

Mortgage Debt and Procyclicality in the Housing Market

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- *Housing market booms and busts have occurred in a number of advanced economies and were frequently associated with rising leverage. These boom-busts misallocate resources and lead to large losses on the balance sheets of households and financial institutions. Policy-makers and regulators are keenly interested in understanding how these booms and busts emerge and how public policy might dampen or prevent them.*
- *Rising house prices increase the value of the main form of household collateral. Some households subsequently increase their borrowing and spending on housing and non-housing consumption. The higher demand for housing leads to further increases in house prices since the supply of housing is slow to adjust. This mechanism amplifies developments in housing markets (procyclicality) and is an important ingredient in the emergence of booms and busts.*
- *Research from a number of countries suggests that the setting of the maximum limit on the loan-to-value (LTV) ratio on a residential mortgage could help to moderate procyclical movements in house prices and housing market activity.*
- *Models developed at the Bank of Canada and elsewhere allow researchers to examine the link between the level of the LTV ratio and the degree of procyclicality in the housing market. They demonstrate that an LTV ratio set at a lower level would dampen procyclicality. Varying the LTV ratio for mortgages countercyclically could mitigate procyclicality even further.*

In the aftermath of the financial crisis, much attention has been focused on the role of mortgage finance in house-price dynamics.¹ The subprime-mortgage crisis that began in 2007 in the United States is an extreme example of how easing financing conditions can amplify a housing market boom and leave the financial system highly vulnerable to a bust in house prices.² Boom-bust cycles in real estate markets are a common precursor to banking crises in advanced and emerging economies (Reinhart and Rogoff 2009); the most severe and costly busts, in terms of lost gross domestic product (GDP), arise when the real estate boom is associated with the increased leverage of households and financial institutions (Crowe et al. 2011). Claessens, Kose and Terrones (2008) show that recessions that coincide with housing busts tend to last longer and be deeper than recessions where no housing bust has occurred. They find that, on average, the cumulative loss to GDP is roughly three times as large when a housing bust coincides with a recession. The high macroeconomic costs of a bust are due to the relatively high direct exposure of the financial system to real estate and to the resulting knock-on effects of financial system losses to the rest of the economy.

A rising supply of credit, often caused by some form of financial liberalization or technological innovation, is a characteristic feature of a real estate boom. A key mechanism for the boom is feedback between rising house prices and household debt that is created because homeowners are able to use their houses as collateral. Rising house prices increase the value of a household's collateral and expand the capacity of households to accumulate debt. If new debt leads to further spending on real estate,

¹ Similar concerns exist for commercial real estate.

² Other notable examples are the boom-bust cycles in the Nordic countries and the United Kingdom between the mid-1980s and early 1990s and, more recently, in the United Kingdom and Spain.

house prices rise, completing the feedback loop. The presence of this effect is associated with greater procyclicality in the housing market. In addition, some portion of this increased debt capacity may also finance non-housing consumption. In this case, higher household indebtedness increases the risk of default when income falls during the bust phase of the cycle. Other factors that are likely to reinforce the procyclical movements of house prices are positive views on the outlook for the economy and the presence of capital inflows from abroad that amplify the boom (Tomura 2010).

In an effort to reduce procyclicality in real estate markets and the magnitude of booms and busts, a number of countries have altered key elements in their regulation of housing finance (CGFS 2010; Wong et al. 2011). Many more are considering such measures (FSB 2011). One area of focus is the appropriate setting of the upper cap or maximum loan-to-value (LTV) ratio, which defines the minimum down payment required to obtain a mortgage for a house purchase. A high LTV ratio allows the borrower to tap into more debt for a \$1 rise in collateral value. This article examines a maximum LTV ratio on mortgages through the lens of a model developed in Christensen et al. (2009) and Christensen and Meh (forthcoming). This model provides an environment in which to examine mortgage market regulation, because it features a housing market and borrowing-constrained households that can borrow up to a specified fraction of the value of their real estate wealth.

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The article begins with a description of the evidence linking housing booms and procyclicality to rising household credit and leverage. It then reviews some of the policies being considered to dampen boom-bust cycles in real estate, notably the LTV ratio on mortgages. The model is then described and used to consider how permanent changes in the LTV ratio alter the feedback effects associated with procyclicality and the effect of reducing the maximum LTV ratio in the face of a rising credit supply.

Housing Booms and the LTV Ratio in Canada

Canada has not been a stranger to real estate booms and busts in the past: one occurred in the mid-1970s and another in the late 1980s (Ahearne et al. 2005). Both had long-lasting impacts on the balance sheets of Canadian financial intermediaries. In fact, the large losses on mortgage loans that trust companies experienced during the 1980s were one of the factors that led to their ultimate demise. The impact on the financial system reflects its exposure to real estate. Since the late 1960s, mortgages and other debt secured by real estate have averaged more than 35 per cent of total private sector credit outstanding, and this share has risen over time to its current level of more than 57 per cent.³

Over the past three years, the Government of Canada has adopted a number of changes to the rules for government-backed insured mortgages,⁴ with the objective of supporting “the long-term stability of Canada’s housing market”⁵ and “to help prevent Canadian households from getting over-extended, and acting to prevent some lenders from facilitating [this].”⁶ These changes have resulted in lower maximum LTV ratios of 95 per cent for new government-backed insured mortgages, 85 per cent for mortgage refinancing, and 80 per cent for non-owner-occupied properties. These changes follow a relaxation of the first two rules between 2004 and 2007.

Allen (2010–11) shows that from 1999 to 2004 most households with insured mortgages borrowed up to, or near, the maximum LTV ratio available at the time they purchased a home. Thus, in that period, the typical LTV ratio for a newly issued insured mortgage was in the range of 90 to 95 per cent. This suggests that changes to the maximum LTV ratio could have significant effects on housing markets.

³ This includes residential and non-residential mortgages and lines of credit secured by real estate. The share is a proportion of credit outstanding and excludes equity, warrants and trust units. All data are from the *Bank of Canada Banking and Financial Statistics*. If we exclude insured mortgages, for which the banks do not bear the losses from default, this number is about 48 per cent in the first quarter of 2011. This measure does not include direct exposures to construction and building-sector loans.

⁴ In Canada, the Bank Act states that federally regulated financial institutions cannot offer mortgages with an LTV ratio higher than 80 per cent, unless that mortgage is insured by a government agency (Canada Mortgage and Housing Corporation) or private insurer. Mortgage insurance backed by the federal government is available for mortgages with LTV ratios up to 95 per cent.

⁵ Government of Canada, press release, 17 January 2011.

⁶ Government of Canada, press release, 16 February 2010.

Mortgage Finance and Procyclicality: Selected Evidence

Research from a number of countries finds an important relationship between mortgage finance and developments in the housing market—a critical link in the U.S. subprime-mortgage crisis, as well as the boom and bust in the United Kingdom (FSB 2011).

Empirical evidence confirms the importance of mortgage market rules for macroeconomic fluctuations. Almeida, Campello and Liu (2006) show that countries with high maximum LTV ratios are those in which house prices and the demand for new mortgage borrowing are most sensitive to income shocks (i.e., procyclicality is the strongest). Lamont and Stein (1999) have similar findings for U.S. cities with a large proportion of highly leveraged (high LTV ratio) households.

Studies based on microdata have also investigated the link between housing finance and household behaviour. Using U.S. credit bureau data and zip-code-level data on house prices, Mian and Sufi (2009a) find evidence that U.S. banks increased the availability of credit to first-time home buyers and that this was a key driver of rising household leverage between 2002 and 2005. In addition, rising house prices allowed existing homeowners to increase their debt levels dramatically (Mian and Sufi 2009b). The authors document that homeowners extracting equity from their homes during the period of rising house prices experienced a jump in default rates as house prices reversed (Mian and Sufi 2009b). This research shows that the feedback effect between house prices and household debt is clearly linked to the degree of vulnerability of the financial system.

Studies suggest that the maximum limit on the LTV ratio could play a role in moderating procyclical movements in house prices and housing market activity

Finally, Ortalo-Magné and Rady (1999) develop a model with young and old households, as well as a property ladder, whereby people seek to move from apartments to houses as they age. A key finding is that the rise in owner occupancy and house prices

during the U.K.'s housing boom in the 1980s can be at least partly explained by credit market liberalization, as captured by an increase in the LTV ratio. An alternative hypothesis, that the boom resulted from rising household incomes, cannot explain these facts.

Together, these studies suggest that the maximum limit on the LTV ratio on a residential mortgage could play a useful role in moderating procyclical movements in house prices and housing market activity.

A Model to Capture Links Between Housing Finance and the Real Economy

Christensen et al. (2009) develop and estimate a dynamic stochastic general-equilibrium (DSGE) model for Canada (referred to as CCMN, after the authors' names—Christensen, Corrigan, Mendicino and Nishiyama), featuring borrower and lender households and a housing market. As in Iacoviello (2005), borrowers and lenders are distinguished by their impatience: impatient households seek to consume more today and borrow from patient households. Differing degrees of impatience across household types is a common modelling device to allow borrowing and lending to occur. It captures some of the differences in household behaviour over the life cycle, where impatient households resemble the young, and patient households the old who have accumulated more wealth. Loan contracts in this model specify that borrowers can borrow up to a fraction of the value of their real estate holdings (the LTV ratio). This type of contract often arises in models where the financial friction takes the form of an enforcement problem: lenders require borrowers to post collateral in view of the risk that they may not repay the loan. Importantly, when this collateral constraint is present, rising house prices lead to a higher value of collateral, giving households greater access to credit and allowing them to increase their expenditures on consumption and housing. Christensen et al. (2009) find that this mechanism helps the model to better capture the empirical relationship between the time series data for house prices and consumption.

Like many models of its type, CCMN does not capture the decision of households to default, which is a key element of financial system vulnerability. In contrast to Meh (2011) and de Resende and Lalonde (2011), there is no explicit role in the model for banks to act as intermediaries for credit, since loans are contracts between lender households and

borrowers. Thus, the model does not capture how loan losses can lead to banking sector stresses, tighter lending standards and further amplification during the bust phase of the cycle. Though stylized in these respects, the model does capture the feedback between house prices and household debt accumulation that drives the procyclicality of the housing market and, as noted above, is the motivation for some of the recent changes to housing-finance policy in Canada. The following sections focus on the role that this mechanism plays in the boom phase.

The LTV Ratio and Spillovers from the Housing Market

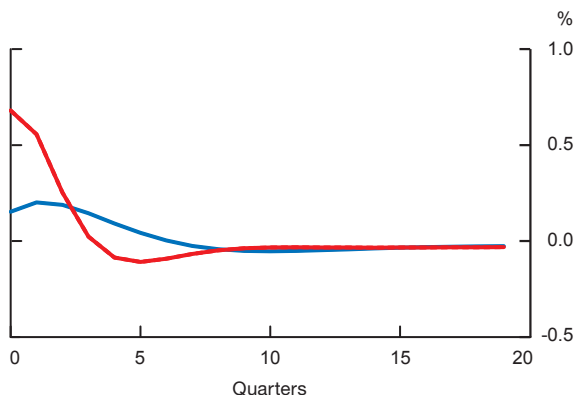
Given the presence of collateral-constrained households, the level of the LTV ratio on mortgage lending is one factor that determines the extent of procyclicality in the housing market. In this case, it is useful to consider economic shocks that may arise in the housing market itself and lead to changes in the price of housing. For example, a number of researchers have studied the impact of shocks to housing demand on the housing sector and on the overall economy.⁷ Iacoviello and Neri (2010) find that housing-demand shocks play an important role in capturing the swings in U.S. house prices in a two-sector monetary DSGE model. Jarociński and Smets (2008) find that this type of shock can account for a significant fraction of the U.S. boom in construction and house prices, but its effect on overall GDP growth and inflation is relatively small.

Chart 1 illustrates the economy's response to a positive shock to housing demand in the CCMN model. This shock is captured as a sudden shift in the desire of households to consume housing services relative to other consumption goods or leisure. It can also be thought of as a rise in the return to residential investment. The higher demand for housing services increases housing investment. However, the stock of housing is slow to adjust, so there is a rise in house prices⁸ and, thus, the value of housing that can be posted as collateral.⁹ Rising collateral values allow households to borrow more against the equity in their home to finance higher (non-housing) consumption in the short run.

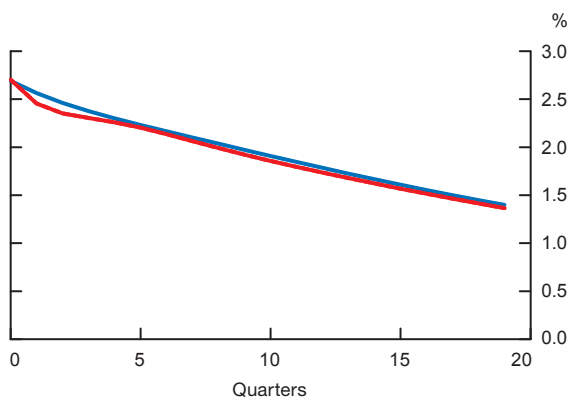
Chart 1: Economic impact of a lower LTV ratio on the volatility of mortgage debt after an increase in the demand for housing

Deviation from steady state

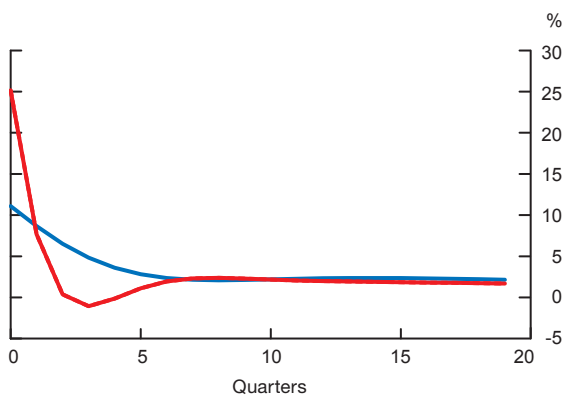
a. Consumption



b. House prices



c. Mortgage debt



— 95% LTV ratio — 80% LTV ratio

⁷ Housing-demand shocks are sometimes described as a shift in preferences toward housing services. Iacoviello and Neri (2010) discuss alternative interpretations.

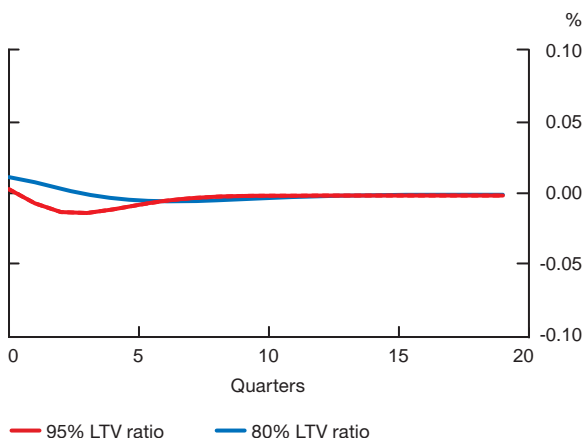
⁸ Charts 1 and 2 show the price of housing relative to consumer prices.

⁹ In this example, the persistence of the house-price response is driven primarily by the high estimated persistence of the shock rather than by the intrinsic dynamics of house prices.

Chart 1: (cont'd)

Deviation from steady state

d. Inflation



Borrowing households subsequently reduce their consumption and repay this debt over time.

In the case where the maximum LTV ratio is set to 80 per cent, the model responses suggest that a 1 per cent rise in house prices is associated with an increase of 0.1 per cent in consumption, which is close to the estimates of Iacoviello and Neri (2010) for the United States.¹⁰ In the case where the maximum LTV ratio is 95 per cent, the initial response of consumption is three times larger. **Chart 1** shows that a lower LTV ratio substantially reduces the magnitude of the rise in consumption and household debt in response to a rise in house prices.¹¹

A Countercyclical Policy for the LTV Ratio

Recent international discussions have begun to examine the merits of adjusting mortgage market rules over time. For example, country authorities could change the maximum LTV ratio in a

countercyclical fashion, lowering it during housing booms and raising it when house prices are depressed.¹² One outcome of this type of policy is an increase in the resilience of the financial system since it requires borrowers to have a larger equity stake in their property during booms, thus reducing the potential losses to financial intermediaries during the bust phase when income and house prices fall. In addition, the lower LTV ratio (higher down payment) would act against the boom in the first place by reducing the extent to which borrowers could extract equity from their homes or take on more leverage to buy a bigger home.

Christensen and Meh (forthcoming) investigate the role of a time-varying maximum LTV ratio in a model based on Christensen et al. (2009).¹³ They consider the impact when the public authorities respond to a credit boom by lowering the regulatory maximum LTV ratio below its long-run setting of 80 per cent. The extent of the countercyclical response of the LTV ratio is determined by a regulatory rule that links the change in the LTV ratio to the level of mortgage credit relative to its long-run value.

Housing booms and busts are often attributed, at least in part, to an easing of mortgage-underwriting conditions. We now turn to the case in which lenders themselves supply more credit and consider how the outcome might differ if the LTV ratio was lowered in response.

Christensen and Meh (forthcoming) capture an increase in the availability of credit as an exogenous shift in the lender's perception of the quality of housing collateral. **Chart 2** illustrates the impact of a large shock, which raises the collateral value of a unit of housing by 5 per cent, when the LTV ratio is held constant at 80 per cent. With the increase in availability of debt, borrowers immediately increase their mortgage borrowing and use these funds to increase both consumption and housing expenditures. The shock produces a growth rate of mortgage debt over the first year that is roughly in line with the average annual growth of mortgage debt seen during the housing boom in the United States in 2003–06. House prices rise in response to the increased demand for housing, raising the value of housing collateral and household debt capacity.

¹⁰ In the model of Iacoviello and Neri (2010), the LTV ratio is 85 per cent. Our results are somewhat higher than the marginal propensity to consume from housing wealth for Canada of 5.7 per cent reported in Pichette (2004) and are in the upper range of estimates reported in Flood, Morin and Kolet (2008).

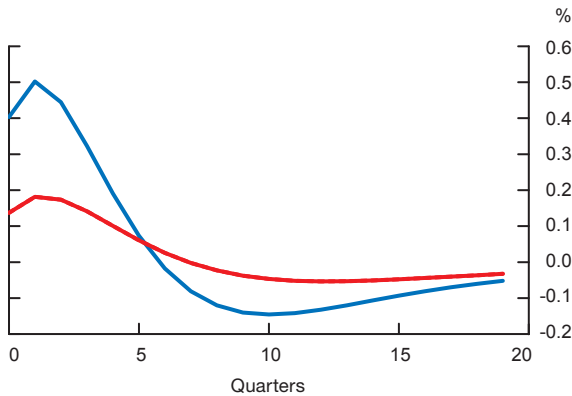
¹¹ The response of house prices to a housing-demand shock is not very sensitive to the level of the LTV ratio in this class of models. Nevertheless, the model captures important effects on quantities of changes in the LTV ratio, as can be seen from the boost to the consumption response of constrained households. Life-cycle effects and different dwelling types, both absent from this model, may be important in capturing larger effects on house prices. For example, if the LTV ratio rises, young households with increased access to credit may bid up the price of starter homes, and this could increase the wealth of others and allow them to move up the property ladder.

¹² Changing the capital-adequacy risk weights for residential mortgages is an alternative approach that has been suggested elsewhere (Borio, Furfine and Lowe 2001; Bank of England 2009).

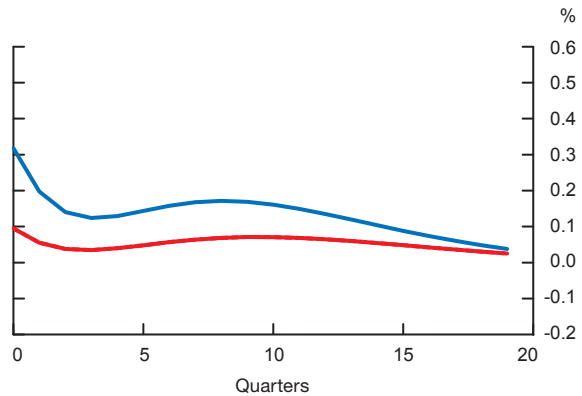
¹³ Research at other institutions has begun to consider related questions. See Kannan, Rabanal and Scott (2009); Angelini, Neri and Panetta (2011); and Lambertini, Mendicino and Punzi (2011).

Chart 2: Economic impact of a countercyclical maximum LTV ratio after an increase in the availability of credit
Deviation from steady state

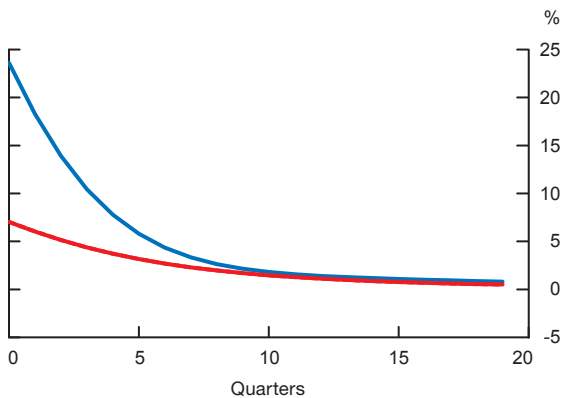
a. Consumption



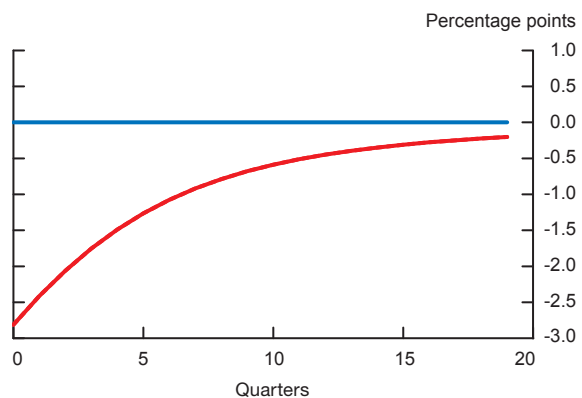
b. House prices



c. Mortgage debt



d. Loan-to-value ratio



— Countercyclical LTV ratio — Constant LTV ratio = 80%

A noteworthy feature of this shock and of the housing-demand shock is that there is little impact on consumer price inflation.¹⁴ This is similar to the U.S. situation in the 2003–06 period, when a housing boom took hold but inflation remained subdued.¹⁵ There is only a small impact on inflation because the largest effects are mainly on borrowing-constrained households (a smaller group than lenders) and the housing market (a small sector), and because households supply more labour, which offsets some of the upward pressure on the cost of production.¹⁶ The mild inflationary impact results in little response from

policy interest rates. The lack of a rise in interest rates allows mortgage borrowing and house prices to expand more strongly.

Rather than holding the maximum LTV ratios on mortgage loans constant, there is the possibility of varying the maximum LTV ratio to stem the buildup of household debt. **Chart 2** illustrates the responses to the credit-supply shock when the authorities lower the regulatory LTV ratio in response to the observed increase in mortgage credit that accompanies the shock. In this case, the drop in the maximum regulatory LTV ratio, which lasts for about 20 quarters, reduces the surge in mortgage debt by about two-thirds. The rises in house prices and consumption are reduced to about one-third of their peak response. Again, policy interest rates hardly move. In this model, the LTV ratio does not have to adjust by a large magnitude to achieve this dampening of the boom: it is lowered by about 2.8 percentage points

¹⁴ The impact would be somewhat higher if the measure of inflation in the model included the direct impact of increases in house prices, as is the case for the Canadian consumer price index.

¹⁵ In the United States, offsetting shocks—for example, from lower import prices—also played a role.

¹⁶ Households supply more labour because the extra costs of working more hours are outweighed by the benefits from the extra income that can now purchase more housing services than before.

from 80 per cent to just above 77 per cent.¹⁷ In this model, changes to the maximum LTV ratio are a more effective tool to mitigate boom-bust cycles in real estate than monetary policy because they are better targeted at the source of the volatility.

One potentially important limitation to this work is that the mortgages in these models have short maturities and are rolled over more frequently than is the case in practice. The implication is that changes in the regulatory maximum LTV ratio in the model have an impact on the entire stock of mortgages outstanding in every period. Since, in practice, those changes apply only to newly issued or refinanced mortgages, the model will overstate the impact of changes in the LTV ratio on the stock of mortgage debt, consumption and real economic activity.

Concluding Remarks

This article has focused on the role of household leverage and housing collateral in generating procyclicality in the housing market and on the potential use of the LTV ratio—both the level and countercyclical variations—to dampen this cycle. The models discussed take some important steps toward understanding the links between housing finance, financial system vulnerability and real economic activity.

¹⁷ In this model, the response of debt and house prices to the shock will rise if the long-run LTV ratio is set higher (e.g., to 95 per cent, as is the case in Chart 1). Nonetheless, a decline in the LTV ratio of 2.8 percentage points produces a similar proportional dampening of house prices and mortgage debt.

To improve our understanding of the impact of housing-finance policy on the vulnerability of the financial system, future work should seek to explicitly model the link between the mechanisms driving procyclicality and the buildup of vulnerabilities in the financial system. In addition, more explicit account should be taken of how losses at financial intermediaries result in tighter lending standards and amplify the bust phase of the cycle. Ultimately, the evaluation of macroprudential policies must consider the benefits associated with less-frequent crises or busts, as well as any detriments to long-run economic growth from higher costs of financial intermediation.

Future work should seek to explicitly model the link between the mechanisms driving procyclicality and the buildup of vulnerabilities in the financial system

In addition, many practical issues related to the implementation of countercyclical regulatory policies remain to be addressed; for example, under what circumstances should public authorities activate countercyclical policies, and how are they held accountable for achieving the objectives of these policies; which policy tools are most appropriate in a given situation; and what information should form the basis for that decision. These questions are of keen interest to policy-makers and offer fertile ground for future research.

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