HOW DO Interest Rate Changes AFFECT EQUITIES?

BY STEPHEN R. FOERSTER AND STEPHEN G. SAPP

Canadian stocks are often driven by interest rates—but some sectors react more strongly.

What factors drive stock prices? According to the well-known Capital Asset Pricing Model (CAPM), the expected return required by investors depends only on a stock's market risk exposure. However, some researchers argue that factors in addition to market risk may help explain equity returns. Arguably, the most intuitively appealing and pervasive factor is the interest rate. This factor is especially important in Canada because a large component of the Canadian market is comprised of the sector of stocks known as "interest sensitives."

We address two important issues related to Canadian stock prices and interest rates. First, if interest rate changes drive stock prices, which is the most important type of interest rate? Second, after controlling for market risk, how do stocks in various industries react to interest rate changes? These questions are important for sector rotators and for hedge fund managers who might be attempting to develop a "market neutral" position while unaware of the resulting interest rate exposure of their strategy. Although interest rate changes should impact on all stocks to some extent, interest-sensitive stocks should be more greatly affected by changing rates than other stocks. Because of this, our investigation is focused on interest-sensitive stocks, primarily financial institution stocks.

While it may seem obvious that interest-sensitive stocks and other stocks should be impacted by changing interest rates, our study emphasizes the impact of controlling for the overall market factor, as some hedge funds attempt to do. We conjecture that, once we control for the overall market effect, the sensitivity to the interest rate factor may be different for stocks in other industries. For example, after controlling for the market effect, resource-based industries may perform better than other industries during increasing interest rate environments. Consequently we complete this analysis by comparing the interest-sensitivity of financial institution stocks to equity indices in other industries.

Financial institution or bank stocks are typically placed among the most interest-sensitive of all stocks. The logic is that commercial banks typically derive a majority of their revenue from net interest income or the difference between what the bank earns on assets such as loans and what it pays on deposits. If there is a mismatch between assets and liabilities, then changes in the level of rates or even the shape of the yield curve should impact on net interest income. Bank earnings tend to react more favourably to interest rate declines since bank balance sheets can be liability-sensitive: deposits tend to re-price before assets. So, if interest rate factors are priced by the market, they should be priced most significantly for bank stocks and other interest-sensitive stocks.

To determine the sensitivity of equity values to interest rates, we investigate a number of different interest rate variables. For example, we ask: How sensitive are these stocks to changes in different types of interest rates such as short-term versus long-term, government versus corporate, the shape of the yield

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curve, and various default premiums? Do bank stocks perform differently in different time periods, and during expansions versus recessions? Is a two-factor model (market and interest rate) appropriate for these stocks? How much more sensitive are these bank stocks to changes in interest rates than equities in other industries?

Data, Models and Methodology

We examine monthly data for the 40-year period from January 1, 1960 to January 1, 2000, focusing on the five largest banks in Canada: Bank of Montreal (Toronto Stock Exchange (TSX) ticker symbol BMO), The Bank of Nova Scotia (BNS), Canadian Imperial Bank of Commerce, or CIBC (CM), Royal Bank of Canada (RY), and The Toronto-Dominion Bank (TD). We gather price and return data for the individual stocks (returns include dividends as well as price changes), the market index (the TSE 300 Composite Index), 14 sector indices, and treasury securities from the Canadian Financial Market Research Centre (CFMRC) database. With the exception of CIBC (CM), data are available for each bank over the entire 40-year period. Monthly TSX price-earnings ratios are obtained from the Statistics Canada Cansim database, while bank and financial services earnings are provided by BMO Nesbitt Burns. The earnings are adjusted for any extraordinary items (based on the judgment of BMO Nesbitt Burns analysts).

Figure 1 compares the price level of the financial services index with the long-term government bond yields over the entire period (representing the average yield of bonds with greater than 10 years to maturity). Recessions are shown in the shaded areas. In the first half of the sample (1960 to 1980), interest rates increased from below 6 per cent to over 10 per cent. In the second half of the sample (1980 to 2000), interest rates peaked at over 17 per cent, then declined steadily to below 6 per cent. Casual inspection of the graph suggests an inverse relationship between changes in the index level and changes in interest rates.

Why should stock prices be influenced by interest rate

FIGURE 1

THE FINANCIAL SERVICES INDEX AND LONG-TERM CANADIAN GOVERNMENT BOND YIELDS

Financial Services index (FINS) from January 1, 1960 to January 1, 2000 and the yield on long-term Canadian government bonds (LTGCY). The shaded areas represent periods of economic recession.

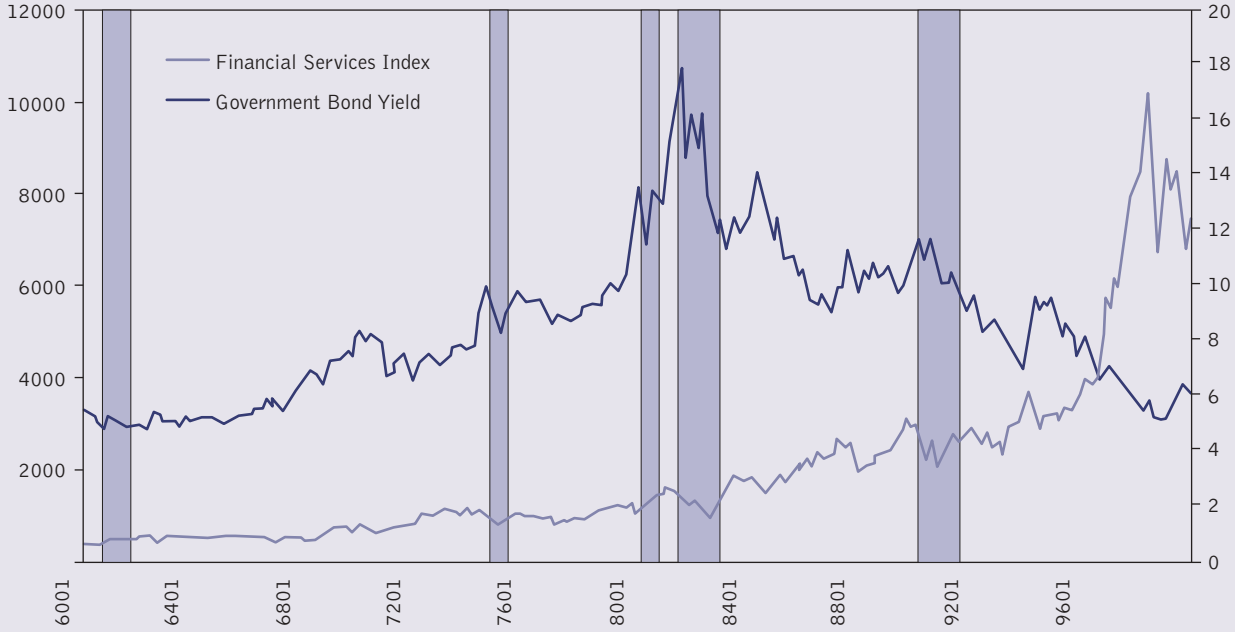
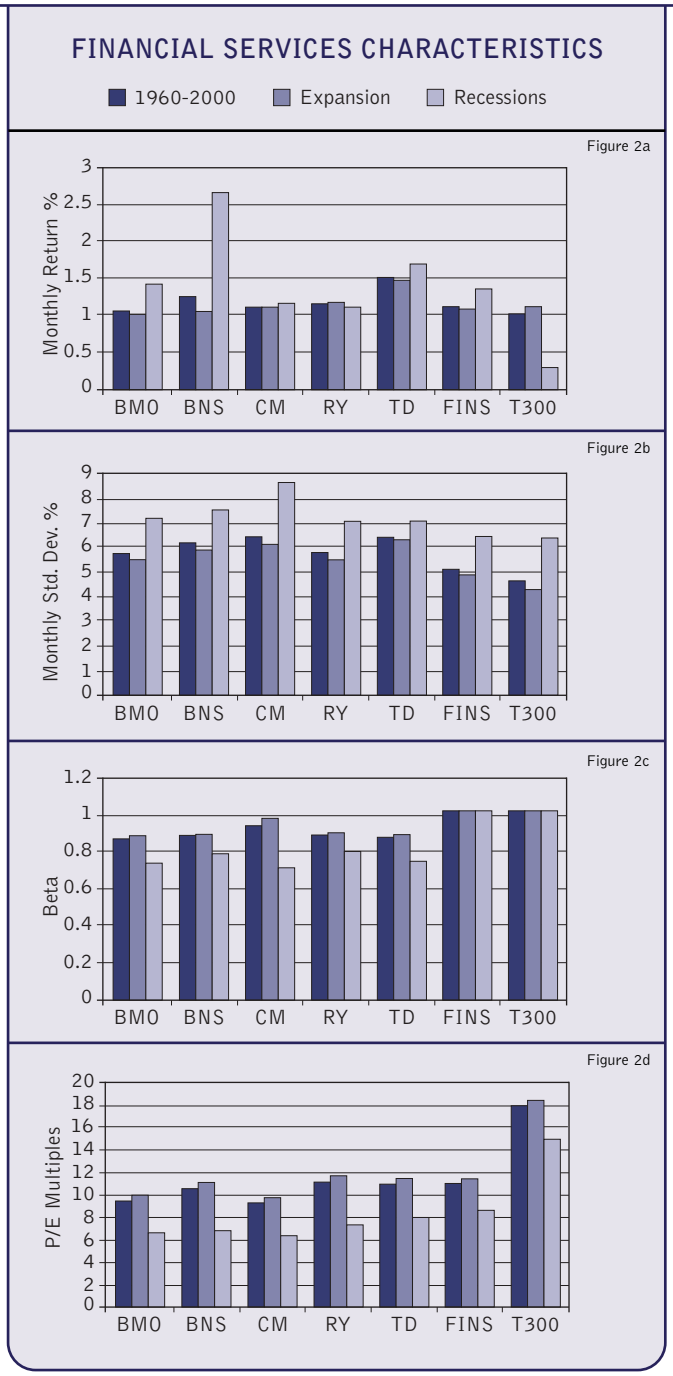


FIGURE 2



changes? Consider the well-known Gordon (or constant growth dividend discount) model:

$$P_0 = DIV_1/(r-g) \qquad (1)$$

where "P_0" is the current share price of the stock, "DIV_1" is the anticipated dividend over the next year, "r" is the expected return on the stock, and "g" is the anticipated constant dividend growth rate. If we incorporate the stock's riskiness through the Sharpe-Lintner CAPM, then "r" can be represented as:

$$r = r_F + ß*MRP \qquad (2)$$

where "r_F" is the risk-free rate, "ß" is the beta of the stock, and "MRP" is the expected market risk premium. Now assume a constant dividend payout such that $DIV_1 = K*EPS_1$ where "EPS_1" is the expected earnings per share over the next year and "K" is a constant dividend payout ratio. Substituting equation (2) into equation (1) gives:

$$P_0 = K*EPS_1/(r_F + ß*MRP - g) \qquad (3)$$

Thus for all stocks, all else equal, a change in r_F should impact, inversely, on price. In addition for bank stocks (and other interest-sensitive stocks), EPS_1 (as well as g) should be impacted inversely as well. Conversely, firm EPS in some industries may be positively related to interest rate changes. For example, resource-based industries, such as the mining sector, may demonstrate stronger performance later in the business cycle, which tends to correspond to a time of increasing interest rates. Thus the extent to which the earning impact dominates (or is dominated by) the rate change becomes an empirical question.

To determine whether different factors affect these stock returns, we consider the following regression forms to estimate multi-factor pricing models:

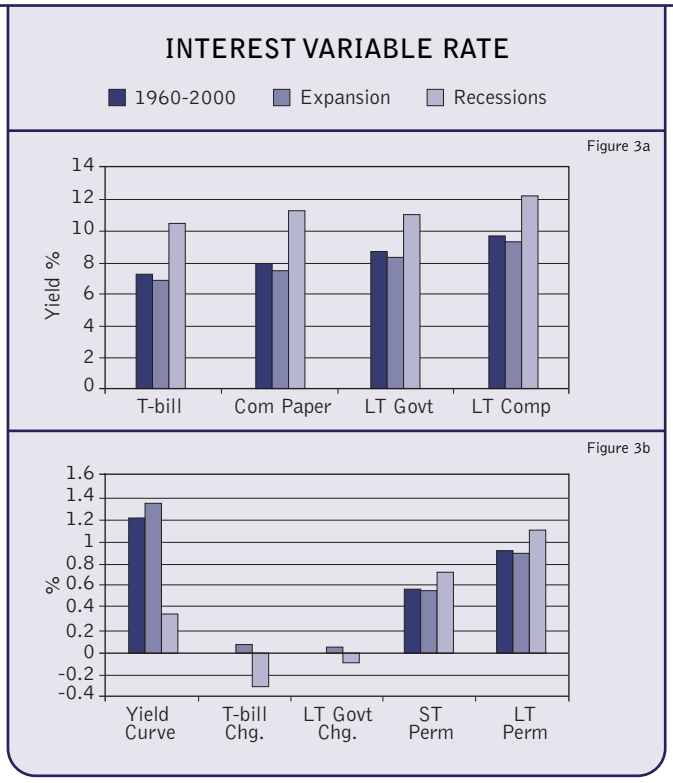
$$r_{it} = a_i + b_{i1}*F_{1t} + b_{i2}*F_{2t} + e_{it} \qquad (4)$$

where "r_{it}" is the return on stock in period t, "F_{1t}" is the value of factor j in period t, "b_{i2}" is the sensitivity of stock i to factor j, "a_i" is the intercept term, and "e_{it}" is the error term. To determine which factors are associated with these returns, we test whether various factors' coefficients are statistically significant.

Individual Bank Stocks and Indices

Summary statistics for individual bank stocks as well as the financial services and overall market indices are presented in Figure 2. The financial services index contains the five large banks, National Bank, plus numerous smaller financial institutions. Average price-earnings multiples for the financial services index were 10.80 times versus 17.69 times for the overall market. Average betas for each bank (based on rolling five-year monthly

FIGURE 3



regressions) were below one. Overall, bank stocks outperformed the market over the entire period, but exhibited less market risk (as measured by the beta from the traditional CAPM). These preliminary results suggest the one-factor CAPM may not be adequately capturing the risk being priced in bank stocks.

Sub-period results were also examined. In the 1960 to 1980 period, on average, the financial services index slightly under-performed the overall market (0.87 per cent per month versus 0.90 per cent). At an average price-earnings multiple of 12.54 times, bank stocks were only slightly lower than the market average 14.50 times. Each stock's average beta was below 1.0 while each stock's average dividend yield was slightly greater than the average market dividend yield. In the 1980 to 2000 period, on average, the financial services index substantially outperformed the overall market (1.31 per cent per month versus 1.02 per cent). At an average price-earnings multiple of 9.05 times, bank stocks were much lower than the market average 20.89 times. Each stock's average beta was still below one. These results suggest that the differences between the pricing of bank stocks and the market indices change over time.

Figure 2 also examines summary statistics for each stock separately during expansions and recessions (as defined by Statistics Canada). Expansions occurred in 417 of the 480 months (87 per cent of the time) while recessions occurred in 63 months (13 per cent of the sample). Average bank stock returns were almost identical to average market returns during expansions but were much stronger during recessions (1.32 per cent per month versus 0.25 per cent for the market). Figure 1 highlights how interest rates have typically declined during recessions, suggesting a reason for the strong bank stock performance during recessions. We investigate this in the next section.

Interest Rate Factors

Figure 3 presents summary statistics for various interest rate variables. We examine the three-month treasury-bill yield (TBY), average three-month commercial paper yields (CPY), average long-term government bond yields (LTGY), and average long-term corporate bond yields (LTCY). The month-to-month changes in the treasury-bill yield (TBYCH) and the long-term government yield (LTGYCH) are estimated along with the shape of the yield curve (YC) and short-term and long-term default premiums (DPST and DPLT). The YC variable is estimated as the difference between LTGY and TBY, DPST is the difference between CPY and TBY, and DPLT is the difference between LTCY and LTGY.

Overall, both short-term and long-term interest rate changes averaged around zero. TBY was 7.24 per cent versus 7.80 per cent for CPY, resulting in an average DPST of 0.55 per cent. LTGY was 8.45 per cent versus 9.34 per cent for LTCY, resulting in an average DPLT of 0.89 per cent. YC was 1.21 per cent, strongly upwardly sloping on average.

During the 1960 to 1980 period the overall level of interest rates was lower. Somewhat surprisingly, both short-term and long-term default premiums were similar. The yield curve was steeper. Treasury-bill yields were increasing by an average of four basis points per month, while long-term government yields were increasing at half that rate.

During the 1980 to 2000 period, average treasury-bill yields were 3.0 per cent higher than in the earlier period while long-term government yields were 2.4 per cent higher, resulting in a less steep yield curve. The average DPLT of 0.90 per cent was much higher than the average DPST of 0.24 per cent. Treasury-bill yields were decreasing by an average of four basis points per month while long-term government yields were decreasing at half that rate.

Average rates were much higher during expansions than recessions since rates had typically risen during the later stages of the business cycle. The yield curve shape was very flat during recessions and default premiums were quite large. During recessions, treasury-bill yields were declining by 31 basis points per month while long-term government yields were declining by ten basis points per month.

We next investigate the significance of the relationship between individual bank stock returns (as well as the financial services index return) and various interest rate factors through univariate regressions over the entire 40-year period. Not surprisingly, the market return variability can explain a large portion of each bank's stock return variability although much is not explained. Consequently we investigate the impact of other factors.

The yield curve variable is barely significant for some of the banks and not significant for others. While the DPST variable is significant for some of the banks, the R-square is very low and the DPLT variable is not significant for any of the banks. The two yield change variables, TBYCH and LTGYCH, are both the expected negative sign and significant for each bank stock. The treasury-bill return variable (TBR) is generally not significant but the long-term government return variable (LTGR) is of similar significance to the LTGYCH variable. Based on five-year sub-samples, results indicate that the long-term government bond-related factors are the only factors, other than the market variable, that are statistically significant in all but one of our eight five-year sub-periods.

Bank Stock Valuation Drivers

Building on our previous analysis, we examine a two-factor model with both a market variable (T300) and one of the most significant interest rate variables, LTGYCH, as the two independent variables.

Overall we find that the interest rate factor has a significant influence (in the predicted direction) on the returns for every bank stock and the financial services index. In the 1960 to 1980 period of generally increasing interest rates, the model is fairly robust at the sector level, although some of the individual stock regression coefficients for the LTGYCH variable are no longer significant. However, in the 1980 to 2000 period of generally decreasing interest rates, all of the LTGYCH coefficients remain significant.

During expansions the LTGYCH coefficient is significant for each bank while during recessions the coefficient is always negative but only significant for some of the stocks. This is probably attributable to the relatively small sample (63 months) for the recession regressions.

Even though we find much evidence suggesting that long-term interest rates play a significant role in this sector, it is unclear why this is the case. Conventional financial theory suggests that short-term interest rates, the default premium, or the term structure of interest rates should play a significant role in the valuation of bank stocks, but there are few theories that explain why long-term interest rates should. One possible explanation is that bank dividend yields are highly correlated with long-term government yields and, consistent with conventional "street" wisdom, bank stocks are a close substitute for government bonds for many long-term investors. A check of the data indicates that bank stock dividend yields average 54 per cent of long-term government bond yields over our sample period and the correlation of the two series is a strong 0.78.

Comparisons with Non-Bank Industries

While our focus up to this point has been exclusively on the financial services sector, in this section we expand our analysis to other sectors. In particular, we test the significance of a two-factor model (the market factor and the change in long-term government yields) on all fourteen market industries (as defined by the TSX): Metals and Minerals (M&M), Gold and Precious Minerals (G&PM), Oil and Gas (O&G), Paper and Forest Products (P&FP), Industrial Products (IP), Transportation (TRAN), Conglomerates (CONG), Consumer Products (CP), Communications and Media (C&M), Merchandising (MERC), Real Estate (RE), Pipelines (PIPE), Utilities (UTIL). These 14 industries are often grouped by analysts into four broader sectors: resources (M&M, G&PM, O&G, and P&FP), industrials (IP, TRAN, CONG), consumer (CP, C&M, MERC), and interest-sensitive (RE, PIPE, UTIL, and FINS). We present results in Table 1.

Not surprisingly, for all industries, the market coefficient is highly significant. Adjusted R-squares range from 20 per cent (G&PM) to 74 per cent (IP). Among the resource industries, the LTGYCH coefficient is positive for each industry, significant at the 10 per cent level

TABLE 1

REGRESSIONS OF INDUSTRY RETURNS ON THE MARKET AND YIELD CHANGES[7]

	RESOURCES				INDUSTRIALS			CONSUMER			INTEREST-SENSITIVES				ALL
	M&M	G&PM	O&G	P&FP	IP	TRAN	CONG	CP	C&M	MERC	RE	PIPE	UTIL	FINS	
Intercept	-0.003	0.002	-0.002	-0.002	0.000	0.001	0.001	0.003	0.006	0.001	-0.002	0.002	0.006	0.003	0.001
(t-stat)	(-1.94)	(0.46)	(-0.85)	(-1.02)	(0.15)	(0.56)	(0.68)	(2.45)	(3.41)	(0.55)	(-0.50)	(1.50)	(4.79)	(2.32)	(2.50)
T300	1.277	1.065	1.194	1.138	1.033	1.020	1.043	0.843	0.762	0.815	1.120	0.701	0.495	0.808	1.107
(t-stat)	(31.4)	(11.1)	(23.8)	(25.3)	(35.5)	(19.6)	(27.3)	(29.9)	(19.9)	(25.6)	(15.0)	(19.3)	(16.6)	(25.8)	(87.4)
LTGYCH	0.0287	0.023	0.008	0.009	0.003	0.009	-0.000	-0.008	-0.013	-0.005	0.001	-0.025	-0.026	-0.026	-0.002
(t-stat)	(5.52)	(1.91)	(1.28)	(1.62)	(0.68)	(1.28)	(-0.08)	(-2.21)	(-2.71)	(-1.30)	(0.12)	(-5.34)	(-6.91)	(-6.44)	(-1.17)
Adj. R^2	0.676	0.205	0.558	0.586	0.741	0.461	0.632	0.684	0.500	0.609	0.347	0.515	0.475	0.650	0.947

for G&PM and almost so for P&FP, and significant at the 1 per cent level for M&M. One interpretation of these results is that these industries tend to perform better later in the business cycle when interest rates are rising. None of the three industrial sector industries has significant LTGYCH coefficients.

All three consumer sector industries have negative LTGYCH coefficients, with the CP and C&M coefficients significant at the 5 per cent level. Again interpreting these results in the context of the business cycle, these stocks would often be viewed as cyclicals, performing better in earlier stages of the business cycle when interest rates are low or worse later in the business cycle when interest rates are increasing.

Finally, of the four interest-sensitive sector industries, all but RE have significantly negative LTGYCH coefficients. In retrospect, while we would expect real estate stocks to be inversely related to interest rate changes, the entire industry sustained a severe decline during the 1990s while interest rates were also declining. The other three interest-sensitive industries have economically large and significant negative LTGYCH coefficients. Both the PIPE and UTIL industries are regulated and highly leveraged, thus benefiting from interest rate declines.

We also include in Table 1 the results of an equal-weighted return index of the 14 sectors regressed on the market as well as LTGYCH. The interesting result is that the LTGYCH coefficient is not significantly different from zero. This important result highlights a potential danger of overlooking industry factors. Since the interest rate sensitivity can be either positive or negative, at an aggregate level, the various industry effects may cancel out or be magnified depending on the investment strategy.

Conclusions

While bank stocks are sensitive to a number of interest rate variables, they are surprisingly most sensitive to changes in long-term government bond yields and returns. Results are robust across different time periods: rising and falling rates, expansions, and recessions. We also find that while long-term interest rate changes are significantly negatively related to returns in other interest-sensitive industries such as utilities and pipelines, and to a lesser extent communications, and consumer products, this is not the case for other sectors. In fact, some resource-based industry returns are significantly positively related to interest rate changes—important results for investors who bet on sectors, and long/short investors who may be market neutral but not interest rate neutral. ▮

Endnotes

1. See Merton, Robert, 1973, "An Intertemporal Capital Asset Pricing Model", Econometrica 41, pp. 867-887; Ross, Stephen, 1976, "The Arbitrage Theory of Capital Asset Pricing", Journal of Economic Theory 13, pp. 341-360; Chen, Nai-fu, Richard Roll, and Stephen Ross, 1986, "Economic Forces and the Stock Market", Journal of Business 59, pp. 383-403; and Fama, Eugene and Kenneth French, 1993, "Common Risk Factors in the Returns on Stocks and Bonds", Journal of Financial Economics 33, pp. 3-56.
2. See Choquette, Kevin, 1998, "Banks", in Joe Kan ed.
3. The CM data start on July 1, 1964, as a result of the merger between Canadian Imperial Bank and the Bank of Commerce.
4. These regression results are available by request from the authors.
5. Gibbons, M, S. Ross, and J. Shanken, 1989, "A Test of the Efficiency of a Given Portfolio", Econometrica 57, pp. 1121-1152 present a specification test applicable for our analysis.
6. These regression results are also available by request from the authors.
7. Regression results for TSX industry total return indices, January 1, 1960 to January 1, 2000 (Real Estate index data starts on August 1, 1961). Independent variables include the return on the TSE 300 index (T300) and the change in the yield on the long-term government bond yield (LTGYCH). Indices include Resources: Metals and Minerals (M&M), Gold and Precious Minerals (G&PM), Oil and Gas (O&G), and Paper and Forest Products (P&FP); Industrials: Industrial Products (IP), Transportation (TRAN), and Conglomerates (CONG); Consumer: Consumer Products (CP), Communications and Media (C&M), and Merchandising (MERC); Interest-Sensitives: Real Estate (RE), Pipelines (PIPE), Utilities (UTIL), and Financial Services (FINS); and an equal-weighted index of all industries (ALL).