2021

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Recommended Citation

Killins, R.N., Egly, P.V., Batabyal, S., 2021. The impact of the yield curve on bank equity returns: Evidence from Canada. The Quarterly Review of Economics and Finance. https://doi.org/10.1016/j.qref.2021.06.016

The impact of the yield curve on bank equity returns: Evidence from Canada

Draft: January 2, 2021

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Draft: Match 9, 2021

Highlights:

- Canadian banks equity returns are positively impacted by contemporaneous (and lagged) yield curve shifts.
- Canadian bank equity returns have become more sensitive to changes in yield curve spreads in the post 2007-2009 financial crisis.
- Equity returns of Canadian banks tend to react in an asymmetric manner to changes in the yield curve (i.e., yield curve spreads above their mean values elicit a greater impact on bank equity returns than yield curve spreads that are below their mean values over our sample time horizon).
- Yield curve swings could induce shifts in banks' profit-seeking behavior towards non-interest income sources.
- Our findings suggest that portfolio managers need to be aware of the sensitivity of bank equity returns to changes in the yield curve given the potential implementation of a yield curve control (YCC) policies by central banks.

Abstract: We examine the reaction of Canadian banks equity returns to changes in yield curve spreads. We find that Canadian banks equity returns are positively impacted by contemporaneous (and lagged) yield curve spreads. Our results also suggest that Canadian banks have become more sensitive to changes in the slope of the yield curve in the post 2007-2009 financial crisis. We also find an asymmetric impact of the slope of the yield curve on Canadian bank equity returns. For equity investors, the yield curve's relevance varies with spread-maturities. Our findings have important implications for the estimations of banks' cost of capital and implicitly suggest regulatory incentives in favor of macro-prudential policy to evaluate bank risk. Swings in yield curve spreads could induce shifts in banks' profit-seeking behavior towards non-interest income sources.

Keywords: bank equity returns; yield curve; Fama-French asset pricing model, Canada
JEL Classification Numbers: G21, E43, G11
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1. Introduction

An important consequence of the unconventional monetary policy intervention, in response to the global financial crisis (2007-2009), was an induced change in the slope of the yield curve under near-zero policy interest rates. The impact of this policy intervention changed the banking operating environment and serves to motivate this research. Unlike many European and American banks, the Canadian banking system remained strong and stable during the global financial crisis (GFC) as they did not require any form of a bailout; moreover, their regulatory system received praise from many countries and global institutions such as the International Monetary Fund (IMF).[1] Because of the apparent success of the Canadian banking system, it is worthwhile to investigate how changes in yield curve spreads affect Canadian banks' equity returns and whether findings differ from previous studies on U.S. and European banks. Given the specific nature of the Canadian banking system, it is particularly interesting to focus on the post-GFC low interest rate environment. The bulk of the past research on the yield curve and bank

[1] See https://www.imf.org/external/pubs/ft/gfsr/2009/01/ for the 2009 Global Financial Stability Report from the IMF.

equity returns focuses on the U.S. and European banking systems (e.g. Schuermann and Stiroh, 2006, Viale et al., 2009, Baek and Bilson, 2015 and Ferrer et al., 2016). This paper departs from the U.S. and European centric samples and focusses on the impact of yield curve spreads on equity returns for the Canadian banking system. The aim of the paper is to provide evidence on how a small-open economy with a highly regulated banking sector reacts to changes in the slope of the yield curve. Canada provides an interesting financial services landscape to evaluate this research due to the concentrated nature of the Canadian banking sector and its historical resilience to financial crisis.

Another country with banking sector characteristics that are similar to the Canadian banking sector is Australia; both of these banking sectors performed well during the GFC. Allen et al. (2011) provides a detailed comparison of Canadian and Australian banks following the GFC in order to better understand why Canadian and Australian banks performed relatively well during the GFC. Their paper identifies a number of factors, including the past conservatism of Canadian and Australian regulatory requirements regarding capital adequacy, the lack of compromised lending standards, and a focus on domestic lending. Advocates for a Canadian-type banking system argue that this success is the outcome of industry structure and strong regulation.[2]

This study explores the following research questions: (1) Do changes in the slope of the yield curve impact equity returns of publicly-traded Canadian banks? (2) Do changes in yield curve spreads have an asymmetric impact on bank stock returns and does the impact gradually

[2] The reasoning behind why the Canadian financial markets faired so well has been attributed to various factors, including strong regulatory regime, stringent capital requirements for banks, federal supervision, a concentrated banking system, strict mortgage market regulations, and a conservative appetite for risk (Bordo et al., 2015; Calmes & Theoret, 2013; Mohsni & Otchere, 2018). Further, it is a common practice for Canadian banks to hold mortgage on their balance sheets, which results in the application of high level of due diligence in the underwriting of bank loans. As a result, Canada did not experience the same degree of housing boom and bust that occurred in many other countries during the 2007-2009 global financial crisis.

diffuse into stock prices? (3) Does the impact of yield curve spreads on Canadian bank stock returns differ between the pre and post 2007-2009 financial crisis periods? To explore these research questions we focus on the slope of the yield curve (aka yields spreads) since it is a well-known measure (used by practitioners and academics) that allows us to corroborate the common belief that bank performance improves (i.e. increased cashflows due to higher net margins and banks' positive maturity gap) with an upward-sloping yield curve rather than under a horizontal or downward-sloping yield curve. The reliance on the slope of the yield curve for this research seems appropriate given the nature of the Canadian banking system (i.e. their focus on domestic lending (including real estate mortgages), and an adherence to a traditional banking model of financial intermediation (i.e. reliance on asset and maturity transformation activities). Modern financial theory usually associates upward-sloping yield curves with rising interest rates and economic expansion; therefore, we anticipate a direct relationship between the slope of the yield curve and bank equity returns. The idea behind potential asymmetric impacts and lagged effects of yield curve spreads on bank stock returns, as framed in our second research question, is that investors respond differently to "good news" versus "bad news" and that stock prices take time to adjust to the arrival of new information.[3] To investigate the impact of the of yield curve spreads on bank equity returns in the pre and post (2007-2009) GFC periods, we include a crisis dummy variable in full-sample estimations while controlling for the slope of the yield curve. This allows to isolate the GFC effect on returns during an unprecedented low interest rate environment.

Examining Canadian banks equity return behavior to changes in interest rates (changes in yield curve spreads) will provide evidence to policymakers, regulators, and practitioners globally

[3] Refer to the methodology and results sections for discussion and citations on asymmetric impacts and the lagged effects (i.e. gradual information diffusion and under-reaction hypotheses).

to better understand how this particular banking structure (concentrated industry, strong regulatory regime, conservative risk profile, etc.) performs in the midst of interest pressure from domestic and global forces. Even with important changes in banking regulations and supervision introduced in response to (2007-2009) GFC, little has been done to incorporate “market signals” to gauge bank risk (Sarin and Summers, 2016). Over our sample period from 01/1997 to 8/2018, we cover two interesting periods of financial turmoil that were preceded by inverted yield curves associated with subsequent burst of the dot-com bubble in 2001 and the 2007-2009 GFC. Over the time frame of our research, yield curve spreads (measured as the difference between the 10-year Treasury and the 3-month Treasury yields) reached a high of 3.781%, a low of -0.243% with an average spread of 0.932% (refer to Figure 2 for a visual of the yield curve spread pattern).

Using data from 01/1997 to 08/2018 and employing the Fama-French five-factor model supplemented with the yield curve factor, we find that changes in yield curve spreads, together with the Fama-French factors, explain the variation in Canadian bank-equity returns. Equity returns of Canadian banks tend to react in an asymmetric manner to changes in the slope of the yield curve (i.e. yield curve spreads above their mean values elicit a greater impact on bank equity returns than yield curve spreads that are below their mean values over our sample time horizon). Further, Canadian bank equity returns have become more sensitive to changes yield curve spreads in the post 2007-2009 Global recession period. Lastly, the empirical evidence from this research suggests that the changes in the slope of the yield curve may gradually diffuse into banks’ equity returns.

These findings provide empirical evidence to supplement the conventional practitioner's viewpoint that fluctuations in yield curve spreads influence the general equity market and, in particular, banks stocks due to their: 1) high leverage, 2) inherent interest rate risk to the financial intermediation process, and 3) market risk associated with trading activities. Further, our paper studies the equity returns of Canadian banks during a period of significant transformation in the banking system. While the Canadian banks performed much better than U.S. banks during the global 2007-2009 crisis period, we find no published research that sheds light on the influence of the yield curve on Canadian bank equity returns in either the pre- or post-crisis interest rate environment with the exception of the study by Allen et al. (2011). Finally, given the increased attention from central banks (including the Bank of Canada) on the potential implementation of a yield curve control (YCC) policy, this research provides a valuable up-to-date analysis of how yield curve spreads can influence equity returns.[4] Given that the financial sector in Canada constitutes approximately 37% of the S&P/TSX composite index, it is also important for institutional and retail investors to recognize the validity of the slope of the yield curve as a factor that helps explain the variation in bank stock returns.[5]

The rest of the paper is organized as follows: Section 2 provides a brief literature review, Section 3 describes the data and methodology, Section 4 discusses the results and Section 5 presents our conclusion and implications.

2. Literature Review

2.1. *Impact of the yield curve on bank equity returns*

[4] On December 10, 2020, Paul Beaudry (Deputy Governor of the Bank of Canada) stated that "Should things take a more persistent turn for the worse, we have a range of options at our disposal to provide additional monetary stimulus. This could include increasing the stimulus power of our QE program, or it could involve targeting specific points in the yield curve, otherwise known as yield-curve control." See https://www.bankofcanada.ca/2020/12/our-quantitative-easing-operations-looking-under-the-hood/

[5] For further details on the S&P/TSX Composite and S&P/TSX 60 indices please see https://us.spindices.com/indices/equity/sp-tsx-composite-index and https://ca.spindices.com/indices/equity/sp-tsx-60-index. The "Big Six" Canadian banks include: the Bank of Montreal (BMO), Bank of Nova Scotia (BNS), Canadian Imperial Bank of Commerce (CIBC), National Bank (NB), Royal Bank of Canada (RBC), and Toronto-Dominion Bank (TD). These six banks make up approximately 90% of the assets under management in the Canadian banking sector (see Calomiris and Haber (2015) for review and history of both the Canadian and U.S. banking sectors).

From an equity return perspective, Schuermann and Stiroh (2006) examine the common factors that drive the equity returns of U.S. bank holding companies from 1997 to 2005. They show that the market risk factor dominates in explaining bank returns followed by the Fama-French factors (Fama and French, 1992, 1993). They also find that interest rate factors (i.e. one period change in the risk-free rate, the slope of the yield curve, and credit spreads) are not generally significant for large banks. However, the returns of small banks appear to be partially driven by the aforementioned interest rate factors. Viale et al. (2009) find that the stock market excess return and shocks to the slope of the yield curve are statistically significant in explaining the cross-section of U.S. bank equity returns. Furthermore, they find no evidence that firm-specific factors such as size and book-to-market ratios are priced in U.S. bank equity returns. Baek and Bilson (2015) empirically test the Fama and French three-factor model, with the inclusion of interest rate factors, on a large sample of U.S. non-financial and financial firms. They find that size and value risk premia commonly exist in both non-financial and financial firms, supporting Barber and Lyon (1997), and that an interest rate risk premium only appears in financial companies. Forming portfolios of U.S. money center, large, and regional commercial banks, Elyasiani and Mansur (1998) employ GARCH-M methodology to investigate the effect of the long-term interest rate (and its volatility) on monthly banks stock returns over the time period 1970M1 to 1992M12. They find that the long-term interest rate has a negative and statistically significant impact on bank stock returns. Furthermore, interest rate volatility is found to be an important determinant of bank stock return volatility and bank stock risk premium for the money center and large bank portfolios. They find that the degree of persistence in shocks is substantial (yet varies) for all three bank portfolios (strongest for large bank portfolio and weakest for the money center banks), and sensitive to portfolio characteristics and the prevalent monetary regime.

2.2. *Impact of the yield curve on bank profitability*

Theoretically, since bank's earning assets (mainly loans and securities) usually tend to exhibit longer maturities than their funding sources (i.e. liabilities), it is reasonable to anticipate a positive relationship between an upward- sloping yield curve and profitability levels. To the degree that banks experience a positive maturity gap between the average maturities of their assets and the average maturities of their liabilities, revenues from longer-term assets should exceed expenses from shorter-term liabilities under an upward-sloping yield curve condition. Empirically, previous research has shed light on the impact of the yield curve on accounting-based measures of profitability. For example, Alessandri and Nelson (2015) compile a sample of 44 U.K. bank groups over the period 1992Q1 to 2009Q3 and find that the level and slope of the yield curve contribute positively to profitability (net interest margins) in the long run. However, in the short run, they find that increases in market rates compress net interest margins. Further, they find that positive changes in the slope of the yield curve affect trading income in the opposite direction, consistent with banks hedging interest rate risk through derivatives. Bolt et al. (2012) report a positive net yield curve effect on net interest margins based on individual bank yearly data for 19 countries from 1990-2007. Egly et al. (2018) find positive effects of the yield curve spreads on net interest margins that vary with bank size and change over time. Specifically, for their full sample comprised of more than 5,500 U.S. commercial banks, the change in net interest margins grows by 3.70%, given a 1% increase in the slope of the yield curve. Additionally, they find that the impact of yield curve spreads on net interest margins is greater for small, medium, and all banks combined in their recovery period (2009Q3 to 2016Q4) estimations when compared to their initial period sample estimations (2001Q1 to 2009Q2).

3. Data and Methodology

3.1. Data

This research uses monthly equity return data for Canadian publicly-traded banks from 01/1997 to 08/2018 extracted from Datastream. Due to the concentrated nature of the Canadian banking system, the eleven banks included in our study consist of all publicly-traded Schedule 1 banks in Canada listed in the S&P/TSX composite index.[6] Appendix A contains a list of the banks employed in the study. Using the complete set of publicly-traded banks also adds to the uniqueness and contribution of this paper, as most of the previous work on the Canadian banking sector has focused on the 'Big 6' banks (e.g., Guidara et al., (2013); Calmes and Theoret (2014); Mohsni and Otchere (2018)). The data for the Canadian yield curve (3-month Treasury Bill rate, 2-year, and 10-year Treasury Bond rate) was obtained via Statistics Canada: https://www.statcan.gc.ca/eng/start (table 10-10-0122-01). Figure 1 provides a visual of the interest rate environment in Canada over the sample period. Figure 2 indicates that Canada experienced an inverted yield curve during the year 2000, which was followed by sharp declines in short-term interest rates. Canada, like other developed economies, experienced a second prolong inverted yield curve that began in mid-year 2004 and ended in late 2006. Since then, long-term rates have been on the decline with gradual increases noted in recent times, while short-term rates declined to historically low levels. Finally, Fama-French (1993, 2015) factors

[6] Banks in Canada are distinguished with regard to whether they are domestic-owned (Schedule 1), foreign subsidiaries operating in Canada (Schedule 2), or foreign bank branches operating in Canada (Schedule 3). For further information please see http://www.osfi-bsif.gc.ca/eng/fi-if/dti-id/bnk-bnq/Pages/default.aspx.

for North America are obtained via the Kenneth French's website.[7] Table 1 provides the summary statistics for the variables included in this study.

The Fama-French variables used in our study do exhibit moderate correlation. As Fama and French (2017) highlight, high book-to-market (*B/M*) value stocks tend to have low profitability and investment levels, and low *B/M* growth stocks, especially large low *B/M* stocks, tend to be profitable and invest aggressively. Specifically, the market (MRK) factor has correlations that range from 0.2311 (with small minus big (SMB) to -0.3784 (with conservative minus aggressive CMA)). The highest degree of correlation amongst the Fama-French factors is related to the high minus low (HML) factor. Its degree of correlation is highest with CMA (0.5978). The overall correlation results show that the market, size, value, profitability, and investment factors (MRK, SMB, *HML*, robust minus weak (*RMW*), and *CMA*) have interesting co-movement patterns which motivates us to examine equity returns. Finally, the yield curve exhibits fairly low correlations with the Fama-French factors. The highest degree of correlation that the yield curve has is with the SMB factor (0.1931) and with the market factor (MRK) the correlation is only 0.0416.[8]

3.2.Methodology and the Models

Given the cross-section and time-series dimensions of the bank sample data set, panel estimation techniques are employed to examine the impact of the yield curve on Canadian bank stock returns over the period January 1997 through August 2018. Our asset pricing model is

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[7] This paper uses the North American Fama-French factors from Kenneth French website since specific factors for Canada are not available through their website. See https://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html. In the robustness section of this paper, we replace the North American Fama- French factors with Canadian specific factors that were downloaded from the Applied Quantitative Research (AQR) Capital Management LLC (https://www.aqr.com/Insights/Datasets/Betting-Against-Beta-Equity-Factors-Monthly).

[8] For brevity, in the narrative we highlight important correlation coefficients which are not presented in Table form. Correlations tables are available from the authors upon request. As reported in the text, correlation coefficients are low to moderate.

based on the Fama- French (2015) five-factor model and incorporates alternative measures of the slope the yield curve (YC) under separate specifications. The use of the Fama-French factor model is motivated by its underpinning to the dividend discount model and prior empirical evidence that suggests that profitability and investment help capture additional variation in average returns. Our sample of Canadian banks exhibit significant profitability and dividend payment history during our sample period.

Our focus on the impact of the slope of the yield on bank equity returns allows us to validate the common belief that banks tend to fare better (i.e. improved cashflows due to higher net margins and banks' positive maturity gap) with an upward-sloping yield curve than under a horizontal or downward-sloping yield curve. Furthermore, since modern financial theory usually associates upward-sloping yield curves with rising interest rates and economic expansion, we anticipate a direct relationship between the slope of the yield curve and bank equity returns. To the extent that our bank sample consist of large and (valued-based) firms, we anticipate an inverse (direct) relationship between the size and (value) risk factors per the Fama- French multi-factor model and bank equity returns. Value firms commonly exhibit high Book-to-Market (*B/M*) levels. Drawing from Fama and French (2017) who find that high *(B/M*) value firms tend to exhibit low profitability and investment levels, we anticipate an inverse relationship between the profitability and investment risk factors per the Fama- French multi-factor model and bank equity returns.

The model is estimated using fixed effects which assumes that differences across units (banks in our case) are captured by the time- invariant (bank-specific) constant intercept terms. This estimation is the preferred panel data technique assuming that z_i (a vector of bank-specific unobserved variables) is correlated with $x_{i,t}$ (the regressors in our model)[9]. It is plausible that bank-specific unobserved factors such as managerial ability, credit cultural, investment strategies, market share objectives, etc., which arguably impact bank stock returns, may also be correlated with the Fama-French model risk-factors. For example, 1) a conceivable relationship between bank-specific market share objectives and the size risk factor (SMB), and 2) a likely connection between bank-specific investment strategies and the valuation risk factor (HML). To validate this empirical approach, a series of diagnostic tests are applied. First, F test results from the fixed effects model determine whether there are differences across banks. Second, we employ Hausman tests to determine whether fixed or random effects are the appropriate specification. The Hausman test statistic is Chi-square distributed; the null hypothesis is that coefficients estimated by random effects estimator are the same as the ones estimated by the fixed effects estimator. This panel estimation approach differentiates our research from the previous work by Barber and Lyon (1997), Viale et al. (2009), and Baek and Bilson (2015), who apply a pooled approach or form bank portfolios on the basis of size and value risk factors. Our modeling approach allows us to capture bank-level heterogeneity and minimize any potential bias that may result from the aggregation of banks into broader aggregates.[10]

To investigate the impact of shifts in the yield curve on bank equity returns, we expand the Fama-French (2015) five-factor model to include alternative measures of the yield curve (YC) under separate specifications. Our benchmark model is expressed as follows:

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[9] If z_i is unobserved yet correlated with $x_{i,t}$ the least squares estimator of β is biased and inconsistent due to an omitted variable. However, in the instance where the model is $y_{i,t} = x_{i,t}'\beta + \alpha_i + \varepsilon_{i,t}$ and $\alpha_i = z_i'\alpha$ embodies all observable effects, an estimable conditional mean equation can be specified. See Greene (2003).

[10] Our estimation results and robust standard errors use the Huber-White sandwich estimator method. Such robust standard errors can deal with concerns about the failure to meet ordinary least squares (OLS) assumptions as to the behavior of the error term. For example, problems about normality of the error-term distribution, heteroscedasticity (non-constant variance of the error term conditioned on explanatory variable levels) ,or observations that exhibit large residuals, high-leverage, or influence.

$$R_{it} - R_{ft} = \alpha_i + \beta_1 (R_{mt} - R_{ft}) + \beta_2\, SMB_t + \beta_3\, HML_t + +\beta_4\, RMW_t + \beta_5\, CMA_t + \beta_6\, YC_t + \varepsilon_{it} \quad (1)$$

where $R_{it} - R_{ft}$is the excess monthly return on bank stock *i*, $(R_{mt} - R_{ft})$ is the excess monthly return on the market portfolio, SMB_t is the difference in monthly returns between a small-cap portfolio and a large-cap portfolio, HML_t is the difference in monthly returns between a portfolio of high book-to-market stocks and one of low book-to-market stocks, RMW_t is the difference in monthly returns between a portfolio of robust profitability stocks and one of weak profitability stocks, and CMA_t is the difference in monthly returns between a portfolio of conservative investment stocks and one of aggressive investment stocks. YC is one of the following measures: 1) The slope of the yield curve, measured as the difference between the 10-year Treasury Bond rate and 3-month Treasury Bill rate or 2) The slope of the yield curve, measured as the difference between the 10-year and 2-year Treasury Bond rates.

Secondly, to test for the potential of significant asymmetric effects of the yield curve on bank equity returns, we expand our benchmark model to include (and adapt) the threshold model specifications similar to Baur and Todorova (2018) as follows:

$$R_{it} - R_{ft} = \alpha_i + \beta_1 (R_{mt} - R_{ft}) + \beta_2\, SMB_t + \beta_3\, HML_t + \beta_4\, RMW_t + \beta_5\, CMA_t + \beta_6\, YC_t + \beta_7\, YC_t D_t + \varepsilon_{it} \quad (2)$$

where the dummy variable D_t is equal to one if the yield curve is above a certain threshold (mean of the YC series over the full sample period) and zero otherwise. Model (2) statistically tests for asymmetry based on the coefficient β_7.

To improve our understanding of asymmetric impacts of the yield curve on bank equity returns, we separate the yield curve series into two parts, one which includes only yield curve increases, YC^+ , and another including only yield curve decreases, YC^-. This alternative model is particularly interesting and important if positive yield curve betas and negative yield curve betas have different signs which may lead to lower and insignificant average yield curve betas and thus potentially misleading conclusions. The idea of this specification is to determine whether investors (and or other relevant economic agents) respond differently to positive and negative movements in the slope of the yield curve. This alternative model specification is written as follows:

$$R_{it} - R_{ft} = \alpha_i + \beta_1 (R_{mt} - R_{ft}) + \beta_2\, SMB_t + \beta_3\, HML_t + \beta_4\, RMW_t + \beta_5\, CMA_t + \beta_6\, YC^{+}{}_t + \beta_7\, YC^{-}{}_t + \varepsilon_{it} \quad (3)$$

Finally, we check for a possible lagged effect of changes in the slope of the yield curve on bank stock returns. This lagged impact hypothesis is motivated by a number of empirical studies (e.g., Bolt et al., 2012) and supported by the under-reaction theory (Daniel et al. 1998), and the gradual information diffusion hypothesis (Hong and Stein, 1999 and Hong et al., 2007). To test for the lagged impact of changes in the slope of the yield curve on bank equity returns, we replace the contemporaneous yield curve term with its one-month lag in our model as follows:

$$R_{it} - R_{ft} = \alpha_i + \beta_1 (R_{mt} - R_{ft}) + \beta_2 SMB_t + \beta_3 HML_t + \beta_4 RMW_t + \beta_5 CMA_t + \beta_6 YC_{t-1} + \varepsilon_{it} \quad (4)$$

4. Results

4.1. Fama-French Five-Factor and Yield Curve Impact

Table 2 provides the results for our benchmark model (equation 1) under two specifications over the full sample period (1/1997 to 08/2018). The first specification includes a yield curve spread between the 10-year Canadian Treasury Bond rate and the 3-month Canadian Treasury Bill (YC 10Y- 3M) while the second specification use the yield curve spread between the 10-year and 2-year Canadian Treasury Bond rates (10Y- 2Y). Canadian banks reflect positive and statistically significant market beta (MRK) coefficients of 0.6656 and 0.6679, respectively.

The relatively low market beta aligns with the common view from practitioners and academics that Canadian banks are less risky and better capitalized compared to the U.S. and other foreign banks. For example, Schuermann and Stiroh (2006) find that the market beta coefficients for large banks in the U.S. market range from 1.0546 to 1.2520. It should be noted that the reported market beta coefficients in Schuermann and Stiroh's (2006) study are for the sample period from 1997 to 2005 and thus may not be directly comparable to our results. Nonetheless, we are able to gain some perspective of market betas for North American banks. Schuermann and Stiroh (2006) also show that the market risk factor is the dominant variable in explaining the variation in bank stock returns followed by the Fama-French factors (SMB and HML).

Gandhi and Lustig (2015) find the market beta increases monotonically with bank size for their sample of U.S. banks over 1970 to 2013. Their portfolio of large banks has a market beta of 1.22 compared to a market beta of 0.46 for a portfolio of the smallest banks; the results suggest that large banks were significantly more exposed to market risk as compared to small banks. The authors attribute this large difference primarily to differences in leverage. Guidara et al. (2013) find that Canadian banks are well-capitalized based on their capital and leverage capital buffers of 5.09% and 0.49% respectively, which exceed the minimum regulatory requirements. These findings provide a possible explanation for Canadian banks' lower market beta risk and their ability to prevail during the 2007-2009 financial crisis.

A review of the (SMB and HML) factors suggests that only the value factor (HML) helps to explain the variation in Canadian bank equity returns based on the positive and statistically significant coefficients on the HML variable. Gandhi and Lustig (2015) find that for their sample of U.S. banks, SMB factor coefficients are close to 0.40 on the 1st 9 market-cap sized portfolios with the SMB factor coefficient turning negative at -0.13 on the final (large market-cap) firm portfolio. The positive (and significant) coefficients on the HML variable in our estimations are in line with those reported by Gandhi and Lustig (2015); in their study, loadings on HML variable range from 0.50 for their smallest portfolio to 0.70 for their largest portfolio.

The profitability (robust vs. weak) and investment style (i.e., conservative vs. aggressive) factors (RMW and CMA, respectively) have an unfavorable impact on bank equity returns given the negative (and statically significant) coefficients reported on these two risk factors. The results related to investment style (our CMA variable) supports the findings of Titman, et al. (2013), who show that high investment is followed by low average returns in many equity markets. Further, Fama and French (2017) also reported a negative coefficient for the investment factor. The negative coefficients related to profitability (our RMW variable) align with the results from Jareño et al. (2018) but are in contrast with the Fama and French (2017) results. The conflicting results could be attributed to sample-specific characteristics and support the conjecture that Fama-French (2015) five-factor models most likely are sensitive to country-specific and industry samples. The results of this study suggest that high levels of profitability generated by the Canadian banking sector lead to lower returns. While our results seem counterintuitive given that higher expected earnings usually translated to higher expected returns, *ceteris-paribus*, Fama and French (2015) report that holding operating profitably roughly constant, average equity returns typically diminishes as firm size increases.

The key variable of interest in this study (the two yield curve measures) generates a positive impact on bank equity returns as reflected in the statistically significant coefficients of 0.0028 and 0.0024 on the YC (10Y-3M) and the YC (10Y-2Y) yield curve variables, respectively. This empirical evidence supports the notion that a steeper yield curve provides increased net interest income from the interest-rates carry trade[11], which involves borrowing shorter-term funds at lower interest rates and investing these funds in longer-term loans and securities at higher interest rates. The positive yield curve spreads impact on bank performance implies that investors expect improved earnings (and potentially a strengthened dividend stream) that should translate to increased expected returns. Banks profitability should be positively related to short-term interest rates as banks raise their loan rates and shrink their lending quantities in response to higher funding costs; however, the short-run and long-run effects can be different. If banks borrow short and lend long, and if their interest rates are not fully flexible in the short run, banks will be exposed to repricing and yield curve risk. Our study shows that the yield curve is a factor in explaining bank equity returns, after controlling for market risk and additional Fama-French risk factors.

4.2. Asymmetric Impacts

Table 3 provides the results of Models 2 and 3, which test for asymmetric impacts of the yield curve on bank equity returns. The Fama-French factors remain stable and consistent throughout these estimations based on the reported coefficients. In columns (1) and (2), the coefficients on the dummy variables (YC(10Y-3M)*YC(D) and YC(10Y-2Y)*YC(D)) suggest that there is an asymmetric impact of the yield curve spread on bank equity returns. Specifically, during times when the yield curve spread is above its mean over the full sample period (steep upward sloping yield curve), the influence it has on bank equity returns is positive with

[11] Typical "interest rate carry trade" activities by commercial banks takes place when costs (tied to interest rates) from funding sources (usually consisting of short-term claims: liabilities) are lower than revenues (linked to interest rates) from longer-term earning assets (i.e. loans and securities). Banks earning assets usually tend to exhibit longer maturities than their funding sources. This interest rate carry trade strategy should be profitable for banks with a positive maturity GAP between their average maturity of assets and their average maturity of their liabilities and under an upward sloping yield curve.

statistically significant coefficients (albeit small in magnitude) of 0.0045 and 0.0060, respectively.

Galbraith and Tkacz (2000) find evidence of an asymmetric impact of the yield spread on output, particularly in Canada and the U.S. If we accept that the yield spread captures the direction

of monetary policy to some degree, then YC spreads above the mean threshold could be associated with strong expansionary monetary episodes that may translate into positive sentiment and investor activity in financial equities. The coefficients for the yield curve factors (YC (10Y-3M) & YC (10Y-2Y)) are both negative. The statistically significant coefficient on the YC (10Y-2Y) variable is almost three times greater than the coefficient on the YC (10Y-3M) variable which was statistically insignificant. This may imply that banks (and their stock prices) are more sensitive to the (10Y-2Y) yield curve spread as opposed to the (10Y-3M) spread. The negative impact of interest rate changes may suggest the presence of short-run repricing frictions, as suggested by Alessandri and Nelson (2015). Unexpected increases in rates can initially compress banks' margins, and only in the long term does it become possible that higher interest rates contribute to higher profitability, and thus equity prices.

The results of the alternative model (columns (3) and (4) of Table 3) also support an asymmetric impact of the yield curve spread on bank equity returns. A negative yield curve spread series (i.e. negative YC movements measured by YC(10Y-3M)-) and YC(10Y-2Y)- variables) elicit a negative response in bank equity returns. Consistent with our expectations, positive changes in the yield curve spread measured through the YC(10Y-3M)+ and YC(10Y-2Y)+ variables elicit a positive effect on bank equity returns. These results are an important contribution to the current literature and suggest that banks' reaction to interest rate movements is influenced by the slope of the yield curve. One plausible explanation for the increased response/reaction by banks and investors to yield curve shifts might relate to the increased coverage given by the financial press on this economic indicator. Although the increase in the R^2 is marginal, the asymmetric impacts reported in Table 3 highlight the importance of enhanced bank-applied risk-control management particularly during periods of unconventional yield curve environments.

4.3. Pre- and Post-Crisis Results

Tables 4 and 5 provide the results for Model 1, for the initial (pre-financial crisis) sub-sample period (1997M01 to 2007M12) and the final post-financial crisis sub-sample period (2009M1 to 2018M8), respectively. Following the global financial crisis, there has been an unconventional monetary policy that led short-term interest rates to approach the "zero-lower-bound". This historical low-interest rate setting provides an opportunity to revisit bank behavior (and by extension bank equity returns) under this new economic environment. The Fama-French factors (except for the RMW factor in the post-financial crisis period) remain relatively stable and robust across the estimations in both sub-sample periods. There is a modest decline in the market risk (MRK) coefficients between the pre-and- post-crisis periods (i.e. pre-crisis coefficients of 0.7526 and 0.7537 vs. post-crisis coefficients of 0.6212 and 0.6252). This finding indicates that the sensitivity of banking stocks to market risk has diminished over time. This decline in bank market betas is explained by the lower covariance of bank stock returns with market returns for the period after the financial crisis and aligns with the findings of King (2009) who document a decline in the market risk factor for a sample of banks from Canada, France, Germany, the United Kingdom, and the U.S.

The impact of the yield curve spreads on bank equity returns becomes relevant only in the post-crisis period. The coefficients on the yield curve variables in the post-crisis period are positive (yet small in magnitude reported at 0.0057 and 0.0068, respectively) and statistically significant. The small magnitude of the yield curve coefficients aligns with previous literature that suggests that the increased availability of advanced tools for measuring and managing interest rate risk, reduces banks stock returns sensitivity to changes in interest rates (e.g., Ryan and Worthington, 2004; Joseph and Vezos, 2006). This empirical evidence is consistent with the hypothesis that interactions between financial institutions and monetary authorities tend to increase in times of (and continues after) financial turbulence due to the existence of significant contagion effects. The positive and statistically significant coefficients on the yield curve variables in the period after the global financial crisis suggests that changes in the yield curve spread and equity price movements have strengthened over the past decade.

At an initial glance, this stronger co-movement may be driven by economic prospects and the flight-to-quality wave from high-risk stocks towards low-risk stocks and government bonds with more solid economic fundamentals. A closer look at our data shows that yield curve spreads were indeed higher in the post-financial crisis period compared to the pre-financial crisis period which helps to explain our findings; higher spreads potentially lead to higher net profit margins (and improved cash flows), which would favorably impact bank-equity prices[12]. To untangle the potential effects of the slope of the yield curve on bank equity returns in the aftermath of the GFC and a historically low-interest rate time period, we incorporate (under alternative estimations) a crisis dummy variable in our full-sample regressions while controlling for the slope of the yield curve. We find that the GFC dummy variable is statistically insignificant when

[12] The mean yield curve spread (10Y-2Y) was (1.0893%) in the post-crisis period vs (0.8427%) in the pre-crisis period.

incorporated into model (1) using both the 10Y-3M and 10Y-2Y measures of the slope of the yield curve. This is plausible since, as previously mentioned, the Canadian banking system remained strong and stable during the GFC and did not require any form of a bailout.[13] This evidence provides academics and practitioners with updated information on how the impact of the yield curve may change over time.

4.4. Gradual Information Diffusion (Lagged Impact)

The regression results from Model 4 reported in Table 6, which tests the gradual information diffusion hypothesis, suggest that the impact of the slope of the yield curve on banks' equity returns in Canada diffuses over time based on the statistically significant coefficients on lagged yield curve spreads. If market participants react gradually to the arrival of new information, Siegel (1998) suggests that a reliable predictor of turning points in the business cycle (e.g. the yield curve) would also serve as a useful tool for equity investors. The statistically significant coefficients for the lag of the (10Y-3M) and (10Y-2Y) variables are 0.0035 and 0.0026, respectively. Since the Bank of Canada (or other central banks) can exert considerable influence on the slope of the yield curve by setting short-term rates at levels that encourage liquidity building by commercial banks, this finding has important monetary policy implications. Monetary policy actions focused on keeping inflation within pre-defined target thresholds may have the unintended consequence of influencing the likely direction of future bank equity returns. It is an open question whether such policy-induced trends (and their eventual reversal due to exogenous economic shocks and/or changes in the course of monetary

[13] Please note that we also included a dummy variable to capture the volatile nature of the financial markets during the "dot.com bubble" correction in 2001. The coefficients for the "dot.com" dummy were also insignificant. In the regression controlling for both the "dot.com" and the GFC periods, the coefficients for the 10Y-3M and 10Y-2Y variables remain fairly stable (albeit small in magnitude) and statistically significant at 0.0027 and 0.0022, respectively. These results are available from the authors upon request.

policy) can have detrimental side effects on the stability of the financial sector or the economy as a whole. Central bankers may find themselves facing a dilemma between the goals of maintaining a stable price level, and avoiding any unfavorable interference with the price formation processes on equity markets.

The Fama-French factors, along with the aforementioned yield curve factors, are consistent with the specification identified as Model 1 that incorporates a contemporaneous yield curve variable. This finding implies that momentum traders can benefit if they know where Canadian banks and investors are in their information diffusion cycle. Momentum traders can enter into Canadian bank stocks approximately one month after a positive change in the yield curve spread and potentially generate greater risk-adjusted returns.

4.5. *Further Analysis and Robustness*

We conducted several robustness tests. First, we ran our benchmark model, based on North-American Fama-French factors (aka "North American Factors"), using the more parsimonious Fama-French three-factor model and including our yield curve spreads (i.e. YC (10Y-3M) and YC (10Y-2Y)) under separate specifications- (refer to Columns 1 and 2 of Table 7). The direction and statistical significance of regressor coefficients (inclusive of the yield spread variables) align well with the results from our benchmark model. Second, to test the robustness of the results, we rerun the specifications reported in Columns 1 and 2 with the Canadian-specific factors aka "Canadian Factors" (MRK, SMB, and HML) downloaded from AQR website. The MRK factor remains relatively consistent (coefficients 0.7532 and 0.7544) based on North American Factors compared to coefficients of 0.5659 and 0.5686, respectively, using the Canadian Factors. The HML factor remains positive and statistically significant when using the Canadian Factors. The positive and statistically significant impact of the yield curve spreads on bank stock returns holds under both data sets (i.e. North American and Canadian Factors). The only important difference in results surrounds the SMB risk factor when employing these distinct data sets. The SMB factor has no impact on bank stock returns given the statistically insignificant coefficients when using the North American Factors downloaded from the Kenneth French website (see Columns 1 and 2). However, the SMB factor has a negative impact on bank stock returns (statistically significant coefficients of -0.2717 and 0.2707, accordingly) based on the Canadian Factors.

This difference in the findings with respect to the SMB factor impact on bank stock returns is likely due to discernible difference in the composition of the data sets (i.e. North American Factors would seem to encompass a broader scope compared to the Canadian-specific Factors available through the AQR website). As Griffin (2002) highlighted, no asset pricing model can completely explain the variation in asset performance. The findings using the Canadian Factors lend some support to the findings of Griffin (2002) and Fama and French (2012) that suggest country-specific versions of asset pricing models may yield more useful metrics when trying to explain the time-series variation in portfolio and individual stock returns. Third, to capture lagged effects of positive and negative movements in the slope of the yield curve on bank stock returns, we ran specifications based on Model 3, which is defined in our "Data and Methodology" section, replacing concurrent yield curve spreads with their one-month lags. With the exception of the lagged positive (L.YC (10Y-3M) +) yield curve spread series, lagged effects seem insignificant. Of note, concurrent positive and negative yield curve spread series were statistically significant in the original specifications (refer to Table 3 Columns 3 and 4).

Fourth, additional estimations were performed on our expanded benchmark model (Model 2) that incorporates the asymmetric impact of yield curve slope effects on bank stock returns employing alternative thresholds in place of the mean value of the yield curve series (e.g., median, moving averages, 75^{th} percentile, etc.). The results were not significantly altered and the alternative estimations are available from the authors upon request. Fifth, we explored two other subsample periods (i.e. (1997-2006) and (2010-2018) to test the robustness of our results using our benchmark Model 1. These sample-period time windows allow us to further insulate the pre and post 2007-2009 financial crisis periods. We chose to exclude the calendar year 2008 in our sub-sample estimations to limit the largest noise component of the financial crisis that spawned major volatility swings in the equity markets. Our general conclusion remains unchanged in that there is no impact of the yield curve spreads on stock returns in the pre-crisis period, and a positive (and statistically significant) impact in the post-crisis period. These subsample estimations are available from the authors upon request.

5. Conclusion and Implications

Given that the Canadian banking system has been one of the most stable and successful in the world over the past several decades and was one of only a few that did not require a 'bailout' during the period of the 2007-2009 GFC, it is meaningful to explore how changes in yield curve spreads affect Canadian banks' equity returns. Examining how the Canadian banking system responds to macroeconomic shocks, particularly in the era of historically low interest rates, is an important contribution to the academic literature on banks reaction to interest rates movements since most of the published research focuses on the U.S and Europe banking systems. We expand scant research that employs the Fama and French (2015) five-factor model to bank-equity returns. Our specifications incorporate changes in the slope of the yield curve and test for asymmetric and lagged impacts of changes in yield curve spreads on Canadian bank-equity returns. Furthermore, by applying a panel regression modeling approach, we depart from the portfolio method commonly used in asset pricing modeling to explain equity return variability. Our modeling approach allows us to account for the potential bank-level heterogeneity that may exist within our bank sample.

Our results suggest that changes in the slope of the yield curve, together with the Fama-French factors, explain the variation in Canadian bank-equity returns. Equity returns of Canadian banks tend to react in an asymmetric manner to changes in the slope of the yield curve (i.e., yield curve spreads above their mean values elicit a greater impact on bank equity returns than yield curve spreads that are below their mean values over our sample time horizon). Our findings complement anecdotal evidence covered by the financial press that ordinarily reports a connection between bank profitability (and by extension, bank stock performance) to yield curve conditions. Evaluating the yield curve spread regression coefficients at the mean yield curve spread values during the recovery period for our sample of Canadian banks leads (on average) to a 3.9115% increase in the monthly excess bank equity returns. Canadian bank equity returns have become more sensitive to changes in the yield curve spread in the post 2007-2009 Global recession period. Lastly, the empirical evidence from this research suggests that the changes in yield curve spreads may gradually diffuse into banks' equity returns.

Our findings suggest that portfolio managers need to be aware of the sensitivity of bank equity returns to changes in the yield curve. Regulators must be cognizant of banks' potential shifts in profit-seeking behavior (e.g., increasing fee-based revenue sources) over a time that could be tied to swings in the yield curve. Bank equity valuations may be negatively impacted in response to reduced cash flows resulting from downward pressure on net interest margins during periods of unfavorable yield curve shifts. When this happens, banks are pressured to retain profits and payout fewer dividends, especially when capital buffers fall below required levels. Our findings have important implications for the estimation of banks' cost of capital and implicitly suggest regulatory initiatives in favor of macro-prudential policy to evaluate bank risk.

Admittedly, there are many potential risk factors that might help to explain the behavior of bank stocks (e.g. liquidity, foreign exchange, credit, market, etc.). An asset pricing model that completely captures average returns does not, and most likely, will never exist. What this study highlights is that for bank stocks, country-specific versions of the traditional factor models using country or regional factors can potentially yield marginal differences in the results. As Griffin (2002) suggested, cost-of capital, performance measurement, and risk analysis using Fama-French-style models may be best done on a within-country basis. Further research may focus on the following: 1) expanding the understanding of which global and regional factors are useful in obtaining factor-based asset model estimates (e.g. McCown, 2001) and Fama and French, 2012), 2) extending this study (that captures asymmetric, current, and lagged impacts of the slope of the yield curve on bank equity returns) by incorporating the level and curvature of the term structure of interest rates, and 3) exploring and presenting up-to-date evidence on the evolution of market risk factors that are used when evaluating bank stock returns.

Declaration of competing interest:
On behalf of all authors, the corresponding author states that there is no conflict of interest.

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Figures

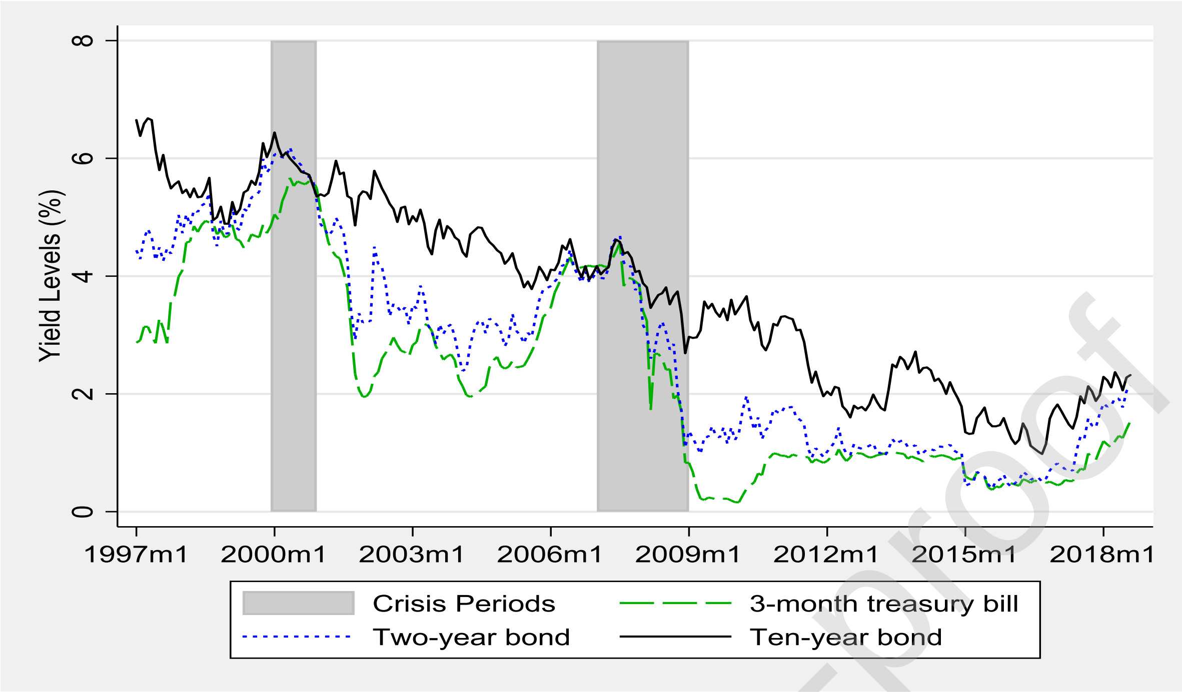

Figure 1: Canadian Interest Rates

Note: Crisis periods represent the "Dot.com" bubble correction in 2001 and the 2007-2009 Global Financial Crisis (GFC)

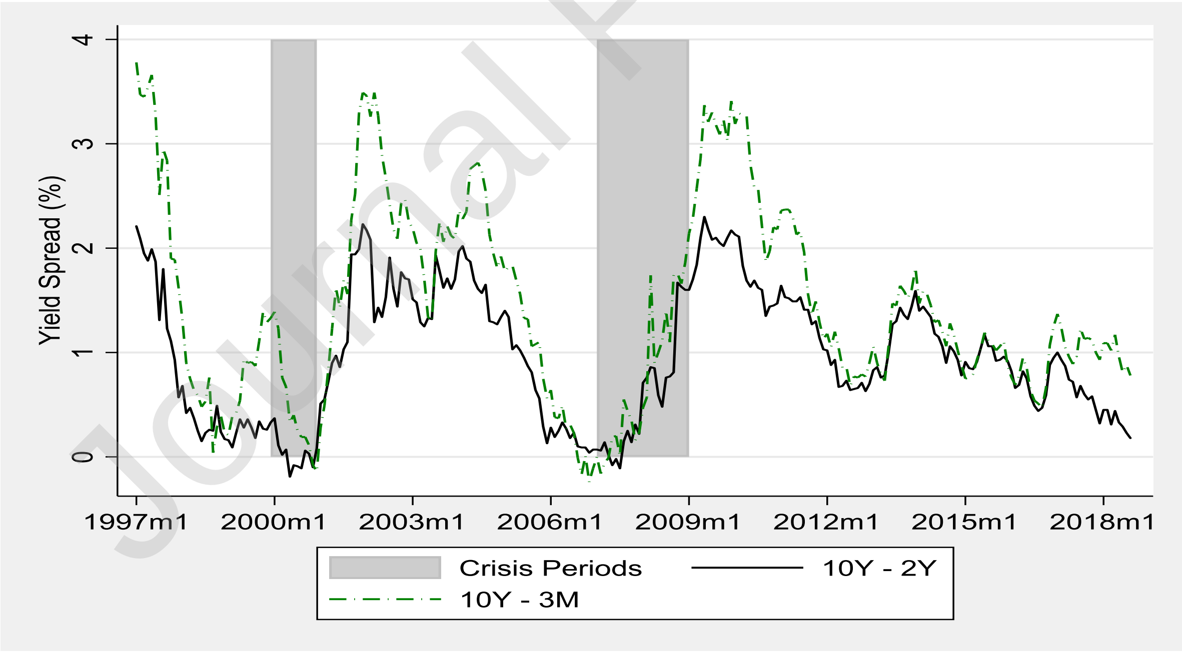

Figure 2: Canadian Yield Curves Spreads

Note: Crisis periods represent the "Dot.com" bubble correction in 2001 and the 2007-2009 Global Financial Crisis (GFC)

Table 1: Summary Descriptive Statistics Model Variables

Variable	Obs	Mean	Std. Dev.	Min	Max
RET	2,564	0.0025	0.0768	-0.3266	0.1930
MRK	260	0.0065	0.0436	-0.1841	0.1156
SMB	260	0.0015	0.0280	-0.1385	0.1668
HML	260	0.0013	0.0341	-0.1401	0.1728
RMW	260	0.0036	0.0258	-0.1536	0.1395
CMA	260	0.0023	0.0275	-0.1071	0.1458
YC (10Y-3M)	260	1.4121	0.9323	-0.2432	3.7809
YC (10Y-2Y)	260	0.9650	0.6261	-0.1901	2.3010

Note: RET is the monthly equity returns of Canadian publicly traded banks excluding dividends. MRK, SMB, HML, RMW, and CMA are the five factors from the Fama-French (2015) model. Where MRK is the excess monthly return on TSX Composite index over the risk-free rate (3-month Canadian treasury bill), SMB_t is the difference in monthly returns between a small-cap portfolio and a large-cap portfolio, and HML_t is the difference in monthly returns between a portfolio of high book-to-market stocks and one of low book-to-market stocks. The original Fama and French (1997) 3-factor model (includes MRK, SMB, and HML) was extended by Fama and French (2015) to include an additional two factors; one to account for profitability (RMW) and one to account for aggressive investment stocks (CMA). YC (10Y-3M) is the difference between the 10-year Treasury yield and 3-month Treasury yield. YC (10Y-2Y) is the difference between the 10-year Treasury yield and the 2-year Treasury yield. The sample covers from 1997M1 to 2018M8.

Table 2: Fixed Effects Panel Models. Dependent Variable: excess bank-stock returns, full sample period 1997M1-2018M8

	(1)	(2)
MRK	0.6656***	0.6679***
	(0.0588)	(0.0588)
SMB	-0.0276	-0.0189
	(0.0964)	(0.0949)
HML	0.5929***	0.5917***
	(0.0354)	(0.0356)
RMW	-0.2782***	-0.2735***
	(0.0666)	(0.0673)
CMA	-0.2756***	-0.2738***
	(0.0631)	(0.0636)
YC (10Y-3M)	0.0028***	
	(0.0009)	
YC (10Y - 2Y)		0.0024**
		(0.0010)
Constant	-0.0047***	-0.0032**
	(0.0014)	(0.0011)
Observations	2,564	2,564
R-squared	0.1955	0.1948
# of Banks	11	11

Note: MRK, SMB, HML, RMW, and CMA are the five factors from the Fama-French (2015) model. YC (10Y-3M) is the difference between the 10-year Treasury yield and 3-month Treasury yield. YC (10Y-2Y) is the difference between the 10-year Treasury yield and the 2-year Treasury yield. Robust standard errors in parentheses. The symbols *, **, and *** refer to levels of statistical significance of 10%, 5%, and 1%, respectively, of the regression coefficients

Table 3: Fixed Effects Panel Models with asymmetric yield curve spread impacts. Dependent Variable: excess bank-stock returns, full sample period 1997M1-2018M8

	(1)	(2)	(3)	(4)
MRK	0.6648***	0.6614***	0.6689***	0.6769***
	(0.0589)	(0.0586)	(0.0585)	(0.0543)
SMB	-0.0285	-0.0339	0.0008	-0.0170
	(0.0964)	(0.0967)	(0.0914)	(0.0947)
HML	0.5883***	0.5935***	0.5913***	0.5936***
	(0.0344)	(0.0357)	(0.0384)	(0.0354)
RMW	-0.2885***	-0.2944***	-0.2826***	-0.2497***
	(0.0652)	(0.0641)	(0.0592)	(0.0676)
CMA	-0.2790***	-0.2901***	-0.2663***	-0.2850***
	(0.0628)	(0.0621)	(0.0617)	(0.0623)
YC (10Y-3M)	-0.0028			
	(0.0019)			
YC (10Y-3M)*YC(D)	0.0045**			
	(0.0015)			
YC (10Y-2Y)		-0.0076**		
		(0.0029)		
YC (10Y-2Y)*YC(D)		0.0060***		
		(0.0017)		
YC (10Y-3M) +			-0.0022	
			(0.0117)	
YC (10Y-3M) -			-0.0224**	
			(0.0098)	
YC (10Y-2Y) +				0.0273**
				(0.0108)
YC (10Y-2Y) -				-0.0390***
				(0.0116)
Constant	-0.0012	0.0010	-0.0028*	-0.0049***
	(0.0016)	(0.0013)	(0.0014)	(0.0011)
Observations	2,564	2,564	2,564	2,564
R-squared	0.1962	0.1970	0.1961	0.1971
# of Banks	11	11	11	11

Note: MRK, SMB, HML, RMW, and CMA are the five factors from the Fama-French (2015) model. YC (10Y-3M) is the difference between the 10-year Treasury yield and 3-monthTreasury yield. YC (10Y-2Y) is the difference between the 10-year Treasury yield and the 2-year Treasury yield. YC(D) is a dummy variable that equals 1 if the level of the yield curve is above its mean and zero otherwise. + indicates a series of the yield curve based solely on positive movements and – indicates a series of the yield curve based solely on negative movements. Robust standard errors in parentheses. The symbols *, **, and *** refer to levels of statistical significance of 10%, 5%, and 1%, respectively, of the regression coefficients

Table 4: Fixed Effects Panel Models. Dependent Variable: excess bank-stock returns, sub-sample period 1997M1-2007M12

	(1)	(2)
MRK	0.7526***	0.7537***
	(0.0737)	(0.0735)
SMB	0.0693	0.0732
	(0.1203)	(0.1205)
HML	0.5597***	0.5584***
	(0.0830)	(0.0827)
RMW	-0.2281**	-0.2258**
	(0.0967)	(0.0969)
CMA	-0.1679**	-0.1668**
	(0.0697)	(0.0707)
YC (10Y-3M)	0.0015	
	(0.0013)	
YC (10Y-2Y)		0.0012
		(0.0017)
Constant	-0.0047**	-0.0038**
	(0.0018)	(0.0016)
Observations	1,224	1,224
R-squared	0.1586	0.1583
# of Banks	10	10

Note: MRK, SMB, HML, RMW, and CMA are the five factors from the Fama-French (2015) model. YC (10Y-3M) is the difference between the 10-year Treasury yield and 3-month Treasury yield. YC (10Y-2Y) is the difference between the 10-year Treasury yield and the 2-year Treasury yield. Robust standard errors in parentheses. The symbols *, **, and *** refer to levels of statistical significance of 10%, 5%, and 1%, respectively, of the regression coefficients

Table 5: Fixed Effects Panel Models. Dependent Variable: excess bank-stock returns, sub-sample period 2009M1- 2018M8.

	(1)	(2)
MRK	0.6212***	0.6252***
	(0.0677)	(0.0678)
SMB	-0.0992	-0.0752
	(0.0712)	(0.0686)
HML	0.6469***	0.6483***
	(0.1102)	(0.1111)
RMW	-0.2136	-0.1931
	(0.1586)	(0.1631)
CMA	-0.5243**	-0.5314**
	(0.1757)	(0.1798)
YC (10Y-3M)	0.0057***	
	(0.0013)	
YC (10Y-2Y)		0.0068***
		(0.0017)
Constant	-0.0072***	-0.0063***
	(0.0019)	(0.0016)
Observations	1,220	1,220
R-squared	0.2290	0.2273
# of Banks	11	11

Note: MRK, SMB, HML, RMW, and CMA are the five factors from the Fama-French (2015) model. YC (10Y-3M) is the difference between the 10-year Treasury yield and 3-monthTreasury yield. YC (10Y-2Y) is the difference between the 10-year Treasury yield and the 2-year Treasury yield. Robust standard errors in parentheses. The symbols *, **, and *** refer to levels of statistical significance of 10%, 5%, and 1%, respectively, of the regression coefficients

Table 6: Fixed Effects Panel Models with lagged yield curve spread impacts. Dependent Variable: excess bank-stock returns, full sample period 1997M1-2018M8

	(1)	(2)
MRK	0.6643***	0.6656***
	(0.0587)	(0.0588)
SMB	-0.0288	-0.0202
	(0.0967)	(0.0955)
HML	0.5933***	0.5923***
	(0.0352)	(0.0355)
RMW	-0.2858***	-0.2771***
	(0.0652)	(0.0669)
CMA	-0.2731***	-0.2732***
	(0.0634)	(0.0637)
L.YC (10Y-3M)	0.0035**	
	(0.0011)	
L.YC (10Y-2Y)		0.0026**
		(0.0011)
Constant	-0.0057***	-0.0033**
	(0.0018)	(0.0012)
Observations	2,564	2,564
R-squared	0.1961	0.1948
# of Banks	11	11

Note: MRK, SMB, HML, RMW, and CMA are the five factors from the Fama-French (2015) model. YC (10Y-3M) is the difference between the 10-year Treasury yield and 3-month Treasury yield. YC (10Y-2Y) is the difference between the 10Y yield Treasury and the 2Y Treasury yield. The YC variables enter the models with a one-month lag. Robust standard errors in parentheses. The symbols *, **, and *** refer to levels of statistical significance of 10%, 5%, and 1%, respectively, of the regression coefficients

Table 7: Fixed Effects Panel Models- robustness checks with Fama-French 3-factor model, AQR data & lagged (+) and (-) changes of YC spreads. Dependent Variable: excess bank-stock returns, full sample period 1997M1-2018M8

	(1)	(2)	(3)	(4)	(5)	(6)
MRK	0.7532***	0.7544***	0.5659***	0.5686***	0.6684***	0.6685***
	(0.0565)	(0.0564)	(0.0345)	(0.0343)	(0.0600)	(0.0591)
SMB	0.0589	0.0650	-0.2717***	-0.2707***	-0.0084	0.0025
	(0.0956)	(0.0941)	(0.0798)	(0.0793)	(0.0958)	(0.0937)
HML	0.3500***	0.3510***	0.0976***	0.0976***	0.5884***	0.5854***
	(0.0524)	(0.0527)	(0.0258)	(0.0257)	(0.0374)	(0.0351)
RMW					-0.2508***	-0.2496***
					(0.0667)	(0.0684)
CMA					-0.2911***	-0.2939***
					(0.0597)	(0.0630)
YC (10Y-3M)	0.0025**		0.0034***			
	(0.0009)		(0.0009)			
YC (10Y-2Y)		0.0024**		0.0047***		
		(0.0010)		(0.0011)		
L.YC (10Y-3M) +					0.0159*	
					(0.0079)	
L.YC (10Y-3M) -					-0.0029	
					(0.0084)	
L.YC (10Y-2Y) +						-0.0039
						(0.0071)
L.YC (10Y-2Y) -						-0.0104
						(0.0127)
Constant	-0.0064***	-0.0052***	-0.0064***	-0.0061***	-0.0027**	-0.0016
	(0.0011)	(0.0008)	(0.0012)	(0.0010)	(0.0012)	(0.0013)
Observations	2,564	2,564	2,564	2,564	2,553	2,553
R-squared	0.1876	0.1871	0.1637	0.1634	0.1952	0.1945
# of Banks	11	11	11	11	11	11

Note: MRK, SMB, HML, RMW, and CMA are the five factors from the Fama-French (2015) model. YC (10Y-3M) is the difference between the 10-year Treasury yield and 3-month Treasury yield. YC (10Y-2Y) is the difference between the 10Y Treasury yield and the 2Y Treasury yield. YC (10Y-2Y) is the difference between the 10-year yield and the 2-year yield. + indicates a series of the yield curve based solely on positive movements and – indicates a series of the yield curve based solely on negative movements.. Robust standard errors in parentheses. The symbols *, **, and *** refer to levels of statistical significance of 10%, 5%, and 1%, respectively, of the regression coefficients

Appendix A: List of Canadian Publicly Traded Banks

Name	Ticker Symbol	Total Assets (MM)	Net Income (MM)
Bank of Montreal *	BMO	781,126	2,218
Bank of Nova Scotia *	BNS	938,580	4,386
Canadian Imperial Bank of Commerce *	CM	622,746	2,635
Canadian Western Bank	CWB	28,107	129
Equitable Group	EQB	21,944	77
Laurentian Bank of Canada	LB	46,854	118
National Bank of Canada *	NA	266,879	1,049
Royal Bank of Canada*	RY	1,335,242	6,051
State Street Capital Group	SCB	8,897	13
Toronto Dominion Bank *	TD	1,325,821	5,233
VersaBank	VB	1,765	8

Note: There are 36 domestic ("Schedule I") banks in Canada, but the 11 banks listed in this appendix are publicly traded. The "Big Six" banks account for approximately 92.7% of the total assets and contribute almost 92% of the credit to loan markets) according to the (Office of the Superintendent of Financial Institutions Canada). A concentration ratio of 92.7% and a Herfindahl Index of 1679, suggests a moderately concentrated market structure. Data on total assets and net income (dollar amounts expressed in millions-MM) are extracted from the Office of the Superintendent of Financial Intuitions website (https://www.osfi-bsif.gc.ca/Eng/wt-ow/Pages/FINDAT.aspx) and numbers reported are from June 2018. Our sample of publicly traded banks is comprised of dividend-paying equity stocks * Denotes a "Big Six" bank.