# Modelling Financial Channels for Monetary Policy Analysis

*Ian Christensen, Ben Fung, and Césaire Meh, Department of Monetary and Financial Analysis*

- *The Bank of Canada's main projection model, like any other model, is a simplification of a complex reality and may not contain all the information that is relevant for policy-makers. While it may be desirable to keep the financial elements of the core projection model relatively simple, there is theoretical and empirical support for taking a broader range of financial variables into account. In the presence of financial frictions, financing costs will depend on the balance sheets of borrowers, resulting in a credit channel for the transmission of monetary policy.*
- *Models under development at the Bank include financial accelerators in which changes in borrowers' balance sheets play an important role in cyclical fluctuations by affecting borrowers' collateral and thus their ability to access external financing.*
- *These models are still at an early stage of development, but the results to date suggest that financial-accelerator mechanisms have the potential to improve policy advice and to help answer various policy questions.*

The Bank of Canada uses various strategies to deal with uncertainty regarding future developments in the Canadian economy. Most importantly, it considers a wide range of information and analysis before making a monetary policy decision and uses carefully articulated models to produce economic projections and to examine alternative scenarios (Jenkins and Longworth 2002). Central to the analysis presented to policy-makers at the Bank is the staff economic projection for Canada from the model ToTEM.[1] Although any model is a simplification of a complex reality and may not capture all the information that is relevant for policy-makers, the staff projection provides the reference point from which the implications of other sources of information are assessed. To analyze information not considered in ToTEM, staff at the Bank use other economic models to assess the implications of this projection for policy.[2]

This article describes an ongoing research agenda at the Bank to develop models in which financial variables play an active role in the transmission of monetary policy actions to economic activity. These models can help analyze information from the financial side of the economy and provide an overall view of the implications of financial developments for the current economic outlook. The article also explains how this research can help address other fundamental issues related to the objectives and conduct of monetary policy. One example is how asset-price movements should be taken into account in the monetary policy framework.

1. For a discussion of ToTEM, see Fenton and Murchison (2006) in this issue.
2. See Coletti and Murchison (2002).

## Why Should We Be Interested in Financial Channels?

A primary purpose of the financial system is to allocate savings to the most productive investments. In many macroeconomic models, the financial system is represented by a single interest rate that equates saving and investment. While this abstraction is useful for some purposes, it is also restrictive. Borrowing and lending do not take place in perfect markets. Financial activities are complicated by *frictions* that arise from transactions costs, asymmetric information, and the limited enforceability of contracts. If information is asymmetric, information such as the quality and outcome of an investment project is known to the borrower, but lenders can obtain this information only by incurring a monitoring or verification cost. In addition, a financial contract requires considerable time and expense to enforce. In the event that a contract is broken, it is costly to reach a legal settlement. These frictions may make lenders more reluctant to lend. As a result, external funds may be more costly or less available than in a model without financial frictions.

Diverse financial arrangements have emerged to reduce the high costs of monitoring and enforcement faced by individual lenders and borrowers. To align the incentives of borrower and lender, these arrangements make the financial position of the borrower an important determinant of the cost of borrowing or the availability of funds.[3] As a result, balance-sheet effects play an important role in economic fluctuations, a role that is not present in more traditional macroeconomic models.

There is also empirical evidence that balance-sheet variables are important determinants of investment and consumption expenditures. For example, empirical studies using firm-level data have provided evidence that financial variables such as cash flow, leverage, and other balance-sheet factors influence investment spending (Fazzari, Hubbard, and Petersen 1988 and subsequent work).[4] As well, small firms, which are often believed to face greater financing constraints, account for a disproportionate share of the decline in manufacturing output and inventory demand after a change in monetary policy (Gertler and Gilchrist 1994).

In the presence of frictions in the financial system, financing costs will depend on the financial position of borrowers, giving rise to a credit channel for the transmission of monetary policy (Bernanke and Gertler 1995). This means that lower interest rates can increase real expenditures because they strengthen borrowers' balance sheets and lower their costs of borrowing. This feature of the economy is not captured by traditional models in which monetary policy affects aggregate demand and inflation only through the interest rate and exchange rate channels. Given the theoretical and empirical support for taking financial channels into account, policy-makers should be interested in models with more developed financial elements in order to better understand how their decisions will affect economic activity.

*In the presence of frictions in the financial system, financing costs will depend on the financial position of borrowers, giving rise to a credit channel for the transmission of monetary policy.*

In addition, the importance of these financial effects could be episodic and could depend on the state of the business cycle. Financial factors are particularly important in explaining some of the biggest economic downturns over the past 100 years. Bernanke (1983) argues that a breakdown in financial intermediation, i.e., the funnelling of savings to investment, turned the U.S. downturn of 1929–30 into the Great Depression. Fisher (1933) highlights how the falling price level drove up the real debt burden of borrowers during this period. As well, many commentators have blamed the protracted slump and deflation in Japan in the 1990s on the bursting of the real estate and stock market bubbles and the subsequent weakening of the financial position of the banking system. Moreover, the U.S. recession of the early 1990s generated much discussion about whether a credit crunch had been brought about by poorly capitalized banks. These problems may have been worsened in some regions by a sharp decline in commercial property prices. A better understanding of the financial factors at play in such episodes is important so that policy-makers can prevent their recurrence.

While policy-makers should be interested in financial channels, it may be a valid strategy to leave many of them out of the core projection model. For example,

3. For example, a lender may require collateral to back a loan to reduce the likelihood that the borrower will default.

4. See Ng and Schaller (1996); Chirinko and Schaller (2004); and Aivazian, Ge, and Qiu (2005) for studies that consider Canadian firms.

financial channels might play a bigger role in some periods than in others and may thus enter into monetary policy decisions on an irregular basis. If so, the gain from adding these channels may sometimes be outweighed by the cost of creating additional complexity in the model. Nonetheless, separate models with better-developed financial channels can complement the core model and reduce the risk of policy errors.

## Contributing to Policy Analysis

Models with a richer financial sector can contribute significantly to the discussion on several policy issues that central banks currently face. One example is that, in recent years, housing prices have increased sharply in several countries while household spending has simultaneously been very strong. The higher housing values have made a large pool of home equity available to households, increasing their ability to borrow.[5] Tapping into this home equity through, for example, home-equity loans, has been an important channel of support to household spending in recent years. In Canada, the strong growth in home-equity lines of credit (HELOCs) has coincided with the increase in housing prices.[6] U.S. survey data suggest that about half of the home-financed borrowing was spent on goods and services, while Canadian household microdata indicate that between 20 per cent and 50 per cent of HELOCs are being used to finance current consumption.[7] Modelling a richer financial sector could help to quantify the contribution of these balance-sheet effects to household spending and housing-market activity.

Changes in the financial system may also have implications for the appropriate setting for the stance of monetary policy. Innovative financial instruments or lending practices may change the amount or type of debt on borrowers' balance sheets, with consequences for the transmission mechanism of monetary policy.[8] In this respect, financial factors are important for understanding how the economy is evolving and for assessing the likely impact of monetary policy actions.

In addition, richer links between financial and real developments are critical for analyzing some key questions related to the monetary policy framework. How a central bank should respond to asset prices depends on what role asset prices play in output and inflation fluctuations and how movements in these prices affect the functioning of the financial system (see the discussion below). Other important questions relate to the optimal level of inflation and the costs and benefits of inflation targeting versus price-level targeting. The prevalence of nominal debt contracts, both short and long term, together with bankruptcy laws that affect the costs of default, should be an important consideration in such analyses (see also Howitt 2005).

*Richer links between financial and real developments are critical for analyzing some key questions related to the monetary policy framework.*

Finally, models with well-articulated links between the financial sector and the real economy will not only be useful for monetary policy analysis, but also for analyzing questions related to financial stability, another topic of keen interest among central bankers. A good grasp of how the financial system works is crucial when considering the impact of a disruption to its normal functioning.

## Modelling Financial Channels

The most popular models for capturing financial channels are referred to as *financial accelerators*. These are models in which there is an explicit link between the balance sheets of borrowers and their access to, or cost of, external financing.

One important strand of this research began with Bernanke and Gertler (1989). In this model, there are two key players: households, who are lenders, and business owners / entrepreneurs, who are borrowers. As well, there is asymmetric information between borrowers and lenders, since lenders can only observe the outcome of a borrower's investment project at a cost. Agency costs that arise from asymmetric infor-

5. Campbell and Cocco (2005) find evidence in U.K. microdata that is consistent with the argument that an increase in housing prices relaxes borrowing constraints.

6. Debt outstanding on personal lines of credit has grown at an average rate of 20 per cent per year since 1999, and about two-thirds of these credit lines are secured by home equity. Some of this growth likely reflects substitution for other forms of lending.

7. See Greenspan and Kennedy (2005) for U.S. circumstances.

8. Examples of such innovations include the use of credit scoring to make screening of loan applicants more efficient or the ability of financial institutions to securitize loans so that they can expand the sources of funds available to lenders. Innovations in the financial system tend to reduce frictions and could bring an economy closer to the one approximated in ToTEM.

mation can drive the price of uncollateralized funds above the cost of the firm's internally generated funds. In this setting, financial position is a key determinant of the credit conditions that a borrower faces. Specifically, the net worth of a firm affects the premium that must be paid for external sources of finance (funds that come from sources outside the firm). In aggregate, changes in the financial position of firms over the business cycle drive a countercyclical risk premium on debt that amplifies fluctuations in output and investment.

This chain of events is known as a financial-accelerator mechanism because there are feedback effects between the financial position of the borrowers and the terms of credit that can amplify business cycle fluctuations. For example, firm net worth deteriorates when a negative shock reduces cash flows and lowers the value of its capital assets. As a result of the deterioration in borrower balance sheets, the cost of finance rises, and this depresses investment. This leads to a further fall in the value of capital, which further reduces firm net worth, reinforcing the increase in financing costs and further depressing investment.

An alternative way of capturing the financial-accelerator mechanism is developed in the seminal work of Kiyotaki and Moore (1997). In this model, the financial friction is an enforcement problem; essentially borrowers can default and never repay. The financial contract that ensures repayment is one in which the quantity of loans available is restricted to some fraction of the value of the borrower's collateral. In this case, it is the quantity of external funds, rather than the cost, which is related to the state of borrower balance sheets.

Many studies argue that the financial-accelerator mechanism can amplify the effects of small shocks (Bernanke, Gertler, and Gilchrist 1999; Iacoviello 2005) or can make their effects on real variables more persistent (Carlstrom and Fuerst 1997). This suggests that financial accelerators could be important for developing more realistic business cycle dynamics in models for policy analysis.

## A Starting Point for Model Development

Our strategy has been to start with the main building blocks of dynamic stochastic general-equilibrium (DSGE) models created for policy analysis at a number of central banks and develop financial elements within those models.

We introduce two financial accelerators, one that applies to households, and the other to firms, into a model that is otherwise fairly similar to ToTEM in terms of the real side of the model. For example, prices are sticky, allowing monetary policy to affect real variables in the short run. This strategy makes it possible to assess the implications of financial channels for risks to ToTEM's analysis.

*Our strategy is to start with the main building blocks of DSGE models created for policy analysis . . . and to develop financial elements within those models.*

Our work so far has followed that of Iacoviello (2005).[9] In the model there are households who lend funds to other households and to firm owners. The financial friction takes the form of a problem of enforcing repayment that leads lenders to require collateral. Households also buy and sell housing, giving rise to a housing market. Loan size is restricted to some fraction of the value of a borrower's real estate. This fraction can be interpreted as the loan-to-value ratio that features prominently in standard mortgages.

To illustrate some key features of the model, consider a shock to the economy that leads to a rise in housing prices. This increases the value of assets held by households and the amount they can post as collateral. Higher collateral values allow households to borrow more, and these resources can be used to purchase more housing and consumption. The accelerator effect is present here because these extra expenditures drive housing prices further up, reinforcing the rise in collateral values and access to debt. Firm owners also face a collateral constraint, but in their case, it also affects their ability to invest.

One interesting feature of this model is that balance sheets improve for all borrowers (households and firms) during an upswing in economic activity. This brings about widespread improvements in financing conditions that affect both households and firms at the same time, suggesting there will be a stronger impact

9. Our research is a work-in-progress, and here we provide some insights from the work we have done so far and from Iacoviello (2005).

on output, since both consumption and investment spending will be affected.[10]

Another interesting insight from this model is that the effects of the accelerator mechanisms on key macro variables depend on the nature of the shock. One key element of the model that generates these differential impacts is that debt contracts are written in nominal terms, as is the case in most real-world financing relationships. If inflation is unexpectedly low over the life of the loan, the debtor faces a cost of repayment that is higher in real terms than was anticipated.[11] Unexpected price declines reduce debtors' net worth and, as a result, their capacity to borrow. The higher real cost of debt repayment shifts funds from borrowers, who have a high marginal propensity to consume, to lenders (savers) who have a low propensity to consume. The result is a reduction in aggregate demand. The financial mechanisms in the model will therefore amplify demand shocks, but dampen supply shocks. A positive demand shock will raise output and inflation, and the increase in inflation (albeit temporary under inflation targeting) will reduce the real cost of debt service, reinforcing the borrower's ability to obtain financing beyond what is available through the standard accelerator mechanism. After a supply shock that raises output and lowers inflation, the real cost of debt repayment rises, reducing borrower net worth and dampening part of the rise in output.

In order to better understand these financial-accelerator mechanisms, two Bank of Canada working papers (Christensen and Dib 2006; Gammoudi and Mendes, forthcoming) consider the impact of the business and household accelerators in isolation. Christensen and Dib (2006) estimate a model very similar to that of Bernanke, Gertler, and Gilchrist (1999) in which firms must borrow to purchase capital and pay a premium on external funds. Their results suggest that this mechanism can help to capture the co-movement in output, inflation, and investment. They also show that the financial accelerator amplifies investment fluctuations, but may dampen consumption movements. This dampening may happen, for example, because households (the ultimate source of funds) will reduce consumption and save more to take advantage of temporarily higher investment returns and the lower risk associated with loans to firms. For some types of shocks this means that the financial-accelerator mechanism has had little impact on output or inflation—the variables of ultimate interest to policy-makers. Gammoudi and Mendes (forthcoming) develop a model with lending and borrowing households. Borrowing households in this model face a collateral constraint based on the work of Iacoviello (2005). One key finding is that the model is better able to capture the correlation between housing prices and consumption than a model without the borrowing constraint. In both of these studies, financial accelerators play an important role in capturing the co-movement in key variables of interest. Results from the integrated model under development suggest that including financial accelerators in both the business and household sectors can lead to a stronger impact on output, under certain types of shocks, than when financial accelerators are restricted to operating in only one sector, as in the two studies discussed here.

*The impact of the financial-accelerator mechanisms . . . will depend on the nature of the shock, showing that such a model could provide a useful alternative interpretation of recent data.*

Research to date suggests that financial-accelerator mechanisms have the potential to provide useful insights for policy deliberations. The impact of these mechanisms on key macroeconomic variables can be important and will depend on the nature of the shock hitting the economy. This suggests that these models may provide a better-informed view of what economic forces have been at play over history. In the policy arena, such a model could provide a useful alternative interpretation of recent data and could guide policy decisions about how economic events will unfold over the forecast horizon.

## Towards a More Complete Analysis of Financial Channels

The quantitative importance of financial frictions is still the subject of much debate. Some have argued that the financial mechanisms in the models described

10. The net impact will depend on the behaviour of those who supply the savings in this model economy. For example, it is likely that a positive shock that is expected to be temporary will induce savers to lend more in the short term.

11. This is the mechanism highlighted in Fisher's (1933) famous paper on debt and deflation.

above are unlikely to play a significant role in business cycle fluctuations. Kocherlakota (2000) and Cordoba and Ripoll (2004), for example, find that the amplification of shocks produced by borrowing constraints may be important only under relatively restrictive assumptions. Chari, Kehoe, and McGrattan (2006) argue that how financial frictions are modelled is critical to a model's usefulness in explaining business cycle fluctuations. The issues these authors raise suggest that there is fertile ground for future research in this area, particularly in exploring the role these mechanisms play in different types of models and in assessing their ability to capture key features of macroeconomic data.

There is also a need to flesh out the mechanisms at play in financial-accelerator models to better reflect the characteristics of real world financial markets. In the work described above, there is no formal distinction between financial institutions and financial markets. This distinction could well be important, however, since bank balance-sheet conditions can influence the ability of borrowers to access credit. As well, the effects of the financial accelerator could be altered if firms are able to access alternative sources of financing, such as bonds and equity. Below, we discuss some areas for additional research.

## Bank capital channel

The models discussed above abstract completely from the role of bank capital (i.e., bank net worth and bank equity) in the monetary policy transmission mechanism. This omission is particularly unfortunate given the strong empirical evidence in support of the role of banks' financial structure in lending decisions and their importance for macroeconomic stability (Peek and Rosengren 1995, 1997). Researchers at the Bank of Canada and elsewhere have studied the importance of bank capital for the amplification and propagation of shocks. This work presents another financial-accelerator mechanism where the endogenous evolution of bank capital and its interplay with entrepreneur net worth (and asset prices) propagate the effects of monetary policy to the real economy.

Meh and Moran (2004) and Sunirand (2002) develop dynamic general-equilibrium models that study the link between the evolution of bank capital and entrepreneur net worth on the one hand, and monetary policy and economic activity on the other. These models feature two sources of asymmetric information. The first comes from the relationship between banks and their borrowers (firms), where firms can choose to undertake riskier projects or not to report truthfully their production in order to enjoy unobservable private benefits. To mitigate this problem, banks require entrepreneurs to invest their own net worth in the projects. This channel, where the ability of firms to borrow depends on their financial position, has been emphasized by most financial-accelerator models, as discussed above (see Bernanke, Gertler, and Gilchrist 1999). The second source comes from the relationship between banks and their own source of funds (depositors or investors) where banks, to which depositors delegate the monitoring of firms, may not do an adequate job because monitoring is costly. In response, investors demand that banks invest their own net worth—bank capital—in the financing of projects. Thus, the available funds that banks can attract from investors to lend to firms are limited by the amount of bank capital.

## Multiple sources of external finance

In all the models discussed so far, it is assumed, for simplicity, that only a single source of external funds—debt financing—is available to firms or banks. In practice, most firms raise external funds from multiple sources, such as marketable debt, bank loans, or equity.

Using data on U.S. firms from the Compustat data set, Covas and den Haan (forthcoming) find that debt and equity issuances are procyclical for most firms. They then construct a DSGE model where firms can have access to two sources of external financing for investment: debt financing and equity financing. In such a model, the net worth of the firm is not only increased through retained earnings (as assumed in the previous models) but also by issuing equity. Another important feature of the model is its heterogeneity in terms of firm size, where small firms are much more likely to rely on equity financing while large firms tend to use more debt financing. A calibrated version of their model shows that the presence of equity financing substantially contributes to the performance of financial-accelerator models. More specifically, after a positive productivity shock, output increases more in the model with debt and equity financing than in the model with only debt financing.

Similarly, Jermann and Quadrini (2006) consider a model in which firms finance production with both debt and equity. In addition, business cycle fluctuations are driven by asset-price shocks that are propagated to the real economy through financial frictions. They show that financial innovations that improve the ability to borrow and issue equity allow firms to adjust more easily to an asset-price shock. The greater flexibility

in financing arrangements leads to greater volatility in the financial structure of firms, but also lowers the volatility of output in response to shocks to asset prices.

### Determination of asset prices

An important characteristic in models with financial frictions (like the one described on pp. 34–35) is that movements in asset prices affect the ability of firms or households to borrow. So the model is a natural laboratory to address key policy questions, such as how monetary policy should react to asset-price shocks. To address such questions, it is important to have a model that links asset-price movements to the real economy and inflation.

Bank researchers Basant-Roi and Mendes (forthcoming) develop a model in which households face an external financing premium similar to that in Bernanke, Gertler, and Gilchrist (1999). The authors use this model to analyze how the financial accelerator interacts with a housing-price bubble (defined as a sustained and growing deviation of housing prices from their fundamental levels) to affect the optimal horizon over which monetary authorities should bring inflation back to target. They find that a housing-price bubble lengthens the optimal horizon appreciably.[12] In their work, and in many other models, bubbles are exogenous and are therefore unaffected by monetary policy actions. A challenge for future work is to develop quantitative models in which large changes in asset prices are endogenous to developments elsewhere in the economy. Researchers at the Bank of Canada and elsewhere have started such work (Caballero and Krishnamurthy 2006; Ríos-Rull and Sánchez-Marcos 2006; and Tomura, forthcoming).

12. For a summary of this and related work, see Coletti, Selody, and Wilkins (2006).

## Conclusions

In this article, we present a research agenda on developing models of financial channels for monetary policy analysis at the Bank of Canada and discuss the progress we have made so far. This research is particularly relevant given recent financial developments and substantial fluctuations in asset prices. Current progress in DSGE modelling and research on financial frictions suggests that this line of research could lead to a better understanding of the role of credit and financial variables in the monetary policy transmission mechanism. Many challenges remain, however, in modelling the financial and real linkages, and various ways to improve the current research are being considered. The progress we have made to date suggests that these models should improve policy advice and are capable of helping to answer different policy questions. This is important for policy-makers, because "looking at the economy through a variety of lenses leads to more comprehensive rigorous analyses" (Macklem 2002).

## Literature Cited


Aivazian, V., Y. Ge, and J. Qiu. 2005. "The Impact of Leverage on Firm Investment: Canadian Evidence." *Journal of Corporate Finance* 11 (1–2): 277–91.

Basant-Roi, M. and R. Mendes. Forthcoming. "Should Central Banks Adjust Their Target Horizons in Response to Housing-Price Bubbles?" Bank of Canada Working Paper.

Bernanke, B. 1983. "Nonmonetary Effects of the Financial Crisis in the Propagation of the Great Depression." *American Economic Review* 73 (3): 257–76.

Bernanke, B. and M. Gertler. 1989. "Agency Costs, Net Worth, and Business Fluctuations." *American Economic Review* 79 (1): 14–31.

———. 1995. "Inside the Black Box: The Credit Channel of Monetary Policy Transmission." *Journal of Economic Perspectives* 9: 27–48.

Bernanke, B., M. Gertler, and S. Gilchrist. 1999. "The Financial Accelerator in a Quantitative Business Cycle Framework." In *Handbook of Macroeconomics*, Vol. 1, eds. J.B. Taylor and M.Woodford. Amsterdam: Elsevier Science.

Caballero, R. and A. Krishnamurthy. 2006. "Bubbles and Capital Flow Volatility: Causes and Risk Management." *Journal of Monetary Economics* 53 (1) 35–53.

Campbell, J. and J. Cocco. 2005. "How Do House Prices Affect Consumption? Evidence from Micro Data." NBER Working Paper No. 11534.

Carlstrom, C. and T. Fuerst. 1997. "Agency Costs, Net Worth, and Business Fluctuations: A Computable General Equilibrium Analysis." *American Economic Review* 87 (5): 893–910.

## Literature Cited (cont'd)


Chari, V., P. Kehoe, and E. McGrattan. 2006. "Business Cycle Accounting." Research Department Staff Report No. 328. Federal Reserve Bank of Minneapolis.

Chirinko, R. and H. Schaller. 2004. "A Revealed Preference Approach to Understanding Corporate Governance Problems: Evidence from Canada." *Journal of Financial Economics* 74 (1): 181–206.

Christensen, I. and A. Dib. 2006. "Monetary Policy in an Estimated DSGE Model with a Financial Accelerator." Bank of Canada Working Paper No. 2006–9.

Coletti, D. and S. Murchison. 2002. "Models in Policy-Making." *Bank of Canada Review* (Summer): 19–26.

Coletti, D., J. Selody, and C. Wilkins. 2006. "Another Look at the Inflation-Target Horizon." *Bank of Canada Review* (Summer): 31–37.

Cordoba, J.-C. and M. Ripoll. 2004. "Credit Cycles Redux." *International Economic Review* 45 (4): 1011–46.

Covas, F. and W. den Haan. Forthcoming. "The Role of Debt and Equity Finance over the Business Cycle." Bank of Canada Working Paper.

Fazzari, S., R. Hubbard, and B. Petersen. 1988. "Financing Constraints and Corporate Investment." *Brookings Papers on Economic Activity* 0 (1): 141–95.

Fenton, P. and S. Murchison. 2006. "ToTEM: The Bank of Canada's New Policy-Analysis and Projection Model." *Bank of Canada Review*, this issue: 5–18.

Fisher, I. 1933. "The Debt-Deflation Theory of Great Depressions." *Econometrica* 1 (4): 337–57.

Gammoudi, M. and R. Mendes. Forthcoming. "Household Sector Financial Frictions in Canada." Bank of Canada Working Paper.

Gertler, M. and S. Gilchrist. 1994. "Monetary Policy, Business Cycles, and the Behavior of Small Manufacturing Firms." *Quarterly Journal of Economics* 109 (2): 309–40.

Greenspan, A. and J. Kennedy. 2005. "Estimates of Home Mortgage Originations, Repayments, and Debt on One-to-Four-Family Residences." Finance and Economics Discussion Series No. 2005–41. Washington: U.S. Federal Reserve Board.

Howitt, P. 2005 "Issues in Inflation Targeting: Panel Discussion." Proceedings of a conference held by the Bank of 24–25 April 2005. Ottawa; Bank of Canada.

Iacoviello, M. 2005. "House Prices, Borrowing Constraints, and Monetary Policy in the Business Cycle." *American Economic Review* 95 (3): 739–64.

Jenkins, P. and D. Longworth. 2002. "Monetary Policy and Uncertainty." *Bank of Canada Review* (Summer): 3–10.

Jermann, U. and V. Quadrini. 2006. "Financial Innovations and Macroeconomic Volatility." Manuscript. University of Pennsylvania and University of Southern California.

Kiyotaki, N. and J. Moore. 1997. "Credit Cycles." *Journal of Political Economy* 105 (2): 211–48.

Kocherlakota, N. 2000. "Creating Business Cycles through Credit Constraints." *Federal Reserve Bank of Minneapolis Quarterly Review* 24 (3): 2–10.

Macklem, T. 2002. "Information and Analysis for Monetary Policy: Coming to a Decision." *Bank of Canada Review* (Summer): 11–18.

Meh, C. and K. Moran. 2004. "Bank Capital, Agency Costs, and Monetary Policy." Bank of Canada Working Paper No. 2004–6.

Ng, S. and H. Schaller. 1996. "The Risky Spread, Investment, and Monetary Policy Transmission: Evidence on the Role of Asymmetric Information." *Review of Economics and Statistics* 78 (3): 375–83.

Peek, J. and E. Rosengren. 1995. "The Capital Crunch: Neither a Borrower Nor a Lender Be." *Journal of Money, Credit, and Banking* 27 (3): 625–38.

———. 1997. "The International Transmission of Financial Shocks: The Case of Japan." *American Economic Review* 87 (4): 495–505.

Ríos-Rull, J.-V. and V. Sánchez-Marcos. 2006. "House Price Movements." Manuscript. University of Pennsylvania (June).

Sunirand, P. 2002. "The Role of Bank Capital and the Transmission Mechanism of Monetary Policy." Manuscript. London School of Economics.

Tomura, H. Forthcoming. "Firm Dynamics, Bankruptcy Laws and Total Factor Productivity." Bank of Canada Working Paper.