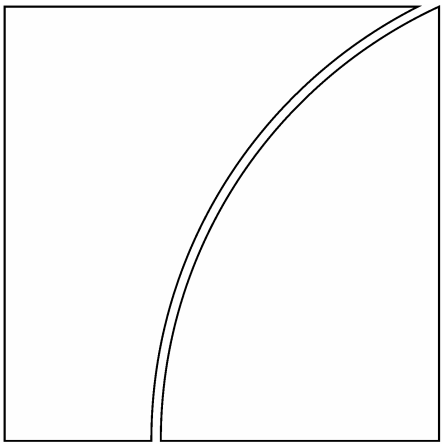
BANK FOR INTERNATIONAL SETTLEMENTS



BIS Working Papers
No 175

Commercial property prices and bank performance

by E Philip Davis* and Haibin Zhu**

Monetary and Economic Department

April 2005

* Brunel University
** Bank for International Settlements

Abstract

We seek to assess the effect of commercial property price movements on the behaviour and performance of individual banks in a range of industrialised economies, extending the existing micro literature on bank performance. Our results suggest that commercial property prices tend to be positively associated with bank lending and profitability, and negatively associated with banks' net interest margin and bad loan ratios. Such an impact exists even when conventional independent variables determining bank performance are included as controls. Further extensions show that the magnitude of this impact is related to the size of the bank, the strength of bank capitalisation, the direction of commercial property price movements, and regional factors. The results have implications for risk managers, regulators and monetary policy makers. Notably, they underline the crucial relevance of commercial property prices as a macroprudential variable that warrants close scrutiny by the authorities.

JEL Classification Numbers: G12, G21
Keywords: commercial property prices, bank performance, panel estimation, financial accelerator

BIS Working Papers are written by members of the Monetary and Economic Department of the Bank for International Settlements, and from time to time by other economists, and are published by the Bank. The views expressed in them are those of their authors and not necessarily the views of the BIS.

Copies of publications are available from:

Bank for International Settlements
Press & Communications
CH-4002 Basel, Switzerland

E-mail: publications@bis.org

Fax: +41 61 280 9100 and +41 61 280 8100

This publication is available on the BIS website (www.bis.org).

ISSN 1020-0959 (print)

ISSN 1682-7678 (online)

Contents

1. Introduction[1]

It is well-known that bank lending and bank profits have been strongly affected on frequent occasions by asset price fluctuations, at times culminating in banking crises. Among various key assets, commercial real estate is of special interest for various reasons. First, commercial property loans are an important component of bank assets. For instance, at year-end 2003, the median ratio of commercial real estate loans to assets for large US banks was 13%, and for mid-tier banks the ratio was as high as 24%. Second, banks' exposure to the commercial real estate sector usually tends to be even larger owing to the widespread use of commercial property as collateral for other types of loans. Third, and most importantly, commercial property loans are often the most volatile component of bank portfolios. Davis (1993) suggests that provisions to property and construction are not only higher than those for loans to other sectors, but also fluctuate more widely. In the United States, the delinquency rate for commercial real estate loans has been extremely volatile in the past 14 years, reaching 12% in year 1991 and now staying at a historically low level of 1.2%. By contrast, delinquency rates for other loans have been more stable (for example, between 1.6% and 3.3% for residential real estate loans and between 2.7% and 4.2% for consumer loans).

Table 1 illustrates the distinctive features of bank behaviour and performance during the up- and downswings in commercial property prices in thirteen major OECD countries. During an upswing of commercial property price movements, the default risk of bank loans tends to be much lower, and bank profitability rises above its average. Banks are therefore encouraged to extend extra loans to the business sector. Reverse effects are observed when commercial property prices fall.

Whereas there is a fairly extensive research literature on the relation between bank lending and commercial property prices at a macro level,[2] there is a more limited body of work on the impact of commercial property prices on the lending decisions, risk and profitability of individual banks. Evidence of a clear and consistent link to bank performance would underline the importance of commercial property prices as a key macroprudential indicator,[3] as well as being relevant to the monetary transmission process.

This paper seeks to fill the gap by undertaking an extensive analysis of a sample of 904 banks worldwide over the period 1989–2002. We seek to assess the effect of changes in commercial property prices on bank behaviour and performance in 15 industrialised economies, extending the existing micro literature in this area. The results suggest that, consistent with macro-level studies, commercial property prices have a marked impact on the behaviour and performance of individual banks. Such an impact exists even when conventional independent variables determining bank performance are included. Moreover, there is evidence that the magnitude of this impact is related to the size of the bank, the strength of bank capital, the direction of commercial property price movements, and regional factors. The results have implications for risk managers, regulators and monetary policy makers.

We organise the remainder of this paper as follows. Section 2 reviews the existing literature and highlights the contributions of our study. Section 3 introduces the framework for the empirical analysis, listing all independent variables and their possible impact on bank behaviour and performance. Section 4 describes the data, followed by empirical results in Section 5. Section 6 concludes.

---

[1] E Philip Davis: Brunel University, Uxbridge, Middlesex, UB8 3PH, UK, e_philip_davis@msn.com. Haibin Zhu: Bank for International Settlements, Basel–4002, Switzerland, haibin.zhu@bis.org. The authors thank Arturo Macias Fernandez for data support, and Claudio Borio, Sylvia Gottschalk, Andros Gregoriou, Kostas Tsatsaronis as well as participants in seminars at the Bank for International Settlements, the International Monetary Fund and Norges Bank for comments.

[2] See recent work and a literature survey in a companion paper by Davis and Zhu (2004).

[3] See Davis (1999). In addition, in the recent draft Compilation Guide on Financial Soundness Indicators (Guide) (IMF 2004), real estate prices and bank exposure to the real estate sector were included in the "encouraged sets" of financial soundness indicators (FSIs).

2. Literature review

Our work draws on two distinct strands in the literature that relate to the nexus between commercial property prices and bank performance. The first strand focuses on the impact on bank loan growth using exclusively macro information, and the second on bank profitability and loan quality using typically micro data. Our contribution is to apply concepts in the bank-performance literature to micro data in a conventional manner, before estimating in the light of the credit-property price literature whether commercial property prices affect bank performance over and above standard variables. Accordingly, we review briefly both strands in the literature.

2.1 The impact of commercial property price cycles on banks: a macro perspective

There are strong financial and economic linkages between commercial property cycles and credit cycles, among which the most influential in terms of theoretical development is the "financial accelerator" mechanism proposed by Bernanke et al (1994) and Kiyotaki and Moore (1997). In their models, credit market imperfections exist because borrowers have informational advantages over lenders regarding the true value of the underlying projects. To avoid the potential adverse selection problem (before the loan is extended) and moral hazard (after lending takes place), the lender will require the borrowers to provide collateral assets.[4] The price of bank loans (the risk premium) then largely depends on the value and quality (in terms of liquidity, price volatility etc) of collateral. This argument applies both to normal industrial and commercial loans and to loans to develop property per se.

The "financial accelerator" framework, together with the fact that commercial property has been widely used as collateral, explains why commercial property cycles tend to have a significant impact on the bank lending behaviour and bank performance. Whenever commercial property prices move up, property loans are considered to be less likely to default and collateralised loans tend to have higher recovery rates in the event of default. Therefore, loan loss provisions decline and loan quality improves. Meanwhile, banks are willing to extend additional credit to borrowers (particularly in the commercial property sector), and the risk premium tends to be lower. Favourable financing conditions may in some circumstances drive up property prices even further, as investment demand for properties increases while supply is slow to respond, generating a self-reinforcing mechanism between the commercial property cycle and the credit cycle (see the model in a companion paper by Davis and Zhu (2004)).

In addition, there are potentially other channels through which commercial property cycles can affect bank performance. Rising commercial property prices may increase banks' fixed assets (if banks own property) and boost their capitalisation. They may also affect the banking sector via indirect channels, for example, through their impact on the macroeconomy. When commercial property prices increase above their fundamental values, constructors and developers will start new construction. The new construction activity generates new demand for other sectors. This can cause expansion in the general economy and may stimulate the demand for bank credit.

Despite the important linkage between the two cycles, most empirical work in this area has so far been related to residential property prices.[5] One exception is Davis and Zhu (2004), who developed a reduced-form theoretical model and tested it on macro data for industrialised countries. Their model

---

[4] There are in practice some ambiguities whether collateral reduces risk in the way bankers appear to believe. On the one hand, low risk borrowers may pledge collateral as a signalling device, implying that secured loans are made to safer borrowers (see Bester (1985, 1987) and Besanko and Thakor (1987)). On the other hand, collateral is probably used to limit moral hazard to riskier borrowers (see Boot et al (1991)). The empirical evidence is mixed as well. Berger and Udell (1990) find evidence that collateral is related to higher credit risk. In contrast, Pozzolo (2004) suggests that, if controlling for borrowers' characteristics, the use of collateral helps reduce credit risk.

[5] For example, country-specific studies reveal strong evidence of dynamic interactions between house prices and bank lending in Hong Kong (Gerlach and Peng (2005)), the Netherlands (de Greef and de Haas (2000) and Rouwendal and Alessie (2002)) and the US (Quigley (1999)). There are also a few studies based on asset prices that include a mix of residential and commercial property prices (generally with a much higher weight on residential property). Work by Goodhart (1995) explains credit conditions with asset prices, while Borio et al (1994) explain asset prices with credit conditions (debt/GDP ratio), and both find significant results. Hofmann (2001) employs a vector-error correction model and again finds a strong dynamic interdependence between bank credit and property prices, with the latter being the causal element.

suggests that bank lending is closely related to commercial property prices, and their interaction can develop cycles given plausible assumptions (eg lags of supply and property evaluation based on current prices). Cross-country empirical analysis based on a sample of 17 developed economies confirmed the model's predictions. An investigation of determinants of commercial property prices shows particularly strong links of credit to commercial property in the countries that have experienced banking crises linked to property losses in 1985–95. Further studies of dynamic interactions suggested, as in Hofmann (2001), that property prices are rather "autonomous", in that they tend to 'cause' credit expansion, rather than being driven by excessive bank lending.

While theory and evidence predicts that higher commercial property prices drive up bank credit, their impact on banks' profitability is less obvious. In the short run, increases in commercial property prices reduce the default risk of real estate loans and the expected losses of collateralised loans. The decline in non-performing loans and loan loss provisions improves the banks' profitability. In the long run, however, the existence of such an impact and its direction are less clear. In an efficient market, bank loan rates reflect the true default risk for the underlying assets, and bank profitability should solely depend on the risk appetite of the banks. The more risk the banks take, the higher the expected return. That is, an upward movement in commercial property prices, which improves the performance of bank loans, will not necessary increase bank profitability since the risk premium component of loan pricing should be smaller from the beginning.

This independence no longer holds when a bank's risk attitude changes over the cycle, or when there are certain distortions in the process of making loan decisions. A typical example is that, during a commercial property boom, banks may underestimate the default risk of property-related loans (Herring and Wachter (1999, 2002)). Banks may also disregard the danger of adverse selection as they seek to expand lending at a rapid pace. This tendency towards "disaster myopia" can arise as a result of poor risk management or changing tolerance for risk. In particular, it can be attributable inter alia to inadequate data, measurement bias (Borio et al (2001)), pervasive incentives linked to the safety net, intensified competition following the liberalisation of the banking sector, or institutional memory loss over time (Berger and Udell (2003)). Whatever the reason, such "disaster myopia" induces a bank to take excessive risk and eventually the risk premia may fail to compensate for potential losses.

2.2 Micro-based studies of bank performance

There is an extensive empirical literature on bank performance, so we do not attempt to cover it in full. Instead, we shall focus on results of typical studies, generally using international data, which cover the performance indicators on which we intend to focus, notably bank loan loss provisions, bank margins and profitability, bank bad debts and bank lending. Our main objective is to ensure that we utilise in our empirical work those non-commercial property price variables that are in line with the existing literature, and hence assure that positive results for commercial property prices are not reflecting omitted variables bias. We also seek to explore any insights likely to be relevant to commercial property prices (eg suggesting they are an omitted variable in existing studies).

In terms of *provisioning,* and typical of the tradition in which our own work is based, previous work includes papers by Cavallo and Majnoni (2001), Laeven and Majnoni (2003) and Bikker and Metzemakers (2004), all of which analyse datasets similar to ours using Bankscope, but with slight differences in sample coverage.[6] A common focus of the three papers is the relationship between banks' provisioning for loan losses and banks' pre-provision income, after controlling for bank-specific variables and country-specific macroeconomic and institutional features. They all find a generally-positive link from banks' profitability to provisioning, as is desirable to "provision for bad loans in good times".[7] At the same time, provisioning decisions are also associated with economic growth, banks'

[6] Cavallo and Majnoni (2001) use a sample of 1176 banks from 36 countries over the period 1988-99, and Laeven and Majnoni (2003) include 45 countries with a total of 1419 banks over the same period. By comparison, the study of Bikker and Metzemakers (2004) covers 29 countries over the period 1991–2001.

[7] The linkage between earnings and provisioning does not always hold. Cavallo and Majnoni (2001) observe a negative impact of earnings on provisioning in non G-10 countries. Laeven and Majnoni (2003) confirm the negative association for Asian banks, and also show a strongly significant effect of a negative earnings dummy, suggesting that banks make provisions heavily by reducing capital when they make losses, "too much too late".

lending behaviour and banks' capital strength. Real GDP growth has a significantly negative effect (Laeven and Majnoni (2003) and Bikker and Metzemakers (2004)), implying there is a deterioration of bank loan quality during economic downturns. Banks with higher loan to asset ratios tend to be involved in higher credit risk and therefore their loan loss provisions are higher (see Cavallo and Majnoni (2001)). The effect of the real loan growth rate of the bank is mixed. Cavallo and Majnoni (2001) and Laeven and Majnoni (2003) find a significantly negative effect, which supports the hypothesis that lending booms are associated with imprudent lending practice. By contrast, Bikker and Metzemakers (2004) find a positive effect of loan growth on provisioning, which seems to be consistent with the view of Borio et al (2001) and Lowe (2002) that credit risk is built up during a boom, but is interpreted by Bikker and Metzemakers as prudential provisioning by banks that are conscious of risk. They also find that provisions rise when the capital ratio is low, suggesting that the two are substitutable buffers against potential losses (the so-called capital management hypothesis proposed by Kim and Kross (1998)).

In terms of *bank profitability and margins,* a key international study is by Demirgüç-Kunt and Huizinga (1999) that estimates bank profitability and interest margins over 1988–95 in 80 countries (again using Bankscope). They find that higher net interest margins and higher profitability are associated with stronger bank capital base, higher inflation, higher real interest rates and lower reserve requirements. Moreover, the existence of an explicit deposit insurance scheme and difference in legal and institutional frameworks also has significant impact. In later work on a similar data set (1990–97 in 45 countries), they further point out that profits and margins are affected negatively by the level of financial development, implying that the banking sector is more competitive in advanced countries (Demirgüç-Kunt and Huizinga (2001)).

As regards *bad loan ratios* Salas and Saurina (2002) model the problem loans of Spanish banks, with a main focus on capturing the lag between credit expansion and the appearance of problem loans. The authors control for macro factors, the level of indebtedness in the non-financial sector and numerous bank-specific variables,[8] as is feasible in a study of a national market. They note that a recession leads to lower income to repay loans by borrowers, as well as a tightening of credit by banks, both of which increase default risk. The effect of recessions is aggravated by high indebtedness. Nevertheless, individual bank level variables also have a high explanatory power for credit risk even after controlling for macroeconomic conditions. For example, growth policies (as shown by credit expansion and market penetration) and managerial incentives ("gambling for resurrection") determine future loan losses. Moreover, the authors also find that savings banks and commercial banks behave very differently, reflecting the different incentives in the ownership structure and related corporate governance aspects.

In terms of *lending* per se, Bikker and Hu (2002) seek to distinguish between supply and demand factors in order to assess whether the banking system itself has a procyclical pattern of behaviour. In particular, in line with the so-called bank lending channel of monetary transmission, they seek to investigate whether a separate supply-channel can be distinguished, based for example on constraints on bank capital. This follows the extensive literature on the US credit crunch of the early 1990s which was thought to be partly linked to such supply constraints (Peek and Rosengren (1995), Bernanke and Lown (1991)). Unlike the other studies cited above, these papers rely on aggregate banking sector data provided by the OECD. Demand side factors included were macro variables such as GDP, unemployment, inflation, share prices and real M3. Supply side factors were the interest differential, non-bank deposits, capital and reserves and bank profits (current and lagged). Demand side factors

[8] Whereas many of these variables cannot be obtained with the less detailed information from Bankscope, they do highlight important aspects of problem loan generation, in particular that such loans are a consequence of strategic decisions driven by banks' past performance. They also provide interesting justifications for the use of the variables they choose. These are: (1) loan growth per se (noting that market share competition leads to quality reductions in the balance sheet); (2) branch growth (again to underline risk of adverse selection in bank expansion strategies); (3) a proxy for inefficiency, ratio of operating expenses to operating margin (with a view that inefficient banks skimp on monitoring and screening); (4) percent of loans without collateral (highlighting that its link to risk is ambiguous); (5) size of the bank (with a prior view that larger banks would have lower problem loans due to better diversification – although this could be offset if there are agency problems between managers and shareholders); (6) lagged net interest margins (to assess whether banks with high problem loans take a deliberately riskier credit policy); (7) lagged capital ratios (to proxy whether the bank was "gambling for resurrection"), and (8) market share (whereby banks with monopoly power may take more credit risk because they can be sure of charging higher margins in future).

were dominant. On the supply side, whereas capital was not significant, profit margins were significant and indicate a role for the bank lending channel.

The previous studies highlight important aspects of determinants of banks' lending behaviour, profitability and problem loan generation. However, there is no role in these studies for property price fluctuations to affect bank performance. To the best of our knowledge, the few exceptions are Arpa et al (2001), Gan (2004) and Gerlach et al (2003). Arpa et al (2001) looks into performance of Austrian banks in the 1990s. After controlling for macro factors, monetary and financial conditions and bank-specific variables, they find that an increase in real estate prices is associated with high profitability for banks. But surprisingly, they also find that loan loss provisions rise when real estate prices rise. Gan (2004) uses a special matched firm-bank data in Japan and examines the collateral-damage effect related to the decline in property prices on bank credit allocation. She finds that banks tend to lend less to those who suffer greater collateral losses. Gerlach et al (2003) in Hong Kong use confidential supervisory bank-level data in their panel study. They note that bank performance is affected by macroeconomic developments, with smaller banks being relatively more exposed to changes in economic conditions that large ones are, consistent with lower diversification. The bursting of the property "bubble" after the East Asia crisis also put banks under stress, but surprisingly, the impact was smaller for those banks with high exposure to the real estate sector. Gerlach et al propose that it might be attributable to a combination of risk-mitigating measures, which cause property loans to be less risky than other type of bank loans.

In this paper we extend the existing literature in several ways. This is, to our knowledge, the first international study of how commercial property price movements affect individual banks' lending strategies and performance. Our assessment based on bank-level data suggest that commercial property prices have a marked impact on banks, even after we control for the effects of conventional explanatory variables, including macro factors, bank-specific variables and country-specific factors. Second, the micro-level data allow us to examine whether the determination of bank performance and the role of commercial property prices vary across different groups of banks and across countries. Finally, we also examine whether commercial real estate booms and busts tend to have asymmetric impacts on bank performance.

However, one potential caveat of our study is that, unlike Gan (2004) and Gerlach et al (2003), we do not have detailed information regarding the exposure (property lending or secured lending to other sectors) of individual banks to the commercial real estate sector. Therefore we are not able to distinguish the impact of distinct channels through which commercial property prices affect bank behaviour. Instead, our results should be interpreted as the combined effect of all these impacts as discussed in Section 2.1.

3. Empirical framework

We are mainly interested in two questions. First, how do commercial property price movements affect banks' lending decisions, such as the amount of lending and its pricing (as shown by the margin)? Second, how do commercial property price movements affect the bank's performance, including loan quality and profitability? Below we explain briefly the empirical framework to be adopted.

Since our focus is on the behaviour of individual banks, it is natural to use the panel approach. For most of the estimation we undertake standard GLS panel estimation with random effects.[9] The GLS panel estimation technique tends to ignore the dynamic linkages between dependent variables and explanatory variables. We employ it for the following reasons. Crucially, the impact of the dependent variables (bank-specific) on macro variables is likely to be negligible, while we lag our bank specific variables to also preclude interaction effects. Second, our previous study (Davis and Zhu (2004)) shows that the direction of the linkage between commercial property cycles and credit cycles is largely one-way, ie rising property prices cause credit expansion but not vice versa. Finally, allowing for dynamic interaction among bank-specific variables may reduce the number of useful observations

[9] The choice of random over fixed effects is supported by the Hausman test. Moreover, from a purely practical standpoint, the fixed effects approach is costly in terms of degrees of freedom.

substantially due to data limitations. Nevertheless, as a robustness check we include a lagged dependent variable in one set of estimates and employ the Generalised Method of Moments difference estimator (Arellano and Bond (1991)).

3.1 Banks' lending decisions

Our first objective is to examine the role of commercial property prices in affecting banks' lending decisions in respect of loan volume growth and the pricing of loans as proxied by the net interest margin. Furthermore, we need to include conventional determinants of bank lending so as to ensure our results for commercial property prices are not vulnerable to omitted variables bias. Our model specifications are as follows:

$$Y_{i,t} = f(MACRO_t, BANK_{i,t-1}, DUMMY, CPP_t) + \varepsilon_{i,t}. \quad (1)$$

In equation (1) Y refers to our dependent variable, namely the percentage real loan growth rate (dLOAN) showing the quantity of loans or net interest margins (NIM), an indicator of the price of loans. Following Demirgüç-Kunt and Huizinga (1999), NIM is defined as bank profits plus operating costs and loan loss provisions, and less non-interest income (or equivalently, banks' net interest income over total assets). In line with the literature reviewed in Section 2.2, there are four sets of explanatory variables:

(1) Macroeconomic variables that reflect the state of the economy. They include the growth rate of real GDP, inflation and nominal short-term interest rates (as a proxy for the monetary policy stance and showing the benchmark risk-free rate). These variables may be both current and lagged, given the likely delayed impact on bank lending. Since we are studying advanced countries, we do not consider it necessary to include GDP per capita which is broadly comparable across the countries studied.[10]

(2) Bank-specific variables, which we lag one period to prevent simultaneity – in particular because balance sheet variables refer to year-end. These are:[11]

- Loan-to-asset ratios and the real loan growth rate (the latter excluded in its own equation), which proxy for the credit risk of bank assets. We assume that loans are a riskier investment compared to typical assets in the securities portfolio of banks (eg government bonds). Hence, a higher loan-to-asset ratio implies higher interest margins charged to compensate for higher credit risk. The impact of the loan growth rate is more ambiguous, depending on whether or not higher growth is associated with adverse selection, less strict monitoring and lower quality.
- Capital strength, defined as the unadjusted[12] equity-to-assets ratio. Typically a strong capital base implies a lower default probability for the bank and therefore its cost of funding is lower (ie the interest margin is higher). It also gives the bank more freedom to take advantage of profitable lending opportunities. Nevertheless, too-low capital ratios may induce banks to "gamble for resurrection", causing opposite impacts on banks lending decisions.
- The net interest margin in the loan growth equation as an indicator of profitability and the credit risk involved in bank assets.
- We also include bank size dummies relative to the domestic market, following the earlier work set out above, notably bearing in mind that small banks may have less interbank business and, hence, a wider margin for that reason alone.

(3) Country dummies to capture idiosyncratic effects, in particular capturing macro and financial structure, financial development and law/regulation variables, to the extent they do not change markedly over the sample period.

---

[10] Moreover, per capita GDP is not significant in explaining bank behaviour and performance, even when emerging market economies are included in the sample. See Demirgüç-Kunt and Huizinga (2001) and Cavallo and Majnoni (2001).

[11] We do not include overheads/assets and customer funding/assets since they were not significant for Demirgüç-Kunt and Huizinga (2001).

[12] Although Basel-risk-adjusted asset data were available for some years, use of the risk-adjusted ratio would have entailed a major loss of degrees of freedom.

(4) The growth rate of real commercial property prices in the country concerned. Ideally we would like to also include individual banks' exposure to the commercial real estate sector, such as the share of commercial property loans and property-collateralised loans, but this information is not available. As noted above, we expect that an increase in commercial real estate prices will not only reduce the default risk of property loans, but also improve the quality of other bank assets through the collateral effect (for property-collateralised loans) and through the indirect effect on investments and macroeconomic developments. Therefore, we would expect a positive effect on loan growth and a negative effect on the net interest margin.

3.2 Bank performance

To study the connection between commercial property prices and bank performance, the empirical framework is the same as that cited above. We study the determination of two variables that represent bank loan quality, non-performing loan ratios (NPL) and loan loss provisions (PROV), where the former reflects bad debts per se and the second the bank's response to them in terms of reserving. In addition, we also estimate the determination of return on assets (ROA) to represent banks' profitability, which is defined as profits before taxes divided by total assets.

Independent variables are similar to those for lending per se, except an additional income-variable, earnings before taxes and provisions as a percentage of bank total assets (EBTDA), is included in the provisioning equation. This variable has proved to be very important in explaining banks' provisioning behaviour, as noted in Section 2.2. In general, the expected impacts of the principal explanatory variables on bank performance, as suggested by previous research and also consistent with their impact on bank lending, are summarised as follows:

- Higher GDP growth rates, or improved macroeconomic conditions, should improve bank performance and reduce the probability of loan default.
- Higher inflation could have a positive effect on bank profits, as default rates are lower due to lower repayment burden in an inflationary environment, as well as leading to a higher "endowment effect" on profits from zero interest demand deposits.
- The impact of interest rates on bank performance is more ambiguous. An increase in nominal short-term interest rates implies a tightening of monetary policy and a rise in cost of funding. However, this effect could be dampened or even reversed, depending how much of the burden could be passed through to customers.
- A higher loan to asset ratio, indicative of a higher credit risk of bank assets, tends to be associated with more problem loans and extra loss provisioning. Its connection with bank profitability is less clear. If the bank's risk attitude remains the same across the credit cycle, its profitability should be higher as a compensation for the higher credit risk. Nevertheless, if the risk-taking behaviour is associated with distorted incentives, such as the "disaster myopia" tendency mentioned above, its linkage with bank profitability is more ambiguous.
- Similarly, the impact of the loan growth rate on bank performance is not clear, depending whether it reflects a shift of the bank's risk attitude or simply the fact that viable investment opportunities are available.
- Capital adequacy has two opposite effects. If the cost-of-funding effect dominates, a higher equity ratio leads to higher bank profitability. If the "gamble for resurrection" effect dominates instead, banks with lower capitalisation will invest more on high-risk assets and the loan quality is impaired.
- The collateral effect suggests that commercial property prices have a negative effect on NPLs and provisioning, and a positive effect on bank profitability.

3.3 Subsamples and cross checks on the results

Besides running the baseline regressions above, we also ran a few variants of the model to examine potential factors that affect the magnitude of the commercial property effect. We first sought to assess whether commercial property price movements have different impacts on different types of banks. The analysis is motivated by a recent study by von Kalckreuth and Murphy (2003), who suggested that the impact of financial constraints on corporate firms is stronger for small firms. In the context of the

banking industry, changes in property prices might have different impacts because for example large banks and small banks may focus on different lines of business, while their lending strategies as well as access to interbank funds may be different. Therefore, we include additional interactive terms between, on the one hand, bank size, and on the other hand, commercial property price growth or macroeconomic variables. The model specifications that take in the size effect are:

$$Y_{i,t} = f(BANK_{i,t-1}, MACRO_t, DUMMY, CPP_t, SIZE_i, INTERACTIVE_{i,t}) + \varepsilon_{i,t}. \quad (2)$$

We also ran basic equations with a lagged dependent variable to assess robustness. This requires cross checking with the more appropriate Generalised Method of Moments estimation approach (Arellano and Bond (1991)) as also adopted in Salas and Saurina (2002).

We then assessed results with lags to the independent variables, including to commercial property prices, to find whether there are different effects at different lags. Notably, we might anticipate that rising property prices, like loan growth, may generate higher profits and lower provisions and bad debts in the short run, but there could be an opposite effect in the longer term when adverse selection becomes apparent and property prices themselves fall.

Furthermore, we examined the issue of whether there exist asymmetric effects of commercial property price movements. Since the "financial accelerator" framework suggests that the collateral effect tends to be larger when financial constraints are binding, it is reasonable to anticipate that the mechanism through which commercial property price movements affect bank behaviour might be different at different stages of the cycle. A related issue is that the channels through which the financial accelerator plays a role might also be different. For example, during a downturn the banks may adjust their lending strategies via either quantity control (credit rationing) or price discrimination (higher risk premia).

Given the scope of the dataset, we are able to estimate separately the benchmark equations, in different geographic areas (North America, Europe and East Asia), to assess whether there are regional differences in the relationship of bank behaviour to commercial property prices.[13]

We also examine the leverage effect of bank capitalisation on the impact of commercial property prices. This leverage effect, if it exists, may reflect the distinct levels of risk management skill or different risk attitude between well-capitalised banks and under-capitalised ones.

Finally, we ran a few robustness checks by using alternative asset prices (residential real estate prices and equity prices) and using nominal commercial property prices (together with real interest rates and nominal loan growth). The results are particularly interesting for financial regulators since they provide a suggestive insight on the relative importance of commercial property prices as a macroprudential indicator.

4. Data

Our empirical work covers 15 industrialised countries and regions, namely Belgium, Canada, Finland, France, Germany, Hong Kong, Italy, Japan, the Netherlands, Norway, Singapore, Sweden, Switzerland, the United Kingdom and the United States. We collect the data from the following sources:

(1) Macroeconomic variables, including GDP, inflation and interest rates, are retrieved from the macroeconomic database maintained by the Bank for International Settlements (BIS).

(2) Commercial real estate prices are available from a database maintained by the BIS, which compiles price indices for national office markets in a number of industrialised countries. The data are provided by leading companies in real estate services and are available annually. Note that in some countries the commercial property prices only refer to the largest cities rather than the whole country.

[13] A similar exercise was implemented by Laeven and Majnoni (2003), who found that Japanese and Asian banks showed less procyclical provisioning behaviour than the peers in other countries.

(3) Balance sheet and income statement information of individual banks are extracted from the Bankscope database over the period 1989–2002. The data were filtered in the following steps, similar to Cavallo and Majnoni (2001):

First, we exclude the central bank, government and multilateral institutions but include all other types of bank and bank-like financial institutions.[14]

Second, we include only consolidated bank reports to avoid the double counting problem with subsidiaries. This reduces the size of the sample in European countries, which often have only unconsolidated data in Bankscope.

Third, since the current Bankscope dataset only includes bank reports in the most recent 8 years (1995–2002), we have combined them with a historical Bankscope dataset that covers the period 1989–1996 in order to get a longer time series and include periods when commercial property prices were more turbulent. Due to discrepancies between the two datasets (mainly as a result of updates and report errors), we chose to restrict our analysis to data in the current database for those banks where there are discrepancies of less than 10% in the level of total assets or total loans in the overlapping years.

Fourth, we have eliminated those banks that have less than four consecutive years of financial statements, in order to control for the quality of bank reports.

Finally, in order to minimize the effects of measurement errors we also exclude those banks that fail one of the following filtering criteria at any particular year:[15]

- the return on bank assets in absolute terms less than 10%;
- a growth rate of bank assets (in nominal terms) smaller than 50% in absolute terms;
- a growth rate of bank loans (in nominal terms) smaller than 50% in absolute terms;
- a ratio of bank loans to bank assets larger than 10% and smaller than 90%;
- a ratio of non-performing loans to total loans smaller than 100%.

The resulting sample includes 904 banks with a total of 6,162 bank/year observations during the sample period (1989–2002). Tables 2 and 3 summarise the distribution of sample banks and the statistics of key variables. The US and Japanese banks dominate our sample set, mainly because we restrict ourselves to consolidated balance sheets only, while as noted most German and French banks typically submit financial reports on an unconsolidated basis.

We have also divided our sample banks into three groups based on their importance in the national market. Two dummy variables, LARGE and SMALL, are used to label those banks whose market shares (as a percentage of the national aggregate levels of bank assets) during the sample period are above 5% or below 1% respectively. In aggregate, 64 banks are classified into the category of “large” banks and 768 into “small” ones, with 76 being mid-sized. Obviously, the larger banks are more likely to view themselves as “too big to fail”, with a possible impact on moral hazard and risk taking. Table 4 summarises the characteristics of each group of banks. At a glance, small banks have better performance; they charge higher interest margins; their loan quality is better and their profitability is higher as measured by the return on assets. However, the latter may be partly due to the fact that they tend to hold a smaller portfolio share of low-yielding interbank or other wholesale assets.

[14] The definition includes bank holding companies, commercial banks, cooperative banks, investment banks and securities houses, medium and long-term credit banks, non-bank credit institutions, real estate / mortgage banks and savings banks.

[15] The filtering criteria typically correspond to the sample distribution at 95–99 percentiles for each variable. At the same time, we acknowledge the possibility that the filtering scheme may also remove troubled or failed banks because their assets (or loans or profitability) could fluctuate substantially.

5. Empirical results

5.1 Baseline results

Table 5 summarises the pooled estimates of equation (1) using the FGLS regression. Since the Hausman test always indicated a preference for random over fixed effects, we have displayed random effects results only. As noted, all the equations include country dummies (not reported here to save space), which capture structural differences in banking and financial systems as well as economic performance. Below we discuss our results for each type of explanatory variable in the regression.

5.1.1 Impact of macro variables

The impact of economic growth is consistent with the existing literature: higher economic growth encourages banks to lend more and permits them to charge higher margins (because the marginal rate of return is higher). It also improves the quality of bank assets (NPL and provisions are lower) and the profitability of the banking sector increases.

The impact of inflation is also consistent with economic intuition. Higher inflation reduces the real present value of future repayments (if the interest rate does not adjust perfectly) and hence the default probability of bank loans is lower and the return on assets is higher. For profitability and margins there is also a benefit from the "endowment effect" of zero interest deposits.

Higher nominal interest rates increase the cost of funds, hurting the borrowers' financial condition. As a result, bank loans are more likely to default. The profitability of banks also decreases, not only because of the tightened financial conditions but also due to the deterioration in loan quality (higher NPLs). At the same time, margins widen with high interest rates, suggesting that deposit rates are usually less responsive to policy rates than lending rates. However, the pass-through is evidently not enough to generate profits for banks, because of borrowers' higher default rates.

On the other hand, the result that interest rates have a positive effect on loan growth is somewhat counter intuitive. Theory predicts that a tight monetary policy (high interest rates) constrains bank lending. One possible explanation is that the positive relationship between interest rates and loan growth may actually reflect the connection in the reverse direction, ie monetary policy tends to be tighter if bank credit grows faster. Also financial liberalisation, which leads to increased loan growth, typically also entails higher interest rates.

5.1.2 Impact of bank specific variables

Generally, the widespread significance of these variables confirms the studies outlined in Section 2, which suggest that bank level variables influence credit policies, risk and profitability separately from macroeconomic trends.

The loan/asset ratio appears to have some positive link to risk in the provisions equation, albeit not for NPLs per se where it is insignificant. A higher loan/asset ratio is associated with a widening of margins, reflecting risk, but a lower return on assets, perhaps reflecting non-interest costs of a high level of loans in the balance sheet (provisions and staff costs). Meanwhile a high loan/asset ratio appears to act as an error correction term for loan growth, with a negative effect of the ratio on next period's loan growth. This is consistent with banks having a desired loan share in the balance sheet in the long run.

The results also show that, on average, the increase in bank lending seems to be based on the viability of the project rather than on perverse incentives. It is notable that higher loan growth tends to be followed by higher banking profitability and improved loan quality. Even though we also observe negative effects for provisions (as also found by Cavallo and Majnoni (2001)) and interest margins, they do not necessarily imply that banks fail to allow adequately for future loan losses when expanding balance sheets. Instead, this result could simply be a manifestation of improved credit environment during a lending boom.

As might be expected, a wide net interest margin tends to improve bank profits and promote loan growth next period. Furthermore, there is also a significant positive relation between the interest margin and NPLs and provisions. It may be recalled that our definition of interest margins not only reflects the profitability of bank loans, but incorporates a risk premium as well. Therefore wide margins indicate sufficient profitability to encourage bank lending and to make provisions as appropriate (as

also found for profitability by Cavallo and Majnoni (2001) cited above). Meanwhile, the higher risk premium implies that the bank may be consciously taking on high risk loans.

The lagged capital ratio positively influences the margin, the provisions and return on assets, while it is negatively related to NPLs. The contrast between provisions and NPLs is of interest, indicating that banks with high NPLs typically have low capital ratios – or, conversely, that banks with high capital ratios have better risk assessment and lower incentives to take risks. Meanwhile capital strength is a sound financial basis for making provisions when required. This is in contrast with the "capital management hypothesis" as proposed by Kim and Kross (1998). The results for return on assets and for net interest margins are consistent with the idea that well-run and profitable banks have high capital ratios – a low ratio is a sign of future weakness in terms of profitability. Also, as suggested by Demirgüç-Kunt and Huizinga (2000), well-capitalised banks have a lower bankruptcy cost, which reduces the cost of funding and increases profitability and the interest margin. Note that we do not find a significant direct effect of capital on lending over the full dataset.

Our results also confirm the positive effect of earnings on provisioning.[16] This could partly be explained by the "income-smoothing hypothesis", ie banks use provisions to compensate for the difference between realised credit losses and average credit losses. This is achieved by higher provisions than required by realised deterioration of the credit portfolio during cyclical expansions and lower provisions during downturns. However, the positive link could also be explained by the possibility that higher earnings are associated with higher risk.

Moreover, bank size matters. Although there seems to be no difference in loan growth between small, medium and large banks, smaller banks charge wider interest margins, consistent with a lower volume of low-margin wholesale business. In addition, small banks' vulnerability to insolvency is indicated by the fact that they typically have high NPLs and lower profitability. This is in sharp contrast with our first impression from Table 4, suggesting that the overall lower NPLs and higher profits for smaller banks are related to other bank-specific factors, and smaller banks usually suffer from weaker credit risk assessment as well as a lower level of diversification.

5.1.3 Impact of commercial property prices

The commercial property price variable is highly significant in all five equations. This suggests that misspecification might be a problem with many studies of bank performance that disregard them. Overall our results give strongly supporting evidence on the financial accelerator mechanism (or the collateral effect), even though they do not rule out other potential channels (eg the wealth effect and the macro effect) as discussed above.

The impact of increasing real commercial property prices on banks' lending behaviour is consistent with theoretical predictions of the financial accelerator. Higher commercial property prices encourage banks to lend more, and the risk premium shrinks when property prices rise.

Higher commercial property prices also turn out to be positive news in the current period for the quality of bank loans and the profitability of the banking sector, since a rise in CPP leads to a fall in provisions and in non-performing loans. Meanwhile, there is a positive relationship to profitability. This is still consistent with the possibility that risk may emerge at a later date, since commercial property loans rarely default in the upturn of the price cycle.

Concerning the quantitative implication, changes in commercial property prices explain almost as much as macro variables. In particular, a one-standard-deviation change in CPP growth (10.85%) tends to increase bank growth rate by 1.74% and ROA by 0.1%, and reduce the margin by 10 basis points, the NPL ratio by 0.22% and the provisioning ratio by 0.053%. By contrast, a one-standard-deviation change in GDP growth only contributes 0.93% to loan growth, 10 basis points to interest margins, and 0.055% to ROA, and it improves NPL ratios and provisioning slightly by 0.1% and 0.03%, respectively.

Indeed, looking at the equations the other way, declining property prices are shown to lead to declining loan growth (which may have macroeconomic consequences) as well as wider interest

[16] As noted, we prefer to lag this variable, in line with the other micro variables. The results are similar when the current level of the variable is included in the provisioning equation.

margins and lower bank profitability, which may entail credit rationing. Equally, we see that falling property prices are strongly significant indicators of rising NPLs and provisions.

5.2 Size effect

An extension of the baseline regression allows for the interaction between bank size and commercial property prices and macro variables. Note that size is defined relative to the national market, which is the aspect relevant to moral hazard, or "too big to fail".

Table 6 reports the results. The effects of the size dummies and commercial property prices, as well as macro variables and bank characteristics (not shown in detail) are quite similar to the baseline study (Table 5). Concerning the interactive effect between bank size and the macro variables, there is no strong evidence of a differential effect between large and medium size banks. However, small banks show different responses to changes in the macroeconomic environment. First, NPLs of small banks are more counter-cyclical to the business cycle than are those of large and (a fortiori) medium size banks. Second, their provisions are less cyclical, which may indicate a degree of vulnerability, if sufficient reserves are not built up in the upturn. Third, higher interest rates boost the margins of small banks more than those of larger ones, as well as entailing higher provisions. In addition, inflation has a weak negative effect on lending of small banks.

The economic impact of commercial property prices is as noted very robust, but its magnitude differs for small banks. In particular, small banks' lending decisions are less dependent on commercial property prices than for mid-size and large banks. One possible reason is that small banks rely more on relationship lending and less on collateralised loans. This seems to be consistent with the finding that commercial property price movements have a smaller effect on the loan quality and provisions for small banks than for large ones (a less negative sign is implied for CPP). In addition, the profits for small banks are less geared to commercial property prices. From a different perspective, these findings could also be explained by the possibility that large banks might be more willing to take risk as a consequence of the safety net and moral hazard.[17]

5.3 Including lagged dependent variables

To examine the robustness of the above results when more dynamics are allowed for, we now present empirical results including a lagged dependent variable in the regression.

Table 7 shows results of estimation of the models using the FGLS method. The lagged dependent variables are always significant and particularly large in the case of the net interest margin, NPLs and the return on assets. At the same time, the results for the independent variables are quite robust. In particular, all the signs and significance of the CPP variables are maintained, with the exception of the interest rate margin where the sign and size is retained but the coefficient becomes insignificant.

We need to be cautious in explaining the results in Table 7, because including a lagged dependent variable causes bias in FGLS estimators when T is finite (Hsiao (1986), pp 88). Arrelano and Bond (1991) propose a GMM difference estimator, which is consistent in this situation. Nevertheless, the number of useful observations is very limited given the short time series in our data. For a satisfactory set of diagnostics, the GMM requires a significant negative first order autocorrelation and no second order autocorrelation; also the instruments must be shown to be appropriate by the significant Sargan test.

We show 2–step GMM estimates with a difference transformation in Table 8, where the instruments are lagged differences of the independent variables, and the second and third lag of the dependent variable. These results show that the CPP effects remain robust except again for the bank interest margin. Hence, property prices are still shown to drive bank profitability and loan growth, positively, and both bad debts and provisions, negatively. There is generally a lower level of significance for the other independent variables, and also a few sign changes. The much lower number of useful observations is a drawback – there are only 1640 observations in the bad debt regression. The

[17] Another possible reason is that smaller banks tend to have higher exposure to local commercial property markets, which our data are not able to recognise.

diagnostics are generally satisfactory. In all cases there is evidence of first order autocorrelation, and there is a general absence of second order autocorrelation. The Sargan test for appropriate instruments is significant at 10% except for the loan growth equation.

5.4 Including lagged macro variables and loan growth

To further examine the robustness of the above results with more dynamics, as well as investigating longer term responses to key macro variables and loan growth, Table 9 shows empirical results if GDP growth, loan growth and commercial property prices are all entered with two year lags as well as (for GDP and CPP) current levels. This is consistent with the approach of earlier work on bad debts by Salas and Saurina (2002) cited above. Again, other independent variables are generally robust in sign and significance.

For GDP growth, signs for loan growth, the net interest margin and provisions are consistent for each of the three years – and all significant also. In particular, we have all lags of GDP growth positive and significant for loan growth and NIM, and negative and significant for provisions. These indicate that a simpler framework with a lagged dependent variable will capture the dynamic pattern adequately. More intriguing are the effects of GDP on NPLs and on the return on assets. Here we see a sign reversal, with the level and lag having a negative effect on NPLs while the second lag has a positive sign. A similar pattern with opposite signs emerges in the return on assets regression. This may reflect simple cyclical patterns but may also indicate over-expansion of lending in the boom, which leads in two years to adverse effects on NPLs and profits.

Loan growth has consistent signs in all cases except for an insignificant opposite (positive) sign on the second lag for provisioning. Nevertheless, the sign reversal is not present for NPLs, suggesting that high loan growth may not necessarily imply high riskiness. Instead, the positive impact on future provisions might be explained by the improved bank profitability, which makes it possible to make sufficient provisions.[18]

Finally, in terms of commercial property prices, only results for the net interest margin (which contracts when commercial property prices rise) are fully consistent with the benchmark result in Table 5. Interestingly, other regressions point at a richer and more complex pattern of the impact of commercial property price movements. For example, rising commercial property prices raise bank lending on a contemporaneous basis but lower it a year on. This could link to caution by banks as to whether rising prices are sustainable. For non-performing loans, there is a strongly negative pattern in the first and second lag, in contrast to the levels term which is positive. Hence, non-performing loans will continue to accumulate even after property prices have started to recover from a decline, perhaps because banks will be more willing to recognise NPLs when they have a prospect of selling the collateral. Meanwhile, the effect on the return on assets is now significant at the second lag rather than contemporaneously, and no significant effect is detectable for provisions.

5.5 Asymmetric effects of property price ups and downs

To investigate whether commercial property booms and busts may have different impacts on bank performance, we added another variable that captures only positive commercial property price movements. This variable is defined as being equal to the change in real commercial property prices when they are growing and zero when property prices decline. Table 10 shows the main results. Again, the magnitude and statistical significance of coefficients on macroeconomic indicators and bank-specific variables remain almost the same as in the baseline study.

There is no clear evidence that commercial property booms and busts have different impact on bank performance, including the quantity and quality of bank loans and the returns on bank assets.

[18] We include only the first two lags of loan growth rates due to data limitation. A robustness check by including three lags reduces the number of useful observation substantially, but does not shed new light on the long-term responses. In fact there are no cases of sign reversal (except for the provisions equation as above) – rapid loan growth tends to continue for a protracted period of time, the negative effect of loan growth on the interest margin persists even three years later, and loan growth is persistently of opposite sign to NPLs (ie they emerge after a prolonged period of slow loan growth). For the return on assets and provision rates, the second and third lags are insignificant.

However, our results show evidence of different loan pricing strategies of banks. During a downturn of a commercial property cycle, banks seem to rely more on pricing discrimination rather than credit rationing. Particularly, there is a less strongly negative effect on net interest margins during an upturn of commercial property cycles. It is likely that banks tend to charge a very high risk premium when commercial property prices fall in order to compensate for the risk or to discourage loan application. Moreover, there is a similar effect on provisioning which is close to the 10% significance level, implying increases in bad loan provisions are more substantial when commercial property prices fall, which, again, may imply additional concern of banks over risk in downturns.

5.6 Separate estimation for Europe, America and Asia

We broke down the dataset into three geographical subcomponents, largely to investigate whether the commercial property price results are consistent. Here we mainly focus on the different impacts of commercial property prices in those areas, even though other omitted results may be of considerable interest as well.

Overall, American banks (Table 11) and European banks (Table 12) respond to commercial property prices similarly to the full sample. However, American banks' bad debts turn out to be more strongly driven by commercial property cycles, whereas the same effect for European banks is close to zero. Furthermore, for American banks provisioning is positively linked to changes in CPP, ie banks raise provisions when commercial property prices rise, in contrast to the balance of the sample as a whole.

Asian banks' results are less well determined than the other groups, with a small number of observations (a dominance of Japanese banks). Many baseline results are not replicated in this context (Table 13), probably reflecting different arrangements and non-conventional economic environment in some Asian financial systems. See Craig et al (2005) for a further investigation of East Asian banks' performance. Property price movements have a much stronger positive effect on loan growth than in other areas, suggesting the importance of the commercial property sector in these economies. This is quite consistent with the well-known fact that collateral-based lending is more widespread in Asia. Nevertheless, the effects of commercial property prices on interest margins, profits, provisions and problem loans are no longer significant. Another intriguing result is that lower capital adequacy is associated with higher profitability, loan delinquencies and loan growth, which seems to support the "gambling for resurrection" story that banks with weak capital base tend to pursue for high-risk, high-return projects (as documented by Inaba et al (2003)).

5.7 Variants and robustness checks

We undertook a number of variants on the basic results set out above so as to assess the robustness of the results. These are shown in Table 14, where we only report the coefficients of interest in each case.

The first exercise aimed to assess whether the sensitivity of lending decisions and general performance depends on bank capitalisation. We might anticipate that well capitalised banks would be prudent and less likely to take risks in order to "gamble for resurrection". This is precisely what we find when we leverage the change in real commercial property prices by capitalisation, and we consider it a very interesting addition to our results. First, the better capitalised banks are less likely to boost their lending when real estate prices rise; equivalently, their lending capacity is less constrained during the downturn of commercial property cycles. Second, the leverage of bad debts and provisions to real estate prices is smaller for well-capitalised banks, which may reflect both better credit assessment and lesser exposure to real estate. Third, their profits are also less affected by fluctuations in real estate prices.

Second, we assessed alternative measures[19] of asset prices, to find whether similar results could be obtained by using the change in real residential real estate price (RPP) or in real equity prices. Results for residential real estate are consistent with those for commercial real estate. On the other hand, real

[19] Note that for East Asia (Craig et al (2005)), lacking commercial property price data per se, employ an alternative measure of RCPP which is the share price index of the real estate sector relative to that of the local market as a whole.

equity prices are clearly much inferior as an indicator, since they appear to be positively related to bad debts, and not related to provisions at all. This might be attributed to the fact that equity holding is not a very important asset class for most commercial banks.

We also tried to compare the quantitative relevance of residential and commercial real estate for bank performance by including both of them in a single equation. The fact that the two real estate prices often have different trends in our sample coverage eases the concern of multicollinearity. We found that results on commercial property prices remain robust except that its impact on bad debts becomes insignificant. Residential property prices affect bank behaviour and bank performance in the same way as commercial property prices, and in most equations their coefficients are even larger. However, the role of commercial property prices might be underestimated in this regression for two reasons. First, residential property prices are much less volatile than commercial ones (their standard deviations are 5.08% and 10.85%, respectively), therefore higher coefficients are not necessarily associated with higher contributions to bank performance. Second, commercial real estate loans typically represent a smaller proportion of total bank loans than residential real estate loans, therefore comparable levels of coefficients actually point at a more substantial role of the commercial property cycle (maybe related to a second-round effect). Taking these factors into account, it is remarkable that, in the loan growth equation, the coefficient of commercial property prices is much larger than that of residential property prices. This is perhaps consistent with a greater role for the supply side in commercial property lending as opposed to residential, suggesting that DCPP is a better indicator of loan growth operating via the financial accelerator.

Finally, although we consider that the variables we use are appropriate in the light of the existing literature and economic theory, as outlined above, we acknowledge that it can be argued that since banking is essentially a nominal activity, not all variables should be included in real terms. While there is a case for using real GDP growth, one could argue for using nominal loan growth and commercial property prices. By contrast, the real short-term interest rate could be used to capture the stance of monetary policy. The inclusion of inflation might not adequately take care of these distinctions. We accordingly re-estimated the basic equations from Table 5 with nominal instead of real loan growth, real interest rates and nominal commercial property prices. It turns out that these amendments make very little difference to the coefficients and significance of the commercial property price variable. The coefficients are virtually identical to those in Table 5, and the significance is slightly higher. Of course, inflation has been subdued in the 1990s and early 2000s and more marked differences might have occurred when inflation was more rapid or volatile.

6. Conclusions

We contend that our results indicate that commercial property prices have a major impact on a wide range of bank performance variables, ranging from risk indicators to profitability and lending activity – an impact omitted from most of the existing literature. The signs found are consistent with a view that commercial property provides an important form of collateral that is perceived by banks to reduce risk and encourage lending. These results hold consistently across a number of econometric specifications, as well as for regions. There are some interesting differences in the response of small and large banks, with in particular commercial property price movements having a smaller effect on the loan quality and provisions for small banks than for large banks. Furthermore, their profits are less geared to commercial property prices than are those of large banks. This is consistent with large banks being more willing to take risk, perhaps as a consequence of enjoying higher protection by the safety net. Generally, and notably in combination with the macro results in Davis and Zhu (2004), these results underline the crucial relevance of commercial property prices as an important driver of bank system performance that warrants close scrutiny by the authorities. They also highlight the need to develop indicators of individual bank exposure to the property market that could help to calibrate the potential impact of changes in prices.

Tables

Table 1

Bank lending and bank performance at different stages of commercial property cycles

(1979-2001)

Country	Growth rate of bank loans (%)		Growth rate of risk-weighted assets (%)		Return on assets (%)		Provisions on loans as a percentage of net income (%)		Memo: number of years	
	Up swing[1]	Down swing	Up swing	Down swing	Up swing	Down swing	Up swing	Down swing	Up swing	Down swing
Belgium	8.69	4.75	7.86	3.42	0.38	0.34	17.13	21.36	14	9
Canada	6.51	8.16	--	--	1.00	1.01	32.33	34.89	9	7
Finland	11.02	-1.73	--	--	0.21	0.32	37.02	27.95	18	5
France	7.42	2.67	--	--	0.44	0.27	30.63	58.25	14	9
Germany	7.33	8.58	--	--	0.54	0.59	39.79	41.44	14	9
Italy	13.02	7.77	9.19	3.29	1.04	0.70	25.73	37.97	8	10
Japan	12.34	-0.18	--	-8.87	0.48	-0.08	6.98	57.02	12	11
Netherlands	13.25	10.20	13.62	5.89	0.69	0.58	18.84	24.69	15	8
Norway	15.00	10.03	9.59	-0.13	0.94	0.02	23.32	145.92	14	9
Sweden	11.39	8.41	5.26	8.26	0.73	0.74	56.10	40.87	16	7
Switzerland	8.58	4.70	3.47	1.17	0.68	0.57	--	--	11	12
UK	10.48	10.45	9.74	14.68	1.02	0.85	--	--	11	12
US	9.64	5.07	9.59	3.62	1.39	1.17	22.59	39.52	9	14
Average	10.36	6.07	8.54	3.48	0.73	0.55	28.22	48.17		

[1] "Up (down) swing" refers to the years when real commercial property prices in that country increase (decrease).

Sources: OECD; BIS; authors' calculations.

Table 2

Distribution of sample banks

By country	Number of banks		By specialisation	Number of banks
Belgium	19		Bank holding company	428
Canada	21		Commercial bank	269
Finland	4		Cooperative bank	67
France	58		Investment bank / securities house	36
Germany	40			
Hong Kong	13		Median and long term credit bank	12
Italy	38			
Japan	143		Non-banking credit institution	26
Netherlands	8		Real estate / Mortgage bank	37
Norway	14		Savings bank	29
Singapore	5			
Sweden	5			
Switzerland	28			
United Kingdom	54			
United States	454			
Total	904		Total	904

Table 3

Summary statistics of regression variables

Variables	No. Obs	Mean (%)	Std. Dev. (%)	Min (%)	Max (%)
Asset growth rate	5244	8.13	10.90	-49.17	49.72
Loan growth rate	5132	8.54	12.03	-49.98	49.98
Loan to asset ratio	6025	61.07	15.22	11.27	89.86
Net Interest Margin (NIM)	5980	3.39	2.19	-5.88	36.72
Non-Performing Loan ratio (NPL)	4353	2.44	3.91	0.00	45.79
Return on Assets (ROA)	6056	0.85	0.90	-7.65	8.79
Provisions / Total Assets	5844	0.40	0.65	-2.16	16.36
GDP growth rate	12656	2.44	2.11	-7.85	15.57
Inflation	12656	2.57	1.66	-4.04	10.97
Interest rate	12656	5.22	2.83	0.09	14.76
Growth rate of real commercial property prices	12651	-3.94	10.85	-49.19	35.49

Table 4

Characteristics of banks grouped by size[1]

Variables	Large banks		Mid-sized banks		Small banks	
	Mean	**Std dev**	**Mean**	**Std dev**	**Mean**	**Std dev**
Loan growth rate (%)	5.91	10.36	5.45	11.90	9.12	12.11
Loan to asset ratio (%)	54.79	14.49	62.33	14.93	61.52	15.19
NIM (%)	1.82	0.86	2.13	1.45	3.67	2.23
NPL (%)	4.58	4.06	4.34	6.23	2.15	3.58
ROA (%)	0.37	0.58	0.44	0.81	0.94	0.91

[1] There are 62 large banks, 76 mid-sized banks and 766 small banks.

Table 5

Pooled regression with random effects

Dependent variables	Loan growth rate	NIM	NPL	ROA	Provisions/ Total Assets
Constant	8.8*** (6.1)	1.94*** (7.8)	1.4** (2.4)	0.42*** (3.2)	-0.21** (2.4)
Macro indicators					
GDP growth	0.44*** (5.2)	0.05*** (10.6)	-0.046** (2.2)	0.026*** (3.7)	-0.013*** (2.8)
Inflation	-0.18 (0.9)	0.007 (0.6)	-0.58*** (10.2)	0.14*** (8.6)	-0.048*** (4.4)
Interest rate	0.42*** (4.0)	0.07*** (11.0)	0.12*** (4.4)	-0.053*** (5.8)	0.007 (1.2)
Bank indicators					
Loan/Asset (-1)	-0.083*** (5.6)	0.01*** (6.3)	-0.0023 (0.4)	-0.0057*** (4.1)	0.0037*** (4.1)
Loan growth rate (-1)		-0.0028*** (3.3)	-0.022*** (6.6)	0.0053*** (4.6)	-0.0043*** (5.6)
NIM (-1)	0.47*** (3.6)		0.14** (2.5)	0.27*** (23.4)	0.007* (8.7)
Capital ratio (-1)	0.084 (1.3)	0.053*** (8.5)	-0.114*** (5.2)	0.052*** (8.9)	0.0066* (1.6)
EBTDA/Total assets (-1)					0.06*** (5.6)
SMALL	Insig	0.74*** (3.5)	1.0** (2.5)	-0.25*** (3.2)	-0.11** (2.3)
LARGE	Insig	Insig	Insig	Insig	Insig
Commercial property sector					
D(CPP)	0.16*** (9.4)	-0.0095*** (8.8)	-0.02*** (4.0)	0.0095*** (6.1)	-0.0049*** (4.8)
No. Obs.	5052	4195	3069	4182	4060

Note: The definitions of explanatory variables are as follows. The three macroeconomic indicators are the annual growth rate of real GDP, inflation rate and the nominal short-term interest rate. Bank-specific variables are the ratio of bank loans to total bank assets, the growth rate of real bank loans, the net interest margin, the ratio of equity capital to total bank assets, and earnings before taxes and provisions as a percentage of total bank assets (only entered in the provisions equation). The two dummy variables LARGE and SMALL refer to those banks whose market share (as a percentage of the national level) in term of bank assets is above 5% and below 1%, respectively D(CPP) is the annual growth rate of real commercial property prices in the home country. All the variables except the two dummies are defined in percentages.

t-statistics in parentheses; * shows significance of the test statistic at 90%, ** and *** at 95% and 99% respectively. Equations include country dummies (not shown in detail).

Table 6

Pooled regression with random effects and leveraged size effects

Dependent variables	**Loan growth rate**	**NIM**	**NPL**	**ROA**	**Provisions/ Total Assets**
SMALL	Insig	0.42* (1.9)	1.1** (2.3)	-0.23** (2.0)	-0.29** (2.3)
LARGE	Insig	Insig	Insig	Insig	Insig
GDP*SMALL	Insig	Insig	-0.24*** (4.1)	Insig	0.022* (1.6)
GDP*LARGE	Insig	Insig	-0.16* (1.9)	Insig	Insig
IR*SMALL	Insig	0.08** (3.8)	Insig	Insig	0.043** (2.3)
IR*LARGE	Insig	Insig	Insig	Insig	Insig
INF*SMALL	-0.94* (1.6)	Insig	Insig	Insig	Insig
INF*LARGE	Insig	Insig	Insig	Insig	Insig
D(CPP)	0.26*** (5.1)	-0.01*** (3.1)	-0.053*** (3.4)	0.019*** (4.0)	-0.0168*** (5.6)
D(CPP)*SMALL	-0.11** (2.2)	Insig	0.04** (2.3)	-0.011** (2.2)	0.014*** (4.4)
D(CPP)*LARGE	Insig	0.0082* (1.8)	Insig	Insig	Insig
No. Obs.	5052	4195	3069	4182	4060

Note: See Table 5. t-statistics in parentheses; * shows significance of the test statistic at 90%, ** and *** at 95% and 99% respectively. Equations include country dummies and other independent variables (not reported in detail)

Table 7

Pooled regression with random effects and lagged dependent variables

Dependent variables	Loan growth rate	NIM	NPL	ROA	Provisions/ Total Assets
Constant	6.6*** (4.5)	0.032 (0.6)	-0.17 (0.6)	0.33*** (3.4)	-0.15** (2.0)
Lagged variable	0.16*** (10.4)	0.93*** (224.0)	0.77*** (77.2)	0.54*** (6.0)	0.32*** (21.2)
Macro indicators					
GDP growth	0.59*** (6.2)	0.021*** (6.1)	-0.076*** (5.0)	0.039*** (6.0)	-0.02*** (4.1)
Inflation	-0.52** (2.4)	0.043*** (5.8)	-0.26*** (6.0)	0.076*** (5.2)	-0.029*** (2.8)
Interest rate	0.31*** (2.6)	-0.016*** (3.9)	0.11*** (5.2)	-0.032*** (3.9)	0.006 (1.1)
Bank indicators					
Loan/Asset (-1)	-0.065*** (4.3)	0.0011** (2.3)	0.008*** (2.9)	-0.0031*** (3.2)	0.002*** (2.8)
Loan growth rate (-1)		-0.0027*** (5.2)	-0.035 (1.5)	0.0005 (0.5)	-0.0017*** (2.3)
NIM (-1)	0.48*** (3.9)		-0.032 (1.1)	0.13*** (14.7)	0.0005*** (6.y)
Capital ratio (-1)	0.013 (0.2)	0.0039* (1.8)	-0.024** (2.1)	0.0084* (1.9)	0.0056* (1.6)
EBTDA/Total assets (-1)					0.057*** (5.1)
SMALL					-0.083** (2.0)
LARGE					0.0047 (0.1)
Commercial property sector					
D(CPP)	0.12*** (5.7)	-0.01 (1.4)	-0.021*** (5.7)	0.0041*** (2.9)	-0.0035*** (3.5)
No. Obs.	4185	4180	2962	4182	4059

Note: See Table 5. t-statistics in parentheses; * shows significance of the test statistic at 90%, ** and *** at 95% and 99% respectively.

Table 8

Pooled regression with random effects, difference specification and lagged dependent variables (2 step GMM estimation)

Dependent variables	Loan growth rate	NIM	NPL	ROA	Provisions/ Total Assets
Constant	-2.2 (0.7)	0.02 (0.4)	0.5* (1.8)	0.03 (0.3)	0.02 (0.7)
D.Lagged variable	0.096*** (2.6)	0.73*** (5.9)	0.73*** (10.0)	0.38** (2.5)	-0.1 (0.6)
Macro indicators					
D.GDP growth	-0.054 (0.3)	0.028*** (2.8)	0.08 (1.4)	0.033* (1.8)	-0.02 (1.4)
D.Inflation	-3.1*** (3.7)	0.11** (2.1)	0.3 (1.0)	0.22*** (3.3)	-0.12*** (2.8)
D.Interest rate	1.6*** (3.3)	-0.052 (1.5)	-0.0008 (0.1)	-0.08** (2.3)	0.037 (1.1)
Bank indicators					
D.Loan/Asset (-1)	-0.71** (2.0)	-0.033** (2.0)	0.1 (1.5)	-0.064** (2.0)	0.012 (0.8)
D Loan growth rate (-1)		-0.0014 (0.6)	-0.003 (0.4)	0.0014 (1.4)	-0.0031 (1.6)
D.NIM (-1)	-6.9** (2.3)		0.4 (1.4)	0.4 (1.6)	-0.015 (0.1)
D.Capital ratio (-1)	1.7 (0.8)	-0.068 (0.9)	0.1 (0.5)	0.09 (0.7)	-0.2** (2.5)
D. EBTDA/Total assets (-1)					0.092 (1.2)
Commercial property sector					
D.D(CPP)	0.103* (1.8)	0.0007 (0.3)	-0.04** (2.4)	0.013*** (3.1)	-0.0066** (2.1)
No. Obs	3282	2454	1640	2441	2392
Joint Wald	*62.4 [0.00]*	*64.1 [0.00]*	*168 [0.0]*	*30.3 [0.0]*	*44.7 [0.00]*
Sargan	*24.9 [0.2]*	*47.5 [0.0]*	*31.9 [0.03]*	*28.7[0.07]*	*109.9 [0.003]*
AR(1)	*-5.5 [0.0]*	*-3.3 [0.01]*	*-2.9 [0.004]*	*-2.7 [0.006]*	*-1.96 [0.05]*
AR(2)	*-0.27 [0.78]*	*-0.3 [0.8]*	*0.3 [0.75]*	*-1.3 [0.2]*	*-1.05 [0.29]*

Note: See Table 5. All variables are differenced (denoted by "D") compared to the other tables, hence are in first or second difference form. D(CPP) is the annual growth rate of real commercial property prices in the home country; t-statistics in parentheses; * shows significance of the test statistic at 90%, ** and *** at 95% and 99% respectively. Equations include country dummies and small/large bank dummies (not reported in detail). The instruments are the first differenced lags of the independent variables and the second and third lags of the dependent variable.

Table 9

Pooled regression with random effects and lagged macro variables

Dependent variables	Loan growth rate	NIM	NPL	ROA	Provisions/ Total Assets
Constant	6.2*** (3.8)	1.6*** (5.9)	1.2* (1.8)	0.5*** (3.4)	-0.122 (1.2)
Macro indicators					
GDP growth	0.73*** (6.2)	0.046*** (7.1)	-0.13*** (4.4)	0.049*** (5.5)	-0.027*** (4.7)
GDP growth(-1)	0.81*** (5.6)	0.03*** (3.8)	-0.19*** (5.1)	0.04*** (3.6)	-0.024*** (3.4)
GDP growth(-2)	0.42*** (3.0)	0.021*** (2.8)	0.11*** (3.3)	-0.02* (1.9)	-0.038*** (5.6)
Inflation	-0.96*** (3.7)	0.035** (2.2)	-0.58*** (7.6)	0.13*** (6.2)	-0.011 (1.2)
Interest rate	-0.16 (1.0)	0.035*** (3.8)	0.24*** (5.4)	-0.065*** (5.3)	0.0011 (1.5)
Bank indicators					
Loan/Asset (-1)	-0.072*** (4.4)	0.013*** (6.3)	0.00081 (0.1)	-0.0057*** (3.6)	0.0031*** (3.1)
Loan growth rate (-1)	0.16*** (9.5)	-0.0016* (1.7)	-0.026*** (6.8)	0.0063*** (4.8)	-0.004*** (4.9)
Loan growth rate (-2)	0.04*** (2.6)	-0.002** (2.0)	-0.02*** (5.2)	0.0004 (0.3)	0.0006 (0.7)
NIM (-1)	0.41*** (3.1)		0.15** (2.3)	0.28*** (21.3)	0.0081*** (3.1)
Capital ratio (-1)	-0.016 (0.2)	0.081*** (11.1)	-0.11*** (4.3)	0.038*** (5.7)	0.007 (1.5)
EBTDA/Total assets (-1)					0.069*** (5.3)
SMALL	0.19 (0.2)	0.66*** (3.0)	0.93** (2.1)	-0.27*** (3.0)	-0.07 (1.1)
LARGE	1.1 (1.0)	0.28 (0.9)	-0.31 (0.5)	-0.15 (1.3)	0.022 (0.3)
Commercial property sector					
D(CPP)	0.068** (2.4)	-0.0049*** (3.4)	0.013* (1.9)	0.002 (1.0)	-0.0012 (1.0)
D(CPP)(-1)	-0.058** (2.1)	-0.0079*** (5.2)	-0.024*** (3.2)	0.0002 (0.1)	0.0008 (0.6)
D(CPP)(-2)	-0.012 (0.6)	-0.011*** (8.8)	-0.021*** (3.8)	0.081** (2.3)	-0.0008 (0.7)
No. Obs.	3316	3324	2416	3313	3216

Note: See Table 5. t-statistics in parentheses; * shows significance of the test statistic at 90%, ** and *** at 95% and 99% respectively; regressions also include country dummies (not shown).

Table 10

Pooled regression with asymmetric effects of commercial property price movements

Dependent variables	Loan growth rate	NIM	NPL	ROA	Provisions/ Total Assets
Constant	10.6*** (6.7)	2.0*** (8.2)	1.52** (2.6)	0.41*** (3.1)	-0.23** (2.6)
Macro indicators					
GDP growth	0.43*** (5.5)	0.052*** (11.6)	-0.042** (2.0)	0.026*** (3.7)	-0.014*** (2.9)
Inflation	-0.16 (0.9)	0.011 (0.9)	-0.60*** (10.2)	0.15*** (8.6)	-0.046*** (4.2)
Interest rate	0.45*** (4.6)	0.068*** (11.9)	0.126*** (4.4)	-0.054*** (5.9)	0.006 (1.0)
Bank indicators					
Loan/Asset (-1)	-0.13*** (7.9)	0.01*** (6.8)	-0.002 (0.5)	-0.0057*** (4.1)	0.0037*** (4.1)
Loan growth rate (-1)		-0.0029*** (3.9)	-0.022*** (6.9)	0.0053*** (4.6)	-0.0043*** (5.6)
NIM (-1)	0.38*** (2.7)		0.145*** (2.6)	0.27*** (23.3)	0.0072*** (8.2)
Capital ratio (-1)	0.20*** (2.9)	0.048*** (8.5)	-0.116*** (5.3)	0.052*** (8.9)	0.0069* (1.7)
EBTDA/Total assets (-1)					0.066*** (5.5)
SMALL	-0.02 (0.02)	0.76*** (3.6)	1.00** (2.5)	-0.25*** (3.2)	-0.12** (2.3)
LARGE	0.87 (0.7)	0.16 (0.5)	-0.434 (0.8)	-0.12 (1.2)	-0.005 (0.1)
Commercial property sector					
D(CPP)	0.14*** (5.1)	-0.014*** (8.2)	-0.01 (1.1)	0.0077*** (2.7)	-0.0075*** (3.9)
D(CPP) *dummy(DCPP)	0.04 (0.86)	0.0096*** (3.4)	-0.02 (1.3)	0.0034 (0.7)	0.0051 (1.6)
No. Obs.	5027	4170	3042	4156	4059

Note: See Table 5. t-statistics in parentheses; * show significance of the test statistic at 90%, ** and *** at 95% and 99% respectively. Equations include country dummies (not shown in detail).

Table 11

Pooled regression with random effects – American banks

Dependent variables	Loan growth rate	NIM	NPL	ROA	Provisions/ Total Assets
Constant	7.8*** (2.6)	2.0*** (7.5)	1.6*** (3.5)	0.71*** (3.4)	0.12 (1.3)
Macro indicators					
GDP growth	0.81*** (3.7)	0.08*** (8.6)	-0.085*** (3.0)	0.026* (1.9)	0.005 (0.7)
Inflation	-1.12* (1.8)	0.004 (0.1)	-0.37*** (4.0)	0.044 (1.0)	0.062*** (2.9)
Interest rate	1.4*** (5.0)	0.07*** (5.3)	0.17*** (4.2)	-0.015 (0.8)	-0.048*** (5.3)
Bank indicators					
Loan/Asset (-1)	-0.11*** (4.5)	0.017*** (10.9)	0.0083** (2.3)	-0.0035** (2.0)	0.004*** (5.0)
Loan growth rate (-1)		-0.002** (2.5)	-0.013*** (5.4)	0.0011 (0.4)	-0.0017*** (3.0)
NIM (-1)	0.44 (1.6)		0.0061 (0.1)	0.21*** (9.8)	0.053*** (4.8)
Capital ratio (-1)	0.02 (0.2)	0.044*** (6.9)	0.016 (0.9)	0.055*** (7.5)	-0.0081** (2.1)
EBTDA/Total assets (-1)					Insig
SMALL	-0.46 (0.2)	0.26 (1.1)	-1.2*** (3.8)	-0.33** (2.4)	-0.33*** (4.8)
LARGE	4.4 (1.3)	0.67 (1.5)	-3.3*** (6.0)	0.15 (0.6)	-0.58*** (4.5)
Commercial property sector					
D(CPP)	-0.035 (0.7)	-0.015*** (6.6)	-0.041*** (6.3)	0.0055*** (7.5)	0.0041*** (2.7)
No. Obs.	2697	2238	2227	2237	2213

Note: See Table 5. t-statistics in parentheses; * shows significance of the test statistic at 90%, ** and *** at 95% and 99% respectively. Equations include country dummies (not shown in detail).

Table 12

Pooled regression with random effects - European banks

Dependent variables	Loan growth rate	NIM	NPL	ROA	Provisions/ Total Assets
Constant	2.4 (0.6)	1.5 (1.4)	10.2*** (3.2)	0.012 (0.1)	0.98** (2.6)
Macro indicators					
GDP growth	0.42** (2.1)	0.09*** (7.3)	-0.064 (0.7)	0.03** (2.2)	-0.00027 (0.25)
Inflation	0.12 (0.3)	-0.025 (0.9)	-0.77*** (3.3)	0.13*** (3.8)	-0.056** (2.3)
Interest rate	-0.18 (0.9)	0.14*** (10.1)	0.049 (0.4)	-0.065*** (3.7)	0.067*** (5.3)
Bank indicators					
Loan/Asset (-1)	-0.024 (1.1)	-0.0044 (1.4)	-0.035* (1.7)	-0.0062*** (3.0)	0.003 (1.58)
Loan growth rate (-1)		-0.0032** (2.0)	-0.063*** (4.8)	0.0074*** (3.9)	-0.0054*** (3.8)
NIM (-1)	0.17 (1.0)		0.71*** (2.7)	0.18*** (10.4)	0.062*** (4.9)
Capital ratio (-1)	0.236** (2.4)	0.114*** (9.3)	-0.32*** (3.8)	0.088*** (9.8)	0.37 (0.6)
EBTDA/Total assets (-1)					Insig
SMALL	-0.06 (0.1)	0.58 (1.4)	3.1** (2.4)	-0.16 (1.3)	0.14* (1.7)
LARGE	1.1 (0.7)	0.13 (0.3)	1.6 (1.1)	-0.12 (0.8)	0.12 (1.3)
Commercial property sector					
D(CPP)	0.146*** (5.8)	-0.0064*** (3.9)	0.003 (0.2)	0.006*** (2.9)	-0.0023* (1.6)
No. Obs.	1712	1462	521	1454	1373

Note: See Table 5. t-statistics in parentheses; * shows significance of the test statistic at 90%, ** and *** at 95% and 99% respectively. Equations include country dummies (not shown in detail).

Table 13

Pooled regression with random effects – Asian Banks

Dependent variables	Loan growth rate	NIM	NPL	ROA	Provisions/ Total Assets
Constant	25.1*** (5.5)	-1.39 (1.4)	Insig	4.4*** (5.3)	-2.2*** (3.0)
Macro indicators					
GDP growth	-0.28*** (3.0)	-0.013 (1.4)	0.15*** (2.6)	0.012 (0.6)	-0.0026 (0.2)
Inflation	0.44** (2.1)	0.072*** (3.2)	-1.2*** (8.4)	0.063* (1.7)	-0.022 (0.7)
Interest rate	0.35* (1.6)	-0.11*** (4.5)	0.26 (0.8)	0.073* (1.7)	-0.13*** (3.9)
Bank indicators					
Loan/Asset (-1)	-0.28*** (6.5)	0.043*** (5.9)	0.027 (0.8)	-0.02** (2.5)	0.02*** (3.0)
Loan growth rate (-1)		0.017*** (4.5)	-0.013 (0.5)	0.016** (2.2)	-0.01 (1.7)
NIM (-1)	1.26*** (5.5)		0.4*** (2.7)	0.72*** (16.9)	-0.0027 (0.6)
Capital ratio (-1)	-0.36** (2.6)	0.0455** (2.5)	-0.39*** (4.7)	-0.205*** (8.1)	0.095*** (4.8)
EBTDA/Total assets (-1)					0.13** (2.2)
SMALL	2.85*** (2.9)	0.93*** (2.8)	0.7 (0.8)	-0.31* (1.7)	-0.5*** (3.0)
LARGE	1.1 (0.9)	0.07 (0.1)	-1.4 (1.0)	-0.035 (0.1)	0.077 (0.3)
Commercial property sector					
D(CPP)	0.268*** (5.6)	0.0062 (1.5)	-0.028 (0.3)	0.003 (0.4)	-0.0033 (0.5)
No. Obs.	643	495	321	491	452

Note: See Table 5. t-statistics in parentheses; * shows significance of the test statistic at 90%, ** and *** at 95% and 99% respectively. Equations include country dummies (not shown in detail).

Table 14

Variants and robustness checks

Dependent variables	Loan growth rate	NIM	NPL	ROA	Provisions/ Total Assets
Interaction with Capital					
DRCP	0.22*** (6.3)	-0.001*** (5.4)	-0.051*** (4.7)	0.021*** (6.5)	-0.013*** (5.9)
DRCP*capital ratio	-0.00007* (1.8)	0.0001 (0.6)	0.00004*** (3.2)	-0.000015*** (4.1)	0.00001*** (3.9)
Real residential prices					
DRRP	0.22*** (6.1)	-0.0285*** (14.3)	-0.094*** (7.3)	0.019*** (5.6)	-0.014*** (6.5)
Real equity prices					
DREP	0.065*** (7.0)	0.00184*** (3.7)	0.01*** (3.8)	0.0028*** (3.5)	-0.0002 (0.3)
Real residential and commercial prices					
DRCP	0.149** (8.0)	-0.004** (3.8)	-0.002 (0.4)	0.007** (3.9)	-0.0028** (2.5)
DRRP	0.05 (1.2)	-0.0245** (11.4)	-0.09** (6.1)	0.012** (3.1)	-0.011** (4.5)
Nominal commercial					
DCPP	0.17*** (10.0)	-0.0092*** (9.6)	-0.02*** (3.9)	0.01*** (6.3)	-0.0055*** (5.3)
Memo: basic results					
DRCP	0.16*** (9.4)	-0.0095*** (8.8)	-0.02*** (4.0)	0.0095*** (6.1)	-0.0049*** (4.8)

Note: t-statistics in parentheses; * shows significance of the test statistic at 90%, ** and *** at 95% and 99% respectively. Equations include country dummies. In the regression where nominal commercial property prices are used, loan growth is defined in nominal term and interest rates in real terms.

References

Arellano, M and S Bond (1991): “Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations”, *The Review of Economic Studies*, vol 58, no 2, pp 277–97.

Arpa, M, I Guilini, A Ittner and F Pauer (2001): “The Influence of macroeconomic developments on Austrian banks: implications for banking supervision”, *BIS Papers* no 1, pp 91–116.

Berger, A and G Udell (1990): “Collateral, loan quality and bank risk”, *Journal of Monetary Economics*, vol 25, pp 21–42.

——— (2003): “The institutional memory hypothesis and the procyclicality of bank lending behavior”, *FEDS Working Paper* no 2003–02.

Bernanke, B and M Gertler (1989): “Agency costs, net worth and business fluctuations”, *American Economic Review*, vol 79, pp 14–31.

Bernanke, B and C Lown (1991): “The credit crunch”, *Brookings Papers on Economic Activity*, vol 7, pp 205–247.

Bernanke, B, M Gertler and S Gilchrist (1994): “The financial accelerator and the flight to quality”, *Review of Economics and Statistics*, vol 78, pp 1–15.

Besanko, D and A Thakor (1987): “Collateral and rationing: sorting equilibria in monopolistic and competitive credit markets”, International Economic Review, vol 28, no 3, pp 671–89.

Bester, H (1985): “Screening vs rationing in credit markets with imperfect information”, *American Economic Review*, vol 75, no 4, pp 850–55.

——— (1987): “The role of collateral in credit market with imperfect information”, *European Economic Review*, vol 31, pp 887–99.

Bikker, J and H Hu (2002): “Cyclical patterns in profits, provisioning and lending of banks”, De *Nederlandsche Bank Staff Report* no 86/2002.

Bikker, J and P Metzemakers (2004): “Bank provisioning behaviour and procyclicality”, presented at *the ECB Financial Stability Workshop*, June.

Boot, A, A Thakor and G Udell (1991): “Secured lending and default risk: equilibrium analysis, policy implication and empirical results”, *Economic Journal*, vol 101, no 406, pp 458–72.

Borio, C, N Kennedy and S Prowse (1994): “Exploring aggregate asset price fluctuations across countries: measurement, determinants and monetary policy implications”, *BIS Economic Papers* no 40.

Borio, C, C Furfine and P Lowe (2001): “Procyclicality of the financial system and financial stability: issues and policy options”, *BIS Papers* no 1, pp 1–57.

Cavallo, M and G Majnoni (2001): “Do banks provision for bad loans in good times? Empirical evidence and policy implications”, mimeo, New York University and the World Bank.

Craig, R S, E P Davis and A G Pascual (2005): “Sources of Pro-Cyclicality in East Asian Financial Systems”, *IMF Working Paper*, forthcoming.

Davis, E P (1993): “Bank credit risk”, *Bank of England Working Paper Series* no 8, April.

——— (1999): “Financial data needs for macroprudential surveillance: what are the key indicators of risk to domestic financial stability?”, *Centre for Central Banking Studies Lecture Series* no 2*,* Bank of England.

Davis, E P and H Zhu (2004): "Bank lending and commercial property prices: some cross country evidence", *BIS Working Paper* No 150.

De Greef, I and R de Haas (2000): “Housing prices, bank lending, and monetary policy”, *De Nederlandsche Bank Research Series Supervision Paper* no 31.

Demirgüç-Kunt, A and H Huizinga (1999): “Determinants of commercial bank interest margins and profitability: some international evidence”, *World Bank Economic Review*, vol 13, no 2, pp 379–408.

——— (2001): “Financial structure and bank profitability” in Asli Demirgüç-Kunt and Ross Levine (Eds): *Financial Structure and Economic Growth: A Cross-Country Comparison of Banks, Markets, and Development*, Cambridge and London: MIT Press. pp 243–61.

Freund, J, T Curry, P Hirsch and T Kelley (1997): “Commercial real estate and the banking crises of the 1980s and early 1990s”, in *History of the 80s: an examination of the banking crises of the 1980s and early 1990s*, Federal Deposit Insurance Corporation.

Gan, J (2004): “Collateral channel and credit cycle: evidence from the land price collapse in Japan”, working paper.

Gerlach, S and W Peng (2005): “Bank lending and property prices in Hong Kong”, *Journal of Banking and Finance*, vol 29, pp 461–81.

Gerlach, S, W Peng and C Shu (2003): “Macroeconomic conditions and banking performance in Hong Kong: a panel data study”, presented at the *BIS Autumn 2003 Central Bank Economists’ Meeting on Investigating the Relationship between the Financial and Real Economy*, mimeo.

Goodhart, C (1995): “Price stability and financial fragility”, in Kuniho Sawamoto, Zenta Nakajima and Hiroo Taguchi (Eds): *Financial Stability in a Changing Environment*, St. Martin’s Press.

Herring, R and S Wachter (1999): “Real estate booms and banking busts: an international perspective”, *The Wharton Financial Institutions Center WP 99–27*.

——— (2002): “Bubbles in real estate market”, *Zell/Lurie Real Estate Center Working paper* no 402.

Hofmann, B (2001): “The determinants of private sector credit in industrialised countries: do property prices matter?”, *BIS working paper* no 108.

Inaba, N, T Kozu, T Nagahata and T Sekine (2003): “Non-performing loans and the real economy: Japan’s experience”, presented at the *BIS Autumn 2003 Central Bank Economists’ Meeting on Investigating the Relationship between the Financial and Real Economy*, mimeo.

IMF (2004): “Compilation guide to financial soundness indicators”, International Monetary Fund, Washington DC, http://www.imf.org/external/np/sta/fsi/eng/2004/guide/.

Kim, M-S, Kross, W (1998): “The impact of the 1989 change in bank capital standards on loan loss provisioning and loan write-offs”, *Journal of Accounting and Economics,* vol 25, pp 69–99.

Kiyotaki, N and J Moore (1997): “Credit cycles”, *Journal of Political Economy*, vol 105, no 2, pp 211–48.

Laeven, L and G Majnoni (2003): “Loan loss provisioning and economic slowdowns: too much, too late?” *Journal of Financial Intermediation*, vol 12, no 2, pp 178–97.

La Porta, R, F Lopez-de-Silanes, A Shleifer and R Vishny (1998): “Law and Finance”, *Journal of Political Economy*, vol 106, no 6, pp 1113–55.

Lowe, P (2002): “Credit Risk Measurement and Procyclicality”, Bank for International Settlements, mimeo.

Peek, J and E Rosengren (1995): “The capital crunch: neither a borrower nor a lender be”, *Journal of Money, Credit and Banking*, vol 27, pp 623–38.

Pozzolo, Z (2004): “The role of guarantees in bank lending”, *Banca D’Italia Temi di Discussione,* no 528.

Quigley, J (1999): “Real estate prices and economic cycles”, *International Real Estate Review*, vol 2, no 1, pp 1–20.

Rouwendal, J and R Alessie (2002): “House prices, second mortgages and household savings: an empirical investigation for the Netherlands 1987–1994”, *Tinbergen Institute 2002–074/3*.

Salas, V and J Saurina (2002): “Credit risk in two institutional regimes: Spanish commercial and savings banks”, *Journal of Financial Services Research*, vol 22, pp 203–24.

——— (2003): “Deregulation, market power and risk behaviour in Spanish banks”, *European Economic Review*, vol 47, pp 1061–75.

Von Kalckreuth, U and E Murphy (2004): “Financial constraints and capacity adjustment in the UK; are small firms really different? Evidence from a large panel of survey data”, mimeo.

Previous volumes in this series

No	Title	Author
174 April 2005	How does fiscal policy affect monetary policy in emerging market countries?	Edda Zoli
173 March 2005	Measuring default risk premia from default swap rates and EDFs	Antje Berndt, Rohan Douglas, Darrell Duffie, Mark Ferguson and David Schranz
172 March 2005	The effectiveness of foreign exchange intervention in emerging market countries: evidence from the Czech koruna	Piti Disyatat and Gabriele Galati
171 March 2005	The role of the natural rate of interest in monetary policy	Jeffery D Amato
170 February 2005	A model of the IMF as a coinsurance arrangement	Ralph Chami, Sunil Sharma and Ilhyock Shim
169 February 2005	Current account adjustment and capital flows	Guy Debelle and Gabriele Galati
168 January 2005	Inflation targeting, asset prices and financial imbalances: conceptualizing the debate	Piti Disyatat
167 December 2004	Asset prices and banking distress: a macroeconomic approach	Goetz von Peter
166 December 2004	Are speculative attacks triggered by sunspots? A new test	Nikola A Tarashev
165 December 2004	Stress-testing financial systems: an overview of current methodologies	Marco Sorge
164 November 2004	Did investors regard real estate as “safe” during the “Japanese Bubble” in the 1980s?	I Serdar Dinc and Patrick M McGuire
163 November 2004	CDO rating methodology: Some thoughts on model risk and its implications	Ingo Fender and John Kiff
162 September 2004	Recent fiscal policy in selected industrial countries	David E Lebow
161 September 2004	The monetisation of Japan’s government debt	David E Lebow
160 August 2004	An empirical comparison of credit spreads between the bond market and the credit default swap market	Haibin Zhu
159 July 2004	The term structure of credit spreads in project finance	Marco Sorge and Blaise Gadanecz
158 July 2004	Market distress and vanishing liquidity: anatomy and policy options	Claudio Borio
157 July 2004	Securing sustainable price stability: should credit come back from the wilderness?	Claudio Borio and Philip Lowe
156 July 2004	Deposit Insurance and Bank Intermediation in the Long Run	Robert Cull, Lemma Senbet and Marco Sorge

All volumes are available on request from the BIS and are also on our website www.bis.org.