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# THE CREDIT CYCLE AND THE BUSINESS CYCLE IN CANADA AND THE U.S.: TWO SOLITUDES?

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# The Credit Cycle and the Business Cycle in Canada and the U.S.: Two Solitudes?*

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ABSTRACT

Recent events highlight the importance of understanding the relationship between credit availability and real economic activity. This paper estimates macroeconomic models for Canada to investigate the relationship between changes in non-price lending standards, business loans and output. We allow for the possibility that macroeconomic and financial market conditions in the U.S. affect those in Canada. The responses to financial shocks are dissimilar in both countries. Real time data are also found to have a significant impact on the results. The U.S. and Canada may indeed be likened to 'two solitudes' insofar as the impact of credit conditions is concerned. Differences in the quality of banking standards and supervision of financial institutions, as well differences in the effectiveness of monetary policies in the two countries may partially explain the results.

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## 1. Introduction

The so-called 'global' financial crisis has highlighted the connection between credit conditions, financial stability, and economic performance. Former Bank of Canada Governor Carney (Carney 2009) points out that such links were previously under-emphasized but have now become an integral part of central bank thinking in the past few years. As such, he draws attention to the "two solitudes" that led monetary policy and financial stability functions inside central banks to operate independently of each other.

At least since Roosa's (1951) classic article economists have viewed the role of credit availability as an essential ingredient in evaluating the effectiveness of monetary policy. Credit availability is also believed to affect the real economy (Blinder and Stiglitz 1983), but asymmetric information can lead to rationing. Moreover, there is potentially a 'non-price' element in credit conditions (Stiglitz and Weiss 1981).

The purpose of this paper is to estimate time series models for Canada and the United States, to investigate the relationship between changes in lending standards, loans and output. In light of the financial crisis of 2008-9, and its aftermath, there has been relatively little research on the influence of loan officers' views and how the lending standards might influence aggregate economic outcomes. We conclude that credit shocks played a more significant role in influencing real economic outcomes in the US than they did in Canada. This evidence stands in contrast with other recent Canadian evidence (e.g., Duttagupta and Barrera 2010). These authors resort to final revised data only and rely on a shorter sample. We argue that analyses such as ours must be supplemented with evidence based on real time data. Next, we examine the links between lending standards, the volume of commercial loans and the conduct of

monetary policy. Do policy rate shocks influence loans standards, and do loan standards also have an effect on monetary policy? We find that Canadian monetary policy has a much bigger impact on Canadian credit standards than did the Fed's policies on its own banks' lending standards, at least over the 1999-2011 period. Our findings suggest that macro-models need to be augmented with an indicator of changing credit standards as a proxy for financial frictions that can impact real economic outcomes.

The importance of non-price credit conditions has long been deemed critical to the delivery of good monetary policy. Credit markets do not reach equilibrium solely on the basis of price. In the present paper frictions stemming, for example, from imperfect information are proxied by the lending standards as interpreted by Senior Loan Officers. The US Federal Reserve's Senior Loan Officer Opinion Survey (hereafter US-SLOS) and a comparable survey carried out by the Bank of Canada (C-SLOS) data are used to proxy lending standards.

While there have been a few studies published based on U.S. data (Lown et. al. 2000, Lown and Morgan 2006), to our knowledge only one study has analyzed Canada's SLOS data in an econometric setting (Duttagupta and Marrera 2010) using final revised data for a sample of data ending in 2008. No policy implications are drawn.

Given differences in economic outcomes between Canada and the U.S., particularly since the financial crisis of 2008-2009, an examination of the two countries' experiences may yield useful insights about the relative contribution of the SLOS to credit conditions and aggregate economic outcomes. Moreover, since loan officers must revise their views in real-time, an assessment of credit standards relying on real-time data may well provide a different interpretation of the role of non-price elements in lending than would be obtained if revised

data are used. Accordingly, we also consider the links between the real and financial sectors for several vintages of data around the time of stressful economic events when credit conditions are likely to be significantly affected. While we are unable to directly estimate separate models for the pre and crisis periods the resort to real-time data comes close to asking whether the impact of financial shocks evolved over time. This approach enables us to explore how misperceptions of economic conditions may have affected the response of the macroeconomy to financial shocks as well as providing some insights about how the estimated relationships may have evolved over time.

Generally, prices and interest rates are not subject to revisions. In contrast, output data are frequently revised. As Croushore (2011) points out, in a recent literature review, it is not only the most recent data point that is revised. Instead, several years of data are revised each time new data are released. Methodological or other processes in constructing time series also affect the previous history of data. Nowhere is this more noticeable than in the case of revisions to real GDP. As a result, those who advocate resort to real time data speak in terms of vintages of data to call attention to the fact that, each month or each quarter, several years of data history for a particular series are revised backwards with the potential to materially change earlier interpretations of past economic performance.[1]

Finally, the so-called 'global' financial crisis raises new questions about the channels through which the U.S. economy influences Canadian macroeconomic outcomes. Models should not only consider shocks stemming from the real side of the economy but also financial

[1] As a result, real time data has a triangular structure such that, for example, the vintage for real GDP growth for a sample ending in 2011Q4 will consist of different values for historical data points than, say, the 2012Q4 vintage of the same series. See Croushore (2011, Table 1) for an illustration of the structure of real time data.

shocks. After all, Canada weathered adverse shocks to the global financial system better than many advanced economies.[2] Accordingly, separate estimates for the U.S. and Canada are shown using a factor-augmented vector autoregression (FAVAR) which attempts to capture the impact of real and financial shocks emanating from the U.S on the Canadian economy. The FAVAR approach is adopted here both to mitigate the over-parameterization that arises when there are potentially too many variables with limited data and to provide a simple way of permitting a wide variety of US economic and financial shocks to simultaneously enter the model for Canada.

The remainder of this paper is structured as follows. Section 2 provides a brief overview of the literature motivating this study. Section 3 describes the VAR and FAVAR methodologies. Section 4 discusses the data and some stylized facts about the Federal Reserve's and the Bank of Canada's Senior Loan Officer Surveys. We then estimate the dynamic relationship between tightening credit standards, loans, and output.[3]

Briefly, this paper finds a negative relationship between the tightening of non-price lending standards, loans, and output, in both Canada and the United States. However, the relative strength of these links is different in the two countries. Estimates reveal that the effect is effectively negligible for Canada but not for the U.S.

Although this analysis does not show a direct causal relationship the survey data appears to contain some critical information with implications for the specification of macro

[2] As a referee points out, the real effects of the 2008-9 crisis on the Canadian economy cannot be ignored. According to Cross and Bergevin (2012), the Canadian economy shrank by 4.2%. However, the recession was shorter-lived than both the 1990-91 and 1981-82 recessions.

[3] We also replicate the VARs estimated in Lown et. al. (2000) on revised U.S. data and then revisit their results for an extended sample. To economize on space the results are not shown here but are available in the working paper version of this study. See Siklos and Lavender (2013).

models. Nevertheless, an unexpected tightening of credit standards affects business loans, output, and other macroeconomic variables. This conclusion is consistent with the credit rationing theory, as non-price lending standards are likely to affect credit availability regardless of the interest rate.

Finally, the FAVAR estimates for Canada suggest that macro-models which omit influences from U.S. macro and financial shocks are potentially mis-specified. Thus, for example, credit standards in Canada react strongly to changes in Canadian monetary policy. Not surprisingly, Deputy-Governor of the Bank of Canada acknowledges that the C-SLOS represents one input in the decision-making process used by the Bank of Canada's Governing Council prior to deciding the stance of monetary policy (Murray (2012)).The same link is considerably smaller for U.S. data. Section 5 concludes with suggestions for further research and draws some policy implications from the analysis.

## 2. Credit Conditions and Macroeconomic Outcomes: A Brief Literature Review

Disequilibria in credit markets have been modeled and empirically tested for decades. In an early contribution, Roosa (1951) proposes the availability doctrine wherein credit availability impacts the effectiveness of monetary policy. Fuerst (1994) identifies two distinct elements in the determination of credit availability, namely credit rationing and a role for monetary policy. The latter can impact the supply of credit. Blanchard and Fischer (1989) define two types of credit rationing. One refers to individuals who cannot borrow as much as they want at the going interest rate. This is a rather narrow definition since loan rates can and do vary across

heterogeneous borrowers.[4] Nevertheless, macro models more often than not tend to downplay the multiplicity of observed loan rates. Another form emerges when borrowers, observed to be broadly comparable, are treated differently in credit markets.

Stiglitz and Weiss (1981) demonstrate that higher interest rates lead the most risk averse firms to drop out of the potential borrowing pool, creating an adverse selection problem. A high interest rate environment also incentivizes borrowers to engage in risky behaviour, resulting in a moral hazard problem. As interest rates increase, the probability that borrowers will successfully pay back loans decreases. This prompts lenders to resort to credit rationing. Schreft and Owens (1991) suggest that the monetary policy authority (viz., the US Federal Reserve in this case) takes the view that, as the cost of available funds increases, interest rates applied to bank loans lag changes in non-price lending standards. Bernanke and Blinder (1992) empirically demonstrate that a reduction in available funds lead banks to sell off securities in the short-run. Hence, interest rates are affected.

It comes as no surprise then that the U.S. Federal Reserve and the Bank of Canada, as well as other central banks, conduct surveys to measure how bank lending standards change over time. Lown et. al. (2000), Lown and Morgan (2006), Swiston (2008), and Beaton et. al. (2009) examine US-SLOS to see if the data represent a reasonable proxy for credit availability. All of these studies conclude in the affirmative.

[4] Of course, borrowing rates can also be tailored according to factors or characteristics independently of whether or not there is asymmetric information. Borrower heterogeneity, differences in default probabilities, represent just two examples with implications for borrowing rates. A complicating factor, however, is that not all frictions in financial markets need show up in observed loan prices. Non-price elements, not easily observed, also play a role.

Lown et. al. (2000) estimate a VAR with real GDP, the GDP deflator, commodity prices, the federal funds rate, commercial and industrial loans outstanding, and US-SLOS data. They report that an unexpected one standard deviation tightening in the US-SLOS data results in commercial and industrial loans declining by 2.5%. Lown and Morgan (2006) conclude that a monetary shock, implying a tightening of U.S. Federal Reserve monetary policy results in an 8% net tightening of standards and decreases output by about 0.5% at its trough.[5] Swiston (2008) incorporates US- SLOS data in a financial conditions index as the data appear highly correlated with real activity and financial market variables. The study finds that a tightening of US-SLOS standards significantly explains economic growth even after accounting for forward-looking financial market information such as equity returns and high yield bond spreads.

Beaton et. al. (2009) report that a one standard deviation shock to US-SLOS standards data, equivalent to a net tightening of 8.6%, reduces GDP by roughly 0.6% after two years. Guichard and Turner (2008) conclude that a 1% percent net tightening in the US-SLOS leading to a decline in GDP growth of approximately 0.25 percent. Cunningham (2006) concludes that US-SLOS survey data produces statistically significant changes in lending and real economic activity.

There is little research that considers C-SLOS or the links between credit shocks and the real economy in the Canadian context. Duttagupta and Barrera (2010) specify Bayesian VARs (BVAR) that are similar, but not identical, to the model outlined in the next section to examine how US financial conditions affect the Canadian economy. Their sample ends in 2008. They

[5] Bayoumi and Melander (2008) also investigate the impact of financial shocks on the US economy. However, they rely on the capital-asset ratio instead of the SLOS and are principally interested in the impact of financial conditions on the components of real GDP (i.e., consumption).

report that US financial shocks have a larger impact on Canada's real GDP than is reported below. One possible drawback of their approach is that BVARs incorporate priors on the steady state values of the model variables based on a relatively short history. Moreover, it is not clear why US-SLOS would have an impact on Canada's real GDP, even if it is indirect.[6] Increases in loans and investment could be explained by easing lending standards or increasing loan demand. Thus, when investigating the predictive properties of the SLOS data, one has to consider controlling for loan demand. There is an identification problem as changes in the price of loans, the going interest rate on loanable funds, reflects both demand and supply factors which operate simultaneously. Duttagupta and Barrera (2010) do not appear to consider this possibility. Their results also suggest that the 'two solitudes' notion raised in the introduction is not supported by their findings while we report more favourable evidence that supports such an interpretation.

## 3. Estimation Approach and Data

### a. Methodology

We begin with a standard vector autoregression (VAR), which recognizes the endogeneity of macroeconomic variables, and is written as follows:

$$\mathbf{y}_t = \mathbf{A}_0 + \mathbf{A}_1 \mathbf{y}_{t-1} + \boldsymbol{\varepsilon}_t \qquad (1)$$

[6] A referee correctly points out that portfolio considerations might suggest that we distinguish between business type loans versus other forms of lending (e.g., mortgage, personal credit). To maintain comparability with the relevant literature we do not consider this extension. Den Haan et.al. (2009) point out that when US and Canadian central banks tighten monetary policy non-business loans decline but business loans rise. Nevertheless, the fraction of business loans declines precipitously during their sample (1972-2007) and it is unclear what their findings imply for the aggregate economic outcomes we are interested in. Also, their framework does not consider the impact of changing lending standards on bank loan portfolios.

where **y** is a vector of observable endogenous variables. Equation (1) is the macroeconomic model that serves as the starting point for investigating the role of credit standards while **ε** is an error term with the usual properties.[7]

The standard VAR can be augmented by adding observables that define credit conditions, following Lown and Morgan (2006), which results in a VAR of the form

$$\mathbf{y}^{*}_{t} = \mathbf{A}_0 + \mathbf{A}_1\mathbf{y}_{t-1} + \mathbf{A}_2\mathbf{z}_{t-1} + \boldsymbol{\varepsilon}_t \qquad (2)$$

where **z** is the vector of endogenous variables that proxy credit conditions while **y** consists of standard macroeconomic economic variables. Equation (2) then represents the benchmark model that captures the essence of the links between the real (macro) and financial sectors of the economy.

As previously discussed, the series proxying credit conditions conflate (loan) demand and supply factors. Thus, for example, a tightening of credit standards can lead to a fall in loans and, hence, in economic activity. Alternatively, the same shock may well represent a response to an ongoing economic slowdown. It is, therefore, useful to consider variables that may help us identify demand from supply factors in influencing the volume of loans and the determination of credit standards. Consequently, an extended VAR is specified, again following Lown and Morgan (2006), wherein we add forward-looking variables which, at least in theory, are thought to primarily affect loan demand as opposed to loan supply which typically reflects past economic conditions. They are: real GDP growth forecasts, the term spread, and an

[7] Exogenous variables can also be added to equation (1) but the relevant term is omitted here for simplicity. See, however, below.

aggregate indicator of financial conditions. Although readers are referred to Lown and Morgan (2006) for the details the fact that each one of these proxies is forward-looking in nature suggests that they are likely to influence loan demand. Presumably, current loan standards are based on an expectation of future economic conditions and, consequently, expected loan demand. The extended VAR is written

$$\mathbf{y}'_t = \mathbf{A}'_0 + \mathbf{A}'_1\mathbf{y}_{t-1} + \mathbf{B}_1\mathbf{x}_{t-1} + \mathbf{A}'_2\mathbf{z}_{t-1} + \boldsymbol{\varepsilon}_t \qquad (3)$$

where **y** and **z** were previously defined and where **x** represents a vector of additional endogenous variables that proxy factors affecting loan demand.

Finally, macroeconomic and financial factors emanating from the U.S. are expected to influence the Canadian economy. One way to accommodate this channel is to estimate equation (3) in a panel setting relying on parallel U.S. data. Unfortunately, this would exhaust available degrees of freedom. A more practical approach is to estimate a factor vector autoregressive model (FAVAR) as proposed by Bernanke, Boivin, and Eliasz (2005). If the factors summarizing U.S. macroeconomic and financial conditions are represented by **F** then, in a first step, we extract the principal components from a VAR based on U.S. data written as follows:

$$\mathbf{y}_t^{US} = \Lambda\mathbf{F}_t^{US} + \mathbf{e}_t^{US} \qquad (4)$$

where $\mathbf{y}^{US}$ is the vector of endogenous US variables, **Λ** are the factor loadings and $\mathbf{e}^{US}$ is a zero mean, constant variance error term. For simplicity, $\mathbf{F}^{US}$ captures both macro and credit or financial factors emanating in the U.S. which impact Canada. The method of principal

components is used to identify two factors that capture U.S. real and financial shocks. Since it is unlikely that Canadian factors impact U.S. real or credit activity we do not have to worry about variables in $\mathbf{y}^{US}$ being contaminated by the Canadian equivalents. The resulting joint dynamics describing the FAVAR can then be expressed as

$$\begin{pmatrix} \mathbf{y}_t' \\ \mathbf{F}_t \end{pmatrix} = \psi(\mathbf{L}) \begin{pmatrix} \mathbf{y}_{t-1}' \\ \mathbf{F}_{t-1} \end{pmatrix} + \nu_t \qquad (5)$$

where $\psi(L)$ is a polynomial or order *d*.

### b. Data and Stylized Facts

For decades the Federal Reserve has conducted a survey of bank officials, known as the Senior Loan Officer Opinion Survey, covering as many as 60 large banks[8]. US-SLOS data convey a balance of opinion based on the following question:

> *"Over the past three months, how have your bank's credit standards for approving applications for C&I* [Commercial & Industrial] *loans or credit lines – other than those to be used to finance mergers and acquisitions – to large and middle-market firms and to small firms changed?" (Federal Reserve 2011) Respondents select one of the following answers: a) Tightened considerably b) tightened somewhat c) remained basically unchanged d) eased somewhat e) eased considerably*[9]

Since 1999, the Bank of Canada has conducted its own quarterly Senior Loan Officer Survey on business lending practices (http://www.bankofcanada.ca/publications-research/periodicals/slos/). The survey, conducted since 1999, consists of 11 financial institutions with a total market share of roughly 60% of total business lending in Canada. The C-SLOS focuses on corporate, commercial and small business loans.

[8] http://www.federalreserve.gov/boarddocs/SnloanSurvey/.

[9] 'Tightening considerably' and 'Easing considerably' responses have twice the weight of the 'Tightening somewhat' and 'Easing somewhat' responses.

In the survey, financial institutions are asked:

"*How have your institution's general standards (i.e. your appetite for risk) and terms for approving credit changed in the past three months?*" (Faruqui et. al., 2008)

Survey respondents indicate whether their business practices have tightened, eased, or remained unchanged with respect to pricing of credit, general standards, limit of capital allocation, and terms of credit. The survey also consists of a series that conveys information about non-price credit standards such as the terms of credit. Non-price information represents a balance of opinion evaluated as the percentage of tightening responses minus the percentage of easing responses. In spite of the distinction between price and non-price factors in the measurement of credit standards, the two indicators appear to be similar.[10]

The fact that both the Bank of Canada and the Fed attach considerable importance to the survey of lending conditions is notable and should be reflected in empirical estimates of the role of credit conditions in the macroeconomy. Of course, banks are not the only source of funds. Nevertheless, approximately 75% of short-term business credit, likely the most relevant source of financing for business cycle analysis, is obtained through banks (see credit.bankofcanada.ca/businesscredit).[11]

The remaining macroeconomic and financial asset data were obtained from CANSIM, the U.S. Bureau of Economic Analysis, Federal Reserve Economic Data

[10] The series appear highly attracted to each other in the sense of being cointegrated. Hence, in the empirical work that follows, we use the non-price balance of opinion stemming from the C-SLOS.

[11] It is difficult to obtain comparable US figures. Nevertheless, almost 30% of credit in the form of commercial and industrial loans from banks or commercial paper is obtained from banks. There is no comparable distinction made between short-term versus long-term sources of external finance based on data from FRED (Federal Reserve Bank of St. Louis, research.stlouisfed.org/fred2). We are grateful to one of the anonymous referees for pointing out this important issue.

(http://research.stlouisfed.org/fred2/; FRED II) and the Board of Governors of the U.S. Federal Reserve System. Data are seasonally adjusted at the source, unless otherwise indicated.

U.S. real GDP (2005) is seasonally adjusted at annual rates. The GDP deflator was calculated using real (2005 prices) and nominal GDP. The monetary policy indicator is the federal funds rate. To proxy commodity prices we experimented with two series, namely oil prices (West Texas intermediate crude price per barrel) as well as the Producer Price Index (PPI; 1982=100). In what follows all results rely on the oil price proxy as the conclusions were essentially unchanged when using the PPI.[12]

Turning to Canadian data the loans variable is annualized Canadian chartered bank business loans. Real GDP is expenditure based using 2002 dollars. The GDP deflator is based on a 2002 basket of goods. The commodity prices series is the Bank of Canada's commodity price index (1982-1990 = 100) evaluated in US dollars. The overnight rate is the indicator of Bank of Canada monetary policy. Real time GDP and potential real GDP data were provided by the Bank of Canada.

Expected real GDP growth is proxied using the one year ahead Consensus Forecasts for the U.S. and Canada, the term spread, and an indicator of financial stress in both countries. The term spread is the 3month commercial paper bill – Treasury bill spread for both the U.S. and Canada. Financial conditions are evaluated using the Chicago Federal Reserve's National Financial Conditions Index (NFCI) which "measures risk, liquidity and leverage in money markets and debt and equity markets as well as in the traditional and "shadow" banking systems". Additional details can be obtained from

[12] Using nominal or real oil prices made little difference to the result. In what follows the nominal price is used.

http://www.chicagofed.org/webpages/publications/nfci/index.cfm. Note that the index does seem roughly coincident with recessions, that is, the value of the index rises sharply with the onset of a recession. Similarly, for Canada, the Bank of Canada's Financial Conditions Index (FCI) serves as the measure of financial stress (http://credit.bank-banque-canada.ca/financialconditions/fci).[13]

The empirical results presented below rely on a sample of quarterly data for the period 1999-2011 for both U.S. and Canadian data. Figures 1a and 1b plot the SLOS survey data against loans for the U.S. and Canada, respectively. Also shown are shaded areas representing recession dates in both countries. The recession dates for the U.S. are from the NBER's business cycle chronology (http://www.nber.org/cycles.html) while the dates for Canada were obtained from the chronology established by the Economic Cycle Research Institute (http://www.businesscycle.com/).[14] The vertical dashed line in Figure 1a represents the end of the sample considered by Lown and Morgan (2006). Two recessions were recorded in the U.S. data and the rise in the US-SLOS standards in these periods, indicating net tightening of credit conditions, is readily apparent. Notice also that the indicator reaches its highest point during the financial crisis of 2008-2009. Canada also experiences a sharp tightening of credit conditions but the rise of C-SLOS in 2008-2009, also a response to the crisis, appears to have its origins as early as 2007 when other events (i.e., the sub-prime event in the U.S. which began in 2007Q3) took place that precipitated the eventual global financial crisis.

[13] There is some overlap between the FCI and some of the variables used in the estimated model. For example, the C-SLOS and interest rates are included in the index although their overall weight is small. However, the FCI also includes housing and equity prices as well as the real exchange rate, and each has a much larger weight in the overall index.

[14] We also considered the recent business cycle chronology for Canada by Cross and Bergevin (2012) which did not change our conclusions. See the note to Figure 1 for the difference between the two chronologies.

Table 1 provides some summary statistics for the key series in the empirical analysis below. Mean real and nominal loan growth and the interest rate spread, are statistically different from each other in the two economies (test results not shown). Other mean values are, however, statistically indistinguishable from each other.[15] It is also worth noting that the correlation between the policy rate and real GDP growth is much stronger in Canada that in the U.S. as is the relationship between the term spread and the tightness of credit conditions.

## 4. Empirical Results

The various specifications considered described were estimated for a variety of samples. Below we consider data only since 1999.[16] One advantage of relying on data since 1999 is that it overlaps with the period when the Fed's monetary policy was relatively more predictable than during the 1970s and 1980s. The sample also matches the available Canadian data which facilitates comparisons. Lag lengths for all VARs, and FAVARs were chosen by relying on well established lag selection criteria. Since the loss of degrees of freedom is an important barrier to estimation, especially for the extended VARs, we typically erred on the side of parsimony. For the most part, however, when the various VARs and their variants were estimated for longer lags, the conclusions were unchanged. All Canadian and U.S. specifications were first separately estimated relying on the following variable ordering

$$\left[y, p, p_c, i, \ell, s\right] \qquad (6)$$

[15] A referee noted that mean values for the SLOS indicator in both countries since 1999 have been positive. This could reflect a steady state tightening bias on the part of survey respondents. Means values for SLOS in both countries have changed and reveal a slight tendency to decline in the last five years of the sample relative to the earlier available data.

[16] Siklos and Lavender (2013) provide additional sub-sample evidence.

where the macro variables, namely the logarithm of real GDP (y), the logarithm of the GDP deflator (p), the logarithm of commodity prices ($p_c$) , the policy rate (*i*), are followed by the financial variables, namely the logarithm of commercial or business credit (*l*), and the credit standards survey indicator (s). The extended VARs are ordered just as in (6) except that real GDP growth forecasts, a term spread, and the financial conditions index precede the credit variables. A Cholesky decomposition is then applied.[17] Although it is generally agreed that macro variables should be ordered before the credit variables there is no apparent consensus on the particular ordering of variables within each group.[18] In any case, the ordering in (6) is the same as the one employed in comparable U.S. studies and is similar to the one specified by Duttagupta and Barrera (2010).[19]

All impulse response functions (IRFs) are evaluated over a 12 quarter horizon and 95% confidence bands are estimated via Monte Carlo (100 replications). Figure 2 presents the IRFs for equation (3), namely the extended VARs, in the levels or log levels of the series for Canadian data. Given the dimension of the VARs the figures focus on three IRFs of particular interest for this study, namely the response of real GDP to a one standard deviation shock in loan standards, as well as the IRFs for the impact of loans standards on loans and the impact of loans on loan standards. In addition, in what follows, we discuss the Canadian results only. Readers are referred to Siklos and Lavender (2013) for the U.S. results.

[17] This means that the variables affected by all others are placed first, while the least endogenous variables in the system are ranked last to indicate that while they influence all others in the system they are unaffected by the ones that precede them in the ordering shown in (6).

[18] In addition to estimating conventional impulse responses, we also estimated generalized impulse responses as these are insensitive to the chosen ordering. All conclusions discussed below remain unchanged.

[19] They do not include a loan variable or GDP growth forecasts.

The impact of US-SLOS on real GDP is negative (not shown), with similar results obtained using real time data, while the response of loans to changes in lending standards is also negative. In contrast, the Canadian evidence shown in Figure 2 suggests an essentially non-existent link between C-SLOS, real GDP or business loans. Hence, conditional on loan demand factors, a rise in loans does have the effect of raising credit standards, but only for U.S. data. Finally, while credit conditions respond significantly and positively to loan demand in the US the same result is only apparent in the Canadian case after 3 quarters and the response cannot be said to be significant.[20] All of the foregoing results, however, are based on revised data and not the conditions that, say, loan officers would have observed at the time standards were being set.

Next, we estimate a FAVAR for Canada to allow shocks from the U.S. to impact the Canadian economy. In the first stage we obtain the first of two principal components from US data and obtain the macro and credit factors (see equations (4) and (5)). The details are relegated to an appendix. Figure 3 displays the factor scores for the two factors, labeled 'macro' and 'financial' conditions. The macro factor is so-named because it highlights the relatively large factor loadings among the U.S. macroeconomic time series considered, namely real GDP, prices, the fed funds rate, commodity prices and commercial loans. The financial conditions factor reflects the large factor loadings among the financial indicators in the model, namely the term spread, the fed funds rate, real GDP growth forecasts, and the financial conditions index.

[20] A common problem with error bands of the kind shown in Figures 2 and 3 is that it is unclear whether the resulting impulse responses of the kind generated here can be said to be statistically 'significant' in the usual fashion. See, for example, Sims and Zha (1999) and references therein.

The estimates highlight the drop in the 'macro' factor once the recession is underway, as highlighted by the shaded NBER recession dates. Estimates for a variety of vintages (not shown) reinforce these findings. The rise in overall economic performance during the early 2000s culminating in the sharp drop in macroeconomic conditions once the financial crisis and recession of 2008-9 materialize is also apparent. Indeed, the very modest recovery in macro conditions is clear from the last few observations in the sample. In spite of the broad similarities in the factors for both revised and real time data there are some differences between the two types of series. For example, improvements in macro conditions emerge earlier in the 2009Q3 vintage, the first quarter after the recession in Canada is thought to have ended, than in the revised data. Second, the deterioration in the macroeconomic environment is also evident earlier in the vintage data (not shown) with a brief reversal during the middle of the 2008-9 recession. This is not apparent from the revised data.

Turning to the FAVAR evidence for Canada, shown in Figure 2, the results appear quite different from comparable U.S. evidence (not shown). Both benchmark and extended FAVARs for Canada indicate that loan standards have no effect on either real GDP or the volume of business loans, as was found for the benchmark model. This is not the case for results based on U.S. data alone. However, estimates based on real time Canadian data (Figure 2c) reveal a modest impact on loans from a shock to terms of credit standards lasting about 2 quarters. The 2007Q3 vintage is the vintage two quarters before the recession in Canada begins (as dated in

Figure 1b).[21] Finally, a tightening (and significant after 3 quarters) of credit standards following a rise in loans is now apparent in real time data unlike the revised data examined above.

We now turn to the variance decompositions (VD) which are displayed in Table 2.[22] To conserve space again only the results for Canada are discussed.[23] The Canadian evidence suggests at least two notable differences vis-à-vis the US results. First, C-SLOS explains a greater portion of the variance of all of the variables than in the comparable benchmark U.S. model. To the extent that differences in regulation and supervision play a role in influencing the tightness of credit standards, the VDs offer some evidence suggestive of a marked contrast between the U.S. and Canadian experiences in recent years. Second, unlike its U.S. cousin, the term spread explains a much larger portion of the variance of all the macro variables. In other words, while there is strong evidence for Canada that the term spread has an important influence on real GDP the same cannot be said to hold for U.S. data.

Perhaps the most interesting result is that monetary policy, as reflected in the Bank of Canada's overnight rate, has a much bigger impact on standards than in comparable US models. This result holds regardless of the estimated model. The impact in Canada is almost 10 times that found for the US in the extended model but is only twice as large when the real time vintages are considered.[24] Hence, monetary policy appears to have been relatively more effective in influencing lending standards in Canada than in the US during the last decade or so.

[21] Recessions are usually said to begin following two consecutive quarters of negative real GDP growth.
[22] Variance decompositions indicate the fraction each variable contributes to the other variables in the VAR.
[23] See Siklos and Lavender (2013) for a discussion of U.S. results.
[24] Strictly speaking, the chosen US and Canadian vintages are not comparable. However, other tests (not shown) reveal that the VDs of the overnight rate on C-SLOS falls when vintages in the 2007-2009 period are examined, at least relative to other full sample estimates.

## 5. Conclusions and Policy Implications

This paper empirically explores the links between loan standards, credit, and macroeconomic activity in both the U.S. and Canada since 1999. In addition, we examine whether macroeconomic and financial conditions in the U.S. may have spilled over into Canada and affected the estimated relationships considered.

Briefly, we conclude that the U.S. and Canadian economies effectively operated as 'two solitudes' during the period considered insofar as credit shocks played a more significant role in influencing real economic conditions in the US than they did in Canada. In other words, the relationship between loan standards and key macroeconomic time series differ between the two countries. Equally interesting is our finding that the estimated impulse responses highlighted in the paper are influenced according to whether the observer relies on revised data instead of the data that both policy makers and loan officers are likely to have had (i.e., in real time) at the time the latter responded to the survey questionnaire or the former were deciding on the appropriate stance of monetary policy. For example, in the US case, the negative reaction of real GDP to a shock from loan standards is larger when a vintage from the recession period is employed. In contrast, the same response disappears when a vintage of data in Canada on the eve of a recession there is used.

Finally, we report results indicating that monetary policy in Canada was more effective in influencing loans and standards than in the US, especially since the late 1990s. It is unclear whether differences in lending standards and overall financial market supervision are the only explanations. Nevertheless, it does appear that the connection between lending standards and

monetary policy operated more forcefully in Canada than in the US, at least over the sample considered.

As noted in the introduction the Bank of Canada now explicitly relies on the SLOS when the Governing Council meets to set monetary policy in Canada. Perhaps the most obvious policy implication is that we now have empirical evidence backing up the assertion that loan officer surveys contain vital economic information that macro models ought to incorporate. If so then the Bank ought to consider extending the survey to include loan officers perceptions of the state of demand for loans. In addition, recent concerns over the effectiveness of regulations and monetary policy have centered on mortgage lending and personal borrowing. Extensions of the surveys in this direction might yield additional insights that could be useful for policy makers. In the eurozone such surveys have been conducted in recent years and early indications are that they provide important insights into credit and financial conditions in the eurozone (Siklos 2012, De Bondt et. al. 2010).[25]

Of course, there exist alternatives to survey data. Since the potential mismatch between demand and supply factors gives rise to stressful conditions in credit markets, several central banks, including the Bank of Canada (see Illing and Liu 2006, and Li and St. Amant 2010), have developed a Financial Stress Index (FSI).[26] While such indicators can be useful, potentially there is a need to distinguish between elements that give rise to more stressful conditions in general versus forces that create systemic risks for the financial sector.

[25] The European Central Bank (ECB) collects such data in its Bank Lending Survey. Moreover, the ECB's lending survey collects separate data on the state of lending for enterprises, mortgage lending and consumer credit. The data are found at http://sdw.ecb.europa.eu.

[26] The U.S. also publishes an FSI (see Hakkio and Keeton 2009). Data are available from the St. Louis Fed's FRED database at http://research.stlouisfed.org/fred2).

Possible extensions one might carry out is a more explicit analysis of whether the responses estimated here are influenced, for example, by the presence of a likely break in any relationship due to the arrival of the U.S. financial crisis of 2007-9 followed by the ongoing sovereign debt crisis in Europe. Moreover, with a longer time span of data, it will also be possible to consider with greater statistical precision the role played by credit and quantitative easing policies implemented in the U.S. beginning in 2007. Canada did not implement such policies. Nevertheless, policy rates remain near the zero lower bound, after 2007, in both countries, thereby possibly impairing the link between monetary policy and loan standards. Exploration of these questions is also left for future research. Finally, another avenue with potentially important policy implications concerns the role of the exchange rate regime. Murray (2011) points out that "…flexible exchange rates, which have a great deal to recommend them, have failed to live up to their initial optimistic billing. … Their stabilizing properties were shown to be more limited than previous enthusiasts had credited." Hence, even if the floating regime is capable of insulating the Canadian economy from foreign shocks there is no guarantee that the next crisis will leave the Canadian economy as relatively unscathed as in the 2007-11 period. Counterfactuals might be useful as a stress test to determine, for example, how large a tightening of standards would tip the economy into a severe recession (e.g., see Siklos 2012).

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**Table 1 Summary Statistics: Key Time Series, 1999-2011**

**(a) Means, standard deviations of key time series**

| Series | U.S. | Canada |
|---|---|---|
| | Mean (SD) | Mean (SD) |
| SLOS | 13.56 (27.08) | 9.64 (27.91) |
| Real loan growth | -0.38 (9.58) | 2.03 (2.93) |
| Central Bank policy rate | 2.84 (2.11) | 3.02 (2.21) |
| Nominal loan growth | 3.05 (9.92) | 4.45 (2.21) |
| GDP deflator (rate of change) | 2.14 (0.83) | 2.44 (2.74) |
| Real GDP growth | 2.12 (2.08) | 2.33 (2.03) |
| CPR-TBR spread | 0.39 (0.37) | 0.26 (0.27) |

Note: Variables are defined in the text and the Appendix. Rates of change are 100 times the fourth log difference of the time series in question. CPR is the commercial paper rate, TBR is the Treasury bill rate. Data are quarterly and end in 2011Q1 for US data and 2010Q4 for Canadian data.

**(b) Correlations between the series: Canadian data**

| Series | SLOS | Real loans | Policy rate | Nom. loans | GDP defl. | Real GDP | Spread |
|---|---|---|---|---|---|---|---|
| SLOS | - | | | | | | |
| Real loans | 0.33* | - | | | | | |
| Policy rate | 0.31* | 0.15 | - | | | | |
| Nom. loans | 0.26 | 0.46** | 0.75** | - | | | |
| GDP defl. | -0.15 | -0.70** | 0.45** | 0.32* | - | | |
| Real GDP | -0.08 | -0.18 | 0.71** | 0.59** | 0.66** | - | |
| Spread | 0.65** | 0.13 | 0.08 | 0.28 | 0.09 | -0.16 | - |

**(c) Correlations between the series: U.S. data**

| Series | SLOS | Real loans | Policy rate | Nom. loans | GDP defl. | Real GDP | Spread |
|---|---|---|---|---|---|---|---|
| SLOS | - | | | | | | |
| Real loans | 0.28* | - | | | | | |
| Policy rate | 0.01 | 0.63** | - | | | | |
| Nom. loans | 0.07 | 0.81** | 0.75** | - | | | |
| GDP defl. | -0.28* | 0.36** | 0.47** | 0.63** | - | | |
| Real GDP | -0.60** | -0.09 | 0.46** | 0.25 | 0.22 | - | |
| Spread | 0.46** | 0.49** | 0.29* | 0.64** | 0.15 | -0.15 | - |

Note: * indicates statistically significantly different from zero at the 5% level, ** at the 1% level.

## Table 2

### a) Variance Decompositions: Benchmark Model, Canada

Variance Decomposition of real GDP

| Period | S.E. | real GDP | GDP Defl | Comm P | ONight | Bus Credit | SLOS |
|---|---|---|---|---|---|---|---|
| 1 | 0.00 | 100.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |
| 2 | 0.00 | 77.91 | 6.48 | 0.18 | 2.75 | 5.24 | 7.44 |
| | | (9.87) | (6.99) | (1.26) | (4.09) | (4.88) | (4.91) |
| 3 | 0.01 | 55.86 | 11.34 | 0.12 | 3.10 | 11.05 | 18.53 |
| | | (13.95) | (11.00) | (2.69) | (5.22) | (8.97) | (9.19) |
| 12 | 0.02 | 18.18 | 20.53 | 2.36 | 6.80 | 14.93 | 37.20 |
| | | (12.23) | (17.65) | (6.08) | (11.37) | (10.72) | (12.19) |

Variance Decomposition of Overnight Rate

| Period | S.E. | real GDP | GDP Defl | Comm P | ONight | Bus Credit | SLOS |
|---|---|---|---|---|---|---|---|
| 1 | 0.28 | 14.16 | 0.06 | 0.78 | 84.99 | 0.00 | 0.00 |
| | | (10.49) | (2.90) | (3.61) | (10.65) | (0.00) | (0.00) |
| 2 | 0.51 | 19.39 | 3.39 | 0.42 | 74.28 | 0.18 | 2.34 |
| | | (13.64) | (6.39) | (4.10) | (14.62) | (2.01) | (2.87) |
| 3 | 0.70 | 26.18 | 2.41 | 0.23 | 62.17 | 1.05 | 7.95 |
| | | (15.98) | (7.22) | (4.25) | (15.85) | (4.19) | (6.64) |
| | | (13.43) | (15.36) | (5.50) | (13.57) | (9.00) | (10.57) |

Variance Decomposition of Bus Credit

| Period | S.E. | real GDP | GDP Defl | Comm P | ONight | Bus Credit | SLOS |
|---|---|---|---|---|---|---|---|
| 1 | 0.00 | 12.67 | 2.51 | 0.08 | 0.07 | 84.67 | 0.00 |
| | | (9.72) | (4.60) | (1.97) | (3.46) | (10.63) | (0.00) |
| 2 | 0.01 | 19.78 | 14.42 | 0.05 | 0.56 | 54.90 | 10.29 |
| | | (11.54) | (10.38) | (2.90) | (5.06) | (12.98) | (6.74) |
| 3 | 0.01 | 18.45 | 20.11 | 0.04 | 0.43 | 39.46 | 21.50 |
| | | (12.18) | (12.83) | (3.57) | (4.76) | (13.62) | (9.40) |
| 12 | 0.04 | 12.82 | 41.73 | 0.35 | 5.99 | 4.16 | 34.94 |
| | | (14.00) | (20.28) | (5.11) | (12.60) | (10.84) | (14.89) |

Variance Decomposition of SLOS

| Period | S.E. | real GDP | GDP Defl | Comm P | ONight | Bus Credit | SLOS |
|---|---|---|---|---|---|---|---|
| 1 | 15.41 | 12.41 | 13.64 | 1.45 | 0.08 | 8.25 | 64.17 |
| | | (10.46) | (8.40) | (4.33) | (2.81) | (6.41) | (10.59) |
| 2 | 17.76 | 9.61 | 17.11 | 1.84 | 0.13 | 7.38 | 63.94 |
| | | (8.00) | (9.94) | (5.06) | (5.94) | (7.58) | (11.96) |
| 3 | 19.03 | 9.21 | 18.35 | 1.81 | 0.11 | 14.42 | 56.09 |
| | | (7.62) | (11.88) | (4.59) | (7.06) | (9.52) | (12.29) |
| 12 | 32.24 | 15.02 | 10.69 | 2.60 | 15.63 | 14.33 | 41.73 |
| | | (10.29) | (12.96) | (5.78) | (9.98) | (7.81) | (10.23) |

Note: See note to Table 1 and note to Figure 4a.

**Table 2**

## b) Variance Decompositions: Benchmark Model, Canada: 2007Q3 Vintage

Variance Decomposition of real GDP

| Period | S.E. | real GDP | GDP Defl | Comm P | ONight | Bus Credit | SLOS |
|---|---|---|---|---|---|---|---|
| 1 | 0.00 | 100.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |
| 2 | 0.00 | 84.38 | 0.61 | 0.49 | 3.42 | 3.62 | 7.48 |
| | | (8.93) | (2.57) | (1.68) | (3.67) | (2.47) | (6.28) |
| 3 | 0.00 | 69.21 | 2.01 | 0.43 | 7.17 | 6.32 | 14.85 |
| | | (12.73) | (5.07) | (2.54) | (6.92) | (4.03) | (8.19) |
| 12 | 0.00 | 51.48 | 5.53 | 4.36 | 16.84 | 4.83 | 16.96 |
| | | (17.81) | (9.71) | (10.02) | (13.36) | (8.06) | (9.84) |

Variance Decomposition of Overnight Rate

| Period | S.E. | real GDP | GDP Defl | Comm P | ONight | Bus Credit | SLOS |
|---|---|---|---|---|---|---|---|
| 1 | 0.36 | 0.93 | 5.32 | 11.46 | 82.30 | 0.00 | 0.00 |
| | | (6.13) | (7.56) | (8.69) | (11.96) | (0.00) | (0.00) |
| 2 | 0.51 | 1.56 | 5.97 | 23.79 | 67.95 | 0.00 | 0.72 |
| | | (5.79) | (7.90) | (11.27) | (11.64) | (0.68) | (2.45) |
| 3 | 0.63 | 2.79 | 5.99 | 36.84 | 53.51 | 0.27 | 0.60 |
| | | (6.15) | (8.37) | (13.02) | (12.78) | (1.14) | (2.80) |
| 12 | 1.20 | 16.09 | 6.86 | 39.00 | 25.23 | 3.81 | 9.02 |
| | | (12.91) | (9.87) | (13.54) | (14.34) | (5.22) | (8.55) |

Variance Decomposition of Bus Credit

| Period | S.E. | real GDP | GDP Defl | Comm P | ONight | Bus Credit | SLOS |
|---|---|---|---|---|---|---|---|
| 1 | 0.00 | 21.32 | 2.35 | 2.52 | 0.58 | 73.23 | 0.00 |
| | | (13.04) | (6.85) | (6.10) | (4.42) | (11.52) | (0.00) |
| 2 | 0.01 | 17.04 | 3.62 | 0.67 | 0.33 | 57.79 | 20.55 |
| | | (11.71) | (6.91) | (2.87) | (5.15) | (10.92) | (6.73) |
| 3 | 0.01 | 17.77 | 6.98 | 0.40 | 0.48 | 47.16 | 27.22 |
| | | (11.87) | (8.65) | (2.83) | (6.12) | (11.49) | (9.29) |
| 12 | 0.03 | 40.53 | 13.51 | 1.19 | 5.82 | 15.05 | 23.91 |
| | | (17.21) | (12.55) | (8.53) | (9.79) | (10.73) | (10.94) |

Variance Decomposition of SLOS

| Period | S.E. | real GDP | GDP Defl | Comm P | ONight | Bus Credit | SLOS |
|---|---|---|---|---|---|---|---|
| 1 | 13.79 | 13.32 | 0.07 | 0.30 | 8.29 | 4.04 | 73.98 |
| | | (11.32) | (3.49) | (3.29) | (8.97) | (5.15) | (12.90) |
| 2 | 15.45 | 17.91 | 2.18 | 1.41 | 11.15 | 3.79 | 63.56 |
| | | (11.00) | (6.31) | (3.36) | (8.82) | (3.95) | (11.88) |
| 3 | 16.42 | 19.79 | 2.44 | 3.08 | 12.26 | 6.15 | 56.28 |
| | | (10.81) | (6.63) | (4.71) | (8.83) | (4.54) | (11.64) |
| 12 | 21.64 | 16.60 | 6.38 | 18.78 | 11.65 | 8.80 | 37.77 |
| | | (10.22) | (8.60) | (10.91) | (10.27) | (5.55) | (12.34) |

See note to Table 2a and note to Figure 4b.

## Table 2

### c) Variance Decompositions: Extended Model, Canada

Variance Decomposition of real GDP

| Period | S.E. | real GDP | GDP Defl | Comm P | ONight | Bu Credit | Exp. Growth | Spread | FCI | SLOS |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.00 | 100.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |
| 2 | 0.01 | 81.96 | 6.93 | 0.51 | 0.40 | 6.27 | 1.73 | 1.01 | 1.11 | 0.09 |
| | | (9.71) | (6.27) | (3.00) | (3.60) | (5.51) | (3.07) | (1.86) | (1.78) | (1.24) |
| 3 | 0.01 | 57.91 | 13.58 | 4.32 | 0.95 | 10.44 | 1.26 | 6.85 | 3.18 | 1.51 |
| | | (13.90) | (9.86) | (7.99) | (3.55) | (7.86) | (3.64) | (5.67) | (3.97) | (2.18) |
| 12 | 0.02 | 8.38 | 18.85 | 12.61 | 10.03 | 5.41 | 2.09 | 35.43 | 3.17 | 4.02 |
| | | (7.56) | (12.91) | (9.94) | (9.82) | (6.50) | (4.49) | (10.20) | (4.44) | (2.90) |

Variance Decomposition of Overnight Rate

| Period | S.E. | real GDP | GDP Defl | Comm P | ONight | Bu Credit | Exp. Growth | Spread | FCI | SLOS |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.26 | 11.26 | 1.04 | 0.03 | 87.67 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | | (9.22) | (4.74) | (2.46) | (10.25) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |
| 2 | 0.49 | 22.56 | 2.60 | 0.71 | 68.51 | 0.10 | 0.18 | 5.28 | 0.01 | 0.05 |
| | | (13.26) | (4.70) | (3.87) | (13.08) | (1.31) | (1.65) | (3.53) | (0.81) | (0.86) |
| 3 | 0.70 | 18.24 | 1.42 | 3.19 | 61.31 | 1.24 | 0.21 | 11.60 | 0.21 | 2.58 |
| | | (12.06) | (5.39) | (6.72) | (13.67) | (3.04) | (3.02) | (6.54) | (1.60) | (2.05) |
| 12 | 1.36 | 6.38 | 2.54 | 9.94 | 37.15 | 9.53 | 1.46 | 25.66 | 0.10 | 7.23 |
| | | (7.03) | (11.88) | (11.03) | (14.56) | (8.03) | (4.35) | (9.49) | (3.97) | (3.86) |

Variance Decomposition of Bus Credit

| Period | S.E. | real GDP | GDP Defl | Comm P | ONight | Bu Credit | Exp. Growth | Spread | FCI | SLOS |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.00 | 3.86 | 1.34 | 6.33 | 3.99 | 84.49 | 0.00 | 0.00 | 0.00 | 0.00 |
| | | (6.01) | (4.40) | (7.43) | (6.05) | (9.85) | (0.00) | (0.00) | (0.00) | (0.00) |
| 2 | 0.01 | 1.70 | 1.85 | 6.21 | 3.84 | 77.41 | 0.07 | 0.69 | 0.05 | 8.18 |
| | | (4.76) | (4.39) | (7.51) | (5.91) | (12.08) | (1.49) | (2.16) | (1.44) | (4.76) |
| 3 | 0.01 | 0.90 | 6.75 | 3.07 | 4.83 | 70.06 | 0.68 | 3.40 | 1.07 | 9.23 |
| | | (4.17) | (8.13) | (5.21) | (7.07) | (13.16) | (2.99) | (3.83) | (2.22) | (5.53) |
| 12 | 0.03 | 0.41 | 24.54 | 4.53 | 11.30 | 11.28 | 2.85 | 32.10 | 1.74 | 11.25 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | (7.37) | (15.50) | (7.92) | (12.73) | (10.44) | (5.37) | (11.83) | (4.65) | (5.06) |
| | | | | | Variance Decomposition of Exp. Growth | | | | | |
| Period | S.E. | real GDP | GDP Defl | Comm P | ONight | Bu Credit | Exp. Growth | Spread | FCI | SLOS |
| 1 | 0.38 | 16.97 | 18.30 | 0.10 | 5.27 | 3.85 | 55.52 | 0.00 | 0.00 | 0.00 |
| | | (11.71) | (10.75) | (2.30) | (6.21) | (4.75) | (10.37) | (0.00) | (0.00) | (0.00) |
| 2 | 0.44 | 15.15 | 14.56 | 0.91 | 8.80 | 4.93 | 43.21 | 11.71 | 0.45 | 0.27 |
| | | (8.38) | (8.23) | (4.45) | (8.62) | (5.96) | (9.38) | (7.36) | (2.24) | (1.97) |
| 3 | 0.49 | 15.10 | 23.49 | 1.40 | 8.06 | 4.57 | 35.22 | 10.28 | 0.36 | 1.51 |
| | | (7.37) | (8.88) | (5.76) | (8.00) | (4.87) | (8.25) | (5.37) | (2.19) | (3.92) |
| 12 | 0.65 | 13.97 | 15.81 | 1.97 | 12.81 | 6.18 | 21.68 | 20.97 | 2.47 | 4.13 |
| | | (6.71) | (8.00) | (6.25) | (8.06) | (5.65) | (5.02) | (7.09) | (3.37) | (4.59) |
| | | | | | Variance Decomposition of SLOS | | | | | |
| Period | S.E. | real GDP | GDP Defl | Comm P | ONight | Bu Credit | Exp. Growth | Spread | FCI | SLOS |
| 1 | 14.39 | 0.00 | 24.16 | 8.58 | 0.05 | 0.05 | 5.30 | 29.70 | 0.08 | 32.07 |
| | | (4.39) | (10.66) | (7.55) | (2.44) | (1.91) | (4.72) | (9.04) | (1.07) | (6.81) |
| 2 | 19.52 | 3.61 | 23.61 | 11.40 | 0.64 | 0.04 | 9.03 | 32.44 | 0.86 | 18.37 |
| | | (7.75) | (11.35) | (8.21) | (4.02) | (3.10) | (6.44) | (8.62) | (2.24) | (4.66) |
| 3 | 21.67 | 3.62 | 23.48 | 10.21 | 1.44 | 4.99 | 7.97 | 31.41 | 1.29 | 15.60 |
| | | (7.66) | (11.55) | (7.35) | (4.53) | (5.94) | (5.69) | (8.55) | (3.04) | (4.71) |
| 12 | 33.76 | 2.29 | 13.75 | 7.52 | 19.80 | 10.71 | 4.41 | 29.20 | 1.45 | 10.87 |
| | | (7.18) | (11.40) | (8.13) | (11.54) | (8.15) | (4.14) | (9.25) | (4.54) | (4.56) |

Note: See note to Table 2a.

**Figure 1a Senior Officer Loan Survey and Commercial Loans, 1999-2011: U.S.**

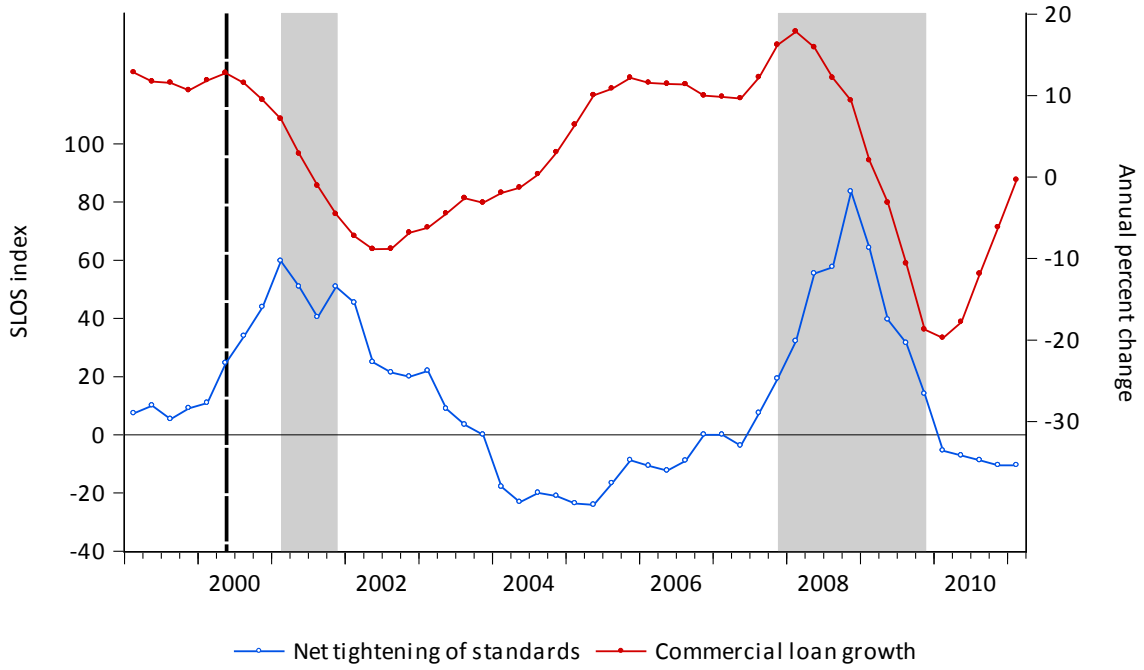
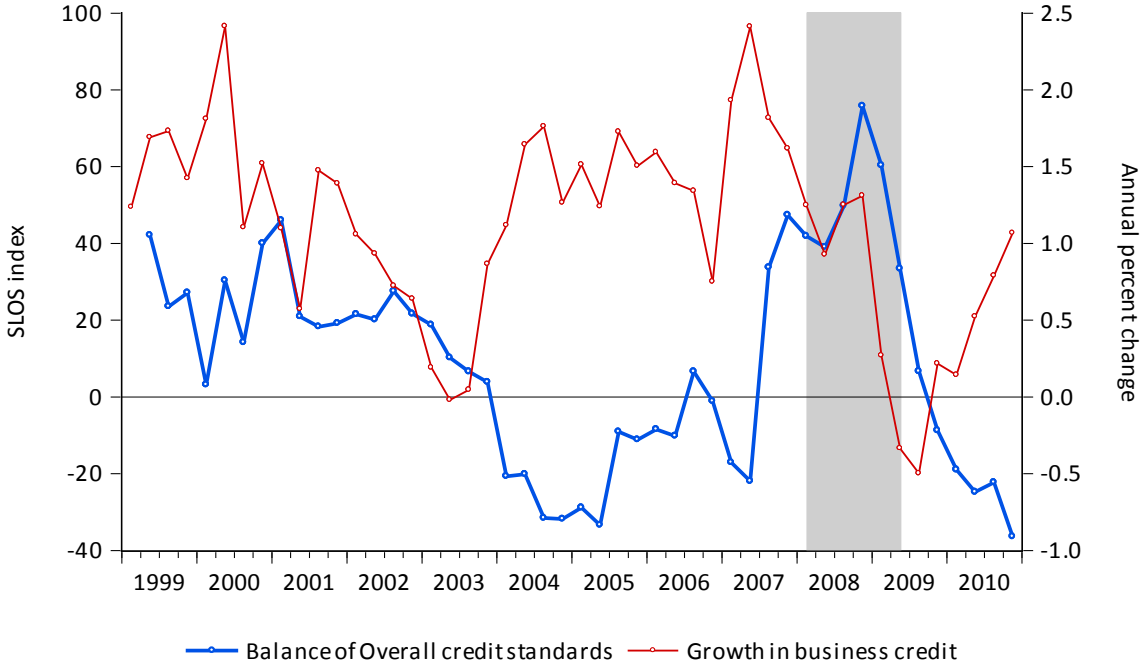
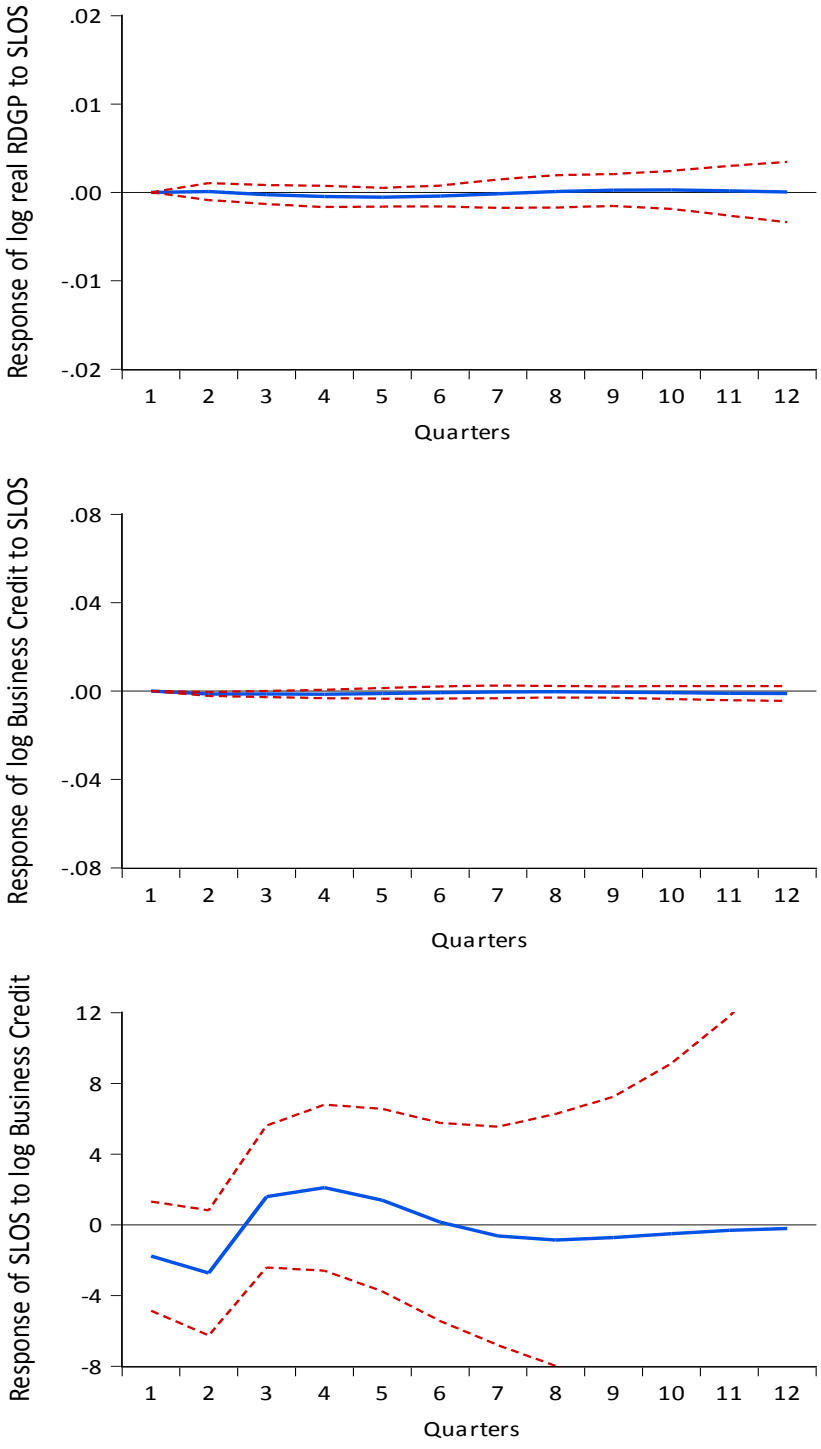



**Figure 1b Senior Officer Loan Survey and Commercial Loans, 1999-2011: Canada**



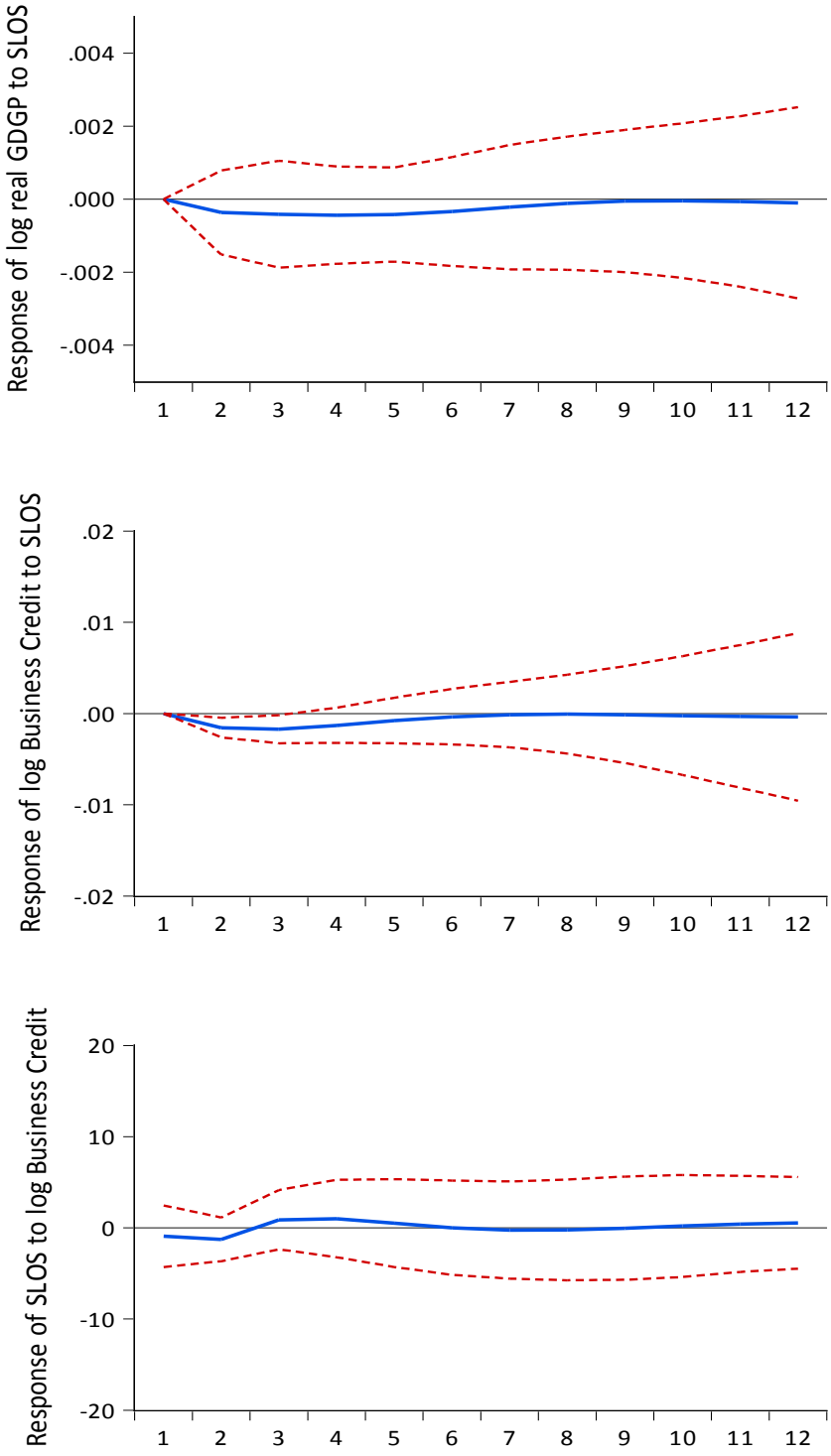

Note: See Appendix for data sources. Series definitions are also provided in the main body of the paper. The shaded areas represent recession dates (2008Q1-2009Q2). Cross and Bergevin (2012) date the recession 2008Q4-2009Q2.

**Figure 2a Impulse Response Functions: Benchmark FAVAR Model, Canada, 1999-2011**



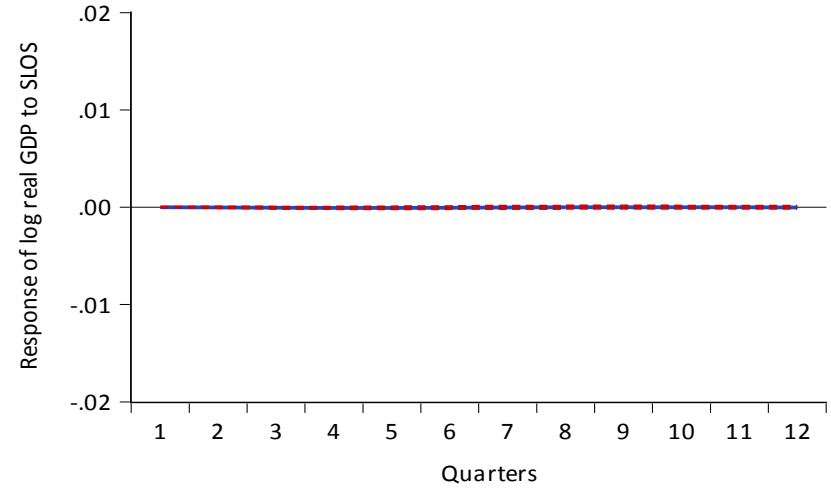

Note: The benchmark model is defined in equation (2). The FAVAR is defined in (5). The confidence bands are based on Monte Carlo simulations (100 replications). VARs were estimated with 4 lags. Revised real GDP data are used. A Cholesky decomposition is used and an adjustment for degrees of freedom is applied.

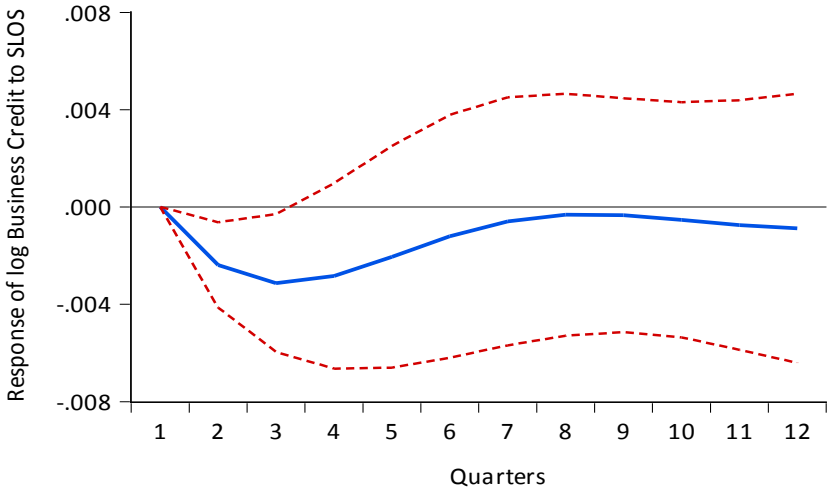
**Figure 2b Impulse Response Functions: Extended FAVAR Model, Canada, 1999-2011**

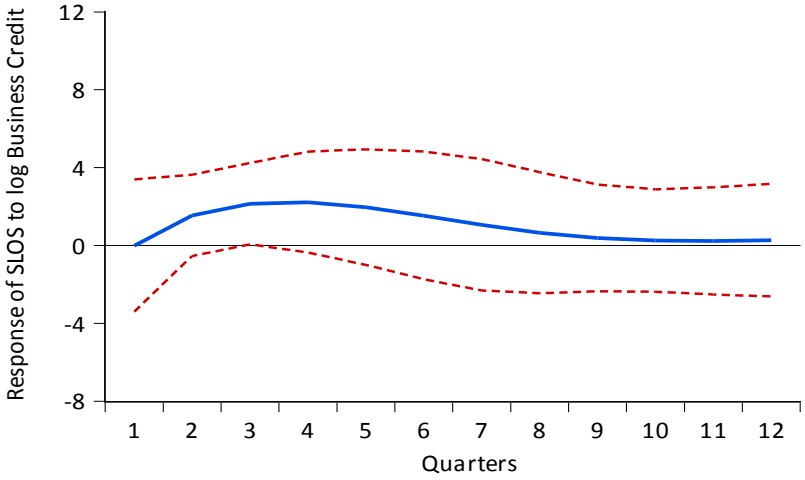



Note: Also see Figure 2a. The extended model adds one year-ahead forecasts of real GDP growth, the term spread and the FCI to equation (3). The FAVAR is estimated with 2 lags. The US Macro factor enters with 1 lag while the US Financial factor enters contemporaneously. The VAR is estimated with 1 lag.

**Figure 2c Impulse Response Functions: Benchmark FAVAR Model, Canada, 2007 Q3 vintage**

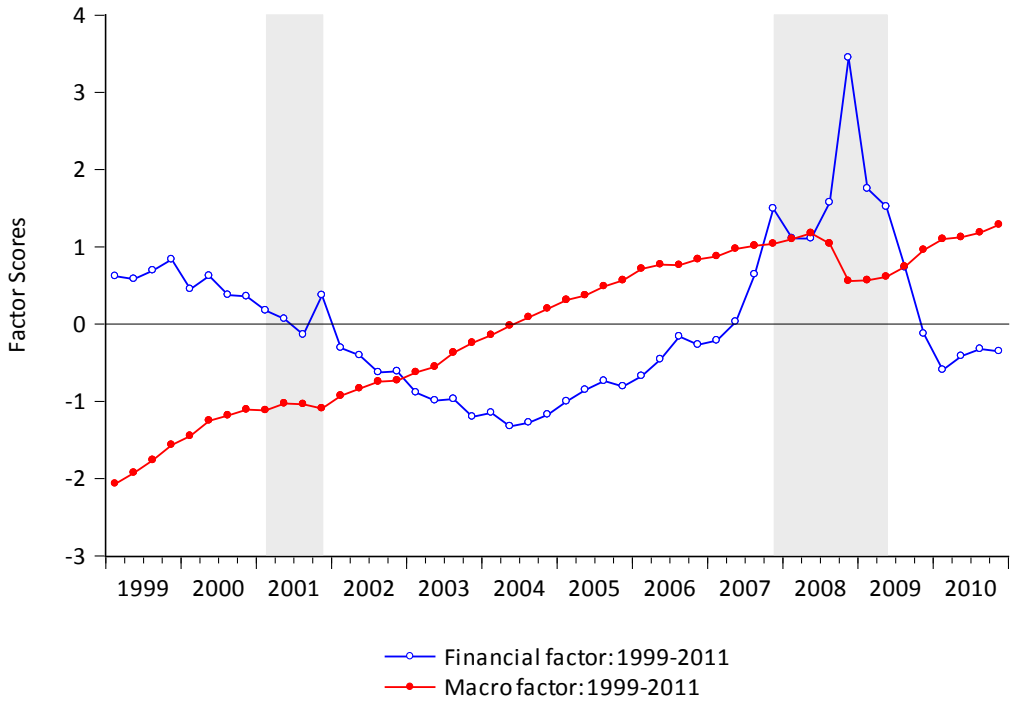



Note: See note to Figure 2a and b. The VAR is estimated with 1 lag. The 2007Q3 vintage is 2 quarters before the Canadian recession begins. See Figure 1.

**Figure 3 Factor Model Scores for the US**




Note: factor scores are based on a model for all the variables in the extended model (see equation (4)), estimated via maximum likelihood, using the Kaiser-Gutman method. Factors were then subjected to a rotation using the varimax method. Factor loading estimates are relegated to an Appendix (not shown).