IMF Working Paper

Real Estate Market Developments and Financial Sector Soundness

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Abstract

The views expressed in this Working Paper are those of the author(s) and do not necessarily represent those of the IMF or IMF policy. Working Papers describe research in progress by the author(s) and are published to elicit comments and to further debate.

This paper analyses the characteristics and functioning of real estate markets. It focuses on the relationship between developments in these markets and the financial sector to determine under what circumstances real estate booms and busts can develop and how they can affect the health and stability of the financial system. It concludes that unbalanced real estate price developments often contribute to financial sector distress and that trends in real estate markets should be monitored closely in the context of financial sector assessments.

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I. INTRODUCTION

In many countries, unbalanced asset price developments are considered to have contributed to financial sector distress and macroeconomic imbalances.[2] This applies not only to developments on markets for financial assets, such as stock markets, but also to developments in real estate markets. The basic development under consideration in this paper is a rapid increase in real estate prices, sometimes fueled by expansionary monetary policies or by large capital inflows, and a subsequent sharp downturn, which has a detrimental impact on the value of collateral and financial sector soundness. The financial system is often not only affected directly, but also indirectly through a deteriorating financial position of its clients, in particular real estate companies and households.

Section II describes the characteristics and functioning of real estate markets, including the determinants of supply and demand, as well as the price determination process. This section also analyzes the important role of financial institutions in this market. Section III discusses empirical evidence underpinning the relationship between developments in real estate markets and financial sector distress. Section IV presents concluding remarks.

II. THE FUNCTIONING OF REAL ESTATE MARKETS AND THE ROLE OF BANKS

A. Main Determinants of Real Estate Prices

Real estate markets are characterized by heterogeneity, consisting of a series of geographical and sectoral submarkets that lack a central trading market. No two properties are identical and information on market transactions is often limited and not generally available. Also, real estate markets are typically characterized by infrequent trades, a negotiated pricing process, large transaction costs and rigid supply. In contrast to stock markets and other financial markets there is, therefore, no clear market price. Differences in financing structure, regulatory framework, tax treatment, and the use of real estate as collateral complicate international comparisons. A number of authors have addressed the issue of the determination of real estate prices, cycles and bubbles, and the presentation below is based on the work of these authors.[3]

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[2]Borio, Kennedy, and Prowse (1994), European Central Bank (2000), Higgins and Osler (1997), Miller and Luangaram (1998), Allen and Gale (1998), Krugman (1998, mimeo), and Herring and Wachter (1999). The importance of asset market developments for financial system stability was also highlighted during a consultative meeting on macroprudential indicators organized by the IMF in September 1999 (Evans, Leone, Gill, and Hilbers (2000)).

[3]DiPasquale and Wheaton (1996) present a textbook model for analyzing real estate markets; Herring and Wachter (1999) discuss a number of theories on real estate cycles with a focus on the role of banks and collateralized assets; Carey (1990) develops a model based on land prices and fixed supply of land; Allen and Gale (1998) emphasize the role of expectations for

The price of an existing property should in principle equal the discounted present value of the expected stream of future income (rents), which depends on expected growth in income, anticipated real interest rates, taxes and other structural factors. In a well-functioning market, the price should equilibrate demand and supply. In other words, the fundamental equilibrium price can be thought of as the price at which the stock of existing real estate equals the replacement cost. If the replacement cost is above the price of real estate, no new construction will take place, and if it is lower, new construction will equilibrate the market. Real estate cycles for well-functioning markets will then be driven by economic cycles, and depend on changes in, for instance, expected growth in income, real interest rates, taxes, and future demographic profiles.[4]

However, as mentioned above, the real estate market is characterized by several market imperfections that distort the adjustment toward equilibrium. First, the market suffers from imperfect information about future demand. Second, supply is rigid in the sense that new construction may take several years to be completed, and in many markets the supply of land is a binding constraint. Also, in markets where collateralized lending is widespread, real estate prices affect the availability of resources to finance real estate, which may again affect the price of real estate. Finally, changes in the structure of the financial sector may foster credit booms and increase the amount of available resources for financing. Some of these market imperfections can lead to cycles that differ from the economic cycle or to bubbles.

B. Real Estate Cycles and Bubbles

A number of mechanisms can trigger or amplify the appearance of cycles and bubbles in real estate markets. Some of them are related to nonfinancial characteristics of real estate markets, but in many cases banks and their lending policies play a large role. Key mechanisms are:

- *Fixed supply and the optimistic investor* (Carey (1990)). In markets where supply (land and in the short run also buildings) is fixed, a few investors willing to pay a price above the fundamental price (i.e., above the replacement cost of existing property) can determine the market price, if their demand is sufficient to clear the market. In efficient financial markets, such a process of price increases would be

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the supply of credit in the dynamics of real estate and equity prices; Krugman (1998) develops a model specific to the Asian crisis that deals with the implications of moral hazard; Kiyotaki and Moore (1995) present a model based on a two-way relationship between borrowers' credit limits and the value of collateralized assets; Kennedy and Andersen (1994) focus on the relationship between house prices and household savings; Samiei and Schinasi (1994) analyze the impact of (changes in) monetary policy on real estate prices; and Iacoviello (2000) estimates the effects of macroeconomic shocks on house prices.

[4]International Monetary Fund (2000a).

moderated by investors selling short and supply would increase until the price has returned to its fundamental level, but in markets with fixed supply this mechanism does not function well, at least not in the short run. These optimistic investors are likely to stay in the market as long as prices are rising and financial resources are available. However, eventually supply will start rising, vacancy rates will increase, and prices will start falling. The optimistic investors are likely to experience financial distress and will leave the market, which will contribute to a further fall in prices. Such dynamics are expected to have particular relevance in cases where land is a scarce resource and real estate prices have risen far more than construction costs, e.g., in densely populated areas.

- *Construction lags and imperfect information* (Herring and Wachter (1999)). When the price of existing real estate rises above the replacement cost, developers will initiate new construction and increase the supply. However, as new construction may take several years to be completed, the adjustment to equilibrium will be slow. Prices will continue to rise until the new construction is ready for occupancy. By that time, demand for real estate may have fallen or several competing construction projects may have resulted in over-supply, without a fundamental equilibrium being reached. Because of this lag in construction and imperfect foresight about future demand, supply may continue to rise for several years after vacancy rates have started to increase. When the new construction is finally ready for occupancy, the developers may not be able to sell their properties, and prices will fall.

- *Loans collateralized by real estate* (Kiyotaki and Moore (1995)). Increasing real estate prices raise the market value of collateral on outstanding real estate loans. This lowers the risks for lenders and may increase their willingness to lend more to finance real estate projects. As additional resources for financing become available, demand for real estate will increase and prices will rise further. On the other hand, if prices start falling, the value of collateral will diminish, thereby increasing the banks' risk, and making it more difficult to obtain financing for real estate purchases. As a result, demand and prices will fall further. Hence, the use of real estate as collateral tends to exacerbate real estate cycles. Also, in many countries real estate is one of the few acceptable forms of collateral, which may create an extra incentive to build properties, so that a company can borrow more to expand. This form of "Ponzi finance" can clearly contribute to overbuilding.

- *Moral hazard* (Krugman (1998)). Moral hazard in the form of over-guaranteed and under-regulated financial intermediaries may result in excessive risk-taking, over-investment and over-pricing of assets. Guarantees against losses create an incentive for lenders to fund risky projects as long as there is a (small) chance of high return. This may also drive up prices of assets.

- *Financial liberalization* (Renaud (1999)). Following liberalization and deregulation, new financial markets and institutions tend to emerge. Prime borrowers find that their funding needs can be met at lower costs on domestic and international capital markets. Depositors seeking higher yields find new alternatives to bank deposits. Faced with shrinking margins, banks will search for better yields and may move to new categories of borrowers while underestimating the risk of these loans. Again, more resources for financing risky real estate projects become available, and can contribute to upward pressure on real estate prices. The liberalization of markets and opening to foreigners will increase the number of potential investors in real estate and, through that channel, contribute to a booming real estate market.

- *Concentration of bank assets* (Herring and Wachter (1999)). Rising real estate prices may finally encourage increased lending to the real estate sector as a bank's own holdings of real estate rise in value and the economic value of the bank's capital increases. The total risk on its real estate portfolio has declined, and the bank might therefore be willing to provide more real estate loans. Again, more resources would become available to real estate projects.

C. Risks of Overexposure

Evidence from several financial sector crises points to a high exposure of banks to the real estate sector. This exposure can take different forms:

- holdings of real estate assets in the banks' portfolios;
- lending to customers for real estate purchases (often collateralized);
- financing of real estate developers and construction companies;
- lending to nonbank intermediaries, such as finance companies, that engage in real estate lending;
- relying on real estate to collateralize other kinds of lending.

The arguments provided above suggest that the higher the exposure of banks to real estate, the more amplified the cycles in real estate markets become. Still, banks tend to underestimate the risks associated with high exposure to this sector. There are a number of explanations for banks to have a relatively high exposure to the real estate sector, despite evidence that this may lead to financial distress:

- *Disaster myopia or low frequency shocks.* Real estate cycles are often long and an entire generation may have passed since the last serious decline in prices occurred. If real estate prices have risen steadily for many years, the repayment record of real estate loans will likely be good. Hence, during a real estate boom, lenders can be lulled into a false sense of security, as real estate prices are rising and loan-to-value ratios on outstanding loans decline, leading to a higher portfolio quality. Profitability in terms of expected returns is high, but the risks are underestimated. Scarce managerial time spent on risk management will be directed to other activities because risks in real estate lending are perceived as low.

- *Inadequate data and weak analysis.* Banks may underestimate the risk of heavy exposure to the real estate sector because of inadequate information and weak analysis. Even under the best of circumstances, it may be difficult to estimate the present value of a real estate project. It will depend, among other things, on projected rents, discount rates, anticipated inflation, loss in value due to depreciation and vacancies due to the development of competing projects. Data on building permits, new construction contracts, rents, market prices and vacancy rates are often not readily available or difficult to obtain and verify. Often, banks rely on appraisals based on comparable properties, which will give an idea of current and past market values, but which may depart significantly from sustainable, long-run, equilibrium prices. Also, the use of real estate to collateralize other lending projects, may lead banks not to worry about the details of the project itself, as long as the 'value' of collateral is larger than the amount advanced. However, in the event of a collapse in real estate prices, the value of collateral can quickly fall below the amount of the outstanding loan, creating an incentive for the borrower to default. Thus, the loan the bank was making to another sector will turn out to be an exposure to the real estate sector. Also, there may be legal obstacles in selling real estate seized from a borrower who cannot repay a loan, and until the property can be sold it is subject to depreciation and often costly to maintain.

- *Perverse incentives or moral hazard.* A combination of high leverage and asymmetric information may lead to the financing by banks of real estate projects that are riskier than if they were financed largely through equity. Highly leveraged real estate developers will initiate riskier projects when they can shift most of the downside risks to banks. Furthermore, if there are bank safety nets, highly leveraged banks with imperfectly marketable assets (such as real estate assets) may be more inclined to undertake risky real estate lending. Even when safety nets cover part of the downside risk, healthier and less leveraged developers and banks are less likely to invest in these risky projects.

III. EMPIRICAL EVIDENCE

A. Data Issues

A major obstacle for analyzing real estate markets appears to be the availability of data, in particular for emerging markets. In our search for data on real estate market developments, we found that no major international database provides data on real estate prices or other indicators of developments in real estate markets. The Bank for International Settlements (BIS) maintains a small database with annual residential and commercial property prices for about 20 industrialized countries. Through individual national databases it has been possible to collect real estate price indices for a few Asian and Latin American countries.

Ideally, a range of indicators for real estate markets—including prices, construction costs, rents, real estate lending, and vacancy rates—should be analyzed to get a sense of a particular market, in particular with respect to the determination of demand, supply and prices, and links to the business cycle and the financial sector. However, given the difficulties in obtaining comparable cross-country data, it was necessary to limit the analysis to prices of commercial and residential real estate, supplemented by information on stock market prices of real estate companies (from Datastream).[5]

As for financial sector data on exposure to real estate market developments, the availability, quality and cross-country comparability of indicators seems to suffer from many of the same problems as real estate data. No international database provides specific detailed data on nonperforming loans and financial sector exposure to the real estate and construction sectors, and in many countries the collection of such data has started only recently. Data on credit to the private sector was derived from the IMF's International Financial Statistics (IFS).

B. Financial Distress Preceded by a Collapse in Real Estate Prices

This section is based on evidence from eleven selected banking crises or events of significant financial distress (Table 1).[6] The list is not meant to be comprehensive and countries were selected largely on the basis of data availability. A few cases where significant real estate cycles have not led to banking sector distress are discussed in the following section.

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[5]The empirical part of this paper generally covers developments up to end-1999.

[6]By banking crisis or significant distress we refer to cases of runs or other substantial portfolio shifts, collapses of financial firms or massive government intervention. This study relies on existing, comparative studies of banking crises, particularly Kaminsky and Reinhart (1999), Lindgren, Garcia, and Saal (1996), and Enoch and Green (1997), as well as on studies for individual country cases. The beginning of distress refers to the first collapse or run, while the peak is defined as the period with the heaviest governmental intervention and/or bank closures.

Table 1. Timing of Banking Sector Distress

Country	Beginning of Distress	Peak of Distress
Spain	1979	1983
Mexico (I)	1982	1984
Netherlands	1982	1982
Canada	1983	1985
Ireland	1985	1986
Finland	1991	1992
Japan	1992	1996
Sweden	1992	1993
Mexico (II)	1994	1996
Thailand	1997	1998
Malaysia	1998	1998

Sources: Kaminsky and Reinhart (1999); Lindgren, Garcia and Saal (1996); Enoch and Green (1997).

In most of the selected cases, *residential real estate prices* surged sharply and began falling prior to the beginning of financial distress (Figure 1). On average, real estate prices, corrected for inflation, rose by more than 20 percent from seven to two years before the beginning of financial distress and fell by more than 15 percent during the two years prior to the beginning of financial distress.[7] After the onset of the banking crisis, real estate prices often continued to fall—at least until the peak of the crisis—indicating that financial sector distress may exacerbate the fall in real estate prices.

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[7]In some cases, real estate prices already reached their peak about four years before the beginning of financial sector distress. This points to the possibility that when a real estate bubble is suspected, supervisory authorities could try to be more conservative on loan classification and provisioning in order to spread out the impact of the real estate downturn on earnings and capital, thus avoiding the need for fire sales later on.

Figure 1. Residential Property Prices in 11 Selected Cases

Residential Property Prices Before and After the Beginning of Banking Distress
(beginning of crisis = 100)

(years from first year of crisis)

(years from first year of crisis)
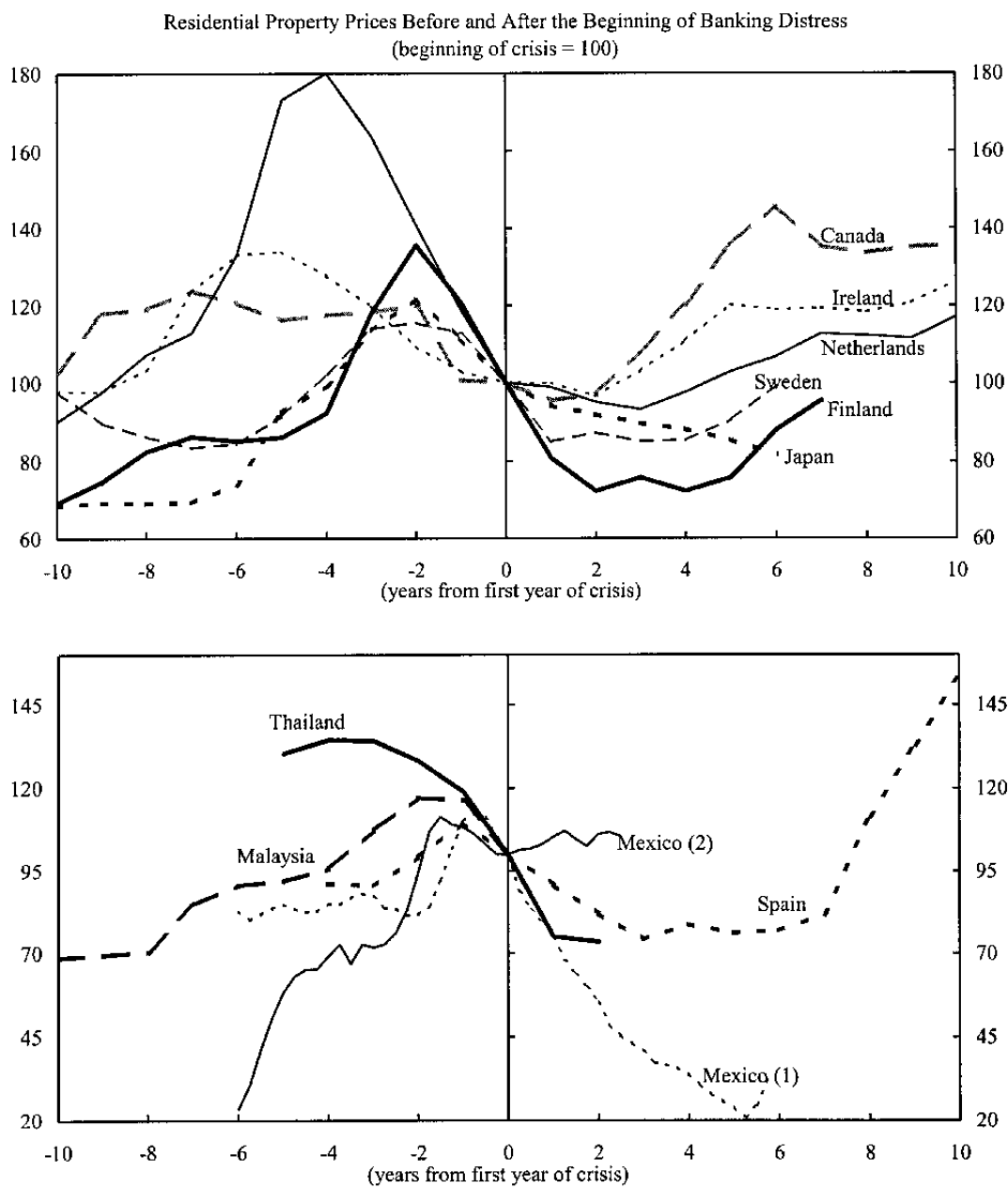
Source: BIS and National Databases

The same pattern can be observed in *commercial property prices*, although the scarce availability of data permits only the inclusion of seven cases (Figure 2).

Figure 2. Commercial Real Estate Prices in 7 Selected Cases

Commercial Property Prices Before and After the Beginning of Banking Distress
(first year of crisis = 100)
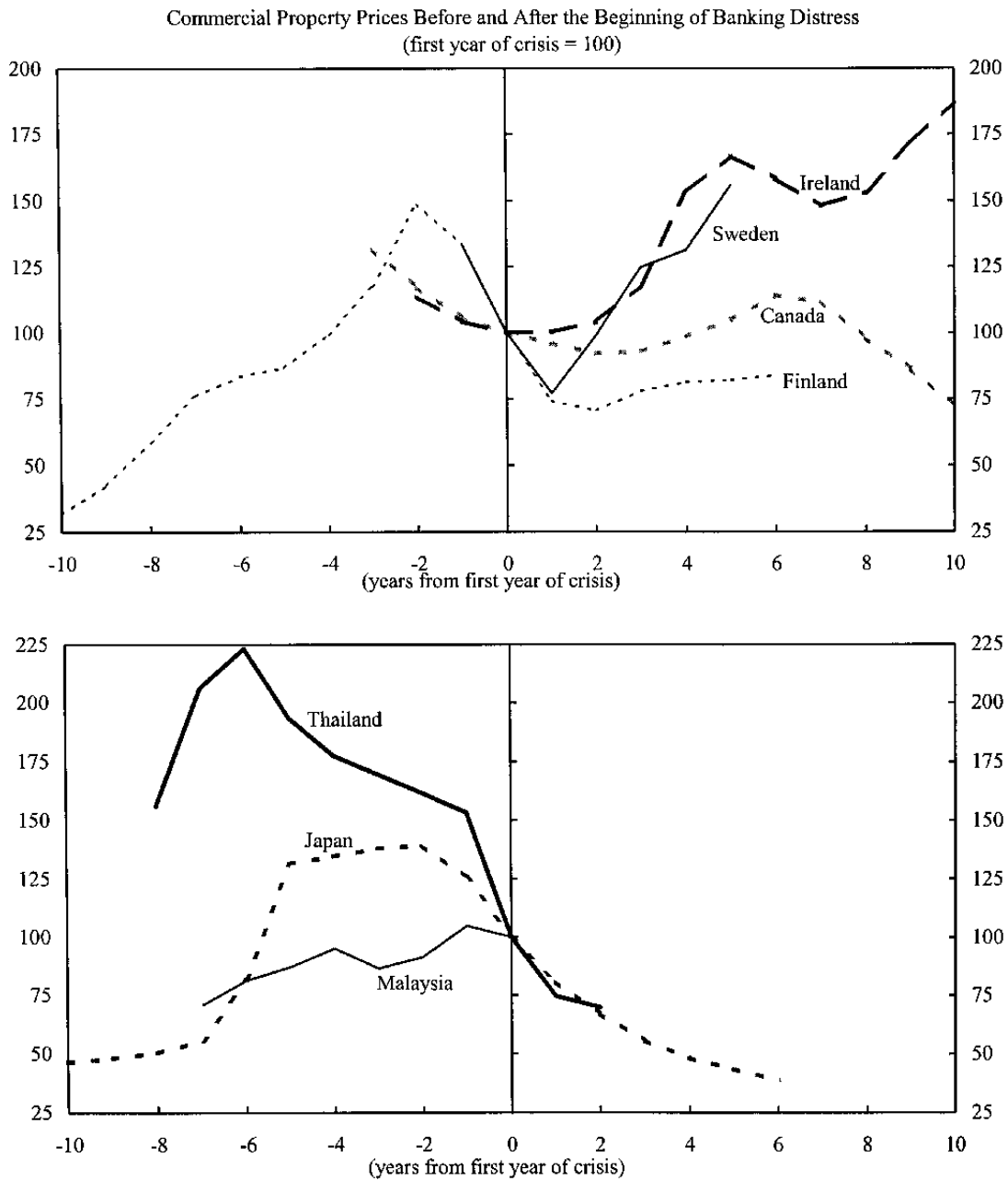
Source: BIS and National Databases

In particular, in the cases of Japan, Finland and Thailand, the boom and bust in commercial real estate prices before the crisis is evident. In these cases, the commercial property price changes are also larger than those in the residential prices. However, on average for these seven cases the cycles in residential and commercial prices have been broadly similar (Figure 3).

Figure 3. Average Real Estate Prices[8] and Banking Sector Distress

Average Real Estate Cycle Before and After the Beginning of Banking Distress
(Beginning of financial sector crisis = 100)
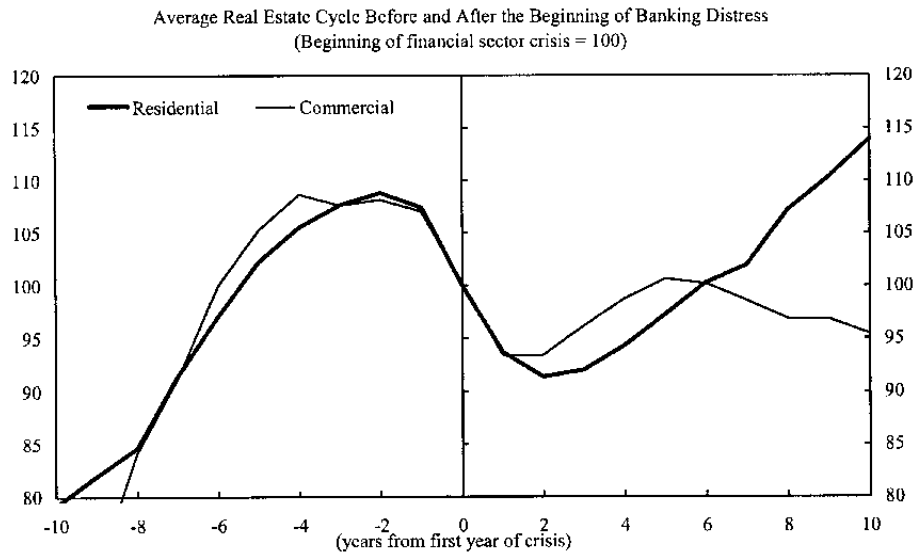
Sources: BIS, National Databases and Fund staff Estimates

Finally, for the few cases where there was sufficient data on *stock prices of real estate companies*, there is a tendency for these market prices to fall drastically before the onset of a banking crisis and to bottom out or stabilize by the beginning of the crisis (Figure 4).

Figure 4. Real Estate Stock Prices and Banking Sector Distress

Real Estate Stock Prices Before and After the Beginning of Banking Distress
(Beginning of financial sector crisis = 100)
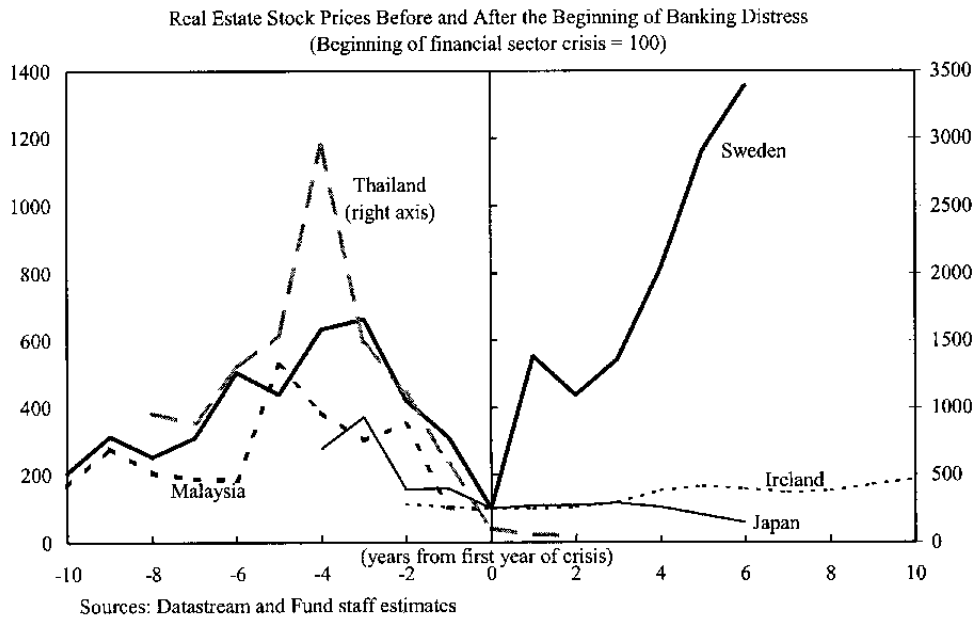
Sources: Datastream and Fund staff estimates

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[8]Based on the selection of countries included in Figures 1 and 2.

The close links between developments in the real estate sector and the financial sector become apparent when real estate prices are seen in relation to credit growth. In all 11 cases, there is a strong correlation between real estate price developments and credit growth—all real estate booms are preceded or accompanied by a boom in banking credit to the private sector, and all collapses in real estate prices by a strong contraction of credit growth (Figures 5-7, 9-11). This supports the notion that availability of financial resources is one of the driving forces of prices in this market. On the other hand, falling real estate prices and rising vacancies are signals to banks to reduce lending to this sector and may exacerbate the contraction in credit, which make prices fall even further.

The downturns in real estate prices before the start of financial sector distress are different in length and magnitude. Some countries experience a relatively fast boom and bust within only a few years (e.g., Finland, Malaysia, Mexico, and Spain), while in other countries the cycle is close to 10 years (Canada, Ireland, and the Netherlands). Table 2 provides an overview of length and magnitude of the price decreases in real estate prices as well as the lag between the peak of real estate prices to the beginning of banking sector distress. It shows that all countries experienced significant decreases in real estate prices. On average, residential property prices fell by 35 percent, while commercial property prices fell by 45 percent. In most countries, the price fall was a gradual process that took place over a number of years (3-8 years) and property prices peaked on average 2-3 years before the beginning of distress in the banking sector.

Table 2. Length and Magnitude of Real Estate Price Falls

|	Price fall		Length of bust period		Lag from peak to distress 1/	
	Residential	Commercial	Residential	Commercial	Residential	Commercial
	(Percent)		(Years)		(Years)	
Canada	-21	-30	3	5	2	3
Finland	-47	-53	4	4	2	2
Ireland	-28	n.a.	7	n.a.	5	n.a.
Japan	-33	-72	8	8	2	2
Malaysia	-15	-5	2 (ongoing)	1 (ongoing)	2	1
Mexico (I)	-81	n.a.	6	n.a.	1	n.a.
Mexico (II)	-10	n.a.	1	n.a.	1 ½	n.a.
Netherlands	-48	n.a.	7	n.a.	5	n.a.
Spain	-32	n.a.	4	n.a.	1	n.a.
Sweden	-26	-42	3	3	2	2
Thailand	-45	-69	6	8	4	6
Average	-35	-45	4.6	4.8	2.5	2.7

Explanation: n.a. = not available
1/ Lag from peak of real estate prices to beginning of financial sector distress.

C. Country Experiences

Despite differences in length, magnitude, and relative timing of banking sector distress and real estate price developments, most of these cases of banking sector distress had fairly

similar backgrounds. The *Nordic* banking crises[9] illustrates clearly the linkages between the real estate sector and banking sector distress. During the 1980s the Nordic countries went through a period of significant liberalization and financial sector deregulation. Capital markets began to develop, and large companies started seeking funding through capital markets rather than bank loans. Also, new types of less regulated nonbank financial institutions emerged (primarily finance companies engaged in real estate lending), which competed aggressively with banks. Property prices rose steadily from the mid-1980s in response to an acceleration in the growth of real income and fueled by a strong growth in private sector credit (Figure 5 a/b), as banks were attracted to the booming real estate market, where a new group of clients were seeking financing of housing and commercial real estate projects. In the context of the Swedish and Finnish post-war experience of fairly stable real estate market developments, real estate lending seemed to be relatively safe. These developments resulted in excessive lending to housing and construction sectors[10] and, as lending decisions relied primarily on availability of collateral rather than cash flow evaluations, the aggregate real estate exposure of banks was much larger than their direct loans to the real estate sector.

Figure 5. Property Prices and Real Credit Growth—Finland and Sweden

a) Finland   b) Sweden
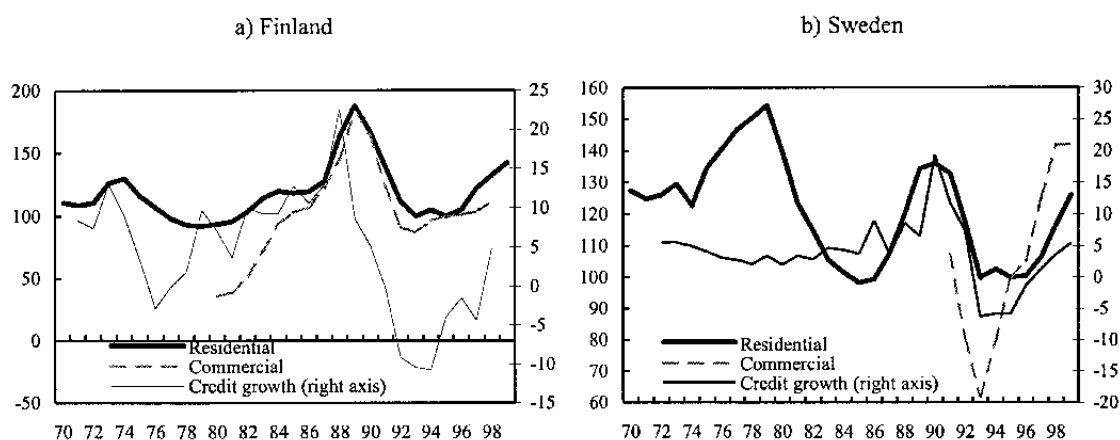
The *Swedish* and *Finnish* real estate booms ended abruptly in 1990 with the beginning of the worldwide economic slowdown, a rise in interest rates, and rising vacancies.[11] In particular,

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[9]Jaffee (1994), Kokko (1999). In this study we focus on the banking crises in Sweden and Finland, however Denmark and Norway experienced similar incidences of banking sector distress.

[10]Available Swedish bank statistics did not identify real estate lending as a separate category.

[11]In Sweden's case, the 1991 tax reform also played an important role by considerably raising housing costs (and reducing demand for housing) as a result of several factors:
(i) higher indirect taxes, implying increased operating and maintenance costs for the entire

(continued...)

finance companies experienced major losses on their real estate loans and began to borrow heavily from banks to stay afloat. In 1991, a systemic financial sector crisis developed in Finland and the same happened in Sweden one year later.

The *Japanese* banking crisis[12] was, as in the Nordic case, to a significant extent caused by high bank exposure to the real estate sector (both directly and indirectly through collateral and loans to housing loan companies, or *jusen*) and a price bubble in the real estate sector fueled by excessive credit expansion. From 1985-91 bank credit increased by an average of 10 percent per year, and credit from nonbank financial institutions grew by almost 18 percent a year. During the same period the direct exposure by banks to the real estate and construction sectors increased from around 13 percent to almost 18 percent of total outstanding loans.[13] In 1991-92 the bubble burst (both in the stock and real estate markets), and the drop in real estate prices was magnified by the sharp contraction in credit growth (Figure 6). With the burst of the bubble problems emerged in the *jusen*. A rehabilitation plan with government support was established in 1993 on the assumption of a recovery of real estate prices. But by 1995, as real estate prices had continued to fall, close to 75 percent of *jusen* loans were nonperforming. Following this adverse development, most *jusen* were liquidated and shortfalls in assets were covered mainly by parent or creditor banks.

Figure 6. Property Prices and Real Credit Growth—Japan

Japan
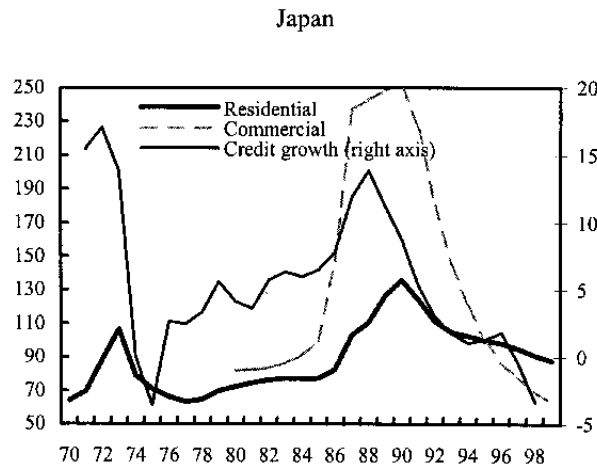
housing stock; (ii) reduced interest deductions, involving higher costs for owners and tenants (depending on the pass-through); and (iii) a cut in interest subsidies for newly constructed rental apartments.

[12]Nagashima (1997); Kanaya and Woo (2000); Herring and Wachter (1999).

[13]Kanaya and Woo (2000).

The *Asian* financial sector crisis occurred after a long period of economic prosperity, during which investment in real estate and commercial office space soared.[14] Poor credit risk management and excessive lending during most of the 1990s (Figure 7 a/b), in particular to the real estate sector, combined with financial sector liberalization without an adequate strengthening of the regulatory and supervisory systems, seem to have played a major role in the distress of the financial sectors in Asia, in particular in Thailand.

Figure 7. Property Prices and Real Credit Growth—Thailand and Malaysia
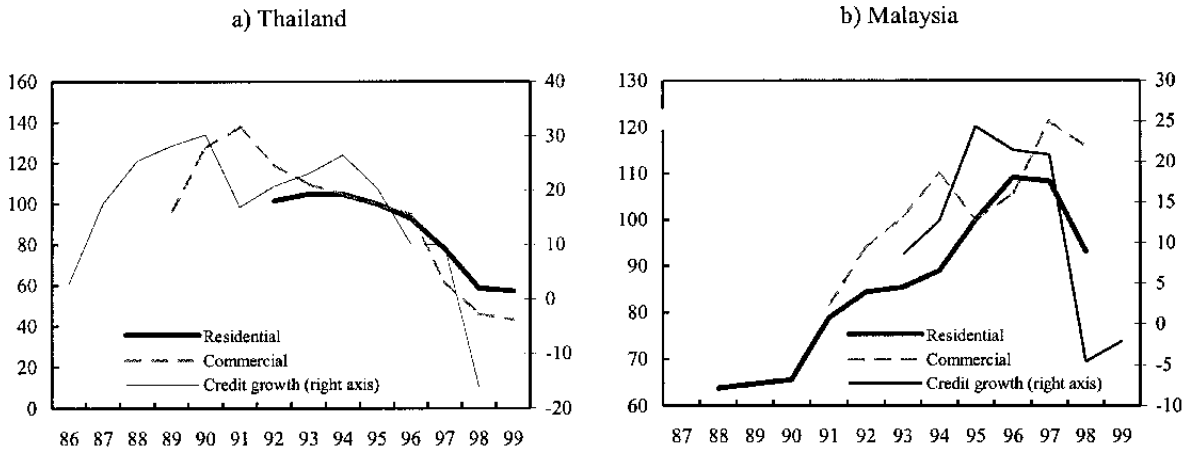
In the *Thai* case, finance companies were hardest hit, as they had increased their exposure to the real estate and construction sectors significantly during the years prior to the crisis. During 1994-96 credit from finance companies to construction and real estate increased by an average of 35 percent a year and in mid-1997 finance companies reached a direct exposure to real estate and construction activities of more than 30 percent of total loans (Figure 8a). The currency crisis in July 1997 had a dual impact: it severely complicated the rolling over of short term loans which funded the finance companies, and it increased the cost of dollar denominated debt by more than 30 percent. In August 1997, 56 finance companies were closed. The financial sector in *Malaysia* was in far better shape than in Thailand, but the drop in real estate prices starting in mid-97 certainly affected the financial sector, as the direct banking system exposure to real estate—although on a declining trend since 1989— still exceeded 30 percent (Figure 8b).

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[14]Renaud et al. (1998); Renaud (1999); Herring and Wachter (1999). In this study we focus on the cases of Thailand and Malaysia. Indonesia and the Philippines also experienced banking crises.

Figure 8. Exposure to Real Estate and Construction—Thailand and Malaysia
(real estate lending as a percentage of total loans)

a) Thailand   b) Malaysia
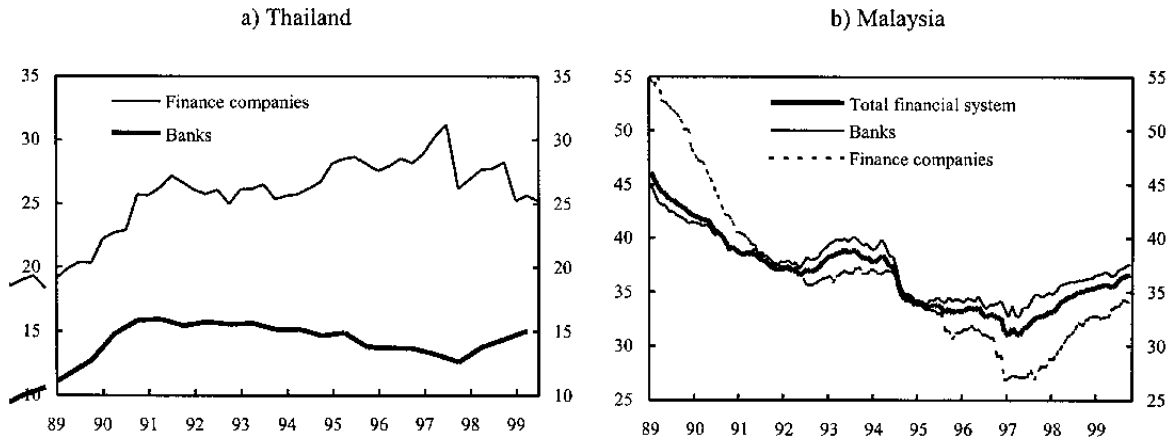
The *Mexican* banking crises[15] (1982-84 and 1994-96) were also triggered by a combination of events, including lending to real estate. Preceding the first crisis in 1982, real estate prices (adjusted for inflation) soared by about 40 percent within only 1½ years. Subsequently, along with the nationalization of banks in early 1982, credit to the private sector contracted sharply and real estate prices began their long fall of about 20 percent per year for almost six years (Figure 9). Following the end of the first banking crisis, Mexico's successful stabilization and structural reforms in the late 1980s, including the deregulation of financial intermediation and privatization of the banking system, fueled a renewed large expansion of the supply of loanable funds. For a couple of years, real credit grew by close to 50 percent per year. The availability of financial resources, a housing shortage and a higher perceived permanent income led to a strong construction and real estate boom during 1988-92, when real estate prices more than quadrupled. However, by early 1993 the net indebtedness of the private sector became increasingly burdensome due to a slowdown in the economy, real estate prices fell slightly, and many bank loans (in particular mortgage loans) that from the start were of dubious quality began to deteriorate rapidly. From late 1992 to early 1994 nonperforming mortgage loans increased rapidly from close to one percent of total loans to around six percent.[16] The situation worsened further due to events in the Mexican political arena and the depreciation of the peso in December 1994.

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[15]Mancera (1997) and Guerra de Luna (1997).

[16]Guerra de Luna (1997)

Figure 9. Property Prices and Real Credit Growth—Mexico

Mexico
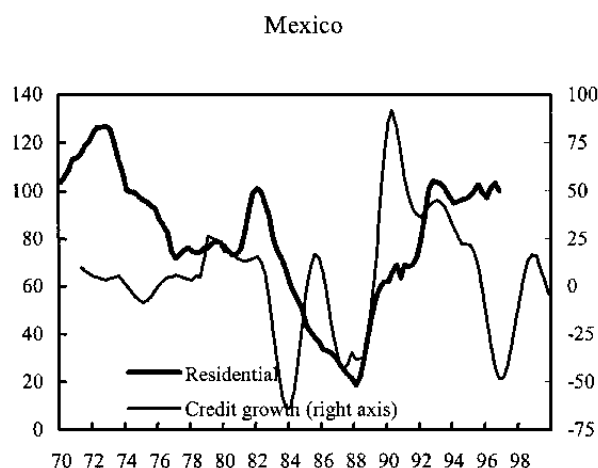
With regard to the *Spanish* banking crisis, the collapse of the real estate market also played an important role.[17] The financial system was heavily regulated until the second half of the 1970s, thus fostering the existence of inefficient intermediaries. With the liberalization, a number of new private banks and banks that had recently changed owner forced the growth of their balance sheets by offering very advantageous rates to potential customers at a time when nominal market rates were sharply rising. Given the high cost of funds and the high level of operating expenses, many banks opted for directing their loans to riskier customers who were willing to take out expensive loans. However, in the late 1970s, a sharp tightening of monetary policy and unfavorable economic conditions hit the marginal businesses hard, building activities went into recession, and real estate prices dropped by more than 30 percent (Figure 10a). Many banks had concentrated their risks heavily either in real estate or other high risk projects, and in most cases, more than half of a bank's loan portfolio was linked to its respective affiliates, thus fostering an even higher concentration of risk. From 1979 to 1983, more than 50 banks became insolvent (about 46 percent of the banking system) and a major liquidation and restructuring effort was initiated.

The *Dutch, Canadian,* and *Irish* banking problems were much less pronounced. These countries did not experience a system-wide banking crisis, but rather significant distress in certain parts of the financial sector. In the *Canadian case*[18] a range of smaller institutions failed, while the major institutions were never seriously at risk and the soundness of the system as such was not in doubt. For those institutions that did fail, the collapse of real estate prices in the early 1980s (Figure 10b) was certainly a factor, as they had very large mortgage

[17]Rodriguez (1989)

[18]Economic Council of Canada (1987).

portfolios (several of the institutions that failed were federally chartered mortgage loan companies). Although the portfolios were diversified across many borrowers, all borrowers suffered from similar economic shocks. The cause of the decline in real estate prices was linked to the severe recession in 1981-82 and significant declines in commodity prices. The collapse of the energy sector and the real estate market was most pronounced in the western half of the country and created severe problems for the small institutions there, which lacked geographical and sectoral diversification in their loan portfolios.

Figure 10. Property Prices and Real Credit Growth—Spain,
Canada, Ireland, and the Netherlands

a) Spain

b) Canada

c) Ireland

d) Netherlands
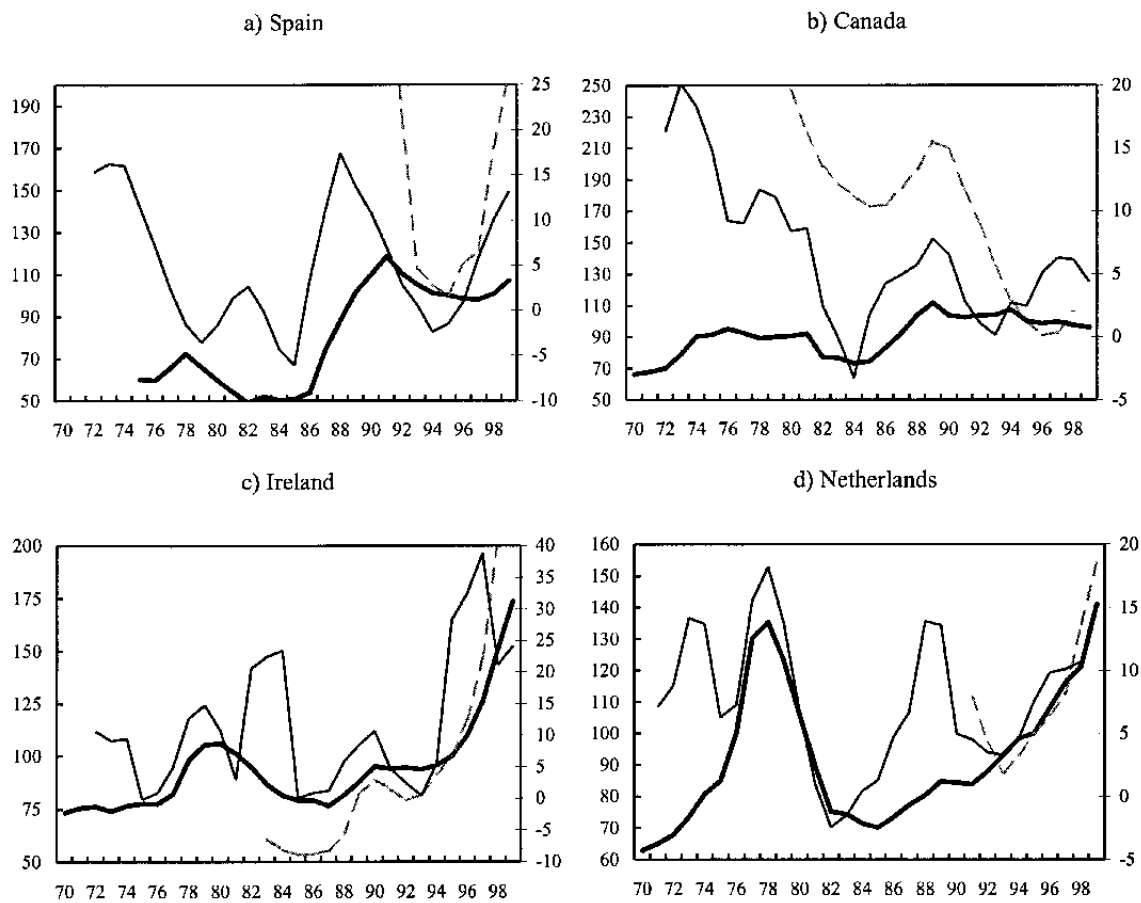
Explanation:

———— Price index residential real estate;
------ Price index commercial real estate
———— Credit growth (in percent; right axis)

In the late 1970s, *Ireland* experienced a boom in real estate prices supported by high real credit growth (Figure 10c). In 1980 real estate prices started to decline for about seven years, despite a continued strong growth in credit to the private sector. In 1985, the banking sector

experienced problems when one of the four large clearing banks wrote off one-fourth of its capital related to sustained losses in its insurance subsidiary, but there were no indications of a direct link between real estate prices and financial sector distress in this case.

The Netherlands experienced problems in the banking sector in the early 1980s.[19] These problems resulted from a combination of a recession and high inflation and interest rates, which led to a rapid increase in bankruptcies. At the same time, there was a sharp decrease in the value of commercial real estate and a rapid deflation of the bubble in prices of residential real estate. Combined with imprudent lending policies, this resulted in the bankruptcy of one medium-sized mortgage bank and the restructuring—mostly through mergers with other banks and institutional investors—of other mortgage banks. These developments served as a wake-up call for the whole financial sector, and no major crisis developed (Figure 10d).

D. Real Estate Cycles in an Environment of Sound Banking Systems

Although *Singapore* experienced a strong boom and bust in real estate prices in the second half of the 1990s, in combination with a relatively large banking sector exposure to the real estate market, a banking crisis did not occur. Looking at the numbers, the case of Singapore looks very much like many of the cases discussed above: real estate prices more than doubled during 1994-97, supported by a strong growth in credit to the private sector (Figure 11a).

Figure 11. Property Prices and Real Credit Growth—Singapore and Hong Kong SAR

a) Singapore

b) Hong Kong SAR
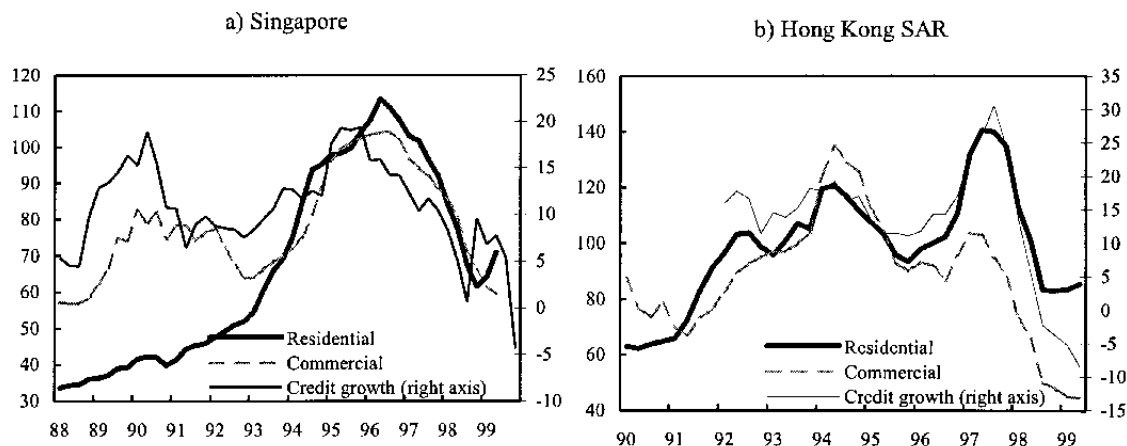
Banks increased their exposure throughout the 1990s to the real estate and construction sectors to more than 35 percent of total loans (Figure 12a). In late 1996 and early 1997, the authorities implemented several measures to cool the market, and real estate prices as well as credit growth started to fall. In many of the cases discussed above, banks were not well prepared for dealing with a shock of this magnitude, but this was not the case in Singapore.

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[19]Hilbers (1998).

Although profitability of banks did decline significantly during 1998 and 1999, and the ratio of nonperforming loans to total loans rose from about 3 percent in early 1998 to a peak of 12 percent in June 1999, banks' capital adequacy ratios—ranging from 17-24 percent in mid-1999—remained well in excess of the regulatory minimum of 12 percent of risk-weighted assets. The financial strength of the domestic banks is ranked by rating agencies as among the highest in Asia, and the prudential and regulatory system is generally considered to function well. Thus, the favorable performance of the financial sector in Singapore during real estates swings seems to be rooted in Singapore's strong macroeconomic fundamentals and a well-supervised banking system with a strong capital base.[20]

The *Hong Kong SAR* banking sector went through similar stress during the Asian crisis but has, like Singapore, weathered the crisis well, despite a significant exposure to real estate. The property market plays a central role in the Hong Kong SAR economy, and movements in property prices have a strong bearing on overall economic activity. The property sector accounts for close to 50 percent of banks' lending (Figure 12b) and about 20 percent of stock market capitalization. Land in Hong Kong SAR is owned by the government, and leased to private developers. Hence, land supply for development is effectively determined by the government, which has, from time to time, used its land disposal policy to stabilize prices and restrain speculative activities. In July 1997, following a sharp rise in property prices,[21] the government announced a five-year land disposal program that envisioned a 50 percent increase in land supply.

Figure 12. Exposure to Real Estate and Construction—Singapore and Hong Kong SAR
(real estate lending as a percentage of total loans)

a) Singapore

b) Hong Kong SAR

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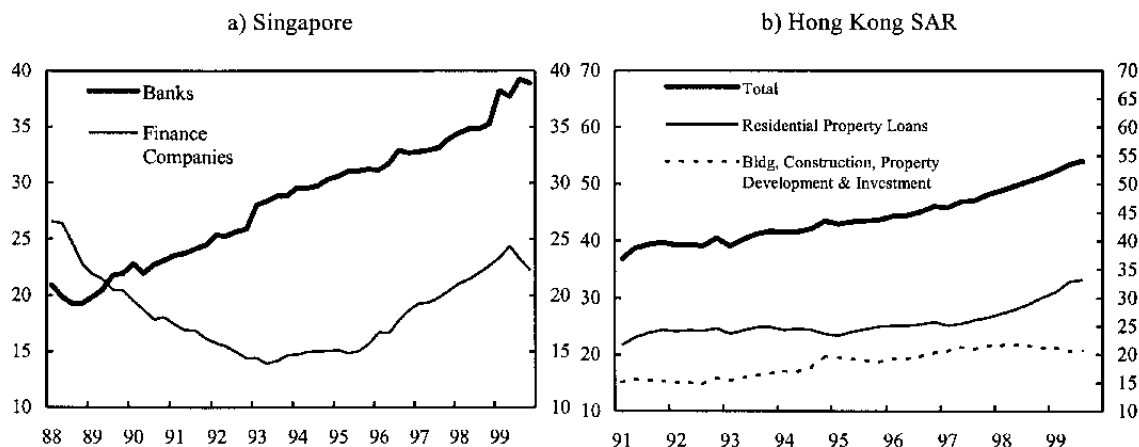
[20]Stone (1999).

[21]Using ARIMA models, Kalra, Mihaljek, and Duenwald (2000) estimate that in mid-1997 property prices were about 40 percent above levels reflecting fundamentals.

However, following the onset of the Asian crisis, property prices dropped dramatically (residential prices by around 40 percent and commercial prices by almost 70 percent), and in June 1998, government land sales were therefore suspended temporarily, and price developments stabilized somewhat. The drop in real estate prices was accompanied by a significant credit squeeze, owing in part to banks having become more cautious in their lending policy in the face of the declining prices and increased interest rate volatility (Figure 11b). These tighter credit conditions made the economic environment even more difficult. The sharp drop in real estate prices and the inevitable pressures arising from declining output and the regional crisis certainly affected banks, but the financial position of the banking system generally remained strong. From end-1997 to mid-1999, nonperforming loans soared from around two percent to ten percent of total loans, but the capital-adequacy remained high—close to 20 percent of risk-weighted assets with no bank below 14 percent—reflecting the strong capital base of Hong Kong SAR banks. Also, banks are required to maintain at least 25 percent of their assets in liquid form, which has helped to reduce the risk of a liquidity crisis.

E. A Probit-Logit Model for Financial Sector Distress

In the remainder of the section, we use a probit-logit approach to explore the potential contribution of price movements in the property market to the observed financial sector distress. In a simple probit-logit model, the likelihood function of a sample of T observations is:

$$l = \prod_{t=1}^{T} F(x_t'\beta)^{y_t} [1 - F(x_t'\beta)]^{(1-y_t)},$$

where $F(\cdot)$ is either the standard normal or logistic cumulative density function for a probit or logit model respectively.

The dependent variable y_t, or $DFIN_t$, is a dummy variable measuring financial sector stress.[22] In the explanatory variables set x_t', we have included the following four variables, subject to data availability: MIU is the M2 multiplier,[23] RR is the real interest rate,[24] $PRES$ is the real residential property price index,[25] and $DRER$ is a dummy variable measuring the

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[22]As mentioned in section III, we primarily relied on two earlier empirical studies in defining the periods of financial sector stress for the countries in our sample (Lindgren, Garcia, and Saal (1996); and Kaminsky and Reinhart (1999)).

[23]This represents the ratio of M2 (IFS line 34 plus 35, or IFS line 35L if available) to base money (IFS line 14), representing monetary conditions.

[24]This variable is derived from the deposit rate (IFS line 60) deflated by consumer prices (IFS line 64).

downturn of the residential property market.[26] The money multiplier and real interest rate have reportedly performed well in previous currency crises studies using logit/probit models.

Taking advantage of the symmetry of both standard normal and logistic distribution functions, we can simplify the log-sample likelihood function as,

$$\ln l = \sum_t \ln f(q_t x_t' \beta),$$

where $q_t = 2y_t - 1$ and $f(\cdot)$ is the probability density function of either the standard normal or the logistic distribution. Our objective is to maximize the sample log-likelihood, and find out the estimators for the coefficient vector β and the marginal effects $f(x_t' \beta)\beta$.[27]

The probit-logit exercise is conducted for nine countries: Australia, Canada, Finland, France, Ireland, Japan, Mexico, Spain, and Sweden. The estimation results for the probit model are listed in Table 3 and those for the logit model in Table 4. Theoretically, the signs associated with all explanatory variables except *PRES* should be positive. From both tables we observe stable positive signs for *DRER*, reflecting that a downturn in the residential property market will increase the probability of financial sector stress. Note that the signs for *MIU* are also relatively stable. This may be interpreted as an adverse impact of an overexpansion in domestic credit on the financial sector soundness.

Insignificant estimators can partly be attributed to the unavailability of more frequent data covering a longer span. The sample size for Mexico is 107, while for the other countries it ranges from 24 to 31. The strongest empirical support for a direct link between falling real estate prices and financial sector stress comes from the case of Mexico, where we have both highly significant estimators and correct signs for the downturn dummy and the M2 multiplier. Judging from the marginal effects, the probit model estimation indicates that a downturn in the residential property market in Mexico will increase the risk of financial sector stress by almost 12 percent, while the logit model specification indicates a 9 percent

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[25]For most countries in our sample, there are only about eight annual observations for the real commercial property price index, which excludes its use in empirical tests. Also, large values of the explanatory variables would produce a problem of "underflow," due to rounding errors. Therefore, in computing the maximum likelihood estimators, we have to readjust the price indices to make the computation feasible; this readjustment of the base for the price indices does not compromise our results.

[26]If the real residential property price falls this period compared to the previous one, then *DRER* = 1 for this period.

[27]We use estimators to approximate the asymptotic covariance matrix for the coefficient vector β and follow the equations (19-25) and (19-26) in Greene (1997) to obtain the asymptotic covariance matrix for the marginal effects, or slopes.

increase of risk. If not taking account of the insignificance of most marginal effects associated with the downturn dummy, on average we would obtain a 7.5 percent risk increase using the probit model and a 6.4 percent risk increase using the logit model.

We also test the null hypothesis that all the slope coefficients in the probit-logit model are zero, by using the likelihood ratio test.[28] The test results are listed in Table 5, which shows that for almost every country at least one marginal effect is nonzero, regardless of whether we are using a probit or logit model.

There is no universally accepted indicator for the goodness of fit in probit-logit models, but the so-called Likelihood Ratio Index (LRI)[29] is often used. This index is constrained within the unit interval, and increases as the fit of the model improves. The results of the LRI are reported in Table 5. The number of incidences of financial sector stress in our sample is fairly small, and the average proportion of financial sector stress is about 18 percent. The mean LRI for the probit model is 0.3758 and that for the logit model is 0.3723. Considering the small sample size for each country and small proportion of stress, the results are not very robust. However, the stability of the signs still gives a good indication of the impact of a downturn in real estate prices on financial sector soundness.

Another indicator of the goodness of fit is a table of hits and misses of a prediction rule, such as $\hat{y}_t = 1$ if $\hat{F}_t > F^*$ and 0 otherwise. Such prediction results are of course highly dependent upon the cut-off value F^*. In this paper we have chosen the commonly used cut-off value of 0.5, which is certainly far larger than the average sample proportion of financial sector stress of 0.18. The results for this type of measurement are also reported in Table 6. Because of the small proportion of incidences of financial sector stress, there are no predicted incidences of financial sector stress in our sample if we use the 0.5 cut-off value, but the prediction matrix itself depicts a seemingly good prediction rate, about 82 percent on average. This "high" predication rate, however, is a mimic of the low sample proportion of incidences of financial sector stress. The estimates confirm that a downturn in the residential property market will contribute to the probability of financial sector stress, but the lack of high frequency data on the real estate markets and unavailability of data about credit exposure to the real estate sector and nonperforming loans for most of the countries prevent us from exploring the relationship between the two sectors in a more precise way.

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[28]The likelihood ratio statistic LR is $LR = -(\ln L_* - \ln L)$, and the restricted log-likelihood for both the probit and logit models is given by $\ln L_* = T[p \ln p + (1-p)\ln(1-p)]$, where p is the proportion of observed financial stress in the sample. LR is asymptotically distributed as a chi-square with degrees of freedom equal to the number of explanatory variables (excluding the constant term).

[29]LRI is defined as $LRI = 1 - \ln L / \ln L_*$, where $\ln L_*$ is given in the footnote above.

Table 3. Estimation Results Using a Probit Model

Country	Coefficients					Slopes			
	C	DRER	MIU	RR	PRES	DRER	MIU	RR	PRES
AUS	-14.1405	0.4026	0.6849		2.0293	0.0174	0.0296		0.0877
	(-0.7220)	(0.4078)	(1.4705)*		(0.4137)	(0.2914)	(0.4238)		(0.4818)
CAN	-1.5094	0.7312		-0.4905		0.1209		-0.0811	
	(-1.7077)**	(1.0693)		(-0.1118)		(1.0972)		(-0.1121)	
FIN	-14.4011	1.2770	0.7944	-12.4889	-0.5140	0.0008	0.0005	-0.0083	-0.0003
	(-0.9503)	(1.2772)	(1.0949)	(-0.6379)	(-0.6327)	(0.0963)	(0.0998)	(-0.1055)	(-0.0867)
FRA	-6.3614	0.4981	0.3443			0.0740	0.0512		
	(-1.9032)**	(0.6512)	(1.5609)*			(0.5705)	(1.9430)**		
IRL	2.1044	6.2507	1.0394		-7.2184	0.0000	0.0000		-0.0000
	(0.0141)	(0.0421)	(1.1801)		(-1.2845)*	(0.0018)	(0.0017)		(-0.0017)
JPN	-12.8651	6.1590	0.4835		0.7648	0.0124	0.0010		0.0015
	(-0.0740)	(0.0354)	(0.6883)		(0.6523)	(0.0036)	(0.0033)		(0.0033)
MEX	-2.4061	0.6198	0.1585		0.1367	0.1166	0.0298		0.0257
	(-3.4655)***	(1.6740)**	(2.3363)***		(0.6042)	(1.7501)**	(2.3790)***		(0.6046)
ESP	3.8388	0.4762		0.9103	-2.1633	0.1327		0.2537	-0.6030
	(1.4893)*	(0.6416)		(0.2858)	(-2.1677)***	(0.6044)		(0.2886)	(-2.4223)***
SWE	-2.6004	1.4929	-0.6178		1.3167	0.1511	-0.0625		0.1332
	(-0.7550)	(1.5246)*	(-1.6086)*		(1.1330)	(1.2618)	(-1.3971)*		(1.4107)*

Notes: Numbers within parentheses are z-statistics. Significance levels of 20%, 10% and 5% are denoted by *, **, ***, respectively.

Table 4. Estimation Results Using a Logit Model

Country	Coefficients					Slopes			
	C	DRER	MIU	RR	PRES	DRER	MIU	RR	PRES
AUS	-27.5058	0.7173	1.2670		4.1957	0.0139	0.0246		0.0815
	(-0.7567)	(0.4255)	(1.4329)*		(0.4624)	(0.3299)	(0.5232)		(0.5464)
CAN	-2.7889	1.4338		-0.2468		0.1171		-0.0202	
	(-1.6157)*	(1.0544)		(-0.0318)		(1.2718)		(-0.0346)	
FIN	-26.9088	2.3072	1.4733	-24.9817	-0.8048	0.0030	0.0019	-0.0321	-0.0010
	(-0.9875)	(1.2600)	(1.1232)	(-0.7324)	(-0.5909)	(0.2052)	(0.2174)	(-0.2346)	(-0.1628)
FRA	-10.9094	0.8884	0.5921			0.0693	0.0462		
	(-1.8371)**	(0.6483)	(1.5087)*			(0.6350)	(1.9181)**		
IRL	-3.4417	17.3322	1.7368		-12.0233	0.0000	0.0000		-0.0000
	(-0.0077)	(0.0386)	(1.1165)		(-1.2511)	(0.0040)	(0.0037)		(-0.0037)
JPN	-28.2215	17.3175	0.6299		1.8427	0.0019	0.0001		0.0002
	(-0.0354)	(0.0217)	(0.5452)		(0.8194)	(0.0026)	(0.0023)		(0.0023)
MEX	-4.0513	0.9481	0.2735		0.2359	0.0935	0.0270		0.0233
	(-3.2725)***	(1.4522)*	(2.2881)***		(0.5819)	(1.6615)**	(2.6232)***		(0.6467)
ESP	6.2750	0.7988		1.7696	-3.5917	0.1237		0.2741	-0.5563
	(1.4091)*	(0.6129)		(0.3131)	(-2.0597)***	(0.6525)		(0.3727)	(-2.2369)***
SWE	-4.8723	2.7847	-1.0778		2.3582	0.1346	-0.0521		0.1139
	(-0.8263)	(1.5343)*	(-1.5917)*		(1.1669)	(1.3526)*	(-1.4187)*		(1.4426)*

Notes: Numbers within parentheses are z-statistics. Significance levels of 20%, 10% and 5% are denoted by *, **, ***, respectively.

Table 5. Goodness of Fit of the Estimations Based on the Probit and Logit Model

| Country | p | Probit Model | | | | | | | Logit Model | | | | | | |
| | | Likelihood | LR | LRI | Prediction Matrix | | | | Likelihood | LR | LRI | Prediction Matrix | | | |
					A0P0	A0P1	A1P0	A1P1				A0P0	A0P1	A1P0	A1P1
AUS	0.1600	-5.3312	11.3211***	0.5150	21	0	4	0	-5.4485	11.0866***	0.5043	21	0	4	0
CAN	0.1071	-8.8656	1.3368	0.0701	25	0	3	0	-8.8599	1.3483	0.0707	25	0	3	0
FIN	0.1429	-5.4995	11.9675***	0.5211	24	0	4	0	-5.5572	11.8522***	0.5161	24	0	4	0
FRA	0.1923	-8.9985	7.4597***	0.2930	21	0	5	0	-9.0811	7.2946***	0.2865	21	0	5	0
IRL	0.0714	-3.3316	7.7467**	0.5376	26	0	2	0	-3.4063	7.5972**	0.5272	26	0	2	0
JPN	0.2500	-6.5392	18.4123***	0.5847	21	0	7	0	-6.4066	18.6776***	0.5931	21	0	7	0
MEX	0.1308	-37.7539	7.5205**	0.0906	93	0	14	0	-38.0045	7.0193**	0.0845	93	0	14	0
ESP	0.3750	-7.7397	16.2756***	0.5125	15	0	9	0	-7.8973	15.9605***	0.5026	15	0	9	0
SWE	0.1429	-8.2491	6.4683**	0.2816	24	0	4	0	-8.3041	6.3583**	0.2769	24	0	4	0

Notes: p is the proportion of observed financial stress in the sample. LR is the likelihood ratio statistic for the null hypothesis that all marginal effects, or slopes, are zero. LRI is the likelihood ratio index defined in footnote 25. A0P0 stands for the case where there is no financial stress in reality and the predicted probability of a financial stress is less than the naïve cut-off value 0.5. A0P1 stands for the case where there is no financial stress in reality and the predicted probability of a financial stress is no less than 0.5. The similar explanation applies to A1P0 and A1P1. Significance levels of 20%, 10% and 5% are denoted by *, **, ***, respectively

IV. CONCLUDING REMARKS

1.   There is consensus that booms and busts in asset prices can contribute to financial sector distress and macroeconomic imbalances. Most studies in this regard focus on stock market prices, for which data are readily available. However, as this study illustrates, unbalanced developments in real estate markets can also be an important factor contributing to vulnerabilities and possibly crises in the financial sector. In this respect, price developments in real estate markets constitute a useful financial soundness indicator, i.e., an indicator that can help in assessing the health and stability of the financial system.[30]

2.   A major complicating factor, however, is the lack of good quality and timely data with respect to developments in real estate markets. Major international databases do not include real estate indicators—such as prices, rents, vacancy rates, construction costs, real estate lending, and stock prices of real estate companies—with the exception of a small database with mostly annual residential and commercial property prices for a selection of industrialized countries maintained by the Bank for International Settlements (BIS). This supports recent pleas for enhanced compilation of real estate data by national authorities. For this study we rely on the BIS data, as well as data derived from national databases for a few Asian and Latin American countries. It should be noted that residential real estate indices are generally based on national averages, whereas commercial real estate indicators typically refer only to one or a few major cities.

3.   Real estate markets have a number of very specific characteristics that complicate their analysis: (i) heterogeneity of supply; (ii) the absence of a central trading market; (iii) infrequent trades; (iv) high transaction costs; (v) prices that are often determined by bilateral negotiations, resulting in a lack of readily available information and transparency; (vi) rigid and constrained supply; (vii) financing through borrowing; and (viii) the use of real estate as collateral. Furthermore, there are large differences between countries in the legal, prudential, taxation, and financing framework within which real estate is produced and traded. All this reduces the international comparability of data, and complicates analyses of real estate developments, and in particular the identification of instabilities. In assessing real estate developments, it is important to address these structural aspects and their impact in shaping market conditions and prices.

4.   There are a number of possible channels through which real estate cycles and bubbles can develop. Optimistic investors, who are willing to pay a price above replacement cost, may drive up the prices, since the supply reaction is slow. More generally, when builders start construction after prices have gone up, the additional supply may come on the market at

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[30]See International Monetary Fund (2001). This also supports the use of real estate indicators in the context of the Financial Sector Assessment Program (FSAP) developed jointly by the IMF and the World Bank to assess the health of financial systems, see International Monetary Fund (2000b).

a time when real estate prices have already started falling, thereby contributing to an over-supply and a fall in prices. In addition, the use of collateral can exacerbate real estate cycles by adding to the available financing when prices go up, while creating a possible credit crunch when prices start falling; this impact may go beyond the real estate sector as such, as real estate may also be used as collateral for other borrowing. Rising real estate prices may also increase the banking sector's possibilities to extend loans by increasing the banks' capital through their own real estate holdings. In addition, financial liberalization may provide more options for financial institutions (both banks and nonbanks) and markets to finance real estate transactions, which may increase the number of investors, including from abroad; unless accompanied by a strengthening of supervision and regulation, this can be expected to increase the risk of overinvestment.

5.   As indicated above, banks play a key role in real estate markets through a variety of channels: lending for real estate purchases, financing of developers and construction companies, lending to nonbank financial intermediaries (finance companies) that engage in real estate lending, use of real estate as collateral for both real estate and other lending, and direct investment in real estate. Overexposure can be the result of disaster myopia, due to the long cycles in real estate; a lack of adequate data and analysis skills, in particular a lack of recent and realistic assessments of the value of real estate; excessive reliance on collateralized lending for risky projects; weak supervision and regulation; and moral hazard, for example, in the form of safety nets.

6.   In the empirical part of our study we analyze 11 selected banking crises or events of significant banking sector distress. In all cases, residential real estate prices surged sharply (on average by more than 20 percent in real terms) and then began falling (by more than 15 percent in two years) before the beginning of financial sector distress. After that, real estate prices continued to fall, at least until the peak of the crises, indicating that financial sector distress may exacerbate a fall in real estate prices. On average, residential property prices dropped by a total of 35 percent. The length of the cycle differed: from within a few years for Finland, Malaysia, Mexico, and Spain, to more than 10 years in Canada, Ireland and the Netherlands. In all cases, there was a strong relationship between real estate price developments and credit growth, supporting the notion that the availability, or lack thereof, of financial resources for real estate projects is one of the driving forces of price developments in this market.

7.   A broadly similar development can be observed for commercial property prices, whereby, in particular in Japan, Thailand, and Finland, the boom-bust cycle in commercial real estate before the onset of the crisis is evident. The average decrease in commercial real estate prices (by 45 percent) was even larger than the fall in prices of residential real estate. Stock prices of real estate companies showed a similar pattern, but tended to bottom out by the beginning of the crisis, which seems to reflect a more rapid process of transmission of expectations in stock prices than in the underlying prices of real estate.

8.   Looking at individual cases, there were many common factors behind the boom-bust cycles. Rapid liberalization of the domestic financial markets, increased competition and the

emergence of new financial institutions—without an accompanying strengthening of supervision—played an important role in the Nordic banking crises and in Spain. These factors also played a key role in the Mexican and Japanese crises, where excessive credit growth contributed to the problems as well. In Thailand, the finance companies were hardest hit and strong foreign demand fueled the boom in local real estate. Canada and the Netherlands did not experience a systemic banking crisis, but suffered from significant distress in parts of their financial systems, due at least in part to a simultaneous slowdown in the economy. Some countries managed to control the implications of sharp boom and bust cycles in the real estate markets for their financial systems quite well, including Singapore and Hong Kong SAR. In these cases, the soundness of the banking system at the outset of adverse developments certainly contributed to this, while in Hong Kong SAR also the moratorium on land sales was a dampening factor.

9.   In order to test the relationship between real estate prices and financial crises empirically, a small logit-probit model was used, with the occurrence of a crisis as the dependent variable, and the money multiplier, the real interest rate, and property prices as explanatory variables. Although the results suffer from the low number of observations, the estimations confirm that a downturn in residential property prices increases the probability of financial sector stress. This study constitutes only a very first step in assessing real estate market conditions as an indicator of financial sector soundness: further analytical and empirical work in this area, supported by more and better data— both on quantitative developments and structural aspects—will be required to enable a more precise assessment of real estate developments as well as their potential as early warning indicators of financial sector distress.

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