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How to deal with real estate booms: Lessons from country experiences

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ABSTRACT

The financial crisis showed, once again, that neglecting real estate booms can have disastrous consequences. In this paper, we spell out the circumstances under which a more active policy agenda on this front would be justified. Then, we offer insights on the pros and cons as well as implementation challenges of various policy tools that can be used to contain the damage to the financial system and the economy from real estate boom–bust episodes. These insights derive from econometric analysis, when possible, and case studies of country experiences. Broadly, booms financed through credit and involving leverage are more likely to warrant a policy response. In that context, macroprudential measures can be targeted more precisely to specific sources of risk, but they may prove ineffective because of circumvention. In that case, monetary policy may have to be used to lean against the wind.

1. Introduction

Real estate booms and busts can have far-reaching consequences. These 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. Despite these dangers, in several countries, the monetary policy approach to real estate booms was one of "benign neglect". This view was held more strongly in the U.S. (Bernanke, 2002; Mishkin, 2010), but extended with some relaxation to Europe as well (Trichet, 2005; Svensson, 2009). There were of course exceptions both in emerging markets (for instance Korea) and advanced economies (for instance Australia and Sweden). This was based on three main premises. First, the belief that, as for other asset prices, it is extremely difficult to identify unsustainable real estate booms, or "bubbles" (sharp price increases not justified by fundamentals), in a timely manner. Second, the notion that the distortions associated with preventing a boom outweigh the costs of cleaning up after a bust. Third, the view that dealing with these imbalances was the job of banking regulation. Yet, regulation, largely relying on a bank-level approach, was ill-equipped to deal with risks stemming from aggregate credit dynamics. Again, in this case there were exceptions, as for instance Spain (see Saurina, 2009). The recent crisis has challenged (at least the second of) these assumptions.

The bursting of the real estate bubble in the U.S. led to the deepest recession since the Great Depression, and quickly spread to other countries; in particular those with their own home-grown bubbles. Traditional macroeconomic policy rapidly reached its limits, as monetary policy rates approached the zero bound and sustainability concerns emerged on the fiscal front. Despite the recourse to less standard policy tools (ranging from bank recapitalization to asset purchase programs and quantitative easing), the aftermath of the crisis has been characterized by a weak recovery, as debt overhang and financial sector weakness continue to hamper economic growth. It remains true that bubbles are difficult to identify with certainty. But this task can be made easier by narrowing the focus to episodes involving sharp increases in credit and leverage, which are, after all, the true source of vulnerabilities. While early intervention may engender its own distortions, it may be best to undertake policy actions on the basis of a judgment call (as with inflation) if there is a real risk that inaction could result in catastrophe.

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Yet, a call for a more preventive policy action raises more questions than it provides answers. What kind of indicators should trigger policy intervention to stop or slow down a real estate boom? Even assuming policymakers were fairly certain that intervention were warranted, what would be the policy tools at their disposal? What are their impacts? What are their negative side effects and limitations? What practical issues (including political economy considerations) would limit their use? This paper explores these questions and aims to provide a summary and discussion of options available to policymakers in dealing with real estate booms and busts, with an eye on encouraging further research on the subject.

The rest of the paper is organized as follows. Section 2 provides a summary of how real estate boom–bust cycles may threaten financial and macroeconomic stability. Section 3 discusses different policy options to reduce the risks associated with real estate booms, drawing upon country experiences and empirical evidence. Section 4 concludes with a brief discussion of guiding principles in using public policy measures to deal with real estate booms and busts.

2. The case for policy action on real estate booms

Before the crisis, in several jurisdictions, the main policy tenet in dealing with an asset-price boom was that it was better to wait for the bust and pick up the pieces than to attempt to contain/prevent the boom altogether. There were notable exceptions to this approach: the Reserve Bank of Australia and Sweden's Riksbank were proactive when faced with rapidly increasing house prices. And central banks in several emerging market paid close attention to real estate developments.[1]

A corollary of the benign neglect approach is that the characteristics of a particular asset class (such as, for example, how purchases are financed and what agents are involved, or whether the asset has consumption value besides investment value) become secondary details. Yet, if the effectiveness of post-bust policy intervention is limited and the costs are large, these details are critical to determine whether it is worth attempting to contain a boom before it reaches dangerous proportions. From this standpoint, several frictions and externalities make the case for early policy intervention in real estate market booms stronger than for booms in other asset classes. In what follows, we describe these frictions and externalities with support from evidence from historical episodes and the literature.

2.1. Leverage and the link to crises

From a macroeconomic stability perspective, what matters may be not the boom in itself, but how it is funded. Busts tend to be more costly when booms are financed through credit and leveraged institutions are directly involved. This is because the balance sheets of borrowers (and lenders) deteriorate sharply when asset prices fall.[2] When banks are involved, this often leads to a reduced supply of credit with negative consequences for real economic activity. In contrast, booms with limited leverage and bank involvement tend to deflate without major economic disruptions. For example, the burst of the dot-com bubble was followed by a relatively mild recession, reflecting the minor role played by leverage and bank credit in funding the boom.

Real estate markets are special along both these dimensions. The vast majority of home purchases and commercial real estate transactions in advanced economies involve borrowing. More often than not, banks and other levered players are actively involved in the financing. Moreover, households are allowed leverage ratios for home buying in orders of magnitude higher than for any other investment activity they undertake. A typical home mortgage loan carries a loan-to-value ratio of 71 percent on average across a global sample of countries (IMF, 2011). In contrast, stock market participation by individuals hardly ever relies on borrowed funds. When it does, loans are subject to margin calls that prevent the build-up of highly leveraged positions. As a comparison, the U.S. Flow of Funds data show that the ratio of mortgage loans to real estate assets held by the household sector hovered around 45 percent during the 2000s while the ratio of security credit to holdings of corporate equity was less than 5 percent.

In the recent crisis, highly levered housing markets had a prominent role. In particular, the boom–bust in U.S. house prices was at the root of the distress in the market for mortgage-backed securities.[3] During the boom phase, lending standards eased considerably and borrowers' ability to service their loans increasingly relied on a continued climb in prices. When house prices started to fall, both speculative buyers and owner-occupiers that were unwilling or unable to repay their mortgages could not roll them over or sell their properties and started to default (Mayer et al., 2008). As uncertainty about the quality of the underlying loans increased, the value of mortgage-backed securities began to decline. Investors holding these securities and their issuers, both often highly leveraged themselves, found it increasingly difficult to obtain financing and some were forced to leave the market. This, in turn, decreased the available funds for mortgage financing, starting a spiral. The role of the boom and associated leverage in explaining defaults is evident in Fig. 1, which plots the increase in delinquency rates against house price appreciation during the boom years for different U.S. regions and also shows the leverage of households. While caution should be exercised not to interpret these as causal links, the size of the house price boom and level of leverage at the end of the boom are correlated and the increase in mortgage delinquency rates was more pronounced in regions with higher leverage for similar boom sizes. Further, commercial banks' exposure to real estate (including commercial real estate and development loans as well as home mortgages) grew rapidly in the 2000s, reaching 54 percent, almost double the steady level hovering around 30 percent observed from 1960 to 1985 (Igan and Pinheiro, 2010). Higher exposure to real estate in a bank's balance sheet, in turn, is often associated with higher sensitivity of bank stock returns to real estate market developments (Allen et al., 2009) and with greater reduction in lending when the real estate market collapses (Gan, 2007).

This pattern is not limited to the U.S. nor is new to this crisis. The amplitude of house price upturns prior to 2007 is statistically associated (although with substantial more variability than in the

[1] There was also a variety of opinions in academia. The "lean versus clean debate" continued into early 2000s with some advocating a more activist approach by "leaning against the wind" (Cecchetti et al., 2002; Bean, 2003) and others arguing that monetary policy should clean up after the bust (Greenspan, 2002; Bernanke, 2002). See Gruen et al. (2005) and Mishkin (2010) for a recap and Ahearne et al. (2005) for a more detailed account of monetary policy responses to house price movements in a cross-country context.

[2] As illustrated in models in the tradition of Kiyotaki and Moore (1997), the collateral role of property magnifies the swings as real estate cycles become highly correlated with credit cycles. A potentially destabilizing two-way amplification process develops between rising house prices and credit boom during the upswing, and declining prices and a credit crunch during the downturn.

[3] For a more detailed discussion of this and other factors leading to the recent global financial crisis, see Claessens et al. (2010) and the references therein. For a more complete description of the events in the U.S. mortgage markets that triggered the global crisis, see, among others, Kiff and Mills (2007), Demyanyk and Van Hemert (2007), Haughwout et al. (2008), and Ellis (2008).

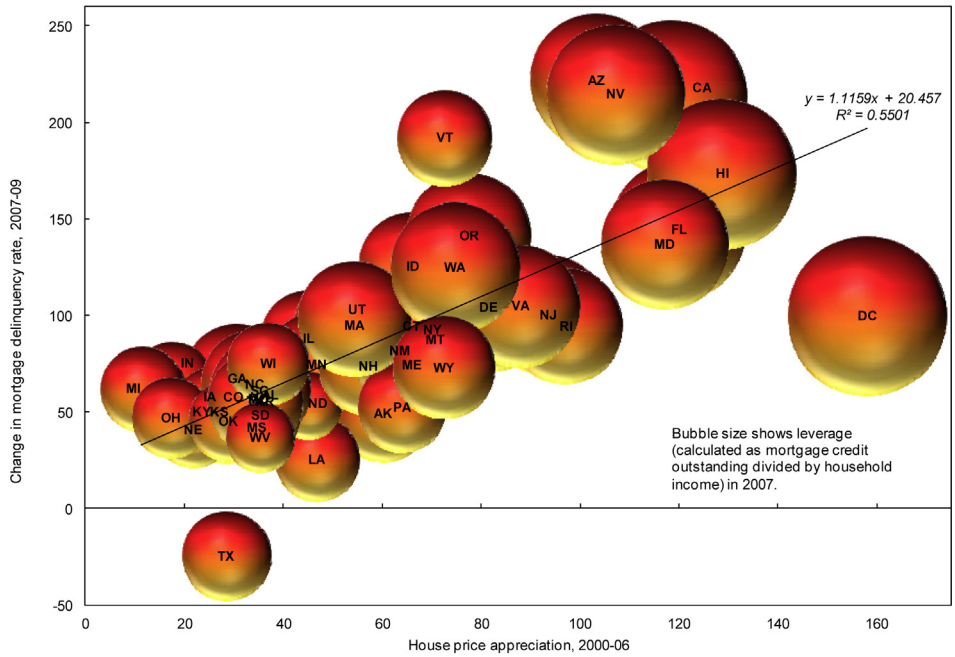

Fig. 1. Leverage: linking booms to defaults.
Sources: Federal Housing Finance Agency, Mortgage Bankers Association, Bureau of Economic Analysis, U.S. Census Bureau.

U.S.) with the severity of the crisis impact across countries (Fig. 2; also see Claessens et al., 2010, showing that this association is not driven by a few outliers such as the Baltic countries). Put differently, the U.S. market may have been the initial trigger, but the countries that experienced the most severe downturns were those with real estate booms of their own. Historically, many major banking distress episodes were associated with boom–bust cycles in property prices (Fig. 3). Of the 46 systemic banking crises for which house price data are available more than two-thirds were preceded by boom–bust patterns in house prices. 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 percent of stock market boom–busts precede systemic banking crises (virtually all of these cases coincide with a real estate boom–bust). Commercial real estate bubbles have played an important role in the savings & loans crisis in the U.S. (Freund et al., 1997), the Nordic crisis (Englund, 1999), the Asian crisis (Collyns and Senhadji, 2002), and Japan's lost decade (Renaud, 2000). Herring

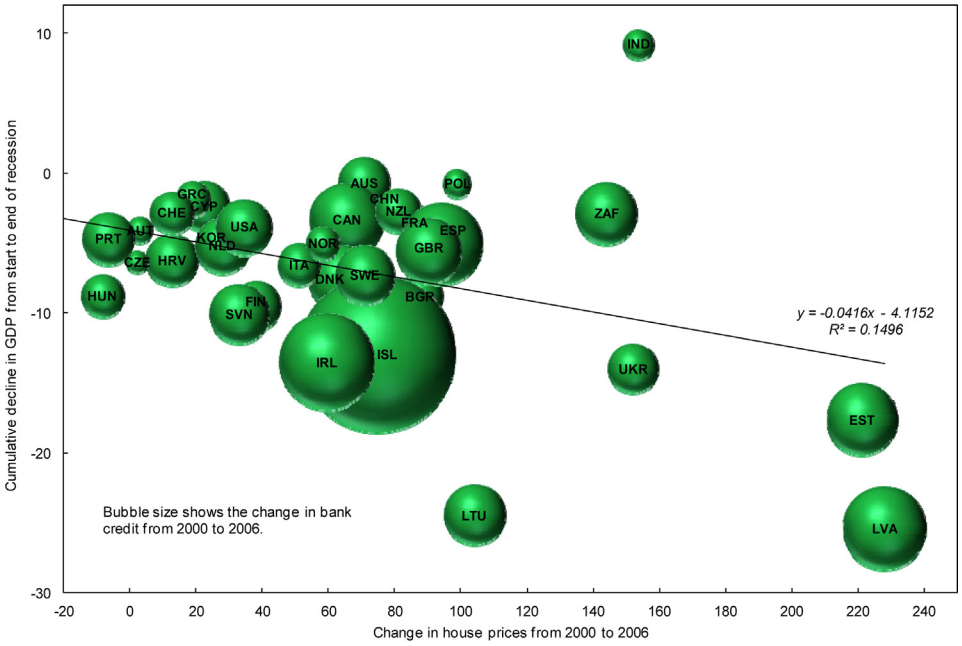

Fig. 2. House price run-up and severity of crisis.

Source: Claessens et al. (2010).

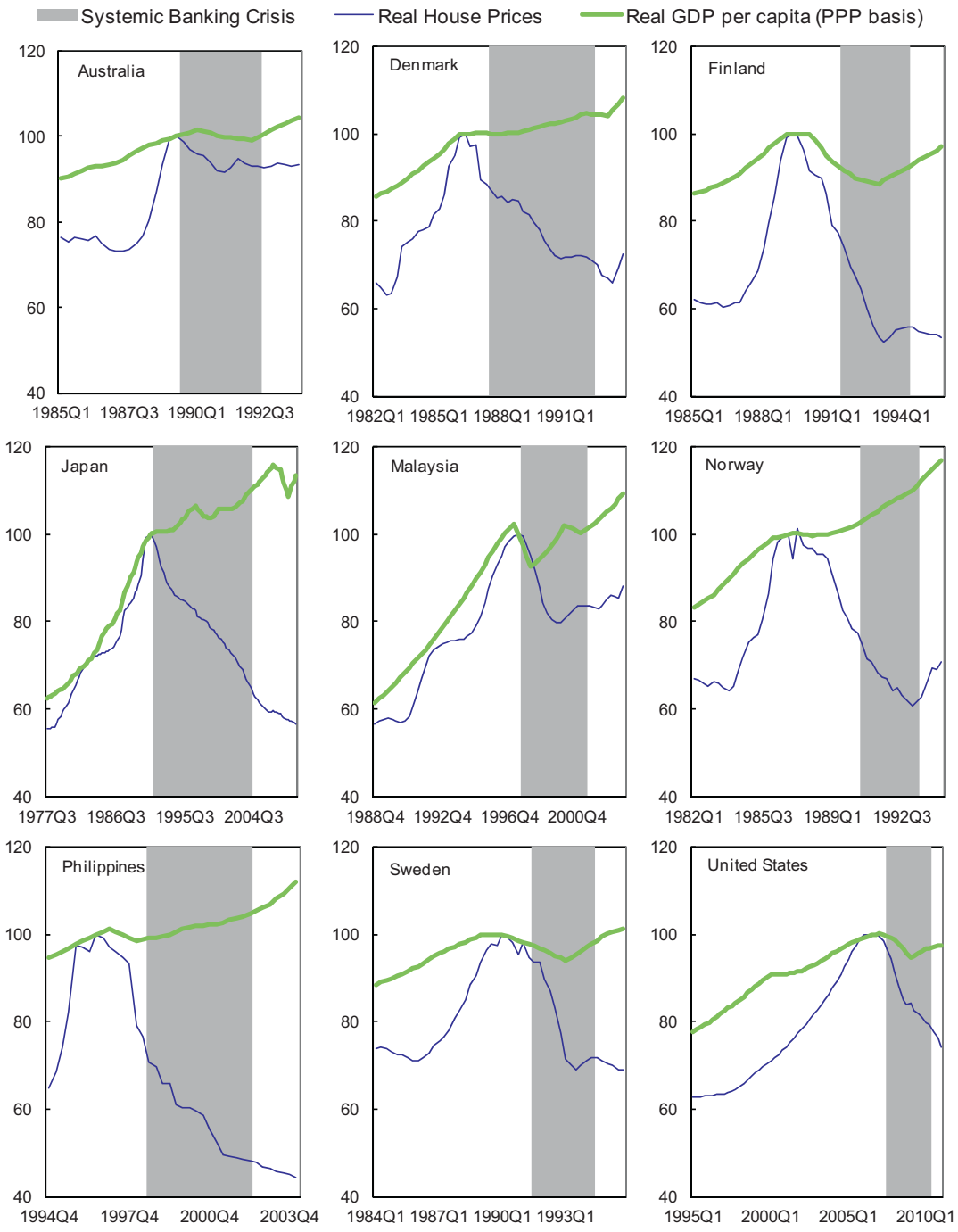

Fig. 3. House price boom-busts and financial crises. *Note*: Crisis dates, shown in gray, are from the 2003 update of the Caprio–Klingebiel Database (1996, 1999) by Caprio, Klingebiel, Laeven, and Noguera, further complemented in Laeven and Valencia (2010).
Sources: OECD, Global Property Guide, World Bank; authors' calculations.

and Wachter (1999), Reinhart and Rogoff (2008), and Duca et al. (2010) also highlight and study further the link between real estate booms and banking busts.

The primary drivers of the link between property boom–bust cycles and financial instability have been different in different crises: commercial property in East Asia, Scandinavia, Japan, and Australia in the 1990s; households in the 2008 crisis in the U.S. (see Ellis, 2008, for an analysis of U.S. institutional features related to household vulnerability); and real estate developers in Ireland and Spain in the current crisis. In general, commercial real estate boom–bust cycles may have been more commonly associated with banking crises than residential real estate boom–bust cycles (Zhu, 2003). Unfortunately, the extremely limited availability of data on commercial real estate makes it difficult to precisely pin down any distinguishing features of commercial versus residential real estate cycles and their respective associations with financial instability episodes.[4]

[4] Evidence based on limited data indicates that the two real estate sectors, commercial and residential, show more similarities than differences: the simple

Table 1
Booms, crises, macroeconomic performance.

Boom	Followed by financial crisis (percent)	Followed by poor performance (percent)	Followed by financial crisis or poor performance (percent)	Followed by financial crisis and poor performance (percent)	Number of countries
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 (Australia, Austria, Belgium, Bulgaria, Canada, China, Croatia, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hong Kong SAR, Hungary, Iceland, Ireland, Italy, Japan, Latvia, Lithuania, Malaysia, Netherlands, New Zealand, Norway, Poland, Portugal, Russia, Singapore, Slovakia, Slovenia, South Africa, Spain, Sweden, Switzerland, Thailand, Ukraine, United Kingdom, United States) where coverage is based on house price and outstanding mortgage debt data availability between 2000 and 2009. The numbers, except in the last column, show the percent of the 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 house price appreciation rate during 2000–2006 is above the ad-hoc threshold of 1.5 percent or the annual real house 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 in percent of GDP is more than the arbitrary cut-off of 20 percent 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 (2010). Poor performance is defined as more than 1 percentage point decline in the real GDP growth rate in 2008–2009 compared to the 2003–2007 average. The calculations are robust to alternative definitions of booms and poor performance including trend-based definitions and different cut-off points.

All in all, however, a distinguishing feature of "bad" real estate boom–bust episodes is the coincidence between the boom and the rapid credit expansion bringing about the increase in leverage and real estate exposure of households, developers, and financial intermediaries (Borio and Lowe, 2002; Davis and Zhu, 2011). In the most recent episode, these two (that is, real estate and credit booms) coincided in more than half of the countries in a 40-country sample (Table 1). Almost all the countries with "twin booms" in real estate and credit markets (21 out of 23) ended up suffering from either a financial crisis or a severe drop in GDP growth rate relative to the country's performance in the 2003–2007 period. Eleven of these countries actually suffered from both damage to the financial sector and 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 recessions.

2.2. Wealth and supply-side effects

Real estate is an important, if not the most important, storage of wealth in the economy. For instance, in the U.S., real estate constitutes roughly a third of total assets held by the non-financial private sector. Additionally, the majority of households tend to hold wealth in their homes rather than in equities: only half of American households own stock (directly or indirectly) while the homeownership rate hovers around 65 percent. This comparison is not specific to the U.S. and actually is more striking in some European economies, e.g., 23 percent of French households hold stocks but 56 percent are homeowners and the respective ratios in the U.K. are 34 and 71 percent (see, for instance, Guiso et al., 2003). Therefore, for a shock of similar magnitude, the wealth effect of changes in house prices is much larger than those in other asset prices. In addition, the marginal propensity to consume out of housing wealth tends to be larger than that out of financial wealth (Case et al., 2005; Sierminska and Takhtamanova, 2007).[5] It should be noted that the measured wealth effects may reflect the use of housing as collateral, and the magnitude of such effects varies across countries and over time (Aron et al., 2012).

In addition, the macroeconomic effects associated with housing market dynamics can be substantial. The construction sector is a significant contributor to value added and employs a significant portion of the labor force. As a result, the interaction between real estate boom–busts and economic activity is not limited to financial crises, but extends to "normal times". In most advanced economies, residential investment and house price cycles tend to lead credit and business cycles (Igan et al., 2011). This suggests that fluctuations in residential investment and house prices create ripples in the economy through their impact on consumption and credit while the reverse effect is not as prominent, implying that the housing sector is a *source* of shocks. In the U.S., a sharp decline in the abnormal contribution of residential investment to growth is a good predictor of recessions (Leamer, 2007). More generally, in advanced economies, recessions that coincide with a house price bust tend to be deeper and last longer than those that do not. Cumulative loss in GDP during recessions associated with housing busts is three times the damage done during recessions without busts (Claessens et al., 2008). Again, by contrast, recessions that occur around equity price busts are *not* significantly more severe or persistent than those that do not.

2.3. Illiquidity, opacity, and network effects

Boom–bust cycles are an intrinsic feature of real estate markets given the delay in supply response to demand shocks and the slow pace of price discovery due to opaque and infrequent trades as well as illiquidity owing to high transaction costs and the virtual impossibility of short sales.[6] These features frequently lead to deviations

correlation between appreciation rates on owner-occupied housing and commercial property is high and both display time series patterns consistent with persistence in the short run and mean reversion in the longer horizon (Gyourko, 2009). Data from the Federal Reserve Board confirms that delinquency rates in the two segments also tend to move together.

[5] Stock markets are typically susceptible to larger fluctuations; therefore, one could expect the wealth loss associated with stock market busts to be bigger in absolute terms. For instance, during the dot-com bust, the value of American households' equity holdings declined by 44 percent or US$5.4 trillion. The real estate bust that started at the end of 2006 has *so far* brought about a 15 percent decline in the value of real estate assets held by households, wiping US$3.7 trillion off their wealth. Interestingly, however, the total wealth lost during the real estate bust, standing at US$10 trillion or 13 percent of end-2006 total household assets, exceeds that lost during the dot-com bust, which reached US$2.8 trillion or 6 percent of end-2000 total assets, because of the spillover to other asset markets from the housing downturn.

[6] The slope of the supply curve is particularly relevant for the characteristics (such as frequency and magnitude) of boom-bust cycles and how these cycles affect the

from equilibrium. In other words, even in the absence of distortions introduced by institutional features of real estate finance systems and policy actions, real estate prices and construction activity can be expected to display large swings over long periods (Ball and Wood, 1999; Igan and Loungani, 2012). Yet another factor that could delay adjustment of prices to fundamentals in real estate markets is the existence of a large set of investors with adaptive expectations (Case and Shiller, 2003; Piazzesi and Schneider, 2009).

Network externalities also complicate the picture. Homeowners in financial distress (and in particular in negative equity) have diminished incentives to maintain their properties and do not internalize the effects of this behavior on their neighbors. Similarly, foreclosures (and the associated empty houses) tend to diminish the value of neighboring properties beyond their effect through fire sales. Large commercial real estate projects can create spatial price movements both in the upward and downward directions. These dynamics highlight the indivisibility (because of which distressed sales weigh heavily on prices as sellers cannot put only a portion of their property on the market) and the double role of real estate as investment and consumption good. These characteristics may also impose constraints on the economy's adjustment mechanisms: households with negative equity in their homes may be reluctant or unable to sell and take advantage of job opportunities elsewhere, reducing mobility and increasing structural unemployment. The preferential tax treatment of homeownership exacerbates this problem, by creating a wedge between the cost of owning and renting, and hence, inducing the loss of this tax shelter when an owner becomes a renter. Indeed, simple panel-data analysis using data from the U.S. Bureau of Economic Analysis, Federal Housing Finance Agency, and Internal Revenue Service at the state level covering the period between 2000 and 2008 suggests that this wedge may have implications for the adjustment mechanisms in the economy. Specifically, U.S. states where house prices have declined more, pushing an increasing number of households into negative-equity territory, experienced sharper declines in the mobility rate (defined as the portion of households that move from the region to another region). This relationship survives when changes in the mobility rate are regressed on changes in employment and house prices and their interaction. Hence, a housing bust may weaken the positive association between employment growth and mobility. Oswald (1996) argues that rises in owner-occupation rates have been associated with an increase in unemployment rates in advanced economies. Ferreira et al. (2010) also find evidence of a negative relationship between negative equity and mobility micro data from the American Housing Survey.[7] Micro data from the European Community Household Panel confirms this effect: the probability of an individual moving is adversely affected if the household has a mortgage, potentially hurting job creation (Boeri and Garibaldi, 2010).

3. Policy options

The crisis has lent some support to the camp favoring early intervention in real estate boom–bust cycles. Policy proved to be of limited effectiveness in cleaning up the mess and there have been large costs associated with the bust. Yet, there are practical and conceptual difficulties with any policy response to real estate booms. The issue remains of distinguishing "bubbles"—that is, price misalignments relative to economic fundamentals—from large or rapid movements in prices. And, as discussed above, there is the risk of targeting a symptom (house prices) rather than the cause (excessive leverage and borrowing) of the imbalances.

Initiatives to improve data availability and quality (especially in the commercial real estate segment) can help and better yardstick indicators (such as price-income and price-rent ratios, capitalization rates, measures of credit growth, balance sheet exposure, and leverage) can be developed to guide the assessment of the risks posed by a run-up in prices and the decision to take action against "bad" booms. True, paucity of reliable real time data and limits to predictive power of statistical analyses will limit the effectiveness of these indicators. Similar to other policy decisions, action may have to be taken under considerable uncertainty when the costs of inaction can be prohibitively high. At the end, the decision to act would reflect the particular policymaker's tolerance between Type I error (i.e., not taking any action when the boom turns out to be a bubble) and Type II error (i.e., taking policy action when the boom turns out to be benign and policy intervention restricts credit unnecessarily) and the perceived costs associated with each error, which would also vary depending on the features of the housing finance system in a country.

Despite these practical difficulties, policymakers might feel that some type of intervention is necessary. On the assumption that such intervention is warranted, even though it is often difficult to separate good from bad booms, the question arises as to which policy lever is best suited to reining in the latter. The main risks from real estate boom–bust cycles are associated with increased leverage in both the real (in particular, households and the construction sector) and financial sectors. In that context, one could think of policies as targeting two main, non-mutually exclusive objectives: (i) preventing real estate booms and the associated leverage build-up at household and banking sectors altogether and (ii) ameliorating real estate busts by increasing the resilience of the financial system to such busts. Table 2 gives a summary of policy measures available to achieve these objectives along with their pros and cons.

It should be recognized at the onset that there is no silver bullet. Each policy will entail costs and distortions, and its effectiveness will be limited by loopholes and implementation problems. Broad-reaching measures (such as a change in the monetary policy rate) will be more difficult to circumvent, and hence potentially more effective, but will typically involve greater costs. More targeted measures (such as maximum loan-to-value ratios) may limit costs, but will be challenged by loopholes, jeopardizing efficacy.

What follows are explorations and contribute to the future discussions and research in this area, especially when it comes to thinking about theoretically based policy recommendations in a practical setting. The narrative focuses mostly on residential real estate, but several (although not all) of the points would apply to commercial real estate booms as well. We examine the potential

rest of the economy. If the supply curve is flat, effect of a demand shock on prices is small and the spillovers to aggregate activity occur mainly through the increase in quantities, e.g., construction value added, limiting the spillovers through leverage (which could threaten financial stability). If the supply curve is steep, prices move more and, while direct impact on economic activity may be limited, leverage would amplify spillovers with implications for both macroeconomic and financial stability. Note that this is a rather static depiction. In practice, a more dangerous situation could emerge as property prices *increase* against the backdrop of a flat supply curve and a delayed albeit strong supply response. This can happen since supply is slow to respond to a demand shock and tries to catch up: the initial demand shock leads to a temporary increase in prices and construction activity picks up taking the past price appreciation as a signal, increased construction activity triggers a feedback mechanism where expectations of further price appreciation emerge as a result of buoyant income growth from increased activity. The recent experiences in Ireland and Spain illustrate how property price booms can coincide with construction booms and ultimately lead to excess inventory in property markets with prices in free fall. For a similar point as well as a discussion on the influence of finance system features on the link between property boom–bust cycles and financial distress, see Ellis et al. (2012).

[7] It should, however, be noted that a recent study challenges their findings arguing that certain observations were systematically left out (Schulhofer-Wohl, 2010).

Table 2
Policy options to deal with real estate booms.

		Potential impact	Side effects	Practical issues
Macroeconomic policy				
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	–	Little room for cyclical implementation
Regulatory policy				
Macro-prudential 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 collateralized 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 house price appreciation	Loss of benefits from financial deepening	Move 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 specialization	Shift lending to newcomers for whom exposure limits do not yet bind or outside the regulatory periphery
Limits on loan-to-value ratio Limits on debt-to-income ratio		(Could) Limit household leverage and house price appreciation while decreasing probability of default	Costs associated with potential credit rationing	Calibration is difficult, circumvention is easy

role of monetary, fiscal, and macroprudential policies.[8] We discuss the benefits and challenges associated with the various policy options, using cases studies of countries with experience in the use of particular measures and, where possible, cross-country evidence.[9]

3.1. Monetary policy

Can monetary policy tightening stop or contain a real estate boom? Arguably, an increase in the policy rate makes borrowing more expensive and reduces the demand for loans. In addition, higher interest payments lower the affordability index (defined as the ratio of median household income to income necessary to qualify for a mortgage loan under terms and conditions typical in each jurisdiction), increase capitalization rates (defined as the ratio of net operating income to the price of a commercial property), and reduce the number of borrowers that can qualify for a loan of given size. Moreover, indirectly, to the extent that monetary tightening reduces leverage in the financial sector, it may reduce the financial consequences of a bust even if it does not stop the boom (Adrian and Shin, 2009; De Nicolo et al., 2010).

Yet, monetary policy is a blunt instrument for this task. First, it affects the entire economy and is likely to entail substantial costs if the boom is limited to the real estate market. Put differently, a reduction in the risk of a real estate boom–bust cycle may come to the cost of a larger output gap and the associated higher unemployment rate (and possibly an inflation rate below the desired target range). Obviously, these concerns are minimized when the boom occurs in the context (or as a consequence) of general macroeconomic overheating.[10] In that context, the distortions associated with monetary tightening would be minimized. Indeed, when financial constraints are present and real estate represent an important vehicle for collateral, a policy rule reacting to real estate price movements (in addition to inflation and the output gap) can

[8] Microprudential regulation obviously is an important part of the equation as well but is beyond the scope of the paper, where we pay more attention to systemic implications of real estate boom–busts and linkages to the real economy rather than the soundness of individual financial institutions.

[9] A growing literature uses dynamic stochastic general equilibrium (DSGE) models to study the role of credit market frictions and the effectiveness of various policy tools in dealing with rapid credit and property price movements. See, among others, IMF, 2009; Cúrdia and Woodford, 2010; Iacoviello and Neri, 2010; Angelini et al., 2010; Christiano et al., 2010; Quint and Rabanal, 2013; Gelain et al., 2012; Kannan et al., 2012. While offering valuable insights, many of these models have caveats (no room for "bubbles" – i.e., house prices fluctuations reflect changes in fundamentals rather than potential deviation from fundamentals, exogenous banking sector markups that are independent of bank balance sheets, etc.). These caveats may limit the ability to derive practical policy conclusions. In contrast, our focus in this paper is exactly on these practicality issues.

[10] In fact, Christiano et al. (2010) find that when anticipated total factor productivity shocks hit the economy, asset prices and credit increase, but CPI inflation declines. In their model, despite the fall in CPI inflation, optimal monetary policy calls for an increase of nominal interest rates, because future productivity improvements raise the natural or neutral interest rate.

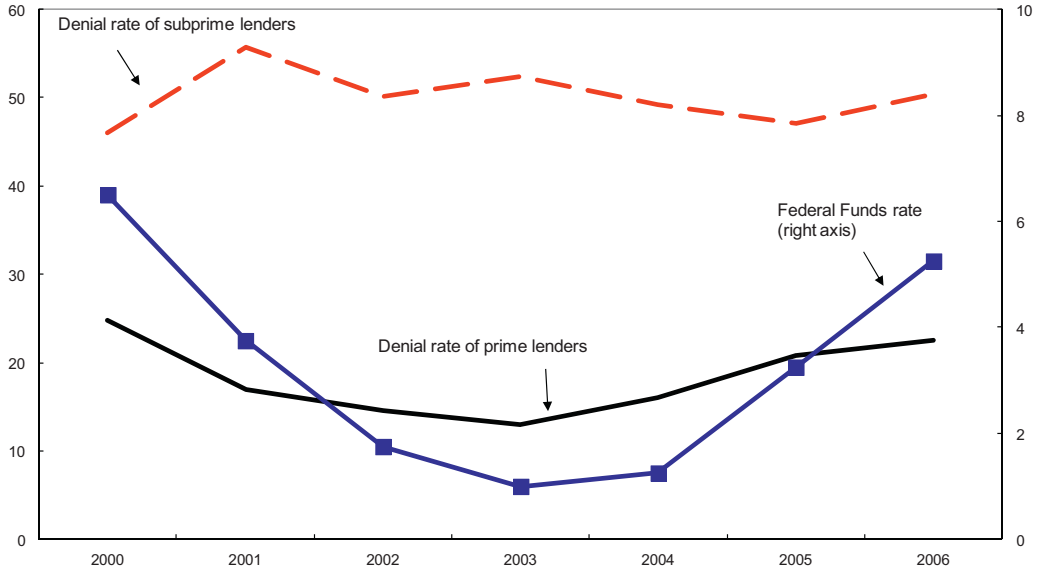

Fig. 4. Mortgage loan granting and monetary policy. *Notes*: All values are expressed in percent. Subprime lenders are identified based on the list prepared by the Department of Housing and Urban Development. Denial rate is calculated as the number of denied mortgage loan applications divided by the total number of applications. *Sources*: Home Mortgage Disclosure Act database, Federal Reserve Board.

actually improve over a traditional Taylor rule by reducing welfare loss (see, for instance, Kannan et al., 2012). Yet, even then time inconsistency, especially when coupled with political business cycles, may pose practical difficulty in using monetary policy to stop a real estate boom.

A second concern is that, during booms, the expected return on assets (in this case, real estate) can be much higher than what can be affected by a marginal change in the policy rate. Consider house prices as the sum of two components: fundamentals-driven and bubble. The fundamentals-driven component would be, more or less mechanically, affected by monetary policy. But the bubble component tends to have a life of its own with less responsiveness to policy rates as inefficiencies in real estate markets allow positively serially correlated returns (see, for instance, Case and Shiller, 1989), making speculation more attractive and bubbles harder to break once they have started.[11] For example, in the U.S., denial rates (calculated as the proportion of loans originated to applications received) in the market for prime mortgages appear highly related to changes in the Federal Funds rate, with banks becoming more choosy when the rate increases. In contrast, denial rates for subprime loans (typically more linked to speculative purchases) do not seem to move systematically with monetary policy (Fig. 4).[12]

3.1.1. Empirical analysis

Empirical analysis on a sample of 19 advanced countries supports these concerns, leading to the bottom line that monetary policy could in principle stop a boom, but at a very high cost.

At first glance, there is little evidence across countries in the sample (comprising Australia, Belgium, Canada, Denmark, Finland, France, Germany, Ireland, Italy, Japan, Korea, Netherlands, New Zealand, Norway, Spain, Sweden, Switzerland, U.K., and U.S.) that the pre-crisis monetary stance had much to do with the real estate boom. Inflationary pressures were broadly contained throughout the period and changes in house prices do not appear correlated with real interest rates or other measures of monetary conditions. This is in line with evidence reported elsewhere that finds little correlation between the extent of the recent house price boom and estimated Taylor residuals (IMF, 2009).

An explanation for this lack of a relationship may be in the rapid decline in import prices driven by the integration of low-cost emerging market economies—notably China—into global production chains, acting as a favorable supply shock that may have offset relatively high inflation in nontradable sectors. Such deflationary effects may have been stronger in countries whose nominal exchange rate relative to the yuan did not fully adjust over time. IMF (2006) finds that globalization reduced CPI inflation by more than 1 percentage point in some advanced economies after the 2001 recession. Assuming that monetary policy followed a classical Taylor rule based on the CPI, this would have tended to reduce policy interest rates by up to 200 basis points.[13] This point is particularly critical because well-founded models for analyzing monetary policy in open economies (e.g., Galí and Monacelli, 2005; Benigno and Benigno, 2006) emphasize that optimal policy responds primarily to inflation in the price of domestically produced goods, not to CPI inflation.

Going along this explanation, we plot nominal house price growth in the 10 years to the end of 2008 against the change in the relative price level of imports over the same time period to find an extremely robust negative relationship across countries (Fig. 5, top panel), particularly once we condition on the asymmetric impact of ECB monetary policy in the core and periphery of the eurozone.

[11] See Allen and Carletti (2010) for more on the role of speculation in real estate bubbles, as well as on the role monetary policy in real estate markets.

[12] Policy rate changes are likely to affect loan values through demand as well as supply channels. The association between denial rates and interest rates noted here is suggestive of a supply effect.

[13] In estimating the Taylor residuals as the difference between the actual policy interest rate and that suggested by the rule expressed as interest rate = 1 + 1.5 × inflation + 0.5 × output gap, we maintain the following assumptions: an equilibrium real interest rate of 200 basis points, an inflation target of 2 percent, and a zero output gap (calculated using the Hodrick–Prescott filter) in equilibrium.

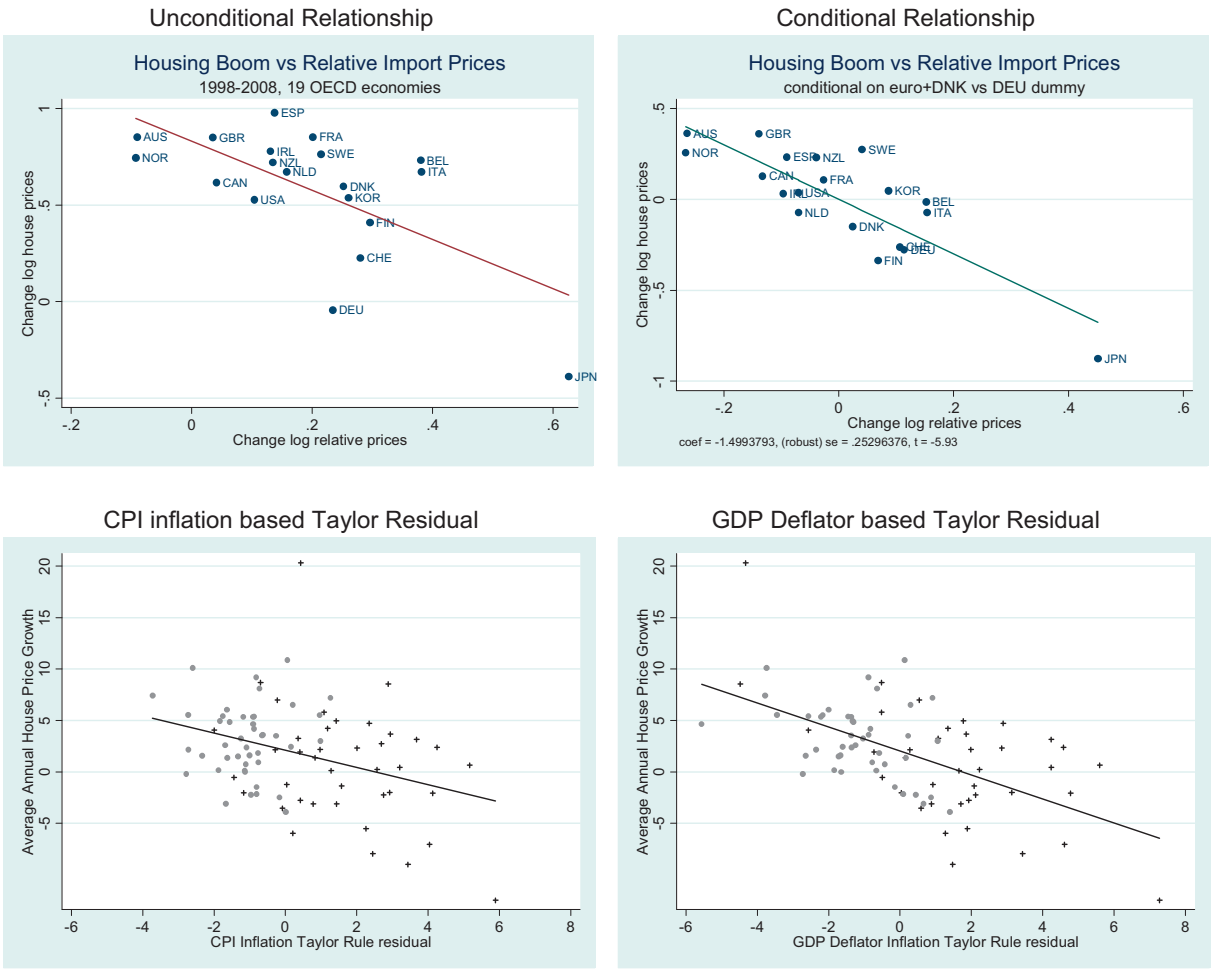

Fig. 5. House price boom, relative import prices, and taylor residuals. *Notes*: The relative price level of imports is measured as the ratio of the implicit price deflator for imports of goods and services to the GDP deflator, taken from the IMF's WEO database. The top left chart plots the simple bivariate relationship; the top right chart shows the partial relationship, controlling for the asymmetric impact of ECB monetary policy inside the eurozone, which appears to have been a key factor in driving the divergent house price dynamics within this region. The ECB sets a single monetary policy for the entire eurozone, but since economic conditions vary significantly across the currency area, this policy is too tight in some countries and too loose in others, relative to policy set optimally for each country. For instance, domestic demand growth was extremely weak at the core (Germany), but very robust in some countries in the periphery (e.g., Ireland and Spain), and policy was thus too tight for the former and too loose for the latter. As a crude way of capturing this asymmetry, the regression underlying the top right chart includes, in addition to the relative price term, a dummy variable that takes the value of −1 for Germany, 1 for eurozone countries other than Germany (including Denmark as its currency is tightly pegged to the euro), and 0 for non-eurozone countries. This variable is a statistically and economically significant determinant of the magnitude of house price appreciation; together the two variables account for more than three quarters of the total cross-sectional variation in the extent of the housing boom across our set of 19 advanced economies. The Taylor residual shown in the bottom charts is based on 5-year averages covering quarterly data for 22 countries since the start of the 1990s. The bottom left chart uses CPI inflation to construct the Taylor residual; the bottom right chart uses the GDP deflator. In each case observations for the last two periods, covering the period after 2000 that generally coincides with the peak of the housing boom, are shown in gray; earlier observations are shown in black.

After controlling for this issue by computing the Taylor residuals based on domestic inflation rather than overall CPI inflation, the relationship between the monetary policy stance and house prices is robust and statistically significant (Fig. 5, bottom panel).[14]

But the slope of this relationship between the monetary policy stance and house prices suggests that economic significance may be weak and it could be rather costly to use monetary policy to stop a boom: the policymakers would have to "lean against the wind" dramatically to have a meaningful impact on real estate prices, with large effects on output and inflation. This intuition is also confirmed by a more formal analysis of the relationship between monetary policy conditions and house price changes based on a panel vector autoregression (see Crowe et al., 2011, for details). This exercise suggests that, at a 5-year horizon, a 100-basis-point hike in the policy rate would reduce house price appreciation by 1 percentage point. But it would also instigate a decline in GDP growth of 0.3 percentage points. To put things in context, between 2001 and 2006, real house prices rose 48 percent in a global sample of 55 countries. A 500-basis-points tightening would have cut the boom by roughly 5 percentage points to 43 percent (still well above the historical average of 27 percent increase in house prices over a 5-year period). And it would have reduced real GDP growth by 1.5 percentage points over this 5-year period.

[14] In particular, using median regressions, to minimize the problems associated with outliers, of house price growth on each of the two Taylor residuals, including in each case time fixed effects to control for global factors driving the real estate cycle, we find that the relationship for the GDP-deflator-based Taylor residual is statistically significant while the apparent negative relationship for the CPI-based residual is not.

Consistent with these estimates, the experiences of Australia and Sweden suggest that marginal changes in the policy rate are unlikely to tame a real estate boom. They were among the few countries that used monetary policy to lean against the wind during the global real estate boom. Australia increased the policy rate by 300 basis points between April 2002 and August 2008 while Sweden had a 325-basis-point hike between December 2005 and September 2008.[15] This tightening notwithstanding, house prices in both countries increased substantially, gaining 80 percent in real terms between 2000 and 2007.

The tighter monetary policy stance, however, may have helped contain the build-up of risk during the boom. Both Australia and Sweden experienced relatively mild declines in house prices and avoided major financial disruptions during the recent crisis. Also, three important factors may lead to the underestimation of the effectiveness of monetary policy in containing real estate booms. First, our back-of-the-envelope calculation using a panel vector autoregression may be underestimating the effectiveness of interest rate large hikes because of potential non-linearities (this problem applies also to the estimates of its effects on output, making it unclear in which direction it would bias the cost-benefit analysis). Second, the model is likely to be misspecified since it imposes common slope parameters and omits potentially important variables, perhaps most importantly, a measure of lending standards that could affect credit availability and property prices. Third, there could be an endogeneity bias. Should central banks tighten the policy rate in reaction to house appreciation, on average, higher rates would coincide with faster house price growth. Put differently, 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, i.e., it would bias the results against monetary policy effectiveness.

3.2. Fiscal tools

Most tax systems involve favorable treatment of debt-financed home ownership.[16] In theory, for households to be indifferent between renting and owning, rent should equal the user cost of owning (Poterba, 1984). Complicating this equation, aside from rent controls, is the fact that tax treatment of owner-occupied housing may significantly alter the latter. Under neutral treatment, imputed rents and capital gains would be fully taxed and mortgage interest payments would be fully deductible. In reality, however, imputed rents and capital gains are seldom taxed (e.g., two out of three OECD countries treat these as tax-exempt; also see IMF, 2011). Transaction, capital gains, and property taxes, all indirect ways of taxing imputed rents, partially offset the bias toward ownership created by this treatment but mortgage interest tax relief is often large enough to undo this partial offset.[17] Moreover, mortgage interest tax relief (available, subject to certain limits, in about three out of five OECD countries; also see IMF, 2011) encourages levered property purchases.

Can tax treatment of home ownership and housing-related debt be adjusted in a cyclical manner to curb house price increases? Hypothetically, in a tax system where imputed rents and capital gains are exempt while mortgage interest and property taxes are deductible, increasing property taxes or trimming down mortgage interest tax relief could reduce house prices, especially for higher-income households that are subject to higher marginal income tax rates. Formally,

$$R = UC = P[(1 - \tau_m)(i + \tau_p) + \beta + m + d - \pi]$$

where R is the rent, UC is the user cost, P is the house price, τ_m is the marginal tax rate, i is the nominal mortgage interest rate, τ_p is the property tax rate on owner-occupied houses, and π is the expected capital gains. β, d, and m measure the recurring holding costs consisting of the risk premium on residential property, depreciation, and maintenance, respectively. Hence, fiscal measures, by changing τ_p and the treatment of i, would alter the wedge between the cost of owner-occupied housing and renting.

Property taxes, arguably, are better suited for cyclical implementation since it is administratively easier to reset tax rates than to abolish/re-establish or change mortgage interest deductibility rules and they can be tailored better to local real estate market dynamics. A better tool yet may be cyclical transaction taxes (of which capital gains taxes and registration fees are two components) that could, in theory, automatically dampen the boom phase of the real estate cycle as well as discourage speculative activity. In what follows, we present some evidence on the level of transaction and property prices, and house price growth. Up to our knowledge, there are no examples of jurisdictions that use explicitly and purposefully countercyclical taxes (i.e., ex ante conditional tax rates) although some countries have used ad hoc changes in response to housing market distress (e.g., U.K.) as well as froth (e.g., Singapore).

3.2.1. Empirical evidence on transaction taxes

The level of transaction taxes does not appear to have a clear relationship with house price dynamics. In theory, one would expect higher transaction taxes to "thin" the market but, at the same time, to reduce the probability of bubbles by limiting speculative activity. Empirically, the relationship remains ambiguous. On the one hand, Belgium, with its high transaction taxes of up to 16.5 percent, has had very modest house price movements with quarterly appreciation not exceeding 2 percent during upturns and depreciation not falling below −2 percent during downturns since the 1970s. On the other hand, Japan also with substantial transaction taxes, experienced one of the most notable real-estate bubbles to date (for more on the Japanese real estate bubble and land taxation, see IMF, 2001).

Transaction taxes/subsidies that change with real estate conditions may be, in theory, more promising.[18] On the bust side, the

[15] The Reserve Bank of Australia, on its media release dated May 8, 2002, stated that "The strong rises in house prices [...] have also been associated with a rapid expansion in household debt, a process that carries longer-term risks [...] To persist with a strongly expansionary policy setting [...] could fuel other imbalances such as the current overheating in the housing market [...]" in communicating its decision to raise the cash rate target (the full statement is available at http://www.rba.gov.au/media-releases/2002/mr-02-10.html). Sveriges Riksbank, on its press release dated January 20, 2006, said "As before, there is also reason to observe that household indebtedness and house prices are continuing to rise rapidly. Against this background, the Executive Board decided to raise the repo rate by 0.25 percentage points [...]" (the full statement is available at http://www.riksbank.com/templates/Page.aspx?id=20017). See also Bloxham et al. (2010) and Giavazzi and Mishkin (2006) for more on Australian and Swedish monetary policies, respectively.

[16] See, for instance, Cremer and Gahvari (1998) and Bourassa and Grigsby (2000) for more on the economic reasons that shape tax treatment of owner-occupied housing. It is important to note that tax treatment of real estate varies considerably across countries, as do institutional characteristics of mortgage and real estate markets, but a general tendency to adopt frameworks that encourage home ownership exists, with government support ranging from direct provision of mortgage credit to advantages in the tax code (IMF, 2011).

[17] Note that the extent of this partial offset will depend on various factors such as deductibility of capital gains and the extent of pass-through from property taxes to rents.

[18] See Allen and Carletti (2010) for a theoretical framework in which transaction taxes that are higher the greater the rate of real estate price appreciation can limit speculative motivations.

use of time-limited tax credits linked to house purchases in the U.S. and the suspension of stamp duty in the U.K. helped stabilize the housing market. And, especially in the U.S., the stabilization in prices and revival of activity disappeared with the expiration of the tax breaks (IMF, 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, 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.

3.2.2. Empirical evidence on property taxes

To address the question of how property taxes affect price dynamics we use data from the U.S. covering 243 metropolitan areas since teasing out significant causal relationships from a small cross-country sample is confounded by a number of challenges. First, results can be sensitive to which countries are included in the sample, and standard econometric problems of endogeneity and omitted variable bias are pronounced. Second, differences in national house price definitions and methodologies create additional noise. Focusing instead on one country has a number of advantages: many of the housing market determinants that vary across countries (such as monetary policy, central government fiscal policy, and the treatment of mortgage loans in the banking system) are relatively constant across geographical areas within a country. Data comparability issues are minimized as the house price measurement is standardized across areas. At the same time, there is substantial variation in property tax rates, which are set at the local government level.

We follow an instrumental variables strategy where the local property tax rate is modeled as a function of the physical properties of the region (e.g., average commuting time). According to the results presented in Table 3, a one standard deviation ($5 per $1000 of assessed value) increase in property tax rates is found to be associated with a 0.9 percentage point decline in average annual price growth (compared to annual growth of around 5.6 percent per year). Moving from the minimum tax rate in the sample (some $2.60 per $1000) to the maximum ($26) is estimated to cut average price growth by 4.3 percentage points per year. The impact on price volatility around the trend growth rate is similar: a one standard deviation increase in tax rates leads to a reduction in the standard deviation of house price growth of around 0.8 percentage points, around one quarter of the average level of volatility in the sample.

This evidence suggests that higher rates of property taxation can help limit housing booms as well as short-run volatility around an upward trend in prices. One interpretation is that property taxes, indirectly taxing imputed rent, may mitigate the effect of other tax treatments favoring homeownership and perhaps reduce speculative activity in housing markets. Of course, caveats apply in deriving implications from this evidence in the international context. The results may be specific to the U.S. housing market, whose characteristics differ markedly from those in many other advanced economies, let alone emerging markets. Moreover, property tax rates clearly did not cause (or prevent) the emergence of a national housing boom in the U.S., although they may have limited its impact on some areas, and the impact at the national level of a hypothetical national property tax might be very different from the localized impact of local taxes. Finally, endogeneity of tax rates remains an important issue: municipalities often face pressure to reduce tax rates when markets are booming and tax revenues are high, challenging the ability of policymakers to use property taxes as a countercyclical tool. On a related note, while they may have an impact on prices, neither transaction nor property taxes get directly to credit and leverage, that is, the true source of vulnerability linking real estate boom–bust to financial instability.

3.2.3. Empirical evidence on mortgage interest tax deductibility

Tax reforms that reduce the value of mortgage interest relief can lead to lower loan-to-value ratios, pointing to the role of tax incentives favoring debt-financed homeownership (see Hendershott et al., 2003, for the U.K. and Dunsky and Follain, 2000, for the U.S.). Tax reforms advocating removal or reduction of this tax shelter are estimated to cause around 10 percent immediate decline in house prices (see Agell et al., 1995, for Sweden and Capozza et al., 1996, for the U.S.). Yet, all of these are one-off changes, hinting at the difficulties in using mortgage interest tax deductibility rules in a cyclical way.

Overall, evidence on the relationship between the tax treatment of residential property and real estate cycles is inconclusive. At the structural level, tax treatment of housing does not appear to be related to the cross-country variation in the amplitude of housing cycles: during the most recent global house price boom, real house prices increased significantly in some countries with tax systems that are highly favorable to housing (such as Sweden) as well as in countries with relatively unfavorable tax rules (such as France). Similarly, appreciation was muted in countries with both favorable systems (e.g., Portugal) and unfavorable (e.g., Japan). Looking at other housing market indicators, the tax treatment of housing is not significantly related to the ratio of mortgage debt to GDP, while levels of homeownership (the main excuse for favorable tax treatment of housing) are, if anything, *negatively* related to the degree to which the tax system is favorable to owning one's own home (although the relationship is, again, not statistically significant). Other research has painted a similarly ambiguous picture. For instance, in the eurozone, more favorable tax treatment of housing may be associated with greater house price volatility (van den Noord, 2005). However, in a broader sample of economies, taxation was not the main driver of house price developments during the recent global housing boom (Keen et al., 2010).

Summarizing, even if fiscal tools can, in a one-off setting, dampen volatile house price dynamics and the build-up of vulnerabilities associated with debt-financed homeownership, scope for the use of such tools in a cyclical setting is likely to be limited given the political economy angle of fiscal policy perceived to be interventionist. In addition, the institutional setup in most countries separates tax policy from monetary and financial regulation policies, making it extremely hard to implement changes in tax policies as part of a cyclical response with financial stability as the main objective. Moreover, local governments may use lower property or transaction tax rates to attract residents during good times if the burden in the case of a bust is shared with other jurisdictions. The ability of cyclical transaction taxes to contain exuberant behavior in real estate markets may be further compromised if homebuyers do not respond to these taxes fully, because they consider them to be an acceptable cost for an investment with high returns and consumption value. Also, during a boom phase, the incentives to "ride the bubble" may increase efforts to circumvent the measure by misreporting property values or folding the tax into the overall mortgage amount. Finally, as with most tax measures, the distortions created by a cyclical transaction tax may hurt the price discovery process, which tends to be rather slow in real estate markets already, and also the mobility of households with potential implications for the labor market.

3.3. Macroprudential regulation

At least in theory, macroprudential measures such as higher capital requirements or limits on various aspects of mortgage credit

Table 3
Association between property tax rates and house prices.

House prices and local property tax rates in 243 U.S. metropolitan statistical areas between 1998 and 2007						
Dependent variable	Price growth			Price volatility		
	I	II	III	IV	V	VI
Estimation method	OLS	OLS	2SLS	OLS	OLS	2SLS
Property tax rate	−0.048**	−0.052***	−0.183***	−0.075***	−0.041***	−0.157***
	[0.022]	[0.015]	[0.043]	[0.024]	[0.014]	[0.050]
Housing supply elasticity		−0.202**	−0.212***		−0.025	−0.068
		[0.083]	[0.079]		[0.026]	[0.069]
Population growth		0.467***	0.292***		0.122	−0.025
		[0.083]	[0.108]		[0.106]	[0.124]
Per capita income growth		1.123***	0.954***		−0.416***	−0.432***
		[0.136]	[0.158]		[0.143]	[0.153]
SD (population growth)					0.431***	0.283
					[0.163]	[0.191]
SD (per capita income growth)					−0.113*	−0.138**
					[0.061]	[0.063]
Longitude		0.779***	0.669***		0.143	0.076
		[0.105]	[0.114]		[0.110]	[0.118]
Longitude^2		0.004***	0.003***		0.001	0.0004
		[0.001]	[0.001]		[0.001]	[0.001]
Share of foreign-born		6.834***	10.191***		6.381***	10.071***
		[1.996]	[2.159]		[1.773]	[2.383]
Share of unmarried households		44.756***	66.911***		20.293**	43.900***
		[9.353]	[12.108]		[8.419]	[14.830]
Price growth					0.787***	0.715***
					[0.077]	[0.079]
Constant	6.024***	35.879***	32.391***	4.135***	5.686	3.782
	[0.296]	[4.962]	[5.442]	[0.342]	[5.136]	[5.475]
Observations	307	243	243	307	243	243
R-squared	0.01	0.72	0.66	0.02	0.83	0.80
Identification test stat Chi2[1]			0.48			0.82
P-value			0.49			0.37
Underidentification test stat Chi2[2]			33.54			22.49
P-value			0.00			0.00
Weak identification stat			34.65			13.82
Crit. value [10 percent maximal IV size]			19.93			19.93
Crit. value [15 percent maximal IV size]			11.59			11.59
Anderson–Rubin Wald test *F*[2, 233]/*F*[2, 230]			11.69			7.027
P-value			0.00			0.00

Notes: The regressions analyze price developments in the U.S. at the Metropolitan Statistical Area (MSA) level in a variation of spatial hedonic house price model similar to the ones discussed in Case et al. (2004). MSAs are agglomerations of counties, typically centered on a large urban conurbation. Counties are included in a particular MSA (or, in the majority of cases, in no MSA) based on factors such as commuting patterns. This means that an MSA typically corresponds to a unified local housing market. Price growth and volatility are measured by the mean and standard deviation, respectively, of change in log annual average price index. In the 2SLS estimation, the excluded instruments are latitude and commuting time (column III) and latitude and the Wharton Residential Land Use Regulatory Index (column VI). House price data come from FHFA (formerly OFHEO), information on property tax rates is provided by NHBA. Other data sources include U.S. Census Bureau and BEA. Robust standard errors are in brackets.

* Significant at the 10 percent level.
** Significant at the 5 percent level.
*** Significance at the 1 percent level.

could be designed to target narrow objectives (for instance, household or bank leverage) and tackle the risks associated with real estate booms more directly and at a lower cost than with monetary or fiscal policy. These measures can be particularly helpful in countries with fixed exchange rate regimes or in currency unions (or with concerns about exchange rate volatility) for which using monetary policy is not an option (or a costly one).[19]

Against the benefit of a lower cost, these measures are likely to present two critical shortcomings. First, they may be easier to circumvent as they target a specific type of contracts or group of agents. When this happens, these measures can be counterproductive, as they may lead to 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 thanks to central banks increasingly achieving credibility and independence. Using measures that were previously confined to the realm of micro-prudential supervision to achieve systemic results would likely be considered as an unnecessary intrusion into the functioning of markets. The more direct impact of these measures would also complicate implementation as winners and losers would be more evident than in the case of macro policies. One way around this political economy issue might be to ensure that the permanent settings of the prudential regime are sufficiently tight, rather than seeking to manipulate them over the cycle.

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 to increase 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 loan-to-value (LTV) and/or

[19] Quint and Rabanal (2013) find that macroprudential policies can help substitute for the lack of national monetary policies in a two-country DSGE model of the euro area.

Table 4
Survey-based assessment of policy frameworks as of September 2010.

	Monetary policy framework		Tax system		Regulatory structure							
					Restrictions on . . .							
	Credit growth explicitly considered? (percent)	Property prices explicitly considered? (percent)	Transactions tax? (percent)	Mortgage interest deductibility? (percent)	Which financial institutions can extend mortgage loans? (percent)	Type of mortgages? (percent)	Loan-to-value ratio? (percent)	Debt-to-income ratio? (percent)	Mortgage credit growth rate? (percent)	Real-estate-specific loan loss provisioning? (percent)	Real-estate-specific risk weights? (percent)	Full recourse on mortgages? (percent)
No	78	64	6	39	50	81	53	50	94	61	56	25
Yes	22	36	94	61	50	19	47	50	6	39	44	75
Directly (not through, e.g., the rent component of CPI)	14	8										
Subject to restrictions			64	44								
Cyclically based										11	11	

Notes: Based on a survey conducted by the IMF of central bankers and bank regulators. Information for a total of 36 countries was gathered through this survey. The numbers correspond to the proportion of respondents giving a particular answer.

debt-to-income (DTI) ratios.[20] Unlike monetary and fiscal policy options that mostly aim at preventing or pricking bubbles, some of these macroprudential tools may be able to achieve both objectives: (i) reducing the likelihood and/or magnitude of a real estate boom (for instance, by imposing measures to limit household leverage), and (ii) strengthening the financial system against the effects of a real estate bust (for example, by urging banks to save in good times for rainy days).

An important caveat is in order before we start our analysis. A major limitation in assessing the effectiveness of macroprudential tools stems from the fact that macroprudential policy frameworks are still in their infancy, and only a handful of countries have actively used them.[21] For example, out of 36 countries for which information is available, as of September 2010, 81 percent reported not having any restrictions on the type of mortgage loans (e.g., interest-only or negative amortization loans, which are more likely to be used by speculators) financial institutions can extend to borrowers (Table 4). While limits on loan-to-value and debt-to-income ratios are reported to exist in roughly half of the countries, a closer look reveals that these are often applicable only to a subset of mortgages (e.g., those insured by the government) or are recommended best practice guidelines rather than strictly enforced rules. Only 3 countries have reported actively using such limits to respond to real estate market developments. On the tools that are more "defensive" in nature than "preventative", a similar picture emerges: a mere 11 percent of the countries in the survey have applied cyclically adjusted real-estate-specific risk weights with 14 percent requiring institutions to provide countercyclical loan loss provisioning on real estate loans (sometimes through a rules-based framework, sometimes at the discretion of the supervisory authority).[22] In addition to the lack of a track record, the fact that these measures have been typically used in combination with macroeconomic policy tools complicates further the challenge to attribute observed developments to a specific policy measure.

Yet, much can be learned from case studies. Following the Asian crisis, some countries in the region (particularly, Hong Kong SAR, Korea, Malaysia, and Singapore) have taken a more heavy-handed approach to deal with risks posed by real estate booms. Spain, following a period of significant credit growth, put in place a dynamic provisioning framework as early as July 2000. Countries in Central and Eastern Europe have experimented with various measures to control the rapid growth in bank credit to the private sector in the 2000s. Table 5 presents some stylized facts on the effects of various policy responses to real estate (and credit) booms.[23] On the whole, success stories appear to be few, perhaps to some extent reflecting the learning curve in expanding the policy toolkit, improving the design of specific tools, and sorting out implementation challenges (Fig. 6). The cases that appear to have the most success (that is, slowing down the boom and avoiding systemic crisis in the bust) almost always have involved some macroprudential measures.

[20] 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.

[21] Note that, of course, some of these tools have been used before, but mostly with microprudential objectives.

[22] Reflecting the commonly accepted 'benign neglect' approach prior to the crisis, not only the macroprudential policy frameworks but also the macroeconomic policy frameworks do not currently incorporate mechanisms to directly respond to real estate market developments. The proportion of countries that report explicitly considering mortgage credit growth or property price appreciation in policy decisions is less than 15 percent.

[23] For more details on particular country cases, some of which are used in the discussion that follows on the efficacy of different tools, we refer the interested reader to Table 3 in Crowe et al. (2011).

Table 5
Stylized facts on policy responses to real estate booms: stocktaking.

Measure	To address . . .	Used in . . .	Impact?
Macroeconomic			
Monetary tightening	Rapid credit growth and/or real estate boom	Croatia, Iceland, Latvia, Ukraine; Australia, Israel, Korea, Sweden	Not always effective, capital flows and currency switching risk are major limitations
Maintaining a flexible and consistent FX policy	Rapid credit growth	Poland, Romania	FX-denominated credit growth slowed down in Poland but not in Romania
Fiscal tightening or removal of incentives for debt financing (e.g., mortgage interest tax relief)	Rapid credit growth and/or real estate boom	Estonia, Netherlands, Poland, United Kingdom; Lithuania, Spain	Limited effect on house prices, slightly more on household leverage
Additional/higher transaction taxes to limit speculative activity	Real estate boom	China, Hong Kong SAR, Singapore	Some effect on transaction activity, but not long lasting
Macro-prudential			
Higher/differentiated capital requirements or risk weights by loan type	Rapid credit growth and/or real estate boom	Bulgaria, Croatia, India, Poland, Norway	Not always effective, some side-effects of shifting the risk elsewhere in the system
Tighter/differentiated loan classification and provisioning requirements	Rapid credit growth and/or real estate boom	Bulgaria, Croatia, Greece, Israel, Ukraine	Limited effect
Dynamic provisioning	Resilience to cyclical downturn/bust	China, Colombia, India, Spain, Uruguay	So far so good, difficulty in calibrating the extent of losses based on historical data
Tightening eligibility requirements, e.g., limits on loan-to-value ratios	Real estate boom	China, Hong Kong SAR, Korea, Malaysia, Singapore; Sweden	Short-lived effect on prices and mortgage activity

Notes: The table gives a snapshot, it is not meant to be a comprehensive and detailed list of cases where authorities took one or more of the measures listed to address credit/real estate developments. Bolivia and Peru have also put in place a dynamic provisioning framework and Romania had employed a battery of policy measures to address rapid credit growth; yet these countries are not included in the table due to lack of house price data. Dynamic provisioning in China and India is discretionary rather than rules-based.

3.3.1. Higher capital requirements/risk weights

3.3.1.1. Background. Capital regulation has a procyclical effect on the supply of credit. During upswings, better fundamentals reduce the riskiness of a given loan portfolio, improving a bank's capital adequacy ratio and its ability to expand its asset holdings. In a downturn, the opposite happens, possibly leading to deleveraging through fire sales. The broadly discussed proposal of procyclical capital requirements could help reduce this bias.[24] Further, by forcing banks to hold more capital in good times, it would help build buffers for future losses (see Gordy and Howells, 2006, and references therein).

In the context of real estate, the procyclical element of capital regulation is largely absent. In most countries, existing rules do not take collateral values into consideration or reflect the heterogeneity among loans backed by real estate, other than the commercial-residential distinction. Under Basel II's standard approach, risk weights for property loans are fixed (50 percent for residential mortgages and 100 percent for commercial property loans).[25] As a result, mortgage loans with predictably different default probabilities (for instance, because of different LTV ratios or their exposure to different aggregate shocks) are often bundled in the same risk category and no adjustment is made through time to account for the real estate cycle.[26] In this context, capital requirements or risk weights linked to real estate price dynamics could help limit the consequences of boom–bust cycles. By forcing banks to hold more capital against real estate loans during booms, these measures could build a buffer against the losses associated with busts. And, by increasing the cost of credit, they might reduce demand and contain real estate prices themselves.[27] Finally, weights could be fine-tuned to target regional booms.

3.3.1.2. Implementation challenges. A few caveats are in order. First, absent more risk-sensitive weights, an across-the-board increase in risk weights (or capital requirements) carries the danger of pushing lenders in the direction of riskier loans (this is essentially the risk-shifting effect identified by models in the spirit of Stiglitz and Weiss, 1981). Thus, the introduction of procyclical risk weights for real estate loans should be accompanied by the implementation of a finer cross-sectional risk classification as well. Second, as with any other measure increasing the cost of bank credit (when credit is in high demand), procyclical risk weights may be circumvented through recourse to non-bank intermediaries 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, while improving the resilience of the banking system to busts, tighter requirements are unlikely to have a major effect on credit availability and prices. Put differently, they are unlikely to reduce vulnerabilities in the real (household) sector. Finally, regulators may be reluctant to allow banks to reduce risk weights during a bust (when borrowers become less creditworthy).

[24] The discussion focuses on the price-related measures of capital regulation but exposure limits would have similar implications working as a quantity-based measure.

[25] Risk weights are generally set higher for commercial real estate loans than residential real estate loans, given the higher risk profile of commercial real estate due to more volatile price dynamics and the dependence of borrower's ability to service the debt on rental income.

[26] Fixed risk weights are applicable only under the standard approach of Basel II. Under internal-rating-based approach, regulators (and banks) can split loans into sub-categories based on several risk indicators and vary risk weights accordingly. Indeed, a few countries have experimented with applying higher risk weights to high-LTV loans (see Crowe et al., 2011, for more information). The U.K. uses supervisory slotting to allocate risk weights to commercial real estate loans.

[27] Obviously, the increase in the cost of borrowing may have a side effect: credit rationing may set in, reducing welfare gains associated with access to finance.

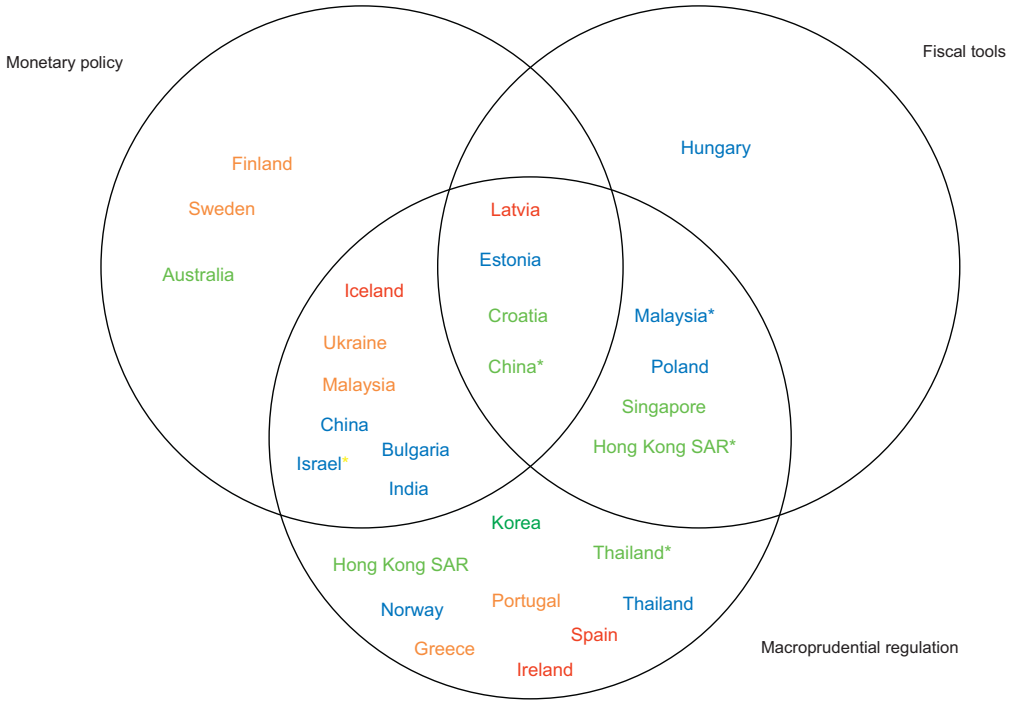

Fig. 6. Policy responses and effectiveness in dealing with real estate booms. *Notes*: The colors of country names indicate the effectiveness of policy response in terms of the impact on real estate price and credit growth rates and the incidence of a systemic banking crisis. A score of 1 is assigned if the percent decline in a growth rate is in the top quintile of the cross-country distribution. A score of 0 (1) is assigned if the boom episode was followed by a (borderline) systemic crisis and a score of 2 is assigned if there were no crisis. Hence, the final score (i.e., the sum of all scores) range from 0 to 4, 4 being the best outcome with largest decline in the magnitude of the boom and avoidance of a crisis. Red, orange, yellow, green, and dark green correspond to scores of 0, 1, 2, 3, and 4, respectively. * indicates that the episode is incomplete but there has been no crisis so far. For each country, the period during which the policies were implemented reflects the country experience detailed in Table 3 of Crowe et al. (2011). China, Hong Kong SAR, Malaysia, and Thailand have employed different combinations of policy tools during different episodes: China monetary and macroprudential tools in 2005–2007 and all three sets of tools in 2009–2010; Hong Kong SAR macroprudential tools in 1991–1997 and macroprudential and fiscal tools in 2009–2010; Malaysia monetary and macroprudential tools in 1994–1997 and macroprudential and fiscal tools in 2009–2010; Thailand macroprudential tools in 2003 and 2010. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of the article.)

Sources: IMF country reports, Hilbers et al. (2007), Borio and Shim (2007), Laeven and Valencia (2010), authors' calculations.

3.3.1.3. Evidence. The empirical evidence on the effectiveness of these measures is mixed. In an effort to contain the rapid growth in bank credit to the private sector and the associated boom in asset markets, several countries have raised capital requirements and/or risk weights on particular groups of real estate loans. Some attempts (such as the cases of Bulgaria, Croatia, Estonia, and Ukraine) have failed to stop booms and the associated post-bust damage to the financial sector; others (such as the case of Poland) were at least a partial success (Table 5).[28]

Yet, it is not easy to say why measures taken in one country may have been more effective than those taken elsewhere or how much other developments account for the observed changes. Furthermore, even in countries where tighter capital requirements appeared to produce some results on controlling the growth of particular groups of loans, real estate price appreciation and the overall credit growth remained strong.

This evidence highlights the implementation challenges associated with these tools: with limited effect on overall credit growth and household leverage, lenders and borrowers may find new, less regulated types of credit. At times, these may go beyond regulatory perimeters (e.g., loans extended by finance companies or mortgage brokers rather than commercial banks) or even national borders (e.g., financing provided by banks in neighboring countries).

3.3.2. Dynamic provisioning

3.3.2.1. Background. Dynamic provisioning (the practice of mandating higher loan loss provisions during upswings) can help limit credit cycles.[29] The mechanics and benefits 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 they can be used when capital ratios maintained by banks are already high.

Provisioning for property loans could be made a specific function of house price dynamics. In periods of booming prices, banks would be forced to increase provisioning, which they would be

[28] Evidence on exposure limits is more limited: only Malaysia tried decreasing the maximum real estate exposure but the measure came in too late in April 1997, just before the Asian crisis hit the markets. In a more structural sense, many countries have constant exposure limits but there is no apparent relationship between the level of these limits and real estate boom–bust episodes.

[29] As it has been the case for capital requirements, procyclicality of regulations governing loan loss provisions has been subject to criticism before the crisis (see, for instance, Laeven and Majnoni, 2003).

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.

3.3.2.2. Implementation challenges. 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 theory, dynamic provisioning has the advantage over capital and risk-weight measures because it affects bank profits as provisions are raised, and therefore hits staff remuneration where this is linked to profits. Incentives are hence better aligned to the financial stability objective. However, practical issues and unintended effects such as calibration of rules with rather demanding data requirements and earnings management (which may raise issues with tax authorities and securities markets regulators) should be discussed in each country's context to design a framework that best fits the country's circumstances. There are also other shortcomings, similar to those of procyclical risk weights (being primarily targeted at commercial banks, dynamic provisioning may be circumvented by intermediaries outside of the regulatory perimeter). Lastly, application of the measure to domestically regulated banks only may hurt their competitiveness and shift lending to banks abroad, raising cross-border supervision issues.

3.3.2.3. Evidence. The experience with these measures suggests that they are effective in strengthening a banking system against the effects of a bust, but do little to stop the boom itself. Spain led the countries who have adopted some form of countercyclical provisioning and constitutes an interesting case study to provide a preliminary assessment on its effectiveness.

As member of the eurozone, Spain's ability to respond to a booming local real estate market with macroeconomic policy is limited. Starting in 2000 and with a major 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 percent of their net operating income. Yet, household leverage grew by a still high 62 percent in Spain. At the end of 2007, just when the real estate bust started, total accumulated provisions covered 1.3 percent of total consolidated assets, in addition to the 5.8 percent covered by capital and reserves (so far, the value of the housing stock decreased by roughly 15 percent in real terms). Hence, Spanish banks had an important buffer that strengthened their balance sheet when real estate prices started to decline and the economy slipped into recession.

3.3.3. Limits on loan-to-value and debt-to-income ratios (LTV and DTI)

3.3.3.1. Background. A limit on LTV will prevent the build-up of vulnerabilities on the borrower side (in particular in the household sector). Containing leverage will reduce the risks associated with declines in house prices. Put differently, the lower the leverage, the greater the drop in prices needed to put a borrower into negative equity. In turn, this will likely 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. In addition, in case of default, lenders will be able to obtain higher recovery ratios. On the macro front, a limit on LTV 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, DTI limits will rein in the purchase 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 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.

3.3.3.2. Implementation challenges. One practical issue with implementing LTV limits is that lenders are generally quick to find ways to circumvent the restrictions. For instance, in the U.S., during the housing boom, the practice of combining two or more loans to avoid the mortgage insurance (which kicked in when LTV exceeded 80 percent) became common.[30] A ban on second liens or LTV applied to a borrower's overall exposure would improve effectiveness. Similarly, an obvious way to get around a DTI limit would be to extend sequential loans and report the ratios separately. In Hong Kong SAR, where regulators impose maximum limits on the debt service ratio (which takes into account the payments the borrower has to make on non-mortgage loans as well), supervisors often encounter cases where lenders choose not to report all outstanding debt obligations. In addition to minimize the effect of these limits, circumvention may entail significant costs, as it results in more liability structures that can complicate debt resolution during busts (for example, in the U.S., it is often second-lien holders that object to restructuring).

The coverage perimeter of these measures is also an issue: in Korea, lower LTV limits for loans with less than 3 years of maturity spurred a boom in loans originated with maturity of 3 years *and* 1 day. 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-bank, less-regulated financial institutions and/or by foreign banks (which may result in increased currency mismatches as the proportion of FX-denominated loans rises).

Another problem is that many lenders already assess credit risk using more nuanced techniques, such as measures of affordability that take into account other obligations and expenses. In these cases, implementing crude DTI or LTV limits in a way that did not undermine existing practices could prove challenging.

The narrow target nature of these measures may increase political economy obstacles (as happened in the case of Israel[31]), particularly since the groups more impacted by LTV and DTI limits tend to be those more in need of credit (poorer and younger individuals). In addition, unlike with more "macro" measures, the consequences of these limits are immediate and transparent. Beyond these political economy considerations, LTV and DTI limits, by rationing sensitive groups out of credit markets, will entail a cost in terms of diminished intertemporal consumption smoothing and lower investment efficiency.[32]

[30] With these "piggyback" loans the first lien would cover 80 percent of the home value and the remainder would be split between a second lien loan and a downpayment (which could be as low as zero).

[31] http://www.businessweek.com/news/2010-05-24/bank-of-israel-may-increase-housing-loan-provisions-update1-.html.

[32] Another concern related to credit rationing that may be associated with LTV limits is that, by changing the status of second liens, such limits may constrain borrowers' ability to use second mortgages for starting new businesses or other small business financing. Yet, according to survey evidence, only a small portion of home equity lines of credit were used for such purposes in the U.S.: the main purposes were home improvement, financing of real estate (e.g. to reduce downpayment on first

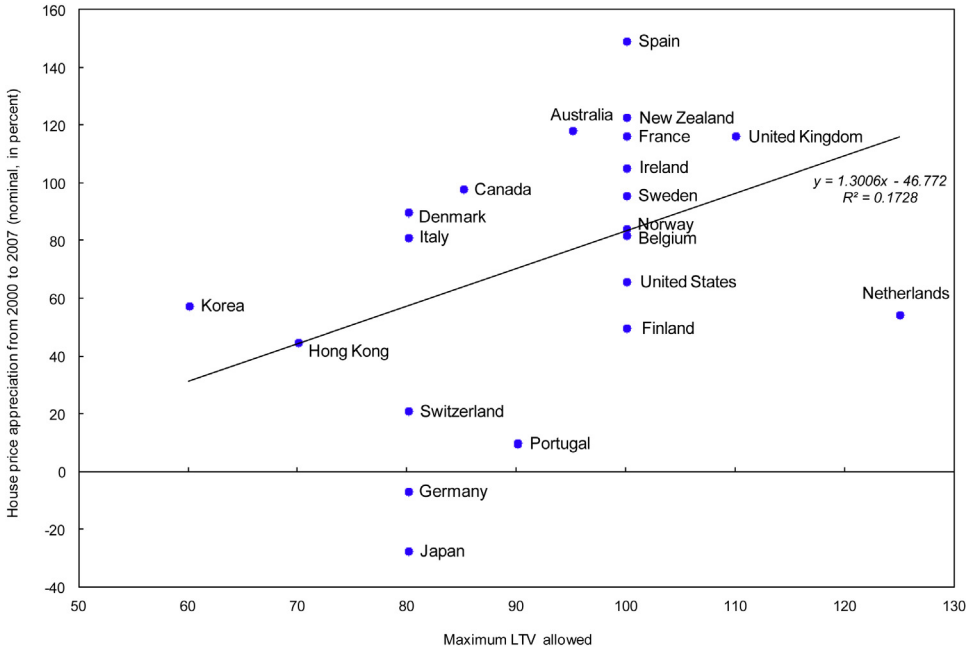

Fig. 7. Maximum LTV and house prices.
Sources: EMF, BIS, OECD, UNECE, ECLAC, IADB, IUHF, IUT, national statistics, and central bank statistics.

To contain these costs, countries have adopted more targeted approaches (trying to protect more vulnerable groups and aiming at those they consider to be market-destabilizing speculators). For instance, Korea differentiates the limits across regions based on the extent of house price appreciation.[33] China and Singapore impose lower limits on second mortgages in an effort not to hurt owner-occupiers. Hong Kong SAR has cut-offs on property values to target the high-end segment of the real estate market. Although less controversial, these limits also receive criticism and opposition from property developers and lenders. In countries where these groups have political influence, effective execution of LTV and DTI limits may still pose a challenge. Even when the policymaker can surmount such political economy problems, calibrating and timing the changes in limits is unlikely to be an easy task as demonstrated by the recent Korean experience, where bubble fear rapidly turned into concern that the real estate markets had become too weak because the macroprudential policy response was too strong, forcing the authorities to reverse the tightening of eligibility criteria.

3.3.3.3. Evidence. Establishing a causal link running from LTVs to price and credit dynamics is a very difficult task and the existing evidence consists of suggestive correlations. In a simple cross-section of 21 (mostly) developed countries, maximum LTV limits are positively related to house price appreciation between 2000 and 2007 (Fig. 7). Back-of-the-envelope calculations suggest a 10 percentage point increase in maximum LTV allowed by regulations to be associated with a 13 percent increase in nominal house prices. Regressions on a panel of U.S. states from 1978 to 2008 suggest a weaker association with house price appreciation of LTV at loan origination: roughly 5 percent increase in house prices for a 10 percentage point increase in LTV (Table 3, Panel B). Duca et al. (2011) construct a series for LTV faced by first-time home buyers and estimate a cointegration model of house price-to-rent ratios at the national level for the U.S. between 1979 and 2007. Their results imply an impact of 8–11 percent on house prices from a 10-percentage point increase in LTV for first-time home buyers, assuming rents remain constant.

It must be noted that there are major drawbacks with this analysis. First of all, it is important to reiterate that these are correlations rather than causal links. In addition, in the international sample, a major concern is the lack of time dimension. In many countries, there is no data available for multiple points in time. Even when data availability is not the problem, very few countries have time variation in maximum LTV allowed since this is not an active part of the regulatory agenda. Another issue, which also applies to the estimates based on U.S. data analysis, is that in many cases there are no *mandatory* maximum limits in practice and the values reported are simple guidelines for mortgage insurance or prudential concerns. In fact, the data for U.S. regions are the actual LTVs because there is not variation across regions in the LTV guidelines. Hence, because of the feedback loop between mortgage credit availability and house price movements, endogeneity remains a concern.

That said, a review of the experience of countries that experimented with mandatory LTV limits changing in response to real estate market developments also suggests that they can be quite effective but perhaps for short periods. For instance, when the Korean authorities introduced LTV limits in September 2002, month-on-month change in house prices went down from 3.4 percent to 0.3 percent immediately and remained low until April 2003. Subsequent reductions in LTVs were also followed by significant

home or to purchase second home), durable goods purchase, and debt consolidation (http://money.cnn.com/2003/10/01/commentary/everyday/sahadi/).

[33] An area is designated as 'speculative' in Korea if the following criteria are met: (i) nominal house prices rose more than 1.3 times the nationwide inflation rate over the past month and (ii) either the average appreciation rate over the past 2 months is higher than 1.3 times the average national appreciation rate over the past 2 months, or the average appreciation rate over the past 12 month is higher than the average national HPI appreciation rate over the past 36 months.

drops in house price appreciation rate. A similar pattern applies to DTI limits, with month-on-month change dropping from 2.3 percent in July 2005 to 0.2 percent in August 2005 with the introduction of the measure. Interestingly, the measures had a much smaller or no impact on prices in 'non-speculative' areas where the limits were untouched. The impact on year-on-year changes, however, has been smaller since prices tend to start increasing at a faster pace again after the first immediate reaction (Igan and Kang, 2011). In Hong Kong SAR, prudent lending practices including, among other practices, limits on LTV and DTI-like but more comprehensive debt service ratios have been credited with pausing the house price boom briefly in 1994 and guarding the system against the fallout from the crash in 1997 (Wong et al., 2004).[34]

4. Conclusion

The correct policy response to real estate booms is, like many other policymaking decisions, an art more than a science. Of the policy options considered, macroprudential measures have some advantages: they can be more precisely targeted at specific risks (for instance, excessive leverage); they can accommodate the specific circumstances in different locations at different times; and have the added benefit of increasing the resilience of the banking system. These measures can be particularly helpful in countries with fixed exchange rate regimes or in currency unions. However, evidence so far suggests that these measures may not always be effective; especially under a lax monetary policy stance and pressure from external demand. When this happens, monetary policy has to play a complimentary role, and may have to be used to lean against the wind.

As a whole, the core principles in guiding policymakers to design an effective policy toolkit to deal with real estate booms emerge as follows:

- Widen the policy perspective to recognize imbalances that do not necessarily show up in traditional measures of inflation targets and output gaps.
- Recognize the local features of real estate markets and use targeted macroprudential tools rather than across-the-board monetary policy responses to respond to excessive and destabilizing movements in prices and activity.
- Complement measures aiming to reduce the risk of bubbles with those aiming to increase the resilience of the financial system and well-defined resolution frameworks to speed up the cleaning in the aftermath of bubbles that survive the first line of defense.
- Minimize distortions due to special treatment of housing and homeownership and strengthen the supply-side response to mitigate the impact of demand shocks in the longer horizon.

When it comes to applying these principles in practice, three important questions arise. First, as for other policy decisions, there is a trade-off between Type I and Type II errors: the risk of letting imbalances grow unchecked and that of distorting fundamentals-driven price changes. This is particularly relevant given the high degree of uncertainty and the relatively limited understanding of causal relationship in the case at hand.

Second, what are the potential complementarities and conflicts between monetary and macroprudential policies and what is the best policy design framework to accommodate these? Undoubtedly, there is a complex relationship between the objectives of macroeconomic and financial stability, the primary objectives of monetary and macroprudential policy, respectively. Take the option of raising capital requirements for loans secured by real estate, which would increase the cost of borrowing in this segment through interest rate changes, which could also spill over to other loan types. Any kind of credit rationing that may stem from this move could also alter real activity. Both consequences are in the realm of monetary policy. In turn, recent studies show that loose monetary policy can fuel risk-taking incentives and build-up of leverage, which could warrant tighter macroprudential rules. Given these interactions, the best option may be to consider the macroprudential policy framework alongside, not apart from, the monetary policy decision.

Third, should the macroprudential framework be based on discretion or rules? On the one hand, a discretionary framework has the advantage that the measures could be better calibrated to particular situations and circumvention may be less likely because of the temporary nature of the measure (less incentive, less time to learn). On the other hand, a rules-based framework could be better because political economy problems may be less severe (no fight to put measures in place during a boom), adjustment of private agents' behavior to the new framework may already accomplish a certain degree of prudence, and time inconsistency is not an issue. At the end, the best option may be a design with robust rules that allow discretion when needed.

[34] Actions in Hong Kong SAR taken over the past few months appear to be less effective though, but the reason for that may be the fact that the boom in this case appears to be driven less by domestic demand/supply and credit conditions and more by external factors, in particular, the capital flows from mainland China. Ostry et al. (2011) looks into the issue of managing capital inflows using different policies.

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