

Basel II and Bank Portfolios: Implications for Property Booms and Financial Stability*

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Second Draft

June 2006

* Paper prepared for the 2006 KDI conference “Adopting the New Basel Accord: Impact and Policy Responses of Asian-Pacific Developing Countries”.

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1. Overview

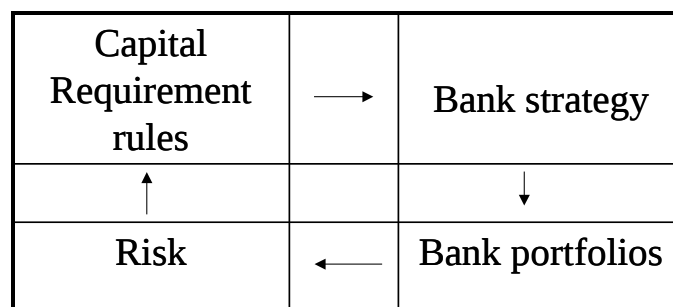
The Basel II rules for determining the minimum capital requirement to meet credit risk were designed with the intention of bringing regulatory bank capital into closer alignment with the true economic risks on a bank's balance sheet. The aim was to maintain the same level of overall regulatory capital in the banking system as under the previous 1988 Basel Capital Accord, but to introduce differences in the regulatory capital depending on the type of borrower and the probability of default. In general, loans to retail borrowers are favored relative to loans to corporate or inter-bank borrowers, in the sense that the regulatory capital requirements are lower (for given probability of default) for retail loans as against corporate or inter-bank loans. Mortgage loans receive particularly favorable treatment under Basel II. The various Quantitative Impact Studies (QIS) organized by the Basel Committee on Banking Supervision (and in particular the third study, QIS3 published in 2003) have confirmed that banks that specialize in retail business and mortgage lending will benefit from very substantial reductions in regulatory capital. The favorable treatment accorded to retail and mortgage loans are "hard-wired" into the system in the sense that the formulas for regulatory capital follow very specific functional forms (as described below) for each category of borrower.

The favorable treatment of retail and mortgage loans draw their justification from the empirical evidence of lower credit risk associated with such loans in the past. However, there are two issues. First, the evidence is drawn from the member countries of the Basel Committee, and hence from countries with advanced financial systems. It is unclear how applicable such evidence is for emerging market countries.

Second, and more importantly, it is questionable whether such empirical associations will remain robust when banks' portfolios change over time. The impact of differential regulatory capital requirements across types of loans will have unavoidable repercussions on the portfolio decisions of banks, and the broader business strategies pursued by them. Under Basel II, it would be reasonable to conjecture that bank lending will be

increasingly skewed toward property-based lending, and especially to residential property lending. However, such increases in property based lending will have important financial stability implications, as credit-fuelled property booms lay the foundations for subsequent busts.

In short, credit risk is endogenous. Credit risk depends on the overall portfolio choices made by the banks themselves. In turn, the portfolio decisions will be affected (in part) by bank capital regulation. Finally, a risk-based approach to bank capital regulation must take heed of credit risk. Regulatory capital requirements depend on credit risk. Credit risk depends on bank portfolios. Bank portfolios, in turn, are influenced by regulatory capital requirements.



Thus, we come full circle, as illustrated above. The endogeneity of credit risk sits uncomfortably with the rigid formulas laid down in the Basel II regulations. Although banks have some discretion in choosing the parameters of the credit risk model, the formulas themselves are laid down rigidly, as we will see below.

The crucial question is this. How will banks' behavior change in response to Basel II? How much will the banks' business strategies (and hence their portfolios) be influenced by the incentives they face in terms of lower capital requirements? It seems hardly credible that banks' behavior will remain unchanged with the introduction of Basel II. The more banks react to the favorable treatment of some classes of loans, the more their portfolios will reflect such disparities.

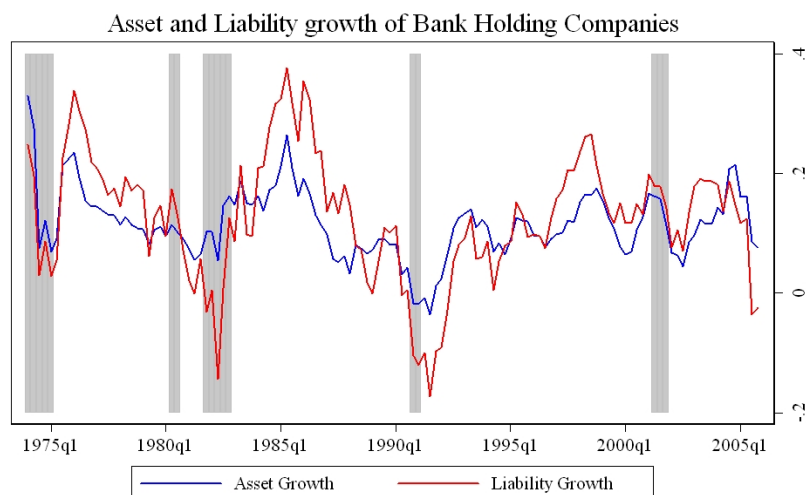
However, much more important than the initial shifts in the banks' portfolios will be the broader feedback effects that ripple through the financial system as a whole. As more credit flows into property-based lending, the overall impact on the financial system (and hence the credit risk on the banks' balance sheets) will depend on the strength of the feedback effects generated by such one-off shift in bank portfolios.

In some ways, many of the desirable features of Basel II are precisely those that increase the potential for amplification of the financial cycle. It is widely acknowledged that the introduction of Basel II will spur the development risk management within the banking sector. Not only will there be adoption of new techniques, but more importantly, Basel II will raise the profile of risk management and risk control within the banking organization to the highest level. Risk management would not simply be the "back office" function of technical staff, but would become a core part of the commercial strategy of the bank, being represented at the highest level of the bank's management and board. However, the heightened awareness of risk within the banking organization is unlikely to guarantee the stability of the overall financial system. The reason is that an individual bank's strategy in managing risk efficiently is based on that bank's balance sheet alone.

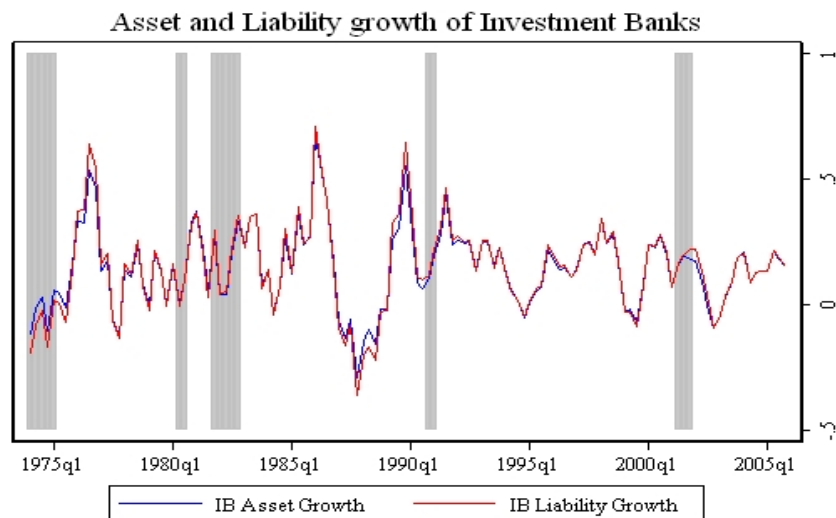
A bank is a leveraged institution – it has liabilities to depositors and other lenders in the financial system. Thus, when the value of its assets rise, its equity value rises at a much faster rate. Thus, when the value of its assets rise, the bank's leverage falls – its equity as a proportion of its liabilities falls. How does the bank react to such an erosion of its leverage? The more the bank is conscious of the bank's profitability as measured by its return on equity, the greater is the incentive to restore leverage by increasing its lending. Indeed, the trend in recent years towards improved corporate governance through greater transparency, greater accountability to shareholders and greater use of incentive schemes tied to the share price will all strengthen the motives of the management to restore leverage. The motivation to restore leverage will be more accentuated for those banks that have adopted more advanced internal management and capital allocation systems such as RAROC (Risk Adjusted Rate of Return on Capital) that attempts to align the activities of the bank to its most profitable activities given their capital.

The empirical evidence on the behavior of banks suggests that they are acutely conscious of their overall leverage, and will act so as to manage their leverage actively. Consider the following charts for banks in the United States, drawn from Adrian and Shin (2006).

The first chart shows the changes in the assets and liabilities of bank holding companies – essentially, the commercial banks. It is apparent that liabilities are much more volatile than the assets, implying that the overall book leverage of commercial banks are highest during booms and lowest during troughs. In other words, bank leverage is *pro-cyclical*. During booms, banks increase their liabilities more than the increases in their assets, resulting in higher leverage. During the troughs, they reduce their liabilities more drastically than their assets, resulting in lower leverage during downturns.

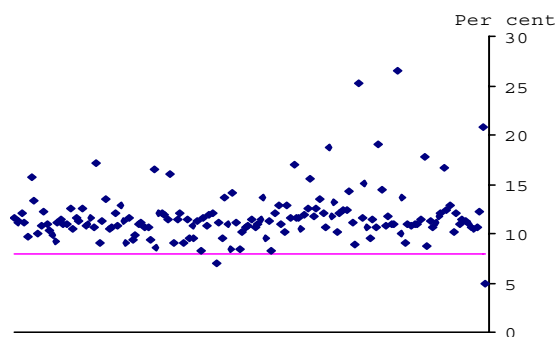


For commercial banks, a large proportion of their assets are loans that are carried at book value. During booms, the book value of loans will understate the market value of such loans, while during troughs in the financial cycle, the book value will *overstate* the market value of such loans. Thus, the chart above for commercial banks is likely to overstate the fluctuations in leverage. Much more striking is the following chart, again for the United States, but this time for investment banks (including brokerage firms).



For investment banks and brokerage firms, their assets consist of marketable claims, and hence the accounting value of their assets would closely mirror the marked-to-market value of such claims. What is striking about the chart above is that the changes in assets and liabilities are almost one-for-one. In other words, it appears that banks have a target leverage ratio, and they will adjust their balance sheets so as to hit this target leverage.

There is another perspective on the issue of banks having a target leverage. It is well known that most G10 banks (as well as many outside the G10) maintain bank capital that is substantially above the regulatory minimum of 8% of risk-weighted assets. The following chart is a snapshot of G10 bank capital ratios reported in Jackson (2001).



G10 Banks Capital Ratios. (Source: Jackson (2001)).

It is apparent from the chart that most G10 banks cluster around the 10 – 12% capital ratio level, indicating a substantial buffer over the regulatory minimum. It is market wisdom that banks aim to target a particular credit rating (single-A or double-A), and that they will adjust their leverage so as to achieve this target. Jackson, Perraudin and Saporta (2002) point to the market discipline exerted by the rating agencies in the interbank swaps market. They argue that banks feel obliged to maintain high levels of capital beyond the regulatory minimum in order to obtain sufficient access to credit markets, including swap and interbank markets for their everyday business. Banks are seen to “target” a particular credit rating (A or above), and they maintain a high capital level to achieve this target. When a bank gets close to its regulatory minimum capital ratio, it loses freedom of action in its daily business, and will be forced to raise new capital or curtail loans. These activities are costly. Hence, banks have an incentive to maintain a cushion of capital above the regulatory minimum so that the additional safety margin will protect them from going too close to the regulatory minimum. A bank’s rating will reflect the value of the capital buffer. Thus, the credit rating of a bank is, itself, an endogenous response that takes into account the regulatory minimum. The upward drift in the capital held by the G10 banks following the 1988 Basel Accord (rising from an average of 9.3% in 1988 to 11.2% in 1996) provides some support for these arguments.

There are far-reaching implications for the amplification of financial cycles when banks aim to maintain a target leverage ratio. The key implication of target leverage is the perverse nature of the demand and supply responses for financial assets over the financial cycle. Contrary to the textbook norm, demand curves become *upward-sloping*, and supply curves become *downward-sloping*.

To see this, consider an increase in the price of residential housing, which strengthens the banks’ balance sheets. When banks’ balance sheets become stronger, their leverage falls, and measures of profitability such as return on equity (ROE) will also fall. If the banks attempt to restore their leverage, they can do so by increasing their lending on residential property. When residential property lending increases, more households borrow to buy

housing, raising the demand for housing. In short, a rise in house prices can lead to an *increase* in the demand for housing. The demand curve for housing is upward-sloping.

The mechanism works exactly in reverse in downturns. Consider a fall in the price of housing. Then, the marked-to-market value of banks' assets falls due to the fall in credit quality of their loans. This leads to an increase in the banks' leverage, since the equity of the bank falls much faster than the asset value of the bank. A bank that attempts to reduce leverage must reduce its lending activities and pay down its liabilities. The flow of credit into the housing sector then slows, and the housing market cools. Thus, a *fall* in house prices could lead to a *rise* in the supply of housing. The supply curve for housing could be *downward*-sloping.

For an individual bank, targeting of leverage may be an entirely natural response to the commercial incentives that it faces. However, when the behavior of the *whole banking sector* is determined in this way, there is the potential for amplification of financial cycles. True credit risk is highest at the peak of the housing cycle – when property prices are high, and balance sheets are generally strong. The strength of banks' balance sheets depends on the prices of the assets on their balance sheet, and in particular on the credit-worthiness of their borrowers. As property prices rise, the higher is the value of collateral assets that back the property loans, and hence the stronger is the banks' balance sheets.

For an economy that is experiencing a boom in residential property prices, property-backed lending will play a pivotal part in fuelling (or accommodating) this boom. The low capital requirement of residential lending will attract additional entry by banks eager to take advantage of the low capital requirement. Household indebtedness will rise, backed by higher valued claims on residential property. However, as property prices rise, and household indebtedness continue to rise, the greater will be the danger that the property boom turns into a property bubble. The elevated value of the collateral assets – the housing stock – will fail to reflect the potential for a downturn. Thus, just at the point where the risk of a housing price collapse is highest, banks' balance sheets will be at their strongest, and there will be the greatest incentives of banks to chase marginal borrowers

in the property market in order to restore their eroding leverage. At the peak of the housing cycle, there is much talk of there being “excess capacity” in the banking sector. Here, the “excess capacity” refers to the excess capital in the banking sector that reflects the generally strong balance sheets of the banks. Banks seek to deploy the excess capital in order to maintain their profitability as measured by return on equity (ROE), and seek out increasingly marginal borrowers, and extend increasingly generous terms.

Prudential regulation is unlikely (by itself) to arrest such developments. The reason why prudential regulation may be powerless in arresting the development of a bubble is because during the build-up phase of the bubble, the banks’ balance sheets will show considerable strength. Indeed, the amplifying mechanism hinted above (and developed in more detail below) arises from the feedback from the strong balance sheets of the banks. Prudential regulation is predicated on signs of *weakness* in a bank’s balance sheet. As such, the regulator will feel constrained to act in arresting the development of a bubble, when the reasons for intervention are not clear-cut from an individual bank’s balance sheet. For these reasons, prudential regulation by itself will not prevent the build-up of financial imbalances that may eventually lead to a sharp downturn in the economy, with the attendant macroeconomic costs. Monetary policy, and the central bank’s role as the guardian of overall financial system stability will be crucial.

In what follows, I will elaborate on the arguments given informally above. I begin with a brief overview of the Basel II rules on bank capital for credit risk, and review the evidence on how banks’ capital requirements will change as a result of the adoption of Basel II. I then provide a sketch of a model of amplified financial cycles. I conclude with some implications for policy.

2. Bank Capital for Credit Risk under Basel II

The aim of Basel II is to establish regulatory capital requirements that more closely match the true economic risks that banks face – aligning *regulatory capital* to the underlying *economic capital*. Basel II is not intended to increase the aggregate level of capital in the system. Rather, the proposal aims at reallocating capital requirements so

that riskier activities attract greater capital requirements. The underlying philosophy of Basel II is that the safety and soundness of banks in the complex and rapidly evolving financial system can be achieved only by the combination of effective bank-level regulation, supervision, and market discipline.

The rules contained in “Pillar I” set out the minimum regulatory capital to risk-weighted assets. Three approaches are permitted in determining minimum capital requirements for credit risk.

- Standardized approach
- Internal Ratings Based (IRB) Foundations approach
- Internal Ratings Based (IRB) Advanced approach

The standardized approach is a ratings based approach similar to the 1988 Basel accord, but which introduces more categories of risk weights. The definition of capital remains the same as the 1988 accord, and the 8% minimum also remains the same, but the definition of risk-weighted assets has been changed to become more risk-sensitive. Thus, we have

$$\text{Regulatory Capital} = 0.08 \times \text{Risk weighted assets}$$

The 1988 accord provides only one risk weight category for corporate lending (100%), but the standardized approach under Basel II will have four categories (20%, 50%, 100% and 150%) depending on the credit rating of the borrower. Unrated borrowers will have the 100% weight, unchanged from current rules. However, non-investment grade borrowers (BB and below) will attract the higher 150% weight.

However, for most banks, the Internal Ratings Based (IRB) approach will be much more relevant. There are two variations of the IRB approach – the Foundations approach and

the Advanced approach. Both IRB approaches are more sophisticated methods that allow banks' internal estimates to serve as inputs into the determination of capital. The Foundation IRB uses the bank's own estimate of the probability of default (PD), but imposes the Basel Committee's numbers for the loss given default (LGD) and the exposure at default. The Advanced IRB method allows the bank to use its own figures for all parameters.

However, there are very definite limits to the discretion of the banks in calculating their capital under the IRB approach. Under the IRB approach, the required capital is computed from a simple one-factor version of the Merton model (used by CreditMetrics). The formula used is:

$$\text{Capital required} = LGD \times \Phi \left(\frac{\Phi^{-1}(PD) + \sqrt{\rho} \Phi^{-1}(C)}{\sqrt{1 - \rho}} \right) \times EAD$$

Where LGD is loss given default, EAD is exposure at default, $\Phi(\cdot)$ is the cumulative distribution function for the standard normal, PD is the probability of default, C is the confidence level, and ρ is the correlation with the single factor assumed in the model. So, as an extreme case, if the correlation is zero, the capital requirement is just

$$\text{Capital required} = LGD \times EAD \times PD$$

At the opposite extreme, if the correlation is 1, the requirement is

$$\text{Capital required} = LGD \times EAD$$

The crucial parameter is the correlation coefficient ρ . Depending on the correlation coefficient imposed, the required capital as a function of the probability of default can take on widely differing values. For corporates, sovereigns and interbank loans, the correlation is calculated as a convex combination of 12% and 24% as follows.

$$\rho = 12\% \left(\frac{1 - e^{-50 \times PD}}{1 - e^{-50}} \right) + 24\% \left(1 - \frac{1 - e^{-50 \times PD}}{1 - e^{-50}} \right)$$

For small and medium sized businesses with turnover of T million euros, there is a “discount” in the correlation, so that

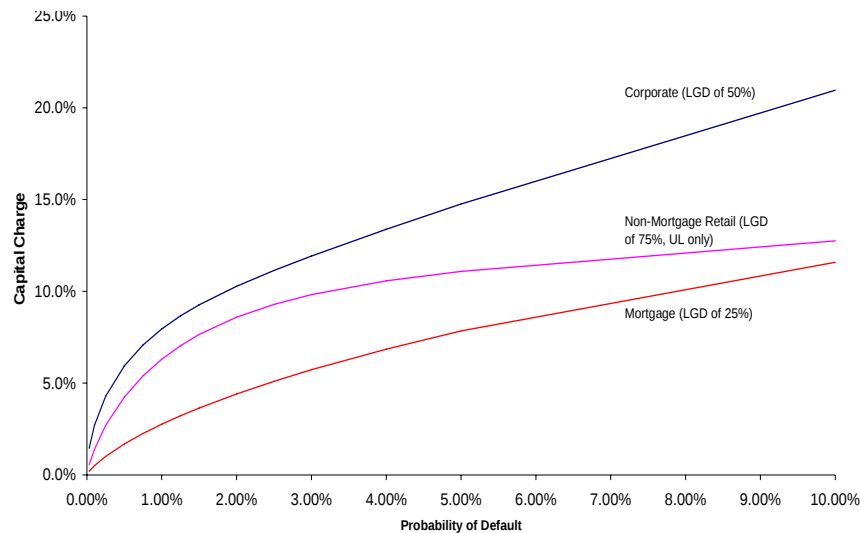
$$\rho = 12\% \left(\frac{1 - e^{-50 \times PD}}{1 - e^{-50}} \right) + 24\% \left(1 - \frac{1 - e^{-50 \times PD}}{1 - e^{-50}} \right) - 4\% \left(1 - \frac{T - 5}{45} \right)$$

For retail loans, the correlations are low. For retail mortgages, it is fixed at 15%. For revolving retail credit (e.g. credit cards)

$$\rho = 2\% \left(\frac{1 - e^{-50 \times PD}}{1 - e^{-50}} \right) + 15\% \left(1 - \frac{1 - e^{-50 \times PD}}{1 - e^{-50}} \right)$$

and for other retail, it is a convex combination of 2% and 17%.

For the relevant range where the correlation coefficient is lower than 0.5, the required capital is increasing in ρ . Thus, the lower value of ρ associated with retail loans and mortgage loans is indicative of the much more favorable treatment given to retail and mortgage loans relative to other loans, such as corporate, inter-bank or sovereign loans. This favorable treatment of retail loans comes through clearly when we map the overall shape of the capital charge as a function of the probability of default. The relationship between capital requirement and probability of default for given values of the loss given default (LGD) are plotted below.



The likely impact of the differential treatment of loans can be gleaned from the Quantitative Impact Studies organized by the Basel Committee on Banking Supervision. We turn to this issue now.

3. Evidence from QIS3

The Basel Committee published the results of its third Quantitative Impact Study (QIS3) on May 5th 2003 (Basel Committee (2003)). The study was a major undertaking, involving more than 360 banks from over 40 countries. The banks that took part in the study were asked to quantify the impact of the proposed capital adequacy rules on their *existing* portfolios. The study did not address the issue of how the portfolios of these banks might change under Basel II.

The results from the survey threw up some notable findings. On average, large G10 banks, referred to in QIS3 as “Group 1 banks” would face an overall increase of regulatory capital under the Standardized approach and the IRB Foundation approach (+10.5% and +2.6% respectively), but a slight decrease when using the IRB Advanced approach (−1.6%). Smaller “Group 2 banks” would see their regulatory capital increase by 3.4% (Standardized approach) and decrease substantially (−19.4%) when using the

IRB Foundation approach, mainly reflecting the importance of retail portfolios for these banks.

Table 2

World-wide Results									
Overall percentage change in capital requirements									
	Standardized			IRB Foundation			IRB Advanced		
	Average	Max	Min	Average	Max	Min	Average	Max	Min
G10 Group1	11%	84%	-15%	3%	55%	-32%	-2%	46%	-36%
Group2	3%	81%	-23%	-19%	41%	-58%			
Other ¹	12%	103%	-17%	4%	75%	-33%			

Source: QIS3

However, for the group of countries under the “other” category, QIS3 revealed substantial increases in capital requirements when keeping the current portfolio of assets fixed for these banks. This group of countries consist of non-G10, and non-EU countries. It includes a group of emerging market countries, but also includes Norway, Australia and Hong Kong. Of course, the increased capital requirement for the “other” category of countries would come about only if the banks in these countries kept their portfolios fixed. If they responded to the changed incentives under Basel II, their portfolios would be able to economize on their capital by shifting their business to retail lending. The QIS3 study did not publish the whole distribution of the changes in capital, but rather only reported the average and the maximum and the minimum. But it would be reasonable to conjecture that the results for the “other” group of countries almost certainly understates the increased capital requirements for the subset of emerging market countries in the sample. This is because the “other” group includes countries such that have relatively more mature financial institutions and banking sectors.

¹ This category includes a very diverse group of countries. The countries are Australia, Brazil, Bulgaria, Czech Republic, Chile, China, Hong Kong, Hungary, India, Indonesia, Korea, Malaysia, Malta, Norway, Philippines, Poland, Russia, Saudi Arabia, Singapore, Slovakia, South Africa, Tanzania, Thailand and Turkey.

More striking are the results of QIS3 on the changes in required capital when broken down into the subclasses of asset categories held by the G10 banks. The following table summarizes the main findings.

Table 3.

	Standardized		IRB Foundation		IRB Advanced
	Group1	Group2	Group1	Group2	Group1
Portfolio	%change in capital requirement				
Corporate	1	-10	-9	-27	-14
Sovereign	19	1	47	51	28
Bank	43	15	45	-5	16
Retail (total)	-25	-23	-45	-44	-49
Residential Mortgages	-27	-20	-53	-44	-58
Non-mortgage retail	-23	-20	-34	-26	-41
SME (total)	-4	-6	-15	-17	-13
SME corporate	1	1	-11	-3	-3
SME retail	-13	-12	-26	-24	-31
Securitized assets	86	51	104	62	130
Overall credit risk	0	-11	-7	-26	-13
Overall change	11	3	3	-19	-2

Source: QIS3

There are several noteworthy results. The first is the importance of **retail activity**. The QIS3 report states that “banks with a large proportion of retail exposures generally have significantly lower capital requirements in the new approaches relative to current levels, reflecting the generally lower risk in this portfolio”. On average, Group 2 banks have a higher proportion of retail activity. These results also suggest that the current rules under Basel I apply high risk-weight to retail activity. Thus, retail banking is likely to gain most from Basel II since overall risk weightings for retail activity under the IRB approach – which many important banks will adopt initially – will fall by around 50%. Retail mortgages, unsecured loans and credit card business will all see significant reductions in required capital. Under the Standardized Approach, “qualifying retail loans (e.g. unsecured loans and certain SME loans) will see a drop in weightings from 100% to

75% and a reduction in mortgage weightings from 50% to 35%. Banks lending mainly to the small and medium sized enterprises will similarly benefit from Basel II.

Under Basel II, **securitized asset** portfolios will carry a higher capital charge, and will trigger increased capital requirements for the same pool of assets. Among the G10 countries, the impact will be felt most in the United States, which has led the way in the securitization. Currently, securitization is a cornerstone of many important markets, such as in residential mortgages, consumer credit card balances, and automobile loans, among others. It can be argued that securitization made certain business lines possible (e.g. student loans in the United States). Basel II is likely to reinforce the recent trend in which banks act merely as the originator of the loans which are then repackaged and its risks transferred to other financial institutions (such as insurance companies). The fact that securitized assets attract a higher capital charge seems likely to give added impetus to this trend.

For some Asian countries such as Korea, the increased capital requirements on securitized assets will have a significant impact on those banks that hold large quantities of asset backed securities (ABS) – an asset class that has been instrumental in the restructuring of distressed companies, and which constitute an important part of the financial landscape following the Asian financial crisis of 1997. The capital charge on asset backed securities in Basel II is very high. The Basel Committee has taken the view that for the lower rated asset-backed securities, the capital charge will be equivalent to the notional value of the asset itself. In other words, under Basel II, the amount of the asset-backed security will be *deducted from capital*. This is equivalent to a capital charge of 1,250% (since 12.5 is the reciprocal of 0.08, and the risk weight of 12.5 is necessary to set the capital charge equal to 8% of risk-weighted assets). The capital charge on securitized assets under Basel II is presented below.

Risk weight on Asset Backed Securities (%)				
Credit Rating	Standardized		Internal Ratings Based	
	ABS	Corporate	ABS	Corporate
AAA	20	20	12	14.75

AA	20	20	15	14.75
A	50	50	20	17.53
BBB	100	100	75	47.24
BB	350	100	425	96.66
Below BB–	1,250	150	1,250	> 182.98

These disadvantageous capital charges for asset backed securities will further strengthen the incentives of EME banks to shift their strategic focus away from corporate lending and ABS assets toward retail and residential property lending.

To the extent that capital charges affect bank strategies, the implications of Basel II go well beyond the mere determination of regulatory capital. Basel II will have a significant impact on the competitive landscape of the banking sector, both domestically and internationally. The impact on emerging market country banking sectors will be particularly far-reaching. We may expect some important shifts in the strategies pursued by G10 banks in response to Basel II.

Broadly, Basel II will alter the relationships surrounding commercial lending in fundamental ways. The increased risk sensitivity brought about by Basel II will promote the use of risk-adjusted pricing and will also put pressure on the practice of cross-subsidizing across different debtor classes. Loans to borrowers with a higher credit rating will require less capital, resulting in lower capital costs. This will result in strongly differentiated conditions for corporate clients. Good credit ratings will trigger lower interest rates, while borrowers with lower ratings will have to pay higher interest rates. The strongly differentiated conditions for corporate clients will improve the competitive situation for companies with high creditworthiness. Companies with lower ratings will increasingly come under pressure to improve their creditworthiness through increased innovation and higher-value products and processes. It is conceivable in the future that, against the backdrop of differentiated loan conditions, commercial lending will become less important in terms of corporate financing and that companies will increasingly turn to capital markets or other financing sources for their capital needs. This shift will, in turn, add to the significance of the market for high-yield bonds (CSFB (2003)).

In addition, the fact that Basel II will bring regulatory capital more in line with economic capital is likely to affect the strategic decision-making at banks relating to which business lines to pursue. One can expect banks to streamline their business line portfolios and focus their activities on where they have a competitive advantage. This is likely to have substantial consequences for the industry and will offer financial institutions opportunities to reposition themselves. Basel II will thus accelerate structural change and the associated process of consolidation and concentration. More merger and acquisition (M&A) activity can be expected. Unsophisticated banks facing a potential increase in their capital charge could be bought by more sophisticated banks. Basel II will thus provide a significant incentive to domestic consolidation. Enhanced disclosure on risk and capital position through Pillar III requirements is another likely driver of M&A activity since it helps potential buyers to screen targets.

Most importantly, the very large differences in capital requirement between retail lending and corporate and ABS activity will induce fundamental changes in bank strategies and behavior. The lower capital requirement on retail lending is likely to induce a shift in bank strategy towards retail lending.

Capital charge on Retail Lending (%)			
	Current (Basel I)	Standardized	IRB Foundation
Mortgage Retail	50	35	3 ~ 48
Other Retail	100	75	5 ~ 52

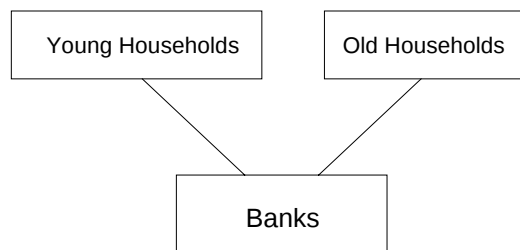
The capital-adjusted returns to retail lending will look very much more attractive compared to corporate lending or ABS assets. Indeed, the types of internal management reforms mentioned in connection with G10 banks will accelerate this process. For banks that employ some type of internal capital allocation scheme such as the Risk Adjusted Rate of Return on Capital (RAROC), the retail sector will look very much more attractive. The shift into retail lending will have major financial stability implications – this will be discussed in later in the paper. All these forces indicate that the indebtedness of the household sector is likely to increase, and impact on the conduct of domestic stabilization policy for the government and the monetary authorities. In Korea, there are two recent

cautionary episodes. First, the rapid increase of credit card debt in the early years of the decade and the subsequent losses and write-downs for some of these operations gives cause for concern of a big shift into retail lending. Second, an expansion of mortgage lending will have implications for the overheating residential property market. Both will have macroeconomic implications.

4. House Price Booms: a Model

Building on the discussion so far in the paper, we will now examine a stylized model of property booms and busts that operate through the financial system. At the heart of the amplifying mechanism is the behavior of banks (already discussed) that aims to target a leverage ratio.

Our financial system has three groups - young households, old households and the banking sector. The only qualification to be a member of the financial system is to have a balance sheet. In this sense, the households are fully-fledged constituents of the financial system.



The sole real asset that underpins the financial system is residential property. The young households hold part of the residential housing stock financed by borrowing from the banks. The young households thus have a particularly simple balance sheet. Its assets consist of property, while its liabilities consist of its liabilities to the banks and net worth (if any).

Assets	Liabilities
Property	Net worth
	Mortgage

Balance sheet of young households

From the banking sector's point of view, the mortgage liabilities of the young households are its assets. The banks finance their lending through deposits of the old households. The contractual features of the deposit contract do not play a role in my argument. The balance sheet of the banking sector can be depicted as follows.

Assets	Liabilities
Mortgage	Net Worth
	Deposits

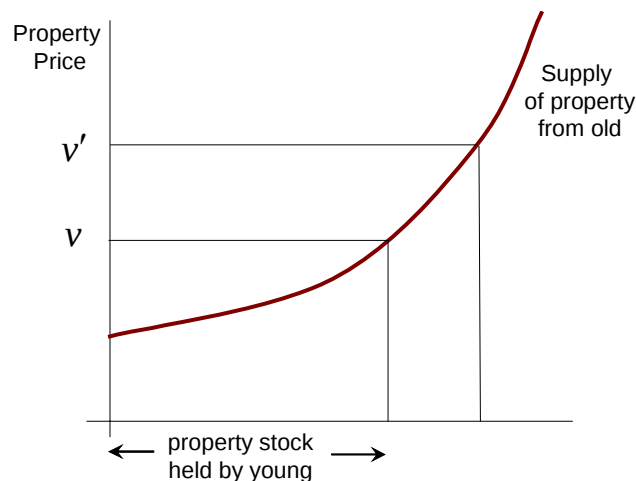
Balance sheet of banking sector

The old households hold residential property, deposits in the banking system, and are the equity holders of the banks themselves. They have no liabilities to other parties in the financial system, so that the whole of the liabilities side consists of net worth.

Assets	Liabilities
Deposits	Net worth
Property	
Equity	

Balance sheet of old households

An important part of the stylized model is the relationship between increased lending and the transactions price for property. Suppose that there is an upward-sloping supply curve for property from the old households. We do not model the exact microeconomic mechanism governing the matching of buyers and sellers, and the bargaining process that leads to the transactions price. However, it is important that the marginal transactions price for a house is increasing in the stock of housing held by the young. The figure below depicts the upward-sloping supply curve.



The implicit assumption is that there is some heterogeneity in the preferences of old households for housing services (which leads to the gradual increase in housing supply as price rises), and that young households (as a group) place a higher value on housing than

the old households. These differences may reflect, among other things, differences in remaining lifespans. Even if the per-period consumption value of housing were the same, younger households have longer to live, and hence may place a higher subjective value on owning the house, reflecting the higher capitalized value of housing services. The young households are credit-constrained, and so rely on the supply of credit from the banks in order to purchase housing. Thus, as lending on residential housing increases, the marginal transactions price increases, too.

The upward-sloping supply curve for housing also illustrates the nature of property wealth in a financial system. The marked-to-market value of the housing stock increases in proportion to the price of the marginal traded property. Does this mean that the net wealth of the economy has increased by the amount of the increase in the marked-to-market value of the housing stock? In our framework the answer would be “no”, since the increased property price simply reflects the marginal rate at which housing is reallocated from the old to the young. We have simply moved from one point in an Edgeworth box to another, rather than seeing an *expansion* of the Edgeworth box.

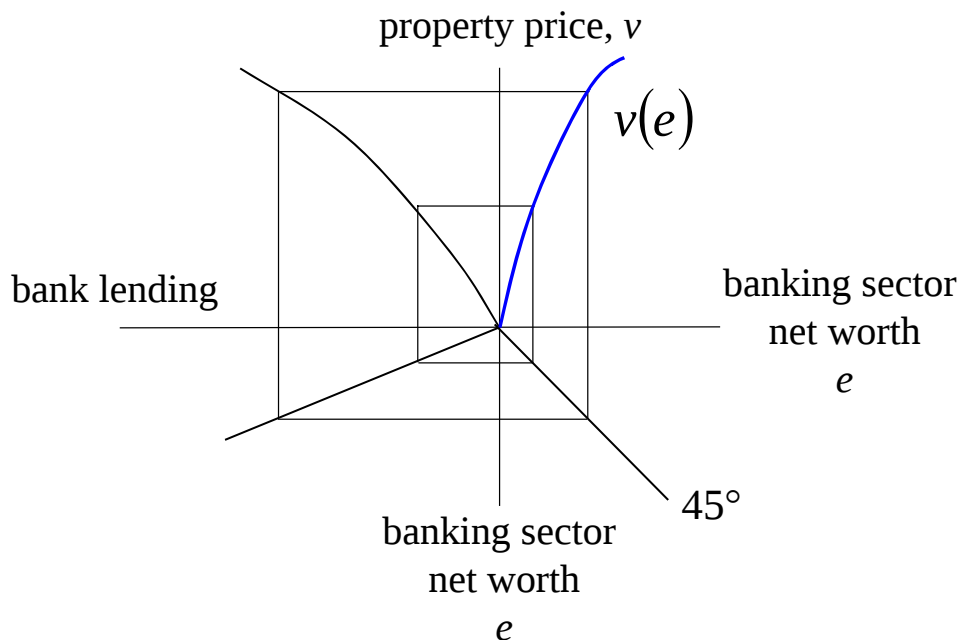
Let us assume that the banks can always find young households that are willing to borrow from them in order to finance the purchase of property, and that they (the banks) can find old households that are willing to lend to them in the form of greater deposits. Thus, from the point of view of the banks, they can always increase the size of their balance sheet by borrowing from old households and lending the proceeds to the young households.

The crucial element in the stylized model is the relationship between the strength of the balance sheet of the banking sector and the availability of credit that results from the behavior of banks that aim to maintain a fixed leverage ratio. When banks attempt to maintain a fixed leverage ratio, they will increase the size of their balance sheets in reaction to an increase in net worth. They do so by increasing their leverage – by borrowing more from the old households, and lending out more to the young households. If the banks were passive, their leverage would be eroded by the increase in their net worth. The assumption here is that the banks do not sit still when they see an increase in

their net worth. The more accountable is the banks' management to their shareholders in maintaining return on equity (ROE), and more responsive it is to short term incentives, the greater is the incentive of the bank to increase its lending. We have seen in the earlier discussion that the empirical evidence points to banks behaving in this way.

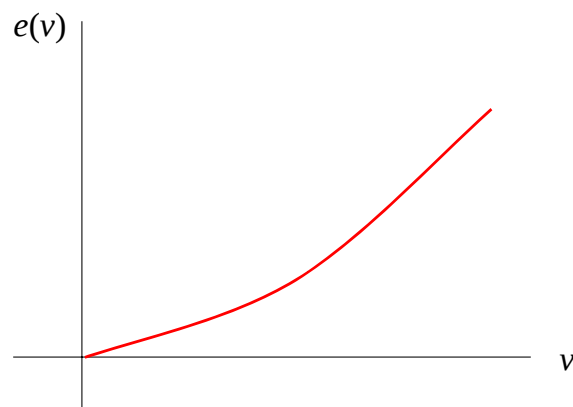
The upshot of the behavior of banks in targeting a fixed leverage ratio is that an increase in banking sector net worth results in a net flow of funds into the property sector, via the banks' balance sheets, which in turn raises the marginal transactions price of residential property.

More formally, we can trace out the link between stronger balance sheets, increased net worth, increased lending, and the property price in the following way. Denote banking sector net worth as e (for "equity"), and suppose that banks attempt to maintain fixed leverage. Then, as e increases, bank lending must also increase, as shown in the bottom left hand quadrant of the figure below.

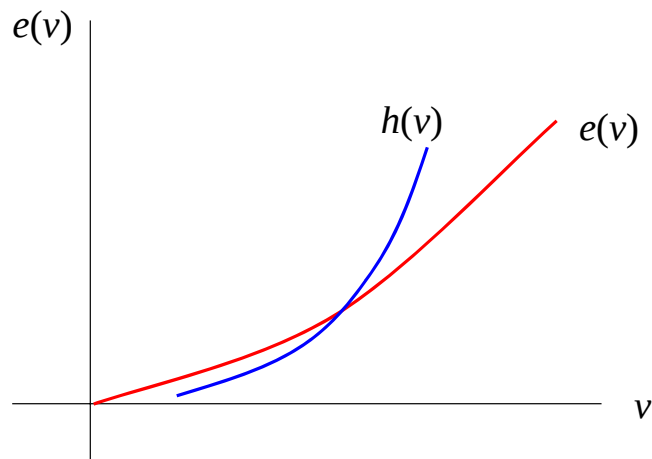


As bank lending increases, the young households enter the property market with new funds obtained from the banks, raising the price of the marginal traded property. Denote the price of property as v . Thus, an increase in banking sector net worth is associated with an increase in property price v . We can thus define $v(e)$ as the price of property that is consistent with net worth e . This mapping is depicted in the top right hand quadrant of the above diagram.

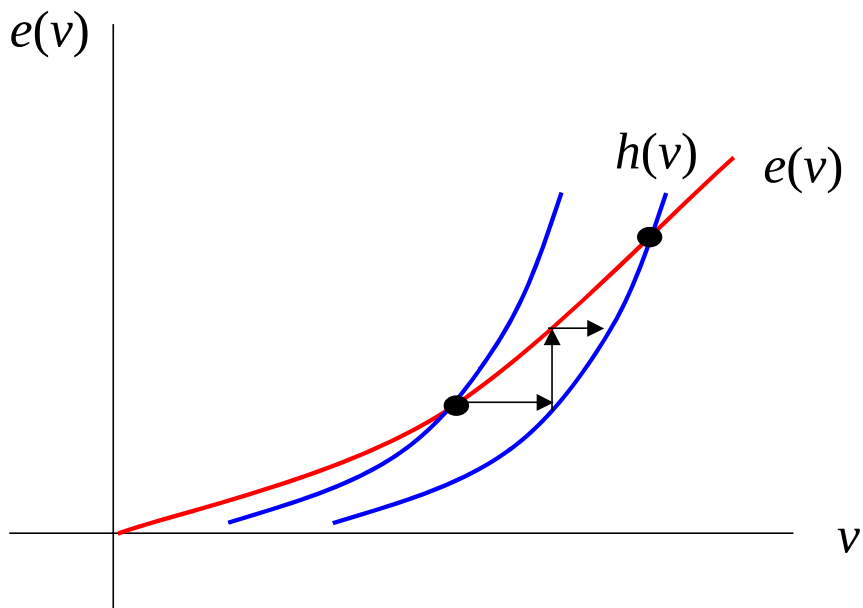
As property price increases, the net worth of the household borrowers who have invested in property increases. To the extent that the loans to the household sector are collateralized against property, the rise in property price raises the credit quality of the mortgage claims held by the banks against the young households, raising the marked-to-market value of the mortgages held on the asset side of the banks' balance sheets. Thus, we can define the value $e(v)$ that is consistent with property price v . Banking sector net worth e is an increasing function of the price of property v .



We can now bring the ingredients together to examine how the price of property interacts with banking sector net worth. Let us define $h(.)$ as the inverse of the function $v(e)$. Thus, $h(v)$ is the banking sector net worth e that would give rise to property price v . Plotting $h(v)$ and $e(v)$ on the same figure, we can derive the combination of property price and banking sector net worth that would be mutually consistent. This is indicated in the figure below.



With this framework, we can conduct some comparative statics with respect to some of the key quantities, and in particular to an increase in property price that results from shift of bank lending toward residential property resulting from the reorientation of bank portfolios following the implementation of Basel II.

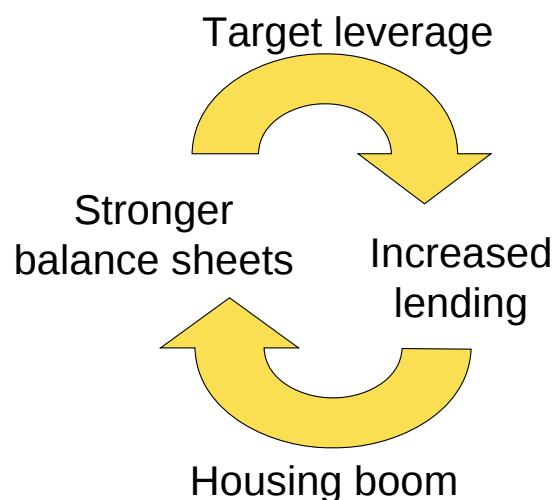


The shift in banks' portfolios toward residential property implies a shift to the right of the $h(v)$ schedule. This is because, for any given level of bank net worth, there is greater lending for housing, which under our framework, results in higher property prices. This

initial shift is indicated in the figure above by the arrow pointing to the right from the initial equilibrium.

However, this initial shift sets off a feedback process in the financial system. When property price increases due to the shift in bank portfolios toward residential property lending, there is an increase in the net worth of the banking sector as a whole, as increases in property prices results in stronger balance sheets of the banks. This second-round shift is indicated by the upward-pointing arrow. After this second round effect, the banks find themselves with higher net worth. Since the banks attempt to keep a fixed leverage ratio, this higher net worth results in increased lending, giving rise to another upward twist to the property price spiral. This adjustment process continues until the new equilibrium is reached, with substantially higher property price v . Depending on the slopes of the two curves, the eventual impact of the shift in bank portfolios can be substantial.

The feedback in the financial system can also be depicted as in the following figure. When banks have a target leverage, strong balance sheets result in increased lending. Conversely, when increased debt leads to a housing boom, banks end up having stronger balance sheets, thus completing the circle.



5. Housing Crash

The amplification mechanisms that operate in the inflating of a housing boom will sow the seeds of amplification mechanisms that operate when boom turns to bust. If the bursting of the property bubble impairs the solvency of the banking sector as a whole, then the dynamics “on the way down” may involve a new set of mechanisms that did not figure in the inflating of the bubble. These new mechanisms - default, distressed selling, and inefficient liquidations - are likely to conspire to exact very large economic costs.

In order to illustrate these new mechanisms, let us modify the stylized model given in the previous section by supposing that the banks hold property directly on their balance sheets, and that they mark their holding of property to market. Neither of these assumptions is appropriate in normal times, but they are a good approximation of an economy in the aftermath of the bursting of a property bubble where defaulting borrowers have put property assets back to the banks, so that the banks end up holding the property directly. Under these assumptions, the balance sheets of the banks look as follows.

Assets	Liabilities
Property	Deposits
Other assets	Net Worth

Bank balance sheet in downturn phase

We maintain the key behavioral trait of the banks that they target fixed leverage ratio. Thus, when a bank finds itself with too little net worth, it must sell some of its assets and pay down its liabilities, so as to reduce the overall size of its balance sheet. In the downturn phase of the property cycle, the regulatory capital constraint will exert

additional constraints on the bank's discretion. Assume that the assets held by a bank attract a regulatory minimum capital ratio, which stipulates that the ratio of the bank's capital - here taken to be simply its marked-to-market net worth to the marked-to-market value of its assets - must be above some pre-specified ratio r^* . Let v continue to denote the price of property. Let us denote bank i 's holding of property by q_i , its holding of liquid assets by c_i and its liabilities by ℓ_i . It would be straightforward to extend this framework to take account of interbank claims (see Cifuentes, Ferrucci and Shin (2004)). If we denote by s_i the amount of property sold by bank i and by t_i the sale by bank i of its liquid assets, the capital adequacy constraint can be expressed as follows.

$$\frac{vq_i + c_i - \ell_i}{v(q_i - s_i) + (c_i - t_i)} \geq r^*$$

The numerator is the (marked-to-market) equity value of the bank while the denominator is the marked-to-market value of its assets after the sale of s_i units of property and sale t_i of the liquid assets. The underlying assumption is that the assets are sold for cash, and that cash does not attract a capital requirement. Thus, if the bank sells s_i units of property, then it obtains vs_i of cash, and holds $v(q_i - s_i)$ worth of property. By selling its assets for cash, the bank can reduce the size of its balance sheet, reduce the denominator in the capital to asset ratio, and thus satisfy the minimum capital asset ratio.

By re-arranging the capital adequacy condition together with the condition that s_i is positive only if $c_i = t_i$ we can write the sale s_i as a function of v . If the capital adequacy ratio can be met by sales of liquid assets or from no sales of assets, then $s_i = 0$ but otherwise is given by

$$s_i = \min \left\{ q_i, \frac{\ell_i - c_i - (1 - r^*)vq_i}{r^*v} \right\}$$

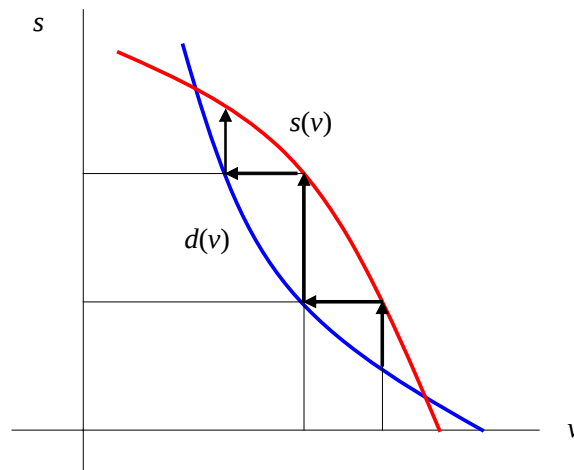
Thus, the sale of property s_i is a *downward-sloping* function of the property price v .

The supply increases as property price falls. The reason for the perverse behavior of supply is due to the fact that, for distressed institutions, they sell their assets because they have to. Thus, the more the property price falls, the greater is their distress, and the more then must sell. Let $s = \sum_i s_i(v)$ be the aggregate sale of property by the banking sector given price v .

Suppose that sale of property by banks can be absorbed by other constituents in the economy, provided the price is low enough (for example, by the old households who will buy their properties back, provided that the price is low enough). To give form to this idea, suppose that there is an exogenous demand function for property given by $d(v)$.

An equilibrium price of property is a price v for which $s(v) = d(v)$

An initial shock to the property price may have an amplified response, if the additional sales of property cause price to fall further. The argument is illustrated below.



Consider a shock to the property price. The price adjustment process can be depicted as a step adjustment process in the arc below the $s(v)$ curve, but above the $d(v)$ curve.

The process starts with a downward shock to the price of property. At the new lower price the forced sales of the banks place a quantity of property on the market as indicated

by the $s(v)$ curve. However, the additional supply of property pushes the property down implied by the $d(v)$ curve. When the banks' balance sheets are evaluated at this lower price, the capital adequacy constraint may be violated, forcing yet more sales. The second round supply of property is implied by the $s(v)$ curve at the lower price. Given this increased supply, the price falls further, and so on. The price falls until we get to the nearest intersection point where the $d(v)$ curve and $s(v)$ curve cross. Equivalently, we may define the function $\Phi(v)$ as

$$\Phi(v) \equiv d^{-1}(s(v))$$

and an equilibrium price of property is a fixed point of the mapping $\Phi(\cdot)$. The function $\Phi(\cdot)$ has the following interpretation. For any given property price v , the value $\Phi(v)$ is the market-clearing price of property that results when the price of property on the banks' balance sheets is evaluated at price v . Thus, when $\Phi(v) < v$, we have the precondition for a downward spiral in the property price, since the price that results from the sale of property is lower than the price at which the balance sheets are evaluated.

The lessons here are quite general. Changes in asset prices may interact with externally imposed solvency requirements or the internal risk controls of financial institutions to generate amplified endogenous responses that are large relative to any initial shock.

Regulators are familiar with the potentially destabilizing effect of solvency constraints in distressed markets. To take one recent instance, the decline in European stock markets in the summer of 2002 was met by the relaxation of various solvency tests applied to large financial institutions such as life insurance firms. In the U.K., the usual "resilience test" applied to life insurance companies in which the firm has to demonstrate solvency in

the face of a further 25 % market decline was diluted so as to preempt the destabilizing forced sales of stocks by the major market players.²

More generally, the importance placed on asset prices follows the recent theoretical literature on banking and financial crises that has emphasised the limited capacity of the financial markets to absorb sales of assets (see Allen and Gale (2004), Gorton and Huang (2003) and Schnabel and Shin (2004)), where the price repercussions of asset sales have important adverse welfare consequences. Similarly, the inefficient liquidation of long assets in Diamond and Rajan (2005) has an analogous effect. The shortage of aggregate liquidity that such liquidations bring about can generate contagious failures in the banking system.

6. Implications for Prudential Regulation and Monetary Policy.

Basel II is likely to have a major impact on the banking sector of emerging market economies. The impact will be felt through the endogenous shifts in banks' commercial strategies in response to the differential risk weights on corporate, ABS and retail activities. There are lessons for the monetary policy authorities, and the financial supervisors.

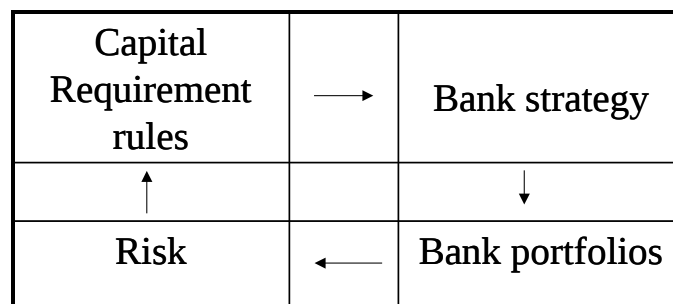
The introduction of Basel II will spur the development risk management within the banking sector. This development consists not only in the adoption of new techniques, but more importantly, it will raise the profile of risk management and risk control within the banking organization. Risk management would not simply be the "back office" function of technical staff, but would become an integral part of the everyday operation of the bank at the highest level of its hierarchy, and will be a driving force in the commercial strategy of the bank.

The importance of risk-management at the heart of the banking organization has many positive effects in allowing commercial decisions to be taken with the benefit of the best

² FSA Guidance Note 4 (2002), "Resilience test for insurers". See also FSA Press Release, June 28th 2002, no FSA/PN/071/2002, "FSA introduces new element to life insurers' resilience tests".

information available, and also in allowing incentive schemes for bank management that allows the aligning the incentives. However, the heightened awareness of risk within the banking organization is unlikely to guarantee the stability of the overall financial system. The reason is that an individual bank's strategies in managing in risks efficiently leads to behavior that contribute to the amplification of the financial cycle as a whole. The most glaring example of such behavior is the practice of banks in targeting their leverage. When a bank targets its leverage (perhaps due to an attempt to target a given credit rating), the stronger balance sheets induce greater loan growth, while weaker balance sheets induce retrenchment. Thus, both on the "way up" and on the "way down", there is the potential for amplification of the financial cycle.

Most importantly, the minimum capital requirements for credit risk under Basel II are considerably lower for retail and residential property loans, as compared to traditional corporate and interbank exposures. The favorable capital requirements for retail and residential property exposures reflect the empirical evidence drawn from the historical evidence of credit risk from the G10 banks in the era prior to the implementation of Basel II. When banks react to changed incentives, the underlying risks are also likely to change. However, by "hard-wiring" the lower capital requirements into the overall framework for regulating capital requirements for credit risk, there is the potential for giving undue impetus to property booms and crashes that are not justified by the true credit risks inherent in the financial system. As noted at the outset, credit risk is endogenous. Credit risk depends on the overall portfolio choices made by the banks themselves. In turn, the portfolio decisions will be affected (in part) by bank capital regulation. Finally, a risk-based approach to bank capital regulation must take heed of credit risk.



The endogeneity of credit risk implies a number of policy implications – for prudential regulation and monetary policy.

For prudential regulation, the most important lesson is that the usual automatic brakes arising from prudential regulation may not arrest the development of a property boom. The reason why prudential regulation may be powerless in arresting the development of a bubble is because during the build-up phase of the bubble, the banks' balance sheets will show considerable strength. Indeed, the amplifying mechanism sketched in the stylized model relies on the feedback from the strong balance sheets of the banks. Prudential regulation is predicated on signs of *weakness* in a bank's balance sheet. As such, the regulator will feel constrained to act in arresting the development of a bubble, when the reasons for intervention are not clear-cut from the individual bank's balance sheet. For these reasons, it is unclear how well prudential regulation will work in preventing the build-up of financial imbalances that may eventually lead to a sharp downturn in the economy, with the attendant macroeconomic costs.

The unwinding of financial imbalances are likely to have far-reaching impact on overall macroeconomic stability – especially for emerging countries whose financial system is vulnerable to shocks both from outside the economy and within. As such, macroeconomic policy – and especially the conduct of monetary policy will need to take heed of the overall financial conditions of the economy. When the automatic brakes that come from prudential regulation cannot be relied upon, then there is greater onus on monetary policy to take up the slack in ensuring that the spillover effects from the bursting of a property bubble can be minimized. The debate on the proper role of monetary policy in tackling asset price bubbles has been an active one in recent years, and is likely to be relevant for those emerging market countries that are due to adopt the Basel II proposals in the next few years.

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