CHAPTER 3

# THE CHANGING HOUSING CYCLE AND THE IMPLICATIONS FOR MONETARY POLICY

*This chapter examines how innovations in housing finance systems in advanced economies over the past two decades have altered the role of the housing sector in the business cycle and in the monetary policy transmission mechanism. It concludes that these changes have broadened the spillovers from the housing sector to the rest of the economy and have amplified their impact by strengthening the role of housing as collateral. This analysis suggests that in economies with more developed mortgage markets, monetary policymakers may need to respond more aggressively to developments in the housing sector, within a risk-management approach that treats house price dynamics as one of the key factors to be considered in assessing the balance of risks to output and inflation.*

The recent booms in house prices and residential investment in many advanced economies, and the sharp correction that has followed in a few of them, have reignited the debate over the link between housing and the business cycle and over how monetary policymakers should respond to developments in the housing sector.[1]

Despite general agreement that developments in the housing sector have important implications for the level of economic activity, there is no consensus on why this is the case. In particular, there is disagreement on the dynamics of residential investment, its consequences for the business cycle, and the impact of house price fluctuations on consumer spending.

Note: The main authors of this chapter are Roberto Cardarelli (team leader), Deniz Igan, and Alessandro Rebucci, with support from Gavin Asdorian and Stephanie Denis and under the supervision of Tim Lane. Tommaso Monacelli and Luca Sala provided consultancy support.

[1]See papers presented at "Housing, Housing Finance, and Monetary Policy," Federal Reserve Bank of Kansas City 31st Economic Policy Symposium, Jackson Hole, Wyoming (August 31–September 1, 2007). www.kc.frb.org/publicat/sympos/2007/sym07prg.htm.

Dramatic changes in the systems of housing finance over the past two decades have only increased the uncertainty about the link between housing and economic activity. What is clear is that more widely available and lower-cost housing financing has contributed to the rapid growth of mortgage debt in a number of countries—including among households with impaired or insufficient credit histories, typically referred to as subprime borrowers. What is less clear is whether these changes have weakened the link between housing and the business cycle.

Some authors advanced the hypothesis that these changes have weakened the link between housing and the business cycle—for example, easier access to credit allows households to better smooth temporary downturns in income (Dynan, Elmendorf, and Sichel, 2006). Indeed, the economies that better weathered the cyclical downturn in the early 2000s—such as the United States and the United Kingdom—were those with stronger housing sector performance. With house prices and residential investment softening in a number of countries, however, there is concern that innovations in housing finance may amplify the impact of spillovers from the housing sector to the wider economy.

Against this background, this chapter investigates whether changes in housing finance systems over the past two decades have altered the links between the housing sector and economic activity, and it explores the implications for the conduct of monetary policy. In particular, this chapter addresses the following questions: Has there been a change in the housing sector's contribution to the business cycle in advanced economies over the past two decades? Are cross-country differences in the role of the housing sector in the business cycle related to the institutional characteristics of national mortgage markets? Is there a need for monetary policymakers

to change how they respond to developments in the housing sector?

There is a substantial literature on the housing cycle; the main contribution of this chapter is twofold. First, it takes a broad cross-country perspective, rather than focusing on a single or a few countries. Second, it uses a methodology that formally identifies the housing sector as both a source of volatility and a channel through which other shocks are transmitted to the broader economy.

The main conclusion of this analysis is that changes in housing finance systems have affected the role played by the housing sector in the business cycle in two different ways. First, the increased use of homes as collateral has amplified the impact of housing sector activity on the rest of the economy by strengthening the positive effect of rising house prices on consumption via increased household borrowing—the "financial accelerator" effect. Second, monetary policy is now transmitted more through the price of homes than through residential investment. In particular, the evidence suggests that more flexible and competitive mortgage markets have amplified the impact of monetary policy on house prices and thus, ultimately, on consumer spending and output. Furthermore, easy monetary policy seems to have contributed to the recent run-up in house prices and residential investment in the United States, although its effect was probably magnified by the loosening of lending standards and by excessive risk-taking by lenders.

This chapter also offers two intuitions on how monetary policy should take into account the changing nature of the housing cycle and the new characteristics of mortgage markets. First, because its impact is greater in economies with more developed mortgage markets, monetary policy may need to be more aggressively responsive to unexpected developments in the housing sector and mortgage markets in these economies. Second, economic stabilization could be enhanced in economies with more developed mortgage markets by a monetary policy approach that responds to house price inflation in addition to consumer price inflation and the output gap.

These suggestions, however, do not constitute a recommendation that house price objectives should have a dominant role in the conduct of monetary policy. Given the uncertainty surrounding both the shocks hitting the economy and the effects of interest rates on asset price bubbles, house prices should rather be considered one of the many factors that affect the balance of risks to the economic outlook, albeit an essential one for central banks taking a risk-management approach to monetary policy. Paying increased attention to house price developments does not require any change to the formal mandates of major central banks, but rather could be achieved by interpreting existing mandates in a flexible manner, for instance by extending the time horizon for inflation and output targets.

## Developments in Housing Finance

Over the past 30 years, there have been profound changes in the housing finance systems in many advanced economies. Until the 1980s, mortgage markets in general were highly regulated. Mortgage lending was dominated by specialized lenders, who faced limited competition in segmented markets—typically, depository institutions such as savings and loan associations in the United States and building societies in the United Kingdom. Regulations set interest rate ceilings and quantitative limits on mortgage credit and repayment periods. These regulations resulted in chronic or temporary credit rationing in the mortgage market and made it difficult for households to access mortgage credit (Girouard and Blöndal, 2001).

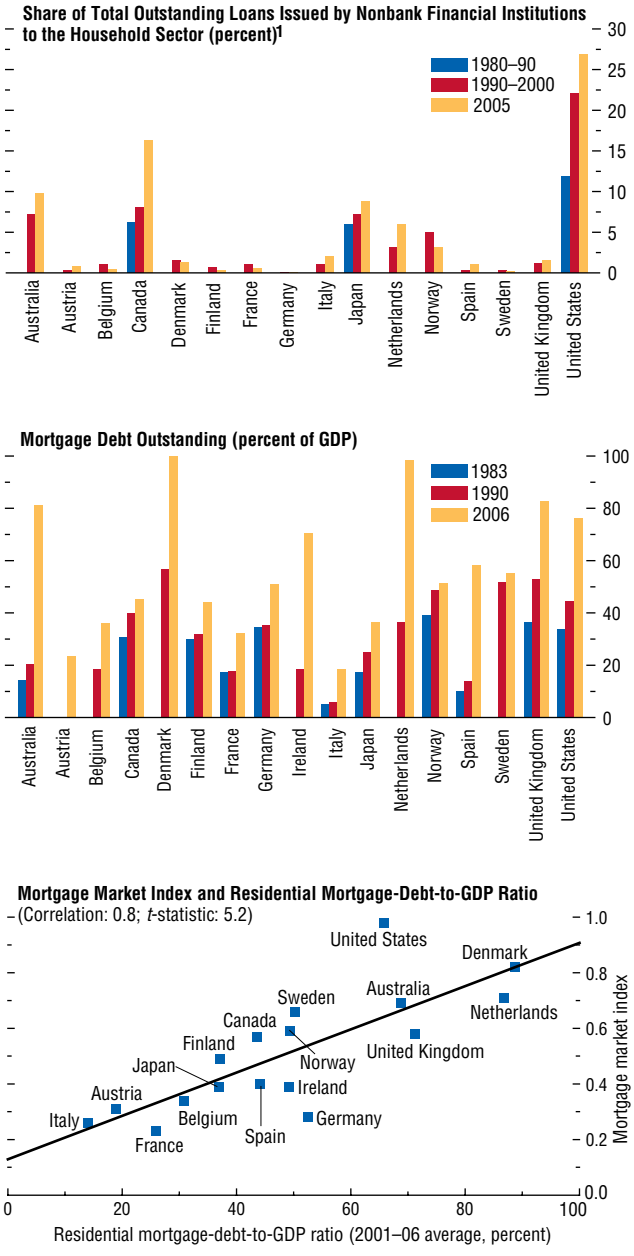
Deregulation of mortgage markets, which began in the early 1980s in many advanced economies, introduced competitive pressures from nontraditional lenders. The result was more responsive pricing and an extended range of services, which broadened households' access to mortgage credit. The process of deregulation, however, took different forms in various countries (Diamond and Lea, 1992).

In the United States, the deregulation of housing finance markets coincided with the phasing out of interest rate controls under Regulation Q in the early 1980s (Green and Wachter, 2007). At the same time, the development of a secondary mortgage market greatly facilitated the funding of mortgage lending via capital markets. Together, these prompted a broad range of banks and other financial institutions to enter the mortgage market. In the United Kingdom, deregulation occurred mainly through the abolition of credit controls ("the corset" was abolished in 1980), which heightened competitive pressures in the mortgage market. In Canada, Australia, and the Nordic countries, deregulation of housing financial markets was also relatively rapid and almost completed by the mid-1980s. In all these countries, the lifting of lending and deposit rate ceilings and of credit controls in the early 1980s opened the way to more competition in new segments of the credit market. In the United States, Canada, and Australia, the share of the total household sector's outstanding loans issued by nonbanking financial institutions had doubled by 2005 compared with the 1980s (Figure 3.1, upper panel). This shift was accompanied by the introduction of new mortgage instruments and easier lending policies, and all these changes contributed to the rapid growth of mortgage credit in these countries (Figure 3.1, middle panel).

By contrast, in some continental European countries and in Japan, the reform process was slower and/or less comprehensive. To be sure, restrictions on interest rates were gradually removed and barriers to entry into mortgage markets were eased in Germany, France, and Italy. However, public sector financial institutions continued to dominate the residential mortgage market in these countries, and this constrained the forces of competition: on average in these countries, nonbank financial institutions accounted for about 1 percent of total outstanding loans to the household sector in 2005 (up only slightly from the mid-1990s), compared with about 30 percent in

## Figure 3.1. Mortgage Debt and Financial Innovation

Countries that experienced faster and deeper innovations in mortgage markets (the United States, the United Kingdom, Canada, Australia, and the Nordic countries) tend to have higher shares of household loans from nonbank financial institutions and a higher stock of mortgage debt as a ratio to GDP.




Sources: National accounts; European Mortgage Federation, Hypostat Statistical Tables; Federal Reserve; OECD Analytical Database; Statistics Canada; and IMF staff calculations.

[1]Calculations based on national accounts data. See Chapter 4 of the September 2006 *World Economic Outlook* for an explanation of the methodology used.

the United States. In Japan, interest rate and credit controls began to be removed in the early 1980s, but the process was not completed until the mid-1990s. Mortgage credit did not rise as quickly in the countries that were slower to deregulate their mortgage markets as it did in the previous set of countries (see Figure 3.1, middle panel).

Following the deregulation of mortgage markets, advanced economies all moved toward more competitive housing finance models—in which households have easier access to housing-related credit, thanks to the increased diversity of funding sources, lender types, and loan products. Despite these common patterns, there remain significant cross-country differences in mortgage contracts, which reflect the uneven rates and extent of mortgage market liberalization as well as differences in legal procedures and regulatory structures.[2]

Households' access to housing-related financing depends on certain key institutional features of the mortgage markets:

- The typical loan-to-value (LTV) ratio (the ratio of a mortgage loan to the property's value) and the standard length of mortgage loans: High LTV ratios allow borrowers to take out more debt, whereas longer repayment terms keep debt-service-to-income ratios affordable.
- The ability to make home equity withdrawals and to prepay mortgages without fees: The capacity to borrow against accumulated home equity allows households to tap their housing wealth directly and to borrow more when house prices increase. Early repayment fees constrain households' ability to refinance their mortgage debt in the event interest rates decline.
- Development of secondary markets for mortgage loans: The more developed the secondary markets for mortgage loans, the easier it should be for lenders to tap funding via capital markets and, all else being equal, to provide credit to households.

In order to summarize cross-country differences along all these dimensions, a synthetic index of mortgage market development is constructed as a simple average of these five indicators. The index lies between 0 and 1, with higher values indicating easier household access to mortgage credit. The results, shown in Table 3.1, indicate that significant differences remain in the institutional features of mortgage markets across the advanced economies considered in this chapter—differences that may help explain the large inequality in the stock of household mortgage debt (see Figure 3.1, lower panel).[3]

Among these countries, the United States, Denmark, Australia, Sweden, and the Netherlands appear to have the most flexible and "complete" mortgage markets. In these countries, typical LTV ratios are about 80 percent, the standard term of a mortgage is 30 years, mortgage products specifically designed for equity withdrawal are widely marketed, and standard loans include an option to prepay without compensating the lender for capital or market value losses. Moreover, in these countries, financial markets are relatively more important as a source of funding for mortgage lending. For instance, about 60 percent of mortgages were securitized in the United States at end-2004, compared with about 15 percent in the EU-15 (see BIS, 2006). The fact that countries in continental Europe rank at the lower end suggests that mortgage markets in these countries provide more limited access to financing.

[2]A crucial factor are the legal protections for collateral. In countries where lenders face high administrative costs and long periods of time in order to realize the value of their collateral in the event of default, they are less likely to make larger loans relative to the value of the property and to lend to higher-risk borrowers.

[3]For "mortgage equity withdrawal" and "refinancing (fee-free prepayment)," values of 0, 0.5, and 1 are assigned to each country depending on whether mortgage equity withdrawal and free prepayment are nonexistent, limited, or widespread, respectively. For the other four variables in Table 3.1, each county is assigned a value between 0 and 1, equal to the ratio to the maximum value across all countries.

**Table 3.1. Institutional Differences in National Mortgage Markets and the Mortgage Market Index**

| | Mortgage Equity Withdrawal[1] | Refinancing (fee-free prepayment)[1] | Typical Loan-to-Value Ratio (percent)[1] | Average Typical Term (years)[1] | Covered Bond Issues (percent of residential loans outstanding)[2] | Mortgage-Backed Security Issues (percent of residential loans outstanding)[2] | Mortgage Market Index[3] |
|---|---|---|---|---|---|---|---|
| Australia | Yes | Limited | 80 | 25 | — | 7.9 | 0.69 |
| Austria | No | No | 60 | 25 | 2.2 | — | 0.31 |
| Belgium | No | No | 83 | 20 | — | 1.9 | 0.34 |
| Canada | Yes | No | 75 | 25 | — | 3.6 | 0.57 |
| Denmark | Yes | Yes | 80 | 30 | 58.5 | 0.1 | 0.82 |
| Finland | Yes | No | 75 | 17 | 2.6 | — | 0.49 |
| France | No | No | 75 | 15 | 1.6 | 1.0 | 0.23 |
| Germany | No | No | 70 | 25 | 3.6 | 0.2 | 0.28 |
| Greece | No | No | 75 | 17 | — | 6.2 | 0.35 |
| Ireland | Limited | No | 70 | 20 | 4.0 | 6.6 | 0.39 |
| Italy | No | No | 50 | 15 | — | 4.7 | 0.26 |
| Japan | No | No | 80 | 25 | — | 4.7 | 0.39 |
| Netherlands | Yes | Yes | 90 | 30 | 0.7 | 4.6 | 0.71 |
| Norway | Yes | No | 70 | 17 | — | — | 0.59 |
| Spain | Limited | No | 70 | 20 | 11.1 | 5.7 | 0.40 |
| Sweden | Yes | Yes | 80 | 25 | 10.1 | 0.9 | 0.66 |
| United Kingdom | Yes | Limited | 75 | 25 | 0.9 | 6.4 | 0.58 |
| United States | Yes | Yes | 80 | 30 | — | 20.1 | 0.98 |

[1]Sources: European Central Bank (2003); Catte and others (2004); Calza, Monacelli, and Stracca (2007).
[2]Average 2003–06. Sources: European Mortgage Federation, Hypostat 2006; Bond Market Association and Federal Reserve for the United States; Dominion Bond Rating Services and Statistics Canada for Canada; Australia Securitization Forum and Reserve Bank of Australia for Australia; FinanceAsia.com and Bank of Japan for Japan.
[3]See text footnote 3 for an explanation of how this index is obtained.

## The Housing Sector and the Business Cycle

Some key aspects of the role of the housing sector in the economic cycle of advanced economies have been well established.[4]

- Movements in real house prices have been closely correlated with the economic cycle. As shown in Figure 3.2, however, real house price movements tend to lag cyclical peaks and troughs—generally by one or two quarters, but with some longer lags in some cases (six quarters in Canada, Sweden, Germany, and Italy).[5]
- For several economies, there is a clear connection between aggregate economic activity and residential investment. First, residential investment has led the business cycle in several countries, with some exceptions in the euro area (Germany, Italy, and Finland) and the Nordic countries (Sweden and Norway) (see Figure 3.2). Moreover, in some countries—the United States, Ireland, the United Kingdom, Denmark, and the Netherlands—residential investment has added significantly to weakness in the economy on the path to recession (Table 3.2).[6] On average across cycles and countries, residential investment accounted for 10 percent of the weakness in GDP growth a year before the recession, with a peak of 25 percent for the United States (see Leamer, 2007).

[4]The stylized facts presented in this section are for 18 countries: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Netherlands, Norway, Spain, Sweden, United Kingdom, and United States. See Appendix 1 for a description of the data. See, among others, Case (2000); Girouard and Blöndal (2001); Catte and others (2004); European Commission (2005); European Central Bank (2003); and April 2003 and September 2004 *World Economic Outlook*.

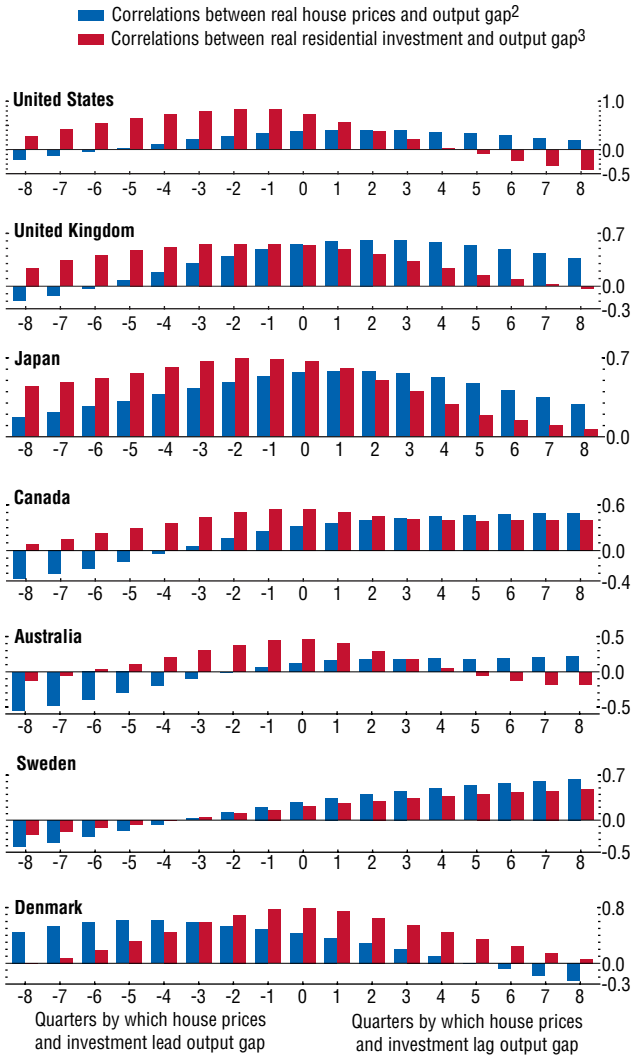
[5]The April 2003 *World Economic Outlook* analyzed the macroeconomic impact of boom-bust housing cycles and showed that housing busts have typically been followed by prolonged periods of very low growth.

[6]To analyze the contributions of residential investment and other GDP components to output fluctuations, the same methodology used by Leamer (2007) is adopted here. See Appendix 1 for further details on Table 3.2.

### Figure 3.2. Correlation of Real House Prices and Real Residential Investment with the Output Gap[1]

*(X-axis in quarters)*

In most countries, real house prices tend to lag the business cycle. Residential investment generally tends to lead the business cycle, with some exceptions in the euro area and Nordic countries.




Source: IMF staff calculations.

[1]Real house prices and real residential investment are expressed as deviations from a log-linear trend.

[2]Correlations between output gap at $t = 0$ and real house prices at $t = -8...+8$. For example, a positive correlation at $t = 2$ means house prices lag output gap by two quarters.

[3]Correlations between output gap at $t = 0$ and real residential investment at $t = -8...+8$. For example, a positive correlation at $t = -2$ means residential investment leads output gap by two quarters.

Some studies note, however, that the link between the housing sector and the business cycle appears to have weakened over the past decade. Indeed, with the exception of the euro area countries, housing was a major source of strength over the economic downturn at the beginning of the 2000s. In the United States, for example, the cyclical downturn experienced in 2001 was unusual in that housing investment contributed only mildly to the weakness of GDP before the recession, compared with previous episodes (see Table 3.2). Moreover, in the current housing downturn, a few countries have so far been able to withstand a sharp reversal of the previous housing boom without going into recession. In particular, in the United States, Ireland, Sweden, Finland, Norway, and Canada, the contribution of residential investment to the weakness of GDP growth over the past year has been much larger than during the typical year before a recession over the past three decades (see Table 3.2).[7]

Does this mean that the role of the housing sector in the business cycle has changed? In addressing this question, two factors need to be taken into account. First, recent housing cycles have been unusual in several respects, including in their duration and amplitude. Across the countries considered here, the recent run-up in house prices has lasted on average about twice as long and has been three times stronger than previously (Table 3.3). Second, despite the higher-than-usual synchronization of the housing cycles across countries (see September 2004 *World Economic Outlook*), developments in the housing sector have differed considerably across the set of countries here. House price growth has been particularly strong in Australia, Ireland, the Netherlands, Spain, and the United Kingdom, followed by the United States and some of the Nordic countries. At the other end of the spectrum are Germany and Japan,

[7]All recessions in the United States over the past 35 years, except the recession of the late 1970s, were preceded by a slowdown in residential investment of intensity at least equal to the one experienced since mid-2006.

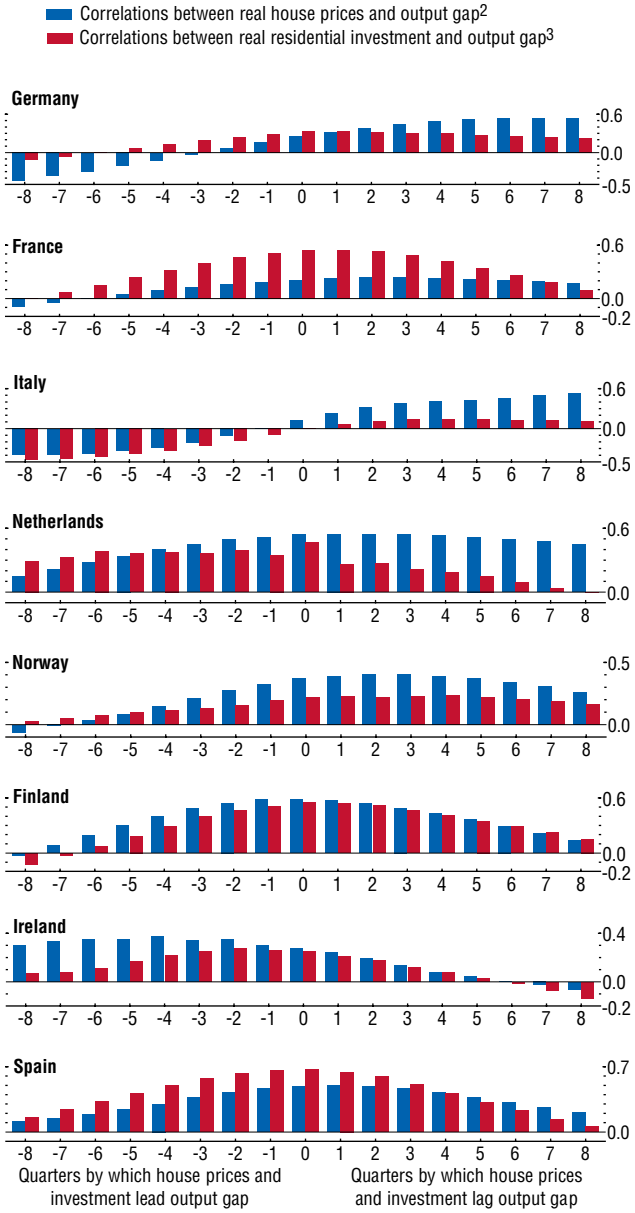
where prices have remained rather flat or have even declined over the past decade. The current housing sector slowdown also differs widely across countries, as do the prospects for further adjustment (Box 3.1).

These cross-country differences remind us that the dynamics of the housing sector and its link with economic activity can vary substantially depending on the many local factors that affect the supply and demand of housing. For example, in countries with more flexible labor markets and more labor-intensive construction sectors, changes in demand can lead to stronger responses in both housing supply and construction employment, and ultimately can have a larger effect on economic activity. The United States scores high in indices of both labor market flexibility and the labor intensity of the construction sector, which may explain why a weakening of U.S. residential investment is such an important leading indicator of cyclical downturns (Figure 3.3).[8] By contrast, in countries with higher constraints on supply, the housing cycle may involve changes in house price levels more than in construction levels, with possible implications for household wealth and consumer spending.

The characteristics and structure of mortgage markets also play a key role in forging links between housing markets and the business cycle. Indeed, some authors argue that financial deepening over the past two decades may have led to a decoupling of the housing sector from both investment and consumer spending (see Dynan, Elmendorf, and Sichel, 2006; and Campbell and Hercowitz, 2005). Others note that the increased integration of housing finance with capital markets has reduced the interest rate elasticity of residential investment. Together with more stable and predictable monetary policy, this may have reduced the macroeconomic importance

[8]Other local structural factors that are likely to have a role in amplifying or dampening the effects of macroeconomic shocks on the housing sector include land availability, local planning systems, and local taxes on housing (see European Central Bank, 2003).

## Figure 3.2 *(concluded)*[1]




Source: IMF staff calculations.
[1]Real house prices and real residential investment are expressed as deviations from a log-linear trend.
[2]Correlations between output gap at $t = 0$ and real house prices at $t = -8...+8$. For example, a positive correlation at $t = 2$ means house prices lag output gap by two quarters.
[3]Correlations between output gap at $t = 0$ and real residential investment at $t = -8...+8$. For example, a positive correlation at $t = -2$ means residential investment leads output gap by two quarters.

**Table 3.2. Abnormal Contributions to GDP Growth Weakness One Year before Recessions**
*(Percent)*[1]

| | Average for All Recessions since 1970 | | | | | | | | Private Residential Investment | |
|---|---|---|---|---|---|---|---|---|---|---|
| | GDP abnormal cumulative decline (in percentage points) | Consumption | | Investment | | | | Net exports | Last recession (after 1995)[2] | Most recent four quarters |
| | | Public | Private | Public | Private residential | Private non-residential | Inventories | | | |
| | | *(relative contributions—sum equals 100)* | | | | | | | | |
| United States | –2.6 | 1 | 41 | 3 | 25 | 10 | 8 | 12 | 18 | 56 |
| United Kingdom | –2.2 | 8 | 16 | 3 | 13 | 2 | 13 | 45 | — | 0 |
| Japan | –1.7 | 9 | 16 | 35 | 7 | 3 | 3 | 27 | 0 | 0 |
| Germany | –3.3 | 1 | 9 | 4 | 6 | 8 | 22 | 51 | 10 | 0 |
| France | –1.5 | 11 | 13 | 4 | 10 | 14 | 6 | 42 | 4 | 5 |
| Italy | –1.8 | 13 | 20 | 7 | 8 | 7 | 18 | 28 | 0 | 0 |
| Netherlands | –2.6 | 2 | 18 | 3 | 16 | 11 | 18 | 32 | 7 | 0 |
| Canada | –2.7 | 9 | 20 | 2 | 8 | 3 | 5 | 53 | 0 | 9 |
| Norway | –6.4 | 1 | 14 | 1 | 5 | 21 | 35 | 24 | 15 | 28 |
| Australia | –1.7 | 15 | 0 | 6 | 6 | 0 | 15 | 58 | — | 0 |
| Sweden | –2.5 | 14 | 13 | 10 | 9 | 7 | 9 | 39 | — | 49 |
| Spain | –2.0 | 5 | 22 | 18 | 11 | 2 | 15 | 28 | — | 0 |
| Ireland | –5.7 | 0 | 33 | 3 | 20 | 15 | 3 | 26 | — | 22 |
| Denmark | –3.1 | 8 | 20 | 4 | 16 | 13 | 2 | 37 | — | 0 |
| Finland | –4.8 | 0 | 28 | 1 | 0 | 9 | 0 | 63 | — | 2 |

[1]See Appendix 3.1 for an explanation of the methodology used to calculate the abnormal cumulative contributions to GDP growth weakness before recessions.

[2]Recession timing is as follows: United States: 2001:Q1–2001:Q4; France: 2002:Q3–2003:Q2; Germany: 2002:Q3–2003:Q2; Italy: 2002:Q4–2003:Q2; Netherlands: 2002:Q3–2003:Q2; Norway: 2002:Q2–2003:Q1; Japan: 2001:Q1–2002:Q1. These dates were obtained by updating the April 2002 *World Economic Outlook*.

of the transmission of monetary policy shocks through the housing sector (Bernanke, 2007).[9]

## Housing Finance and Spillovers from Housing

The importance of home values as a share of household total wealth suggests that fluctuations in house prices may affect consumer spending through wealth effects. Such effects are complicated, however, because housing has a dual role both as a real asset and as a necessary outlay (a good that produces housing services). As a result, an increase in house prices redistributes wealth within the household sector, rather than boosting net aggregate wealth.[10] Looked at this way, the cyclical impact of house prices on consumer spending reflects the important role of housing as collateral: increases in house prices may raise the value of the collateral available to households, loosen borrowing constraints, and support spending. This effect might be especially strong if income expectations rise at the same time as house prices, giving households an opportunity to borrow against that higher expected income.[11]

Two pieces of cross-country evidence support the hypothesis that the influence of house prices

[9]Several authors link the decline in the volatility of output and inflation since the early 1980s to improvements in monetary policy (see October 2007 *World Economic Outlook*).

[10]Increases in house prices primarily redistribute wealth from those who intend to consume more housing services in the future toward those who intend to consume fewer. Because the household sector as a whole is not necessarily made better off by a higher level of house prices, the effect on consumption of higher house prices should be around zero in the long term—but in the short term, a significant net effect would be expected if marginal propensities to consume are substantially different among various groups of households (see Mishkin, 2007; and Muellbauer, 2007).

[11]Both theory and evidence indicate a strong link among income expectations, house price developments, and spending in a range of countries (Benito and others, 2006).

### Table 3.3. Features of House Price Cycles[1]

| | Duration (quarters) | Amplitude (in percent) |
|---|---|---|
| Upturns | 26 | 39.2 |
| Downturns | 17 | 20.4 |
| Recent upturn | 59 | 116.6 |

[1]Table shows averages across countries. It uses quarterly data for real house prices in the 19 Organization for Economic Cooperation and Development economies considered in the chapter for the period 1970–2007. A peak (trough) is identified as the local high point (low point) in real house prices. If two local peaks are within eight quarters of one another in a particular country, the more extreme of the two is selected.

on household spending stems mainly from housing's role as collateral:

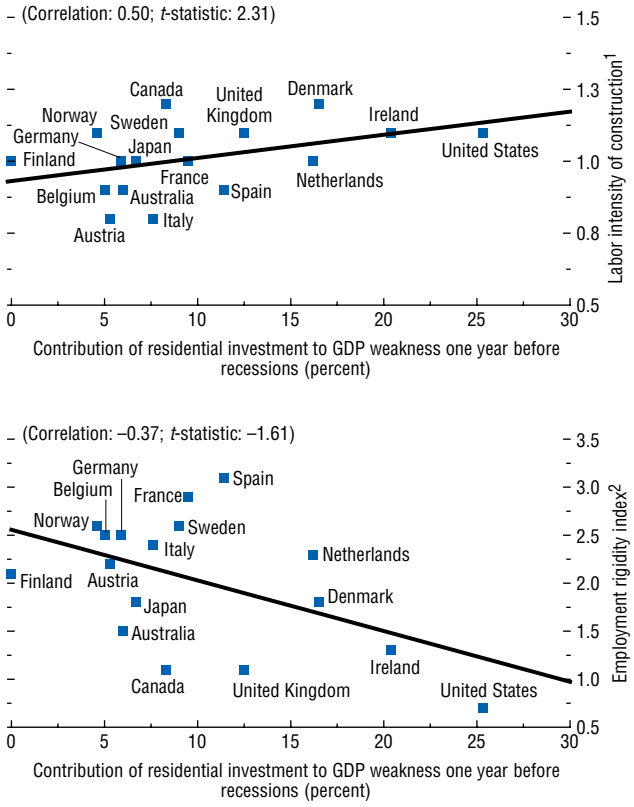
- The correlation between consumption and house prices at business cycle frequencies is stronger in economies with higher values of the mortgage index (Figure 3.4, upper panel).
- The coefficients relating consumer spending to housing wealth in an econometric (error-correction) model for consumption are greater for countries with higher values of the mortgage index (Figure 3.4, lower panel).

Changes in housing finance systems over the past two decades may have increased the potential scope for collateral effects from rising house prices. In principle, however, the resulting impact on consumption and output volatility is ambiguous, because two countervailing effects may be at work. First, households' ability to smooth consumption in the face of adverse shocks to their income may be enhanced through more ready access to financing collateralized by home equity (Dynan, Elmendorf, and Sichel, 2006). Second, macroeconomic fluctuations may be amplified by endogenous variations in collateral constraints tied to real estate values—the financial accelerator analyzed by Kiyotaki and Moore (1997); Bernanke and Gertler (1995); Bernanke and Gilchrist (1999); and Iacoviello (2005).

Although the potential for housing finance to smooth consumption is relevant, it may not fully apply to all households (Dynan and Kohn, 2007). Many households that experience income shortfalls will be unable to borrow to smooth

### Figure 3.3. Labor Market Characteristics and the Contribution of Residential Investment to the Business Cycle

The contribution of residential investment to GDP weakness before recessions is larger in economies with lower rigidity in the labor market and a higher share of labor in the construction sector.



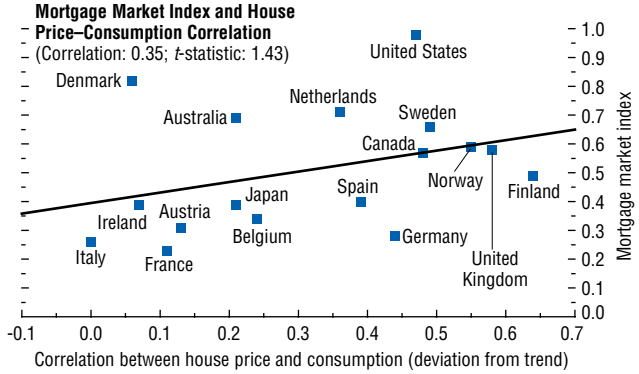

Sources: UNIDO, Industrial Statistics Database; and IMF staff calculations.
[1]Labor intensity of construction is the average over 1979–2005 of the labor share of income in the construction sector relative to the average across countries.
[2]Employment Protection Legislation Index from OECD (2004).

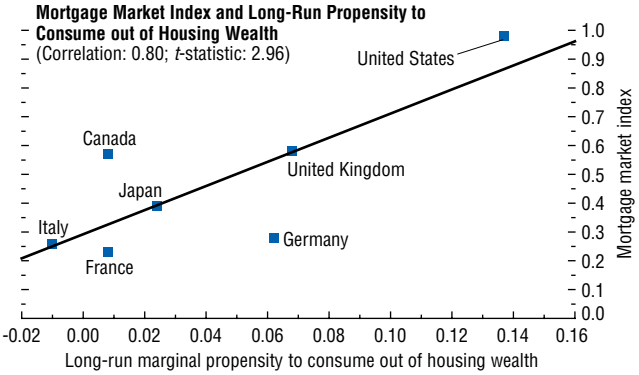
consumption, even in economies with more flexible mortgage markets. And, if income falls short of expectations at the same time that house prices weaken, some households may need to scale down their spending plans sharply. Furthermore, as illustrated by recent developments among subprime mortgage borrowers in the United States, easier access to housing-related credit may have weakened an important form of discipline on borrowing behavior for some households. The excessive accumulation of debt may mean that for some households an adverse shock to income may bring financial distress and thereby amplify rather than smooth the response of consumption to income (Debelle, 2004). Finally, for consumers who are credit-constrained even when home equity finance is available, innovations that facilitate borrowing against rising home values are likely to increase their consumption response to various economic shocks—consistent with the financial accelerator.[12]

Has there been a change over time in the role of the housing sector in accounting for output fluctuations, and has this varied across countries? To examine these questions more systematically, a vector autoregression (VAR) model for real house prices, residential investment, and other key macroeconomic and monetary policy variables is estimated separately for 18 countries, using quarterly data for the period from 1970 (or the first year for which data are available) to

## Figure 3.4. Mortgage Market Index, Consumption and House Price Correlation, and the Long-Run Marginal Propensity to Consume out of Housing Wealth

The link between private consumption and housing wealth is stronger in economies with more developed mortgage markets.




Source: IMF staff calculations.

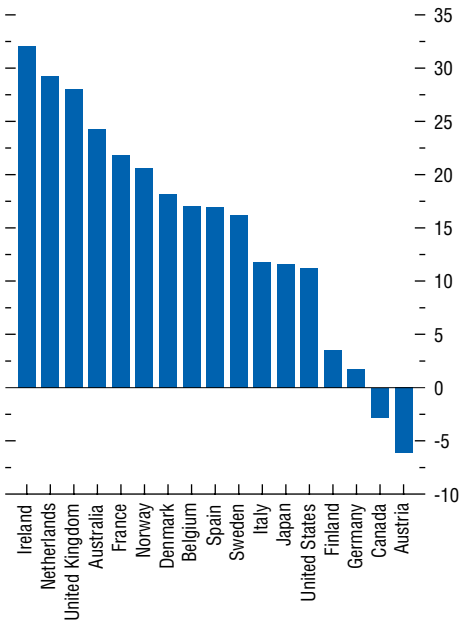
[12]In the general equilibrium model using housing as collateral that is introduced later in this chapter, such credit-constrained behavior is captured by positing "impatient" households, which have a preference for current consumption rather than consumption smoothing (see also Iacoviello, 2005; and Monacelli, 2008). For example, as house prices increase or interest rates decrease, impatient consumers will desire to raise the amount of their mortgage loans against the greater value of their collateral or to refinance their mortgages and use the additional funds for a variety of purposes—such as consumption, purchase of financial assets, or home improvements. Indeed, housing equity withdrawal seems to have boosted both consumption and residential investment (home improvements) in countries where this product has been prevalent over the past decade (Klyuev and Mills, 2006).

## Box 3.1. Assessing Vulnerabilities to Housing Market Corrections

Following a long and pronounced housing boom, several advanced economies have recently experienced symptoms of a cooling housing market (see Figure 1.6, lower panels). In real terms, house price growth has decelerated in many countries, and in a few of them—including the United States, Ireland, and Denmark—real house prices have fallen over the past year. As a share of GDP, real residential investment also has declined in several countries over the recent past, particularly in Australia, the United States, and especially Ireland, where it has fallen by about 3½ percentage points of GDP since its peak over the past five years.

Which countries are most likely to experience a further slowdown in housing prices and residential investment? In this box, the vulnerability to a housing market correction is assessed based on two different indicators: first, the extent to which the increase in house prices in recent years cannot be explained by fundamentals, and second, the size of the increase in the residential investment-to-GDP ratio experienced during the past 10 years.

**House Price Gaps**
*(Percent)*




Source: IMF staff calculations.

### *Assessing Overvaluation in House Prices*

For each country, house price growth is modeled as a function of an affordability ratio (the lagged ratio of house prices to disposable incomes), growth in disposable income per capita, short-term interest rates, long-term interest rates, credit growth, and changes in equity prices and working-age population.[1] The unexplained increase in house prices (defined as the "house price gap") might reflect variables omitted from the model—for instance, macroeconomic volatility, household formation, and inward immigration—but could also be interpreted as a measure of overvaluation and, therefore, used to identify which countries may be particularly prone to a correction in house prices.

The first figure shows the percent increase in house prices during the period 1997 to 2007 that is not accounted for by the fundamental drivers of house prices. The countries that experienced the largest unexplained increases in house prices were Ireland, the Netherlands, and the United Kingdom—by the end of the decade, house prices in these countries were about 30 percent higher than justified by fundamentals. A group of other countries, including France, Australia, and Spain, have house price gaps of about 20 percent. Based on this measure, the United States is among the middle-ranked countries in terms of vulnerability to a housing correction, partly reflecting the fact that U.S. house prices have already declined (as measured by the U.S.

Note: The main author of this box is Roberto Cardarelli. Gavin Asdorian provided research assistance.

[1]This updates a similar exercise presented in the October 2007 *World Economic Outlook*.

## Box 3.1 *(continued)*

Office of Federal Housing Enterprise Oversight, OFHEO, in the third quarter of 2007 real house prices were 2¼ percent lower than their peak at end-2006).

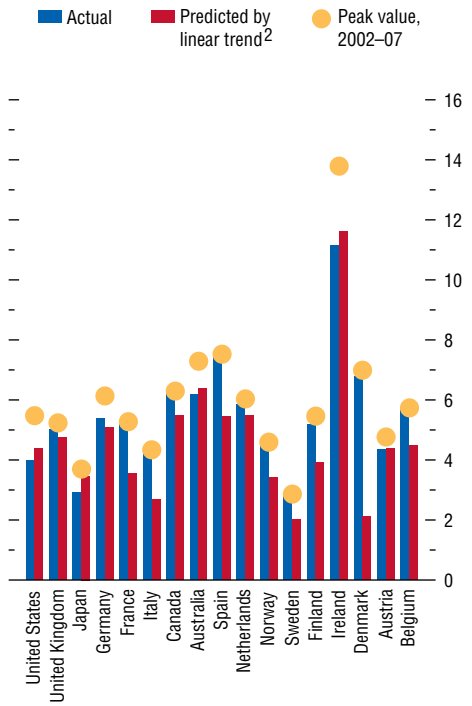
Clearly, although a significant house price gap might be expected to be corrected over time, a decline in nominal house prices is only one way for this adjustment to occur. Moderate inflation and support from the fundamental variables driving real house prices may also help close the gap over time. At the same time, negative changes in some of these fundamentals could increase the gap and require an even larger adjustment of house prices. In particular, downward revisions to income expectations and tighter credit conditions may put additional downward pressure on house prices.

### *Residential Investment*

The ratio of residential investment to total output is a measure of the direct exposure of the economy to a weakening housing market. Residential investment, however, does not normally account for a very large share of the economy. Some notable exceptions are Ireland and Spain, where at the end of 2007 residential investment accounted for 12 and 9 percent of GDP, respectively, against an average for advanced economies of about 6½ percent (second figure). The relatively low GDP share of housing construction helps explain why the average contribution of residential investment to economic growth for the advanced economies over the past three decades has been rather low, at about 5 percent.

Still, very large corrections in housing construction may have a nonnegligible impact on economic growth. In the United States, for example, the 1½ percentage points of GDP decline in real residential investment since late 2005 lowered GDP growth by ¾ percent in both 2006 and 2007. Furthermore, as discussed in this chapter, residential investment appears to lead the business cycle in many advanced economies, and a softening of housing construction may be an important factor leading to a cyclical downturn.

**Real Residential Investment-to-GDP Ratio, Most Recent Quarter[1]**
*(Percent)*



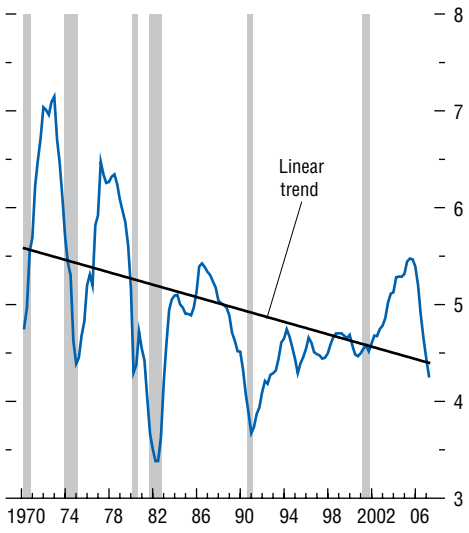

Source: IMF staff calculations.
[1]2007:Q2 data used for Belgium, Germany, Ireland, Netherlands, New Zealand, and United Kingdom. All other countries are 2007:Q3 data.
[2]Linear trend of real residential investment calculated from 1970:Q2 to most recent quarter available.

For these reasons, it may be of interest to assess the exposure of advanced economies to a softening in residential investment. Two pieces of evidence can be used to gauge a country's vulnerability to a decline in housing construction.

First, the residential investment-to-GDP ratio appeared to be significantly above the historical trend in several economies at the end of 2007, especially Spain and Denmark, but also France, Italy, Finland, and Belgium (by about ¾ percentage point of GDP for the euro area) (see second

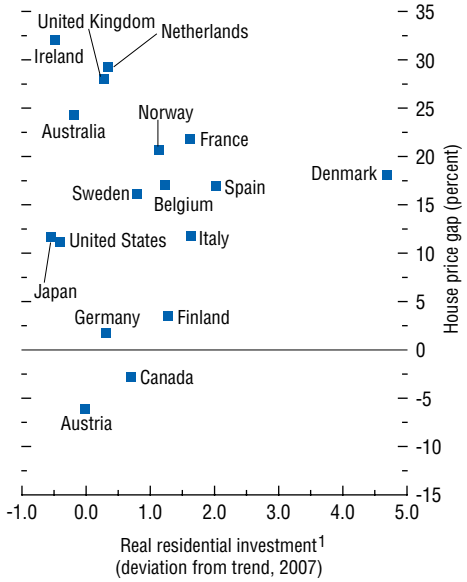
**United States: Real Residential Investment-to-GDP Ratio**

*(Percent; shaded areas represent U.S. recessions)*




Source: IMF staff calculations.

**House Price Gaps and Real Residential Investment**




Source: IMF staff calculations.

[1] Deviation of real residential investment from trend is calculated as the difference between actual investment (in percent of GDP for the most recent quarter available) and investment predicted by a linear trend beginning in 1970:Q2.

figure). In other economies, the residential investment-to-GDP ratio at mid- or end-2007 seems close to, or even below, the historical trend. In particular, the decline in residential investment since early 2006 seems to have taken the ratio back to trend in Ireland, the United States, and Australia. However, this does not mean that residential investment will not experience a further decline in these countries. As demand for housing cools and inventories build, a below-trend residential investment ratio may be necessary to bring the stock of housing back down to desired levels. Indeed, on average over the past three decades, cyclical downturns in the United States have seen residential investment falling by about 1 percentage point of GDP below trend (with a maximum of 2 percentage points in the recession of the early 1980s) (third figure). Hence, based on historical evidence and the still-high inventories of unsold homes, residential investment in the United States could decline by another ½ to 1 percentage point of GDP in the coming quarters.

Second, there seems to be a positive association between the increase in residential investment over the past decade and the extent of house price overvaluation (fourth figure). This suggests that countries that experienced the greatest exuberance in house prices also saw the largest acceleration in residential investment, as the supply of housing responded to the price signal. Residential investment in these countries thus may be more exposed to a further correction of house prices, consistent with fundamentals. Based on this approach, Denmark, Spain, and France appear to be the most vulnerable economies, whereas the United Kingdom and the Netherlands seem to be less at risk, because

**Box 3.1 *(concluded)***

they have not experienced as pronounced an increase in residential investment over the past decade despite the strong increases in house prices.

***Conclusions***

Many advanced economies have experienced a remarkably large and long-lasting run-up in their national housing markets in recent years. Nonetheless, housing market developments have varied across countries, reflecting the largely local nature of many factors affecting the demand and supply of housing. The importance of these country-specific factors means that the U.S. housing market correction need not necessarily presage corrections elsewhere. Nevertheless, allowing for country-specific influences suggests that similar pressures also exist in other national housing markets.

Countries that look particularly vulnerable to a further correction in house prices are Ireland, the United Kingdom, the Netherlands, and France. In these economies, it is difficult to account for the magnitude of the run-up in house prices on the basis of those countries' fundamentals. Furthermore, a weakening housing market can also present a direct drag on growth from reductions in residential investment. Countries that witnessed the largest run-up in house prices also appear more vulnerable to this effect—in particular, Denmark, Spain, and France.

2006.[13] For countries with sufficiently long data series, the sample period is split into two parts, from 1970 to the mid-1980s and from the mid-1980s to 2006, to examine changes over time.

Within the model, a monetary policy shock is identified through a conventional recursive identification scheme: short-term interest rates are allowed to influence all other variables with a one-quarter lag, but they have an immediate effect on the term spread. A housing demand shock is identified by combining the recursive identification strategy with sign restrictions: that is, housing demand shocks have no contemporaneous effect on output and prices, and they move residential investment and house prices in the same direction.[14]

- On average across the countries considered, housing demand shocks account for a large proportion (one-fourth to about one-half) of the observed fluctuations in residential investment and house prices (Table 3.4).[15] This suggests that the housing sector tends to have its own distinct dynamics (see also Zhu, 2005). Moreover, these internal dynamics strengthened in the second subperiod, suggesting that the housing sector may have become a more important source of economic volatility over the past two decades than previously.
- The extent to which housing demand shocks explain fluctuations in the aggregate economy varies significantly across countries and over time (Figure 3.5). In the United States and Japan, housing demand shocks account for a share of between 20 and 25 percent of the variance in output (after eight quarters) in the second period, up substantially from the first period. By contrast, housing demand shocks in many European countries account for 5 percent or less of the variation in output. Interestingly, in countries where exogenous housing demand shocks play a more important role in shaping the housing market, these

[13]The model includes six variables: output, inflation (GDP deflator), real house prices, residential investment, the short-term (nominal) interest rate, and the long-term interest rate spread over the short-term rate. See Appendix 3.1 for a description of the data used.

[14]This model is broadly similar to that recently estimated for the United States by Jarociński and Smets (2007). See Appendix 3.1 for further details on the methodology and results of the VAR.

[15]The combined effect of the other variables in the VAR—that is, GDP, inflation, interest rates, and the terms spread—accounts for the rest.

### Table 3.4. Forecast Variance Decomposition: Housing Demand Shocks—Average across Countries[1]

| Time Horizon (quarters) | 1 | 4 | 12 | 18 |
|---|---|---|---|---|
| | | *(output, in percent)* | | |
| First period | 4 | 8 | 8 | 9 |
| Second period | 1 | 4 | 8 | 12 |
| | | *(residential investment, in percent)* | | |
| First period | 40 | 31 | 26 | 25 |
| Second period | 49 | 49 | 39 | 33 |
| | | *(house prices, in percent)* | | |
| First period | 44 | 29 | 21 | 21 |
| Second period | 62 | 55 | 38 | 30 |

[1]Percent of the variance of the error made in forecasting a variable (e.g., output) at a given time horizon (e.g., 12 quarters) as a result of a housing demand shock.

shocks also have a stronger influence on the overall economy (Figure 3.6).

These patterns suggest that the role of the housing market in providing collateral for loans reinforces the links from the housing market to the wider economy. Figure 3.7 provides further support for this interpretation: it shows that countries with a more flexible system of housing finance tend to experience stronger spillovers from the housing sector.

## Housing Finance and Housing as a Transmission Channel for Monetary Policy

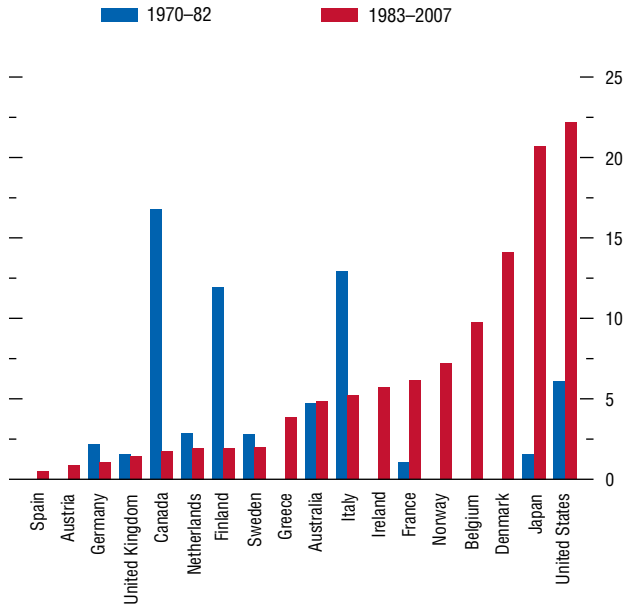
Figure 3.8 summarizes the main channels through which monetary policy is transmitted through the housing sector. Changes in interest rates affect domestic demand both directly, by affecting residential construction and household spending plans through the change in cost and availability of credit, and indirectly, by moving house prices. Changes in house prices in turn may affect aggregate demand by altering the incentives for housing investment (Tobin's *q* effect[16]) and by changing households' ability

[16]According to Tobin's *q* approach, the profitability of property investment depends on the ratio between house prices and construction costs. When property prices rise above the cost of construction, it is profitable for property developers to construct new buildings.

### Figure 3.5. Share of Output Variation Explained by Housing Demand Shocks[1]

*(Percent, at eight quarters)*

There is great heterogeneity across countries in the share of output fluctuations accounted for by housing demand shocks.

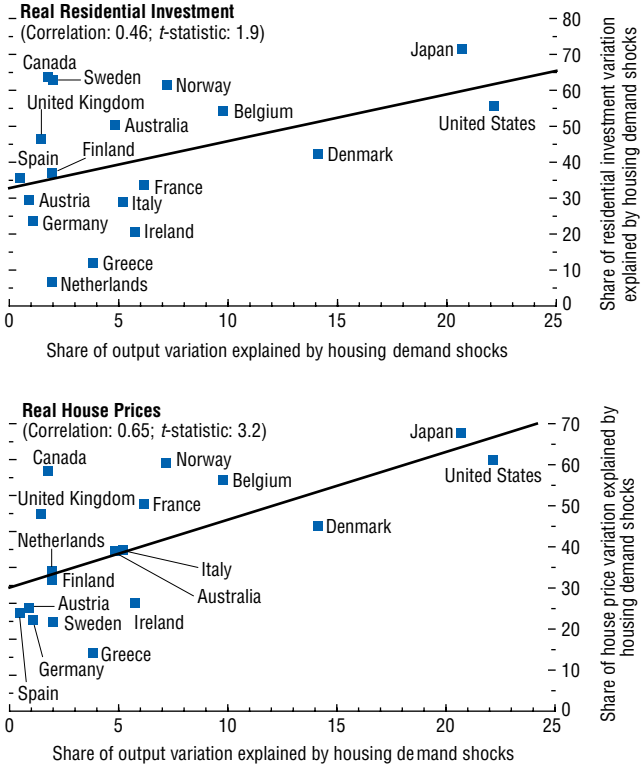



Source: IMF staff calculations.
[1]The absence of values in the first subperiod for some countries reflects a lack of sufficiently long time series on housing variables. See Appendix 3.1 for details on the data used in the vector autoregression.

### Figure 3.6. Correlation between the Shares of Output and Housing Sector Variation Explained by Housing Demand Shocks

*(Percent, at eight quarters, 1983–2007)*

In countries where housing demand shocks explain a larger share of fluctuations in housing variables, they also explain a larger share of output fluctuations.




Source: IMF staff calculations.

to use the collateral value of their homes to finance consumption.

Before the deregulation of mortgage markets, changes in monetary policy generally had a strong effect on residential investment by changing the available quantity of housing credit. Housing finance was dominated at that time by specialized lenders who funded long-term mortgages mainly through shorter-term savings deposits that were subject to an interest rate ceiling. Therefore, increases in policy interest rates would trigger an outflow of such savings deposits and squeeze mortgage finance institutions' net incomes—both of which would result in reduced credit availability.

As mortgage markets were integrated into the wider financial system, funding for housing came from a much broader set of investors, and the importance of credit availability as a channel of monetary policy transmission was greatly diminished. Indeed, several authors attribute the decline in the amplitude of housing investment cycles since the mid-1980s in the United States to the reduced importance of the credit volume effects of monetary policy (see Estrella, 2002; Schnure, 2005; and Bernanke, 2007).

At least three other considerations, however, suggest that financial deregulation may have strengthened the role of housing in monetary policy transmission. First, with increased competition in housing finance, mortgage retailers may adjust interest rates more rapidly in response to policy rates. Second, because households and firms have access to a wider array of credit products, residential investment and consumer durable expenditure may respond more strongly to changes in interest rates.[17] Third, greater access to mortgage credit may make house prices more responsive to interest rates, thereby

[17]Estimating a consumption equation for the United Kingdom, Muellbauer (2007) shows that the relaxation of credit constraints over the past two decades increased the role of intertemporal substitution and thus the interest rate channel for monetary policy. For example, households have become better able to substitute consumption now for consumption in the future in the wake of a reduction in interest rates.

strengthening the collateral effect of monetary policy (Iacoviello and Minetti, 2002).

In order to assess the net effect of these dynamics on the role of housing in monetary policy transmission in the United States, the VAR model is used to compare the response of residential investment, house prices, and output to monetary policy shocks in the United States in the periods before and after mortgage market deregulation.[18]

The results confirm that there are noticeable differences between the two periods. Monetary policy shocks had a smaller impact on both residential investment and output in the second period, but their effect lasted much longer (Figure 3.9). House prices reacted more slowly during the second period, but their decrease was more persistent and eventually stronger—reaching their maximum decline after about four years, compared with two years during the first period.[19]

These results, however, do not take into account differences in the size and duration of monetary policy shocks in the two subsamples. Before the mid-1980s, monetary policy was characterized by large swings in interest rates—in the first subsample, the monetary policy shock corresponds to an initial 130-basis-point increase in the federal funds rate, which returns to the initial level after about two years. By contrast, since the mid-1980s monetary policy has become more predictable and systematic in its response—in the second subsample, the increase in the federal funds rate in the period of the shock is much smaller (about 35 basis points) and more persistent (it fades away only after three years).

To take account of these differences in monetary policy shocks, the maximum responses of output and housing variables are normalized by the increase in short-term interest rates during the period of the shock—yielding the elasticity

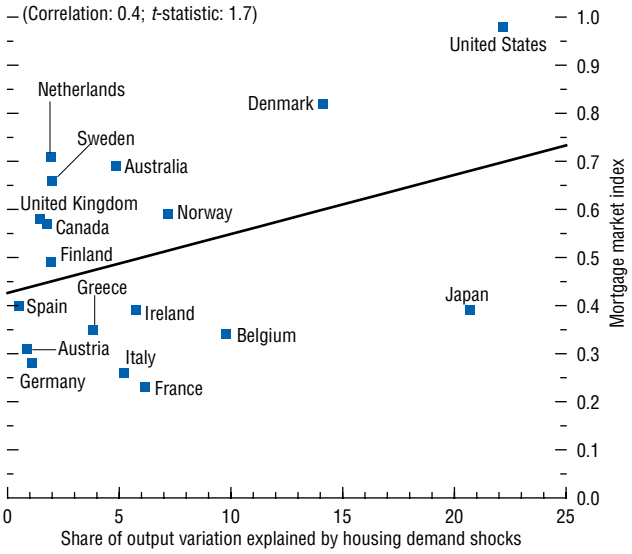
[18]These are impulse response functions to a monetary policy shock, identified as a one-standard-deviation change in interest rates.

[19]See also McCarthy and Peach (2002).

### Figure 3.7. Correlation between the Share of Output Variation Explained by Housing Demand Shocks and the Mortgage Market Index

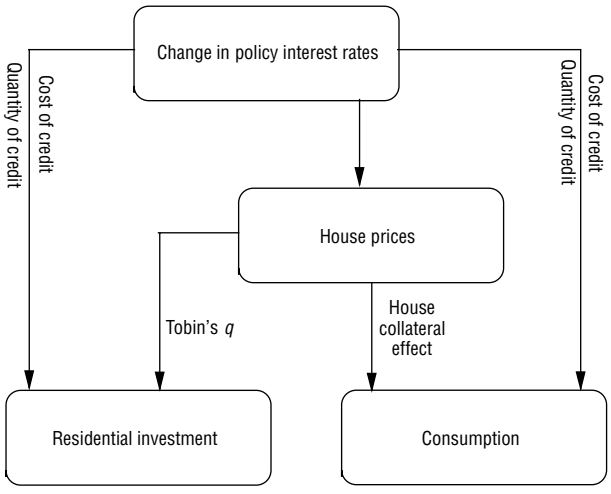
*(Percent, at eight quarters, 1983–2007)*

In countries with more developed mortgage markets, housing demand shocks tend to explain a larger share of output fluctuations.




Source: IMF staff calculations.

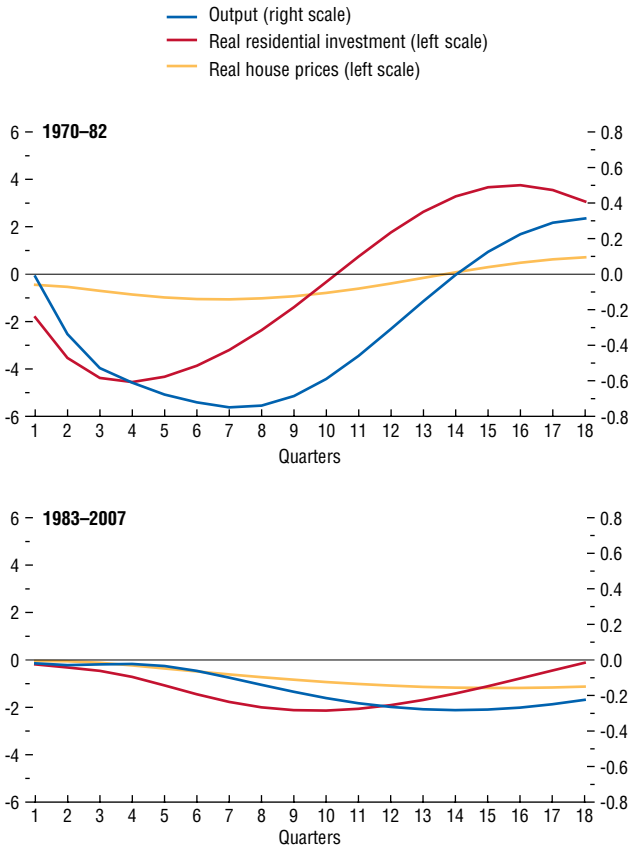
### Figure 3.8. Housing and the Monetary Transmission Mechanism



### Figure 3.9. Effect of Monetary Policy Shocks on Output and Housing Sector Variables in the United States[1]

*(Percent)*

In the second period, residential investment and output react less strongly to monetary policy tightening, but their decline is more persistent. Real house prices react more slowly, but their maximum decline is stronger than in the earlier period.




Source: IMF staff calculations.
[1]Monetary policy shocks are defined as a one-standard-deviation increase in short-term interest rates.

of these variables to a 100-basis-point tightening of interest rates. Such normalization suggests that the elasticity of residential investment to monetary policy shocks in the United States has declined only modestly during the second period, whereas the elasticity of house prices and output has increased (Figure 3.10).[20]

For the other economies, there is no clear pattern of change over time in the elasticity of residential investment to monetary policy shocks, although the sensitivity is estimated to have risen somewhat in the United Kingdom, the Netherlands, and France. By contrast, the response of house prices and output to estimated monetary policy shocks is generally stronger during the second period across the countries considered. Of particular relevance for this analysis is that countries with more developed mortgage markets also tend to have higher elasticities of house prices and residential investment to monetary policy shocks during the second period (Figure 3.11).[21] Moreover, the response of output to monetary policy shocks is also greater in economies that have more flexible mortgage markets.

Overall, these results suggest that the housing finance system has an important influence over the role of housing in the monetary transmis-

[20]In particular, a 100-basis-point increase in the policy rate in the United States leads to an estimated reduction in residential investment of about 4 percent in the second period, against a 4½ percent decline in the first period—estimates broadly in line with those in Jarociński and Smets (2007) and Erceg and Levin (2002). On house prices, a 100-basis-point increase in the policy rate in the United States leads to a fall in real house prices of about 3 percent from baseline in the second period, compared with a decline of 1 percent in the first period—broadly similar to Jarociński and Smets (2007) and Iacoviello and Neri (2007).

[21]While positive, the correlation between monetary policy shocks and the peak response of house prices is not statistically significant because of some outliers, such as Spain, France, and Italy, where house prices respond strongly to unexpected changes in monetary policy despite the relatively low level of the mortgage market index for these countries. This may reflect the relevance of direct cash-flow effects in the overall monetary transmission mechanism for the euro area (see Giuliodori, 2004, for similar results regarding France and Italy).

sion mechanism, but that the interrelationship is complex.[22] In particular, the results show that easier access to housing collateral may link house prices more closely to monetary policy shocks, and that the effects of monetary shocks on output are larger in those economies where housing finance markets are relatively more developed and competitive. At the same time, no systematic relationship is found between mortgage market development and the effects of monetary policy shocks on residential investment.

The same VAR framework also can be used to model what would have happened to the recent housing booms if systematically tighter monetary policy had been maintained during the preceding five years. This can be done using two counterfactual scenarios, one that traces the path of house prices and residential investment with interest rates constant throughout that period, and another with rates 100 basis points above the rates actually observed.[23]

Comparing these counterfactuals with the actual path of housing variables suggests that the unusually low level of interest rates in the United States between 2001 and 2003 contributed somewhat to the elevated rate of expansion in the housing market, in terms of both housing investment and the run-up in house prices up to mid-2005 (Figure 3.12), as has been argued by Taylor (2007).[24] The impact of easy monetary conditions on the housing cycle presumably was magnified by the loosening of lending standards and excessive risk-taking by lenders, as suggested by the boom-bust credit cycle in the

[22]Calza, Monacelli, and Stracca (2007); Aoki, Proudman, and Vlieghe (2002); and Iacoviello and Minetti (2002).

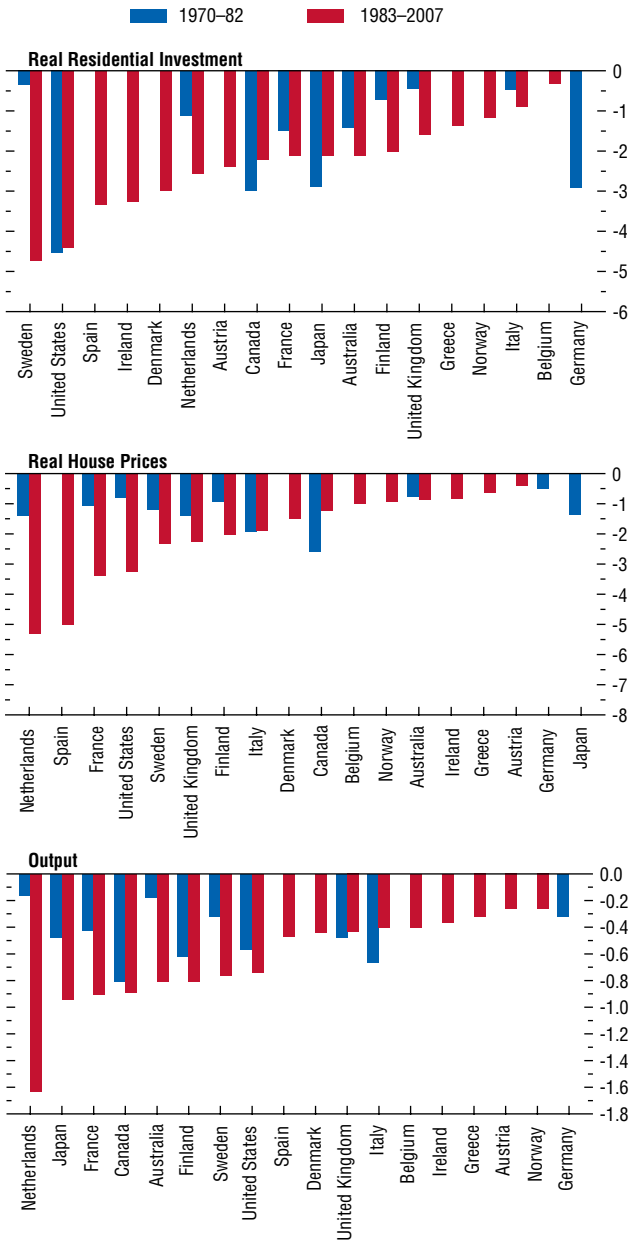
[23]It is worth mentioning that imposing an alternative path for interest rates is susceptible to the Lucas critique, namely, that spending decisions would be altered by a different policy regime. This effect should be limited by the fact that the counterfactuals are considered for a relatively short period of time. See also Sims (1998).

[24]Iacoviello and Neri (2007) also suggest that monetary conditions explain a nonnegligible portion of the increase in U.S. house prices (more than one-quarter) and residential investment (about one-half) between 2000 and 2005.

## Figure 3.10. Elasticity of Real Residential Investment, Real House Prices, and Output to a 100-Basis-Point Increase in Short-Term Interest Rates[1]

*(Percent)*

Normalizing the maximum decline of output and housing variables by the size of the monetary policy shock suggests that the interest rate elasticity of residential investment and output has declined only modestly in the United States, and that the elasticity of house prices has increased in the majority of countries.

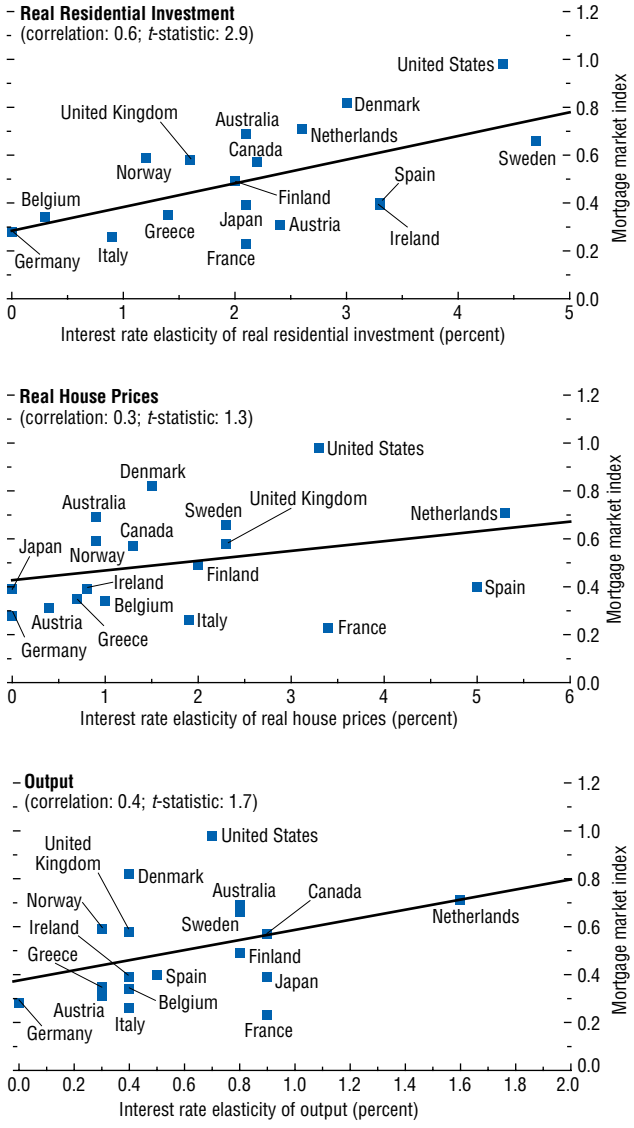



Source: IMF staff calculations.

[1]Peak impulse responses to a one-standard-deviation innovation in short-term interest rates divided by the initial change in interest rates. For Austria, Belgium, Denmark, Greece, Ireland, Norway, and Spain, no data are available for the first period. For Germany, the missing elasticities in the second period reflect the "wrong" sign of the response, possibly reflecting the impact of German unification (see also Calza, Monacelli, and Stracca, 2007).

### Figure 3.11. Interest Rate Elasticity of Real Residential Investment, Real House Prices, and Output and the Mortgage Market Index[1]

In the second subperiod (1983–2007) the interest rate elasticity of both housing variables and output tends to be higher in countries with more developed mortgage markets.




Source: IMF staff calculations.

[1]The interest rate elasticity of real residential investment, for example, is the maximum response (in absolute value) of real residential investment to a one-standard-deviation increase in the interest rate divided by the size of the interest rate increase at the time of the shock.

U.S. subprime mortgage market (Dell'Ariccia, Igan, and Laeven, 2008). A similar analysis has also been carried out for two smaller European economies, Ireland and the Netherlands, whose mortgage markets differ significantly in their degree of flexibility, according to the index used in this chapter (0.34 for Ireland and 0.69 for the Netherlands). For Ireland, which has a less-flexible market, the analysis does not indicate that a tighter monetary policy would have resulted in significantly different housing market outcomes. In the Netherlands, however, the analysis suggests that tighter monetary policy during this period might have contained the housing dynamics, especially with regard to house prices.

## Should Changes in the Housing Cycle Affect the Conduct of Monetary Policy?

The recent house price boom in many advanced economies, and the prospect of a global downturn driven by the sharp softening of the housing sector in the United States, have reignited the debate over whether monetary policymakers should respond to asset prices, and in particular to house prices. There is general agreement that when asset prices fall sharply—for example, after the bursting of an asset price bubble—monetary policymakers should react promptly and aggressively to contain inflation and stabilize output. However, there is much less consensus on how best to respond to rising asset prices.

In particular, central bank orthodoxy suggests that monetary policymakers should refrain from targeting any specific level of asset prices and should respond to changes in asset prices only insofar as they affect inflation and output outcomes and expectations (Mishkin, 2007). The difficulties of identifying bubbles in asset prices and the uncertainty over the impact of monetary policy on asset prices are the main arguments against responding to asset price changes over and above the response warranted by their implications for inflation and output.

However, some argue that there are benefits to be derived from "leaning against the wind,"

that is, increasing interest rates to stem the growth of house price bubbles and help restrain the buildup of financial imbalances (Borio and White, 2004; and Bordo and Jeanne, 2002). Such a preemptive response could diminish the risks that a bigger crash would occur later on, with serious consequences for the real economy and inflation. Moreover, restricting monetary policy to "cleaning up the mess" after a decline in asset prices could encourage excessive asset price swings and could reinforce market perceptions that there are only limited risks to investors' asset price bets (Ahearne and others, 2005).

Based on this view, central banks should be ready to respond to abnormally rapid increases in asset prices by tightening monetary policy even if these increases do not seem likely to affect inflation and output over the short term. This view need not, however, imply any change in the mandate of central banks, particularly those that operate with an inflation targeting regime: asset price misalignments matter because of the risks they pose for financial stability and the threat of a severe output contraction should a bubble burst, which would also lower inflation pressure. But given the considerable time it takes for imbalances to build up and unfold, paying attention to asset prices may entail a lengthening of the time horizon for inflation targets beyond the one to two years typical of many inflation targeting regimes (Borio, 2006).[25]

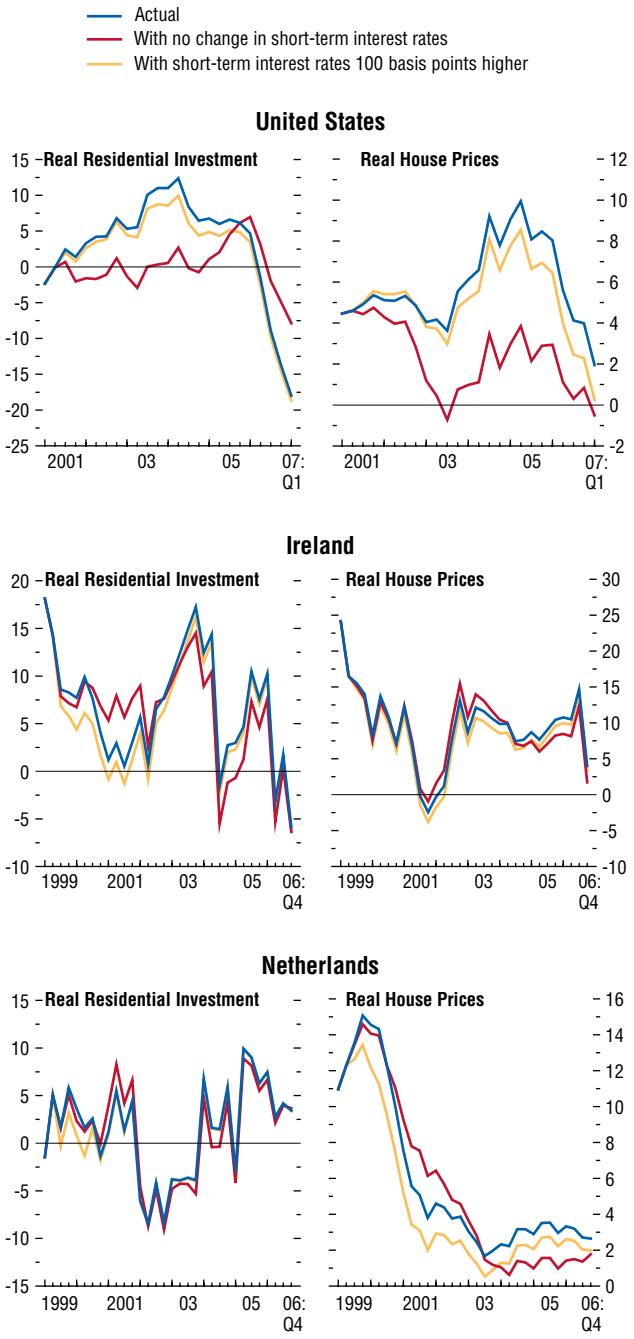
Recently, an increasing number of central bankers—including some at the Bank of England, Norges Bank, Bank of Canada, and Reserve Bank of New Zealand—have argued that central banks should on rare occasions "lean against" exceptionally large surges in asset prices. A concrete example is provided by the decision of the Swedish central bank in early 2006 to increase its policy rate despite reducing

[25]Although the focus of this chapter is on monetary policy, prudential and regulatory financial policies are also essential tools for constraining the procyclical mechanisms in financial markets that tend to amplify the business cycle (see Borio and White, 2004).

## Figure 3.12. Monetary Policy Counterfactuals

*(Year-over-year growth rates; percent)*

The increase in house prices and residential investment in the United States over the past six years would have been much more contained had short-term interest rates remained unchanged. The difference would have been relatively small in Ireland and, especially for residential investment, in the Netherlands.




Source: IMF staff calculations.

its inflation forecast—a decision justified with an explicit reference to rising household debt and house prices. Furthermore, recent statements from officials in a number of central banks—including at the Bank of England, European Central Bank, and Reserve Bank of Australia—acknowledge that central banks may need to look at the effects of asset prices on inflation and output beyond the usual one- to two-year horizon (see Mishkin, 2007).

The main findings from this analysis are that innovations in housing finance systems have increased the scale of spillovers from the housing sector to the general economy and that housing seems to be particularly important in the monetary transmission mechanism in countries with more developed mortgage markets. These findings raise the question of whether the response of monetary policymakers to changes in the housing sector should differ depending on the level of development of their mortgage markets.

In order to address this issue, a macroeconomic model with a stylized representation of the housing sector, as in Calza, Monacelli, and Stracca (2007), is used to illustrate how the role of housing as collateral in the lending process may affect consumption and output volatility.

This model captures the idea that a fraction of consumers may be credit-constrained by assuming a mix of "patient" and "impatient" consumers: the latter do not smooth consumption based on permanent income, but have preferences tilted toward current consumption.[26] Their access to credit is constrained by the value of their collateral, which is endogenously tied to the evolution of house prices. A more developed mortgage market is represented by a higher LTV ratio—a parameter that determines the extent to which housing can be used as collateral for borrowing to consume nondurable goods. Monetary policy follows a simple, Taylor-type interest rate rule, responding to changes in the inflation and output gaps.

Despite its stylized nature, this structural model is consistent with the empirical findings from the VAR that output and consumption are more responsive to housing demand shocks in economies with more developed mortgage markets. In economies with a higher LTV ratio (90 percent), as residential investment and house prices increase following a positive housing demand shock, impatient consumers are allowed to borrow more against the rising value of their collateral, and thus to consume more nondurable goods, compared with those in economies with a lower LTV ratio (60 percent) (Figure 3.13, upper panel).[27] Similarly, a higher LTV ratio amplifies the decline in output and consumption following a negative financial shock, identified as an exogenous tightening of lending standards that restricts the ability of households to borrow against collateral for any given level of house prices (Figure 3.13, lower panel).

Having built a model that rationalizes the empirical evidence about the link between housing and economic volatility, the next step is to derive some normative implications for monetary policy. Although the model is highly stylized—abstracting from many factors affecting monetary policy decisions—the exercise is nevertheless instructive because it provides some insight into how monetary policy should vary according to the characteristics of mortgage markets in an economy where borrowing limits are tied to collateral values and where some households do not behave in the farsighted way that is more traditionally supposed.[28]

[26]Impatient consumers always borrow the maximum amount possible given their income, although that borrowing may be insufficient to allow them to consume their desired amount of housing services or other goods. Because some households borrow as much as possible, the model allows for the possibility that some households may be shortsighted in their financial planning, which is consistent with the recent lesson from the U.S. subprime market.

[27]It should be noted that the monetary policy responses considered in this section are to changes in fundamental determinants of housing demand, rather than to speculative, bubble-type developments in the housing market.

[28]In particular, the model does not allow for uncertainty concerning the types of shocks hitting the economy and for the possibility of a time-variant, nonnormal

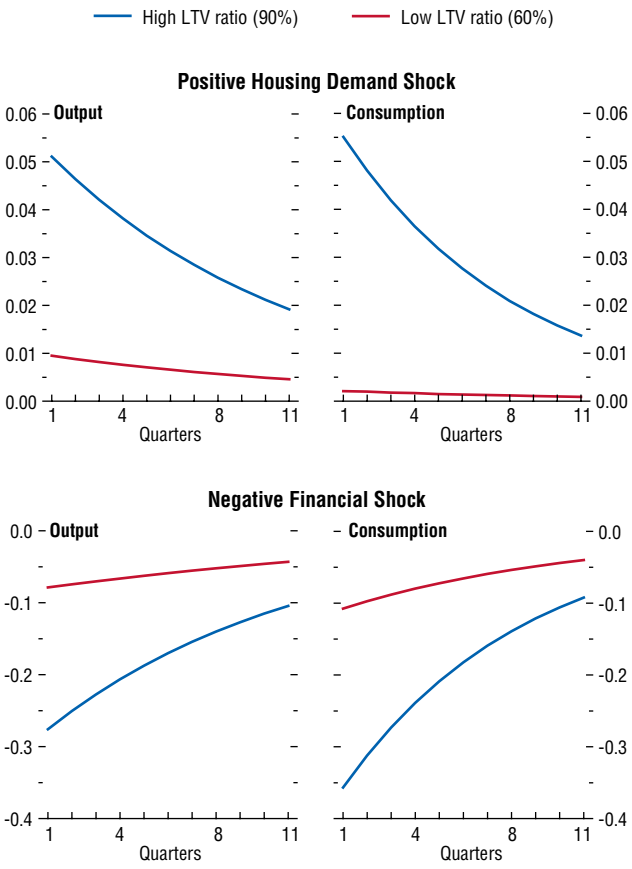
A first result from the model is that, for any given monetary policy objective, monetary policymakers in economies with more developed mortgage markets must respond more aggressively to housing demand and financial shocks, compared with those in economies with less-developed housing finance systems. This is because such shocks have a greater impact on inflation in economies with a higher LTV ratio, reflecting the larger response of consumption and output in these economies. As an example, assuming for simplicity that the sole objective of monetary policy is to stabilize inflation, a positive housing demand shock would require a larger increase in the policy rate of interest in an economy with a higher LTV ratio than in an economy with a lower LTV ratio (Figure 3.14, upper panel). By contrast, offsetting the deflationary impact of a negative financial shock would require a larger decrease in the policy rate in an economy with a higher LTV ratio (Figure 3.14, lower panel).

A second result is that monetary policymakers may need to pay particular attention to house prices in economies with more developed mortgage markets, where house prices play a special role in providing collateral for loans. Indeed, Table 3.5 shows that the monetary policy rule that minimizes the central bank's loss function (with inflation and output gap volatility as arguments) includes *both* the output gap and house price inflation for each type of shock considered in economies with LTV ratios equal to 90 percent. By contrast, when the LTV ratio is lower, at 60 percent, adding house price inflation to the Taylor-type interest rate rule does not improve economic stabilization when the economy is hit by a housing demand shock or a productivity shock. The main reason underlying this result is that, in this model, responding to house price inflation is an effective way of

distribution of these shocks, and thus it is not equipped to address risk-management considerations that are key in monetary policy decision making (see Mishkin, 2008). Moreover, the conclusions presented here might change if the objective of monetary policy were welfare maximization rather than economic stabilization.

**Figure 3.13. Macroeconomic Model with Housing as Collateral: Responses of Output and Consumption to Shocks for Different Loan-to-Value (LTV) Ratios**
*(Percent deviation from model steady state)*

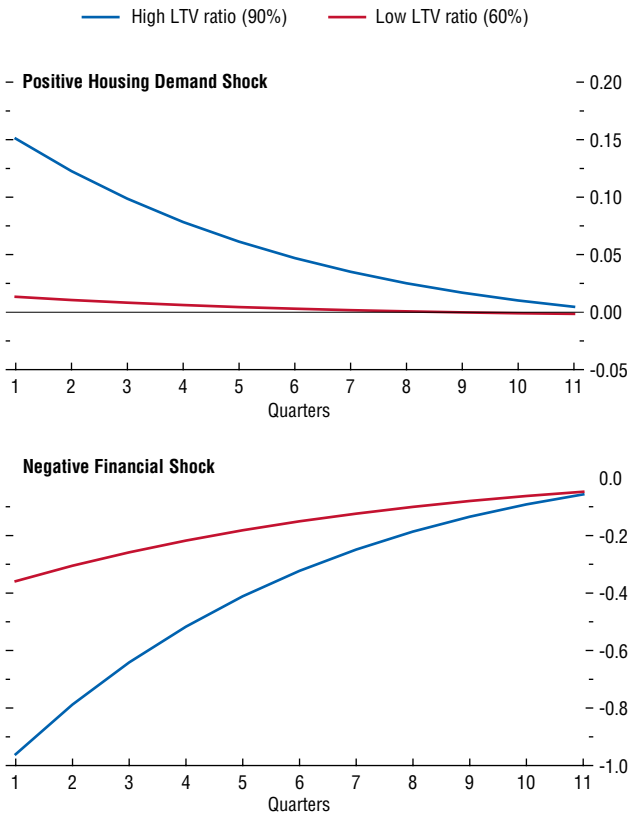
Following a positive housing demand shock and a negative financial shock, output and consumption react more strongly in economies with higher LTV ratios than in economies with lower LTV ratios.




Source: IMF staff calculations.

**Figure 3.14. Macroeconomic Model with Housing as Collateral: Response of Nominal Interest Rates to a Positive Housing Demand Shock and a Negative Financial Shock for Various Loan-to-Value (LTV) Ratios**
*(Percent deviation from model steady state)*

After a positive housing demand shock and in order to fully stabilize inflation, interest rates have to increase more strongly in economies with higher LTV ratios. In these economies, interest rates have to decrease more following a negative financial shock.




Source: IMF staff calculations.

dampening the output volatility caused by the financial accelerator effect resulting from the endogenous variation in the value of housing as collateral. Because it is precisely in economies with a high LTV ratio that this volatility is strong, the gains from responding to house price movements are large.[29] In contrast, in economies with less-developed mortgage markets, paying special attention to house prices does not provide additional benefits compared with a monetary policy rule that responds to both inflation and the output gap.

## Conclusions

The sharp weakening of the housing sector in several advanced economies over the past couple of years, and especially the financial turbulence triggered by increasing defaults in the subprime mortgage market in the United States, have raised concerns that, as a result of innovations in mortgage markets, the housing sector could be a source of macroeconomic instability.

The evidence presented in this chapter indeed suggests that countries where innovation in housing finance systems has advanced the most are more exposed to shocks originating in the housing sector. The reason could be that the greater "liquidity" of housing equity in these economies has amplified the financial accelerator effect from endogenous variations in the collateral constraint tied to the value of homes. The stylized model of the role of housing as collateral provides an explanation of these empirical findings that suggests economies with more developed financial markets and households that are shortsighted in their financial planning are more exposed to housing shocks.

This chapter also suggests that house prices and overall output have become more responsive to monetary policy shocks in the wake of mortgage deregulation and that this responsiveness tends to be greater in economies with

[29]See Gilchrist and Saito (2006) for similar results in a model with equity prices.

**Table 3.5. Optimal Coefficients in the Taylor Rule[1]**

| | Financial Shocks | | Housing Demand Shocks | | Productivity Shocks | |
|---|---|---|---|---|---|---|
| | High LTV | Low LTV | High LTV | Low LTV | High LTV | Low LTV |
| House price growth | 0.4 | 0.75 | 1.2 | 0 | 0.95 | 0 |
| Output gap | 0.35 | 0.15 | 0.1 | 0.1 | 0 | 0 |

[1]The Taylor rule is defined as $i_t = \phi_\pi \pi_t + \phi_x x_t + \phi_q \Delta_q$, where $\pi_t$ and $x_t$ are deviations of inflation and output gap from their steady-state values, and $\Delta_q$ denotes real house price growth. The optimal coefficients on house price growth and output gap are those that minimize a quadratic loss function, with the variance of $\pi_t$ and $x_t$ as arguments. The inflation coefficient is held constant and equal to 2. High LTV = loan-to-value ratio equal to 90 percent. Low LTV = loan-to-value ratio equal to 60 percent.

more developed mortgage markets. At the same time, the evidence about the responsiveness of residential investment to monetary policy is mixed. For the United States, the results suggest that monetary policy shocks have had a somewhat smaller impact on residential investment since the mid-1980s, presumably because of the reduced importance of the quantity-rationing effect from these shocks and the more predictable and systematic monetary policy pursued during this period. In some other countries, the elasticity of residential investment to monetary policy shocks seems actually to have increased over time. Overall, the results are consistent with the hypothesis that there has been a change in the transmission of monetary policy through housing in economies with more flexible and developed mortgage markets, namely, that monetary policy is now transmitted more through the price of homes than through residential investment.

This chapter also examines the implications for monetary policy of changes in mortgage markets. First, it suggests that monetary policymakers may need to respond more aggressively to housing demand shocks in economies with more developed mortgage markets—that is, with higher LTV ratios and thus, presumably, higher stocks of mortgage debt. They may also need to respond more aggressively to financial shocks that affect the amount of credit available for any given level of house prices. Hence, the model would "predict" a more aggressive reduction of interest rates in the United States compared with the euro area in the face of recent turmoil in the credit markets—and this is in line with what has occurred so far.

Second, this chapter suggests that, in economies with more developed mortgage markets, economic stabilization could be improved by a monetary policy approach that responds to house price developments in addition to consumer price inflation and output developments. In a risk-management framework, such an approach would need to accommodate the uncertainty about what factors drive house price dynamics—in particular, whether house prices reflect changes in fundamentals or speculative forces—and their impact on the economy. House prices would seem relevant for calculating the risks to the outlook for overall economic activity and prices, particularly during periods of rapid change in house prices and when house prices seem to be moving out of line with historical norms.

Such attention to house price developments need not require a change in the formal mandates of major central banks, but could be achieved by interpreting existing mandates more flexibly, for instance, by extending the horizon for inflation and output targets. Moreover, it is important that such an approach be applied symmetrically: while an aggressive easing may be justified in response to a rapid slowdown of the housing sector, some "leaning against the wind" may also prove useful to limit the risk of a buildup of housing market and financial imbalances. In this context, monetary policy certainly should not bear the full weight of responding to possible asset price bubbles; regulatory policy also has a critical role to play in guarding against the inappropriate loosening of lending standards that may fuel extreme house price movements.

## Appendix 3.1. Data and Methodology

### Data

| Variable | Source |
|---|---|
| Real house prices | Organization for Economic Cooperation and Development (OECD), Bank for International Settlements (BIS) |
| Real residential investment | OECD Analytical Database |
| Real private consumption | OECD Analytical Database |
| Real disposable income | OECD Analytical Database |
| Consumer price index | OECD Analytical Database |
| Short-term interest rates | OECD Analytical Database, International Financial Statistics (IFS) database, OECD *Economic Outlook,* Haver Analytics |
| Long-term interest rates | OECD Analytical Database, IFS Database, OECD *Economic Outlook,* Haver Analytics |
| Output gap | OECD Analytical Database |
| Housing wealth | OECD |
| Share price index | IFS database, Haver Analytics |

Note: Nominal house prices are deflated using the Consumer Price Index (BIS data only).

### House Prices

| Country | Source | Start Date |
|---|---|---|
| Australia | OECD | 1970:Q1 |
| Austria | BIS | 1986:Q3 |
| Belgium | BIS | 1988:Q1 |
| Canada | OECD | 1970:Q1 |
| Denmark | OECD | 1970:Q1 |
| Finland | OECD | 1970:Q1 |
| France | OECD | 1970:Q1 |
| Germany | OECD | 1970:Q1 |
| Greece | BIS | 1993:Q1 |
| Ireland | OECD | 1970:Q1 |
| Italy | OECD | 1970:Q1 |
| Japan | OECD | 1970:Q1 |
| Netherlands | OECD | 1970:Q1 |
| Norway | OECD | 1970:Q1 |
| Spain | OECD | 1971:Q1 |
| Sweden | OECD | 1970:Q1 |
| United Kingdom | OECD | 1970:Q1 |
| United States | OECD | 1970:Q1 |

### Contributions to GDP Growth

The contribution of residential investment and other GDP components to output fluctuations around the business cycle, shown in Table 3.2, are calculated as follows:

- The quarterly contribution to total GDP growth of eight different components was calculated for 18 advanced economies. The eight components are (1) government consumption, (2) private consumption, (3) government gross fixed capital formation, (4) private residential investment, (5) private nonresidential investment, (6) inventories, (7) exports, and (8) imports. When possible, contributions from national statistical sources were used. When not available, the contributions were estimated using OECD data on quarterly national accounts and the methodology described in OECD's *Understanding National Accounts*, 2007.
- The "abnormal" contribution of the components to GDP growth was calculated as the difference between the actual and "normal" contributions to GDP—the latter was obtained by smoothing the actual contributions over the whole period using a kernel regression (as in Leamer, 2007).
- The peaks and troughs of the business cycles were determined using the same methodology as in the "Recessions and Recoveries" chapter of the April 2002 *World Economic Outlook*. This methodology uses a simplified Bry-Boschan (1971) dating algorithm, which determines peaks and troughs in log level of real GDP by first searching for maximums and minimums in five-quarter data windows, and then picking pairs of adjacent, locally absolute maximums and minimums that meet the criteria for the minimal duration (five quarters) and phases (two quarters) of cycles.
- The abnormal contributions were then cumulated over the four quarters before business cycle peaks. The average across all business cycles since 1970 of the cumulative GDP growth decline in this period is shown in the first column of Table 3.2 (for example, cumulative GDP growth was on average 2.6 percentage points lower than trend in the year before a recession in the United States).
- The rest of the table shows the contributions to this abnormal cumulative decline of GDP growth from its eight components. For example, in the United States, below-trend growth in private residential investment accounted

**Table 3.6. Estimates of the Error-Correction Model of Consumption**

| | Canada | France | Germany | Italy | Japan | United Kingdom | United States |
|---|---|---|---|---|---|---|---|
| **Long run** | | | | | | | |
| Income | 0.547 | 0.69 | 0.632 | 0.271 | 0.067 | –0.194 | 0.664 |
| | (0.116) | (0.041) | (0.047) | (0.060) | (0.036) | (0.135) | (0.025) |
| Equity wealth | 0.017 | 0.017 | 0.086 | 0.051 | –0.038 | 0.040 | 0.034 |
| | (0.007) | (0.007) | (0.021) | (0.024) | (0.023) | (0.022) | (0.005) |
| Housing wealth | 0.008 | 0.008 | 0.062 | –0.010 | 0.024 | 0.068 | 0.137 |
| | (0.003) | (0.003) | (0.018) | (0.003) | (0.003) | (0.009) | (0.005) |
| **Short run** | | | | | | | |
| Change in income | 0.494 | 0.502 | 0.958 | 0.194 | 0.377 | 0.494 | 0.643 |
| | (0.072) | (0.141) | (0.120) | (0.101) | (0.061) | (0.199) | (0.060) |
| Change in equity wealth | 0.033 | 0.006 | 0.042 | 0.062 | –0.015 | 0.025 | 0.007 |
| | (0.036) | (0.008) | (0.016) | (0.028) | (0.011) | (0.017) | (0.006) |
| Change in housing wealth | 0.084 | 0.017 | 0.103 | 0.004 | 0.014 | 0.058 | 0.121 |
| | (0.031) | (0.008) | (0.029) | (0.007) | (0.005) | (0.016) | (0.034) |
| Inflation | –0.021 | –0.001 | –0.019 | 0.005 | –2.320 | –0.016 | –0.010 |
| | (0.004 | (0.0005) | (0.018) | (0.005) | (1.060) | (0.010) | (0.033) |
| Adjustment to long run | –0.350 | –0.203 | –0.990) | –0.526 | –0.506 | –0.317 | –0.419 |
| | (0.070) | (0.263) | (0.287) | (0.167) | (0.153) | (0.323) | (0.120) |
| Observations | 46 | 27 | 15 | 30 | 36 | 19 | 47 |

Note: Standard errors are in parentheses. Annual data; sample period varies by country. Coefficients in the short-run equation are short-run marginal propensities to consume. Coefficient and standard-error-on-inflation terms are multiplied by 100.

for 2 percent of the 2.6-percentage-points-below-trend GDP growth in the year before recessions. A value of zero for a particular GDP component means that component was actually adding strength to GDP growth in that period, rather than contributing to its below-trend decline.

## Long-Run Propensity to Consume out of Housing Wealth

The long-run propensity to consume out of housing wealth shown in Figure 3.4 is derived from the table below, presenting estimates of an error-correction specification of consumption (Table 3.6), with income, equity wealth, and housing wealth as explanatory variables (see April 2002 *World Economic Outlook,* for a similar methodology).

## Vector Autoregression

The vector autoregression (VAR) model estimated in this chapter consists of three blocks. The first block contains output (real GDP) and the price level (GDP deflator). The second block contains real house prices and residential investment. The third block consists of the short-term (nominal) interest rate and the long-term interest rate spread over the short-term rate.

As usual in the literature, monetary policy shocks are identified using a block recursive identification strategy—that is, shocks to the short-term interest rates are allowed to influence the variables in the first and second blocks, only with a one-quarter lag, but have an immediate effect on the term spread.

Housing demand shocks are identified by combining the block recursive identification strategy with sign restrictions. Reflecting the block recursive identification strategy, housing demand shocks have no contemporaneous effects on output or prices. Moreover, housing demand shocks are those that move house prices and residential investment in the same direction over the four quarters following the shock. There may be several identification

schemes consistent with these criteria, so the median across these schemes is reported in this chapter.

As in the vast majority of the monetary literature based on VARs (Christiano, Eichenbaum, and Evans, 1999), although standard unit root tests indicate that some variables used in the models might be integrated of order one, we estimate the systems in levels, without explicitly modeling cointegrating relationships. Sims, Stock, and Watson (1990) show that if cointegration exists among the variables, the system's dynamics can be consistently estimated in a VAR in levels. A time trend was also included, but the results are very similar with and without a time trend.

This model is estimated separately for each of 16 OECD economies using quarterly data for the period 1970 (or the first year for which data are available) to 2006. For economies with all time series starting from 1970:Q1, the sample is broken down into two subperiods, one from 1970:Q1 to 1982:Q4 and the other from 1983:Q1 to 2007:Q1. Results with a 1985:Q4 cutoff are very similar and available on request.

Countries with data from 1970:Q1 are Australia, Canada, Finland, France, Germany, Italy, Japan, the Netherlands, Sweden, the United Kingdom, and the United States. Countries with different starting dates are Austria (1986:Q3), Belgium (1988:Q1), Denmark (1990:Q1), Greece (1994:Q1), Ireland (1997:Q1), Norway (1978:Q1), and Spain (1995:Q1).

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