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Sources of Pro-Cyclicality in East Asian Financial Systems[1]

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Abstract

Procyclicality is a normal feature of economic systems but financial sector weaknesses can exacerbate it sufficiently to pose a threat to macroeconomic and financial stability. These include weaknesses in bank risk management and governance, in supervision and the legal infrastructure. The paper first assesses the extent of pro-cyclicality in the financial systems of 11 Asian countries. It then examines whether features exacerbating pro-cyclicality may be present in Asian financial systems and tests for their importance using econometric analysis. The combination of qualitative and quantitative analysis utilized makes it possible to identify specific policy measures for East Asian countries that could limit the extent to which the financial system exacerbate pro-cyclicality.

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[1] This paper should not be reported as representing the views of the IMF. The views expressed are those of the author and do not necessarily reflect the views of the IMF or IMF policy.

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I. INTRODUCTION

In most countries, financial systems are pro-cyclical. Credit to the non-financial private sector typically increases when output is expanding and contracts during recessions, while asset prices respond to favorable growth expectations. Pro-cyclicality is a normal consequence of the process through which the financial system finances economic growth. However, the experience of some emerging markets and OECD countries, where rapid credit growth and asset price bubbles have preceded sharp cyclical downturns, often accompanied by episodes of financial instability, suggests that features of the financial system can exacerbate the cycle. Interest in this issue has been heightened by the strong output growth coupled with rapid credit growth and asset price inflation in many Asian countries. This has contributed to concerns that a build-up of risk in financial systems could exacerbate the cyclical downturn, as it did in a number of countries in 1997-8. This paper identifies features of financial systems that have the potential to exacerbate pro-cyclicality and empirically assesses their importance for eleven East Asian economies, five of which are "advanced" (Australia, Hong Kong, Japan, New Zealand, Singapore) and six are "emerging market economies" (China, Indonesia, Korea, Malaysia, Philippines, Thailand).

A relatively broad concept of pro-cyclicality may be needed to encompass the experiences of many emerging markets. The traditional concept, where real credit and output growth and other variables move together in a relatively smooth fashion over the cycle, is based on the experiences of industrial countries with stable financial systems (Borio et al 2001). In some emerging markets, the experience has been somewhat different with sharper and more sudden simultaneous falls in credit, output and asset prices often associated with financial instability. Accordingly, a broad concept would need to take into account the contribution of structural weaknesses in financial systems to pro-cyclicality. It can build on the extensive empirical research showing that recessions in emerging market, developing and some industrial countries are sometimes associated with sharp falls in asset prices, especially property prices, and financial instability.

Pro-cyclicality is a normal feature of economic systems. It reflects a process where credit expansion support economic growth and asset prices rise to facilitate an efficient allocation of resources. It relies on a sound, well-functioning financial system that accommodates the changing demand for credit over the cycle. The provision of credit over the cycle reflects the response of the financial system to information asymmetries (discussed in the literature on the "financial accelerator"). Since this represent an effective response of sound financial institutions to risks created by imperfect information, it is unlikely to exacerbate pro-cyclicality sufficiently to generate financial or macroeconomic stability. Rather, it is necessary to look to the structure and dynamics of financial systems to identify features or weaknesses that could substantially exacerbate pro-cyclicality and test for their significance.

The literature highlights a range of structural features that could exacerbate pro-cyclicality. They can arise from shortcomings in bank risk management or supervision, or shifts in the availability in foreign bank and non-bank finance and tend to become more influential with financial liberalization. Inadequate risk management, for example, is reflected in excessive

reliance on collateral, which may not adequately limit credit risk, rather than on an evaluation of the repayment capacity of borrowers. Also, banks' credit assessment capacity may become stretched during episodes of rapid credit growth as the volume of new loans increases sharply so that the credit quality of new loans worsens. Banks that can not adequately estimate default risk over the cycle are also more likely to underprice credit risk. These features make financial systems more prone to unsustainable surges in credit growth and a build up in credit risk, which when the credit risk materializes can contribute to credit crunches.

Weaknesses in supervision allow a build up of risk in the system that ultimately exacerbates pro-cyclicality. When adverse shocks and/or weak credit assessment lead to a deterioration in asset quality, forbearance allows banks to continue lending and accumulating non-performing loans (NPLs). A failure to enforce provisioning means that the losses are not reflected in capital, which reduces its disciplinary role. While this can lessen pro-cyclicality in the short run, it usually increases it in the long run because forbearance is usually unsustainable. As NPLs accumulate, they pose a growing threat to financial stability, and supervisors are forced to act to avoid a financial crises. This can involve requiring banks to recognize and provision against losses and to raise capital ratios and restructuring weak or insolvent banks. This exacerbates procyclicality as banks often respond by restructuring their balance sheets to raise their capital adequacy ratio by reducing lending. When banks cannot raise new capital because they are perceived as risky, they must reduce risk-weighted assets by cutting loans and holding more zero-weighted government securities.

Features of financial systems such as bank ownership structure and the importance of non-bank sources of finance can also influence how credit is provided over the cycle. Foreign banks and state-owned banks can influence the cycle, because their response to it differs from private domestic banks. Reliance on international interbank financing can allow banks to lend beyond the domestic deposit base but entail liquidity risks because this funding source is highly sensitive to changes in counterparty credit risk. Thus, if the credit quality of banks is perceived to deteriorate in a cyclical downturn, this can result in a loss of interbank funding for some banks forcing them to sharply reduce lending, as illustrated by the 1997 crisis. The availability of non-bank sources of funds can influence the cycle because of the scope it provides borrowers to shift among funding sources.

The empirical analysis in the paper tests for the importance of the factors driving pro-cyclicality in 11 Asian countries. It finds that pro-cyclicality among property prices, credit growth and GDP is strong but asymmetric. The much higher correlations in cyclical downturns is consistent with financial instability playing a role in procyclicality. This analysis also shows that asset prices and credit growth have in the past undergone large deviations from trend and occasionally exceeded thresholds associated with financial instability in many countries. Panel estimation using macro data for Asian countries and bank-level data for almost 300 Asian banks found that structural features of Asian financial systems have been significant sources of pro-cyclicality. In particular, developments in the property sector, provisioning policies and a compression of lending margins contribute strongly to the pro-cyclicality of credit. There is also evidence that for banks in emerging markets, credit assessment becomes less effective as the lessons learned in the last downturn

fade. Foreign banks have offsetting effects, while their subsidiaries behave less pro-cyclically than domestic banks, the interbank funding they provide contributes to pro-cyclicality.

In sections II and III this paper illustrates the extent of procyclicality in Asian financial systems and identifies a variety of financial factors that can exacerbate pro-cyclicality, drawing on the extensive available literature (which does not however focus specifically on these economies). Section IV reviews qualitative information on the extent to which certain structural features that may contribute to pro-cyclicality are present in each East Asian country's financial system. Section V tests for the importance of the different potential sources of pro-cyclicality in Asian financial systems using several econometric models. Section VI concludes with a discussion of prudential and monetary policies that countries could use to avoid excessive pro-cyclicality.

Box 1. Sources of Pro-Cyclicality Originating in the Structure of Financial Systems

1. Excessive reliance on collateral to mitigate credit risk
2. Delayed recognition of, and provisioning for, NPLs and regulatory forbearance
3. Underpricing of credit risk so that lending margins that are too narrow to cover the risk
4. Deterioration in the quality of credit assessment during cyclical upswings
5. Directed lending by state-owned bank and connected lending
6. Bank reliance on volatile foreign sources of funding
7. Financial liberalization

II. Features of Pro-Cyclicality in Asia

The extent of pro-cyclicality in Asia can be assessed based on the correlation of real GDP growth, real credit growth and the change in real property prices. GDP is the standard variable used to measure of the business cycle, while real credit growth reflects the role of the financial sector in the cycle. Property prices are is the most relevant asset price because property is the principal form of collateral required to obtain credit. Overall, the analysis shows strong positive but asymmetric correlations, with higher correlations during cyclical downturns, although with significant differences across Asian countries.

The correlations of the annual change in real credit to annual growth in GDP are often high (Table 1). These correlations are strong both contemporaneously and between current credit and GDP lagged by one year. They are consistent with pro-cyclicality but not with credit playing a causal role.[2] To detect asymmetries in these correlations, the sample was split into

[2] In contrast, the correlation between credit and lagged GDP is close to zero. The finding that GDP leads credit, is confirmed by Granger Causality tests, which are not reported due to space constraints. These tests also confirm the results, below, that property prices lead credit. Similar results are found for a group of advanced countries by Davis and Zhu (2004a).

periods of above or below trend GDP growth and correlations were computed for each sub-sample. This analysis indicated that the correlation of credit to GDP is much stronger on average when growth is weak, suggesting that pro-cyclicality is greater in a recession (Table 2). This cyclical asymmetry is consistent with an environment where constraints on credit play a more important role in downturns than credit growth does in upturns.

The results for the relationship between credit and asset prices (real house prices) are similar with property prices leading credit growth. Changes in property prices have a strong positive correlation both contemporaneously and when property prices are lagged one year, indicating they lead credit growth (Table 2). In contrast, property prices are only contemporaneously—and positively—correlated with GDP (Table 3). These findings could reflect both: (i) that the price of property is an asset price that can adjust quickly (or "jump") in response to shifts in growth-expectations (which would increase demand for property); and (ii) the important role property prices play in facilitating the extension of credit by increasing in the value of property used as collateral for this credit.

The correlations with property prices are also asymmetric over the cycle. When the sample is split into periods of above and below average GDP growth, property prices are more highly correlated with credit in the downturn (Table 5). A striking result is that there is virtually no correlation between house prices and real GDP in the period of expansion but a very strong contemporaneous correlation in the downturn. These results are consistent with changes in collateral values driven by asset prices declines playing a stronger role in cyclical downturns. In assessing these results, it is important to bear in mind that correlations can only detect patterns in macro data and do not indicate causality, which needs to be assessed using econometric analysis.

A. Role of Financial Instability in Pro-Cyclicality

There is extensive evidence that cyclical downturns are associated with episodes of financial instability in emerging markets. Hardy and Pazarbasioglu (1998) used data from 38 countries from 1980-97, and found that banking distress is proceeded by credit expansion and capital inflows and associated with: a sharp fall in GDP growth; rising real interest rates; declining bank deposits; a sharp fall in the real exchange rate, declining imports and an adverse terms-of trade-shock. Kaminsky and Reinhart (1999) examined 20 developed and developing countries from 1970-95 to assess macroeconomic variables whose behavior is systematically different in the period prior to banking and currency crises. Banking crises were preceded by recession, declines in the terms of trade, stock-market crashes, real exchange rate appreciation, lending booms, and increases in the money multiplier and real interest rates.

Sustained credit growth and large increase in asset prices appear to contribute to pro-cyclicality but also to increase the probability of financial instability. This makes it possible to use credit and asset price deviations from trend as indicators of growing financial vulnerability. Borio and Lowe (2002) propose a methodology to detect future financial sector problems by examining the behavior of credit and asset prices. Their approach—building upon the work of Kaminsky and Reinhart (1999)—identifies thresholds for these indicators

which if jointly exceeded point to the risk of an asset price bubble and build up of excessive credit risk. Borio and Lowe calculate thresholds for the ratio of credit to GDP and the real stock market index using data for 34 countries for the period 1960 to 1999. They estimate the thresholds for credit to be 4 to 5 percent above long-run trend and for asset prices to be about 40 to 50 percent above trend.

Credit and asset price deviations from their long-term trend for 11 Asian countries over 1960 to 2004 Q3 along with the Borio and Lowe thresholds are shown in Figure 1. Many countries were temporarily above or below both thresholds during the 1990s, implying that sharp changes in asset prices and credit were associated with financial instability over this period. Currently, most countries are below the thresholds except for Indonesia,[3] where a sizeable credit gap of 25 percent and a moderate asset price gap of 55 percent are above the respective thresholds. Overall, the asset price increase seems to be a relatively recent phenomenon, as there is no evidence of excessive positive gaps in the recent periods, with the possible exception of Indonesia.

III. The Contribution of the Financial System to Pro-cyclicality

Pro-cyclicality is a normal feature of macroeconomic systems in which credit expansions support the business cycle and contribute to economic growth, while asset prices respond to growth expectations and may buoy the availability of credit. This process relies on a sound and well functioning financial system that can meet the changing demand for credit over the cycle without taking on excessive risk that could threaten its solvency. A sound financial system, however, will not passively accommodate the demand for credit as it manages risks arising from imperfect information. This response affects the availability and pricing of credit over the cycle and is discussed in the extensive literature on the financial accelerator.

The financial accelerator can add to pro-cyclicality but only to a limited extent. It should not lead to the macroeconomic or financial instability that can severely exacerbate pro-cyclicality since it reflects the effective management of risks arising from imperfect information. It needs to be distinguished from structural features and weaknesses in a financial system that can exacerbate pro-cyclicality from the supply side contributing to financial instability. There are a range of such features identified in the literature that can be classified according to whether they arise from shortcomings in bank risk management, weaknesses in supervision or shifts in the availability in foreign bank and non-bank finance. These features have tended to become more important with financial liberalization, although liberalization has also led to some offsetting developments such as development of securities markets that provide alternative sources of funds to bank credit.

[3] For the case of Indonesia, given the relatively short length of the time series, the estimation of the trend and cycle may suffer from a short-sample bias.

A. The Financial Accelerator

A principle channel through which the financial system influences the business cycle in the literature is termed the "financial accelerator" (Bernanke et. al., 1996). It derives from information asymmetries between borrowers and lenders and the associated agency costs. Lenders try to mitigate problems arising from imperfect information by basing lending on collateral, borrowers' net worth and observable cash flow. This makes the availability and pricing of credit more vulnerable to shocks that weaken borrowers balance sheets and earnings and can give rise to pro-cyclical feedback effects by affecting real expenditures.

A central insight from the literature is that this role of collateral provides a mechanism through which asset prices can exacerbate procyclicality (Kiyotaki and Moore, 1997). Increasing asset prices in cyclical upswings push up collateral values, raising household borrowing capacity and credit growth. Conversely, in downturns this mechanism leads to a sharper decline in credit.

The literature show that the effect is stronger for borrowers whose net worth is most heavily affected during cyclical downturns and whose activities are riskier or harder to monitor, such as smaller and new firms. It also finds that banks are more likely than markets to continue to provide credit to smaller and weaker borrowers during cyclical downturns. Banks are better able to manage problems of imperfect information and, thus, to monitor the changing risk profile of such borrowers. A consequence of this is that banks can influence the availability of market forms of finance through a signaling effect. The literature shows that the existence of a lending relationship is viewed by markets as a positive signal about the quality of borrowers.

In sum, the financial accelerator can explain why financial systems are procyclical. However, it views credit cycles as largely demand driven. The role of financial institutions is modeled as a rational profit maximizing response to agency costs arising from imperfect information. Their response influences the availability and pricing of external finance in a way that contributes to pro-cyclicality. This, however, is unlikely to exacerbate pro-cyclicality sufficiently to generate macroeconomic and financial instability. It results from the financial system effectively doing its job in managing the risks arising from the fundamental problem of imperfect information.

The financial accelerator implicitly assumes that banks are sound, manage risk effectively, and do not fail. The failure of these assumptions to hold provides scope for the supply side of the financial system to exacerbate pro-cyclicality. This effect, together with the weaknesses in the financial system, can account for the observed association between pro-cyclicality and macroeconomic and financial instability. It implies that other hypotheses in addition to the financial accelerator are needed to explain pro-cyclicality, as noted by Borio et al, (2001).

B. Weaknesses in Bank Risk Management and Governance

Excessive reliance on collateral to mitigate credit risk

In the financial accelerator, collateral plays a key role in addressing the problems of imperfect information but can exacerbate pro-cyclicality. This model abstracts, however, from a critical feature of many financial systems, which is that the protection that collateral can provide is limited by the costs and legal impediments to seizing and liquidating collateral. Given that collateral is generally not sufficient to avoid credit risk, it needs to be supplemented by an assessment of whether borrowers' also have a capacity to repay. Exclusive reliance on collateral (where repayment capacity is ignored) can itself be a source of pro-cyclicality through several channels:

- During the cyclical upswing when collateral values are rising, banks that rely only on collateral are more likely to rapidly expand lending to high risk borrowers.

- Sharp falls in the value of collateral in cyclical downturns reduces the protection it provides.

- As this credit risk materializes and losses occur in the cyclical downturn, banks try to liquidate collateral simultaneously, which contributes to the decline in the market value of collateral, opening up under-collateralized credit exposures.

- Long delays in the re-evaluation of collateral to recognize declines in asset prices can result in large hidden uncollateralized exposures that force banks to recognize large losses when revaluation occurs.

Even when banks are fully protected by collateral, a failure to assess repayment capacity could exacerbate procyclicality. Loans made to borrowers without assessing their capacity to repay are likely to be riskier. This makes them more likely to default in a downturn, which would exacerbate the recession. More generally, the literature shows that property prices were indeed an important determinant of banks' lending and lending margins.

Deterioration in the quality of credit assessment during cyclical upswings

The quality of credit assessments can deteriorate during cyclical upswings as credit growth accelerates. As the number of new loans increases sharply, banks' credit assessment capacity become stretched so that the credit quality of loans worsens. This feature also makes financial systems more prone to surges in credit growth, as banks are less likely to limit lending growth as additional loans become increasingly risky, and credit crunches become more likely when the credit risk materializes.

Another reason for the deterioration in credit assessment capacity during cyclical upswings is that the knowledge gained by banks during the last cyclical downturn is gradually lost with the departure of experienced loan officers. Also, bank management becomes less able to

monitor and assess quality of loan assessment as there are less problem loans on which to base an evaluation. The discipline of external stakeholders may weaken for similar reasons (i.e., a lack of observed loan performance problems).

Evidence for this "institutional memory hypothesis" has been found by Berger and Udell (2002) for US banks over the 1980-2000 period, with loan growth rising and lending spreads narrowing as the time since the last recession increased. While this hypothesis has not been tested outside the US, the authors suggest that the problem is likely to be significant in developing countries with limited credit assessment capacity and less well-regulated banking systems.

Underpricing of credit risk during cyclical upswings

Borio et. al. (2001) and Lowe and Stevens (2004) argue that financial systems are good at pricing relative risks but may be less able to properly price the time dimension of risk. At the operational level, this can be reflected in a compression of lending margins during cyclical upturns to the point where they are insufficient to cover the credit risk on longer maturity loans over the cycle. Often, competitive pressures lead banks to try to maintain market share by lowering of credit standards and providing credit at narrower interest rate spreads. This is likely to be associated with abundant liquidity in a banking system, where growing deposits and other bank liabilities create pressures for rapid credit growth. In this situation, the risk-adjusted rate of return is generally insufficient to cover the losses incurred by banks when credit risk materialize during the ensuing cyclical downturn. This can exacerbate pro-cyclicality as these banks are likely to reduce credit more sharply than banks that priced risk more accurately.

One source of underpricing of credit risk is estimation of the probability of default (PD) over time horizons that are too short relative to the effective maturity of the credit. This can lead to an underestimation of PD for longer-maturity assets during cyclical upswings, since PD tends to decline during cyclical upswings and rise in cyclical downturns. The narrow lending margins based on a low PD in periods of expansions will generally not be sufficient to cover losses when the PD rise in the ensuing downturn, which tends to weaken banks. While banks often try limit their risk by lending at floating interest rates or by providing short maturity loans that are rolled-over at regular intervals, these measures are generally insufficient. First, an increase in lending margins when the PD rises can push up the PD further and is unlikely to fully compensate for the forgone earnings when credit risk was underpriced. Second, when short-maturity loans are used to fund longer-maturity, multi-year projects, banks do not have the option of not rolling-over credits since this could precipitate a default.

This source of underpricing of credit risk may be present in banks' internal models or rating agency ratings used by banks to calculate the PD on loans. One reason is that banks' internal risk management models must use a one-year horizon because of a lack of data on default rates over longer horizons (Horvath, 2002). Another is the one year accounting period over which banks report profits determines the time horizon over which they measure risk to allocate economic capital to cover it. While rating agencies in principle seek to assess credit

risk through the cycle, rating agencies ratings tend in practice to be pro-cyclical (Amato and Furfine, 2003). This means lending margins based on ratings would tend to fall during cyclical upturns and increase in downturns. There is evidence that ratings often react retrospectively to credit risk events (Mero, 2002). Specifically, rating agencies had reduced sovereign rating prior to financial crises in only one-quarter of the cases, suggesting that this source of credit risk is often underestimated (Haldane, 2000).

More generally, an underpricing of credit risk in cyclical upswings is consistent with the "disaster myopia" hypothesis (Guttentag and Herring, 1984). There is substantial empirical evidence that the likelihood of low-probability high-risk events is underestimated and too much weight is given to recent events (Herring and Wachter, 1999). Borio et al (2001), Horvath (2002), and Banque de France (2001a and b) argue that it results because banks fail to fully recognize the build-up of non-diversifiable risk as their exposures increase during credit expansions. Davis and Zhu (2004b) found that in industrial countries loan growth had a negative impact on margins, which could be consistent with a weakening of credit standards when banks seek rapid balance sheet expansion.

C. Weaknesses in the Supervision of Banks

Delayed recognition of, and provisioning for, NPLs and forbearance

Delaying provisioning can lead to pro-cyclicality if risks are allowed to build up in the upturn but provisions are only taken when risks materialize in the subsequent downturn. This weakens banks, which can exacerbate pro-cyclicality by leading them to cut lending further. There is substantial empirical research showing that provisioning is pro-cyclical which, as Borio et. al. (2001) show for 10 OECD countries, explains a strong pro-cyclical pattern in bank profitability and credit. Studies using individual bank-level data (Cavello and Majnoni, 2001, Laeven and Majnoni, 2003, Bikker and Metzemakers, 2004, and Davis and Zhu, 2004b), find that:

- Banks tend to delay provisioning until the deterioration of loan quality becomes evident during economic downturns, which is consistent with the hypothesis that during lending booms provisioning is insufficient to cover expected loss.

- Stronger banks with high earnings provision more, which is consistent with forbearance by weak banks.

The effect of "evergreening" of loans due to regulatory forbearance can have positive or negative effects on pro-cyclicality depending on the time horizon and the condition of the banking sector. Banks that are allowed to avoid recognizing losses are less likely to contract credit, which would tend to lessen pro-cyclicality. However, this generally leads to a build-up of NPLs to a high level, progressively weakening the banking sector. Forbearance becomes increasingly difficult to sustain and when banks' condition deteriorates sufficiently, the threat of financial instability can force supervisors to act, requiring banks to recognize losses and to

restructure or liquidate insolvent banks. This typically leads to a sharp contraction in credit and fall in output, contributing to pro-cyclicality.

Bank balance sheet restructuring triggered by credit losses

When banks incur losses, they seek to limit the impact on their capital ratio by restructuring their balance sheet to reduce risk weighted assets (in the denominator). This occurs because banks find it difficult to raise new capital when they have been weakened by losses. They often do this by reducing high risk-weighted loans with zero-weighted government securities. When widespread, this contraction in lending can contribute to a "credit crunch." There is an extensive evidence showing that the US credit crunch of the early 1990s was exacerbated by tighter capital requirements (Peek and Rosengren, 1995). More recently, Chiuri et al (2002) found a similar pattern when Basel ratios were introduced in Emerging Market Economies.

D. Role of Alternative Sources of Funding

Availability of alternative sources of funding

In financial systems with multiple sources of finance borrowers that lose access to securities markets can obtain funding from banks or, conversely, when banks experience problems and cut lending they can turn to securities markets. This implies that the absence of alternative sources of funding could make financial systems more pro-cyclical. The absence of well-developed securities market is a feature of many emerging markets, especially in Asia (Roldos et. al., 2004). Evidence that this mechanism is not operative in emerging markets is provided by Davis and Stone (2004). They found that a banking or currency crisis had a positive effect on corporate bond issuance in OECD countries but a negative effect in emerging markets.

Foreign interbank funding

In some Asian countries, banks rely significantly on funding from the international interbank market, making their lending vulnerable to shifts in the availability of these funds (Table 7). These shifts tend to be pro-cyclical because the market is relatively sensitive to perceived changes in counterparty credit risk so bank borrowers are more likely to lose access when their financial condition deteriorates in a cyclical downturn. Bernard and Bisignano (2000) document that banks in many emerging market depend on the international interbank market for funding. This is consistent with the finding that changes in capital flows have a strong effect on credit growth, and thus tend to be pro-cyclical (as found by Kaminsky et al, 2004).

E. Factors Relating to the Structure of the Financial System

Directed lending by state-owned banks and connected lending

Connected lending channels credit to related parties without regard for the associated credit risk. This both fuels more rapid credit growth during cyclical upswings and increases the

likelihood of defaults in cyclical downturns, which could exacerbate the downturn. Also, borrowers without privileged access to credit are more likely to lose it in downturns, which could also contribute to procyclicality. Evidence for these effects is limited, however, due to the difficulties identifying and measuring connected lending.

State ownership can have positive or negative effects on pro-cyclicality depending on the time horizon and the condition of the banking sector. State-owned banks are generally better able to maintain lending in cyclical downturns, but the build up of credit risk can exacerbate the downturn when the government is forced to bail-out or restructure insolvent state banks. Also, government effects to maintain credit to state-owned enterprises can reduce the availability of credit to the private sector in a downturn. Finally, directed lending by governments to support unviable state-owned enterprises can build up a contingent fiscal liability, setting the stage for a fiscal crisis that can threaten the banking system. Mian (2003) showed that across a large sample of countries, state banks in emerging market economies run at a loss on average, despite having lower deposit costs than private banks (due to state guarantees). They have significantly lower capital ratios and higher loan loss and provisioning rates than private banks, consistent with the hypothesis that their lending decisions are often not based on credit risk assessment.

The role of foreign banks

Foreign banks play an important role in many Asian countries (Table 7), but their impact on the pro-cyclicality of credit may vary across countries and by bank. Some foreign banks may be “fair weather lenders” that provide substantial credit during cyclical upturns but withdraw in downturns, often because of the sharp rise in country risk. In other countries, international bank subsidiaries and branches may maintain lending, taking advantage of the fact they are inherently more diversified and so less vulnerable to the downturn than domestic banks.

De Haas and van Lelyveld (2003) show that in Eastern Europe, foreign banks are less likely to reduce credit in a downturn, although this role was influenced by the health of the parent bank. Mian (2003) shows that foreign banks tend to hold more liquidity than domestic banks and to lend to lower risk borrowers. They also tend to reduce credit by less in response to domestic macro shocks to the local corporate sector. Crystal et al. (2002) focusing on foreign banks in Latin America, found that average loan growth was consistently higher and less volatile, which should reduce pro-cyclicality. Foreign banks were also found to maintain higher risk-adjusted capital ratios and to be more aggressive in provisioning. On balance, the evidence seems to suggest that foreign banks behave less procyclically than domestic banks.

Financial liberalization

Financial liberalization reduces restrictions on expansion of credit and entry of foreign banks and, thus, can contribute to pro-cyclicality by enhancing the impact of the factors identified above. O’Brien and Browne (1992) argued that more intense competition between banks arising from liberalization may induce banks to be more responsive to changing cyclical conditions and perceptions of risk, making credit more pro-cyclical. Similarly, the greater

scope for cyclical asset price movements should contribute to the pro-cyclicality of credit through their effect on collateral values. Habermeier et. al. (2002) shows that financial liberalization in emerging markets with weak financial sectors has been associated with financial instability, which has tended to exacerbate pro-cyclicality. On the other hand, abolition of credit controls, development of securities markets, and removal of barriers segmenting types of financial business, could lead to the development of substitutes for bank credit (Romer and Romer, 1990), lessening pro-cyclicality.

IV. Methodology to Assess the Importance of Pro-Cyclicality in Asia

The ultimate objective of the empirical analysis is to assess the extent to which the different factors identified above may be exacerbating pro-cyclicality so that policies can be developed to limit the risks to macroeconomic and financial stability. For this purpose, two complementary types of information are needed to assess the importance of the factors driving pro-cyclicality in Asian financial systems:

- Qualitative information on bank risk management, supervision, and financial structure drawn from published Financial System Stability Assessment (FSSAs) and other sources to determine whether the factors identified above have been present in Asian countries;

- Econometric analysis using macro data and a panel of bank-level data for almost 300 Asian banks to test the empirical importance of the different factors identified above.

Qualitative information on the supervisory regime and financial infrastructure in different countries can show whether these factors may have been, or are, present in a country. This makes it possible to identify the specific policy measures to limit pro-cyclicality in a country. Qualitative information, however, cannot by itself reveal the importance of each factor as a source of pro-cyclicality. For this, econometric estimates of the impact of different factor on pro-cyclicality are needed. Accordingly, the next section summaries the qualitative information that can be obtained from FSSAs, while subsequent section report estimation results based on a panel of macroeconomic and bank-level covering the 11 Asian countries.

V. Presence of Factors Contributing to Pro-cyclicality in Asian Countries

To determine which factors identified above are contributing to pro-cyclicality in Asian countries, comprehensive and reliable qualitative information on the financial system and quality of supervision is needed. This is available for the six Asian countries have had Financial Sector Assessment Programs (FSAPs)—Hong Kong, Korea, Japan, New Zealand, the Philippines and Singapore. For these countries, is should be possible to identify specific policies that can be precisely targeted at the factors exacerbating pro-cyclicality. For the other 5 Asian countries—Australia, China, Indonesia, Malaysia and Thailand—information is available from central bank Financial Stability Reports, where available, and other official publications. Since this information sometimes does not cover specific factors or is relatively

general, it is considerably more difficult to identify and prioritize appropriate polices to limit risks from pro-cyclicality.[4]

Space constraints prevent discussion of specific countries but analysis of the available information yields conclusions about the relative importance of different factors. Overall, there is a clear difference between the developed and emerging market countries. For the former—Australia, Hong Kong, Japan, New Zealand and Singapore—few of the factors exacerbating pro-cyclicality are present. The one factor that appears to be present in all of them is the tendency for banks to assess risk over relatively short horizons, which can lead to underpricing of risk in cyclical upswings. Also, in several of them banks may have relied excessively on property collateral, although in each case supervisors have taken steps to ensure that lending decisions also take into account borrowers capacity to repay. There is no evidence that alternative avenues of finance have helped dampen pro-cyclicality in either developed or emerging market countries, reflecting limited capital market development.

Among the emerging market economies, a number of factors exacerbating pro-cyclicality have been important. First, lending has been largely collateral based, although in several countries supervisors are working to ensure that lending decisions take into account the capacity to repay. Second, there are indications that the credit assessment capacity of many banks in these countries is limited, increasing the risks from rapid credit growth. Third, in many of the countries, banks have been allowed to delay recognition of NPLs and provisioning against them, allowing credit risk to build up undetected. Fourth, in several countries, some credit decisions have been based on directed lending by state-owned banks and connected lending, which also can lead to a build-up of unrecognized credit risk. Finally, all of these countries liberalized their financial systems over the last 10 years and experienced episodes of rapid credit growth.

Authorities in Asian Countries are aware of many of these weaknesses and some have taken steps to address these. In countries with FSAPs, they were often taken in response to codes and standards assessments. They range from measures focused on limiting risks in the property sector to fundamental reform of financial sector oversight. Space constraints do not permit a systematic review of measures in each country but a few examples reveal the scope of these activities. *Hong Kong SAR*, *Singapore* and several other countries have introduced measures targeted at the real estate sector that include; income thresholds for borrowers; haircuts on collateral; limits on leverage (e.g., maximum loan to value ratio); and mortgage insurance. Another example, is the *Australian* authorities' measures to strengthen the capital framework covering mortgage lending, increasing regulatory capital requirement for mortgage insurers and the risk sensitivity of regulatory capital to real estate prices.

[4] Several of these countries have scheduled or are considering FSAPs, which should improve the quality of information and allow better calibrated policy recommendations.

A number of countries have had to take more comprehensive measures to strengthen bank loan classification and provisioning systems and rules governing collateral. For example, measures taken by *Korea* include strengthening rules limiting connected lending; requiring use of "forward looking criteria" in loan evaluation; more critical assessment of collateral; and tightened provisioning requirements on loans to households through credit cards. *Thailand*, *Indonesia* and *China* have taken steps to strengthen loan classification and provisioning rules. *China* has recently made fundamental reforms aimed at strengthening oversight, including established the China Banking Regulatory Commission with a clear mandate and operational independence. In sum, significant progress is being made in strengthening regulation and supervision in some countries but implementation remain a major challenge.

VI. Empirical Specification and Results

The quantitative analysis to assess the importance of difference factors is based on earlier empirical studies that assess the determinants of bank performance (such as Demirgüç-Kunt and Huizinga (2001), Bikker and Hu (2002) and Davis and Zhu (2004b)). They use standard macroeconomic variables that capture demand-side influences on pro-cyclicality together with a variety of financial variables, including standard bank-specific variables, that capture supply side effects. The analysis is done using two different panel data sets covering the Asian countries as a group:

- A macro data panel composed of macro data for which a long time series of quarterly data are available, which allows an analysis of the long run determinants of pro-cyclical real aggregate credit growth.

- A micro, bank-level, data panel using annual data for roughly 300 banks, which permits testing of specific hypotheses about the sources of pro-cyclicality through estimation of three specifications with different individual-bank level dependent variables that capture different aspects of procyclicality: (i) bank loan growth, (ii) bank lending margins over money market rates in each country; and (iii) bank provisioning rates.

A. Econometric Specification and Results using a Macro Data Panel

The model specification was estimated on a panel of nine countries (Australia, Hong Kong, Japan, Indonesia, Korea, Malaysia, New Zealand, Singapore, and Thailand) for which a sufficiently long quarterly time series are available (1960:1-2004:3). It uses aggregate real bank credit growth as the dependent variable and the following explanatory variables: [5]

[5] Appendix I provides the detailed estimation results and a description of the data. To obtain robust and reliable time series estimation results, only variables with a long enough time series at a quarterly frequency were used. This meant that specific supply-side factors such as banking system capital or profitability could not be included. This is one reason for

(continued)

- Real GDP growth, to capture the demand side effects on credit growth associated with pro-cyclicality.

- Real property prices, to capture the key role of collateral in lending growth, and the change in the growth rate of real housing prices to capture the non-linear effect of large changes in property prices on the value of collateral.

- The real interest rate to control for monetary policy shocks (which, a priori, can have a negative or positive sign where the latter occurs if demand shocks are prevalent).

- An error correction term (ECT) to capture adjustments back to the long-run equilibrium, and the ECT squared to allow for possible non-linear effects where this adjustment is more rapid for large deviations (a long-run co-integration relationship between credit and the main explanatory variables was found for six countries, so the model with the ECT was estimated using only the sub-sample of these countries).

- Lags of the above variables, and country-specific fixed effects, which are reported in the Appendix.

In the specification for the full set of countries (column 1, Table 8), the explanatory variables have the expected signs. The low coefficient on GDP growth points to a weak procyclical effect (although results below show a much stronger effect). An increase in housing prices raises credit growth but also has a significant positive non-linear effect on credit growth. This providing support for the view that rapid growth in housing prices can lead to credit booms, which can be quickly reversed when the property price bubble busts causing a sharp fall in credit.

The specification for the sub-sample of countries for which there is a long-run co-integration was found between credit and its determinants (column 2). The estimates indicate that all variables have the same qualitative effect with no major quantitative changes in the size of the coefficients—with the exception of housing prices whose effect almost doubled.

When the ECT is added to the latter specification (column 3) it has the expected negative sign—giving evidence of mean reversion—but it is not statistically significant. The ECT squared, however, is highly significant with the expected sign, indicating a non-linear mean reversion effect: large deviations of credit from its fundamentals would tend to revert

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undertaking the panel estimation using individual bank-level data (see next section), where the very large cross section dimension provided by data for 300 banks compensated for the short time series and low (annual) frequency of such supply side variables. The only banking sector variable that met these time series data requirements was the value of the banking-sector stock index relative to the overall stock-market but, like the overall equity market index, was not significant.

relatively fast to equilibrium. This could reflect a special feature of procyclicality, with large deviations being corrected much more rapidly, and is consistent with financial instability playing a role in pro-cyclicality because large corrections would tend to occur during such episodes.

B. Econometric Specification and Results using a Panel of Bank-Level Data

Bank level data allow identification of supply side effects that correspond to factors exacerbating pro-cyclicality and must be combined with macro data that capture demand effects.[6] The specification below is estimated using a panel of 300 Asian banks and macro variables for 11 countries over 1996-2003. Three dependent variables are used ("Y" in equation 1): real loan growth, the loan pricing margin and the provisioning rate. Real loan growth (deflated by CPI) measures the expansion of individual banks' loan portfolios which, when aggregated, corresponds to the real credit growth that is the link to pro-cyclicality (although the 300 banks are only a subset of the total). The lending margin (interest receipts/assets less the money market rate) measures the pricing of credit risk and thus helps identify the factors that could contribute to the under pricing of risk. Provisions/assets show the extent to which bank provisioning is pro-cyclical. Following Davis and Zhu (2004b), there are four sets of explanatory variables:

$$Y_{i,t}=f(\text{macro variables, bank-level variables}_{i,t-1}, \text{dummy variables}_i, \text{other}_t) + e_{i,t} \quad (1)$$

1. Macroeconomic variables that reflect the state of the economy—GDP growth, inflation and short term nominal interest rates.

2. Bank-level variables (lagged one period to avoid simultaneity problems): the loan/asset ratio as a proxy for credit risk (as other assets such as securities are less risky); short term funding/assets, as a proxy for liquidity risk (e.g. greater vulnerability to bank runs); the capital ratio, measuring banks' capacity to absorb losses (the equity/assets is used since there are more observations but results with the Basel capital adequacy ratio are similar); and EBDTA/assets in the provisioning equation as an indicator of underlying profitability. Lending growth and interest margins are also added as independent variables in all equations except their own.

3. Country dummies to capture idiosyncratic country effects, such as differences in financial structure, financial development and law/regulation variables.

4. Additional aggregate variables added sequentially to capture specific effects that could generate pro-cyclicality: the property sector relative equity price (the property sub sector equity index relative to the market index), the change in the U.S. Dollars exchange rate, the change in real interbank liabilities (in U.S. Dollars), years since

[6] In effect, the cross-section variation of the bank level data in the panel can be used to solve the identification problem that arises in pure time series estimation.

the last "bust" (defined as when provisions were increased in two successive years), a Japan dummy, and dummies for domestically owned banks and state owned banks.

Estimates of equations for real loan growth, asset margins and provisioning rates are shown in Tables 9, 10 and 11. Equations were also run to test for differences between emerging market and industrial countries (Table 12) and between domestic and foreign banks (Table 13). Also, as a robustness check the equations were run excluding Japan (Appendix Table 10) but the results were mostly unchanged despite Japanese banks being around half the sample (Appendix Table 4). Bank level data are for commercial banks from the Bankscope database[7] and details of the data coverage are in Appendix Table 5.

The estimation results for different specifications of the model make it possible to assess the importance of many of the factor identified above in terms of their potential to exacerbate pro-cyclicality.

Testing for the pro-cyclicality of bank lending growth

Estimation results confirm the influence of the standard demand side variables on the pro-cyclicality of lending at the level of the individual bank (Table 9, equation 1). Real GDP growth, inflation and nominal short term interest rate are significant in explaining real loan growth and, with the exception of inflation, this remains the case when additional micro and financial variables are included (Table 9, equations 2-8). In all cases, loan growth is pro-cyclical due to the positive sign on GDP growth. The coefficient on GDP growth is close to 1, suggesting that the pattern of credit is in line with the cycle on average rather than having a much greater amplitude. The positive sign on interest rates suggests that the authorities increase interest rates as credit growth accelerates, which suggests monetary policy is not adding to pro-cyclicality. The capital adequacy ratio is significant and positive (equations 3-8), suggesting stronger banks increase lending more rapidly.

Testing for excessive reliance on collateral

The importance of collateral values to credit growth is confirmed by the significance of property prices in the specification using macro data (Table 8) and the correlations reported in Section II, since property is a primary form of collateral. Various asset prices were used in the estimation with bank-level data. The most successful was the property sector equity market sub-index relative to overall market index, which is consistently significant and

[7] Filtering of the data was used to eliminate extreme observations that could reflect misreporting. Any bank that failed the following tests in at least one year removed from the dataset: the return on bank assets in absolute terms less than 10 percent; a growth rate of nominal bank assets smaller than 100 percent in absolute terms; a growth rate of nominal bank loans smaller than 100 percent in absolute terms; a ratio of bank loans to bank assets larger than 10 percent and smaller than 90 percent; a ratio of non-performing loans to total loans smaller than 100 percent.

positive (Table 9). Rising property share price also reduce lending margins, suggesting that rising collateral values lead to perceptions of lower risk, and consistent with this, also reduce provisioning (Tables 10 and 11).

The property sector equity index variable is consistently significant across equations in a way that is not true for the change in real house prices or in real share prices (Table 14) as these variables become insignificant when the change in the exchange rate is added. This apparent inconsistency between the high significance of property prices in with macro data estimation can be explained by several factors: (i) the short sample period dominated by the Asian crisis in which property prices and the exchange rate were very highly correlated. The resulting multi-colinearity may cause property prices not to be significant in specifications when the exchange rate is included; (ii) different and offsetting responses of domestic and foreign bank credit to property prices, where property prices are highly significant for foreign and domestic banks separately but with opposite signs (Table 15); and, (iii) residential housing market loans are less important on average for the banks than lending for commercial property, where commercial property prices (which were not available) are better proxied by the property company share index than housing prices at the individual bank level.

Testing for deterioration in the quality of credit assessment during cyclical upswings

This test follows the approach of Berger and Udell (2002) of adding a variable representing the number of years since peak provisioning relative to loans. The estimation results are consistent with a deterioration of lending practices during cyclical expansions. As the time since the last "bust" increases loan growth accelerates (Table 9), and lending margins decline (Table 10), which together are consistent with increased risk taking. Furthermore, the variable is negatively related to provisioning (Table 11), although this correlation may be partly due to the variable being itself defined relative to peak provisions.

Testing for the compression of lending margins during cyclical upswings

This involved testing for effects of GDP growth and credit growth on interest margins. Estimation results (Table 10) show that interest margin is strongly counter cyclical in East Asia (i.e. it narrows in cyclical upswings). This contrasts with the positive estimates for global banks in Davis and Zhu (2004b). Margins also fall when loan growth is rapid, consistent with a build up of credit risk. There is also a significant negative sign on different property price variables (Tables 10 and 14), suggesting that rising collateral values lead to a narrowing of margins. There is also a positive effect of inflation and a negative one from the money market rate, which may again indicate pro-cyclicality.

Testing for delayed recognition and provisioning for NPLs and regulatory forbearance

This can be tested using estimates of the impact of GDP growth, credit growth and earnings on the provisioning rate (Table 11). The sign on real GDP growth and on asset prices is consistently negative, suggesting that banks do not provision in good times for later losses but only when the downturn occurs. Also there is a negative sign on loan growth, suggesting that provisions are not responsive to risk (which typically rises when loan growth increases

owing partly to adverse selection). There is a negative relation between earnings (EBDTA/assets) and provisioning indicating that banks tend to increase provisions when earnings are declining or negative rather than when they are doing well. This result is contrary to global results from Davis and Zhu (2004b) and Laeven and Majnoni (2002) for developed countries. The result also exists when we exclude Japan (Appendix Table 7). Overall, the results suggest that delays in provisioning may be a feature of Asian banking systems.

Moreover, lagged provisioning rates in the lending equation have a consistently negative sign, suggesting that the taking of provisions reduces banks' willingness to lend (Table 9). A one percentage point rise in the provision rate reduces loan growth by around 0.75 percentage points. This confirms that delayed provisioning can exacerbate pro-cyclicality.

Testing whether losses lead banks to restructure balance sheets by reducing loans

An impact of the capital adequacy ratio on lending and margins might suggest that banks restructure balance sheets to reduce risk weighted assets so as to maintain their CARs in times of stress. For Asian banks, the capital ratio has a positive effect on lending (Table 10) consistent with prudence (robust banks lend more), although this result appears to apply most strongly to advanced country banks (Table 13). For asset margins, no effect was detectable in the full sample, but Table 13 shows that there is an important distinction between banks in advanced countries and in emerging markets. The former have a positive effect of capital adequacy on margins (robust banks take higher risks but also charge higher margins) but for emerging market country banks, capital has a negative effect on margins suggesting "gambling for resurrection" i.e., with low-capitalised banks having also riskier lending.

Testing for bank dependence on offshore foreign sources of funds

To test for bank dependence on offshore foreign sources of funds and a corresponding impact on procyclicality, the percentage change in real interbank loans to each country (in dollars) by all BIS reporting banks and the exchange rate are added. The former in particular reveals the extent to which inflows and outflows from the international interbank market may drive domestic financing conditions. The results show that a rise in foreign interbank loans raises domestic lending growth (Table 9) and narrows margins (Table 10), and it also coincides with lower provisioning (Table 11). These imply a pro-cyclical effect arising from external flows, as the liquidity they provide to banks eases constraints on lending, to the extent that interbank loans are also procyclical.

An exchange rate depreciation reduces lending, notably when allowance is made for different behaviour by Japanese banks (dummy for Japan times exchange rate). Note that this is contrary to "textbook" behavior which would suggest a depreciation raises lending and reduces risk as competitiveness of domestic firms increases, as say in the UK following the 1992 ERM crisis. It suggests depreciation is often linked to currency crises which entail a cutting off of capital flows. Also, as noted by Gertler et al (2003), the Asian crisis countries devalued together in 1997-8 so the competitiveness gain from devaluation was lessened.

There is a difference between advanced country and emerging market banks, where for the former there is a positive link of bank lending to exchange rate depreciation, while for the latter, as for the whole sample, lending falls when there is depreciation, consistent with the currency-crisis explanation (Table 12). Meanwhile, depreciation raises margins and has little effect on provisioning, except for Japanese banks.

Testing for the effect of foreign banks

To assess the role of foreign bank subsidiaries on pro-cyclicality within a country, two empirical tests were used. First, a dummy variable for domestic banks was added to the lending, interest margins and provisioning equations to differentiate behavior of domestic and foreign banks with respect to these dependent variables. Second, each of the coefficients were leveraged in each equation by the same dummy variable.

Addition of the single-dummy shows that foreign ownership entails lower lending growth overall (Table 10), and wider margins (Table 11). This is consistent with greater prudence by foreign banks in respect of credit risk. Table 13 suggests that there are significant differences between domestic and foreign banks in the emerging market economies but less so in the advanced countries (the ownership dummy is more often significant for emerging market economies). In sum, the behavior of domestic banks in the emerging market economies differs from both foreign banks in the countries and domestic banks in advanced Asian economies.

Table 14 reports results distinguishing between foreign and domestic bank behavior for each determinant of lending, provisioning and margins separately, by leveraging each coefficient by a domestic bank dummy. In the table, the foreign bank effect is shown in the column "variable" while the domestic bank effect is "variable" plus "leveraged". For loan growth, domestic banks are more procyclical in terms of the relationship of lending to GDP than foreign banks and their lending growth responds more to the interest margin. Other effects are similar for both groups (i.e., the leveraged coefficients are insignificant). When the property sector equity index is replaced with house prices, there is greater sensitivity of foreign than domestic banks to rising house prices, as discussed above (Table 15).

For the asset margin, the positive effect of the loan/asset ratio on margins is weaker for domestic banks than foreign banks, implying that they are more willing to shift portfolio composition without raising lending costs. This is plausible, since the foreign bank subsidiaries shown in Bankscope are only part of the parent bank's world wide balance sheet. Also, for domestic banks, as noted above, there is a negative effect of the capital ratio on the interest margin. Their interest margins respond negatively to property prices, while foreign banks do not. The negative effect of international interbank flows on margins is greater for domestic banks. All of these suggest it is domestic banks that are more procyclical in their behaviour than foreign banks, although an offset is that the estimated "memory loss" in terms of margins appears to be less for domestic than foreign banks.

Provisioning appears to be less cyclical in terms of GDP for domestic than foreign banks, but it is more procyclical relative to the property price. This may reflect differences in balance sheets, whereby domestic bank lending is more collateral-based than foreign banks. It is domestic and not foreign banks that are failing to income-smooth by raising provisions when income is strong (indeed, there is a strong negative effect of EBDTA on provisions for domestic banks). Finally, domestic banks' provisioning responds strongly to interbank flows, while foreign banks' does not.

Testing for the effect of state-owned banks

State owned bank behavior was significantly different from other banks. Estimation results show that they have higher provisioning rates, implying their lending is riskier with a higher default rate (Table 16). Moreover, they have lower margins implying that they margin is unlikely to be adequate to cover the credit risk. This is consistent with the result that state banks make losses on average in emerging markets (Mian, 2003). On the other hand they also have slower loan growth. This could reflect credit rationing but may also be because public banks include some distressed banks under resolution or restructuring.

Financial liberalization

To detect some of the effects of financial liberalization, the correlations between GDP, credit and house prices in periods of above and below trend growth were re-estimated for the period since 1990 (Appendix, Tables 2-3). The Credit-GDP correlations are similar, as are those between GDP and house prices in the downturn. However, there seems to be a greater correlation since financial liberalization between house prices and GDP. On the other hand the credit-house price correlation is rather less, consistent with a release of credit rationing constraints with financial liberalization (credit availability does not constrain changes in asset prices).

VII. Conclusion and Implications for Policy

This paper has shown how specific features of financial systems may be exacerbating pro-cyclicality in Asia. The association of pro-cyclicality with financial and macroeconomic instability in emerging markets highlights the need for policies that address these sources of procyclicality. While these policies are largely prudential and are intended to strengthen structural and institutional aspects of financial systems, they can also provide substantial additional benefits by limiting pro-cyclicality. Other potential benefits are enhanced credibility of monetary and exchange rate policies where, for example, the lower risk of financial and macroeconomic instability could contribute to the sustainability of exchange rate regimes.

Both the qualitative and quantitative analysis point to specific policies where these benefits could be substantial:

- Measures to avoid excessive reliance on collateral to limit the extent to which large movements in property prices exacerbate pro-cyclicality that ensure that bank loan evaluation is based on borrowers' capacity to repay using forward-looking criteria.

- Prompt recognition of impaired assets through implementation of a rigorous loan classification system to avoid the build-up of unrecognized credit risk during periods of expansion that materializes in a cyclical downturn.

- Measures to lessen the extent to which provisioning is pro-cyclical by, for example, putting in place an ex-ante general provision system to ensure early provisioning against expected loss, rather than waiting for losses to occur in a cyclical downturn.

- Measures to limit the under-pricing of credit risk in cyclical expansions that encourage banks to assess credit risk in a more forward-looking way over a longer horizon, or, if this proves difficult, that involve adjusting regulatory capital ratios counter-cyclically to increase capital held against new loans in the expansion.

Implementation may need to take into account the need to limit pro-cyclicality. This could involve using prudential policies in a more pro-active manner aimed at offsetting the pro-cyclical effects of financial system developments. The purpose would be to reduce the risks of financial instability associated with pro-cyclicality. Thus, prudential policies would contribute to macroeconomic stability but would not be substituting for macroeconomic policies. It could involve prudential policy responding to aggregate macro-prudential risks (such as accelerating credit growth or rapidly rising property prices) to a greater extent than is now the case. A number of Asian countries have put in place such policies largely to address identified weaknesses in their financial system and could consider using them in a more pro-active manner to limit procyclicality.

There are two examples of more pro-active prudential policies that are currently receiving a lot of attention: the adjustment of regulatory capital ratios in a counter-cyclical way; and, dynamic provisioning, which essentially involves extending ex-ante general provisions to cover risks associated with the economic cycle in addition to the microeconomic risks in specific sectors. Preparations for Basel II have also highlighted the role of more pro-active prudential policies. Specifically, Pillar 1 of Basel II has been shown to be inherently pro-cyclical, which has led to proposals for "Pillar 2" policies that make regulatory capital ratios counter-cyclical to offset this effect.

Thus far, effort to address weaknesses in financial systems has been conceived of as a largely static exercise focused on strengthening financial institutions at the micro level. This has, and should continue to, yield substantial benefits in terms of macroeconomic and financial stability. However, increased attention to pro-cyclicality has highlighted the potential additional benefits from more dynamic pro-active prudential policies. Their purpose would be to limit the extent to which existing fundamental weaknesses in the financial sector contribute to risks at the aggregate level by, for example, contributing to rapid credit growth

or asset price inflation. This would protect the financial sector by lessening the risk that increased macroeconomic volatility could reverberate back to harm the sector.

Table 1. Correlation Coefficients with Fourth Difference of Log of Real GDP

	Fourth Difference of Log of Real Credit (+4)	Fourth Difference of Log of Real Credit
Australia	0.26	0.34
China	0.31	-0.15
Hong Kong SAR	0.39	0.44
Indonesia	0.82	0.32
Japan	0.48	0.65
Korea	0.09	0.35
Malaysia	0.51	0.49
New Zealand	0.27	0.03
Philippines	0.33	0.43
Singapore	0.69	0.35
Thailand	0.32	0.35
Average	0.41	0.33
Memo item:		
Average for G-7 & 7 EU cos.	0.31	0.41

Table 2. Correlation Coefficients with Fourth Difference of Log of Real GDP—Cyclical Asymmetries

Boom (Growth Exceeding Average)	Fourth Difference of Log of Real Credit (+4)	Fourth Difference of Log of Real Credit
Australia	0.05	0.04
China	-0.05	-0.34
Hong Kong SAR	0.38	0.08
Indonesia	0.13	0.37
Japan	0.09	0.23
Korea	0.33	0.30
Malaysia	0.04	0.15
New Zealand	0.63	0.30
Philippines	0.14	0.16
Singapore	0.21	0.01
Thailand	0.33	0.56
Average	0.21	0.17
Recession (Growth Below Average)		
Australia	0.23	0.38
China	0.13	-0.02
Hong Kong SAR	0.26	0.54
Indonesia	0.89	0.24
Japan	0.47	0.51
Korea	-0.02	0.42
Malaysia	0.52	0.35
New Zealand	0.13	0.26
Philippines	0.53	0.70
Singapore	0.77	0.26
Thailand	0.31	-0.30
Average	0.38	0.30

Table 3. Correlation Coefficients with Fourth Difference of Log of Real House Prices

	Fourth Difference of Log of Real Credit (+4)	Fourth Difference of Log of Real Credit
Australia	0.38	0.50
China		
Hong Kong SAR	-0.01	0.66
Indonesia	0.82	0.16
Japan	0.50	0.85
Korea	0.01	0.35
Malaysia	0.28	0.71
New Zealand	0.18	0.10
Philippines		
Singapore	0.60	0.42
Thailand	-0.04	-0.23
Average	0.30	0.39
Memo item:		
Average for G-7 & 7 EU cos.	0.34	0.44

Table 4. Correlation Coefficients with Fourth Difference of Log of Real GDP

	Fourth Difference of Log of Real House Prices (+4)	Fourth Difference of Log of Real House Prices
Australia	0.10	0.42
China		
Hong Kong SAR	0.02	0.64
Indonesia	0.01	0.91
Japan	0.25	0.61
Korea	-0.02	0.43
Malaysia	-0.36	0.81
New Zealand	0.06	0.37
Philippines		
Singapore	0.18	0.61
Thailand	-0.13	0.48
Average	**0.01**	**0.59**

Table 5. Correlation Coefficients with Fourth Difference of Log of Real House Prices—Cyclical Asymmetries

Boom (Growth Exceeding Average)	Fourth Difference of Log of Real Credit (+4)	Fourth Difference of Log of Real Credit
Australia	0.02	0.33
China		
Hong Kong SAR	0.57	0.82
Indonesia	0.03	-0.1
Japan	0.22	0.63
Korea	0.04	-0.21
Malaysia		
New Zealand	0.24	0.02
Philippines		
Singapore	0.004	0.18
Thailand	-0.46	-0.29
Average	**0.08**	**0.17**
Recession (Growth Below Average)		
Australia	0.29	0.42
China		
Hong Kong SAR	-0.18	0.41
Indonesia	0.57	0.05
Japan	0.45	0.65
Korea	-0.24	0.55
Malaysia	0.08	0.72
New Zealand	-0.11	0.02
Philippines		
Singapore	0.43	0.04
Thailand	-0.2	0.26
Average	**0.12**	**0.35**

Table 6. Correlation Coefficients with Fourth Difference of Log of Real GDP—Cyclical Asymmetries

Boom (Growth Exceeding Average)	Fourth Difference of Log of Real House Prices (+4)	Fourth Difference of Log of Real House Prices
Australia	0.06	-0.004
China		
Hong Kong SAR	-0.39	-0.59
Indonesia	0.15	-0.37
Japan	-0.04	0.47
Korea	0.32	0.28
Malaysia		
New Zealand	-0.14	-0.03
Philippines		
Singapore	0.18	0.28
Thailand	-0.20	-0.30
Average	-0.01	-0.03
Recession (Growth Below Average)		
Australia	-0.04	0.51
China		
Hong Kong SAR	0.07	0.78
Indonesia	-0.11	0.95
Japan	0.34	0.42
Korea	-0.12	0.54
Malaysia	-0.06	0.81
New Zealand	0.06	0.17
Philippines		
Singapore	0.06	0.65
Thailand	-0.08	0.63
Average	0.01	0.61

Table 7. Exposure of International (BIS) Banks to Asian Countries (end-December 2003, in percent)

	BIS banks' exposure/ domestic credit	BIS banks exposure in FX to local banks/ domestic credit	Local currency liabilities of BIS Banks/ total deposit liabilities
China	2.5	1.0	0.3
Hong Kong SAR	116.4	18.4	49.4
Indonesia	29.4	2.1	6.1
Japan	10.1	3.5	2.2
Malaysia	49.1	3.0	30.4
New Zealand	106.2	12.2	85.9
Philippines	57.5	14.8	13.1
Singapore	171.6	71.6	48.3
Thailand	27.2	2.7	14.0

Sources: BIS and IFS (to be updated)

Table 8. Determinants of Credit Growth, Panel Estimation

		Sub-sample	
	All sample	Without ECT	With ECT
GDP growth	0.1022	0.0760	0.0752
	0.0036	0.0126	0.0187
Change in real housing prices	0.0285	0.0516	0.0414
	0.0025	0.0000	0.0007
Acceleration in real housing prices	0.0199	0.0850	0.0668
	0.0729	0.0004	0.0117
Real interest rate	0.4227	0.4244	0.4044
	0.0000	0.0000	0.0000
Real interest rate lagged	-0.2301	-0.3381	-0.2841
	0.0122	0.0000	0.0004
ECT(t-1)			-0.0064
			0.3680
ECT(t-1)^2			-0.0246
			0.0477
R-squared	0.8317	0.8970	0.8978
Adjusted R-squared	0.8227	0.8943	0.8946
Durbin-Watson stat.	2.2005	1.8581	1.8540

Note: The figures under the coefficient estimates are p-values; a p-value below 0.05 indicates significance at a 95 percent confidence level. The panel also includes lagged values of the right-hand-side variable as well as country-specific fixed-effects.

Source: Staff own estimates. The panel includes Australia, HK, Japan, Indonesia, South Korea, Malaysia, New Zealand, Singapore, and Thailand. The sub-sample corresponding to the last two columns includes Australia, HK, Japan, South Korea, and Singapore (those countries for which (i) an adequate time-series length was available and (ii) evidence of co-integration was found). It covers the period 1960:1 to 2004:2, however only in a few countries, including Australia, Japan and New Zealand, a complete time series was available.

Table 9. Equations for Loan Growth

Independent variables	(1) Macro only	(2) +Standard micro	(3) +Property shares	(4) +Exchange rate	(5) +Japan dummy	(6) +Interbank flow	(7) +"Since bust"	(8) +Owner-ship
Constant	-3.7	4.3	-8.0	-7.0	-7.9	-7.7	-8.3	-13.0
	(1.0)	(0.6)	(1.1)	(1.1)	(1.1)	(1.1)	(1.2)	(1.8)
Macro indicators								
GDP growth	1.03**	1.1**	1.1**	0.96**	0.96**	0.87**	0.75**	0.74**
	(6.4)	(7.2)	(7.4)	(5.5)	(5.4)	(5.0)	(4.4)	(4.4)
Inflation	-1.5**	-1.2**	0.12	0.098	0.11	0.14	-0.07	-0.06
	(8.4)	(6.7)	(0.5)	(0.4)	(0.4)	(0.5)	(0.2)	(0.2)
Interest rate	0.46**	0.48**	0.51*	0.72**	0.75**	0.55**	1.1**	1.2**
	(2.7)	(2.7)	(1.8)	(2.2)	(2.3)	(1.6)	(3.4)	(5.3)
Bank indicators								
Loan/Asset (-1)		-0.19**	-0.13**	-0.13**	-0.13**	-0.12**	-0.12**	-0.12**
		(3.7)	(2.3)	(2.4)	(2.4)	(2.3)	(2.2)	(2.2)
Asset margin (-1)		0.69**	0.09	0.13	0.08	0.12	0.11	0.14
		(5.7)	(0.2)	(0.35)	(0.2)	(0.3)	(1.3)	(0.4)
Capital ratio (-1)		0.13	0.32**	0.31*	0.31*	0.32**	0.36**	0.45**
		(1.2)	(2.0)	(1.9)	(1.9)	(2.0)	(2.2)	(2.7)
St funding/ Assets (-1)		0.02	0.08	0.08	0.08	0.09	0.07	0.07
		(0.5)	(1.3)	(1.3)	(1.4)	(1.5)	(1.2)	(1.2)
Additional variables								
Property share relative			0.07**	0.093**	0.076**	0.09**	0.05*	0.05*
			(3.3)	(3.5)	(2.4)	(2.7)	(1.6)	(1.7)
Change in USD rate				-0.083	-0.12*	-0.08	-0.11*	-0.11*
				(1.4)	(1.7)	(1.1)	(1.7)	(1.7)
Japan dummy*DUSD					0.1	0.04	0.17*	0.17*
					(1.0)	(0.4)	(1.6)	(1.6)
Change real interbank (USD)						0.04**	0.06**	0.06**
						(2.5)	(3.5)	(3.5)
Years since last "bust"							1.03**	1.05**
							(4.2)	(4.3)
Domestic ownership								6.3**
								(2.9)
Obs	1326	1300	1094	1093	1092	1093	1030	1029
R2	0.285	0.3	0.26	0.26	0.26	0.27	0.27	0.27

Note: All equations include country dummies—not reported in detail.
* and ** indicate significance at 90 percent and 95 percent respectively.
If lagged provision ratio is added to equation (3), the coefficient is –0.73 and the t-value (4.1)

Table 10. Equations for Bank Margin over Short Rate

Independent variables	(1) Macro only	(2) +Standard micro	(3) +Property shares	(4) +Exchange rate	(5) +Japan dummy	(6) +Inter-bank flow	(7) +"Since bust"	(8) +Owner-ship
Constant	4.7**	1.5**	2.3**	2.2**	2.2**	2.3**	2.0**	2.3**
	(11.7)	(2.0)	(5.2)	(5.1)	(5.1)	(5.3)	(4.8)	(5.2)
Macro indicators								
GDP growth	-0.03**	-0.08**	-0.052**	-0.034**	-0.04**	-0.028**	-0.014	-0.014
	(2.7)	(5.8)	(5.7)	(3.2)	(3.2)	(2.7)	(1.4)	(1.4)
Inflation	0.05**	0.1**	0.072**	0.081**	0.079**	0.074**	0.13**	0.13**
	(3.3)	(4.9)	(3.9)	(4.3)	(4.2)	(4.0)	(6.9)	(6.9)
Interest rate	-0.7**	-0.61**	-0.41**	-0.45**	-0.45**	-0.45**	-0.49**	-0.49**
	(50.8)	(31.7)	(23.5)	(21.9)	(21.8)	(22.6)	(24.6)	(24.6)
Bank indicators								
Loan/Asset (-1)		0.031**	0.027**	0.028**	0.028**	0.027**	0.025**	0.025**
		(5.6)	(8.1)	(8.3)	(8.3)	(8.1)	(7.6)	(7.7)
Loan growth (-1)		-0.009**	-0.003**	-0.004**	-0.004**	-0.003**	-0.004**	-0.004**
		(5.2)	(2.0)	(2.5)	(2.5)	(2.0)	(2.5)	(2.3)
Capital ratio (-1)		-0.007	-0.015	-0.013	-0.013	-0.014	-0.01	-0.014
		(0.8)	(1.3)	(1.2)	(1.1)	(1.2)	(0.9)	(1.2)
St funding/ Assets (-1)		0.012**	-0.004	-0.004	-0.0038	-0.0043	0.001	0.001
		(2.2)	(1.0)	(1.0)	(1.1)	(1.2)	(0.2)	(0.3)
Additional variables								
Property share relative			-0.002	-0.005**	-0.004**	-0.007**	-0.004**	-0.004**
			(1.5)	(3.0)	(2.3)	(3.8)	(2.0)	(2.1)
Change in USD rate				0.011**	0.012**	0.008**	0.009**	0.009**
				(3.3)	(3.2)	(2.2)	(2.6)	(2.6)
Japan dummy*DUSD					-0.004	0.005	-0.003	-0.003
					(0.8)	(0.9)	(0.5)	(0.4)
Change real interbank (USD)						-0.0062**	-0.006**	-0.006**
						(6.2)	(5.6)	(5.6)
Years since last "bust"							-0.091**	-0.091**
							(5.9)	(5.9)
Domestic ownership								-0.31**
								(2.5)
Obs	1562	1057	888	887	886	885	840	839
R2	0.86	0.88	0.73	0.73	0.73	0.74	0.76	0.76

Note: All equations include country dummies—not reported in detail. * and ** indicate significance at 90 percent and 95 percent respectively.

Table 11. Equations for Bank Provisioning Rate

Independent variables	(1) Macro only	(2) +Standard micro	(3) +Property shares	(4) +Exchange rate	(5) +Japan dummy	(6) +Inter-bank flow	(7) +"Since bust"	(8) +Owner-ship
Constant	1.7**	0.2	1.2**	1.2**	1.2**	1.3**	1.8**	1.8**
	(4.0)	(0.1)	(2.3)	(2.3)	(2.3)	(2.4)	(3.5)	(3.5)
Macro indicators								
GDP growth	-0.06**	-0.002**	-0.06**	-0.04**	-0.04**	-0.04**	-0.03**	-0.03**
	(2.9)	(0.1)	(4.6)	(3.2)	(2.9)	(2.6)	(2.3)	(2.3)
Inflation	0.13**	0.1**	0.03	0.04	0.05*	0.04	0.05*	0.05*
	(5.2)	(2.4)	(1.2)	(1.4)	(1.8)	(1.4)	(1.7)	(1.7)
Interest rate	0.08**	0.15**	0.11**	0.09**	0.1**	0.09**	0.033	0.033
	(3.5)	(3.9)	(4.6)	(3.2)	(3.5)	(3.2)	(1.2)	(1.2)
Bank indicators								
Loan/Asset (-1)		0.04**	0.02**	0.021**	0.02**	0.02**	0.02**	0.02**
		(4.2)	(4.8)	(4.9)	(4.8)	(4.7)	(3.8)	(3.8)
Loan growth (-1)		-0.007*	-0.01**	-0.01**	-0.01**	-0.01**	-0.01**	-0.008**
		(1.6)	(4.7)	(4.8)	(4.8)	(4.5)	(4.1)	(4.1)
Asset margin (-1)		0.012	-0.007	-0.01	-0.03	-0.03	-0.05	-0.05
		(0.6)	(0.2)	(0.3)	(0.8)	(1.0)	(1.5)	(1.5)
Capital ratio (-1)		0.055**	-0.02	-0.02	-0.02	-0.02	-0.005	-0.005
		(2.5)	(1.5)	(1.4)	(1.3)	(1.3)	(0.4)	(0.4)
St funding/ Assets (-1)		-0.02*	-0.008*	-0.008*	-0.007*	-0.008*	-0.006	-0.006
		(1.8)	(1.9)	(1.9)	(1.6)	(1.7)	(1.4)	(1.4)
EBDTA (-1)		0.08	-0.1**	-0.1**	-0.11**	-0.12**	-0.15**	-0.15**
		(1.3)	(2.2)	(2.2)	(2.5)	(2.7)	(3.4)	(3.4)
Additional variables								
Property share relative			0.001	-0.001	-0.005**	-0.007**	-0.004*	-0.004*
			(0.5)	(0.4)	(2.1)	(2.9)	(1.7)	(1.7)
Change in USD rate				0.007**	-0.0003	-0.003	-0.001	-0.001
				(1.6)	(0.1)	(0.5)	(0.0)	(0.0)
Japan dummy*DUSD					0.03**	0.03**	0.02**	0.02**
					(3.4)	(4.0)	(2.3)	(2.3)
Change real interbank (USD)						-0.004**	-0.002*	-0.002*
						(3.2)	(1.8)	(1.8)
Years since last "bust"							-0.18**	-0.18**
							(8.9)	(9.0)
Domestic ownership								0.001
								(0.1)
Obs	1441	965	813	812	811	810	808	807
R2	0.26	0.28	0.21	0.21	0.21	0.22	0.28	0.28

Note: All equations include country dummies—not reported in detail. * and ** indicate significance at 90 percent and 95 percent respectively.

Table 12. Equations for Advanced and Emerging Market Economies

Independent Variables	Loan Growth Advanced	Loan growth EMEs	Asset Margin Advanced	Asset Margin EMEs	Provisioning Advanced	Provisioning EME
Constant	-19.4**	13.4	0.67	4.6**	1.4**	0.67
	(3.3)	(0.7)	(1.4)	(5.1)	(3.3)	(0.4)
Macro indicators						
GDP growth	0.73**	0.4	-0.05**	0.04**	-0.013	-0.04
	(4.5)	(0.9)	(4.5)	(2.0)	(1.5)	(1.2)
Inflation	0.25	-0.6	0.14**	0.18**	0.024	0.11
	(1.1)	(0.7)	(6.2)	(4.2)	(1.4)	(1.3)
Interest rate	0.36	3.0**	-0.35**	-0.59**	0.011	0.05
	(0.9)	(3.4)	(14.1)	(14.5)	(0.6)	(0.6)
Bank indicators						
Loan/Asset (-1)	0.01	-0.3**	0.03**	0.011**	0.008**	0.02**
	(0.2)	(2.4)	(7.6)	(1.9)	(2.3)	(2.0)
Loan growth (-1)			-0.0002	-0.003	-0.006**	-0.007*
			(0.1)	(1.4)	(3.3)	(1.8)
Asset margin (-1)	-1.1**	0.9			0.08**	-0.04
	(2.2)	(1.3)			(2.9)	(0.6)
Capital ratio (-1)	0.87**	0.17	0.043**	-0.074**	0.003	0.01
	(4.3)	(0.6)	(2.7)	(4.0)	(0.3)	(0.3)
St funding/ Assets (-1)	0.15**	-0.15	-0.001	-0.01	-0.013**	0.003
	(3.5)	(1.0)	(0.1)	(1.4)	(4.5)	(0.3)
EBDTA (-1)					0.013	-0.26**
					(0.3)	(3.0)
Additional variables						
Property share relative	0.07**	-0.009	-0.001	-0.003	0.0005	-0.005
	(2.0)	(0.1)	(0.6)	(0.9)	(0.3)	(1.0)
Change in USD rate	0.19**	-0.48**	0.013**	0.028**	-0.003	-0.014
	(2.7)	(3.3)	(3.0)	(4.0)	(0.9)	(1.3)
Japan dummy*DUSD	-0.16		-0.015**		0.015**	
	(1.5)		(2.2)		(2.7)	
Change real interbank (USD)	0.07**	0.03	-0.0016	-0.011**	-0.0007	-0.004
	(3.5)	(0.9)	(1.2)	(5.9)	(0.7)	(1.1)
Years since last "bust"	1.0**	0.8	-0.054**	-0.11**	-0.13**	-0.3**
	(4.6)	(1.4)	(3.2)	(3.9)	(10.0)	(5.0)
Domestic ownership	-1.8	12.0**	-0.03	-0.76**	-0.12	0.04
	(1.0)	(2.6)	(0.2)	(3.2)	(1.0)	(0.1)
Obs	715	336	577	285	561	271
R2	0.29	0.27	0.51	0.81	0.36	0.21

Advanced countries are defined as Australia, Hong Kong SAR, Japan, New Zealand and Singapore, while emerging market economies are defined as China, Indonesia, Korea, Malaysia, Philippines and Thailand.
Note: all equations include country dummies—not reported in detail. * and ** indicate significance at 90 percent and 95 percent respectively.

Table 13. Equations Differentiating Foreign and Domestic Effects

Independent variables	Loan Growth		Asset Margin		Provision rate	
	Variable	Leveraged by domestic dummy	Variable	Leveraged by domestic dummy	Variable	Leveraged by domestic dummy
Constant	-14.6**		2.1**		2.0**	
	(2.0)		(4.9)		(3.9)	
Macro indicators						
GDP growth	0.38	0.63**	-0.03**	0.03	-0.07**	0.07**
	(1.4)	(1.9)	(2.2)	(1.5)	(3.8)	(2.8)
Inflation	-0.22	0.32	0.17**	-0.07**	0.04	0.003
	(0.6)	(0.6)	(6.2)	(2.1)	(1.2)	(0.1)
Interest rate	1.22**	-0.12	-0.52**	0.03	0.07*	-0.07
	(2.3)	(0.2)	(18.2)	(0.8)	(1.7)	(1.3)
Bank indicators						
Loan/Asset (-1)	-0.13*	0.05	0.033**	-0.014**	0.02**	-0.01
	(1.6)	(0.5)	(7.3)	(2.4)	(3.5)	(1.4)
Loan growth (-1)			-0.0044*	0.001	-0.012**	0.005
			(1.9)	(0.4)	(3.8)	(1.2)
Asset margin (-1)	-0.66	1.4*			0.01	-0.08
	(1.1)	(1.8)			(0.2)	(1.4)
Capital ratio (-1)	0.32*	0.4	0.009	-0.066**	-0.009	-0.004
	(1.7)	(1.4)	(0.6)	(3.3)	(0.5)	(0.1)
St funding/ Assets (-1)	0.11	-0.03	-0.003	0.008*	-0.015**	0.01*
	(1.3)	(0.4)	(0.7)	(1.7)	(2.3)	(1.9)
EBDTA (-1)					-0.05	-0.2**
					(0.8)	(2.4)
Additional variables						
Property share relative	0.03	0.03	0.003	-0.01**	0.01**	-0.02**
	(0.5)	(0.4)	(0.8)	(2.4)	(2.2)	(4.0)
Change in USD rate	-0.05	-0.12	0.008	0.005	-0.001	0.0008
	(0.5)	(0.9)	(1.4)	(0.6)	(0.2)	(0.1)
Japan dummy*DUSD	0.22*		0.002		0.04**	
	(1.8)		(0.3)		(3.9)	
Change in real interbank flows (USD)	0.08**	-0.019	-0.004**	-0.005**	-0.0004	-0.005*
	(2.8)	(0.5)	(2.4)	(2.2)	(0.2)	(1.9)
Years since last “bust”	1.6**	-0.88	-0.14**	0.06*	-0.23**	0.07
	(3.2)	(.1.5)	(4.4)	(1.8)	(5.7)	(1.4)
Obs	991		803		795	
R2	0.27		0.78		0.28	

Note: all equations include country dummies—not reported in detail. * and ** indicate significance at 90 percent and 95 percent respectively.

Table 14. Varying Property Price Proxies

Different asset price variables added to existing equations	Loan growth (Table 9)	Asset margin (Table 10)	Provisioning (Table 11)
Equation (8) full sample			
Change in property share index relative to broad equity index	0.05*	-0.004**	-0.004*
	(1.7)	(2.1)	(1.7)
Change in real house prices	-0.02	-0.007	-0.01
	(0.4)	(1.3)	(0.9)
Change in real share prices	-0.09**	0.009**	0.0004
	(3.6)	(3.9)	(0.1)
Equation (3) full sample			
Change in property share index relative to broad equity index	0.07**	-0.002	0.001
	(3.3)	(1.5)	(0.5)
Change in real house prices	0.08	-0.025**	0.002
	(1.6)	(4.7)	(0.1)
Change in real share prices	-0.12**	0.013**	-0.002
	(5.4)	(6.1)	(0.4)
Equation (8) full sample without exchange rate			
Change in property share index relative to broad equity index	0.066**	-0.002*	0.0001
	(3.2)	(1.7)	(0.1)
Change in real house prices	0.05	-0.016**	0.003
	(0.9)	(2.9)	(0.3)
Change in real share prices	-0.097**	0.011**	-0.005
	(4.6)	(5.2)	(0.9)
Equation (8) full sample without exchange rate variables and 1997, 1998 dummies			
Change in property share relative	0.059**	-0.001	0.0005
	(2.8)	(0.7)	(0.3)
Change in real house prices	0.044	-0.012**	0.003
	(0.9)	(2.2)	(0.3)
Change in real share prices	-0.083**	0.012**	-0.002**
	(3.8)	(5.5)	(5.1)

Note: All equations include country dummies—not reported in detail.

Table 15. Equations Differentiating Foreign and Domestic Effects using Residential Property Prices

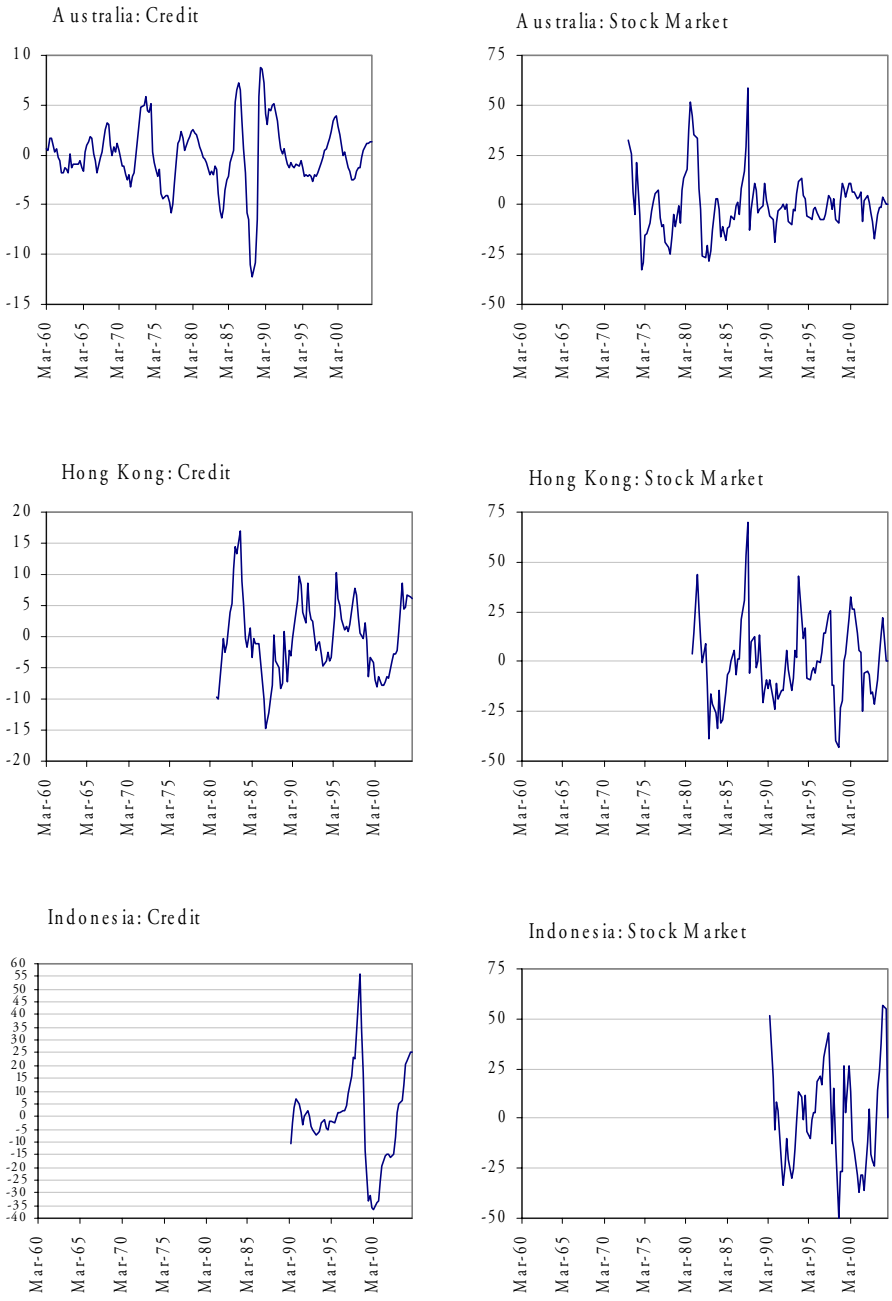
Independent variables	Loan Growth	
	Variable	Leveraged by domestic dummy
Constant	7.4	
	(0.66)	
Macro indicators		
GDP growth	0.06	0.80**
	(0.16)	(2.0)
Inflation	-2.03**	1.27**
	(7.0)	(3.4)
Interest rate	1.51**	-1.92**
	(5.4)	(5.4)
Bank indicators		
Loan/Asset (-1)	-0.32**	0.13
	(3.8)	(1.2)
Asset margin (-1)	0.87**	0.27
	(5.6)	(1.1)
Capital ratio (-1)	-0.50**	0.75**
	(2.4)	(3.0)
St funding/ Assets (-1)	0.28	0.07
	(0.31)	(0.5)
Additional variables		
Rise in real residential property price	0.23**	-0.23**
	(3.4)	(2.9)
Obs	991	
R2	0.40	

Note: All equations include country dummies—not reported in detail. * and ** indicate significance at 90 percent and 95 percent respectively.

Table 16. Estimates for public bank ownership dummy

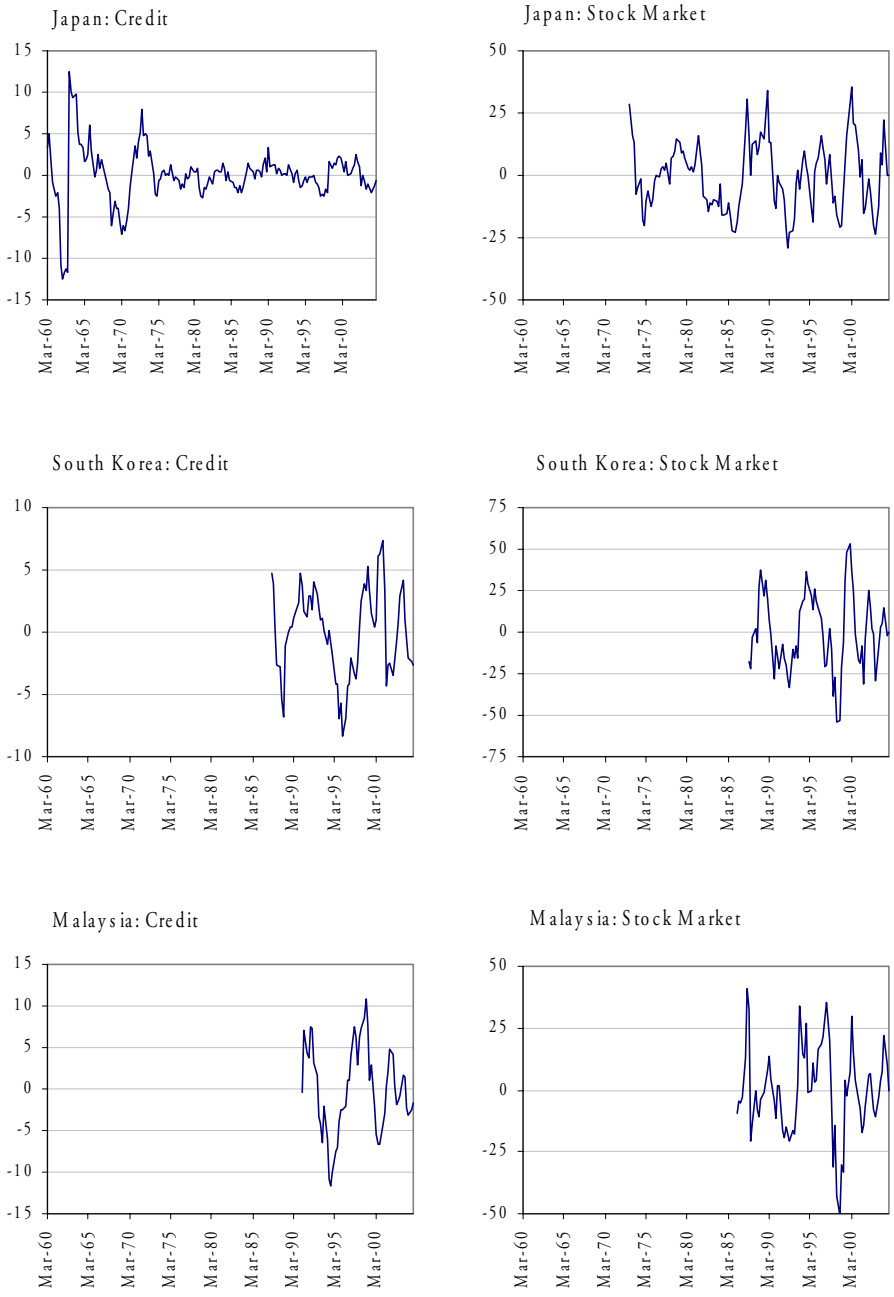
Independent variables	Loan growth (Table 9)	Asset margin (Table 10)	Provisioning (Table 11)
Equation (8) full sample			
Public banks dummy	-10.3**	-0.35**	0.44**
	(3.6)	(2.1)	(2.2)
Equation (7) full sample			
Public banks dummy	-8.5**	-0.41**	0.43**
	(3.0)	(2.5)	(2.2)
Equation (3) full sample			
Public banks dummy	-7.2**	-0.19	1.3**
	(2.7)	(0.6)	(2.8)

Figure 1. Credit and Asset Price Deviations from Trend



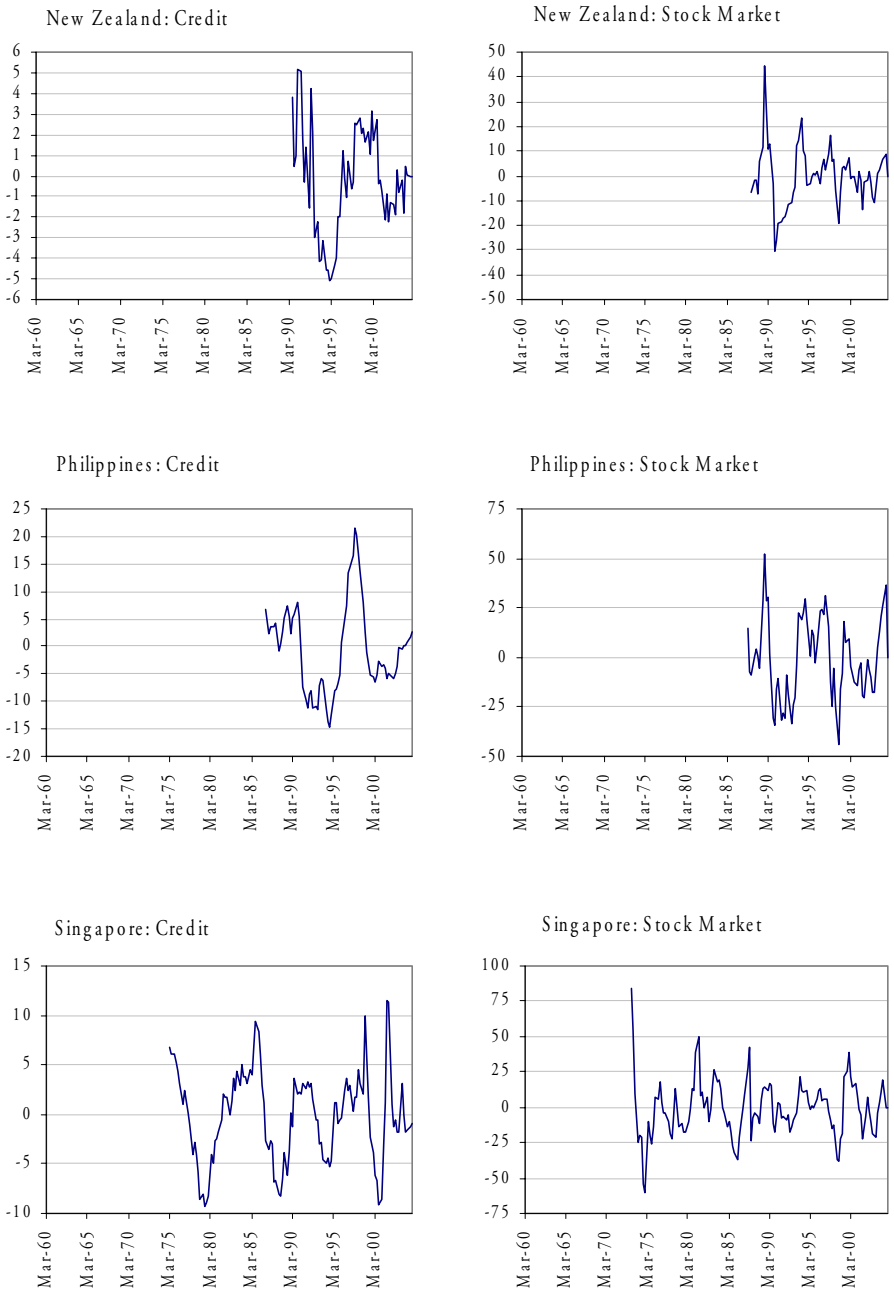
Source: Staff own estimates. The Credit series correspond to deviations of the seasonally adjusted series of private sector credit to GDP ratio from its long-run trend. The Stock Market series correspond to deviations of the ratio of stock market to CPI from its long-run trend.

Figure 1. Credit and Asset Price Deviations from Trend (continued)



Source: Staff own estimates. The Credit series correspond to deviations of the seasonally adjusted series of private sector credit to GDP ratio from its long-run trend. The Stock Market series correspond to deviations of the ratio of stock market to CPI from its long-run trend.

Figure 1. Credit and Asset Price Deviations from Trend (concluded)



Source: Staff own estimates. The Credit series correspond to deviations of the seasonally adjusted series of private sector credit to GDP ratio from its long-run trend. The Stock Market series correspond to deviations of the ratio of stock market to CPI from its long-run trend.

ESTIMATION OF THE MODEL USING MACROECONOMIC DATA

The model specification for real credit growth entails elements of both credit demand and supply. On the demand side, the growth of real private sector credit can be explained by the growth of real GDP, DLGDP, with an positive effect of economic activity on credit growth expected. On the supply side, the growth in real housing prices, DLRHP, is expected to have a positive effect on credit, as an increase in the value of collateral fosters granting of private sector credit. The acceleration of housing prices, DLRHP(t)-DLRHP(t-1), is added to the model specification in order to capture the effect of "rapid" movements in housing prices on credit boom-bust episodes. Also on the supply side, the value of the banking-sector stock index relative to the overall stock-market (BIN) is added to proxy for possible credit constraints related to poor bank performance in terms of profitability. In principle, it would have been desirable to include financial soundness indicator variables, but these were not available for the countries concerned over a sufficient time period. The effect of the real interest rate on credit is a-priori ambiguous. On the one hand, an increase in the interest rate (i.e., an increase in the price of loans) will tend to decrease the private demand for credit; on the other hand, rising interest rates tend to coincide with increasing private sector demand which tends to raise the demand for credit. Also financial liberalization, which eases credit constraints, typically raises the real interest rate.

$$DLRCR_{i,t} = \alpha_i + \sum_{j=0}^{b} \beta_j DLGDP_{i,t-j} + \delta_0 DLRHP_{i,t} + \delta_1 (DLRHP_{i,t} - DLRHP_{i,t-1}) + \sum_{j=2}^{d} \delta_j DLRHP_{i,t-j} + \sum_{j=0}^{f} \phi_j RIN_{i,t-j} + \sum_{j=0}^{z} \theta_j BIN_{i,t-j} + \sum_{j=0}^{m} \mu_j DLRCR_{i,t-j} + \rho ECT(t-1) + \varepsilon_{it} \quad (1)$$

- **DLRCR4(t)** = ln[(CR(t)/CPI(t)) / (CR(t-4)/CPI(t-4))] "annual growth of real credit", where ln denotes the natural logarithm, CR is credit to the private sector, CPI is the consumer price index, and t denotes quarters.
- **DLGDP4(t)** = ln[GDP(t)/GDP(t-4)] "annual growth or real GDP" GDP represents real GDP.
- **DLRHP4(t)** = ln[(HP(t)/CPI(t)) / ((HP(t-4)/CPI(t-4))] "annual growth of real housing prices", HP denote a housing price index from Datastream.
- **RIN(t) =** ln[(1+IN(t))/(1+PI(t))] "real interest rate", where IN denotes the money market interest rate, and PI is the annual (CPI based) inflation rate.
- **BIN(t)** = bank stock index relative to the market stock index.[8]
- **ECT(t)** = "error correction term" defined as the linear combination of LRCR4, LGDP4, LRHP4, RIN, and BIN, where the weights correspond to the country-specific cointegrating vector based on the Johansen approach.

[8] BIN, which proxies supply-side determinants of bank credit, turned out to be insignificant in the panel specifications hence it was excluded from the final models. It was however, found marginally significant in the estimation of the long-run cointegration relationships, thus it was included in the cointegrating vectors.

In addition to the cyclical (or short-run) determinants of real credit, in some specifications an error correction term (ECT) is added to capture deviations of real credit from its long-term fundamentals, which include output, interest rate, housing prices, and BIN. This specification is similar to a vector error correction model which includes short-term determinants of credit growth and long-term determinants—the latter captured by the ECT. The ECT is constructed based on a country-by-country estimation of a cointegration relationship by applying the Johansen method to the levels of real credit, interest rate, housing prices, and BIN. The parameter ρ measures the degree of mean reversion of credit to its long-run equilibrium, hence a negative relationship is expected between the ECT and credit growth.[9]

As noted above, macro data shows that asset prices lead credit and are positively correlated with it (Table 6). On the other hand, asset prices and GDP are broadly contemporaneously—and positively—correlated (Table 7). Splitting between periods with above and below average GDP growth (Table 10 and 11) we find that between house prices and real GDP there is virtually no correlation in the boom period but a very strong one in the downturn, whereby real house prices lead or change contemporaneously with real GDP. As regards the link of house prices to credit, there is a link both in the boom and recession, albeit stronger in the latter, with credit lagging house prices. These results are consistent with pro-cyclicality driven by asset prices and collateral, whereby asset prices drive credit availability both in the upturn and the downturn, but real economic effects are particularly strong in the downturn.

Estimation results for the model based on time series data

Turning to the OLS estimation of equations for real credit growth using macro data, they are consistent with a marked effect of asset prices as well as GDP on credit. In more detail, results of the fixed-effects panel estimation of equation (1) without an error correction term (ECT) are shown in Table 17.[10] Table 17 presents 5 different specifications, ranking from general (Model 1) to specific (Model 5). The lag-length specification for the right-hand-side variables was statistically determined—based on the significance of the corresponding lagged-variables, the Akaike information criterion, and the structure of the residuals of the regression. According to the model selection criteria, Model 5 is the "preferred" specification. In Model 5, the variables have the expected qualitative effect on the growth of credit: GDP and the housing price index have a positive and significant effect on credit; the acceleration term on the housing price index has a positive and significant effect on credit (at the 90 percent confidence level). The real interest rate has a positive and significant effect on credit, consistent with the demand side effect. However, credit growth falls with an increase in the real interest rate in period (t-1), the effect is also statistically significant. Additionally, an increase in last year's real interest rate (t-4) has a negative effect on credit growth. Note

[9] The results of the Johansen cointegration analysis are available from the author upon request.

[10] The panel includes Australia, Hong Kong SAR, Japan, Indonesia, South Korea, Malaysia, New Zealand, Singapore, and Thailand for the period 1960:1 to 2004:3 (only for a small sub-sample of countries a full time series is available including Australia, Japan, and New Zealand).

that the real interest rate in (t-2) and (t-3) are not significant and were dropped from Model 5. BIN as well as all of its lagged values were not found statistically significant in any of the model specifications, hence they were dropped—with no qualitative impact on the estimates of the rest of the equation.

Lagged values of the dependent variable were also included in the specification in order to account for the autocorrelation structure observed in the credit data.[11] It is interesting to see how lag (t-4), i.e., last year's value, has a relatively large and significant negative effect on the current period growth rate, which could be interpreted as banks making credit growth decisions for next year based on current credit portfolio conditions. In other words, when banks experience a period of significant credit expansion, they may tend to cut next year's private credit growth.

Table 18 shows the fixed effect panel estimates for a sub-sample of countries: Australia, Hong Kong SAR, Japan, South Korea and Singapore. The sub-sample was selected based on those countries where (i) a long enough time series was available to perform cointegration analysis and (ii) evidence of long-run cointegration was found. Table 18 presents three model specifications: Model 1 shows a similar specification to that of Model 5 in Table 17—without the error correction term. The effect of all the variables is qualitatively similar to that of Model 5 in Table 18, with the exception of the fourth lag of the real interest rate which turned out to be statistically insignificant and dropped from the specification. Model 2 adds an ECT to Model 1. The ECT has a negative effect as expected, but it turns out not to be statistically significant. To investigate whether mean reversion takes place in a non linear fashion, the square of the ECT ("ECT^2") is added to the specification in Model 3. The results show that "ECT^2" has a negative and significant effect on credit growth, suggesting that large deviations of real credit from its long-run determinants tends to have a comparatively larger effect on credit growth (i.e., tend to be absorbed relatively faster) relative to smaller deviations from long-run equilibrium.

[11] The optimal lag structure (5 lags) was based on the analysis of the residuals and the Akaike information criterion.

Table 1. Determinants of Credit Growth, Panel Estimation

	Model 1	Model 2	Model 3	Model 4	Model 5
DLGDP(t)	0.1480	0.0919	0.0965	0.0954	0.1022
	0.0105	0.0160	0.0067	0.0073	0.0036
DLGDP(t-1)	-0.1190				
	0.1058				
DLGDP(t-2)	0.0960				
	0.1889				
DLGDP(t-3)	-0.0239				
	0.7416				
DLGDP(t-4)	0.0965				
	0.0919				
DLRHP(t)	0.0272	0.0321	0.0266	0.0263	0.0285
	0.0412	0.0215	0.0061	0.0064	0.0025
DLRHP(t)-DLRHP(t-1)	0.0205	0.0246	0.0193	0.0204	0.0199
	0.1203	0.0859	0.0915	0.0728	0.0729
DLRHP(t-2)	-0.0115	-0.0147			
	0.4446	0.3633			
DLRHP(t-3)	0.0050	0.0050			
	0.7295	0.7463			
DLRHP(t-4)	0.0046	0.0170			
	0.7469	0.2484			
RIN(t)	0.4080	0.4113	0.4199	0.4261	0.4227
	0.0000	0.0000	0.0000	0.0000	0.0000
RIN(t-1)	-0.1542	-0.2184	-0.2248	-0.2303	-0.2301
	0.2225	0.0696	0.0517	0.0137	0.0122
RIN(t-2)	-0.1166	-0.0662	-0.0769		
	0.3492	0.5774	0.5009		
RIN(t-3)	0.1725	0.1782	0.1636		
	0.1607	0.1287	0.1482		
RIN(t-4)	-0.1959	-0.2033	-0.1898	-0.1043	-0.0944
	0.0274	0.0168	0.0205	0.0408	0.0591
DLRCR(t-1)	0.9977	1.0145	1.0174	1.0160	0.9685
	0.0000	0.0000	0.0000	0.0000	0.0000
DLRCR(t-2)	0.0332	0.0294	0.0258	0.0225	0.0777
	0.6133	0.6521	0.6854	0.7183	0.1360
DLRCR(t-3)	-0.0747	-0.0920	-0.0863	-0.0697	-0.0447
	0.2198	0.1274	0.1400	0.2254	0.3878
DLRCR(t-4)	-0.5432	-0.5235	-0.5076	-0.5127	-0.5161
	0.0000	0.0000	0.0000	0.0000	0.0000
DLRCR(t-5)	0.5189	0.5231	0.5187	0.5056	0.3818
	0.0000	0.0000	0.0000	0.0000	0.0000
DLRCR(t-6)	-0.0657	-0.0804	-0.0809	-0.0718	
	0.3073	0.2038	0.1853	0.2370	
DLRCR(t-7)	-0.0523	-0.0402	-0.0409	-0.0423	
	0.2252	0.3418	0.3222	0.3047	
R-squared	0.8317	0.8272	0.8264	0.8254	0.8217
Adjusted R-squared	0.8227	0.8191	0.8195	0.8192	0.8160
Durbin-Watson stat.	2.2005	2.2045	2.1964	2.2038	2.0877

Source: Staff own estimates. The panel includes Australia, HK, Japan, Indonesia, South Korea, Malaysia, New Zealand, Singapore, and Thailand. It covers the period 1960:1 to 2004:2, however only in a few countries, including Australia, Japan and New Zealand, a complete time series was available. See Appendix 1 for variables definition. The figures under the coefficient estimates are p-values; a p-value below 0.05 indicates significance at a 95 percent confidence level. The panel also includes country-specific fixed-effects.

Table 2: Determinants of Credit Growth, Panel Estimation

	Model 1	Model 2	Model 3
ECT(t-1)		-0.0021	-0.0064
		0.7487	0.3680
ECT(t-1)^2			-0.0246
			0.0477
DLGDP(t)	0.0760	0.0803	0.0752
	0.0126	0.0113	0.0187
DLRHP(t)	0.0516	0.0439	0.0414
	0.0000	0.0003	0.0007
DLRHP(t)-DLRHP(t-1)	0.0850	0.0731	0.0668
	0.0004	0.0064	0.0117
RIN(t)	0.4244	0.4355	0.4044
	0.0000	0.0000	0.0000
RIN(t-1)	-0.3381	-0.3098	-0.2841
	0.0000	0.0001	0.0004
DLRCR(t-1)	0.9844	0.9593	0.9614
	0.0000	0.0000	0.0000
DLRCR(t-4)	-0.4447	-0.4451	-0.4464
	0.0000	0.0000	0.0000
DLRCR(t-5)	0.3186	0.3111	0.3202
	0.0000	0.0000	0.0000
R-squared	0.8970	0.8963	0.8978
Adjusted R-squared	0.8943	0.8932	0.8946
Durbin-Watson stat.	1.8581	1.8372	1.8540

Source: Staff own estimates. The panel includes Australia, HK, Japan, South Korea, and Singapore (those countries for which (i) an adequate time-series length was available and (ii) evidence of cointegration was found). It covers the period 1960:1 to 2004:2, however only in a few countries, including Australia and Japan, a complete time series was available. See Appendix 1 for variables definition. The figures under the coefficient estimates are p-values; a p-value below 0.05 indicates significance at a 95 percent confidence level. The panel also includes country-specific fixed-effects.

PROPERTY PRICES AND CREDIT GROWTH AND RISKS TO FINANCIAL STABILITY

As is well known, sustained credit growth and large increases in asset prices appear not just to contribute to pro-cyclicality, as demonstrated above, but also to increase the probability of financial instability. This has led to research into the behavior of credit and asset prices to assess whether significant deviations from their trend values can be used as indicators of the risk of a financial crisis.

1. Identifying Crisis Thresholds

Borio and Lowe (2002) propose a methodology to detect future financial sector problems by examining the behavior of credit and asset prices. The approach—building upon the work of Kaminsky and Reinhart (1999)—consists of a threshold analysis for financial indicators. The framework proposes that deviations of credit and asset prices above a threshold constitutes an "early warning" for the policy maker, signaling potential financial-sector vulnerabilities in the near future. Two indicators are considered: the ratio of credit to GDP and the ratio of stock market index to the CPI.[12] The threshold values of these indicators are computed using an algorithm that minimizes the noise to signal ratio—i.e., the ratio of Type II errors to one minus the size of Type I error, for a given level of Type I error.[13] It is reported that the lowest noise to signal ratio in forecasting financial crises over a 3-year forecast horizon is accomplished in the event of coincident signals by the two variables (rather than each one separately). Based on a cross-section of 34 countries for the period 1960 to 1999, it is estimated that credit gaps (gaps above long-run trend) of about 4 to 5 percent and asset price gaps of about 40 to 50 percent provide the best threshold combination to project future problems in the financial system.

2. Methodology

The Borio and Lowe (2003) methodology uses two financial indicators, the credit to GDP ratio and real asset prices (i.e., the ratio of stock market index to CPI). With the help of time series techniques, we separate trend from cycle in order to assess whether there is evidence of "excessive" deviations in the actual series from their long-term trend. "Excessive" deviations are defined as movements beyond the B&L thresholds. In separating trend and cycle in the credit to GDP series, we take the following steps:

- Step 1: An ARIMA model is fitted to the series, as well as to its seasonal component—provided that a seasonal component is present in the quarterly series.

[12] Borio and Lowe (2002) also add the investment gap, however, it makes no significant improvement in the forecasting ability of the indicators: although it reduces marginally the noise to signal ratio, it also reduces the number of crises that are correctly predicted.

[13] Type I error are the percentage of financial distress that are not correctly predicted. Type II error are the percent of non-crisis periods in which a crisis is incorrectly signaled. An indicator is consider to successfully signal a crisis if it is "on" in the year of the crisis.

- Step 2: A Hodrick-Prescott filter is applied to the fitted ARIMA specification with a conventional smoothing parameter of 1,600 for quarterly data.

- Step 3: The percentage deviation of the seasonally adjusted series from its trend is computed. Values above 5 percent are considered a signal of a vulnerable financial system to future financial distress.

The process of separating cycle from trend in the real asset price is less complex, as the asset price series are well-approximated by a random walk. Thus, there is no need for ARIMA modeling or seasonal adjustment, and a Hodrick-Prescott filter can be directly applied to the real asset price series. The deviation from trend is computed as the percentage difference of the actual series from the trend. Values above 50 percent are considered a signal of a vulnerable financial system.

3. Episodes of Rapid Credit Growth and Sharp Asset Price Changes

The existence of significant credit and asset price gaps in recent periods is investigated in the following East Asian countries: Australia, Hong Kong SAR, Indonesia, Japan, South Korea, Malaysia, New Zealand, Philippines, Singapore, and Thailand. The sample covers the period 1960:1 to 2004:3. The results of the analysis are shown in Figure 1, which presents deviations of the credit and asset price series from their long-term trend (i.e., credit and asset price gaps). In Australia, Japan, South Korea, Malaysia, New Zealand, the Philippines, Singapore, and Thailand, both the credit and asset price gaps are within the Borio and Lowe threshold—although Thailand's credit gap of 3.5 percent appears to be on a rising trend. There are two cases in which either one or both of the indicators are above the threshold. In Hong Kong SAR, the credit gap is 6.2 percent, however there is no evidence in recent periods of large asset price gaps. In Indonesia, both a sizeable credit gap of 25 percent and a moderate asset price gap of 55 percent are above the respective thresholds. The asset price increase seems to be a relatively recent phenomenon, as there is no evidence of excessive positive gaps in the recent periods.[14]

Overall, based on the credit and asset price gap analysis, there appears to be no evidence of significant growing vulnerabilities for the sample of countries considered, with the exception of Indonesia. However, caution is needed in interpreting these results. First, the threshold used for this analysis may not be the best suited to the sample of countries in this paper. Borio and Lowe (2002) used a broader sample of 34 countries (which excluded the Philippines). Although the methodology provides a common threshold for the entire cross-section of countries, there may be country-specific or regional-specific differences. Second, their calibration of the thresholds was based on annual data (for the period 1960 to 1999) while we use quarterly data. Third, the methodology give only a "zero/one" signal, however, the size of the credit gap and the asset price gap matters so an upward trend in those gaps that remains below the threshold corresponds to growing vulnerabilities (Figure 1).

[14] For the case of Indonesia, given the relatively short length of the time series, the estimation of the trend and cycle may suffer from a short-sample bias.

DATA AND ADDITIONAL REGRESSIONS

Table 1. Correlation Coefficients with Fourth Difference of Log of Real GDP—Cyclical Asymmetries Since 1990

Boom (Growth Exceeding Average)	Fourth Difference of Log of Real Credit (+4)	Fourth Difference of Log of Real Credit
Australia	0.01	0.20
China	-0.05	-0.34
Hong Kong SAR	-0.57	-0.67
Indonesia	0.01	0.48
Japan	0.88	0.99
Korea	0.56	0.71
Malaysia	0.05	0.12
New Zealand	-0.22	-0.14
Philippines	0.24	0.34
Singapore	0.35	0.09
Thailand	0.33	0.55
Average	0.14	0.21
Recession (growth below average)		
Australia	0.71	0.37
China	0.13	-0.02
Hong Kong SAR	0.42	0.72
Indonesia	0.90	0.19
Japan	0.25	0.31
Korea	-0.39	0.52
Malaysia	0.52	0.35
New Zealand	0.12	0.26
Philippines	0.19	0.56
Singapore	0.79	0.05
Thailand	0.31	-0.30
Average	0.36	0.27

Table 2. Correlation Coefficients with Fourth Difference of Log of Real GDP—Cyclical Asymmetries since 1990

Boom (Growth Exceeding Average)	Fourth Difference of Log of Real House Prices (+4)	Fourth Difference of Log of Real House Prices
Australia	0.03	0.06
China		
Hong Kong SAR	-0.39	-0.59
Indonesia	0.15	-0.37
Japan	0.17	0.99
Korea	0.33	0.56
Malaysia	0.92	
New Zealand	0.20	0.21
Philippines		
Singapore	0.22	0.44
Thailand	-0.20	-0.30
Average	0.16	0.13
Recession (Growth Below Average)		
Australia	0.04	0.30
China		
Hong Kong SAR	0.07	0.78
Indonesia	-0.11	0.95
Japan	-0.27	0.20
Korea	-0.20	0.52
Malaysia	-0.06	0.81
New Zealand	0.12	0.25
Philippines		
Singapore	0.04	0.65
Thailand	-0.08	0.63
Average	-0.05	0.57

Note: all equations include country dummies—not reported in detail. * and ** indicate significance at 90 percent and 95 percent respectively.

Table 3. Correlation Coefficients with Fourth Difference of Log of Real House Prices—Cyclical Asymmetries since 1990

Boom (Growth Exceeding Average)	Fourth Difference of Log of Real Credit (+4)	Fourth Difference of Log of Real Credit
Australia	0.30	0.22
China		
Hong Kong SAR	-0.91	0.94
Indonesia	-0.20	-0.50
Japan	-0.99	-0.24
Korea	0.15	0.14
Malaysia		
New Zealand	-0.07	-0.04
Philippines		
Singapore	0.04	0.05
Thailand	-0.33	-0.79
Average	-0.25	-0.03
Recession (Growth Below Average)		
Australia	0.06	-0.06
China		
Hong Kong SAR	0.20	0.29
Indonesia	-0.57	0.55
Japan	-0.16	0.18
Korea	-0.01	0.30
Malaysia	-0.61	0.26
New Zealand	0.00	0.32
Philippines		
Singapore	0.17	0.07
Thailand	-0.75	0.65
Average	-0.19	0.28

Table 4. Number of Banks per Country

Country	Number of banks	Of which foreign
Australia	12	4
China	24	3
Hong Kong SAR	17	9
Indonesia	17	9
Japan	102	1
Korea	15	2
Malaysia	20	10
New Zealand	5	4
Philippines	15	4
Singapore	4	1
Thailand	9	2
Total	242	49

Table 5. Characteristics of the Bankscope Sample

Variable	Observations	Mean	SD	Min	Max
Loan/asset ratio	1579	61.00	13.80	10.0	90.0
Loan growth	1330	5.80	20.40	-99.5	99.3
Asset margin	1576	0.47	4.55	-47.0	9.4
Unadjusted capital ratio	1589	7.65	8.48	-84.0	100.0
St funding/assets	1586	82.10	13.50	0.5	173.0
EBDTA/assets	1455	1.30	1.73	-14.5	16.8
Provisions/assets	1455	0.97	2.74	-8.9	67.8
Memo: ROAA	1584	0.17	2.95	-70.7	8.8

Table 6. Equations for Hong Kong SAR

Independent variables	Loan Growth	Asset Margin	Provisioning
Constant	24.0	6.2**	4.7**
	(0.9)	(3.5)	(2.4)
Macro indicators			
GDP growth	1.0*	-0.11**	0.002
	(1.6)	(2.9)	(0.6)
Inflation	0.54	0.27**	0.02
	(1.1)	(5.8)	(0.5)
Interest rate	0.005	-0.2**	-0.05
	(0.1)	(2.4)	(0.6)
Bank indicators			
Loan/Asset (-1)	-0.4**	0.03**	0.026*
	(2.0)	(2.7)	(1.8)
Loan growth		-0.004	-0.022**
(-1)		(0.6)	(4.1)
Asset margin	-0.95		0.04
(-1)	(1.0)		(0.6)
Capital ratio	0.47	-0.009	-0.016
(-1)	(1.2)	(0.3)	(0.6)
St funding/ Assets (-1)	-0.03	-0.04**	-0.06**
	(0.1)	(2.1)	(3.0)
EBDTA			-0.13
(-1)			(0.8)
Additional variables			
Property share relative	0.11	0.03**	-0.001
	(1.1)	(4.2)	(0.1)
Change real interbank	0.043	0.02**	-0.007
(USD)	(0.3)	(2.4)	(1.0)
Years since last “bust”	1.23	-0.23**	-0.096*
	(1.3)	(3.8)	(1.8)
Domestic ownership	-7.8**	0.08	-0.09
	(2.2)	(0.4)	(0.4)
Observations	110	93	93
R2	0.22	0.76	0.34

Note: * and ** indicate significance at 90 percent and 95 percent respectively.

Table 7. Equations Excluding Japan

Independent variables	Loan Growth	Asset Margin	Provisioning
Constant	-3.4	2.1**	1.3**
	(0.3)	(2.9)	(1.4)
Macro indicators			
GDP growth	0.7**	-0.014	-0.04**
	(3.0)	(1.0)	(2.3)
Inflation	-0.05	0.13**	0.035
	(0.1)	(5.3)	(1.0)
Interest rate	1.24**	-0.49**	0.034
	(2.8)	(18.7)	(1.0)
Bank indicators			
Loan/Asset (-1)	-0.16*	0.026**	0.018**
	(1.9)	(5.7)	(3.0)
Loan growth (-1)		-0.0029	-0.009**
		(1.4)	(3.5)
Asset margin (-1)	0.16		-0.06*
	(0.3)		(1.6)
Capital ratio (-1)	0.33	-0.009	0.0012
	(1.4)	(0.6)	(0.1)
St funding/ Assets (-1)	-0.013	0.0013	-0.0002
	(0.1)	(0.2)	(0.1)
EBDTA/Assets (-1)			-0.21**
			(3.2)
Additional variables			
Property share relative	0.06	0.001	-0.0045
	(1.1)	(0.3)	(1.3)
Change in USD rate	-0.12	0.009*	-0.0007
	(1.5)	(1.9)	(0.1)
Change real interbank	0.05**	-0.006**	-0.0011
(USD)	(2.3)	(4.1)	(0.6)
Years since last “bust”	1.17**	-0.12**	-0.19**
	(2.9)	(4.9)	(6.0)
Domestic ownership	6.8**	-0.31**	-0.001
	(2.4)	(2.0)	(0.1)
Observations	596	468	452
R2	0.18	0.76	0.25

Note: * and ** indicate significance at 90 percent and 95 percent respectively.

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