorted on the bases of book-to-market ratios and size. Finally, the authors found that stock returns have shared variation due to the stock market factors and they are linked to bond returns through shared variation in the bond market factors.

Daniel and Titman (1997) disagreed with the conclusion reached by Fama and French that the association between these characteristics (book-to-market ratio and size) and returns arises

[1] Banz (1981), for example, documented the size anomaly; leverage by Bhandari (1988); the earnings-to-price ratio by Basu (1983); and the book-to-market effect by Rosenberg, Reid, and Lanstein (1985).

because the characteristics are proxies for non-diversifiable factor risk. Daniel and Titman do not dispute the supposition that the return premia of high book-to-market and small size stocks can be explained by a factor model. They argue, however, that there is no separate return premium associated with these particular firm characteristics. On the other hand, Daniel and Titman suggest that it is the characteristics that determine the expected returns. In other words, although high book-to-market stocks covary strongly with other high book-to-market stocks, the covariances do not result from there being particular risks associated with distress, but instead reflect that high book-to-market firms tend to have similar properties, i.e., they might be in the same industry, or operate in the same region.

In a recent reply to the work of Daniel and Titman, Davis, Fama and French (2000) showed that the three-factor risk model explains the value premium in equities better than the characteristics model. The authors show that the evidence provided by Daniel and Titman is specific to their rather short time period. In more powerful tests over a 68-year period, the risk model provides a better story for the relationship between book/market ratios and average stock returns across firms.

In this paper we examine the return premium for Canadian stocks associated with each of the three stock-market factors and the two bond-market factors identified by Fama and French. Sixteen portfolios are then formed on the basis of size and book-to-market ratios. These portfolios are then used to test the explanatory power of the factors and the integration of the Canadian stock and bond markets.

2. *Development of Mimicking Portfolios*

The explanatory variables used in the time-series regressions include the excess returns on the market and the returns on two mimicking portfolios for firm size and the book-to-market ratio, in addition to the returns on two term structure factors. Similar to Fama and French (1993), we form six portfolios from sorts on the market value of the firm's equity (ME) and the book-to-market ratio (BE/ME). We then use these six portfolios to form portfolios which mimic the underlying risk factors in returns related to size and book-to-market of the equity.

To avoid "look ahead bias" in the data, i.e. using accounting variables that are unknown

before the returns they are used to explain, we match the accounting data for all fiscal yearends in calendar t-1 (1982-1999) with the returns for July of year t to June of t+1. The 6-month gap between fiscal yearend and the returns appears conservative since firms are required to file their annual financial statements within 140 days of their fiscal yearend.[2]

The economic factors are determined in the following manner. First, a sample is created of firms having data available on both the Canadian Financial Markets Research Centre (CFMRC) Database and the Compustat Canadian Database over the January 1982 through December 1999 period. In June of each year, all stocks on the CFMRC Database are ranked on size (price times shares outstanding). The median size is then used to split the stocks in that month into two groups, small (S) and big (B). We also divide the stocks into three book-to-market groups based upon the breakpoints for the bottom 30% (Low), middle 40% (Medium), and top 30% (High) of the ranked values of BE/ME. BE is defined as the book value of stockholders' equity, plus balance sheet deferred taxes, minus the book value of the preferred stock.[3] Book-to-market equity is the book common equity for the fiscal year ending in calendar year t-1 divided by the market value of the equity at the end of December of t-1.

We then construct six portfolios (S/L, S/M, S/H, B/L, B/M, B/H) from the combination of the two ME and three BE/ME groups. Monthly value weighted returns on the six portfolios are calculated from July of year t to June of t+1, and the portfolios are reformed in June of t+1.

Our small minus big (SMB) portfolio which is meant to mimic the return factor related to size, is the difference, each month, between the simple average of the returns on the three small-stock portfolios (S/L, S/M, S/H) and the simple average of the returns on the three big-stock portfolios (B/L, B/M, B/H). SMB is thus the difference between the returns on small- and big-stock portfolios for the same weighted average book-to-market equity. In other words, this difference should be largely free of any influence of BE/ME, and instead should provide only for the difference in size of firms.

The high minus low (HML) portfolio is meant to mimic the return factor related to the

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[2] The Securities Act, R.S.O. 1990, c. S.5, Section 78 (1).

[3] The decision to sort firms into three groups on BE/ME and two groups on ME follows the evidence in Fama and French (1992).

book-to-market of equity. HML is the monthly difference between the simple average of the returns on the two high-BE/ME portfolios (S/H and B/H) and the average of the returns on the two low-BE/ME portfolios (S/L and B/L). Thus, HML is the difference between the returns on high and low BE/ME portfolios with about the same weighted average size. Finally, our proxy for the market factor is the total monthly return on the CFMRC value weighted portfolio less the 30-day return on T-Bills.[4]

The term structure factors are formed as follows. The default factor, DEF, is defined as the difference in monthly yields on a portfolio of long term corporate bonds and long term Canada bonds.[5] The DEF factor proxies shifts in economic conditions that change the likelihood of default. The term to maturity factor, TERM, is the difference in monthly returns on long term Canada bonds and the 30-day return on T-Bills measured at the end of the previous month.[6] Because of the lag in the maturity factor, the first available monthly observation is February 1982. While the T-Bill proxies the general level of expected returns on bonds, TERM proxies for the deviation of long term bonds from expected returns due to shifts in interest rates.

Table 1 provides summary statistics for the data used to estimate the multi-factor model. The average monthly stock market risk premium over the estimation period of February 1982-June 1999 is 0.384%, or about 4.71% per year. This estimate is only 1.24 standard errors away from 0. This compares to 5.28% per annum for the U.S. market over the July 1963-December 1991 period as reported by Fama and French (1993) and 11.78% over the same February 1982-June 1999 period using the Fama and French data.[7] The average SMB return (or average premium

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[4] The CFMRC value weighted portfolio consists of 3361 domestic common equities. The return on the TSE300 composite was also used to represent the market with negligible differences from the results reported in the paper.

[5] Unlike Fama and French (1993) who use the difference in returns on long corporate bonds and long government bonds as their measure of DEF, we use the difference in yields since no long term corporate bond return series is available.

[6] Interest rate series were obtained from the Statistics Canada Canadian Socio-Economic Information Management System (CANSIM) database and the CFMRC/TSE database.

[7] Website of Kenneth French (http:/mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html) The smaller market risk premium in Canada relative to the U.S. market appears to be due to a combination of a higher market return in the U.S. (1.45% per month in U.S. compared to 1.05% per month in Canada) and a higher rate on 30-day T-Bills in Canada (.68% per month in Canada compared to .51% per month in U.S.) over

for the size-related factor in returns) is 0.427% per month and is a significant 1.77 standard errors away from 0. From the regression of excess return on variables SMB and HML, the average coefficient of SMB for the smallest size portfolios (see Table 5) is about .965, so that the expected return due to size is quite large, .965×.427=.412% per month (compared to .46% per month in Fama and French). At the same time, the average HML return (book-to-market factor) produces an average premium of .43% per month (compared to .40% per month in Fama and French). Both the DEF and TERM factors are significantly different from 0 with the mean TERM factor .528% per month, or approximately 6.52% per year and the mean DEF factor .063% per month, or approximately .75% per annum. If we focus on the correlation between the independent variables, Table 1 suggests that it is negligible for each of the variables. This implies that the standard errors of the regression estimates will not be large due to problems of multi-collinearity between the independent variables.

3. Time Series Regressions

Time-series regressions are convenient for examining an important asset pricing issue. As Fama and French (1993) pointed out, if assets are priced rationally, the factors such as size and book-to-market equity should explain the shared variation in stock and bond returns not explained by the other factors such as the excess market returns. The slopes and R^2 values of the time series regressions show whether the mimicking portfolios for the risk factors relating to size and book-to-market do indeed capture the shared variation in stock and bond returns not captured by the other variables.

The inputs to the time-series regressions include the returns on a market portfolio of stocks and mimicking portfolios for size, book-to-market, and term structure factors in returns. The returns to be explained are for 16 stock portfolios formed on the basis of size and book-to-market equity. The 16 size-B/M stock portfolios are formed similarly to the six portfolios used to construct the stock market factors, SMB and HML. Each year from 1982 to 1999, the sample of firms common to both the CFMRC/TSE Database and the Compustat Canadian Database are

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the February 1982-June 1999 period.

divided into size (market value of equity) quartiles. Similarly, the sample of firms in each year is also divided into four book-to-market equity groups. The 16 size-B/M stock portfolios are formed as the intersection of the four size and four book-to-market groups in each year.[8]

Our proxy for the market factor in stock returns is the excess market return (RM-RF). RM is the monthly total return on the CFMRC value weighted portfolio while RF is the 30-day return on T-Bills.

Tables 2a and 2b show descriptive statistics for the 16 stock portfolios over the 18 year period, 1982-1999. Except for the number of firms in each portfolio, these 16 portfolios are generally consistent with the 25 portfolios developed each period by Fama and French over similar characteristics. The excess returns which form the dependent variables in the time-series regressions are presented in Table 2b. There appears to be a strong small firm effect after controlling for differences in book-to-market ratios across portfolios. Firms in the smallest size portfolio earn higher excess returns than in any other size quartile for any given book-to-market ratio. Although there appears to be a similar distinction between Fama and French's small and big portfolios, the effect is not nearly as strong as with the Canadian firms.

Table 3 examines the relationship between the excess returns on the 16 stock portfolios and the TERM and DEF factors which measure the common variation in stock and bond returns. While the TERM coefficients are generally significant, the DEF coefficients are generally not significant. Similar to Fama and French, these factors alone explain less than 20% of the variation in excess returns across firms.

Table 4 shows that the excess returns on the market (RM-RF) captures most of the common variation in excess stock returns. The explained variance is greater, moreover, the bigger is the size of the portfolio. While the coefficients are all highly significant, for the two smaller size quartile portfolios, the R^2 values range from .106 to .550. For the two larger size quartile portfolios, the R^2 values range from .664 to .867. From the results in Table 2b, there appears to be significant variation in excess returns within the small size portfolios to be explained

[8] Because of the smaller number of Canadian firms overall compared to Fama and French's (1993) U.S. sample, and even smaller number in the intersection portfolios, we were not able to split the sample into quintiles as did Fama and French.

by the SMB factor.

Table 5 shows that in the absence of the market portfolio, SMB and HML typically capture significant time-series variation in stock returns in many portfolios, but substantially less than observed by Fama and French with U.S. equities. As in Fama and French, SMB and HML explain the greatest variation in the small portfolios, leaving much to be explained by the market in the larger portfolios as shown in Table 4.

When excess market returns are added to the SMB and HML factors, Table 6 shows that the three stock market factors capture strong common variation in stock returns. With the exception of the smallest portfolios, the R^2 values range from .595 to .876. The market betas are all highly significant. The t-statistics on the SMB slopes are all above 5 and most are above 15. SMB clearly captures variation that is not picked up by the market and HML. The slopes of SMB, moreover, decrease monotonically from smaller to bigger-size quartiles for each book-to-market quartile.

The slopes on HML are similarly related to the book-to-market ratios. In each size quartile of stocks, the HML slopes increase monotonically from strong negative values for the lowest book-to-market quartile to strong positive for the highest book-to-market quartile. The t-statistics on the HML slopes are generally very significant as well. HML appears to capture significant shared variation in stock returns that is missed by the market and SMB.

Given the strong slopes on SMB and HML, it is not surprising that adding these factors to the regressions in Table 4 that included only the market results in large increases in R^2. Like Fama and French, the increase in R^2 values is most noticeable for the smallest portfolios though not as dramatic an increase as observed by these authors using U.S. stocks. Further, while Fama and French found that adding SMB and HML to the regressions collapsed the betas for stocks toward 1.0, this is not observed in comparing the results in Tables 4 and 6. In both tables, the stock betas are close to 1.0 in each of the 16 stock portfolios. The reason for this difference is that the correlation between the excess market returns and SMB and HML are .32 and -.38, respectively, for the U.S. stock return data used by Fama and French while these correlations are only .008 and -.021, respectively, for Canadian stock returns.

When the term structure factors are added to the regressions, Table 7 shows little change

from the previous results. The slopes of both TERM and DEF are almost always insignificant suggesting that the bond market factors capture little, if any, of the overall variation in stock returns. In contrast to the U.S., it appears that there is much less correlation between the underlying factors which effect the stock and bond markets in Canada.

4. Application to the Industrial Sector

The above analyses suggests that the stock market factors, RM-RF, SMB and HML, explain most of the variation in Canadian stock returns with little variation being explained by the bond market factors, DEF and TERM. In this section we employ the multi-factor model to explain the variation in returns within the 14 sectors (industries) comprising the TSE300 in order to see if our results are robust across industries, or if there are industry-specific characteristics that might cause certain factors having greater explanatory power for certain industries and not others.[9] Formally, we have

$$R_{it} - RF_t = \alpha_i + \beta_{i1}(RM_t - RF_t) + \beta_{i2} SMB_t + \beta_{i3} HML_t + \beta_{i4} TERM_t + \beta_{i5} DEF_t + \epsilon_{it}$$

where R_{it} is the return on industry i in period t; RM_t is the return on the market (CFMRC value weighted portfolio) in t; RF_t is the risk-free return in t (30 day return on T-Bills); SMB_t is the return on the small minus big portfolio in t; HML_t is the return on the high book-to-market less low book-to-market portfolio in t; $TERM_t$ is the difference in monthly returns on long term Canada bonds and the 30-day return on T-Bills in t; DEF_t is the difference in monthly yields on7 a portfolio of long term corporate bonds and long term Canada bonds in t; and ϵ_{it} is an error term with mean of zero and variance σ^2_i.

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[9] For inclusion in the TSE300 a firm must have an annual trading volume of at least 100,000 shares and have a trading value of at least $1 million per year. The 300 stocks with the largest adjusted market value that meet these criteria are included in the index. We need to keep in mind when interpreting our results that each of the 14 sectors within the TSE300 is a value-weighted portfolio comprised of a sample of the largest (by market value) firms in that industry. For some industries, like the utilities, where there is reasonable homogeneity over firms, the sample comprising the subsector is quite representative of the overall industry along each factor. In other sectors, like the oil & gas sector, the firms comprising that sector within the TSE300 are quite large and probably much more financially secure than the average Canadian oil & gas firm trading on the TSE.

The results presented in Table 8a suggest that the strongest explanatory variable is the excess market return. For each of the 14 industries the coefficient of RM-RF is significant with t-statistics ranging from 9.58 to 21.27. The size factor varies depending upon whether the industry is composed of large versus small companies. For the small gold & silver, real estate and merchandising companies, there is a strong positive size risk premium while for the large utilities, pipelines and financial service companies, there is a large negative risk premium. The results suggest that the metals & minerals, paper & forest products, real estate, pipelines, merchandising, and financial services sectors are comprised of value-based securities and as such attract a positive risk premium from investors. Finally, while in general the coefficients of the TERM factor are not significant, for certain interest-sensitive industries, like utilities and financial services, they are quite strong. The coefficients of the other bond related factor, DEF, are significant less than half the time. It appears the market may be paying a premium for default risk in the metals & minerals, gold & silver, and paper & forest products industries. At the same time, there appears to be a negative default risk premium in other industries like utilities, merchandising, real estate, and communications & media.

Comparison of the multi-factor model estimates in Table 8a with the single factor CAPM estimates in Table 8c shows that the coefficient of the excess market term (β) appears to be similar in both models across industries. The addition of the size factor (SMB) produces a positive risk premium for smaller firms and a negative risk premium for larger firms. All other things equal, for example, there is a positive size risk premium required by investors in the gold & silver sector, suggesting that the cost of equity is higher because of this size effect than the estimate using the CAPM. In other words, the small firm risk phenomenon is not being captured by the market factor. At the same time, in other industries like the pipelines, utilities and financial services, there is a negative risk premium associated with the relatively large size of these firms which is again not captured by beta alone. The financial stress risk associated with HML also differs across industries. The real estate & construction industry is sensitive to financial stress and investors in that industry require a premium to compensate for this risk which again is not captured by beta. At the same time, the firms comprising the oil & gas sector within the TSE300 are financially strong and there is a negative risk premium required by investors in those firms due

to their financial stability.[10]

We can also compare the findings in Table 8b to those of Fama and French (1997) who find that their cost of equity estimates are generally higher across industries using the three-factor model than when using the CAPM.[11] Because the firms in our industry analysis comprise an elite group chosen to be part of the TSE300, they are not as representative (in terms of the factors) of the overall sample of firms within the economy that fall within each sector as are the Fama and French industry classes. For some industries, however, the samples are probably more closely representative of the overall sample of firms in the respective economies, e.g., the utilities. Comparing the results for the utility sector in Tables 8b and 8c, it is clear that the three-factor model leads to a lower cost of equity than the standard CAPM. Further, Fama and French estimate a size coefficient of -.20 while we estimate a slope of -.240 for the utility sector. For the coefficient of HML, Fama and French estimate a coefficient of .38 while we estimate a coefficient of -.109 for the utilities. What this suggests is that while the negative premium associated with size is similar for the utilities in both countries, there is less financial stress within the firms comprising the utility sector of the TSE300 than there is within the average U.S. utility. It follows then that because of the additional risk which the average U.S. utility must bear relative to the average firm within the TSE300 utility subsector, the cost of equity would be expected to be higher for the average U.S. utility relative to the average firm within the TSE300 utility subsector, ceteris paribus.

5. Summary and Conclusions

This paper described the development of a multi-factor model for explaining stock returns across Canadian firms. The model adopts the Fama and French (1993) methodology for determining the common risk factors in the returns of stocks. Unlike the U.S. stock returns

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[10] To compare the findings in Tables 8a and 8c, F-tests were performed for each of the 14 sub-indices. The results suggest that we reject the null hypothesis that the coefficients of SMB, HML, TERM, and DEF are jointly equal to zero for all but the Consumer Products, Industrial Products, Transportation and Conglomerate sectors at the 5% level. At the 1% level, the Oil & Gas sector is added to the above list.

[11] Fama and French (1997) use excess market returns on the market, SMB, and HML as their three explanatory variables.

examined by Fama and French, our results suggest that the three stock market factors, RM-RF, SMB, and HML explain most of the variation in Canadian equity returns over time. The addition of the bond market variables, TERM and DEF, provide little explanatory power for the average Canadian equity, suggesting that unlike in the U.S. equity market, the underlying factors influencing stocks and bonds are more distinct in Canada. Aside from the market risk premium which provides the greatest explanatory power, our results suggest a significant size factor in the Canadian equity market. A positive risk premium exists for smaller firms and this premium becomes negative as size increases within each of the book-to-market equity portfolios.

The multi-factor model is applied to 14 different industry portfolios and we find the excess return on the market explains most the variation in returns across industries. A strong positive size premium appears within the gold & silver sector and a strong negative premium appears in the utilities, pipelines, transportation and financial service sectors. Generally, the HML and bond market factors do not appear to have much explanatory power, with the exceptions being the metals & minerals, utilities, and financial service sectors. A comparison of our results with those of Fama & French suggest differences across industries between Canada and the U.S. One notable distinction is that while the utilities in both countries exhibit interest rate sensitivity, as expected, it is also clear that Canadian utilities are subject to significantly less financial distress than their U.S. counterparts.

Table 1

Summary statistics for monthly dependent and explanatory returns February 1982 to June 1999.

Name	Mean	Std. Dev.	t(mn)	Correlation				
RM	1.051	4.447	3.41					
TB	0.677	0.281	34.27					
				RM-RF	**SMB**	**HML**	**DEF**	**TERM**
RM-RF	0.384	4.450	1.24	1.000				
SMB	0.427	3.482	1.77	0.008	1.000			
HML	0.426	4.006	1.53	-0.021	-0.008	1.000		
DEF	0.063	0.025	36.47	-0.123	0.111	-0.135	1.000	
TERM	0.528	2.953	2.58	0.327	-0.219	0.179	-0.070	1.000

RM is the monthly return on the CFMRC value weighted portfolio. TB is the monthly return on T-Bills. SMB (small minus big) is the difference between the returns on small-stock and big-stock portfolios with about the same weighted average book-to-market equity. HML (high minus low) is the difference between the returns on high and low book-to-market equity portfolios with about the same weighted average size. DEF is the difference in monthly yields on a portfolio of long term corporate bonds and long term Canada bonds, TERM is the difference in monthly returns on long term Canada bonds and the monthly return on T-Bills. t(mn) is the t-statistic associated with the mean value.

Table 2a

Descriptive statistics for 16 stock portfolios formed on size and book-to-market equity for 1982-1999.

	Book-to-market quartiles			
Size Quartile	**Low**	**2**	**3**	**High**
	Avg. of monthly avgs. of firm size ($million)			
Small	**27.7**	**28.5**	**25.4**	**21.7**
2	**99.7**	**94.4**	**96.1**	**97.1**
3	**317.9**	**317.2**	**300.7**	**299.6**
Big	**2466.8**	**2970.8**	**2641.4**	**1870.2**

	Book-to-market quartiles			
Size Quartile	**Low**	**2**	**3**	**High**
	Avg. of monthly number of firms			
Small	**11.2**	**11.0**	**13.1**	**20.1**
2	**18.1**	**18.7**	**15.9**	**15.3**
3	**23.7**	**18.9**	**18.2**	**13.6**
Big	**20.9**	**23.1**	**21.5**	**15.8**

	Book-to-market quartiles			
Size Quartile	**Low**	**2**	**3**	**High**
	Avg. B/M for portfolio			
Small	**0.275**	**0.580**	**0.905**	**3.489**
2	**0.286**	**0.573**	**0.892**	**1.933**
3	**0.287**	**0.575**	**0.894**	**1.758**
Big	**0.268**	**0.582**	**0.889**	**1.569**

The 16 size-B/M stock portfolios are formed as follows. Each year from 1982 to 1999, the sample of firms common to both the CFMRC Database and the Compustat Canadian Database are divided into size (market value of equity) quartiles. Similarly, the sample of firms in each year is also divided into four book-to-market equity groups. The 16 size-B/M stock portfolios are formed as the intersection of the four size and four book-to-market groups in each year. The descriptive statistics are computed as an average over the 18 years.

Table 2b

Descriptive statistics for 16 stock portfolios formed on size and book-to-market equity for 1982-1999.

	Book-to-market quartiles			
Size Quartile	**Low**	**2**	**3**	**High**
	Mean monthly excess return on portfolio (%)			
Small	**1.50**	**0.85**	**0.62**	**1.55**
2	**0.58**	**0.75**	**0.52**	**1.17**
3	**0.47**	**0.57**	**0.27**	**0.24**
Big	**0.28**	**0.29**	**0.64**	**0.40**

	Book-to-market quartiles			
Size Quartile	**Low**	**2**	**3**	**High**
	Std dev of mean monthly ex. ret. on portfolio (%)			
Small	**14.45**	**7.73**	**6.73**	**7.62**
2	**6.67**	**5.75**	**5.85**	**8.26**
3	**5.80**	**5.46**	**4.93**	**4.89**
Big	**5.68**	**4.39**	**4.85**	**5.28**

	Book-to-market quartiles			
Size Quartile	**Low**	**2**	**3**	**High**
	T-stat. for mean excess return on portfolio			
Small	**1.50**	**1.55**	**1.34**	**2.93**
2	**1.26**	**1.89**	**1.29**	**2.05**
3	**1.19**	**1.52**	**0.80**	**0.71**
Big	**0.71**	**0.96**	**1.92**	**1.11**

The 16 size-B/M stock portfolios are formed as follows. Each year from 1982 to 1999, the sample of firms common to both the CFMRC Database and the Compustat Canadian Database are divided into size (market value of equity) quartiles. Similarly, the sample of firms in each year is also divided into four book-to-market equity groups. The 16 size-B/M stock portfolios are formed as the intersection of the four size and four book-to-market groups in each year. The descriptive statistics are computed as an average over the 18 years.

Table 3

Regressions of excess stock returns on the bond market returns, TERM and DEF: February 1982 to June 1999.

$$R(t) - RF(t) = a + mTERM(t) + dDEF(t) + e(t)$$

Dependent variable: Excess return on 16 stock portfolios

	Book-to-market quartiles							
Size Quartile	**Low**	**2**	**3**	**High**	**Low**	**2**	**3**	**High**
	m				**t(m)**			
Small	0.249	0.102	0.185	0.073	0.74	0.53	1.17	0.40
2	0.218	0.355	0.188	0.531	1.38	2.65	1.38	2.76
3	0.392	0.372	0.370	0.418	2.92	2.93	3.28	3.79
Big	0.428	0.469	0.658	0.688	3.26	4.78	6.27	6.09

	Book-to-market quartiles							
Size Quartile	**Low**	**2**	**3**	**High**	**Low**	**2**	**3**	**High**
	d				**t(d)**			
Small	1.030	-0.014	0.016	-0.137	2.58	-0.07	0.09	-0.64
2	-0.023	-0.053	-0.367	-0.064	-0.12	-0.34	-2.27	-0.28
3	-0.162	-0.087	-0.284	-0.317	-1.02	-0.58	-2.13	-2.43
Big	-0.213	-0.148	-0.115	-0.345	-0.14	-1.27	-0.92	-2.58

	Book-to-market quartiles							
Size Quartile	**Low**	**2**	**3**	**High**	**Low**	**2**	**3**	**High**
	R^2				**s(e)**			
Small	0.023	-0.009	-0.003	-0.007	0.143	0.078	0.067	0.076
2	-0.000	0.025	0.026	0.028	0.067	0.057	0.058	0.081
3	0.037	0.034	0.074	0.081	0.057	0.054	0.048	0.047
Big	0.041	0.102	0.159	0.176	0.056	0.042	0.045	0.048

DEF is the difference in monthly yields on a portfolio of long term corporate bonds and long term Canada bonds. TERM is the difference in monthly returns on long term Canada bonds and the monthly return on T-Bills. R^2 and the residual standard error are adjusted for degrees of freedom.

Table 4

Regressions of excess stock returns on excess stock market returns, RM-RF: February 1982 to June 1999.

$$R(t) - RF(t) = a + b[RM(t)-RF(t)] + e(t)$$

Dependent variable: Excess return on 16 stock portfolios

	Book-to-market quartiles							
Size Quartile	**Low**	**2**	**3**	**High**	**Low**	**2**	**3**	**High**
	b				**t(b)**			
Small	1.081	0.787	0.821	1.009	5.06	7.00	9.291	10.48
2	1.067	0.961	0.898	1.084	14.55	15.93	13.41	10.33
3	1.096	1.030	0.912	0.897	22.30	22.08	20.71	20.24
Big	1.097	0.919	0.986	0.996	24.14	36.80	30.35	22.20

	Book-to-market quartiles							
Size Quartile	**Low**	**2**	**3**	**High**	**Low**	**2**	**3**	**High**
	R^2				**s(e)**			
Small	0.106	0.197	0.292	0.344	0.137	0.069	0.057	0.062
2	0.505	0.550	0.464	0.338	0.047	0.039	0.043	0.067
3	0.706	0.702	0.674	0.664	0.031	0.030	0.028	0.028
Big	0.738	0.867	0.816	0.704	0.029	0.016	0.021	0.029

RM is the monthly return on the CFMRC value weighted portfolio and RF is the 30-day return on T-Bills. R^2 and the residual standard error are adjusted for degrees of freedom.

Table 5

Regressions of excess stock returns on the mimicking returns for size (SMB) and book-to-market equity (HML) factors: February 1982 to June 1999.

$$R(t) - RF(t) = a + sSMB(t) + hHML(t) + e(t)$$

Dependent variable: Excess return on 16 stock portfolios

	Book-to-market quartiles							
Size Quartile	**Low**	**2**	**3**	**High**	**Low**	**2**	**3**	**High**
	s				**t(s)**			
Small	1.382	0.937	0.677	0.865	5.18	6.46	5.36	6.22
2	0.906	0.675	0.619	1.238	8.42	6.42	5.67	10.44
3	0.350	0.318	0.302	0.169	3.10	2.96	3.13	1.76
Big	0.079	-0.115	-0.137	-0.165	-0.72	-1.32	-1.44	-1.64

	Book-to-market quartiles							
Size Quartile	**Low**	**2**	**3**	**High**	**Low**	**2**	**3**	**High**
	h				**t(h)**			
Small	-0.749	-0.330	-0.84	0.244	-3.23	-2.65	-0.77	2.03
2	-0.596	-0.090	0.064	0.965	-6.38	-0.98	0.67	9.36
3	-0.182	-0.004	0.115	0.164	-1.86	-0.05	1.37	1.96
Big	-0.317	-0.018	0.196	0.358	-3.29	-0.23	2.36	4.07

	Book-to-market quartiles							
Size Quartile	**Low**	**2**	**3**	**High**	**Low**	**2**	**3**	**High**
	R^2				**s(e)**			
Small	0.147	0.191	0.117	0.164	0.134	0.070	0.063	0.070
2	0.348	0.163	0.129	0.483	0.054	0.053	0.055	0.059
3	0.052	0.032	0.045	0.023	0.057	0.054	0.048	0.048
Big	0.043	-0.001	0.027	0.077	0.056	0.044	0.048	0.051

SMB (small minus big) is the difference between the returns on small-stock and big-stock portfolios with about the same weighted average book-to-market equity. HML (high minus low) is the difference between the returns on high and low book-to-market equity portfolios with about the same weighted average size. R^2 and the residual standard error are adjusted for degrees of freedom.

Table 6

Regressions of excess stock returns on excess stock market returns (RM-RF) and the mimicking returns for size (SMB) and book-to-market equity (HML) factors: February 1982 to June 1999.

$$R(t) - RF(t) = a + b[RM(t)-RF(t)] + sSMB(t) + hHML(t) + e(t)$$

Dependent variable: Excess return on 16 stock portfolios

	Book-to-market quartiles							
Size Quartile	**Low**	**2**	**3**	**High**	**Low**	**2**	**3**	**High**
	b				**t(b)**			
Small	1.058	0.760	0.816	1.099	5.48	7.67	10.09	12.14
2	1.051	0.956	0.896	1.095	25.46	19.79	15.39	20.79
3	1.091	1.028	0.912	0.899	24.42	23.32	22.61	21.37
Big	1.091	0.920	0.991	1.004	26.28	38.09	34.84	27.23

	Book-to-market quartiles							
Size Quartile	**Low**	**2**	**3**	**High**	**Low**	**2**	**3**	**High**
	s				**t(s)**			
Small	1.371	0.907	0.668	0.855	5.49	7.12	6.47	8.05
2	0.895	0.665	0.609	1.227	16.97	10.78	8.20	18.23
3	0.339	0.308	0.292	0.160	5.93	5.51	5.67	2.98
Big	-0.091	-0.125	-0.148	-0.176	-1.71	-4.04	-4.06	-3.73

	Book-to-market quartiles							
Size Quartile	**Low**	**2**	**3**	**High**	**Low**	**2**	**3**	**High**
	h				**t(h)**			
Small	-0.724	-0.313	-0.065	0.268	-3.34	-2.86	-0.72	2.91
2	-0.572	-0.067	0.084	0.991	-12.47	-1.25	1.31	16.93
3	-0.157	0.020	0.136	0.185	-3.16	0.40	3.04	3.96
Big	-0.292	0.004	0.219	0.381	-6.32	0.13	6.92	9.30

	Book-to-market quartiles							
Size Quartile	**Low**	**2**	**3**	**High**	**Low**	**2**	**3**	**High**
	R^2				**s(e)**			
Small	0.250	0.377	0.408	0.512	0.125	0.062	0.052	0.053
2	0.843	0.712	0.595	0.833	0.026	0.031	0.037	0.034
3	0.757	0.738	0.726	0.697	0.029	0.028	0.026	0.027
Big	0.781	0.876	0.859	0.800	0.027	0.015	0.018	0.024

RM is the monthly return on the CFMRC value weighted portfolio. RF is the 30-day return on T-Bills. SMB (small minus big) is the difference between the returns on small-stock and big-stock portfolios with about the same weighted average book-to-market equity. HML (high minus low) is the difference between the returns on high and low book-to-market equity

portfolios with about the same weighted average size. R^2 and the residual standard error are adjusted for degrees of freedom.

Table 7

Regressions of excess stock returns on excess stock market returns (RM-RF) and the mimicking returns for size (SMB) and book-to-market equity (HML) and bond market returns, TERM and DEF, factors: February 1982 to June 1999.

$$R(t)-RF(t) = a + b[RM(t)-RF(t)] + sSMB(t) + hHML(t) + mTERM(t) + dDEF(t) + e(t)$$

Dependent variable: Excess return on 16 stock portfolios

	Book-to-market quartiles							
Size Quartile	**Low**	**2**	**3**	**High**	**Low**	**2**	**3**	**High**
	b				**t(b)**			
Small	1.074	0.741	0.829	1.081	5.17	6.70	9.49	12.20
2	1.025	0.936	0.901	1.088	23.15	18.00	14.62	19.29
3	1.091	1.049	0.908	0.891	22.61	22.29	21.00	19.77
Big	1.120	0.925	0.977	0.978	25.24	35.51	32.63	24.76

	Book-to-market quartiles							
Size Quartile	**Low**	**2**	**3**	**High**	**Low**	**2**	**3**	**High**
	s				**t(s)**			
Small	1.340	0.924	0.656	0.793	5.24	6.98	6.10	7.27
2	0.918	0.682	0.610	1.230	16.82	10.65	8.04	17.71
3	0.340	0.289	0.299	0.170	5.72	4.90	5.62	3.07
Big	-0.117	-0.130	-0.138	-0.152	-2.14	-4.04	-3.75	-3.12

	Book-to-market quartiles							
Size Quartile	**Low**	**2**	**3**	**High**	**Low**	**2**	**3**	**High**
	h				**t(h)**			
Small	-0.678	-0.329	-0.054	0.313	-3.07	-2.89	-0.59	3.32
2	-0.590	-0.079	0.077	0.993	-12.51	-1.43	1.17	16.53
3	-0.159	0.035	0.128	0.174	-3.09	0.70	2.78	3.63
Big	-0.269	0.008	0.215	0.362	-5.69	0.30	6.75	8.60

	Book-to-market quartiles							
Size Quartile	**Low**	**2**	**3**	**High**	**Low**	**2**	**3**	**High**
	m				**t(m)**			
Small	0.223	0.056	-0.037	-0.323	0.69	0.34	-0.27	-2.34
2	0.089	0.093	-0.112	0.084	1.29	1.14	-1.16	0.95
3	-0.012	-0.010	-0.023	-0.010	-0.16	-0.95	-0.35	-0.14
Big	-0.080	-0.12	0.102	0.095	-1.15	-0.29	2.19	1.54

	Book-to-market quartiles							
Size Quartile	**Low**	**2**	**3**	**High**	**Low**	**2**	**3**	**High**
	d				**t(d)**			
Small	0.909	-0.078	0.066	0.120	2.57	-0.43	0.45	0.08
2	-0.078	0.007	-0.271	0.161	-1.04	0.08	-2.59	1.09
3	-0.043	0.070	-0.136	-0.146	-0.53	0.87	-1.85	-1.91
Big	0.142	0.037	0.121	-0.078	-1.63	0.83	2.38	-1.17

	Book-to-market quartiles							
Size Quartile	**Low**	**2**	**3**	**High**	**Low**	**2**	**3**	**High**
	R^2				**s(e)**			
Small	0.269	0.371	0.403	0.520	0.124	0.061	0.052	0.053
2	0.844	0.711	0.607	0.835	0.026	0.031	0.037	0.034
3	0.755	0.737	0.728	0.700	0.029	0.028	0.026	0.027
Big	0.784	0.875	0.865	0.802	0.026	0.016	0.018	0.024

RM is the monthly return on the CFMRC value weighted portfolio. RF is the monthly return on T-Bills. SMB (small minus big) is the difference between the returns on small-stock and big-stock portfolios with about the same weighted average book-to-market equity. HML (high minus low) is the difference between the returns on high and low book-to-market equity portfolios with about the same weighted average size. DEF is the difference in monthly yields on a portfolio of long term corporate bonds and long term Canada bonds. TERM is the difference in monthly returns on long term Canada bonds and the monthly return on T-Bills. R^2 and the residual standard error are adjusted for degrees of freedom.

Table 8a

Multi-factor model estimates for 14 TSE300 Subsectors: February 1982 to June 1999. T-statistics in parentheses.

Dependent variable: Excess return on TSE300 Subsector

	Coefficient of:						
TSE Subsector	**Constant**	**RM-RF**	**SMB**	**HML**	**TERM**	**DEF**	**R^2**
Metal & Minerals	-0.025	1.348	-0.105	0.348	-0.515	0.333	0.603
	-2.80	17.53	-1.11	4.24	-4.29	2.55	
Gold & Silver	-0.045	1.453	0.935	0.082	-0.095	0.596	0.431
	-2.79	10.51	5.50	0.56	-0.44	2.54	
Oil & Gas	-0.152	1.062	0.038	-0.200	-0.121	0.168	0.485
	1.64	13.20	0.38	-2.34	-0.97	1.23	
Paper & Forest Prod.	-0.024	1.204	0.035	0.268	-0.152	0.304	0.625
	-2.92	17.20	0.41	3.59	-1.40	2.56	
Consumer Prod.	0.003	0.809	-0.053	-0.075	0.075	-0.021	0.625
	0.49	16.59	-0.88	-1.45	0.98	-0.25	
Industrial Prod.	0.006	1.070	-0.065	-0.087	0.019	-0.120	0.722
	1.02	21.27	-1.05	-1.63	0.24	-1.41	
Real Estate & Const.	0.179	1.004	0.187	0.251	0.615	-0.521	0.459
	1.71	11.13	1.68	2.61	0.44	-3.40	
Transportation	-0.006	1.12	-0.303	0.073	-0.135	0.050	0.437
	0.55	12.08	-2.66	0.74	-0.94	0.32	
Pipelines	-0.005	0.620	-0.197	0.194	0.113	0.027	0.431
	-0.75	10.64	-2.74	3.12	1.24	0.27	
Utilities	0.010	0.489	-0.164	-0.109	0.338	-0.164	0.464
	1.75	9.58	-2.61	-2.00	4.25	-1.89	
Communications & Media	0.016	0.799	0.086	0.005	0.206	-0.259	0.600
	2.65	14.93	1.31	0.10	2.47	-2.85	
Merchandising	0.006	0.713	0.117	0.110	0.138	-0.151	0.589
	1.01	14.59	1.94	2.12	1.82	-1.82	
Financial Svcs.	0.002	0.881	-0.142	0.231	0.385	-0.078	0.717
	0.39	18.09	-2.36	4.45	5.10	-0.95	
Conglomerates	-0.003	1.060	-0.078	0.120	0.016	0.016	0.682
	-0.48	19.60	-1.16	1.90	0.19	0.17	

RM is the monthly return on the CFMRC value weighted portfolio. RF is the 30-day return on T-Bills. SMB (small minus big) is the difference between the returns on small-stock and big-stock portfolios with about the same weighted average book-to-market equity. HML (high minus low) is the difference between the returns on high and low book-to-market equity portfolios with about the same weighted average size. DEF is the difference in monthly yields on a portfolio of long term corporate bonds and long term Canada bonds. TERM is the difference in monthly returns on long term Canada bonds and 30-day T-Bills. R^2 is adjusted for degrees of freedom.

Table 8b

Multi-factor model estimates for 14 TSE300 Subsectors: February 1982 to June 1999. T-statistics in parentheses.

Dependent variable: Excess return on TSE300 Subsector

	Coefficient of:				
TSE Subsector	**Constant**	**RM-RF**	**SMB**	**HML**	**R^2**
Metal & Minerals	-0.006	1.211	0.018	0.249	0.559
	-1.82	16.07	0.18	2.98	
Gold & Silver	-0.007	1.389	1.000	0.019	0.418
	-1.23	10.69	6.02	0.13	
Oil & Gas	-0.005	1.024	0.074	-0.231	0.484
	-1.53	13.68	0.77	-2.78	
Paper & Forest Prod.	-0.005	1.149	0.088	0.221	0.598
	-1.70	17.39	1.04	3.01	
Consumer Prod.	0.002	0.827	-0.069	-0.063	0.618
	0.89	18.28	-1.18	-1.26	
Industrial Prod.	-0.002	1.083	-0.078	-0.075	0.722
	-0.76	21.14	-1.31	-1.43	
Real Estate & Const.	-0.015	1.055	0.134	0.304	0.433
	-3.83	12.28	1.22	3.18	
Transportation	-0.003	1.08	-0.274	0.051	0.440
	-0.87	12.64	-2.50	0.53	
Pipelines	-0.003	0.643	-0.215	0.207	0.432
	-1.15	10.87	-3.11	3.44	
Utilities	0.002	0.575	-0.240	-0.049	0.414
	0.69	11.59	-3.78	-0.89	
Communications & Media	0.001	0.863	0.027	0.055	0.576
	0.40	16.85	0.42	0.98	
Merchandising	-0.003	0.754	0.080	0.142	0.570
	-1.55	16.41	1.35	2.78	
Financial Svcs.	-0.001	0.972	-0.220	0.290	0.683
	-0.46	20.27	-3.59	5.44	
Conglomerates	-0.002	1.060	-0.079	0.111	0.685
	-0.87	21.21	-1.24	1.99	

RM is the monthly return on the CFMRC value weighted portfolio. RF is the 30-day return on T-Bills. SMB (small minus big) is the difference between the returns on small-stock and big-stock portfolios with about the same weighted average book-to-market equity. HML (high minus low) is the difference between the returns on high and low book-to-market equity portfolios with about the same weighted average size. R^2 is adjusted for degrees of freedom.

Table 8c

CAPM estimates for 14 TSE300 Subsectors: February 1982 to June 1999. T-statistics in parentheses.

Dependent variable: Excess return on TSE300 Subsector

	Coefficient of:		
TSE Subsector	**Constant**	**RM-RF**	**R^2**
Metal & Minerals	-0.005 -1.48	1.206 15.75	0.544
Gold & Silver	-0.003 -0.47	1.395 9.94	0.321
Oil & Gas	-0.006 -1.73	1.038 13.53	0.468
Paper & Forest Prod.	-0.004 -1.25	1.145 17.00	0.582
Consumer Prod.	0.001 0.62	0.828 18.26	0.616
Industrial Prod.	-0.002 -1.08	1.084 23.06	0.720
Real Estate & Const.	-0.013 -3.31	1.050 11.95	0.407
Transportation	-0.004 -1.12	1.081 12.47	0.427
Pipelines	-0.003 1.12	0.638 11.25	0.378
Utilities	0.0003 0.135	0.575 11.23	0.377
Communications & Media	0.001 0.565	0.862 16.87	0.578
Merchandising	-0.002 -1.08	0.752 16.08	0.554
Financial Svcs.	-0.0006 -0.286	0.965 18.40	0.620
Conglomerates	-0.002 -0.811	1.060 20.99	0.680

RM is the monthly return on the CFMRC value weighted portfolio. RF is the 30-day T-Bill rate. R^2 is adjusted for degrees of freedom.

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