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Military Pogs

David Bergeron, Curator, Currency Museum

Even in this era of virtual money and electronic payment systems, military forces continue to issue special tokens to reduce the need to ship heavy, bulky coinage to troops deployed in war zones. Canadian and allied troops stationed at Kandahar Airfield in Afghanistan use such tokens to purchase goods on the base. Owing to their size and composition, the tokens are more familiarly known as “pogs”—a term that can be traced back to Hawaii in the 1920s. A company on the island of Maui sold its fruit drink in glass bottles sealed with wax-covered paper discs. The drink was made from the juices of passion fruit, oranges, and guavas, hence the name pog, coined by children playing games with the discs.

Two kinds of pogs currently circulate at Kandahar Airfield: those issued by the Army and Air Force Exchange Service (AAFES) for the American military and those issued by the Expeditionary Force Institute (EFI) for the British Armed Forces. Officially called gift certificates because they are not legal currency, both are made of thin plastic or laminated paper and are printed in denominations of 5, 10, and 25 cents. All denominations are the same size—about that of a \$2 coin. Pogs are given in change instead of coins and are redeemable in cash at the issuing offices. Given their limited use, their circulation remains local.

The most interesting aspect of military pogs is the multitude of images found on the tokens. Every year since it began issuing pogs in 2001, the AAFES has

issued a new series, each depicting a different theme, such as military vehicles, historic battles, and military personnel. Twelve designs were produced for each denomination, for a total of 36 different pogs per series. The EFI began issuing pogs in Iraq in 2005 and have limited the number of different designs on all three denominations to 12 per series. Because of the large variety of pogs available, they have become collector’s items. The most popular pog among collectors depicts Elvis Presley in military garb.

Canadian Forces also issued tokens for soldiers stationed in Kabul (mainly in Camp Julien) between 2004 and 2005. Because the cost of shipping coins was prohibitive, and those sent along with soldiers bound for Afghanistan quickly disappeared into circulation in the city, Canadian Forces Personnel Support Agency ordered \$5000 worth of 25-cent tokens to meet the resulting coin shortage. When the Canadian Forces base was moved from Kabul to Kandahar in the autumn of 2005, the tokens were no longer required because AAFES pogs were already circulating there.

The military pogs pictured on the cover are part of the National Currency Collection of the Bank of Canada.

Photography by Gord Carter, Ottawa

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Has Exchange Rate Pass-Through Really Declined? Some Recent Insights from the Literature

Jeannine Bailliu, Canadian Economic Analysis Department; Wei Dong, International Economic Analysis Department; and John Murray, Deputy Governor

- *A substantial empirical literature has shown that the correlation between changes in consumer prices and changes in the nominal exchange rate has been quite low and declining over the past two decades for a broad group of countries.*
- *The issue of exchange rate pass-through (ERPT) has recently been explored more fully in the context of sticky-price, open-economy, dynamic stochastic general-equilibrium (DSGE) models. The findings of these studies put into question results from previous work based on reduced-form equations. In particular, ERPT to import prices may remain larger than the estimated parameters from reduced-form regressions would indicate, owing to an econometric bias related to the endogeneity of the exchange rate.*
- *Nevertheless, there is fairly convincing evidence to suggest that measured short-term ERPT to consumer prices has declined because of a shift to more credible monetary policy regimes, and, in this case, the findings from DSGE models confirm the results of reduced-form models.*
- *Studies using microdata are a promising area of research, since they provide additional insights that help us to better understand the phenomenon of ERPT by providing evidence of some of its drivers at the micro level.*

The extent to which exchange rate movements are “passed through” to prices has long been a question of interest to both central bankers and academics. Exchange rate pass-through (ERPT) typically refers to the direct effect that a change in the external value of a currency has on the domestic price of imported goods and services and on domestic prices more generally. For instance, a depreciation in the Canadian dollar is usually expected to increase the prices of goods that are imported into Canada. If the effect of the depreciation is fully reflected in import prices, then pass-through is said to be complete. If only a portion of the depreciation is reflected in import prices, then the pass-through is described as partial or incomplete.

The pass-through process consists of two stages. In the first stage, exchange rate movements are transmitted to import prices, while in the second stage, changes in import prices are reflected in the consumer price index (CPI).¹ While the response of import prices to exchange rate movements is important, it is the behaviour of the CPI that matters most for monetary policy in Canada and in other inflation-targeting countries. The extent of pass-through to the CPI will depend on the rate of pass-through to import prices, the share of imports in the consumption basket, and the response of the prices of domestically produced goods to movements in the exchange rate. The extent and speed of the pass-through to import prices will also depend on several factors, including expectations as to the duration of the depreciation or appreciation, the cost of adjusting prices, demand conditions, and the

¹ It should be noted that ERPT to the CPI would include any effects of changes in the exchange rate on the prices of import-competing goods and on the prices of imported inputs.

Exchange Rate Pass-Through and the Bank of Canada's Inflation Projection

The Bank of Canada's inflation projection—a key element in the conduct of monetary policy—is based on a fully articulated, five-sector, structural DSGE model of the Canadian economy called ToTEM.¹ In ToTEM, the extent to which movements in the exchange rate are passed through to prices depends on many factors, such as the share of imports in the CPI basket, the frequency of price changes, and the expected response by

the monetary authority. Notably, it is assumed that monetary policy can significantly influence ERPT in the short run through its effect on inflation expectations. Pass-through from the exchange rate to the core CPI is quite low in the short run (about 0.03 after one year and 0.05 after two years), and in the long run, the model assumes that all prices, including the exchange rate, will change by the same proportion after an exchange rate shock.

¹ For more information on ToTEM, see Murchison and Rennison (2006).

elasticity of substitution among alternative domestic and foreign suppliers.²

Several stylized facts on ERPT have emerged from the large body of research that has examined this issue. First, it appears that the full effect of a depreciation or appreciation of the domestic currency is typically not passed through to the local-currency prices of imports, even in the long run. Second, exchange rate movements are passed through to prices with a lag, such that ERPT in the short run seems to be much lower than in the longer run. Third, there is considerable heterogeneity in the extent of ERPT at the industry level: pass-through seems to be higher in industries that produce homogeneous goods, such as energy and raw materials, and lower for those that produce more differentiated manufactured goods. Finally, it has been suggested, based on casual observation and empirical work, that ERPT to consumer prices may have diminished over time.

The issue of whether ERPT has declined is an important one for central banks because a decline in pass-through would imply that movements in the exchange rate have smaller effects on consumer prices and, hence, on short-run inflation, than previously thought. Assessing this view thus has important implications for Canadian monetary policy, particularly in an environment characterized by sizable

movements in the Canadian dollar. Indeed, when the Canadian dollar moves on a sustained basis, it is important for the Bank of Canada to accurately estimate its impact on the Bank's forecast of the future path of inflation—a key element in the conduct of monetary policy. For more on ERPT and the Bank of Canada's inflation projection (**see Box**).

In this article we build on an earlier *Review* article by Bailliu and Bouakez (2004) and critically reassess the premise that ERPT has declined, in light of recent work that analyzes this issue in the context of a dynamic stochastic general-equilibrium (DSGE) framework. These more-recent contributions to the literature help to emphasize the potential pitfalls of studies based on reduced-form equations, which have formed the basis for much of the evidence to date. We also discuss insights from recent studies of ERPT based on microdata. We conclude with a discussion of policy implications.

Has Exchange Rate Pass-Through Declined?

Before discussing the evidence which suggests that ERPT may have declined, we review the explanations put forward in the literature to explain how a decline in ERPT could arise, focusing first on import prices and then on consumer prices.

² If the price of an imported good rises because of a depreciation, domestic importers may simply switch suppliers. This would be measured as low pass-through, even though pass-through may be complete.

Why might we expect pass-through to import prices to have declined in recent years?

One reason links a decline in ERPT to import prices to increased trade integration, because supply chains have become more interconnected and globalized. Multinational firms generally produce and trade in both intermediate and final goods. Under this vertical relationship, exchange rate changes can influence decisions about the production of final goods directly and indirectly through changes to input prices (Aksoy and Riyanto 2000). The increased use of cross-border production within the same firm may thus have contributed to lower ERPT to import prices by distributing production over a wide set of countries, subject to different currency movements. It is important to note, as pointed out by Murray (2008), that any change in the exchange rate that is not passed through to the price of imports must be absorbed by foreign exporters. Thus, from the importers' perspective, declining pass-through will be associated with increased exchange rate sensitivity with regard to export prices.

In addition, the role of large importers may suggest that the recent process of globalization has contributed to the observed decline in ERPT (Dvir 2007). Large importers have significant market power, in particular, the power to discriminate between suppliers based on location. Thus, when there are exchange rate movements, it is optimal for large importers to conduct trade through discriminatory procurement auctions and simply switch suppliers. This way, measured import-price indexes would attach a larger weight to lower prices, and the observed ERPT would be smaller.

The composition of imports may have shifted towards sectors that have lower degrees of ERPT.

An alternative, and possibly complementary, explanation for the decline in ERPT to import prices is based on the notion that the composition of imports may have shifted towards sectors that have lower degrees of ERPT. Campa and Goldberg (2005) find support for this hypothesis in their study of OECD countries over the period 1975–2003. The decline in pass-through to aggregate import prices can therefore be attributed to changes in the underlying composition of products in each country's import bundle, particularly the move

away from commodities and towards products in sectors with higher degrees of product differentiation and lower degrees of ERPT, such as manufacturing.

Finally, the recent decline in ERPT to import prices has been linked to the growing importance of emerging markets in the world economy. Indeed, the swift and significant integration of emerging economies into global markets may have contributed to the fall in ERPT to import prices in many industrial countries by increasing the prevalence of pricing-to-market (PTM). The decline in pass-through to import prices in some advanced economies, notably the United States, is consistent with a rise in the proportion of imports coming from firms in emerging markets, many of whom practise PTM (Bussière and Peltonen 2008). China's surging exports to the United States may also have contributed to the decline in observed pass-through in recent years (Marazzi and Sheets 2007). Interestingly, Marazzi and Sheets find that the U.S. markets that have experienced the greatest reductions in pass-through in recent years are those in which China has recorded an increased market share.³

Why might we expect pass-through to consumer prices to have declined recently?

While the response of import prices to exchange rate movements is important, it is the behaviour of the CPI that matters most for monetary policy in Canada and in other inflation-targeting countries. Although the degree of ERPT to import prices is important in determining the extent of ERPT to consumer prices, other factors are at play.

First, distribution costs—such as transportation, marketing, and services—will cause import and consumer prices to diverge, and the wedge between the two prices can be significant. For example, U.S. distribution margins are in the order of 50 to 70 per cent, according to research by Berger et al. (2009). The large non-tradable component in distribution margins thus significantly insulates consumer prices from exchange rate movements (Burstein, Neves, and Rebelo 2003; Goldberg and Campa 2008; Berger et al. 2009).

Second, monetary policy may have played an important role in the decline in ERPT to consumer prices. Taylor (2000) and others argue that the

³ Moreover, with the increase in globalization, many retailers now have access to a larger number of potential suppliers. Thus, when the exchange rate changes, the importer could simply switch suppliers, making it appear as though ERPT had declined.

establishment of a strong nominal anchor in many countries over the past two decades may have contributed to the decline in ERPT. According to this argument, ERPT is primarily a function of the persistence of exchange rate and price shocks, which tends to be reduced in an environment where inflation is low and monetary policy is more credible.⁴ Work by Bailliu and Fujii (2004) and Gagnon and Ihrig (2004), showing that break points in pass-through estimates coincide with changes in the monetary policy regime in a panel of countries, including Canada, supports Taylor's view. Studies by Bouakez and Rebei (2008) and Murchison (2009), based on DSGE models, also suggest that short-run ERPT has declined as a result of the move to inflation targeting.

Finally, increased competition among retailers in the local market can also lead to a decline in ERPT to consumer prices. As discussed by Bacchetta and van Wincoop (2003), the insensitivity of consumer prices to changes in the exchange rate may be the outcome of an optimal strategy from the retailer's perspective. Indeed, when there is rising competition in the local market, it may be optimal for retailers to absorb some of the fluctuations in the exchange rate into their margins, regardless of the sensitivity of border prices to exchange rates. Moreover, when there is limited substitution between non-tradable goods and imported goods, the prices of non-tradable goods can be very sticky, even after large exchange rate movements, leading to very little response in aggregate consumer prices.

Evidence from Reduced-Form Macroeconomic Models

A substantial empirical literature has shown that the correlation between changes in consumer prices and changes in the nominal exchange rate has been quite low and declining over the past two decades for a broad group of countries. Ihrig, Marazzi, and Rothenberg (2006) show that all G-7 countries experienced a decline in ERPT to import prices from 1990 to 2004, relative to the period from 1975 to 1989, with the decline being statistically significant for the United States, Japan, and France. There is also evidence of declining ERPT in developing countries, where the pass-through of exchange rate changes has traditionally appeared to be greater and more rapid than in

⁴ As predicted by Taylor (2000), Canada's adoption of an inflation-targeting monetary policy regime has been matched by a significant decline in inflation persistence (Mendes and Murchison 2009–10).

advanced economies (Frankel, Parsley, and Wei 2005).

Marazzi and Sheets (2007) document a robust and sustained decline in ERPT to U.S. import prices, suggesting that it has fallen from above 50 per cent in the 1970s and 1980s to about 20 per cent during the past decade. Di Mauro, Ruffer, and Bunda (2008) find that the extent of exchange rate pass-through to import prices may have declined somewhat in the euro area over recent years. And in their study on Japan, Otani, Shiratsuka, and Shirota (2003) find that ERPT to Japan's import prices fell in the 1990s.

Some of the most striking macro evidence of the weak correlation between exchange rates and inflation comes from case studies of episodes in which prices respond by very little to large currency depreciations.

Some of the most striking macro evidence of the weak correlation between exchange rates and inflation comes from case studies of episodes in which prices respond by very little to large currency depreciations (Burstein, Eichenbaum, and Rebelo 2007). For example, following a sharp depreciation of their currencies in the autumn of 1997, inflation in some Asian countries, such as Korea, remained relatively stable; and after the United Kingdom withdrew from the Exchange Rate Mechanism in 1992, inflation there also remained low.

Potential Pitfalls of Reduced-Form Models

The empirical findings discussed above, regarding the decline in ERPT, are generally based on reduced-form regressions, which tend to be motivated by partial-equilibrium models. This methodology typically consists of estimating an equation where the rate of inflation (for the relevant price index) depends on current and lagged changes in the nominal exchange rate, as well as on other control variables suggested by economic theory. The coefficients associated with the exchange rate variables are then interpreted as estimates of ERPT. Reliance on this methodology to draw strong conclusions for policy has raised concerns, mainly in three areas.

By assuming that exchange rates are exogenously given, the reduced-form approach misses the important feedback effect running from prices to interest rates and from interest rates to exchange rates, and, ultimately, back to prices.

First, exchange-rate movements are treated as an exogenous process in studies based on reduced-form models, whereas, in practice, exchange rates are determined endogenously and are often a function of macrofundamentals. This framework therefore overlooks the channels through which these macrofundamentals might influence the exchange rate. For example, domestic interest rates may rise as a result of the monetary policy response to inflationary pressures, leading to an appreciation of the domestic currency. In this situation, an appreciating exchange rate may be linked to rising rather than falling prices, producing what appears to be a perverse ERPT effect. By assuming that exchange rates are exogenously given, the reduced-form approach misses the important feedback effect running from prices to interest rates and from interest rates to exchange rates, and, ultimately, back to prices.

Second, reduced-form specifications can generate misleading results because they rely on models with too little structure. The reduced-form framework links variables of interest but not in a structural way. In particular, pass-through coefficients derived with this method cannot attribute the extent of ERPT to specific factors, such as the degree of price stickiness, and can also result in false attribution.

Finally, the reduced-form approach provides limited insight into the extent and manner in which the degree of ERPT depends on the nature of shocks. Exchange rate movements are symptomatic of some underlying change in world markets. Some changes have a direct impact on the relative demand for Canadian goods and services, while others do not. Depending on the nature of the shocks, their effects on the economy can be quite different. Specifically, exchange rates and prices are jointly determined, and both respond to structural shocks. Thus, the degree of ERPT will be a function of the nature of the shocks affecting the economy.

The issue of ERPT has been explored more fully in the context of sticky-price, open-economy, DSGE

models. The DSGE framework avoids the endogeneity issue, since it takes into account the fact that prices and the nominal exchange rate are determined simultaneously. With a structural model, the analysis can be made conditional on the shocks. The findings of these studies put into question results from previous studies based on reduced-form equations.

Murchison (2009) uses an open-economy DSGE model to illustrate the types of misleading results that can be generated from reduced-form models. He finds that as monetary policy responds more aggressively to the output gap and inflation, the estimated pass-through coefficient declines dramatically. Moreover, calibrations of the Bank's reaction function consistent with the observed behaviour of Canadian monetary policy since the adoption of an explicit inflation target in 1991 result in pass-through estimates close to zero. In this model, wages and prices display some short-run stickiness but adjust completely in the long run to ensure that temporary shocks do not generate permanent changes in relative prices. Exchange rate shocks are eventually matched by a proportionate increase in import prices that is, in turn, fully reflected in consumer prices. ERPT is thus complete in the long run by assumption, but incomplete in the short run, owing to the presence of a combination of nominal and real rigidities. Nevertheless, as policy responds more aggressively to expected inflation, *measured* short-run pass-through declines rapidly to zero, even when positive short-run pass-through exists in the underlying structural model.

Bouakez and Rebei (2008) provide supportive evidence for Murchison's results. They estimate a DSGE model for Canada over two subsamples, covering the periods before and after the adoption of inflation targeting. They find that pass-through to Canadian import prices has been stable and significant, contrary to findings from studies based on reduced-form models.⁵ Like Murchison, they find that ERPT to Canadian consumer prices may, nevertheless, have declined, as a result of the adoption of the inflation-targeting regime.

⁵ Since a significant number of Canadian import prices are constructed by multiplying the foreign-currency price by the nominal exchange rate, the estimated degree of pass-through reported by reduced-form studies is likely to be biased upwards. A general-equilibrium perspective, however, allows estimating the degree of pass-through to import prices without using data on import prices: the structural parameters that affect the behaviour of import prices can be identified indirectly through links in the structural model.

Insights from Recent Microdata Studies

In addition to the studies of ERPT based on aggregate price indexes, some authors have examined the issue at the sectoral, firm, and goods levels, using microdata, which have become more accessible in recent years. A general insight that emerges from these studies is that the stickiness observed in aggregate price indexes masks a substantial amount of flexibility and diversity in the behaviour of prices at a more disaggregated level (Nakamura and Steinsson 2008; Crucini and Telmer 2007). In particular, substantial heterogeneity characterizes the frequency of price adjustment at the goods level.

Gopinath and Itskhoki (2010) examine the link between the frequency of price adjustment and long-run ERPT using microdata on U.S. import and export prices collected by the Bureau of Labour Statistics. They find that firms that adjust prices infrequently also tend to pass through the effects of exchange rate movements to a lesser extent—even after several periods and multiple rounds of price adjustment—compared with high-frequency adjusters. From a macro perspective, if more firms were to adjust prices infrequently, the degree of exchange rate pass-through would decline.

The increased availability of microdata also helps us to better understand the structural determinants of ERPT. Such an understanding is important not only for forecasting future pass-through patterns, but also because it provides guidance regarding the measurement of pass-through. Existing micro studies have examined a variety of industries (e.g., autos, beer, coffee), and the results have been surprisingly robust regarding the sources of incomplete pass-through, such as non-tradable local costs (Goldberg and Hellerstein 2008). Although there are relatively few studies of ERPT based on microdata, this is a promising area of research.

Policy Implications

If exchange rate movements were regarded simply as additional noise—distorting domestic-price signals and subverting market efficiency—any decline in pass-through could be treated as a positive development. However, to the extent that exchange rates are believed to move for a reason, in response to underlying fundamentals, any interference in this transmission mechanism would be cause for concern. Movements in the exchange rate can significantly influence inflation dynamics, both in terms of their

direct effect on prices and their indirect effect through changes in aggregate expenditure and production. Policy-makers must be able to gauge how large these effects are likely to be, in order to determine the size and persistence of underlying inflation pressures and any monetary policy responses that might be required to deal with them.

Changes in relative prices across borders are important for allocative efficiency and are a critical element of the global macroeconomic adjustment process.

More broadly, exchange rate pass-through can act as a “shock absorber” mechanism for the economy. In this context, the economy converges to a new equilibrium after a shock through an expenditure-switching effect. Changes in relative prices across borders are important for allocative efficiency and are a critical element of the global macroeconomic adjustment process. For example, the expenditure-switching effect helps to redirect consumption and investment in a country with a trade deficit away from imports, as the exchange rate depreciates, making the country’s exports more attractive to foreigners. The benefits of a flexible exchange rate regime are also a function of the extent of ERPT, since the existence of expenditure-switching effects is often cited as a critical element in the case for flexible exchange rates, and these effects depend on ERPT to import prices for their genesis.

Concluding Remarks

Several key insights on ERPT emerge from this critical assessment of recent findings in the literature. First, there is fairly convincing evidence to suggest that short-run measured ERPT to consumer prices has declined because of a shift to more credible monetary policy regimes. In this case, the findings from DSGE models confirm the results of reduced-form models. Second, ERPT to import prices may, nevertheless, remain larger than the estimated parameters from reduced-form regressions would indicate, owing to an econometric bias related to the endogeneity of the exchange rate. Taking liberties with the warning that often appears on the rear-view mirrors of cars, one might say that “the import-price effects caused by exchange rate movements may be larger than they

appear.” The benefits of a flexible exchange rate may also be larger than they appear, since the existence of expenditure-switching effects is often cited as a critical element in the case for flexible exchange rates, and these effects depend importantly on ERPT to

import prices for their genesis. Third, studies using microdata are a promising area of research, since they provide additional insights that help us to better understand the phenomenon of ERPT by providing evidence of some of its drivers at the micro level.

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Financial Stress, Monetary Policy, and Economic Activity

Fuchun Li, *Financial Stability Department and Pierre St-Amant, Canadian Economic Analysis*

- *The recent global crisis is a prime example of the substantial impact that periods of high financial sector stress can have on the real economy. Indeed, this crisis clearly demonstrates that the real economy and the financial sector can undermine each other, with financial stress and weak output feeding each other.*
- *This article examines the potential for non-linear relationships between financial stress, monetary policy, and the real economy by surveying the relevant literature and estimating a model with Canadian data.*
- *The research summarized indicates that the economy can be characterized by regimes of low and high financial stress and that monetary policy can influence the likelihood of transitioning between the two regimes.*
- *It also implies that monetary policy actions have stronger effects when financial stress is high and that tightening monetary policy tends to have more impact than easing.*

Although there have been various episodes of high financial stress (e.g., the recession of the early 1980s, the Asian crisis of the 1990s, the 1998 LTCM scare, and the high-tech bust of the early 2000s), the recent crisis has been remarkable for the intensity of the negative feedback process between financial sector developments and the real economy that characterized it. Policy-makers had to take exceptional measures to break this process, in particular, reducing interest rates to historic lows. While policy actions were successful at reducing financial stress, the crisis nevertheless stimulated interest in the relationship between financial sector developments, the real economy, and monetary policy. This article briefly reviews the economic literature on this topic, focusing on studies that allow for non-linear relationships between monetary policy, financial stress, and the real economy.

Results obtained from an empirical model estimated with Canadian data and allowing for the presence of two financial-stress regimes are also presented. The methodology used builds upon Balke (2000), and financial stress is measured with the index proposed by Illing and Liu (2006), which was designed to reflect tensions in the Canadian financial system.

Selective Literature Review

Seminal contributions by economists as diverse as Knut Wicksell, Irving Fisher, and Friedrich von Hayek have emphasized the role that financial sector developments play in explaining economic fluctuations.¹ More recent contributions have examined the potential for non-linear or amplifying relationships between financial stress, monetary policy, and other economic variables (i.e., the relationship between these variables may not be proportional).

¹ See Laidler (2007) for an excellent discussion.

For example, Blinder (1987) presents a theoretical model with credit frictions (imperfect information about borrowers) in which the economy can enter credit-rationing regimes in which some creditworthy borrowers cannot access credit. This could be caused by tight monetary policy, which Blinder defines as a decrease in central bank reserves. Output growth is lower in such a regime, since a tighter monetary policy can imply that businesses lose access to credit, amplifying non-linearly the effects of the monetary policy tightening (over and above more traditional effects on investment and consumption).²

Bernanke and Gertler (1989) present a model with agency costs in which changes in borrowers' balance sheets can give rise to a "financial accelerator" amplifying fluctuations in output. In their model, negative exogenous "technology" and "balance-sheet" shocks are likely to have a greater effect than positive shocks, because financing constraints likely become binding only after a certain level of borrowing. Subsequent work extended this analysis to models that include monetary policy. For instance, Bernanke and Gertler (1995) discuss models in which the effects of monetary policy shocks on real spending can be magnified through a higher premium on external financing (the cost of financing a project through borrowing minus that of using internal funds). They also discuss a bank-lending channel through which a bank's financial situation also acts as an accelerator mechanism. More recently, Adrian and Shin (2009) argue that the effects of monetary policy can be amplified through impacts on the balance sheets of other types of financial intermediaries.³

Even though these models differ in various dimensions, they all imply non-linear dynamics between financial stress, monetary policy, and the real economy, and they provide a theoretical rationale for empirical analyses of non-linear and regime-dependent relationships between the degree of financial stress, monetary policy, and economic activity.

One example of such an exercise is McCallum (1991). He uses U.S. data to estimate a simple output equation in which the coefficient associated with the monetary variable (M1 in one version) changes when the economy is thought to be in a regime of credit rationing. He finds that monetary tightening has stronger effects (output

slows more) when credit is tight, a result that he says corroborates a prediction of Blinder's (1987) model.

Like McCallum, Galbraith (1996) uses a single-equation model. However, while in McCallum's work credit regimes are determined exogenously, Galbraith's model allows for endogenously determined threshold effects (i.e., the economy can be in different credit regimes with different economic relationships). He finds evidence of such effects for the United States but not for Canada. The absence of a credit variable in Galbraith's model might explain his mixed results.

Since the empirical exercise presented in this article builds largely on Balke (2000), we discuss his approach in more detail. It consists of (i) selecting and estimating a four-variable threshold vector autoregressive (TVAR) model with U.S. economic data; (ii) testing formally for the presence of threshold effects; and (iii) analyzing impulse responses to see if they reveal signs of non-linear propagation of shocks across the regimes identified by the threshold model. Balke uses the yield spread between commercial paper and Treasury Bills to identify credit regimes. The other variables included in his TVAR model are real output, inflation, and a monetary variable (approximated by M2 growth or the federal funds rate). Balke finds strong evidence of threshold effects related to credit conditions. He also finds that, on average, tightening monetary policy (a higher interest rate or slower growth rate of money) has larger effects than easing.⁴ In addition, he finds that monetary shocks have larger effects in the tight-credit regime.

Various studies have used approaches similar to that of Balke. For example, Atanasova (2003) finds significant evidence of threshold effects with models applied to U.K. data. In addition, she finds that monetary policy has a greater impact when credit is tighter. However, she also finds that the effects of positive and negative monetary policy shocks are symmetric.

It is important to note that most of the studies mentioned use market-specific measures of financial stress. For instance, Balke focuses on the commercial paper market, ignoring potential stresses in other markets. To address this limitation, the empirical exercise presented here uses a financial stress index (FSI) designed to reflect tensions in various Canadian credit markets.

² Azariadis and Smith (1998) also present a model with endogenously determined credit-rationing regimes.

³ The "financial accelerator" ideas popularized by Bernanke and Gertler have generated a large literature that Bernanke (2007) summarizes in non-technical terms. There have been attempts to integrate these ideas in policy models; for example, Christensen et al. (2009).

⁴ A related literature, using different approaches, generally reaches the same conclusion: monetary tightening has a stronger impact than monetary easing. See, for instance, Cover (1992) and Karras (1996). In contrast, Weise (1999) finds that the effects are symmetric.

The Model

Within the class of possible non-linear models, we concentrate on the TVAR model. Such a model provides a relatively simple and intuitive way to formulate non-linearity, such as regime switching, asymmetry, and multiple equilibriums, implied by the theoretical models of financial and macroeconomic activity. A TVAR model works by splitting time series endogenously into different regimes. The role of financial-stress conditions as a non-linear propagator of shocks is captured by a TVAR model containing four variables: Canadian real output growth, inflation, the real overnight rate, and a financial stress index. Although the FSI is the chosen threshold variable, because all the variables included in the model are endogenous, shocks to output, inflation, the overnight rate, and to financial-stress conditions may induce a shift to a different financial-stress regime.⁵

Although the FSI is the chosen threshold variable, because all the variables included in the model are endogenous, shocks to output, inflation, the overnight rate, and to financial-stress conditions may induce a shift to a different financial-stress regime.

In addition, we assume that the TVAR model has a recursive structure, with the causal ordering as follows: output growth, inflation, the real overnight rate, and the financial-stress variable. This ordering implies that monetary policy shocks are shocks to short-term interest rates and do not have a contemporaneous impact on output or inflation. This is consistent with the view that monetary policy shocks affect output and inflation only after a lag. Monetary policy shocks can, however, have a contemporaneous impact on the FSI. This assumption reflects the view that financial variables can respond very quickly to all types of shocks.⁶

Financial stress is measured using the index for Canada proposed by Illing and Liu (2006). The index is a continuous variable composed of various measures

⁵ See Li and St-Amant (2010) for more details about the methodology.

⁶ Balke (2000) and Atanasova (2003) use similar assumptions, as do various other empirical models of monetary policy.

of tension in credit markets. The variables in the FSI are selected based on a literature review and are weighted by the relative size of the market to which they pertain in Canadian total credit. This weighting approach produced an index that could fit episodes of financial stress identified in a survey of Bank of Canada senior managers and economists. It is important to note that movements in the FSI could be caused by shocks originating outside Canada. This is because foreign developments can affect Canadian variables captured by the FSI and because the FSI includes foreign economic variables, such as volatility in the Can\$/US\$ exchange rate and the spread between Canadian and U.S. short-term borrowing rates.⁷

Results

The sample period is 1981Q4 to 2009Q4.⁸ All series are quarterly. **Chart 1** presents the time series for the growth rate of real GDP, inflation, the real overnight rate, and the FSI—the threshold variable. For reference, periods with significant economic events are shaded. **Table 1** presents tests of a linear VAR model against a TVAR alternative, as well as the estimated threshold values for the FSI. The test results in **Table 1** provide strong evidence against linearity in the VAR model and in favour of the TVAR specification. Whether this non-linearity results in economically meaningful asymmetry in the effects of monetary policy shocks, however, must be determined by examining the dynamic effects of these shocks in the TVAR model.

Table 1: Tests for threshold VAR

Threshold variable	Threshold value	Sup-Wald statistic	Exp-Wald statistic	P-value
FSI	50.58	134.32	63.85	0.00

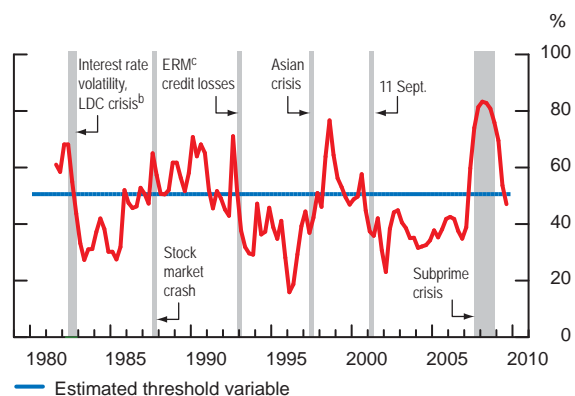
Note: The delay for the threshold variable is given by $d = 1$, and the lag of the TVAR is 3. The p-values are calculated by Hansen's (1996) bootstrap method with 500 replications.

⁷ The index also includes the following variables: the spread between yields on bonds issued by Canadian financial institutions and the yields on government bonds of comparable duration; the yield spread on Canadian non-financial corporate bonds; the inverted term spread (i.e., the 90-day treasury bill rate minus the 10-year government yield); the beta derived from the total return index for Canadian financial institutions; TSX GARCH volatility; the average bid/ask spread on Canadian treasury bills; and the spread between Canadian commercial paper rates and rates on treasury bills of comparable duration. See Illing and Liu (2006) for more details.

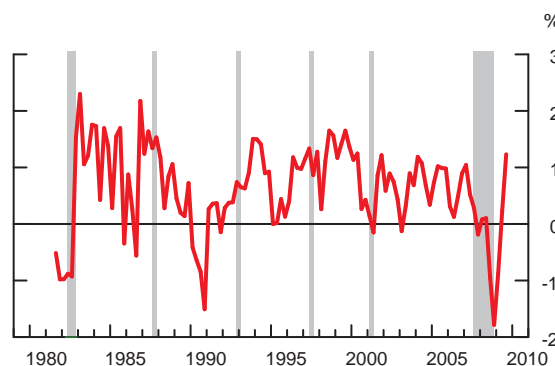
⁸ The sample used by Li and St-Amant (2010) is 1981Q4 to 2006Q4. In addition, total inflation is used in the working paper, instead of the core inflation measure used here. Most results are qualitatively the same, but the longer sample provides more evidence that monetary shocks have a larger impact on output when financial stress is high.

Chart 1: Variables used and estimated threshold value^a

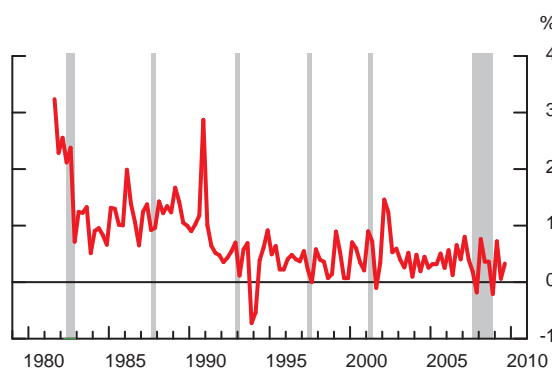
a. Financial-stress indicator



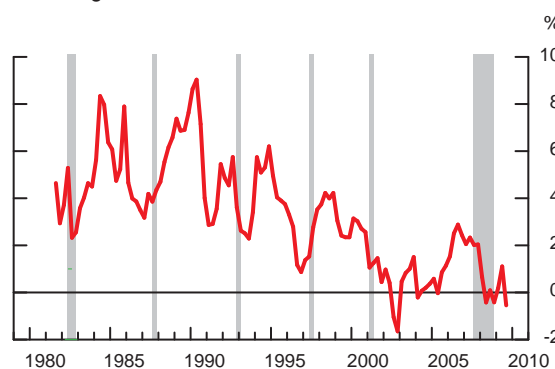
b. GDP growth



c. Inflation



d. Overnight rate



a. Shaded areas on each chart denote the events labelled in Chart 1a.

b. LCD: Less-developed country

c. ERM: Exchange rate mechanism

Source: Authors' calculations

The asymmetric effects of monetary policy shocks are explored along three dimensions.⁹ First, does a contractionary policy shock (a higher real overnight rate than predicted by the model) have different effects than an expansionary policy shock? Second, do monetary policy shocks have different effects in regimes of low and high financial stress? Third, do shocks of different magnitudes have disproportionate effects?

Chart 2 presents the estimated impulse response of our four variables over 12 quarters to a one-time shock to the real overnight rate in regimes of low and high financial stress. The size of the shock is set to the standard deviation of monetary policy shocks computed in the linear model. The responses to contractionary shocks, along with their 95 per cent point-wise confidence band (calculated with the bootstrap

method) are plotted, as well as the responses to expansionary shocks with the sign reversed.

Regardless of the initial level of financial stress, a contractionary monetary shock has a stronger effect on output growth and the FSI than an expansionary shock.

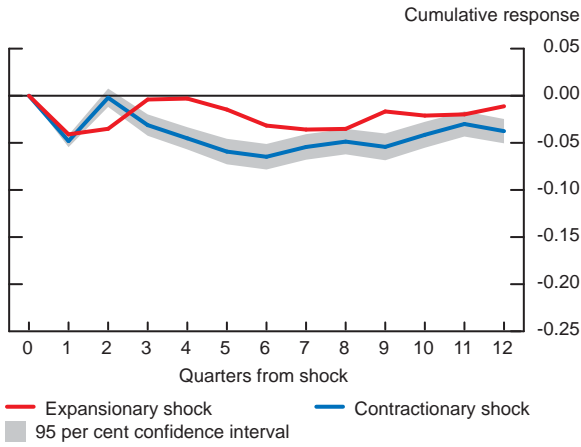
Chart 2 provides some evidence of asymmetry in the effects of contractionary and expansionary monetary policy shocks on output growth and the FSI. This result indicates that regardless of the initial level of financial stress, a contractionary monetary shock has a stronger effect on output growth and the FSI than an expansionary shock. This asymmetric response of output growth is consistent with the results of McCallum (1991), Balke (2000), Cover (1992), and

⁹ Whereas in a linear model, one set of impulse-response functions is sufficient to characterize the estimated model, in the non-linear case, the impulse-response functions are sensitive to the initial conditions and to the magnitude of the impulses. Details on computing the impulse-response functions for a TVAR model are discussed in Atanasova (2003).

Chart 2: Response to monetary policy shocks in different financial-stress regimes

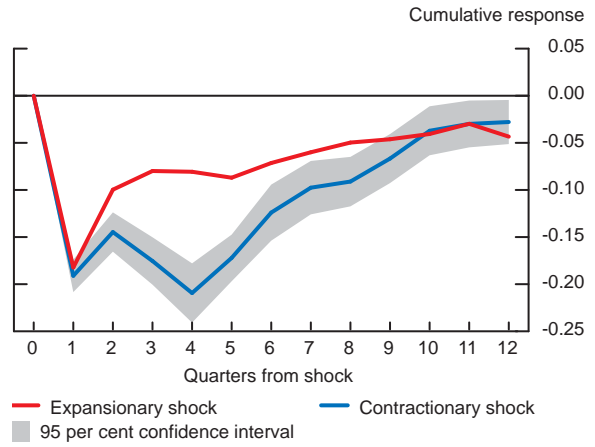
Low-financial-stress regime:

a. Output growth

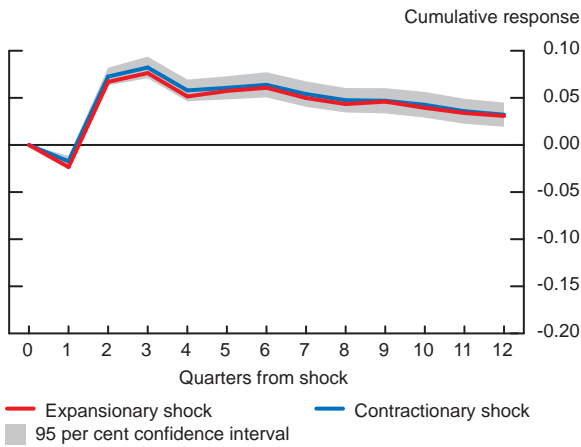


High-financial-stress regime:

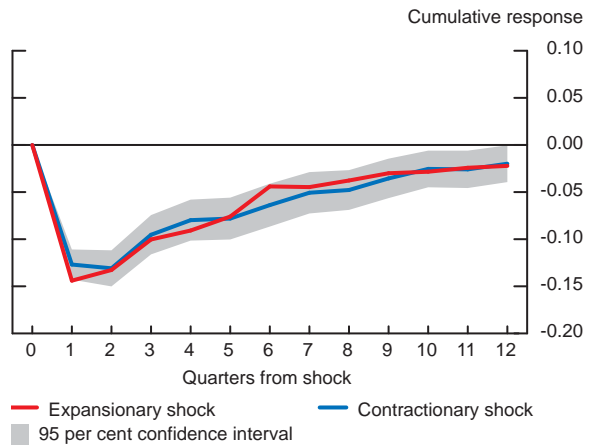
b. Output growth



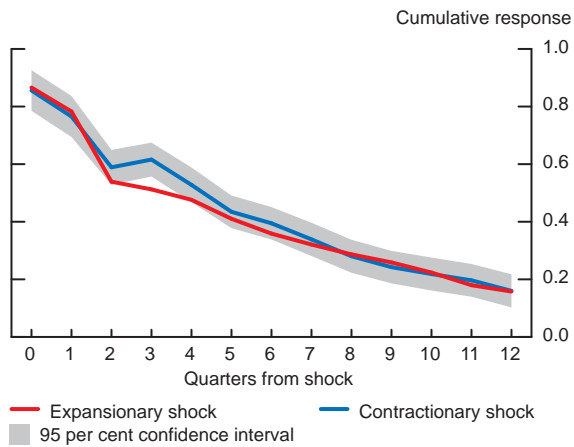
c. Inflation



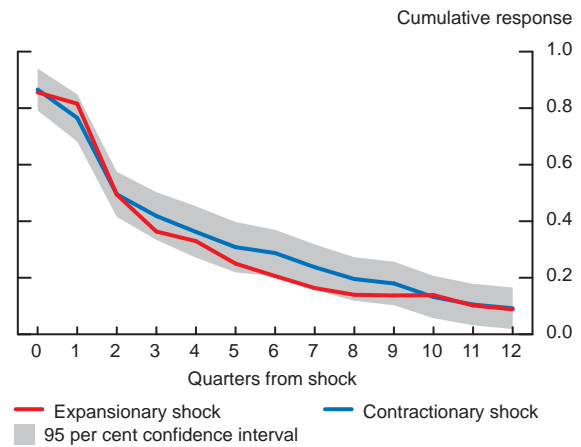
d. Inflation



e. Overnight rate



f. Overnight rate

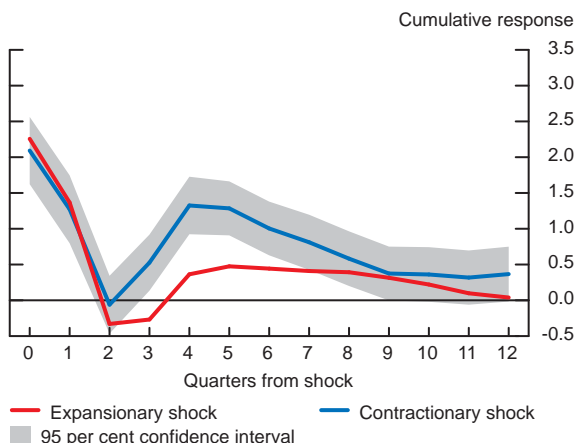


Source: Authors' calculations

Chart 2: Response to monetary policy shocks in different financial-stress regimes (cont'd)

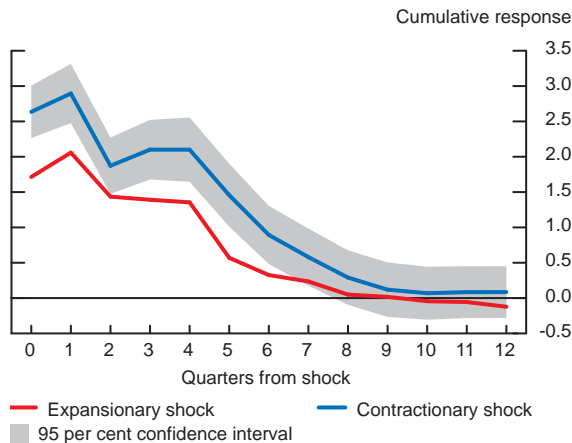
Low-financial-stress regime:

g. FSI



High-financial-stress regime:

h. FSI



Source: Authors' calculations

Karras (1996). However, it differs from those of Weise (1999) and Atanasova (2003).

Chart 2 also shows that, when the economy is in a regime of low financial stress, inflation begins to fall quickly in response to a contractionary policy shock, and the negative responses persist for a quarter, after which the responses are positive. To explore the possible reasons for the positive responses, **Table 2** reports the average values of the four variables in different financial regimes, indicating that, on average, in the high-financial-stress regime, inflation, the FSI, and the real overnight rate are higher, and output growth lower, than in the low-financial-stress regime.¹⁰ Obviously, one of the most important features of the TVAR model is that shocks can cause regimes to change, suggesting that the impulse-response functions depend not only on the original state of the economy at the time of the shock, but also on the current state of the economy. We also find that when the economy is initially in a regime of low

financial stress, a contractionary policy shock has a higher probability of switching the economy into a high-stress regime than the absence of a monetary policy shock (**Chart 4**).

We find that when the economy is initially in a regime of low financial stress, a contractionary policy shock has a higher probability of switching the economy into a high-stress regime than the absence of a monetary policy shock.

Table 2: Mean values of variables in different regimes

Financial-stress regime	GDP growth rate	Inflation rate	Real overnight rate	FSI
Low stress	0.84	0.58	2.85	38.13
High stress	0.26	0.99	4.01	62.43

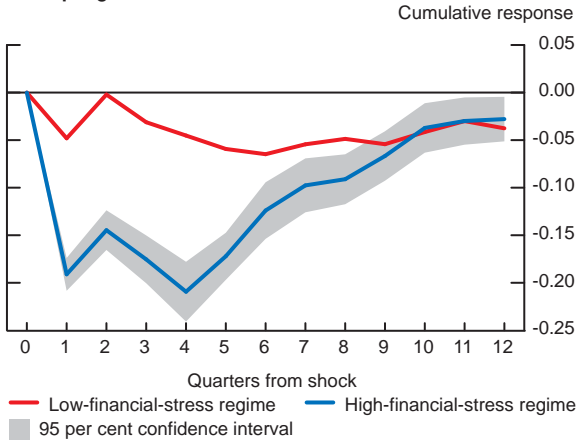
¹⁰ These are average values that do not need to repeat themselves in the future. For instance, the ongoing global financial crisis appears to be associated with disinflation, not inflation.

Chart 3 displays information similar to that in **Chart 2**, except that regimes of high and low financial stress are grouped together on the same chart instead of positive and negative shocks. This chart provides strong evidence to support the hypothesis that the effects of monetary policy shocks differ depending on the initial state of the economy. For instance, **Chart 3** shows that a contractionary shock to monetary policy causes more financial stress and a greater decrease in output growth when the economy is in high financial stress than when it is in low financial stress. Inflation also responds more strongly. According to Blinder's (1987) model of credit rationing, a tightening of monetary policy has stronger effects on the real

Chart 3: Response in different financial-stress regimes experiencing a contractionary or expansionary shock to monetary policy

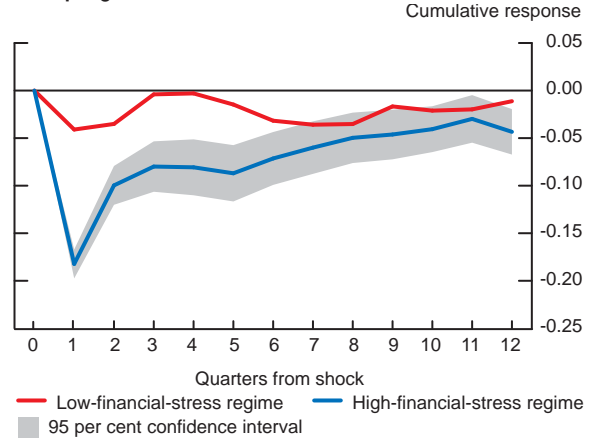
Contractionary shock:

a. Output growth

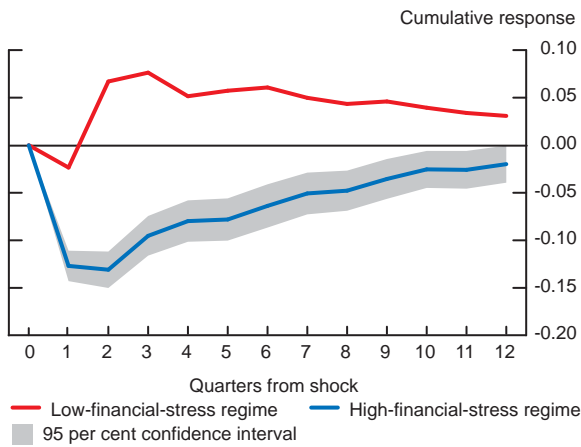


Expansionary shock:

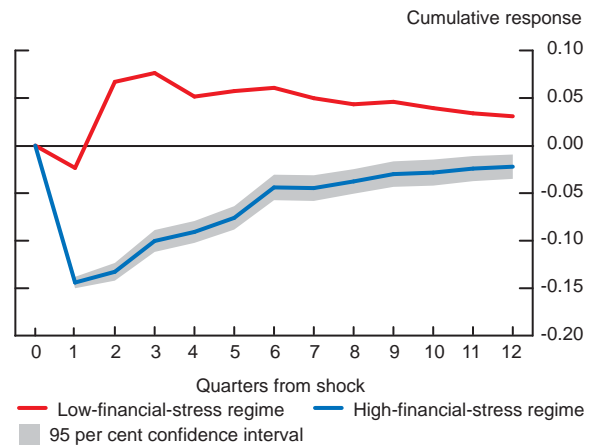
b. Output growth



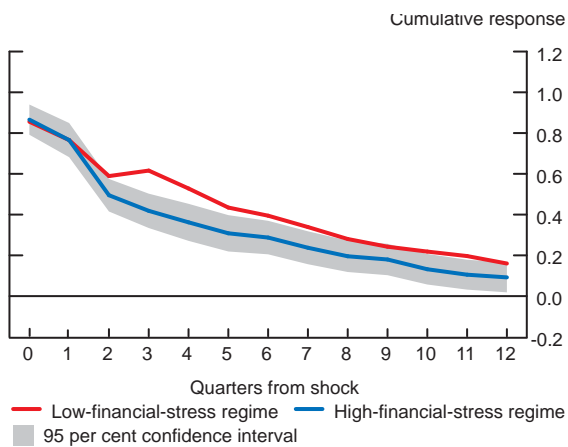
c. Inflation



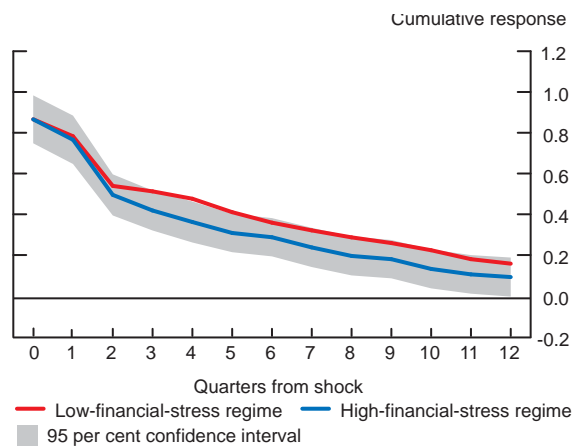
d. Inflation



e. Overnight rate



f. Overnight rate

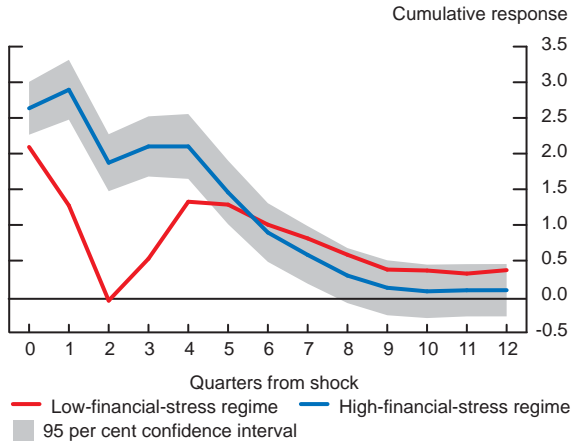


Source: Authors' calculations

Chart 3: Response in different financial-stress regimes experiencing a contractionary or expansionary shock to monetary policy (cont'd)

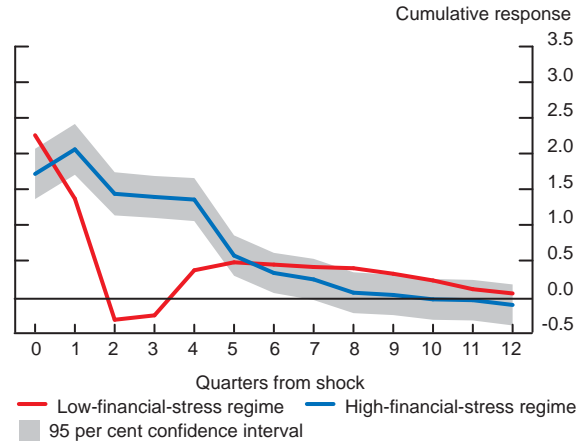
Contractionary shock:

g. FSI



Expansionary shock:

h. FSI



Source: Authors' calculations

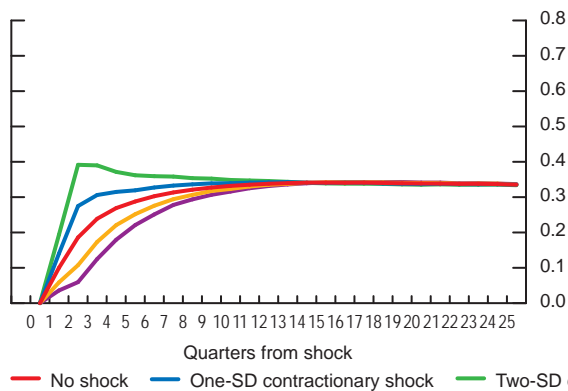
sector when credit is already tight but weak effects when credit is initially plentiful. Hence, our empirical finding regarding the impact of a contractionary monetary policy shock on output growth is consistent with Blinder's view.

Chart 4 plots the estimated probability of a transition from one regime to the other. For comparison, the probability of such a transition in the absence of a monetary policy shock is also plotted. **Chart 4** indicates that contractionary monetary policy shocks can increase the likelihood of switching to, or staying in,

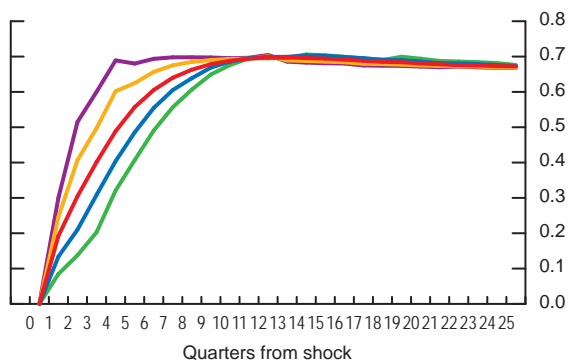
a regime of high financial stress, while large expansionary shocks can increase the likelihood of moving to, or remaining in, a regime of low financial stress. Larger shocks have more impact on the likelihood of regime switching. These results suggest that monetary policy shocks have an impact on the FSI and play an important role in the evolution of financial-stress regimes.

Chart 4: Impact of monetary policy shocks on the probability of transition

a. Probability of transition from low-stress to high-stress regime



b. Probability of transition from high-stress to low-stress regime



Source: Authors' calculations

Conclusions

Some previous research has emphasized the role that financial sector developments could play in the transmission mechanism of monetary policy. Both theoretical models and empirical findings point to the possibility that there are non-linear relationships between monetary policy, the business cycle, and developments in the financial sector.

Using Canadian data and a TVAR model that allows for such non-linear relationships, we obtain results that are generally consistent with the previous literature. That is, when the economy can move into different financial-stress regimes, monetary policy actions can influence the likelihood of moving into these regimes, and monetary policy tightening appears to have more powerful effects, in general, than monetary policy easing. Moreover, the effects of tighter monetary policy are particularly large in regimes of high financial stress.

These results point to the need for policy-makers to take into account the impact that their actions might have on financial conditions. They also point to the need to be aware of the possibility that conditions in the financial sector influence the effects of policy actions. These transmission mechanisms must be factored into the models used to guide monetary policy decisions. While progress has been made in developing such models, much remains to be done.

These results point to the need for policy-makers to take into account the impact that their actions might have on financial conditions.

The empirical models discussed in this article are simple, however, and care must be taken in interpreting the results. Also, Canada has experienced only a few episodes of very high financial stress, and these could be driving our results. More research is needed before strong policy conclusions can be reached. In addition, our results should not be seen to imply that monetary policy should remain easy in order to avoid situations of high financial stress. Another, related literature shows that excessive growth in credit and asset prices, associated with a monetary policy that is kept too easy for too long, can be a source of disequilibrium that may eventually result in high financial stress.¹¹ Easy monetary policy could produce such developments. More generally, a monetary policy stance that is kept too easy for too long would cause inflation and instability.

¹¹ See Borio and Lowe (2002) for international evidence with a detailed discussion. See also Misina and Tkacz (2009) and Misina, St-Amant, and Tkacz (2008) for evidence and discussion in a Canadian context. Boivin, Lane, and Meh (2010) provide analysis, based on general-equilibrium models of how monetary policy can affect financial imbalances.

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Trends in Issuance: Underlying Factors and Implications

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- *In the past decade, trends in issuance have changed significantly, both in the period leading up to the financial crisis and subsequently.*
- *Prior to the crisis, there was a large increase in the issuance of riskier and more innovative forms of financing, and a high level of future issuance will likely be required to refinance this past issuance as it matures.*
- *In Canada, the increased use of innovative and riskier financing sources was less pronounced, and future refinancing needs are more in line with historical issuance levels.*

The increasing global issuance of innovative and riskier forms of financing, such as subprime-mortgage securitizations, contributed to the recent financial crisis. This crisis and the subsequent regulatory response will have implications for the future issuance of corporate bonds, corporate equities, and securitization.

Canada withstood the global crisis better than most other industrialized countries. This reflected a number of core economic strengths, most notably a well-capitalized financial sector and strong corporate balance sheets. This position, in addition to differences in issuance patterns leading up to the crisis, means that the repercussions for Canadian issuers are somewhat different from those being experienced by issuers in other countries.

The objective of this article is to provide an update on trends in issuance in Canada relative to those in other capital markets and, where possible, to assess the factors underlying these trends in the context of the financial crisis.¹ It also aims to analyze the impact of the financial crisis on Canadian corporate issuance, relative to historical issuance and to issuance patterns in other markets. To do so, it examines trends in capital markets in Canada and other regions over the past ten years, with a focus on three areas: the issuance of financial and non-financial corporate bonds, the issuance of financial and non-financial corporate equity, and securitization.²

¹ Kennedy (2004) and Freedman and Engert (2003) have examined the state of Canada's capital markets, both historically and in comparison to those of other countries.

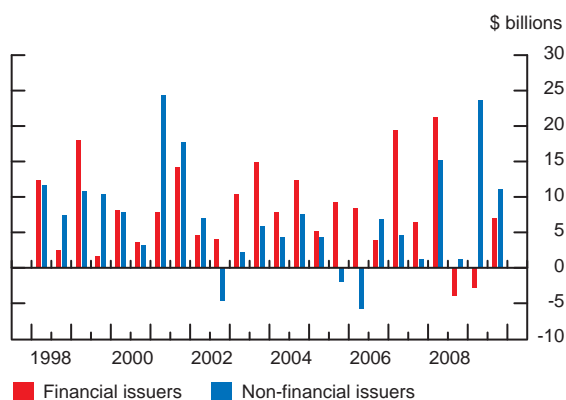
² This article does not examine asset-backed commercial paper (ABCP) and money markets. For a discussion of the Canadian ABCP market, see Kamhi and Tuer (2007a, 2007b).

Debt Markets

Debt market composition

Roughly in line with economic growth, non-financial Canadian corporate issuers have consistently increased their bonds outstanding over the past decade, with annual net issuance positive for most of the period (**Chart 1**). Nevertheless, there were notable differences in bond issuance. In 2001, in the first half of 2008, and throughout 2009, non-financial net bond issuance was larger than in the past. Some of this increase can be explained by a substitution from other sources of funding. For example, the increase in net corporate bond issuance in 2009 was more than offset by a reduction in short-term business credit. However, in the first half of 2008, short-term business credit increased. The increase in both short-term business credit and net bond issuance in this period could be explained by precautionary borrowing: as economic conditions started to deteriorate during these periods, corporations accessed credit markets as a safeguard against worsening credit conditions.

Chart 1: Net issuance of Canadian corporate bonds



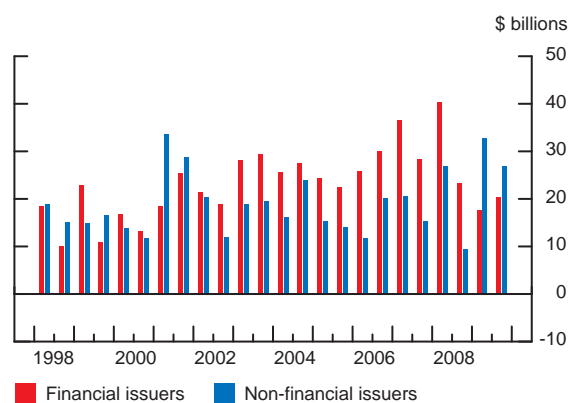
Source: Bank of Canada

Throughout the 1990s, the debt-to-equity ratio of Canadian non-financial corporations was well above that of the United Kingdom and the United States (Côté and Graham 2007). However, notwithstanding the net positive bond issuance of Canadian non-financial corporations over the past decade, the debt-to-equity ratio of non-financial corporations has declined since 2002 and, at the end of 2009, was below that of the United Kingdom and the United States (Bank of Canada 2010).

The net issuance of bonds by Canadian financial institutions was also positive until the financial crisis,

leading to an increase in financial bonds outstanding that outpaced economic growth as the amount of net bond issuance by financial issuers rose from 2002 to 2008. During the crisis, however (i.e., the second half of 2008 and the first half of 2009), conditions in global markets deteriorated, with yield spreads on Canadian investment-grade financial institutions widening out sharply from a pre-crisis level of about 50 basis points (bps) to a peak of around 400 bps.³ In Canada, the introduction of the Insured Mortgage Purchase Program (IMPP) in October 2008, through which the government purchased a large amount of government-insured, mortgage-backed securities from the banks, alleviated banks' funding needs (Department of Finance 2008). As a result, net financial bond issuance turned negative, as the gross issuance of financial corporations fell (**Chart 2**).⁴

Chart 2: Gross issuance of Canadian bonds



Source: Bank of Canada

Credit spreads on investment-grade financial institutions widened out even more sharply in the United States, reaching close to 900 bps at the peak of the crisis (Bank of America Merrill Lynch). In October 2008, to address worsening market conditions, the U.S. Federal Deposit Insurance Corporation (FDIC) announced the Debt Guarantee Program through which the FDIC guaranteed newly issued senior unsecured debt of insured depository institutions and most U.S. bank holding companies (FDIC 2008). This program was a vital source of funding for these institutions. Under the program, US\$305 billion was issued—almost 40 per cent of average annual

³ Source: Bank of America Merrill Lynch.

⁴ At \$69 billion, the amount of government-insured, mortgage-backed securities purchased through the IMPP more than offset the drop in financial issuance in the second half of 2008 and the first half of 2009 (Chart 2).

corporate (financial and non-financial) bond issuance from 2000 to 2007 and about half of the maximum amount of FDIC-guaranteed debt that could be issued by these entities.⁵

As a result of the elevated bond issuance by banks globally prior to the crisis, as well as a shortening of maturities on this bond issuance over the past five years, a sizable amount of bank bonds will be maturing between now and 2012 (Moody's 2010a). Thus, the concentrated need for issuance over this period could lead to heightened refinancing risks. This is less of a problem in Canada, since the amount of bonds from Canadian financial and non-financial issuers maturing over the next few years is roughly in line with issuance prior to the crisis (Bank of Canada 2010).

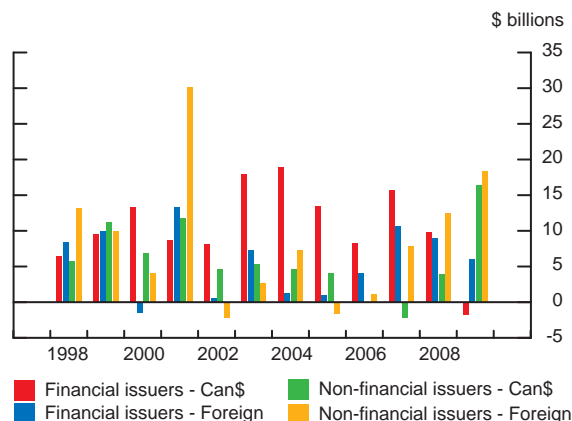
The currency composition of debt markets

Bonds are issued in foreign currency for various reasons. Some issuers choose to fund themselves in U.S. dollars as a natural hedge for U.S.-dollar cash flows. Other reasons to issue in the U.S. market include the ability to issue larger amounts of funds, given the greater market depth; the ability to issue bonds with a longer maturity (Freedman and Engert 2003; Anderson, Parker, and Spence 2003); as well as the reduced all-in cost of that funding (i.e., after the cash flows from the bond are converted back into Canadian dollars) relative to domestic sources.

From 2002 to 2006, the net issuance of foreign-currency bonds by Canadian financial and non-financial corporations was low, relative to domestic bond issuance over the same period and relative to foreign-currency bond issuance over the preceding period (**Chart 3**). Since 2007, however, the net issuance of foreign-currency bonds by Canadian financial and non-financial corporations has increased relative to the period preceding the crisis.

In the wake of the financial crisis, covered bonds have become an attractive funding alternative for banks.

Chart 3: Net bond issuance by Canadian corporations
By currency



Note: Issues payable in foreign currencies have been converted into Canadian dollars at the average noon market rate for the month.

Source: Bank of Canada

In particular, Canadian banks began issuing covered bonds in late 2007, which, until 2010, were denominated in foreign currencies.⁶ Three Canadian banks had issued covered bonds by the end of 2008, and midway through 2010, all five of the largest Canadian banks had issued covered bonds. The earlier issues were denominated in euros, since the market for euro covered bonds is the most developed, but more recently Canadian banks have also issued these bonds in Swiss francs, U.S. dollars, and Canadian dollars. In the wake of the financial crisis, covered bonds have become an attractive funding alternative for banks because they allow the diversification of their funding sources and investor base and can be cost-advantageous relative to the issuance of unsecured debt.

At \$24 billion, the covered bonds issued by Canadian banks to date represent less than 1 per cent of their total assets. Since banking regulation allows banks to issue up to 4 per cent of their total assets in covered bonds (OSFI 2007), there is the potential for more covered bond issuance in the future. This trend is likely to continue, since the federal government announced in its March 2010 budget that it will introduce legislation on covered bonds in Canada, thus contributing to greater certainty about the structure and treatment of covered bonds. This, in turn, should help bolster investor confidence and possibly lead to a decline in the associated cost of funding.

⁵ This maximum amount was equal to 125 per cent of the face value of outstanding senior unsecured debt, as of 30 September 2008, that was scheduled to mature on or before 30 June 2009. For issuance under this program, refer to: http://www.fdic.gov/regulations/resources/tlgp/total_issuance03-10.html. Average annual bond issuance data is from the Securities Industry and Financial Markets Association (SIFMA).

⁶ See Gravelle and McGuinness (2008) for a discussion of the covered bond market. Covered bonds are marketable debt securities backed by a dedicated pool of collateral, typically residential mortgage loans.

The Canadian market had also become attractive to foreign issuers. By the end of 2007, the so-called Maple Bond market had developed and grown to \$69 billion.⁷ The development of this market can be attributed to a confluence of factors, including the elimination by the Canadian federal government of the Foreign Property Rule in 2005 (which had previously capped tax-shielded investments by Canadians in foreign assets), the reduction in Canadian government debt issuance, and attractive rates on Can\$/US\$ basis swaps that resulted in attractive financing rates for foreign issuers when the proceeds from the sale of Maple Bonds were converted back into the issuer's funding currency of choice. These last two factors also help to explain why net bond issuance by Canadian financial and non-financial corporations in the period just prior to the crisis was predominantly in Canadian dollars.

During and after the financial crisis, however, new issuance in the Maple Bond market was limited by several factors. First, there were concerns over the health of foreign financial issuers who made up a dominant segment of this market, since a number of former issuers, such as Bear Stearns and Lehman Brothers, collapsed during the crisis. Second, market liquidity dried up in most non-core markets worldwide, making Maple Bonds less attractive for investors.⁸ There have recently been signs of a revival in this market, with several new issues of Maple Bonds in 2010.

The high-yield bond market

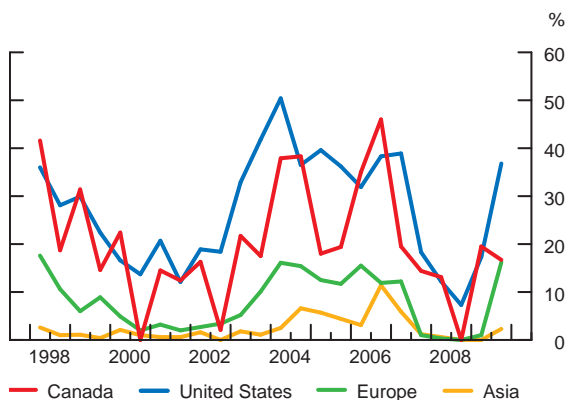
Over the years, Canadian firms have benefited from their proximity and access to the large U.S. high-yield debt market: the issuance of high-yield securities by Canadian non-financial corporations (in all currencies), as a proportion of total bond issuance by Canadian non-financial corporations, is comparable to that of U.S. non-financial issuers and is much higher than that of both Asian and European non-financial issuers (**Chart 4**).⁹ Since most Canadian high-yield securities have historically been issued in the United States, high-yield bond issuance by Canadian corporations

follows trends in the global issuance of high-yield bonds.

Leading up to the financial crisis, throughout 2006 and the first half of 2007, spreads on high-yield bonds narrowed substantially.¹⁰ At the same time, the issuance of high-yield bonds by global issuers increased as firms used this opportunity to either refinance their current obligations at lower costs or to increase their leverage (**Chart 5**). This was facilitated by strong investor demand for higher-yielding, and relatively simple to understand, fixed-income securities, given the low-interest-rate environment. A substantial fraction of this global high-yield issuance was by large firms that drastically increased their leverage via leveraged buyouts (LBOs).

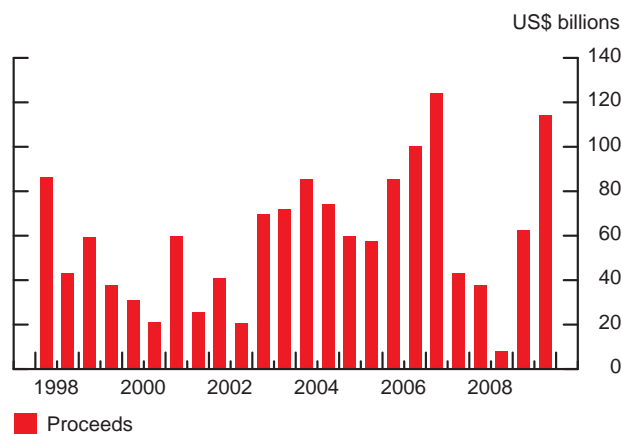
Chart 4: Issuance of high-yield bonds by Canadian issuers

As a proportion of total non-financial issuance



Source: Thomson Financial

Chart 5: Issuance of high-yield bonds by global issuers



Source: Thomson Financial

⁷ Maple Bonds are Canadian-dollar-denominated bonds issued in Canada by non-Canadian borrowers. See Hately (2006) for an in-depth discussion of the Maple Bond market.

⁸ Liquidity in the secondary market for Maple Bonds has been limited to date, so investors may have little choice but to hold the securities until maturity. This weak secondary market support is partially due to the limited number of underwriters typical of most Maple Bond issues.

⁹ The overall volume of high-yield issuance in Canada varies widely because the total issuance of Canadian high-yield debt is generally low and is concentrated in a few large names. Therefore, one large issue can cause the total volume of high-yield issuance in Canada to spike in a given quarter.

¹⁰ Spreads on U.S. high-yield credit (based on the Bank of America Merrill Lynch index) narrowed from over 400 bps at the end of 2003 to under 250 bps in the middle of 2007, before widening sharply to over 1800 bps by the end of 2008.

While the wave of LBOs in the late 1980s was driven by the development of the high-yield market, the LBO wave in 2006 and 2007 was driven largely by another financial innovation: collateralized debt obligations (CDOs).¹¹ The advent of this source of financing facilitated access to a wider base of investors and, in an environment where investors were searching for yield, contributed to lower spreads and looser covenants. CDOs also allowed larger U.S. firms to undergo an LBO that might not have been possible otherwise (Shivdasani and Wang 2009). Of course, in hindsight, these loose financial conditions turned out to be a precursor to the financial crisis.

From the beginning of the credit crisis in mid-2007 through the end of 2008, the issuance of both high-yield debt and CDOs dropped drastically, and credit spreads on high-yield issues, proxied by the Bank of America Merrill Lynch U.S. high-yield index, widened significantly to over 1800 bps. Since it was no longer possible to securitize leveraged loans during the crisis, a substantial pipeline of leveraged loans unexpectedly remained on bank balance sheets.¹² LBOs virtually disappeared, and some previously announced LBOs either collapsed or were renegotiated amid the marked deterioration in credit conditions.

As market conditions improved in 2009, the issuance of high-yield debt resumed, especially in the United States, where it accounted for over 25 per cent of total corporate debt issuance in the second half of 2009 (Chart 4). In the United States, over 78 per cent of high-yield issuance in 2009 refinanced existing debt or extended debt maturities (Moody's 2010b). Significant volumes of high-yield debt will need to be issued in the future simply to refinance existing debt: about US\$200 billion of high-yield bonds and US\$500 billion of leveraged loans are set to mature in the United States between 2012 and 2014 (Moody's 2010b). Of course, the ability to sustain this level of high-yield issuance is dependent on market conditions, including investors' capacity and appetite for risk, and deterioration of these conditions could spell trouble for high-yield debt issues.

In Canada, about US\$26 billion of high-yield bonds and leveraged loans are set to mature between 2012 and 2014 (Moody's 2010c). While this is small relative

to U.S. high-yield refinancing needs and manageable relative to the total amount of annual Canadian non-financial gross issuance (high-yield and investment-grade) of about US\$30 billion (Chart 1), the similar maturity structure to U.S. high-yield debt and reliance on that market may compound difficulties in refinancing.

There have been several high-yield transactions in Canada over the past year, pointing to a developing Canadian market for high-yield bonds.

Although historically most Canadian high-yield bonds have been issued in the large U.S. market,¹³ there have been several high-yield transactions in Canada over the past year, pointing to a developing Canadian market for high-yield bonds. A number of factors are contributing to this development, including the low-interest-rate environment; attractive spreads on high-yield bonds relative to historical levels; as well as an increased appetite for high-yield bonds by Canadian investors, evidenced by the more than doubling of the assets of Canadian high-yield, fixed-income mutual funds from \$4.4 billion at the end of 2008 to \$9.5 billion at the end of 2009 (IFIC 2009). While most of these recent high-yield issues in the Canadian market have been small in size, the trend towards more high-yield issuance in Canada may persist, since income-trust conversions will also be looking to issue into the high-yield market.

Equity Markets

Although the financial crisis originated in the United States, it has had a profound effect on financial wealth around the world. Capitalization of global equity markets had doubled from US\$30 trillion to just over US\$60 trillion from the end of 2003 to the end of 2007, before these gains were completely erased over the course of 2008 and the first quarter of 2009 (Chart 6).¹⁴ Equity markets rebounded strongly through 2009 to recover about half of the decline experienced during the crisis. Nevertheless, the net loss of global wealth from the decline of US\$15 trillion

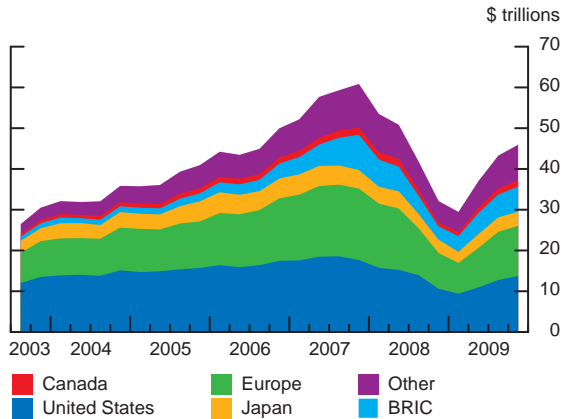
¹¹ CDOs generally have bank loans (referred to as collateralized loan obligations or CLOs), bonds (referred to as collateralized bond obligations or CBOs), structured finance (e.g., ABS, MBS, other CDOs) or some mixture of the above as their collateral.

¹² In June 2007, the pipeline of banks' leveraged loan and bond commitments was about US\$400 billion but has since declined (CGFS 2008). Source: Lehman, S&P Leveraged Commentary and Data

¹³ For example, as of July 2010, 11 per cent of the Bank of America Merrill Lynch index of high-yield Canadian issuers was in Canadian dollars, with the remainder in U.S. dollars.

¹⁴ During the October 1987 stock market crash, 19 of 23 major stock markets declined by 20 per cent or more (Roll 1988).

Chart 6: Equity market capitalization



Source: Bloomberg

in global equity market capitalization from the peak still represents about a quarter of global GDP. To put the magnitude of this US\$30 trillion drop in wealth in perspective, it is more than ten times as large as the global writedowns by financial institutions during the crisis (estimated at US\$2.3 trillion).

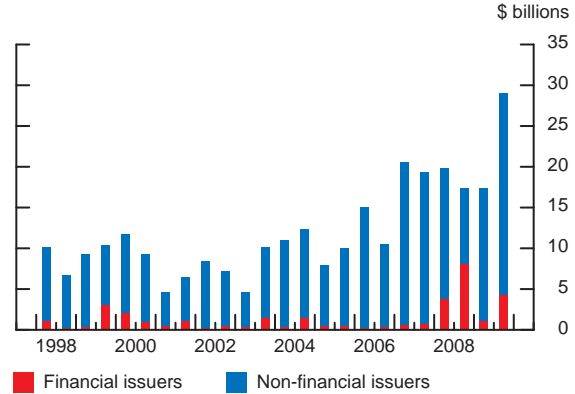
Canadian equity markets have experienced similar fluctuations in capitalization: it rose from US\$1 trillion at the end of 2004 to US\$1.75 trillion at the end of 2007, then fell to US\$1 trillion at the end of 2008, before partly recovering to US\$1.6 trillion at the end of 2009.¹⁵ Over the same period, combined market capitalization in BRIC countries (Brazil, Russia, India, and China) followed a similar path but increased much more markedly, from US\$1 trillion at the end of 2004 to US\$6 trillion at the end of 2009, reflecting the growing importance of these emerging markets in the global economy and market place.

Equity issuance

The volume of equity raised by Canadian firms has increased over the past ten years: the total annual value of equity issued in 2007 was more than double its 2003 level (Chart 7). While there was a temporary decline in equity issuance by Canadian firms during the worst of the financial crisis, this decline was much more muted than that observed in other markets, and the amount of equity issued was still above the levels seen from 1998 through 2006. However, some of the

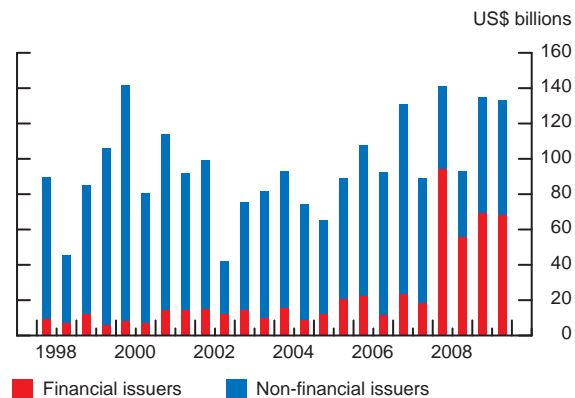
¹⁵ Pichette (2004) examines the relationship between consumer spending and wealth and finds that consumer spending responds to changes in housing wealth but responds very little to changes in equity wealth. She posits that the lower sensitivity to changes in equity wealth can be explained by the more transitory nature of equity-price changes and by the concentration of equity ownership among a small proportion of households.

Chart 7: Canadian issuance of common equity



Source: Bank of Canada

Chart 8: U.S. issuance of equity



Source: Thomson Financial

equity issuance since 2007 has been the result of income-trust conversions, which partially explains this more muted decline. Equity issuance by U.S. firms did not increase as dramatically as that of Canadian firms from 2003 to 2007 but, nonetheless, declined in the second half of 2008 (Chart 8).

While total equity issuance was less affected during the crisis than issuance in other segments of capital markets, such as debt and securitized products, there has been a marked change in the distribution of issuance between financial and non-financial corporations since the onset of the crisis. In both Canada and the United States, the issuance of non-financial equity declined substantially during the poor market conditions (e.g., low market valuations) in the second half of 2008.¹⁶ However, as market valuations rebounded

¹⁶ Firms could also rely on internal sources of funds. Non-financial firms in both countries had steadily increased the proportion of assets held in cash since the 1990s (McVanel and Perevalov 2008; Bates, Kahle, and Stulz 2008).

from the lows reached in March 2009 and as the investors demanded higher returns—with higher risk—the issuance of Canadian and U.S. non-financial equity returned to pre-crisis levels.¹⁷

In contrast, global financial institutions have increased their equity issuance substantially to offset the effect of the large writedowns and losses experienced during the crisis and to build capital in anticipation of more stringent regulatory requirements. As of July 2010, financial institutions, mainly from Europe and the United States, had raised US\$1.5 trillion in new private and public capital since mid-2007 to offset US\$1.8 trillion in writedowns and losses.¹⁸ Canadian institutions have had considerably fewer writedowns and losses (US\$21 billion), have raised US\$14 billion in private capital, and did not require any capital injection from the public sector. In 2008, financial equity issuance accounted for 32 per cent and 64 per cent of total equity issuance in Canada and the United States, respectively, compared with an average of 9 per cent and 26 per cent, from 1998 through 2006. A similar pattern was evident in Europe.

The future issuance of equity by financial corporations will depend on the amount of future writedowns and on the need to strengthen their capital positions. While the IMF estimates that approximately \$550 billion of bank writedowns had not yet been realized by mid-2010 (IMF 2010b), it also suggests that most of this amount could be covered by earnings of the aggregate banking system (IMF 2010a). Also, banks may need to issue some equity to strengthen their capital position to meet the proposed revisions to capital requirements, which call for an improvement in the quality of the capital base of banks and higher minimum levels of capital (BCBS 2010). However, since banks can strengthen their capital position through retained earnings during the phase-in period for these revisions, there may be less need for the issuance of more common equity.

Securitization

The securitization process converts pools of non-marketable assets, such as loans, mortgages, and credit card receivables, into marketable securities. Prior to the financial crisis, securitization had become an important source of credit in developed economies, particularly in the United States and, to a

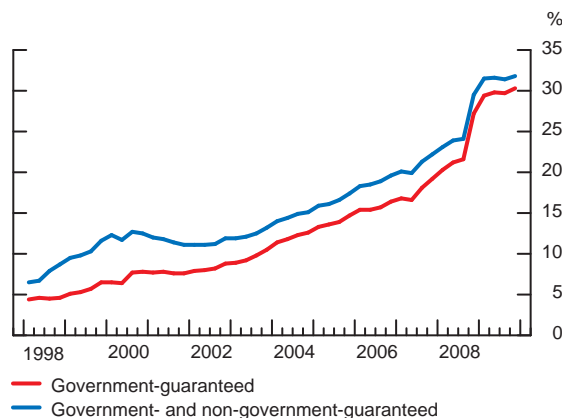
lesser extent, in Canada.¹⁹ Nevertheless, there are differences between the U.S. and Canadian securitization markets in terms of relative size, breadth of development, and structure.

Residential mortgage-backed securities

In the years leading to the crisis, the securitization of mortgages became a more important source of credit, enabling Canadian banks to increase lending to households. This was particularly true for National Housing Act Mortgage Backed Securities (NHA MBS), which increased from about 5 per cent of outstanding residential mortgages in 1998 to almost 20 per cent in 2007 (**Chart 9**).²⁰ This upward trend was at least partly due to changes in the NHA MBS program (e.g., the introduction of NHA MBS with more flexible features), the creation of the Canada Mortgage Bond (CMB) program in 2001, and increased investor demand for securitized products. The further increase in government-guaranteed MBS at the end of 2008 and in 2009 can be attributed to the government's IMPP, which brought the proportion of government-guaranteed MBS in Canadian mortgages to 30 per cent by the end of 2009.²¹

Non-government-guaranteed securitization in Canada was used more for subprime mortgages than for

Chart 9: Canadian RMBS outstanding
As a proportion of total amount of mortgages outstanding



Source: Thomson Financial

¹⁹ For a discussion of the economic benefits and potentially destabilizing effect of securitization, see Selody and Woodman (2009).

²⁰ NHA MBS are backed by mortgages that benefit from an explicit government guarantee. The NHA MBS themselves also benefit from a government guarantee of timely payment of interest and principal.

²¹ The government announced that it would purchase up to Can\$125 billion in NHA MBS. In total, Can\$69 billion of NHA MBS were purchased under this program.

¹⁷ Baker and Wurgler (2000) investigate the relation between market valuations and equity issuance.

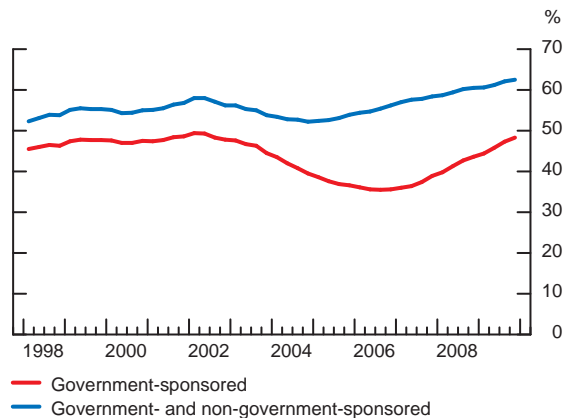
¹⁸ Source: Bloomberg, 19 July 2010.

prime mortgages (Traclet 2010). Subprime-mortgage markets were much less developed in Canada than in the United States, reflecting the more conservative nature of Canadian investors and of Canadian mortgage-lending practices. Hence, the non-government-guaranteed segment of the market for residential mortgage-backed securities (RMBS) in Canada is small at less than 3 per cent of the total amount of residential mortgages outstanding at the end of 2007, and this proportion has since declined.

In the United States, the share of total RMBS (government-sponsored and non-government-sponsored) relative to total outstanding mortgages has increased slightly over time (Chart 10). However, the breakdown between government-sponsored and non-government-sponsored MBS changed: from 2000 to 2006, the government-sponsored share declined by 10 per cent as the non-government-sponsored MBS share (backed by jumbo, Alt-A, and subprime mortgages) increased by a similar amount.

Chart 10: U.S. RMBS outstanding

As a proportion of total amount of mortgages outstanding



Source: Thomson Financial

The securitization of subprime mortgages reduced incentives for the monitoring and screening of borrowers and, over time, led to a strong deterioration in lending standards and, consequently, in the credit quality of the mortgages underlying non-government-guaranteed MBS.²² Although securitization removed subprime-mortgage assets from bank balance sheets,

²² See Paligorova (2009) for a discussion of agency problems in the securitization process. Ashcraft and Schuermann (2008) identify seven informational frictions in the process of subprime-mortgage securitization and discuss how these frictions can contribute to problems with mortgage securitization. Demyanyk and Van Hemert (2008) find evidence of deterioration in the quality of subprime-mortgage loans in the years leading up to the crisis.

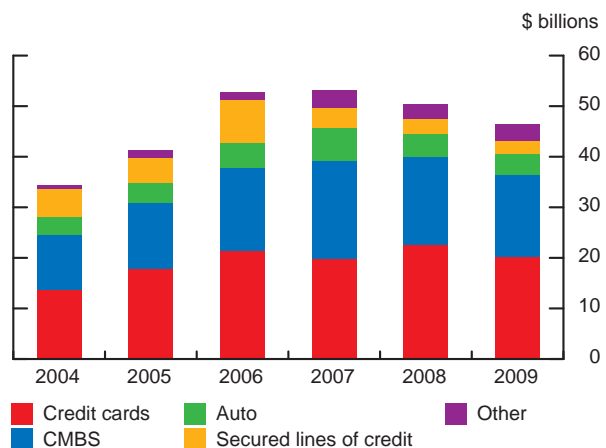
banks sustained large losses because the risks related to those assets were not fully transferred away from the banks (Acharya and Richardson 2009). Amid these losses, the issuance of non-government-guaranteed MBS virtually disappeared in 2008, resulting in a decline in the absolute level of non-government-sponsored MBS as older issues matured.

Asset-backed securities

The market for term asset-backed securities (ABS) in Canada is relatively small, with just under \$50 billion outstanding at the end of 2009 (Chart 11). The two largest segments of this market are ABS backed by credit card receivables and commercial mortgage-backed securities (CMBS), which together account for about three-quarters of outstanding amounts. The third largest segment is ABS backed by auto loans and leases. As in other markets, ABS issuance was severely disrupted by the financial crisis, and yield spreads on ABS widened significantly.²³ To address these disruptions in the Canadian ABS market and to help consumers and businesses to finance the purchase of new vehicles and equipment, the federal government announced the Canadian Secured Credit Facility (CSCF) in its Economic Action Plan of January 2009. Administered by the Business Development Bank of Canada (BDC), the program could purchase up to \$12 billion of newly issued ABS backed by vehicle and equipment loans and leases.²⁴

Chart 11: Canadian term ABS outstanding

By asset type



Source: Dominion Bond Rating Service

²³ For example, spreads on 3-year Schedule I bank credit card programs widened to over 350 bps, from about 50 bps prior to the crisis. Spreads on non-bank credit card programs widened even further. Source: RBC Capital Markets.

²⁴ By the time the CSCF expired in March 2010, the BDC had purchased \$3.7 billion of ABS (Halde 2010).

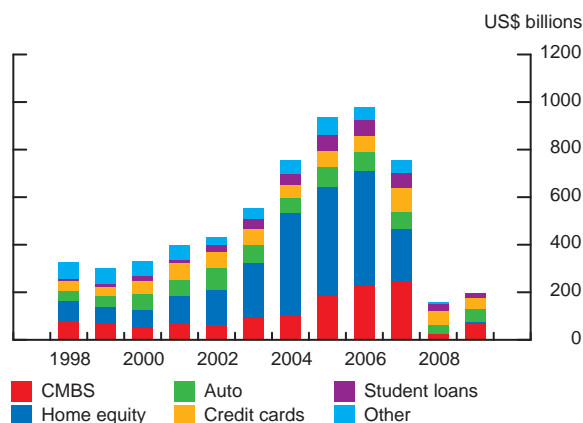
After the announcement of the CSCF, and helped by positive developments in other securitization markets (mainly the introduction of the Term Asset-Backed Securities Loan Facility by the U.S. Federal Reserve) and improvements in financial market conditions more generally, spreads on Canadian ABS tightened.²⁵ However, from the first quarter of 2008 to the first quarter of 2010, the ABS market shrank from \$52 billion to \$47 billion as maturities outpaced new issues (**Chart 11**). Anecdotal evidence suggests that this was caused as much by a limited supply of assets to securitize, because of weak credit demand and the availability of cheaper funding alternatives, as by a lack of investor demand or an impaired market. However, there are signs that the Canadian securitization market has been recovering in 2010. Through the first three quarters of 2010, almost \$8 billion of non-CSCF term ABS transactions were made in the Canadian market, compared with less than \$6 billion throughout 2009.

A number of notable differences between Canadian and U.S. ABS markets contribute to explaining the stronger impact of the crisis on the U.S. securitization market.²⁶ First, the distribution of collateral types is significantly different, with home-equity loans representing a much larger—and growing—share of the U.S. market prior to the crisis (**Chart 12**). Traditionally having second lien status, home equity lines of credit were used more heavily in the United States to cash out on increasing home values (Lucas, Goodman, and Fabozzi 2006). The issuance of ABS backed by home equity loans—the largest category of ABS issuance in the United States prior to the crisis—disappeared amid the correction in the U.S. housing market. Second, the fundamentals of the underlying collateral were healthier in Canada. For example, delinquency rates on CMBS remain below 1 per cent in Canada, whereas U.S. delinquency rates have risen above 8 per cent, owing to stress in the U.S. commercial real estate market (DBRS 2010). Delinquency rates on credit card ABS also remain much lower in Canada than in the United States.

With the onset of the global credit crunch in 2008, U.S. issuance of ABS slowed considerably to levels

Chart 12: U.S. ABS issuance

By asset type



Sources: SIFMA and Bloomberg

below those witnessed in the late 1990s. In October 2008, the issuance of term ABS came to a complete halt, as spreads on the traditional ABS asset classes exploded. This lack of issuance and the sharp increase in spreads prompted the Federal Reserve to announce a US\$200 billion Term Asset-Backed Securities Loan Facility (TALF) on 25 November 2008, to “help market participants meet the credit needs of households and small businesses by supporting the issuance of asset-backed securities (ABS).”²⁷ The TALF offered non-recourse three- or five-year loans to investors, collateralized by certain types of ABS that were eligible for the program. Since the implementation of the TALF, ABS spreads have retreated, and issuance has resumed, although less strongly than before the crisis. Initially accounting for about half of non-mortgage ABS issuance, the TALF was no longer being used extensively when it expired in 2010 (Sack 2010).

The financial crisis will undoubtedly have a long-lasting effect on securitization markets.

The financial crisis will undoubtedly have a long-lasting effect on securitization markets, and future levels of issuance in these markets will depend on reducing the conflicts of interest in the securitization process, simplifying and standardizing securitization

²⁵ For example, spreads on 3-year Schedule I bank credit card programs tightened to 75 bps towards the end of 2009. Source: RBC Capital Markets.

²⁶ This article does not focus on issuance in short-term markets; however, it is important to mention that the crisis had a strong impact on the Canadian market for non-bank-sponsored ABCP. The majority of assets underlying the non-bank-sponsored ABCP conduits were CDOs. Trading in this market came to a halt in 2007, and the non-bank-sponsored ABCP was subsequently restructured into floating rate notes. The market for bank-sponsored ABCP, while more resilient, was also affected by the crisis, and the outstanding amount of ABCP has declined. For a discussion of the Canadian ABCP market, see Kamhi and Tuer (2007a, 2007b).

²⁷ The TALF was tweaked several times, following the original announcement. See <http://www.newyorkfed.org/markets/talf.html>

structures, applying appropriate prudential regulation and accounting standards, and enhancing disclosure and transparency.²⁸ In addition, the elimination of certain withholding taxes on Canadian cross-border transactions on 1 January 2008 could help Canadian securitization markets by making it more economical to securitize a broader range of asset classes into the U.S. market (Kroft, McElheran, and Kelly 2008).

Conclusion

The period before the recent credit crunch was characterized by a dramatic increase in the issuance of several related debt-type asset classes, such as high-yield bonds, ABS, MBS, and CDOs. Despite double counting in these issuance figures (the assets underlying CDOs include high-yield bonds, leveraged loans, MBS, ABS, and even other CDOs), this trend led to increased leverage in the U.S. economy in what is often referred to as the shadow banking sector. Since the credit crunch, issuance in almost all of the asset classes that had experienced substantial growth has declined dramatically to levels not seen in the past ten years.

In Canada, the increase in securitization leading up to the crisis was less pronounced, but, nonetheless, ABS issuance was severely disrupted. Both Canada and the United States introduced programs to address these disruptions. Although the Canadian securitization market was dormant in the aftermath of the crisis, there have been signs of recovery in 2010.

New trends have emerged in the wake of the crisis that will likely continue. For instance, Canadian banks began issuing covered bonds as a diversified funding source and potentially lower-cost alternative to other forms of financing. Issues were originally denominated

in euros, but Canadian banks have recently issued covered bonds denominated in U.S. and Canadian dollars. Moreover, the federal government's recent announcement that it will introduce legislation on covered bonds in Canada should also facilitate the continuance of covered bond issuance, given that the current outstanding covered bonds of Canadian banks are well below the 4 per cent of total bank assets allowed by banking regulation.

After coming to a halt at the peak of the crisis, global issuance of high-yield debt rebounded to levels higher than those before the crisis as issuers extended the maturities of their issues. There will be an ongoing need for a high level of global high-yield issuance over the next five years simply to refinance upcoming maturities. For Canadian issuers of high-yield bonds, the profile of upcoming maturities is more benign. Nonetheless, there may be increased issuance, owing to the potential for conversions from income trusts. There have recently been several Canadian-dollar, high-yield issues, and several factors suggest that the Canadian high-yield market will continue to develop.

Globally, financial corporations have increased their equity issuance to offset the losses and writedowns experienced since the crisis began and to build capital in anticipation of more stringent regulatory requirements. Canadian financial institutions experienced fewer losses and writedowns than those in other jurisdictions, however, and thus the rise in their equity issuance has been less marked.

Overall, Canadian corporate issuance has fared relatively well in the wake of the crisis, given that Canadian issuers were in a relatively stronger position and did not employ innovative and riskier forms of financing to the same extent as issuers from other countries. However, while these trends have become apparent in the recent aftermath of the crisis, other repercussions of the financial crisis on issuance will likely emerge over time.

²⁸ See Hendry, Lavoie, and Wilkins (2010) and Selody and Woodman (2009). The Financial Stability Board is also looking at what actions could be taken to "encourage resumption of securitisation with genuine economic value" (FSB 2010).

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