

Property Prices and Bank Risk-taking

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1. Introduction

Real estate boom-bust cycles can have far-reaching consequences. Booms are generally accompanied by fast credit growth and sharp increases in leverage, and when the bust comes, debt overhang and deleveraging spirals can threaten financial and macroeconomic stability. Banks have a critical role in this process and can amplify the swing by changing their lending standards over the cycle.

These dangers notwithstanding, before the crisis, real estate booms and the associated credit booms fell into a sort of policy no-man’s land. First, there was the long-standing (benign neglect) view that it was better to deal with the bust than try to prevent the boom. Unhealthy booms were difficult to separate from healthy ones. And, in any event, it was believed that policy was well equipped to contain the effects of a bust (there were of course a few notable exceptions, including Sveriges Riksbank and the RBA; see Mishkin (2011), for more on the ‘lean’ versus ‘clean’ debate). Second, with the diffusion of inflation targeting, many central banks had increasingly focused on price stability as their main (sole) objective and viewed financial stability as the realm of bank regulation. Regulatory policy, however, typically focused on individual institutions and was ill-equipped to deal with the aggregate credit dynamics associated with real estate booms.

A similar gap existed in the economic literature. In models dealing with inflation and the macroeconomic cycle, there was little or no role for finance. And certainly little attention was paid to financial stability. Corporate finance models dealing with bank risk-taking focused on how to correct market failures stemming from limited liability and asymmetric information. They essentially ignored monetary policy and few explicitly considered real estate prices.

The crisis has both encouraged a reconsideration of the existing policy consensus and spurred academia towards research that fills the gap between macro and corporate finance models. Both processes are ongoing. Most central banks have maintained their pre-crisis policy frameworks. But many have altered their rhetoric and have made (timid) openings to the idea of having credit aggregates and real estate prices play a bigger role in their policy decisions (Bernanke 2011; Mishkin 2011). Similarly, we still lack a unifying theory of bank risk-taking over the cycle but several models have been developed that take into account the role of credit, leverage, and asset prices. And ‘finance’ modules are increasingly incorporated into the large DSGE models that central banks and other institutions use for policy guidance.

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This paper reviews theoretical stories and empirical evidence on the link between real estate price cycles and bank behaviour in terms of credit provision and risk-taking. And it discusses their implications for macroeconomic policy.

2. Real Estate Cycles and Bank Lending Behaviour

We lack a unifying theory of how banks behave over the business cycle and react to changes in asset prices, much less a theory about how banks react specifically to real estate market developments. We have, however, several distinct theoretical frameworks that can provide important insights into the relationship between real estate cycles, bank lending and risk-taking behaviour. Few of these are specifically about real estate. (And some do not even have banks!) Yet, we argue that they are all relevant for the issue at hand because of several characteristics specific to real estate assets (such as their intrinsic lumpiness and resulting reliance on bank lending, their critical role as a store of wealth and resulting macro relevance, their illiquidity, opacity and sluggish supply response, which results in their inclination to deviate from fundamentals).

2.1 Credit constraints

Finance is 'neutral' in standard textbook macro models. Real fundamentals determine long-term equilibria and the structure and conditions of financial markets are irrelevant. In these models, real estate prices (and any other asset price) reflect discounted future payoffs, and in themselves play no particular role in economic fluctuations.

Financial frictions change all this. Agency problems between borrowers and lenders stemming from the introduction of asymmetric information and/or limited liability generate macro-relevant deviations from the Modigliani-Miller outcome. A wedge appears between the costs of internal and external finance and changes to borrowers' net worth become a critical variable that amplifies fluctuations in investment and activity. For example, in the original Bernanke and Gertler (1989) model, a shock that lowers current cash flow reduces a firm's ability to fund investment from retained earnings (lowering future profits). This lower net worth widens the cost of external finance. At the macro level, this results in reduced aggregate investment to the further detriment of economic activity and future cash flows.

When loans must be collateralised, real estate prices can have real effects (beyond those reflecting changes in fundamentals) by affecting the balance sheet positions of potential borrowers. In Kiyotaki and Moore (1997) endogenous cycles emerge as a result of the interaction between firms' credit constraints and their use of productive assets as collateral. Changes in the value of collateral assets affect these credit constraints. This has an impact on investment activity, which feeds back onto asset prices. More recently (especially in the wake of the 2008 financial crisis), strides have been made to introduce such dynamics and the role of housing into DSGE models (see, for example, Iacoviello and Neri (2010)). Yet, in most of these models, there are no banks in any meaningful sense. The structure and behaviour of financial intermediation remains irrelevant and indeterminate.

The latest generation of DSGE models addresses this problem by explicitly allowing for a role for financial intermediaries (see, for instance, Gertler and Kiyotaki (2011)). These banks are subject to credit constraints (or more properly, leverage constraints) stemming from problems akin to

those that characterise borrowers. Fluctuations in their net worth (in addition to what happens to consumers and investors), originating for instance from a shock to their credit portfolio, affect their ability to raise deposits and extend credit, with large effects on economic activity. In this context, lower real estate prices may imply bank losses: borrowers' incentives to repay decline as the value of the equity they hold in the house declines; developers selling at a lower-than-expected price may not be able to service their debt. Losses reduce bank capital and the financial system's ability to raise and lend funds, potentially resulting in a credit crunch (Iacoviello 2011).

These models have built increasingly more powerful and comprehensive versions of a financial accelerator. By doing so, they are able to explain how small shocks to fundamentals, amplified by financial frictions, can lead to wide economic fluctuations (all in a general equilibrium environment that can be calibrated to guide policy decisions). This progress notwithstanding, these models say relatively little about bank risk-taking. Indeed, lending limits for both banks and borrowers are set exactly so that the incentive compatibility constraint is satisfied. The focus is on the quantity of credit, not its quality. The financial frictions considered entail an inefficiency that exacerbates cyclical fluctuations, but cannot explain discontinuous phenomena such as a crisis. In equilibrium, there is no bank default.

2.2 Leverage cycles

Capital regulation may amplify the effects of real estate price changes on bank lending behaviour. Rising property prices increase bank capital directly, through higher valuations of a bank's own real estate holdings, and indirectly, through increased mark-to-market values of real estate-backed securities and loans. Banks may respond to this higher capitalisation by increasing lending (although not necessarily real estate-related lending). In addition, under risk-weighted capital regulation, they may also take on more aggressive risk profiles. More credit in turn, may increase real estate prices further. A bust inverts this chain, possibly leading to a credit crunch. These swings can be even wider if leverage is procyclical (Adrian and Shin 2010; Geanakoplos 2010). Further, supervisors and regulators may also amplify this cycle if they react to a worsening real estate market by increasing capital requirements and by requiring stricter rules for classifying and provisioning against real estate assets (Herring and Wachter 1999).

2.3 Asymmetric information and bank strategic effects

The observation that banks change their lending standards systematically over the cycle (and with real estate prices) motivates several recent partial equilibrium papers. In these models, bank strategic interaction and information collection amplify marginal changes in the distribution of borrowers (generated, for instance, by better economic prospects) with large effects on bank lending standards. These models are generally static (although see Gorton and He (2008)), do not have the richness of DSGE frameworks, and cannot provide quantitative policy guidance. Yet, they provide important insights into the dangers associated with cyclical changes in banks' risk-taking behaviour. When acquiring information is costly, banks will adjust their information collection activities in response to changes in the distribution of borrowers (Ruckes 2004). In a recession, most applicant borrowers are bad. Banks obtain little benefits from individual screening and deny most applications based on aggregate conditions. In intermediate phases of the cycle,

there is a high variance in the quality of applicants, incentives for individual screening are high, and banks tend to acquire much more information and fund relatively high-quality borrowers. In booms, however, it may be optimal to save on screening costs and lend indiscriminately to the entire applicant population. Then, the upswing of a business cycle can be characterised by a sharp credit expansion and a reduction in lending standards. This provides a theoretical explanation for Alan Greenspan's famous observation that there is an unfortunate tendency among bankers to lend aggressively at the peak of the cycle and that is when they extend the majority of bad loans.

Bank competition exacerbates this tendency. When banks compete for borrowers, they face an adverse selection problem. There is always a positive probability that an applicant accepting a loan offer has been rejected by a competing bank; namely, the winner's curse (Dell'Ariccia and Marquez 2006). When the market expands and the proportion of new borrowers increases (or the expected screening intensity at other banks decreases), the distribution of applicants each bank faces improves, and banks may find it profitable to reduce screening and, at the limit, grant credit to all borrowers indiscriminately. An endogenous cycle in lending standards can emerge, independent of fluctuations in real fundamentals (Gorton and He 2008).

These models do not deal specifically with real estate cycles, but their predictions apply to real estate-related lending. When house prices are on the rise, banks have little incentive to discriminate across borrowers. Increasing prices allow even bad borrowers (for instance, those without sufficient income to service their debt) to refinance their mortgages or sell their properties. Thus, the expectation of further price increases reduces the importance of idiosyncratic borrower risk and banks may find it optimal to lower lending standards (for example, by increasing loan-to-value and debt-to-income ratios). Lower standards allow large numbers of previously untested borrowers to obtain credit (hence reducing adverse selection) and support house prices. Note that it is individually optimal for banks to follow this strategy as long as they believe their competitors will as well. More importantly, competitive forces may punish a deviation from this strategy toward more 'conservative' lending. Borrowers will switch to easier-lending competitors. Investors will punish managers not delivering high returns. And managerial compensation schemes may induce herding behaviour and strengthen these effects (Rajan 1994). It is the game-theory version of the then CEO of Citigroup, Charles Prince's, infamous 2007 quote: 'As long as the music is playing, you've got to get up and dance ... We're still dancing'.

This equilibrium of reduced lending standards can also be welfare-efficient from a risk-neutral standpoint (i.e. it can maximise aggregate surplus for banks and borrowers). However, the associated reduction in screening and higher leverage ratios results in a banking system with a more fragile loan portfolio, increasing the probability of financial instability. It follows that in a 'less linear' context (e.g. one with a risk-averse social planner or one where crises are associated with non-linear social losses), this equilibrium would be welfare dominated by one with tighter lending standards.

2.4 Bubbles

Real estate markets seem to live under two possible regimes. Most of the time, prices follow fundamentals according to standard valuation principles. The value of an asset (in this case real estate) reflects the discounted stream of expected payoffs (in this case rental payments), adjusted

as needed for various risks, taxes and expenses. At times, however, housing prices can rise/fall sharply in ways that are difficult to reconcile with changes in the underlying fundamentals. These bubble episodes are generally accompanied by wide swings in bank credit and are often harbingers of financial crises. A few recent papers (generally based on agency-theory models of bubbles such as Allen and Gorton (1993) and Allen and Gale (2000)) have explored the role played by financial intermediaries in funding real estate bubbles.

In several markets land is scarce. And, even when it is not, it takes a relatively long time to plan and develop housing. It follows that, at least in the medium run, real estate price dynamics are primarily driven by fluctuations in the demand for housing. This can come from two sources: consumers, who purchase housing for their own use, and speculators, who purchase housing with a view to selling it at a higher price in the future (obviously, the two groups may overlap). In tranquil times, consumers (or more precisely, consumption motives) dominate the market and prices reflect an arbitrage condition between renting and owning a home. Essentially, the price today has to be equal to the discounted stream of rental payments plus the expected price change (based on expected changes in the supply of housing). In contrast, when leveraged speculators enter the market, a bubble can develop. Because of limited liability, these agents care only about the upper part of the distribution of future prices (the cases in which the supply of houses turns out to be too low). Thus, they can support valuations above what is justified by fundamentals. However, when the realised supply of housing is too high (and prices too low) they default (Allen and Carletti 2011a, 2011b).

In this context, banks may be willing to lend to speculators because of government guarantees, or because they are unable to discriminate between legitimate consumers and speculators. Banks may also adapt the financial contracts they offer in response to the emergence of speculation. Back-loaded products, such as interest-only and teaser-rate mortgages, can protect banks by forcing early repayment/refinancing, and are also preferred by speculators since they maximise leverage and defer equity repayment (Barlevy and Fisher 2010). The use of this kind of instrument may also reflect banks engaging in risk-shifting once they find themselves exposed to a bubble. If a sharp drop in housing prices can lead to financial distress, and banks find it too costly or impossible to diversify this risk, they will have an incentive to increase the correlation between their portfolio and housing prices. Further, the emergence of a bubble (and increased volatility in price this entails) can offer leveraged institutions an opportunity to increase risk-taking in a fashion that is more difficult to detect (and hence price) than in tranquil times. This is individually optimal for institutions protected by limited liability, but increases the cost of the crisis if and when the crash occurs.

Note, however, that (depending on the set-up) bubbles can also lead to expansions in capital stock and output. Essentially, higher asset valuations raise the net worth of entrepreneurs and reduce the effects of financial frictions, such as the credit constraints considered in DSGE models, hence improving aggregate welfare (Martin and Ventura 2011). This is akin to what happens in the low screening equilibrium described in the previous section.

2.5 Strategic complementarities

Banks' excessive exposure to real estate prices may also result from strategic complementarities. Implicit or explicit guarantees of government intervention in case of a systemic crisis, and externalities associated with large bank failures provide banks with incentives to correlate their portfolios. Put differently, banks may find it optimal to trade idiosyncratic risk for macro risk, increasing both the probability of systemic crises and their depth should one occur.

Governments are unlikely to rescue isolated banks in distress (we abstract from too-big-to-fail arguments here). And, when they do, they can impose harsh sanctions that help limit moral hazard. In a systemic crisis, however, authorities may find it optimal to resort to untargeted actions (such as drastic monetary policy easing, fiscal stimulus, or international bailouts in support of exchange rate pegs) for which they cannot administer immediate punishment. These policies are *ex post* optimal, but entail *ex ante* distortions. If a sufficiently large portion of the financial system engages in risky lending (e.g. real estate-related lending with massive maturity mismatches and interest rate exposure as in the United States, or with currency mismatches, as in eastern Europe), it is individually optimal for a bank to do the same. If things go well, profits will be high. If they go badly, a rescue will come. As in the low screening equilibrium described above, deviating from this strategy implies lower returns. It does not pay to play safe when everybody is taking risks (Acharya and Yorulmazer 2007; Diamond and Rajan 2011; Farhi and Tirole 2012). But here the result is an inefficient equilibrium in which authorities may be forced to take actions that distort the economy at large. For instance, the central bank may be forced to ease monetary policy to support the financial sector in a fashion inconsistent with its price stability objective.

Externalities associated with bank failures can lead to a similar equilibrium. Financial institutions are exposed to each other directly through the interbank market, and indirectly through the real economy, reputation channels and financial markets. Some of these risks can be diversified, others not. The resulting threat of contagion affects banks' risk-taking incentives. If a large portion of the banking system is exposed to real estate prices, and a systemic crisis would severely affect the economy (and thus the creditworthiness of all borrowers), it may be individually optimal for other banks to take that same exposure (Dell'Ariccia and Ratnovski 2012). The key mechanism is that when a bank can fail due to exogenous circumstances, it does not pay as much to invest to protect itself from idiosyncratic risk. Further, the threat of contagion generates a strategic complementarity: banks take more risk when other banks take more risk, because the risk-taking of other banks increases the threat of failure and hence contagion.

3. Evidence

There is a growing empirical literature exploring how real estate booms affect bank risk-taking and speculative behaviour. Papers can be roughly divided into two groups. First, there is a well-established body of empirical work linking boom-bust cycles to episodes of financial distress. This 'reduced-form' approach does not provide direct evidence of changes in bank risk-taking behaviour. But it does show that sharp increases in credit and leverage are at the core of the relationship between real estate booms and crises. Second, there is a recent, but growing, set of studies addressing directly the issue of how banks behave during real estate booms. These papers find evidence that real estate booms are associated with declines in lending standards, greater

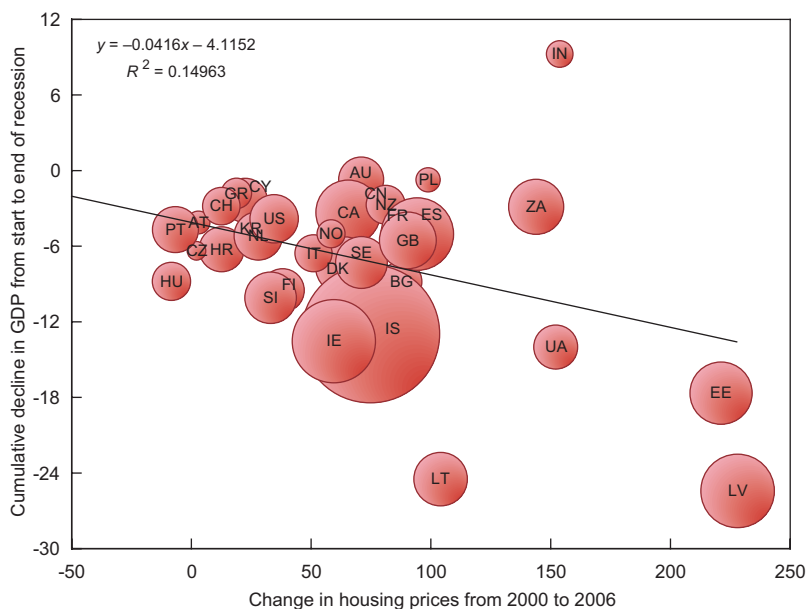
recourse to riskier contract structures, changes in leverage, and risk shifting. We review these two groups of papers in turn. A caveat before we start. Different linkages and effects identified by theoretical frameworks are likely to coexist in individual markets, lending institutions and even borrowers. As a result, empirical evidence can be consistent with multiple stories (theories) at the same time. That said, in what follows, when possible, we make an effort to link evidence to theory.

3.1 Real estate booms, credit booms and financial crises

The recent crisis has brought to centre stage the dangers to bank stability posed by real estate boom-bust cycles. The bursting of the real estate bubble in the United States led to the deepest recession since the Great Depression and quickly spread to other countries; in particular those with their own home-grown bubbles. Banking crises erupted in several countries (Laeven and Valencia (2012) document 17 systemic crises and an additional 8 borderline cases), at the cost of sharp increases in sovereign debt ratios and deep output contractions.

Yet, the pattern is not new. Recessions associated with housing busts have been typically deeper (output losses are two-to-three times larger) and longer (averaging 18 quarters versus 4 quarters) than 'standard' downturns (Claessens, Kose and Terrones 2008). The crisis confirmed these regularities. Across countries, the amplitude of housing price upturns prior to 2007 is statistically associated with the severity of the impact of the crisis across countries (Figure 1).

Figure 1: Severity of Crisis and Housing Price Run-up



Notes: Bubble size shows the change in bank credit from 2000 to 2006; see Glossary for a listing of country codes

Source: Claessens *et al* (2008)

Further, there is ample evidence that these negative effects are largely due to the role of the banking sector. The Scandinavian banking crises of the early 1990s and the Asian financial crisis were associated with boom-bust cycles in property prices (Herring and Wachter 1999), as were two of Reinhart and Rogoff's (2009) other 'big five' crises, Spain 1977 and Japan 1992. More generally, real estate boom-bust patterns preceded more than two-thirds of the 46 systemic banking crises for which housing price data are available (Crowe *et al* 2011). Similarly, 35 out of 51 boom-bust episodes were followed by a crisis. By contrast, only about half the crises follow a boom-bust in stock prices and only about 15 per cent of stock market boom-busts precede systemic banking crises (virtually all of these cases coincide with a real estate boom-bust).

Boom-bust episodes tend to have worse consequences when the booms coincide with rapid increases in leverage and exposure of households and financial intermediaries. In the global financial crisis, this occurred in more than half of the countries in the sample of 40 countries (Table 1). Almost all the countries with 'twin booms' in real estate and credit markets ended up suffering from either a financial crisis or poor performance (21 out of 23). Eleven of these countries actually suffered from both damage to the financial sector and a sharp drop in economic activity. In contrast, of the seven countries that experienced a real estate boom, but not a credit boom, only two went through a systemic crisis and these countries, on average, had relatively mild

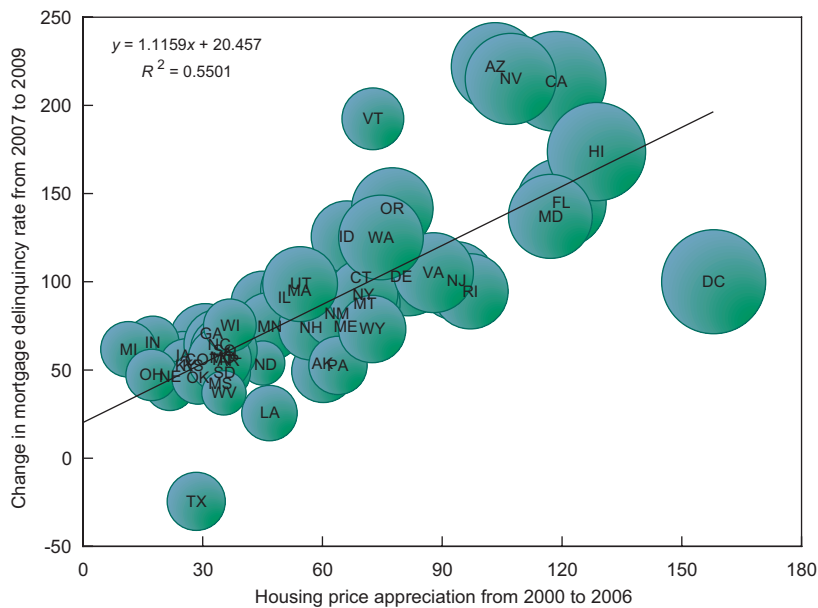
Table 1: Booms, Crises and Macroeconomic Performance

Boom	Probability of being followed by:				Number of countries
	financial crisis	poor performance	financial crisis or poor performance	financial crisis and poor performance	
	Per cent				
Real estate	53	77	87	43	30
Credit	67	78	93	52	27
Real estate but not credit	29	71	71	29	7
Credit but not real estate	100	75	100	75	4
Both	61	78	91	48	23
Neither	27	18	45	0	11

Notes: The sample consists of 40 countries. The numbers, except the last column, show the per cent of cases in which a crisis or poor macroeconomic performance happened after a boom was observed (out of the total number of cases where the boom occurred). The last column shows the number of countries in which a boom occurred. A real estate boom exists if the annual real housing price appreciation rate during 2000–2006 is above the *ad hoc* threshold of 1.5 per cent or the annual real housing price appreciation rate in the upward phase of the housing cycle prior to the crisis exceeds the country-specific historical annual appreciation rate. A credit boom exists if the growth rate of bank credit to the private sector as a per cent of GDP is more than the arbitrary cut-off of 20 per cent or it exceeds the rate implied by a country-specific, backward-looking, cubic time trend by more than one standard deviation. A financial crisis is a systemic banking crisis as identified in Laeven and Valencia (2012). Poor performance is defined as more than a 1 percentage point decline in real GDP growth in 2008/09 compared to the 2003–2007 average.

recessions. The role of the boom and associated leverage in explaining defaults was also evident in the recent US boom-bust cycle (Figure 2). Post-bust increases in delinquency rates were larger in regions that had experienced greater rates of housing price appreciation during the boom. Further, delinquencies increased more in regions with higher increases in household leverage (Mian and Sufi 2010).

Figure 2: Leverage – Linking Booms to Defaults



Notes: Bubble size shows leverage (calculated as mortgage credit outstanding divided by household income) in 2007; see Glossary for a listing of United States state codes

Sources: Bureau of Economic Analysis; Federal Housing Finance Agency; Mortgage Bankers Association; US Census Bureau

This confirms the critical role played by the interaction between real estate dynamics and bank behaviour. Indeed, while real estate booms (as with other asset price booms) have been identified as a predictor of financial distress (Borio and Lowe 2002; IMF 2011), they lose significance once one conditions for the presence of credit booms. Real estate prices do grow faster during credit booms than in tranquil times. But they grow at about the same pace in credit booms that end up badly as in those that have a soft landing (Dell'Ariccia, Igan, Laeven and Tong *et al* 2012).

3.2 Changes in credit standards

Lending standards generally refer to any of the various non-price lending terms in bank business loans or credit lines (collateral, covenants, loan limits) and to less observable bank activities such as borrower screening and information collection. Laxer lending standards are sometimes identified by a decline in collateral requirements or an increase in loan limits. But more often they are measured with summary statistics from survey data (such as the Fed's Senior Loan Officer Opinion Survey on Bank Lending Practices), or by looking at loan denial data after controlling for borrower fundamentals.

There is ample evidence that credit standards for mortgages and other real estate-related lending vary over the economic cycle: they are easier in the upswing and tighter in the downturn (Asea and Blomberg 1998; Berger and Udell 2004; Lown and Morgan 2006). However, while this evidence is consistent with the notion that standards change in a similar fashion over real estate cycles (the two phenomena are observationally equivalent to the extent that business and real estate cycles overlap), it does not address the role of real estate prices directly.

The recent global financial crisis offers greater insights into how banks alter their lending standards in response to changes in real estate market conditions.

Mortgage originations in the United States increased across the board in the run-up to the crisis. But they did more so in the subprime market, the segment characterised by less creditworthy borrowers. This was not necessarily a bad development. Rising housing prices contributed to the relaxation of credit constraints for the most marginal borrowers, who were able to leverage newly acquired equity in their houses to fund other expenses. For instance, home equity-based borrowing was stronger for younger households, households with low credit scores, and households with high initial credit card utilisation rates. However, after the bust, these households represented a significant share of new defaults (Mian and Sufi 2010).

Critically, the increase in loan volumes was not fully explained by improvements in the quality of the borrower pool or macroeconomic conditions. Instead, the analysis of mortgage performance adjusted for differences in borrower characteristics, loan characteristics and macroeconomic conditions shows that the quality of loans deteriorated for six consecutive years before the crisis (Demyanyk and Van Hemert 2011).

Rising real estate prices (which were partly fuelled by this credit expansion) had an important role in these developments. As the boom continued, rising prices allowed poorly performing borrowers to sell or refinance their properties. This provided support for loan performance and masked (temporarily) the 'true' riskiness of subprime mortgages. Indeed, lower-credit quality borrowers (with very high post-bust default rates) living in areas with fast-rising house prices experienced a relative decline in default rates from 2002 to 2006 (Mian and Sufi 2010). And housing price appreciation after origination, measured as the change in housing prices between the time of origination and the time of loan evaluation, was a critical determinant of loan performance (Demyanyk and Van Hemert 2011). Thus, rising prices helped interest rates remain low along the entire mortgage production chain.

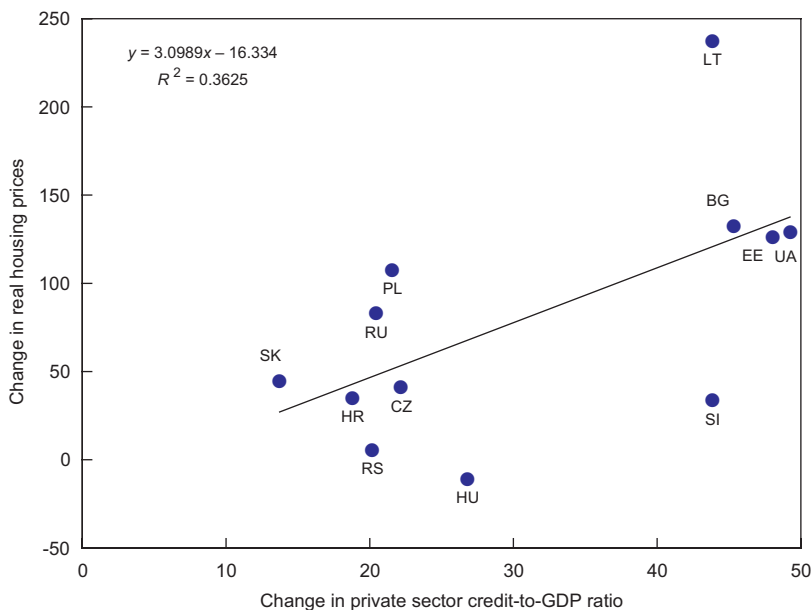
Rising prices also allowed for (and reflected) continued lax lending standards: loan denial rates (adjusted for borrower characteristics) declined more in regions with faster rising housing prices, even after controlling for their endogenous component (Dell'Ariccia, Igan and Laeven 2012). In itself, this might have reflected a 'legitimate' response on the part of lenders to the (unobservable) positive effect of higher borrower net worth on creditworthiness. However, it is also consistent with lenders 'gambling' on the real estate bubble through speculative borrowers. The fact that this effect was most pronounced in the subprime market, and evidence of a steady increase in loan-to-value (LTV) ratios (Demyanyk and Van Hemert 2011), support the latter hypothesis.

Also consistent with the 'speculative behaviour' hypothesis is the fact that lenders increasingly resorted to mortgage contract structures whose performance relied on continued favourable macroeconomic conditions.

In the US subprime market, the share of fixed-rate mortgages dropped from over 30 per cent to below 20 per cent between 2001 and 2006. Hybrid mortgages (including interest-only mortgages) rose accordingly. This development also holds cross-sectionally. For instance, back-loaded products such as interest-only mortgages were used primarily in areas that experienced large housing price appreciations (Barlevy and Fisher 2010). Hybrid contracts typically entail steep increases in payments and interest resets that most borrowers can satisfy only through refinancing or selling their property. Loan performance, then, depends critically on the continuing rise in house prices and low interest rates.

In Europe, a similar trend took the form of a sharp increase in the share of FX-denominated loans. In several eastern European countries, real estate booms were funded by credit booms associated with a rapid growth of foreign currency loans (Figure 3).

Figure 3: Selected Central and Eastern European Countries – Housing Prices and Private Sector Credit
2003–2008



Notes: As the boom in the Baltic states ended in 2007, data for the Baltics refer to 2002–2007; see Glossary for a listing of country codes

Sources: IMF, International Financial Statistics database; national statistical offices

In particular, Swiss franc borrowing, with its very low interest rates, became increasingly popular in countries with floating exchange rates (Croatia, Hungary, Poland and, to a lesser extent, Romania), while euro-denominated loans became more prevalent in countries with currencies pegged to the euro (such as Latvia and Estonia). The lower interest rate attached to FX-denominated contracts increased affordability and reduced idiosyncratic risk. But it exposed the entire system to massive exchange rate risks. Borrowers without foreign currency income would not be able to repay their mortgages in case of a sharp devaluation of the domestic currency.

The recourse to instruments that traded idiosyncratic risk for macro risk (FX loans in Europe and hybrid mortgages in the United States) is also consistent with risk-shifting associated with the expectation of government intervention should the macro risk be realised (as in Farhi and Tirole (2012)). In addition, to the extent that some financial institutions found themselves overexposed to real estate markets, seeking further exposure may have been a form of 'gambling for resurrection'. This second source of risk-shifting may have been particularly relevant in the 2004 to 2006 period, when the Fed's monetary policy tightening resulted in an adverse shock to highly exposed institutions (Landier, Sraer and Thesmar 2011). In the end, macro (and micro) bailouts happened in both cases: with massive monetary policy easing and fiscal stimulus in the United States and with international packages in support of exchange rate pegs in eastern Europe.

Lending standards also declined as banks reacted to large increases in the market for potential borrowers. (These dynamics were obviously associated with the increase in housing prices, but were not directly dependent on them. They could also occur in non-housing-related credit booms.) In the United States, denial rates were relatively low in areas that experienced faster credit demand growth and lenders in these high-growth areas attached less weight to applicants' loan-to-income ratios (Dell'Ariccia, Igan and Laeven 2012). This was in addition to the effect of housing price appreciation, mortgage securitisation and other economic fundamentals. Overall, this evidence is consistent with models of bank strategic interaction in which changes in the distribution of borrowers arising from changes in credit demand affect the standards that banks apply in lending (Ruckes 2004; Dell'Ariccia and Marquez 2006; Gorton and He 2008).

Finally, lending standards declined in response to the securitisation boom associated with the development of new products in the mortgage intermediation chain (Mian and Sufi 2009; Ashcraft, Goldsmith-Pinkam and Vickery 2010; Keys *et al* 2010). The increasingly widespread use of securitisation (especially for subprime loans) obviously contributed to the real estate boom. And, to the extent that rising real estate prices made mortgage-backed securities less information sensitive (including through reliance on credit rating agencies), the booms contributed to the development of this market.

4. Policy Options

Before the crisis, the consensus on the correct policy approach to real estate booms was one of 'benign neglect' (Bernanke 2002; Greenspan 2002). This view was based on two beliefs: speculative bubbles were too difficult to distinguish from price changes based on fundamentals; and policy (in particular monetary policy) was well equipped to deal with the consequences of a bust.

The crisis has shifted (at least in part) this consensus toward the notion that real estate booms are too dangerous to leave alone. In particular, partly reflecting the analyses reported above, a view is emerging that the interaction of large real estate price fluctuations with the volume and quality of credit (in particular bank credit) deserves far greater policy attention. To be fair, some of the dangers associated with boom-bust cycles were recognised before the crisis. But, with a few limited exceptions (for instance, Sveriges Riksbank and the RBA), monetary authorities took the position that controlling excessive risk-taking was in the realm of regulation (Mishkin 2008). And regulatory policy, with its focus on individual institutions, was ill-equipped to deal with asset-price fluctuations and aggregate credit dynamics.

Obviously, some of the rationale that backed the benign neglect approach is still valid. It remains difficult to separate (in real time) ‘bubbles’ from large or rapid movements in prices based on fundamentals. And, although better yardstick indicators (such as price-to-income and price-to-rent ratios, measures of credit growth, and leverage) can be developed to guide policy, just as with many other policy decisions, action may have to be taken under considerable uncertainty, when the costs of inaction can be prohibitively high.

The question then arises as to which policy lever is best suited to deal with the dangers associated with real estate boom-bust cycles. Based on the analysis above, the main risks appear to come from rapid credit expansions and the associated deterioration in bank and household balance sheets. Policies should thus aim at containing these risks rather than the price increases themselves. In that context, one could think of policies as targeting three (not mutually exclusive) objectives: (i) preventing real estate booms, to avoid the associated dangers altogether; (ii) altering lenders’ behaviour over the real estate cycle to contain excessive credit expansion and risk-taking; and (iii) increasing the resilience of the financial system to a real estate bust. Table 2 gives a (non-exhaustive) summary of policy measures available towards achieving these objectives along with their pros and cons.

We should recognise at the onset that there is no silver bullet. Each policy entails costs and distortions. And effectiveness is limited by loopholes and implementation problems. Broad-reaching measures (such as a change in the monetary policy rate) are more difficult to circumvent but they typically involve greater costs. More targeted measures (such as maximum LTV ratios) may have more limited costs but they are challenged by loopholes, which may jeopardise their efficacy.

Table 2: Policy Options to Deal with Real Estate Booms
(continued next page)

Macroeconomic policy		Potential impact	Side effects	Practical issues
Monetary measures				
Interest rates	} responding to property prices and/or real estate loan growth	Potential to prevent booms, less so to stop one that is already in progress	Inflict damage to economic activity and welfare	Identifying 'doomed' booms and reacting in time; constraints imposed by monetary regime
Reserve requirements				
Fiscal measures				
Transaction/ capital gains taxes linked to real estate cycles		Automatically dampen the boom phase	Impair already-slow price discovery process	Incentive to avoid by misreporting, barter, folding the tax into the mortgage amount
Property taxes charged on market value		(Could) limit price increase and volatility		Little room for cyclical implementation
Abolition of mortgage interest deductibility		Reduce incentives for household leverage and house price appreciation	(Potentially) inflict damage on the real estate sector by taking away a sectoral advantage	Little room for cyclical implementation

Table 2: Policy Options to Deal with Real Estate Booms
(continued)

	Potential impact	Side effects	Practical issues
Regulatory policy			
Macroprudential measures			
Differentiated capital requirements for real estate loans	Increase cost of real estate borrowing while building buffer to cope with the downturn	Costs associated with potential credit rationing	May get too complicated to enforce, especially in a cyclical context; effectiveness also limited when capital ratios are already high
Higher risk weights on real estate loans			
Dynamic provisioning for loans collateralised by real estate	Increase cost of real estate borrowing while building buffer to cope with the downturn	Earnings management	Data requirements and calibration
Limits on mortgage credit growth	(Could) limit household leverage and housing price appreciation	Loss of benefits from financial deepening	Shift lending outside the regulatory periphery
Limits on exposure to real estate sector	(Could) limit leverage and price appreciation as well as sensitivity of banks to certain shocks	Costs associated with limiting benefits from specialisation	Shift lending to newcomers for whom exposure limits do not yet bind or outside the regulatory periphery
Limits on loan-to-value ratio	(Could) limit household leverage and housing price appreciation while decreasing probability of default	Costs associated with potential credit rationing	Calibration is difficult; circumvention is easy
Limits on debt-to-income ratio			

4.1 Monetary policy

Since credit activity is at the centre of the problem, monetary policy seems like a natural place to start. After all, M2, a common measure of the money supply, is highly correlated with aggregate credit.

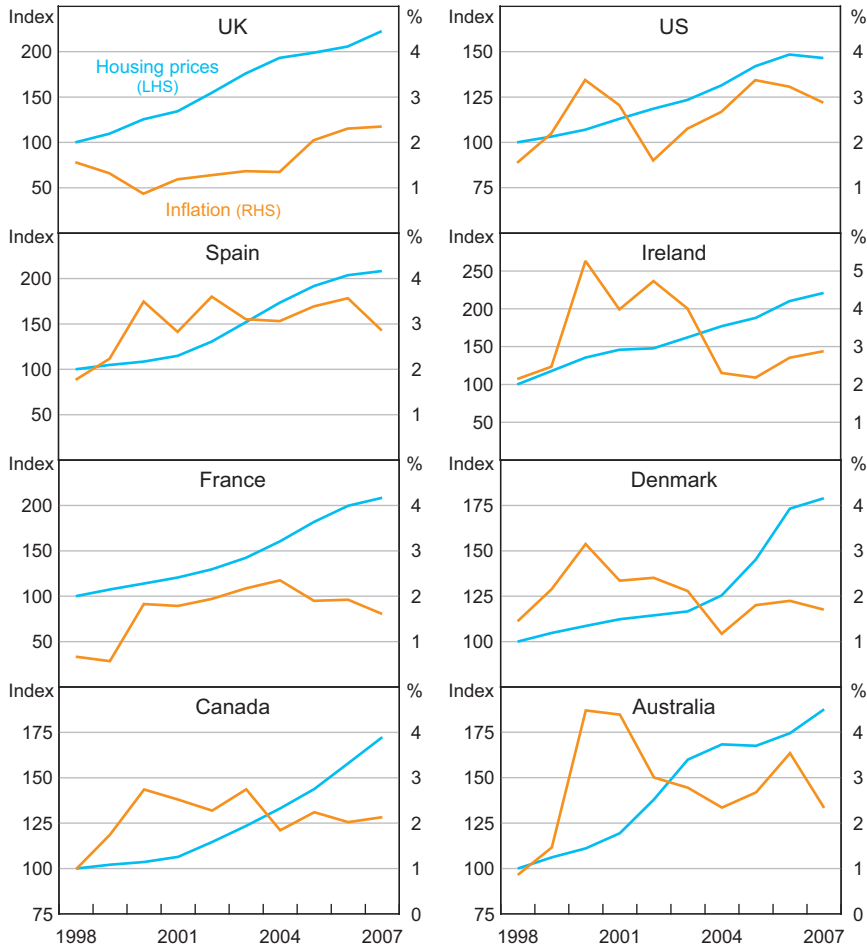
An increase in the policy rate makes borrowing more expensive and reduces the demand for loans. Higher interest payments lower the affordability index (the ratio of the median household income to the income necessary to qualify for a typical mortgage loan) and shrink the number of borrowers that qualify for a loan of a certain amount. Indirectly, to the extent that monetary tightening reduces leverage and risk-taking in the financial sector, it may alleviate the financial consequences of a bust even if it does not stop the boom (Borio and Zhu 2008; Adrian and Shin 2010; De Nicolò *et al* 2010).

Yet, monetary policy is a blunt instrument for the task at hand. First, it affects the entire economy and is likely to entail substantial costs if the boom (and associated credit expansion) is limited to the real estate market. This may entail a conflict of objectives. Put differently, a reduction in the risk of a real estate boom-bust cycle may come at the cost of a larger output gap and a higher unemployment rate (and possibly an inflation rate below the desired target range). Indeed, in the run-up to the crisis, several countries experiencing real estate (and credit booms) were enjoying low and stable inflation rates and small output gaps (Figure 4).

Obviously, these concerns are diminished when the boom occurs in the context (or as a consequence) of general macroeconomic overheating. Then, the distortions associated with monetary tightening would be minimised. Indeed, when financial constraints are present and real estate represents an important vehicle for collateral, a policy rule reacting to real estate price movements and/or credit growth can dominate a traditional Taylor rule but only for booms that occur in the context of general macroeconomic overheating (Kannan, Rabanal and Scott 2009; Iacoviello and Neri 2010).

A second complication can arise when capital accounts are open and 'the impossible trinity' comes into play. Countries with a fixed exchange rate regime simply do not have the option to use monetary policy. Others float, but are seriously concerned about large exchange rate swings associated with the carry trade when monetary policy is tightened. Then, unless intervention can be fully sterilised, capital inflows attracted as a result of higher interest rates can undo the effects of a tighter stance. Moreover, credit funded by capital inflows brings about additional dangers, including an increased vulnerability to a sudden stop.

A third issue is that, during booms, the expected return on assets (in this case, real estate) can be much higher than what can be affected by reasonable changes in the policy rate. Then, tightening may not be effective in curbing the speculative component of demand. If that is the case, it may have the perverse effect of inducing borrowers (who would have otherwise qualified for standard mortgages) to employ more dangerous loan contracts (such as interest-only, variable-rate loans, and, in some cases, foreign currency loans).

Figure 4: Housing Prices and CPI Inflation

Note: Housing prices normalised at 100 in 1998

Sources: IMF, International Financial Statistics and World Economic Outlook databases

Finally, the effectiveness of a change in the policy rate will also depend on the structure of the mortgage market. In systems where mortgage rates depend primarily on long-term rates, the effectiveness of monetary policy will depend on the relationship between long and short rates.

Empirical evidence supports these concerns. There is little cross-country evidence that the pre-crisis monetary stance had much to do with the real estate boom. Inflationary pressures were broadly contained throughout the period and the extent of housing price booms do not appear to be correlated with real interest rates or other measures of monetary conditions, except in a sub-sample of euro area countries (Fatás *et al* 2009).

On the banking front, evidence lends very limited support to the notion that monetary policy can effectively curb credit booms. However, evidence supports the view that a tighter monetary policy stance deters bank risk-taking over the longer run (see Jiménez *et al* (2011) and Maddaloni

and Peydró (2011)). But it may lead to risk-shifting and riskier contractual structures (see Brzoza-Brzezina, Chmielewski and Niedźwiedzińska (2010) for the case of Europe, and Landier *et al* (2011) for the United States) in the short run if banks are overexposed to interest rate risk.

It should be noted that this evidence may underestimate the effectiveness of monetary policy due to an endogeneity problem. If central banks tightened their stance in reaction to credit or real estate booms, policy rates would be on average higher during booms than in normal times. Then, positive deviations from conditions consistent with a Taylor rule would stem from the booms themselves. In turn, this would tend to reduce the size and significance of the regression coefficients, that is, it would bias the results against monetary policy effectiveness. However, given the monetary policy framework prevalent before the crisis, this bias probably affects only a few countries.

The bottom line is that monetary policy can in principle stop a boom, but at a very high cost. According to most estimates (see Crowe *et al* (2011)), in a boom real estate prices and credit are unlikely to react significantly to marginal changes in policy rates. And policymakers would have to 'lean against the wind' dramatically to have a meaningful impact, with consequent large effects on output and inflation. That said 'open-mouth' operations aimed at warning the public of the dangers associated with real estate-related imbalances could be of value.

4.2 Fiscal tools

In theory, various taxes and fees could be adjusted in a cyclical fashion (with real estate prices, or aggregate credit, or some systemic risk measure) to alter bank and borrower behaviour. In practice, however, cyclically adjusted fiscal measures may be of limited use. First, the evidence on the relationship between the tax treatment of residential property and real estate cycles is inconclusive. Second, proposed taxes on certain bank activities or balance-sheet items (such as short-term liabilities) are likely to be circumvented and may entail undesired side effects. And, finally, technical and political economy problems may complicate implementation.

Empirical evidence supports these considerations. At the structural level, the tax treatment of housing does not appear to be related across countries to the amplitude of real estate cycles. In particular, tax structure was not likely to have been a main driver of housing price developments during the recent global housing boom (Keen, Klemm and Perry 2010). Real housing prices increased significantly in countries with tax systems that are highly favourable to housing (such as Sweden) as well as in countries with relatively unfavourable tax rules (such as France). On the banking front, fiscal tightening does not seem to be associated with either a reduced incidence of credit booms or a lower probability of a boom ending badly (details in Dell'Ariccia, Igan, Laeven and Tong *et al* (2012)).

Cyclical transaction taxes are, in theory, more promising in dealing with booms (Allen and Carletti 2011b). But it should be recognised that these taxes may induce considerable distortions in real estate markets and, indirectly, on labour markets through their impact on mobility. On the bust side, the use of time-limited tax credits linked to housing purchases in the United States and the suspension of stamp duty in the United Kingdom helped stabilise the housing market. And, especially in the United States, the stabilisation in prices and the revival of activity disappeared with the expiration of the tax breaks (Igan and Loungani 2010). On the boom side, China and

Hong Kong SAR have recently introduced higher stamp duties to dampen real estate prices and discourage speculation. Their experience, however, also indicates that transaction volume responds more than prices do (suggesting that the associated collateral costs are high) and the impact of the introduction of the tax may be transient.

Similarly, new fiscal tools aimed at specific components of bank balance sheets have been proposed in the aftermath of the global financial crisis. These could take the form of levies imposed on financial activities – measured by the sum of profits and remuneration (Claessens *et al* 2008) – or a countercyclical tax on debt aiming to reduce leverage and mitigate the credit cycle (Jeanne and Korinek 2010). These can have a direct impact on the externalities associated with leverage and risk-taking. Such ‘financial activities taxes’ or ‘taxes linked to credit growth’ could reduce the speed at which individual financial institutions can expand and prevent them from becoming ‘too systemically important to fail’. The associated revenues can be used to create a *public* buffer rather than private buffers for individual institutions as do capital requirements. Moreover, unlike prudential regulation that applies only to banks, the proposed tools could contain the credit expansion of non-bank financial institutions as well.

Yet, practical issues with these newly proposed fiscal tools also exist. Incentives to evade the new levies may lead to an increase in the resources devoted to ‘tax planning’. These incentives may actually strengthen when systemic risk is elevated because, as the possibility of having to use the buffers increases, financial institutions may attempt to avoid ‘transfers’ to others through the public buffer. A further complication may arise if there are provisions to protect access to finance for certain borrowers or access to certain type of loans: circumvention through piggyback loans or by splitting liabilities among related entities may generate a more complex and worse situation for resolution if the bust comes. In addition, in order for these new measures to be effective, they would have to take into account how banks react to their imposition. This is likely to mean a diversified treatment for different categories of banks (which opens up the risk of regulatory arbitrage) and progressive rates based on information similar to what is used for risk-weighted capital requirements (Keen and de Mooij 2012).

In summary, ‘financial taxation’ proposals make sense on paper, but remain to be tested. In the meantime, the best (most practical) shot for fiscal policy is likely to be in creating room in boom years for intervention to support the financial sector or stimulate the economy, if the bust arrives. Obviously, this is easier said than done. Political economy will make it difficult to sustain large fiscal surpluses for prolonged periods, especially when real estate booms do not fully overlap with macro cycles.

4.3 Macroprudential regulation

The limited effectiveness and high potential costs of macroeconomic policies in curbing real estate booms (and the associated credit booms) suggest the need for a different approach. At least in theory, macroprudential measures, such as higher capital requirements or limits on various aspects of mortgage credit, can target narrow objectives (for instance, household or bank leverage) and tackle (excessive) bank risk-taking associated with real estate booms more directly and at a lower cost than traditional macroeconomic policies.

Against the benefit of a lower cost, these measures are likely to present two shortcomings. First, they may be easier to circumvent as they target specific types of contracts or groups of agents. When this happens, these measures can be counterproductive, possibly generating liability structures that are more difficult to resolve/renegotiate in busts. Second, they may be more difficult to implement from a political economy standpoint. Over time, monetary policy decisions have come to be accepted as a 'necessary evil' and central banks have increasingly achieved credibility and independence. In contrast, macroprudential measures could be perceived as an unnecessary intrusion into the functioning of markets. Their more targeted impact would also complicate implementation, as winners and losers would be more evident than in the case of macro policies (although several countries seem to have dealt effectively with this problem).

In this review, we focus our analysis on three specific sets of measures. First, capital requirements or risk weights that change with the real estate cycle. Second, dynamic provisioning, that is, the practice of increasing banks' loan-loss provisions during the upswing phase of the cycle. And third, the cyclical tightening/easing of eligibility criteria for real estate loans through LTV and/or debt-to-income (DTI) ratios.¹ In principle, these tools may (indirectly) reduce the likelihood and/or magnitude of a real estate boom. But by directly targeting risk-taking, containing leverage and increasing provisioning, they are explicitly aimed at altering bank behaviour during booms and at strengthening the financial system against the effects of a real estate bust.

A caveat is in order before we start our analysis. Macroprudential policy frameworks are still in their infancy, and only a minority of countries have actively used them (Borio and Shim 2007; Crowe *et al* 2011). This limits data availability. In addition, these measures are typically used in combination with macroeconomic policy and direct interventions to the supply side of housing markets (such as in Singapore), which further complicates the challenge to attribute outcomes to specific tools (Table 3).

¹ Other measures not discussed here include cyclical ceilings on portfolio exposure to real estate, speed limits on real estate lending, and restrictions on certain type of loans. These tools have been used even more sparingly.

**Table 3: Survey-based Assessment of Policy Frameworks
as at September 2010**

Per cent of respondents giving a particular answer

	No		Yes		
			Directly ^(a)	Subject to restrictions	Cyclical
Monetary policy					
Credit growth explicitly considered?	78	22	14		
Property prices explicitly considered?	64	36	8		
Tax system					
Transactions tax?	6	94		64	
Mortgage interest deductability?	39	61		44	
Regulatory structure					
Restrictions on ...					
which financial institutions can extend mortgage loans?	50	50			
type of mortgages?	81	19			
LTV ratio?	53	47			
DTI ratio?	50	50			
mortgage credit growth rate?	94	6			
Real estate-specific loan loss provisioning?	61	39			11
Real estate-specific risk weights?	56	44			11
Full recourse on mortgages?	25	75			

Notes: Compiled responses from 36 countries; country-by-country responses to this brief in-house survey are in Crowe *et al* (2011)

(a) That is, not through the rent component of the CPI

Source: Crowe *et al* (2011)

4.4 Higher capital requirements/risk weights

Capital requirements or risk weights linked to real estate price dynamics, force banks to hold more capital against real estate loans during booms to build buffers against losses during busts. Further, by increasing the cost of credit during booms, they might reduce demand and contain real estate prices themselves. Weights could be fine-tuned to target regional booms, potentially reducing the macroeconomic costs of the intervention.

A few caveats are in order. First, absent more risk-sensitive weights, an across-the-board increase in risk weights (or capital requirements) may push lenders towards riskier loans. Second, (as with any other measure targeting the banking system), procyclical risk weights may be circumvented through recourse to non-bank intermediaries, foreign banks and off-balance sheet activities. Third, these measures will lose effectiveness when actual bank capital ratios are well in excess of regulatory minima (as often happens during booms). Fourth, as for marginal changes in the policy rate, tighter requirements are unlikely to have the economic magnitude to stop a boom. Finally, there is a time-consistency issue: regulators may be reluctant to allow banks to reduce risk weights during a bust (when borrowers become less creditworthy).

Evidence on the effectiveness of these measures is mixed. Several countries have raised capital requirements and/or risk weights on particular groups of real estate loans during credit and housing booms (Table 3). Some attempts (such as the cases of Bulgaria, Croatia, Estonia and the Ukraine) failed to stop the boom; others (such as the case of Poland) were a partial success (Crowe *et al* 2011). In these countries, tighter capital requirements appeared to curb the growth of particular groups of loans, but real estate price appreciation and overall credit growth remained strong.

4.5 Dynamic provisioning

The mechanics and benefits of dynamic provisioning (mandating loss provisioning linked to aggregate credit growth) are similar to those of procyclical capital requirements. By forcing banks to build (in good times) an extra buffer of provisions, it can help cope with the potential losses that come when the cycle turns (see, for example, the case of Spain). It is, however, unlikely to cause a major increase in the cost of credit, and thus to stop a boom. That said, one advantage over cyclical capital requirements is that dynamic provisioning would not be subject to minimums as capital requirements are, so it can be used when capital ratios maintained by banks are already high. Provisioning for property loans could be made a specific function of housing price dynamics. In periods of booming prices, banks would be forced to increase provisioning, which they would be allowed to wind down during busts. As in the case of risk weights, provisioning requirements could depend on the geographical allocation of a bank's real estate portfolio.

As noted, this type of measure is primarily targeted at protecting the banking system from the consequences of a bust. Consequently, it is not meant to have a significant impact on credit and contain other vulnerabilities associated with a boom, such as increases in debt and leverage in the household sector. In addition, there may be practical issues with the calibration of rules with rather demanding data requirements and unintended effects such as increased earnings management (which may raise issues with tax authorities and securities markets regulators). There are also risks of circumvention similar to those of procyclical risk weights.

The experience with these measures suggests that they can help strengthen a banking system against the effects of a bust, but do little to stop the boom itself. Spain led the countries that have adopted counter-cyclical provisioning. Starting in 2000 and with a major (downward) revision in 2004, the Bank of Spain required banks to accumulate additional provisions based on the 'latent loss' in their loan portfolios (for more details on the Spanish dynamic provisioning framework, see Saurina (2009)). Dynamic provisions forced banks to set aside, on average, the equivalent of

10 per cent of their net operating income. Yet, household leverage still grew by a high 62 per cent in Spain. At the end of 2007, just when the real estate bust started, total accumulated provisions covered 1.3 per cent of total consolidated assets; certainly a help, but far too little to deal with the ongoing crisis. The questions are then how provisioning requirements relate to the general macroeconomic policy stance, and whether provisioning can be made ‘sufficiently procyclical’ to appropriately deal with major systemic crises.

4.6 Limits on LTV and DTI ratios

Limits on LTV ratios can help prevent the build-up of vulnerabilities on the borrower side (in particular in the household sector), and at the same time curb risk-taking on the lender side. Containing leverage will reduce the risks associated with declines in housing prices. Put differently, the lower the leverage, the greater the drop in prices needed to put a borrower into negative equity. In turn, this is likely to result in fewer defaults when the bust comes, as more borrowers unable to keep up with their mortgages will be able to sell their houses or refinance into loans with lower interest rates (assuming the monetary policy stance would be accommodative to the bust). In addition, in case of default, lenders will be able to obtain higher recovery ratios. On the macro front, a limit on LTV ratios will reduce the risk that a large sector of the real economy ends up with a severe debt overhang. In addition, it will reduce the pool of borrowers that can obtain funding (for a given price) and thus will reduce demand pressures and contain the boom.

Similar to limits on LTV ratios, DTI limits will rein in the purchasing power of individuals reducing the pressure on real estate prices. In particular, they will be effective in containing speculative demand (they will screen out borrowers that would only qualify for a mortgage on the assumption that the house would be quickly turned around). They will also reduce vulnerabilities as borrowers will have an ‘affordability’ buffer and will be more resilient to a decline in their income or temporary unemployment.

Circumvention may entail significant costs, as it may result in liability structures that can complicate debt resolution during busts. In addition, circumvention may also involve shifting of risks not only across mortgage loan products but also outside the regulatory perimeter through expansion of credit by non-banks, less-regulated financial institutions and/or by foreign banks (which may result in increased currency mismatches as the proportion of FX-denominated loans rises).

As with monetary policy, calibration of these tools will be a learning process and a clear communication strategy will need to be developed to improve their efficiency. Frequent intervention and excessively sharp changes in the limits may lead to confusing signals and increase the risk of generating policy-induced real estate cycles. The narrow target nature of these measures may increase obstacles related to the political economy (as happened in the case of Israel), particularly since the groups more affected by LTV and DTI limits tend to be those more in need of credit (poorer and younger individuals).

The scant existing empirical evidence suggests that these are promising measures. A review of country cases that experimented with changing mandatory LTV limits in response to real estate market developments indicates that they can be quite effective (see Crowe *et al* 2011). On the banking side, there is evidence that macroprudential tools (including LTV and DTI limits) can reduce the incidence of credit booms and decrease the probability of financial distress and below

par growth performance following the boom (see Dell'Ariccia, Igan, Laeven and Tong *et al* (2012)). This suggests that macroprudential policy can reduce the risk of a bust while simultaneously reducing vulnerabilities of the rest of the economy to troubles in the financial system.

5. Conclusion

The crisis has challenged the benign neglect approach to real estate (and other asset price) bubbles. That approach was backed by a theoretical framework that saw the structure and behaviour of financial intermediaries largely as macroeconomic-neutral and by the belief that policy was well equipped to deal with the consequences of a bust.

The theoretical work and empirical evidence reviewed in this paper suggest that both tenets were wrong. Banks alter their lending and risk-taking behaviour over real estate cycles with significant implications for macroeconomic fluctuations and financial stability. And massive policy interventions notwithstanding, the most recent bust triggered the deepest recession since the Great Depression.

This calls for the revision of both models and policies. The good news is that both processes are happening. The bad news is that both will take time.

With regards to theoretical frameworks, DSGE models increasingly deal with real estate prices and with the role of financial intermediation. Several partial equilibrium models have been developed that highlight different angles of the relationship between asset prices, monetary policy and bank risk-taking. Yet, it will take time for these building blocks to be incorporated into larger frameworks and calibrated to provide quantitative policy guidance.

On the policy front, a view is gaining ground that not all bubbles are alike and those that are funded through credit and leveraged intermediaries deserve close policy attention (Crowe *et al* 2011; Mishkin 2011). There is the associated recognition that imbalances relevant to the macroeconomy (such as real estate booms and the associated excessive increases in leverage and bank risk-taking) do not necessarily show up in traditional measures of inflation and output gaps (Blanchard, Dell'Ariccia and Mauro 2010). Yet, the question of how to deal with these phenomena remains largely an open one.

Central banks are becoming increasingly involved in financial stability issues. Looking forward, aggregate credit and real estate price developments are likely to play a bigger role than before in monetary policy decisions (especially, should new macroprudential tools prove ineffective). But monetary policy remains a blunt tool to deal with real estate booms (unless they happen to occur in sync with general overheating of the macroeconomy) and its effects on bank risk-taking are still only partly understood.

Macroprudential measures are a promising addition to the policy toolkit and regulatory frameworks have already started to adapt them. For instance, Basel III introduced a capital buffer range that can be adjusted 'when there are signs that credit has grown to excessive levels' (BCBS 2011). But it will take time to design and calibrate these new tools, understand their relationship with other macroeconomic levers, and build the institutions that will control them.

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