CHAPTER 1

Adapting Macro Prudential Approaches to Emerging and Developing Economies

Hyun Song Shin*

Introduction

Traditionally, the focus of prudential policy has been on the solvency of individual financial institutions. Indeed, prior to the global financial crisis of 2007–09 the overall approach and reasoning underlying prudential regulations could have been broadly characterized by the following set of propositions:

- Minimum capital requirements serve as a buffer against loss of bank assets, thereby protecting depositors from loss. The fact that risk-weighted assets are used as the denominator in the capital ratio reveals the purpose of the capital requirement as setting a buffer against loss for the senior creditors, especially the depositors. If deposits are insured by the government, the bank capital requirement also serves as a buffer against loss by taxpayers.
- Minimum capital requirements ensure that the banks' owners have a stake in the value of the bank's assets, thereby ensuring that owners have sufficient "skin in the game" to deter moral hazard on their part toward excessive risk taking.
- Having ensured financial stability through bank capital requirements and in the presence of well-functioning international capital markets, the role of monetary policy is to focus on macroeconomic stabilization by setting interest rates to stabilize components of aggregate demand such as consumption and investment.

The global financial crisis has raised questions regarding the adequacy of a policy framework based on these propositions alone, and has spurred a reassessment of the purpose and effectiveness of prudential regulations. However, the

* **Hyun Song Shin** is Hughes-Rogers Professor of Economics at Princeton University. He thanks Swati R. Ghosh and Stijn Claessens for comments and guidance on this chapter.

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thinking has not yet borne fruit in terms of any fundamental shift in the debate concerning prudential policy.

Thus, the Third Basel Accord (Basel III), the new capital and liquidity framework for banks, has continued the tradition of basing banking regulation on building buffers against loss. The centerpiece of the new agreed framework is a strengthened common equity buffer of 7 percent together with newly introduced liquidity requirements and a leverage cap to be phased in over an extended timetable running to 2019 (BCBS 2010).

Basel III also incorporates a countercyclical capital surcharge in the range of 0–2.5 percent that can be introduced at the discretion of national regulators. The rationale for the countercyclical surcharge is to lean against the procyclicality of the financial system by demanding a higher capital buffer at the peak of the financial cycle. Basel III also envisages additional requirements on systemically important financial institutions (SIFIs) in the form of capital surcharges, leverage caps or levies designed to impose a higher margin of safety on institutions that are deemed "too big to fail."

However, neither the countercyclical capital requirement nor the SIFI surcharge has found universal and consistent acceptance among the member countries of the Basel Committee on Banking Supervision (BCBS). In the case of the countercyclical capital requirement, disagreement among the BCBS member countries on a uniform rate of the capital surcharge has meant that countries can, in effect, opt out of the requirement. The countercyclical capital surcharge is left to the discretion of the national regulators, who can impose them within a range of 0–2.5 percent. In the case of SIFIs, discussions are currently focused on the imposition of a possible capital surcharge on global SIFIs (G-SIFIs), such as large banks with cross-border operations. Discussions have revolved around the difficulties of cross-border resolution and, hence, the need to overcome the moral hazard engendered by the banks being too big to fail. For emerging or developing countries, though, the issues raised by cross-border banking are somewhat different and have to do with their impact during booms and their role in creating excess liquidity as discussed later.

Overall, the common denominator in Basel III that applies universally (that is, not considering the countercyclical capital or SIFI surcharges) is almost exclusively micro prudential in its focus, that is, concerned with the resilience of individual banks, rather than being macro prudential and concerned with the resilience of the financial system as a whole. Its focus remains on "loss absorbency" of bank capital.

Achieving greater loss absorbency by itself is almost certainly inadequate to achieving a stable financial system for two reasons:

- Loss absorbency does not address directly the procyclicality of the financial system and the *excessive asset growth* during booms.
- Preoccupation with loss absorbency diverts attention from the *liabilities* side of banks' balance sheets and vulnerabilities from the reliance on unstable short-term funding and short-term foreign currency funding.

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These two shortcomings have special importance for developing and emerging economies given their susceptibility to global liquidity conditions and the relatively early stage of the development of their financial systems. Indeed, the Basel process has focused almost exclusively on the imperatives of advanced-country financial systems, rather than on the needs of emerging markets and developing countries.

This chapter discusses the principles behind macro prudential policies and how these principles can be translated into a policy framework. It is intended primarily as a conceptual document that lays out the economic principles that underpin macro prudential policy rather than as a "how to" manual that details an exhaustive list of possible policy measures and relevant country experiences.

Analytical Background

In keeping with its conceptual focus, the chapter begins by outlining salient elements of the theory and practice of balance sheet management by financial intermediaries. Against this background of financial institutions' balance sheet management, the next section discusses how global liquidity conditions and the external environment affect banks' funding options and their implications for financial stability.

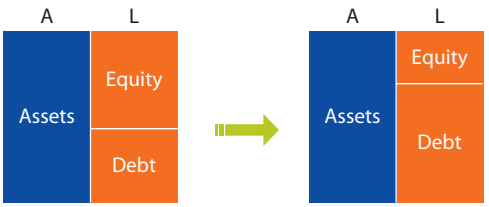
Balance Sheet Management

The banking system occupies a pivotal role for financial stability. Principles of balance sheet management that can inform policy discussions are described here.[1]

In textbook discussions of corporate financing decisions, the set of positive net present value (NPV) projects is often taken as given, with the implication that the size of the balance sheet is fixed and determined exogenously. In a simplified setting, the choice can be depicted as in figure 1.1. The assets are fixed, given exogenously by the set of projects (assets) in grey that have positive NPV. Having fixed the asset side of the balance sheet, the discussion turns on how those assets are financed—that is, on the liabilities side of the balance sheet.

The left-hand panel of figure 1.1 shows a balance sheet in which the assets are financed predominately by equity. The arrow indicates a shift in the funding mix to a state in which some of the equity is replaced by debt. One way this could be accomplished is through the repurchase of equity by using the

Figure 1.1 Choice of Mix of Debt and Equity Financing



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proceeds of a debt issue. The leverage of the firm is defined as the ratio of assets to equity. Hence the shift depicted in figure 1.1 leads to an increase in the leverage of the firm but without any change in the size of the balance sheet as a whole.

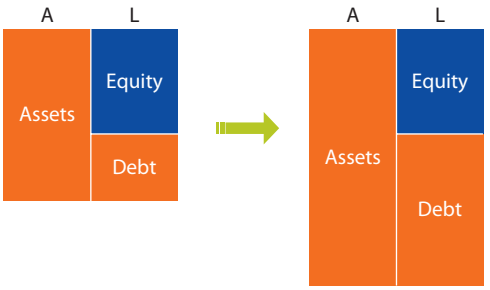
However, figure 1.1 is not a good description of the way banking sector leverage varies over the financial cycle. The distinguishing feature of banking sector leverage is that it fluctuates through changes in the total size of the balance sheet. Credit increases rapidly during the boom phase and increases less rapidly (or even decreases) during the downturn. Some of the variation in the size of banking assets can be accounted for by the fluctuations in the size of the pool of positive NPV projects but some of the fluctuation is caused by shifts in the bank's willingness to take on risky positions over the cycle—that is, on the bank's risk appetite.

Adrian and Shin (2010, 2011) show that shifts in the leverage of financial intermediaries conform more closely to figure 1.2 in which leverage increases by an expansion of *assets*, taking the equity of the bank as a given.

One plausible scenario with empirical backing that is consistent with the change depicted in figure 1.2 is when the bank manages the size of its loan book so that its risk-weighted assets are maintained to be equal to its capital. If the bank assesses that the risks of lending have declined, it can expand its lending without breaching its minimum capital requirements.

Consider, for example, what happens when the equity of the bank itself is subject to shocks—both positive and negative. During the upward phase of the financial cycle, greater profitability of the bank bolsters its capital position. This bolstered capital position constitutes a positive shock to equity. (Conversely, during the downward phase of the financial cycle, losses or provisioning for bad debt constitutes a negative shock to equity.) Even if the bank were to target a fixed leverage ratio, the positive shock to equity would cause the bank to increase the size of its balance sheet. For instance, suppose that a financial intermediary manages its balance sheet actively so as to maintain a constant leverage ratio of 10 and that the initial balance sheet is as follows: the intermediary holds $100 worth of assets and the bank holds marketable securities, which have been funded with debt worth $90 and equity of $10 as in figure 1.3.

Figure 1.2 Increased Leverage through Expansion in Assets



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Now assume that the value of the debt is approximately constant for small changes in total assets. First, let's assume that the price of securities increases by 1 percent to 101. This shock impacts the balance sheet as depicted in figure 1.4.

Leverage falls to 101/11 = 9.18. If the bank targets leverage of 10, then it must take on additional debt of D to purchase D worth of securities on the asset side so that:

$$\text{Assets/equity} = (101+\text{D})/11 = 10, \text{ which implies that D} = 9.$$

The bank takes on additional debt worth $9 and with the proceeds purchases securities worth $9. Thus, an increase in the price of the security of $1 leads to an increased holding worth $9. The demand response for the assets held by the bank is upward sloping. After the purchase, leverage is back up to 10 (figure 1.5).

If the bank's assets consist of loans rather than securities, then the increase in equity is better viewed as a result of improved profitability of the bank, when some of the net income is accumulated into bank equity. The practice of "marking to market," where assets are valued according to prevailing market prices, will mean a more immediate reflection of the asset value increase on the bank's equity position.

Figure 1.3 Initial Balance Sheet

Assets	Liabilities
Securities, 100	Equity, 10
	Debt, 90

Figure 1.4 Price of Securities Increases

Assets	Liabilities
Securities, 101	Equity, 11
	Debt, 90

Figure 1.5 Bank Adds Debt

Assets	Liabilities
Securities, 110	Equity, 11
	Debt, 99

The mechanism works in reverse on the way down. Suppose there is a shock to the price of securities so that the value of security holdings falls to $109. On the liabilities side, it is equity that bears the burden of adjustment, since the value of debt stays approximately constant (see figure 1.6).

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Figure 1.6 Value of Securities Falls

Assets	Liabilities
Securities, 109	Equity, 10
	Debt, 99

Figure 1.7 Bank Sells Securities

Assets	Liabilities
Securities, 100	Equity, 10
	Debt, 90

Leverage is now too high (109/10 = 10.9). The bank can adjust down its leverage by selling securities worth $9 and paying down $9 worth of debt. In this way, a fall in the price of securities leads to a sale of securities. The supply response is downward sloping, unlike the textbook case of an upward sloping supply response. The new balance sheet is hence restored to where it stood before the price changes and leverage is back down to the target level of 10 (figure 1.7).

In this way, maintaining constant leverage entails upward-sloping demand responses and downward-sloping supply responses for the assets held by the bank. *The perverse nature of the demand and supply curves is even stronger when the leverage of the financial intermediation is procyclical, that is, when leverage is high during booms and low during busts*. As demonstrated in Adrian and Shin (2010, 2011), banks' active management of their balance sheets and their use of value-at-risk (VaR) models results in procyclical leverage because the boom (downturn) reduces (increases) measured risk and hence induces banks to increase (decrease) their leverage.

If, in addition, there is the possibility of feedback, the adjustment of leverage and of price changes will reinforce each other in amplification of the financial cycle. If greater demand for the assets tends to put upward pressure on its price, there is potential for feedback in which a stronger balance sheet triggers greater demand for the asset (that is, greater lending), which in turn raises the asset's price and leads to stronger balance sheets. In the case of banks with loans rather than securities on the balance sheet, the amplification goes through the greater profitability of the banks during the up-phase of the financial cycle.

The mechanism works in reverse in downturns. If greater supply of the asset tends to put downward pressure on its price, then weaker balance sheets lead to greater sales of the asset, which depresses the asset's price and leads to even weaker balance sheets. Figure 1.8 illustrates the amplification mechanism in both the upward and downward phases of the financial cycle.

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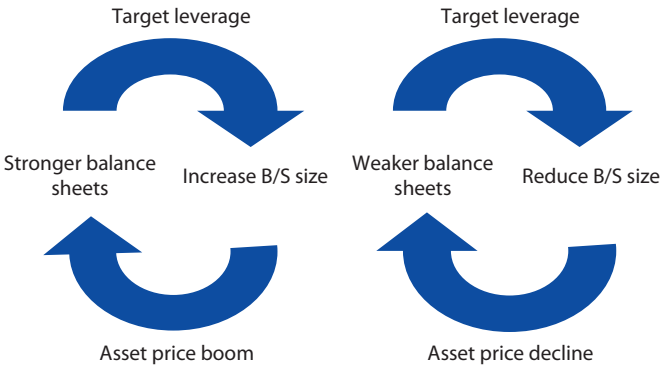
Figure 1.8 Amplification Mechanism



The amplifying nature of banking sector balance sheet management has far-reaching implications for financial stability. Financial intermediaries are not typical of the textbook rational portfolio optimizer who decides on the asset holdings based on an assessment of some fundamental value. Instead, banks and other financial intermediaries have quite perverse portfolio choice behavior where the holding of assets depends on their "balance sheet capacity." Balance sheet capacity depends on two things: the amount of bank capital and the degree of permitted leverage.

During a boom, balance sheet capacity is bolstered for two reasons. First, bank capital is bolstered by increased profitability of the bank, or the capital gains implied by the increase in asset prices. Second, lowered measured risks during the tranquil up-phase of the financial cycle raise banks' leverage. In particular, if a bank is managing asset risk through managing its value-at-risk, then a fall in measured risk translates directly into an increase in bank leverage (Adrian and Shin 2009).

This perspective of the banking sector balance sheet capacity also sheds light on one finding regarding the financial stability implications of banking-sector foreign direct investment (FDI) (see Ostry and others 2010). FDI flows are usually equity stakes held by foreign investors and are conventionally associated with long-term financing that has beneficial effects. In this sense, FDI is normally regarded as being a benign form of capital inflow. However, banking-sector FDI appears to have a more destabilizing influence. This point is especially relevant with respect to the experience of emerging Europe during the recent global crisis. Ostry and others (2010) find in their empirical analysis that financial-sector FDI is associated with larger stocks of debt liabilities of the banking sector and does not have the conventionally expected beneficial effect. Indeed, countries with larger financial FDI fared worse in the current crisis, while those with larger nonfinancial FDI fared better. The vulnerability of emerging Europe in the wake of the recent crisis and the region's heavy dependence for capital on foreign banking groups, particularly those from Western Europe, gives some clues on the likely mechanism. Larger financial-sector FDI in the form of greater inflows of

banking sector capital is the base on which larger banking sector balance sheet capacity will be built. Thus, the banking-sector FDI inflow will be accompanied by the debt financing that builds up the banking sector's total lending capacity. If the local savings pool (say, through local retail deposits) is not large enough to finance the expansion in lending, the parent bank will supply intragroup funding through wholesale deposit funding or other wholesale funding. In this way, financial-sector FDI in the banking sector is inextricably bound with greater debt flows into the banking sector and leads to a growth in the nondeposit funding used by the local banking system. Ostry and others (2010) find that both debt and financial FDI are strongly associated with credit booms and foreign exchange (FX)-denominated lending by the domestic banking system, which in turn is associated with greater vulnerability. Both are key channels through which a country becomes susceptible to crises. The greater vulnerability to crises holds even controlling for credit booms and FX-denominated lending, perhaps because households and firms may borrow directly from abroad (or flows are intermediated through nonbank financial institutions).

External Environment and Global Liquidity

External financial conditions provide the backdrop to domestic financial conditions, especially when the domestic banking system is open to funding from internationally active banking groups with cross-border operations and also purely domestically focused banks with cross-border financial activities. This section outlines the ways in which the external environment and global liquidity impact on financial stability.

The low interest rates maintained by advanced-economy central banks in the aftermath of the global crisis have ignited a lively debate about capital flows to emerging markets. One of the distinguishing features of the credit boom that preceded the global financial crisis of 2008 was the role played by banking sector inflows. Banking sector inflows surged during the period leading up to the Lehman Brothers bankruptcy, in contrast to the Asian crisis and in the immediate aftermath of the current crisis, when banking-sector inflows accounted for less than 20 percent of capital inflows (see IMF 2011). Understanding the external environment and the role of cross-border banking is important in putting the recent crisis in context.

The U.S. dollar bank funding market has special significance in this debate. As well as being the world's most important reserve currency and invoicing currency in international trade, the U.S. dollar is also the currency that underpins the global banking system. It is the funding currency of choice for global banks. The United States hosts branches of about 160 foreign banks whose main function is to raise wholesale dollar funding in capital markets and then ship it to their head offices.

Some of the borrowed dollars return to the United States to finance purchases of mortgage-backed securities (MBS) and other assets. But much of it flows to Europe, Asia, and Latin America where global banks are active local lenders (figure 1.9). In this way, global banks become the carriers for the transmission of

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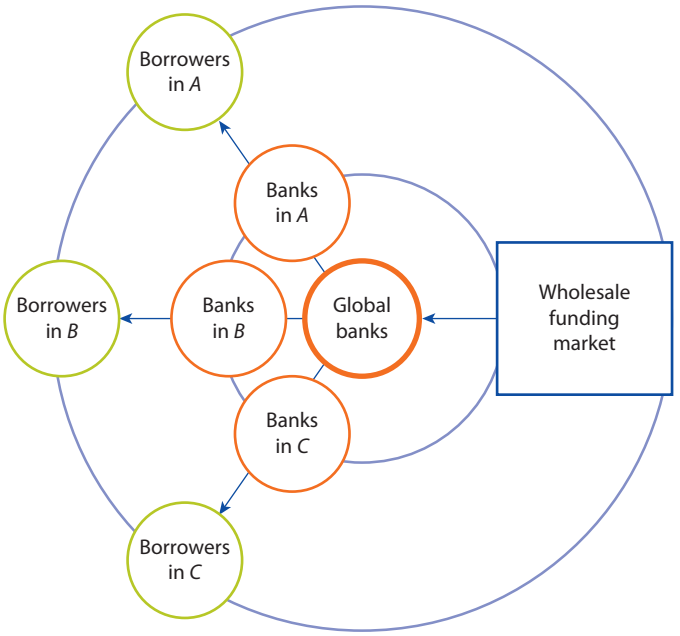
Figure 1.9 Role of Global Banks



liquidity spillovers across borders. At the margin, the shadow value of bank funding will be equalized across all regions through portfolio decisions of global banks so that global banks become the carriers of dollar liquidity across borders. As such, permissive U.S. liquidity conditions are transmitted globally and U.S. monetary policy becomes, in some respects, global monetary policy.

Foreign bank branches raise over US$1 trillion of funding, of which over US$600 billion is channeled to their headquarters (CGFS 2010). This figure covers just the branches of foreign banks, not their subsidiaries. If the funding shipped to the parent by the U.S.-based subsidiaries is also considered, the total funding shipped to headquarters would be substantially higher. A key quantity is the interoffice assets of foreign bank branches in the United States—the lending by branches to headquarters—as shown in figure 1.10. Interoffice assets increased steeply in the last two decades, saw a sharp decline in 2008, but bounced back in 2009.

What is remarkable about the U.S. dollar funding market is that even in net terms, foreign banks have been channeling large amounts of dollar funding out of the United States to their respective head offices. Figure 1.11 shows net interoffice assets of foreign banks in the United States. Net interoffice assets measure the net claim of the branch or subsidiary of the foreign bank on its parent. Normally, net interoffice assets would be negative, as foreign bank branches act as lending outposts. However, we see that the decade 2001–11 was exceptional, when net interoffice assets turned sharply positive, before reversing into negative territory during the height of the European crisis in 2011. In effect, between 2001 and 2011, foreign bank offices became funding sources for the

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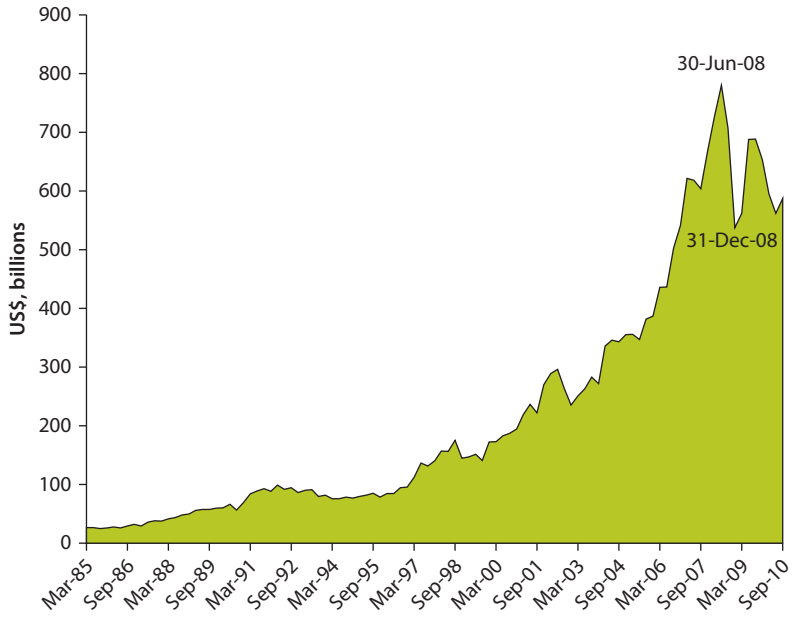
Figure 1.10 Interoffice Assets of Foreign Bank Branches in United States



Source: Federal Reserve.

parent, rather than lending outposts. As noted in a recent Bank for International Settlements (BIS) report, many European banks use a centralized funding model in which available funds are deployed globally through a centralized portfolio allocation decision (BIS 2010a). The net interoffice position of foreign banks in the United States therefore reflects the extent to which global banks were engaged in supplying U.S. dollar funding to other parts of the world.

We thus face an apparent paradox: although the United States is the largest net debtor in the world, it is a substantial net creditor in the global banking system. In effect, the United States is borrowing long (through treasury and other securities) but lending short through the banking sector. This situation is in contrast to countries such as Ireland and Spain that financed their current account deficits through their respective banking sectors and that have subsequently paid the price through runs by wholesale creditors on their banks.

In this chapter we will make frequent use of the net interoffice account position of foreign banks in the United States as an empirical proxy for the availability of wholesale funding provided to borrowers in the capital-recipient economy. Bruno and Shin (2011) conducted an empirical study of the sensitivity of capital flows to global factors.

Although there is a large degree of synchronization of banking-sector flows across different geographical regions and countries, there is also some diversity in the pattern of banking flows. Emerging Europe saw the most rapid increase in banking-sector inflows, followed by countries such as Turkey and the Republic of Korea. One factor in the diverse regional experiences has to do with the divergent business models pursued by cross-border banks that form the bridge between a

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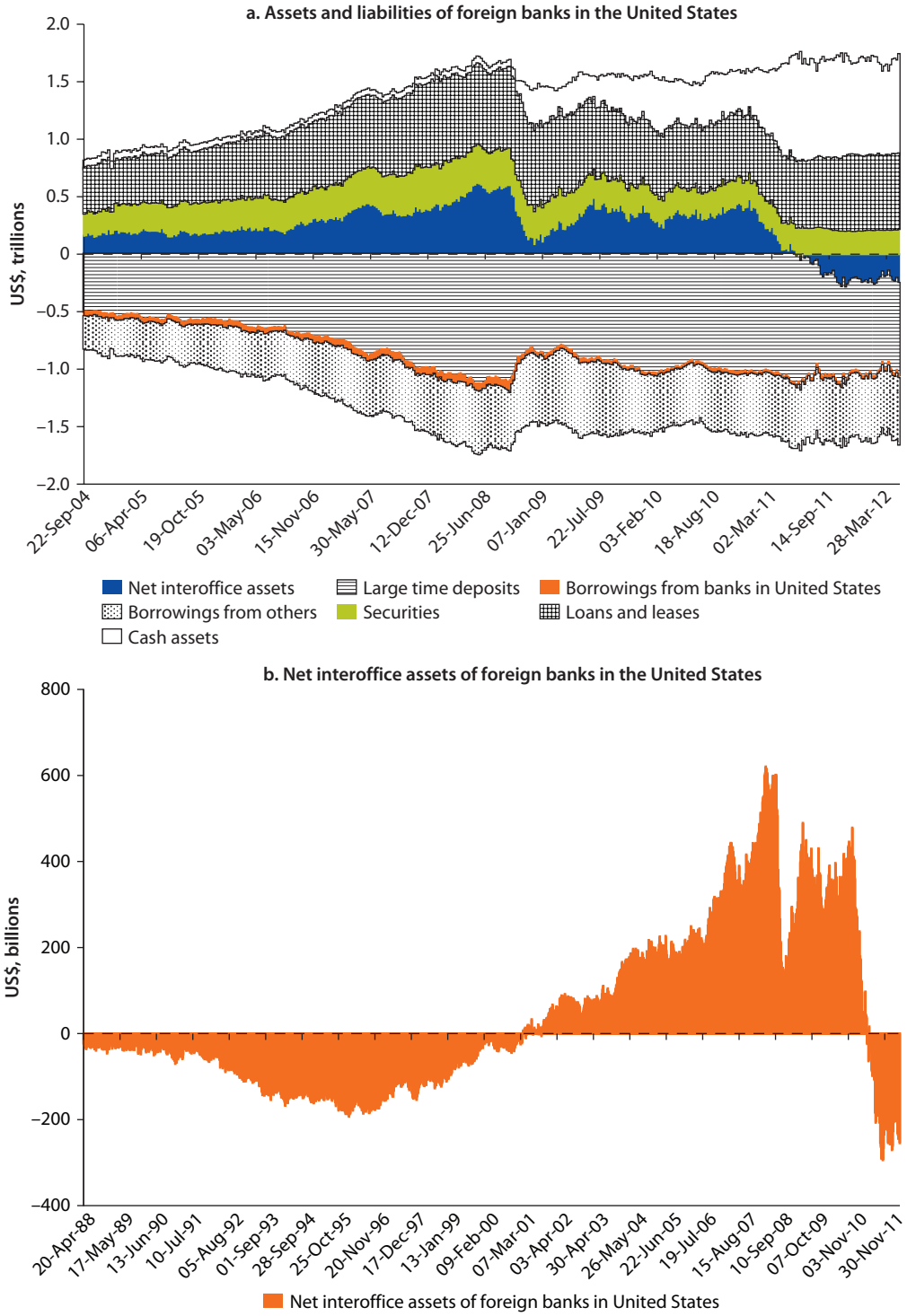
Figure 1.11 Trends in Assets of Foreign Banks in the United States



Source: Federal Reserve Board H8 series on commercial banks.

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particular region and the global banking system. Another BIS paper on funding patterns of global banks draws a distinction between global banks that operate a centralized portfolio allocation model and those that pursue a more decentralized operational model (BIS 2010b). Spanish banks that have large local subsidiaries in Latin America are cited as an example of the decentralized mode of operation, where the local subsidiaries draw on local deposit funding and operate largely independently from the parent in terms of its asset allocation. In contrast, European banks operate a more centralized portfolio allocation model where the portfolio allocation and funding decisions are made at the group headquarters and the banking group's global portfolio decision follows a centralized pattern.

Macro Prudential Framework

Drawing on the analytical background discussed earlier, we turn to the elements of a macro prudential framework. A macro prudential framework encompasses two key elements:

- A set of indicators that can inform judgments on the degree of vulnerability to financial instability and hence serve as the informational basis for policy actions
- An associated set of policy tools or automatic stabilizers that can kick in when circumstances warrant to anticipate and mitigate the vulnerabilities.

Macro Prudential indicators

Given the centrality of the banking sector and its potential for amplifying the procyclicality of the financial system, the pace of asset growth is of first-order interest. The challenge for policy makers is knowing when asset growth may be "excessive" and finding policy tools that can address and counter the excessive asset growth in a timely and effective manner.

Ratio of Credit Growth to GDP

Indicators that capture some notion of the ratio of total private sector credit to GDP have been discussed. This ratio has been shown to be a useful indicator of the stage of the financial cycle, as demonstrated by the work of BIS economists, notably Borio and Lowe (2002, 2004).

Under the Basel III framework, the ratio of credit to GDP has been given a central role in the framework for countercyclical buffer. The initial consultation document (BCBS 2009) issued by the Basel Committee in December 2009 first proposed a countercyclical capital buffer surcharge to act as a further buffer against loss during the upswing of the financial cycle. Subsequent development of the concept focused on the credit-to-GDP ratio as a measure of procyclicality that would trigger increased capital requirements on banks. The final version of the Basel III framework left the implementation of the countercyclical capital buffer to the discretion of national regulators, with the additional buffer in the range of 0–2.5 percent.

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Conceptually, it is natural that credit growth should be scaled by normalizing it relative to some underlying fundamental measure. Normalizing credit growth by GDP has many advantages. GDP is an aggregate flow measure of economic activity that reflects current economic conditions, and one that is readily available under basic national income calculations. Moreover, it is a measure that is highly standardized across countries, which helps in competition and level-playing field disputes in the consistent implementation of international banking regulation rules.

However, there are measurement challenges, even for the concept of credit growth. To serve as a signal of procyclicality, credit growth should mirror the risk-taking attitudes of market premiums, where they are relevant. The need for judgment is important in emerging and developing countries where long-term structural changes through financial development may render credit growth statistics less useful as a gauge of risk appetite. For instance, if the ratio of private credit to GDP shows rapid increase because of informal credit arrangements moving into the formalized banking sector, such a development has benign consequences for financial stability. In contrast, if the ratio of private credit to GDP increases because of a housing boom that is fed by cheap credit and the recycling of funding by nonfinancial companies, the financial stability implications are more worrying. The simple credit-to-GDP ratio may suffer from the fact that the aggregate measures of credit growth may mask some subtleties that cannot be summarized in one simple aggregate. It is also conceivable that there may be endogenous changes in economic relationships if the reduced-form economic relationships that underpin credit and GDP are used for policy purposes.

A possible counterargument to the accusation that the credit-to-GDP ratios may be too blunt is that any policy maker would exercise judgment when interpreting figures. Also, it could be argued that there is an asymmetry between the upswing part of the financial cycle and the downswing part. During the upswing, it may be argued that the policy of "leaning against the wind" can utilize information contained in the rapid growth of the credit-to-GDP ratio.

Assenmacher-Wesche and Gerlach (2010) present an opposing viewpoint to the emphasis placed by Borio and Lowe (2002, 2004) on the credit-to-GDP ratio as an informative signal of the buildup of vulnerabilities in the economy. Assenmacher-Wesche and Gerlach (2010) take a skeptical line on the link between credit growth and property price increases. Although they find that credit shocks are associated with increases in real GDP and equity prices, they do not find evidence that credit growth has a large impact on property prices. The authors take this result as evidence that the bulk of the variation in credit growth is related to expected future changes in real economic activity, and they conclude that the widely accepted view that fluctuations in credit growth have been a major driver of property price shocks seems not to be supported by the data. Assenmacher-Wesche and Gerlach's (2010) study uses data from the Organisation for Economic Co-operation and Development (OECD) countries covering the period 1986–2008. Hence, their study applies to advanced economies rather than to developing and emerging economies. However, the difficulty of finding

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conclusive evidence for the link between credit and property prices may be more widely applicable.

The fundamental difficulty is that a simple credit-to-GDP ratio lacks a conceptual framework that can easily link the measurement to measures of financial vulnerability. The skeptic could always argue that a surge in credit could either be caused by a structural change in the economy, the increase in positive net present value projects, and hence the *demand* for credit that is fully justified by the fundamentals, or simply by the migration of lending relationships to the formal banking sector that were previously taking place in the informal sector. Further research will be necessary to determine to what extent the simple credit-to-GDP ratio can serve as a finely calibrated signal that can support the use of automatic tightening of bank capital standards, as envisaged in the Basel III framework.

Bank Liability Aggregates

Because of the difficulties in using the simple credit-to-GDP ratio as the appropriate signal of the stage of the financial cycle, alternatives may be preferable. Measures derived from the *liabilities side* of banking-sector balance sheets show promise. In particular, the growth of various components of noncore-to-core liabilities of the banking sector may be especially useful in gauging the stage of the financial cycle, as argued by Shin and Shin (2010). The following discussion draws closely on this study.

Although traditional monetary aggregates such as M1 and M2[2] are also liability-side aggregates of the banking sector (measuring mainly the deposit liabilities), there are reasons to believe that such traditional monetary aggregates can be refined and improved upon so as to serve as effective indicators that underpin effective macro prudential policy.

Banks are the most important financial intermediaries in emerging and developing economies. Traditional monetary aggregates give a window on the size and composition of bank liabilities. Key monetary aggregates such as M2 track the size of the deposit base of the domestic banking system, and hence can serve as a proxy for the claim of the household sector on the banking sector. In more advanced financial systems where market-based debt instruments are more developed, the claims on the intermediary sector could include money market funds and other short-term claims held by the household sector.

To the extent that monetary aggregates reflect the size and composition of the banks' balance sheets, they may play a role in macro prudential policy. Central banks that continue to give some attention to monetary aggregates in their policy frameworks have increasingly emphasized the financial stability properties of monetary aggregates, moving away from the more traditional rationale for focusing on monetary aggregates based on the quantity theory of money and the association with inflation.

Traditional classifications of monetary aggregates focus on the transactional role of money as a medium of exchange. As such, the criterion is based on how close to cash—how "money-like"—a particular financial claim is. The classic study by Gurley and Shaw (1960) emphasized the distinction between "inside

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money," which is a liability of a private sector agent, and "outside money," (such as fiat currency) which is not. The traditional focus of monetary analysis has been on money as a medium of exchange.

Demand deposits are the archetypal money measure, since such liabilities of the banking sector can be quickly transferred from one person to another. Savings deposits are less moneylike, and hence figure in broader notions of money, such as M2, but even here they fall outside the M2 measure if the depositor faces restrictions on easy access to the funds. In this way, the traditional hierarchy of monetary aggregates goes from cash to the very liquid claims such as demand deposits and continuing to more illiquid claims such as term savings deposits. The criterion is how easily claims can be used to settle transactions. In the context of the quantity theory of money and the main quantity theory accounting identity $MV = PY$, the traditional monetary aggregate is more appropriate in identifying the extent to which inflation is likely.

For financial stability purposes, however, an alternative classification system for liability aggregates may be needed that is conceptually a better fit for the vulnerability to financial shocks and their propagation. The key task would be to draw on existing knowledge of the behavior of financial intermediaries (as discussed in the balance sheet management section of this chapter) and to find the counterparts in banking sector liability aggregates that have implications on the procyclicality of financial system. Traditional transaction-motivated monetary aggregates may not be the most useful measure in this respect.

Core and Noncore Bank Liabilities

One clue can be obtained from our earlier examination (in the external environment and global liquidity section of this chapter) of the role of external funding conditions in influencing banking-sector behavior. A useful distinction is that between *core* and *noncore* liabilities of the banking sector. Core liabilities can be defined as the funding that the bank draws on during normal times, and is sourced (in the main) domestically. What constitutes core funding will depend on the context and the economy in question, but retail deposits of the household sector would be a good first conjecture in defining core liabilities.

When banking sector assets are growing rapidly, the core funding available to the banking sector is likely to be insufficient to finance the rapid growth in new lending. This shortage is because retail deposits grow in line with the aggregate wealth of the household sector. In a lending boom, when credit is growing very rapidly, the pool of retail deposits is not likely to be sufficient to fund the increase in bank credit. Other sources of funding must then be tapped to fund rapidly increasing bank lending. The state of the financial cycle is thus reflected in the composition of bank liabilities.

To better focus the discussion around the key concepts, we first lay out an accounting framework for the financial system as a whole that will be useful later in distinguishing between core and noncore liabilities.

Suppose there are n banks in the domestic banking system. The term "bank" should be interpreted broadly to include firms in the intermediary sector

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generally. The exact composition of the sector will depend on the country's financial system, including its degree of openness and financial development. We denote the banks by an index that takes values in the set $\{1, 2, \ldots, n\}$. The domestic creditor sector (for example, households and domestic pension funds) is given the index $n+1$. The foreign creditor sector is given the index $n+2$.

Bank i has two types of assets. First, there are loans to end users such as corporations or households. Denote the total loans by bank i to such end users of credit as y_i. Next, there are the claims against other financial institutions. Call these the "interbank" assets, although the term covers all claims on other intermediaries. The total interbank assets held by bank i are

$$\sum_{j=1}^{n} x_j \pi_{ji}$$

where x_j is the total debt of bank j and π_{ji} is the share of bank j's debt held by bank i.

Note that $\pi_{i,n+1}$ is the proportion of the bank's liabilities held by the domestic creditor sector (for example, in the form of deposits), while $\pi_{i,n+2}$ is the proportion of the bank's liabilities held by foreign creditors (for example, in the form of short-term foreign currency-denominated debt). Since "banks" $n+1$ and $n+2$ are not leveraged, we have $x_{n+1} = x_{n+2} = 0$. The balance sheet identity of bank i is given by

$$y_i + \sum_{j=1}^{n} x_j \pi_{ji} = e_i + x_i$$

The left-hand side of the equation is the total assets of the bank. The right-hand side is the sum of equity and debt. Letting $x = [x_1 \quad \ldots \quad x_n]$ and $y = [y_1 \quad \ldots \quad y_n]$, we can write in vector notation the balance sheet identities of all banks as

$$y + x\prod = e + x$$

where Π is the matrix whose (i,j)th entry is π_{ij}. Solving for y,

$$y = e + x(I - \prod).$$

Define leverage as the ratio of total assets to equity, given by

$$\frac{a_i}{e_i} = \lambda_i.$$

Then defining Λ as the diagonal matrix with λ_i along the diagonal, we have

$$y = e + e(\Lambda - I)(I - \prod)$$

where Π is the matrix of interbank liabilities. By post-multiplying the above equation by the unit column vector

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$$u = \begin{bmatrix} 1 \\ \vdots \\ 1 \end{bmatrix}$$

we can sum up the rows of the vector equation above, and we have the following balance sheet identity:

$$\sum_i y_i = \sum_i e_i + \sum_i e_i z_i (\lambda_i - 1)$$

where z_i is given by the ith row of $(I - \Pi)u$. Here, z_i has the interpretation of the proportion of the bank's liabilities that come from outside the banking sector, that is, the proportion of funding that comes either from the ultimate domestic creditors (for example, deposits) or the foreign sector (for example, foreign currency-denominated banking-sector liabilities).

Therefore, we can rewrite the aggregate balance sheet identity in the following way:

$$\text{Total credit} = \text{Total equity of banking sector} + \text{Liabilities to nonbank domestic creditors} + \text{Liabilities to foreign creditors.}$$

This accounting framework helps us understand the connection between (1) the procyclicality of the banking system, (2) systemic risk spillovers, and (3) the stock of noncore liabilities of the banking system.

Within this accounting framework, the *core liabilities* of a bank can be defined as its liabilities to nonbank domestic creditors (such as through retail deposits). Thus, the *noncore liabilities* of a bank are either (1) a liability to another bank or (2) a liability to a foreign creditor. Two features distinguish noncore liabilities. First, noncore liabilities include claims held by intermediaries on other intermediaries. Second, they include liabilities to foreign creditors, who are typically the *global* banks, and hence also intermediaries, albeit foreign ones. Even for liabilities to domestic creditors, if the creditor is another intermediary, the claim tends to be short term. The distinction between core and noncore liabilities becomes meaningful once there are differences in the empirical properties of the two types of liabilities.

Table 1.1, taken from Shin and Shin (2010), is a two-way classification of banking sector liabilities that distinguishes the traditional concern with the liquidity of monetary aggregates for transaction purposes together with the question of whether the liabilities are core or noncore. The distinction between core and noncore liabilities has widespread applicability, but the precise demarcation line between core and noncore funding depends on the particular economy and the context of financial development. For advanced economies with developed financial systems, noncore liabilities will include nondeposit funding that is raised in the wholesale bank funding market.

It would be reasonable to conjecture that core liabilities are more stable (or "sticky") than noncore liabilities. For instance, retail deposits of household savers

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Table 1.1 Classification of Core versus Noncore Liabilities

	Core liability	*Intermediate*	*Noncore liability*
Highly liquid	Cash Demand deposits (households)	Demand deposits (nonfinancial corporate)	Repos Call loans Short-term FX bank debt
Intermediate	Time deposits and CDs (households)	Time deposits and CDs (nonfinancial corporate)	Time deposits and CDs (banks and securities firms)
Illiquid	Trust accounts (households) Covered bonds (households)	Trust accounts (nonfinancial corporate)	Long-term bank debt securities (banks and securities firms) ABS and MBS[a]

Source: Shin and Shin 2010.
Note: CDs = certificates of deposit.
a. ABS is asset-backed securities; MBS is mortgage-backed securities.

would be more stable than corporate deposits, which in turn could be subdivided into nonfinancial company deposits and financial institution deposits. Again, it would be a reasonable conjecture that nonfinancial corporate deposits are more "sticky" than financial company deposits. Indeed, there is considerable empirical support for the different properties of bank liabilities depending on who holds the claim.

Hahm et al. (2010) examine the components of Korean banks' liabilities, subdivided into the two-dimensional categorization illustrated in table 1.1, that is, by classifying liabilities into how liquid they are and who holds them. They present evidence of a clear hierarchy within each liquidity category of the relative "stickiness" of the liability, depending on whether the liability is due to the household sector, nonfinancial corporate sector or financial corporate sector.

As mentioned, the dividing line between core and noncore liabilities will depend on the financial system in question and its degree of openness and the level of development of its financial markets and institutions. For a developed financial system like the United States or Western Europe, the distinction between core and noncore liabilities seems reasonably well captured by the distinction between deposit and nondeposit funding. Figure 1.12, which is taken from Shin (2009), shows the composition of the liabilities of Northern Rock, the U.K. bank whose failure in 2007 heralded the global financial crisis.

In the nine years from 1998 to 2007, Northern Rock's lending increased 6.5 times. This increase in lending far outstripped the funds raised through retail deposits with the rest of the funding gap being made up by wholesale funding (securitized notes and other lending as shown in figure 1.12). Northern Rock's case illustrates the general lesson that during a credit boom, the rapid increase in bank lending outstrips the core deposit funding available to a bank. As the boom progresses, the bank resorts to alternative, noncore liabilities to finance its lending. Therefore, the proportion of noncore liabilities of banks serves as a useful indicator of the stage of the financial cycle and the degree of vulnerability of the banking system to a downturn of the financial cycle.

For emerging or developing economies, more thought is needed to find a useful classification system between core and noncore liabilities. In an open emerging

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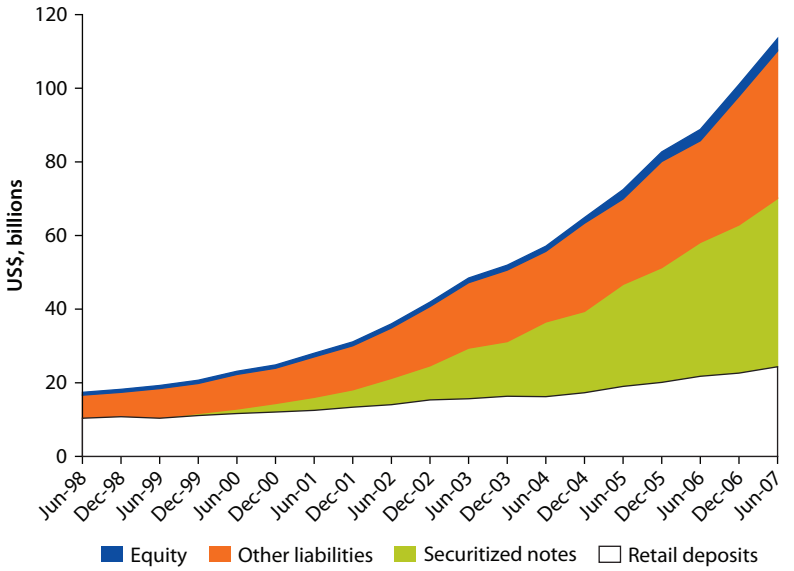
Figure 1.12 Northern Rock Bank's Liabilities, 1998–2007



Source: Shin 2009.

economy where the banking system is open to funding from global banks, rapid increases in the noncore liabilities of the banking system would show up as capital inflows through increased foreign exchange-denominated liabilities of the banking system. For this reason, foreign exchange-denominated liabilities of the banking sector can be expected to play a key role in diagnosing the potential for financial instability.

For the case of Korea, Shin and Shin (2010) proposed a definition of noncore liabilities as the sum of (1) foreign exchange-denominated bank liabilities, (2) bank debt securities, (3) promissory notes, (4) repos, and (5) certificates of deposit.[3] Note that this measure of noncore liabilities is an approximation of "true" noncore liabilities defined in our accounting framework above, as the classification is still based on financial instruments rather than actual claim holders. For instance, bank debt securities such as debentures and certificates of deposit (CDs) can be held by households, and must be excluded from the noncore liabilities. Figure 1.13 charts the noncore liabilities of the Korean banking sector, taken from Shin and Shin (2010) with the FX liabilities shown as "other FX borrowing." It is noticeable how the first peak in noncore liabilities coincides with the 1997 crisis. After a lull in the early 2000s, noncore liabilities increase rapidly in the runup to the 2008 crisis.

Note that the major peak occurs some weeks after the outbreak of the crisis because the total amounts are measured in Korean won, and the outbreak of the crisis coincides with a rapid depreciation of the won, which implies an increase in the won value of the foreign currency-denominated bank liabilities.

The pronounced procyclicality of the noncore liability series for Korea should not come as a surprise, given what we know (see earlier discussion in this chapter)

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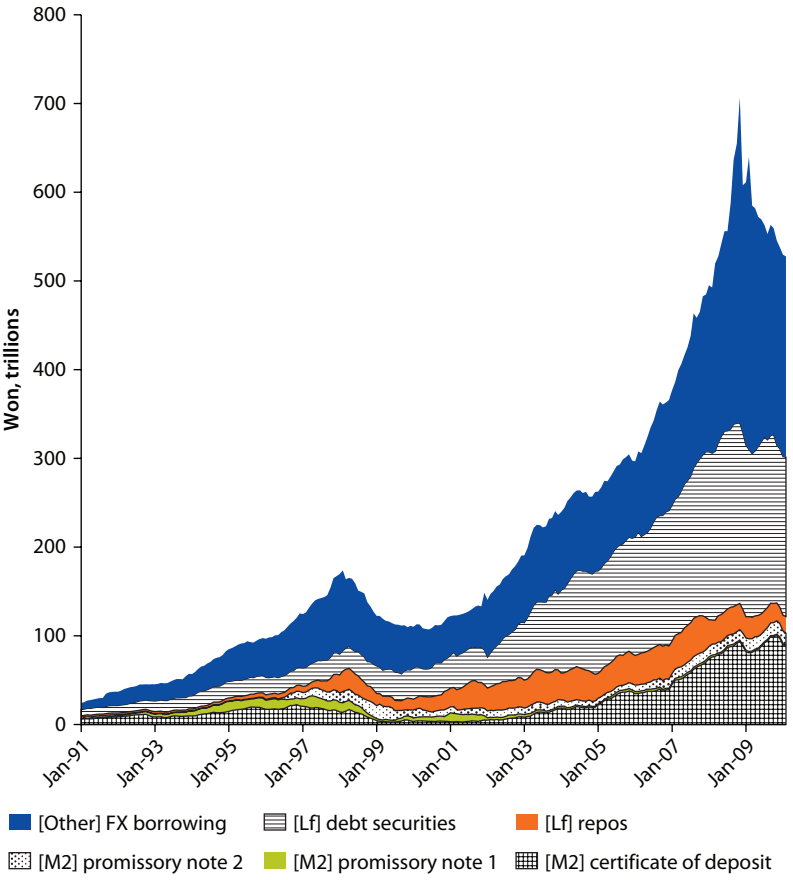
Figure 1.13 Noncore Liabilities of the Korean Banking Sector



Source: Shin and Shin 2010.

about the balance sheet management practices of banks and the perverse nature of the demand and supply responses to asset price changes and shifts to measured risks. During a credit boom, when measured risks are low and funding from global banks is easy to obtain, we would expect to see strong credit growth fuelled by capital inflows into the banking sector, often in foreign exchange.

Figure 1.14 shows how capital flows associated with foreign currency liabilities of the banking sector played a key role in the foreign exchange liquidity crisis of 2008 in Korea. Figure 1.14 plots and compares the net of capital inflows and outflows for two sectors: the equity sector and the banking sector. The equity sector actually saw *net inflows* during the crisis in the autumn of 2008. Contrary to the common misperception (perpetuated by television broadcasts from the stock exchange after turbulent trading) that the exit of foreign investors from the Korean stock market is the main reason for capital outflows, we can see that the flows in the equity sector was *net positive* immediately after the crisis.

There are good reasons for why the equity sector should see net positive flows during a crisis. Equity outflows have two mitigating factors. During a crisis, not

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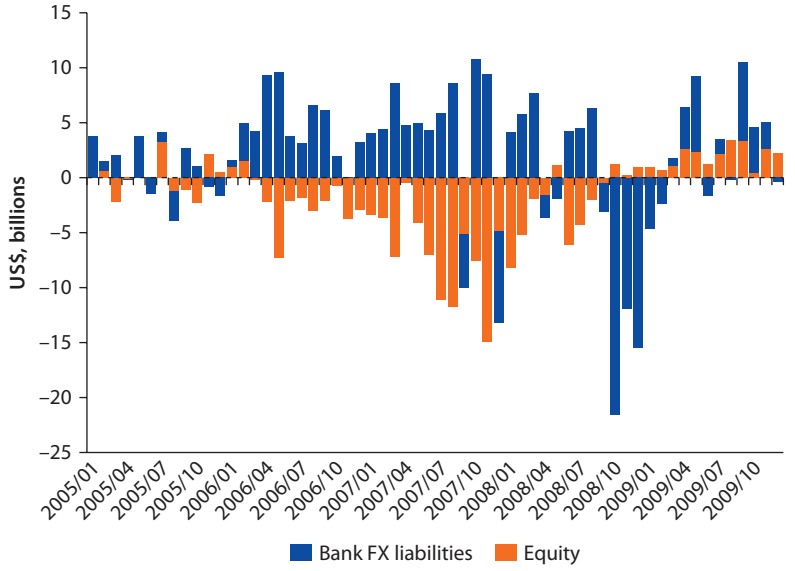
Figure 1.14 Net Capital Flows of Equity and Banking Sector in Korea



Source: Shin and Shin 2010.

only do stock prices fall sharply but there is a steep depreciation of the local currency relative to U.S. dollars. For both reasons, foreign investors suffer a "double whammy" if they withdraw from the local stock market. Provided that the exchange rate is allowed to adjust, equity outflows will not be the main culprit in draining foreign currency reserves. When Korean investors have equity investments abroad, the repatriation flows back to Korea will outweigh the outflows from foreign investors.

However, the banking sector is different for three reasons. First, foreign currency liabilities of the banks have a face value that must be met in full. Second, the face value is in foreign currency. Third, the dynamics of deleveraging set off amplifying effects through price changes and shifts in measured risks.

For all three reasons, the deleveraging of the banking sector is associated with precipitous capital outflows. Unlike long-term investors, such as pension funds, mutual funds, and life insurance companies, leveraged institutions are vulnerable to erosion of their capital, and hence engage in substantial adjustments of their assets even to small shocks. The feedback loop generated by such reactions to price changes amplifies shocks.

As figure 1.14 shows, the banking sector in Korea saw substantial capital outflows in the aftermath of the Lehman crisis. In the three months following the Lehman bankruptcy, the outflow from the banking sector was US$49 billion, which more than accounts for the decrease in Korea's foreign exchange reserves from over US$240 billion before the Lehman crisis to US$200 billion at the end of 2008. Deleveraging by banks and the associated amplification effects have figured prominently in emerging economy financial crises.

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Cross-Section Measures of Risk and Core and Noncore Liabilities

In a boom when credit is growing rapidly, the growth of bank balance sheets outstrips the growth in the pool of retail deposits. As a result, the growth of bank lending results in greater lending and borrowing among the intermediaries themselves, or results in the "sucking in" of foreign debt. Thus, the "cross-section" dimension of risk where banks are vulnerable to a common shock is closely related to the "time-series" dimension of risk having to do with procyclicality of the balance sheet where assets are larger during the peak of the financial cycle.

To illustrate the principle that the cross-section and time-series dimensions of risk are closely related, consider the simple case where there is no foreign creditor sector. Figure 1.15 depicts a stylized financial system with two banks: Bank 1 and Bank 2. Both banks draw on retail deposits to lend to ultimate borrowers. They can also hold claims against each other, if they so choose.

Imagine a lending boom in which the assets of both banks double in size, but the pool of retail deposits stays fixed. Then, the proportion of banking-sector liabilities in the form of retail deposits must fall. In other words, rapidly expanding bank assets are mirrored by increased cross-claims across banks. The growth in bank assets and increased systemic risk are two sides of the same coin.

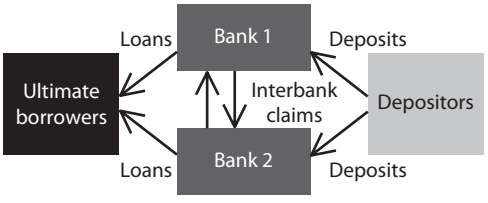
The relationship between banking-sector assets and increased cross exposure across banks holds more generally in the accounting identity described earlier. Recall our definition of core and noncore liabilities. The *core liabilities* of a bank are its liabilities to claimholders who are not financial intermediaries themselves, such as retail deposits. Any liability of an intermediary held by another intermediary would be a *noncore liability*.

From our earlier accounting identity for the financial system as a whole, we can define the total core liabilities of the banking sector as:

$$\text{Total core liabilities } = \sum_{i=1}^{n} e_i z_i (\lambda_i - 1)$$

where, as before, e_i is the equity of bank i, λ_i is the leverage of bank i, z_i is the ratio of bank i's core liabilities to its total liabilities, and n is the number of banks in the banking system. Since total core liabilities (such as retail deposits) are slow moving, a rapid increase in total bank assets (equity multiplied by leverage) must result in lower z_i values, implying a greater reliance on noncore funding. More generally, in the presence of a foreign creditor sector, the increase in bank lending will result not only in increased cross lending between banks but also in

Figure 1.15 Cross-Claims between Banks



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the sucking in of foreign debt. In this way, there are close conceptual links between procyclicality, systemic risk spillovers, and the banking system's stock of noncore liabilities. The stage of the financial cycle is reflected in the composition of the liabilities of the banking sector. In a boom, we have the conjunction of three features:

- Total lending increases rapidly
- Noncore (especially foreign currency) liabilities increase as a proportion of total liabilities
- Systemic risk increases through greater cross holdings between intermediaries.

Measures of cross exposures across intermediaries (such as the CoVaR measure, the value-at-risk (VaR) of the financial system *conditional* on institutions being in distress measure due to Adrian and Brunnermeier [2009]) may be useful complementary indicators, bearing in mind that cross exposures themselves are procyclical, and track noncore liabilities. The study of cross exposures across financial institutions is still in its infancy, but there has been a growing interest in this issue, especially from researchers in central banks from advanced economies that suffered financial distress during the recent financial crisis. Among advanced-economy central banks, the Bank of England has been one of the most active in research into the systemic risk generated by cross exposures between financial intermediaries. In November 2009, the Bank of England published a discussion paper on the role of macro prudential policy that discusses the issues and policy concerns regarding the United Kingdom's experience with the failure of Northern Rock bank and the subsequent intervention and resolution in the U.K. banking system (Bank of England 2009). Although there is a gap between the concerns of an advanced economy and those of an emerging economy, many of the lessons on excessive asset growth and the growth of volatile market-based liabilities are common themes.

Nonfinancial Corporate Deposits as a Measure of Noncore Liabilities

The discussion so far is appropriate for an economy (such as Korea) in which the domestic banking sector has access to funding from the global banking system. However, in financial systems at an early stage of development or where the banking sector is restricted by regulation from having access to the global banking system, the distinction between core and noncore liabilities of the banking system may look different, although the principles from the systemwide accounting framework will apply.

When the domestic banking sector is mostly closed from the global banking sector, deposits will constitute the lion's share of banking-sector liabilities, and traditional monetary aggregates such as M2 itself becomes highly variable and procyclical, encompassing volatile banking liabilities. In such instances, it may be more meaningful to decompose M2 into its core and noncore components. The noncore component may include the deposits of nonfinancial companies that

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recycle funding within the economy and hence become integrated into the intermediary sector. China and India are two examples of countries where the distinction between core and noncore liabilities may be usefully employed. In both cases, foreign exchange-denominated bank liabilities or market-based funding instruments play a much smaller role than in a more open economy such as Korea.

Somewhat paradoxically, perhaps, one way to illustrate the role of nonfinancial firms in financial intermediation is to draw on the experience of Japan in the 1980s during the liberalization of its financial sector. Japan's 1980s experience was taken up by Hattori, Shin, and Takahashi (2009), who examined the role of the nonfinancial corporate sector in amplifying the financial cycle. Some themes that overlap with macro prudential policy are worth mentioning.

The focus of Hattori, Shin, and Takahashi (2009) is on corporate lending following the sectoral changes that took place in Japan after the liberalization of the securities markets and the accompanying liberalization of the rules governing bank deposits.

As a result of the financial liberalization of the 1980s, securities markets enabled the opening up of new funding sources—both domestic and foreign—for companies that had traditionally relied on the banking sector. Of particular interest is the role played by Japan's large manufacturing firms. Before the 1980s, manufacturing firms in Japan received most of their financing from the traditional banking sector, both for long-term investment and short-term liquidity needs. However, with the liberalization of the securities market beginning in the mid-1980s, nonfinancial companies were able to tap new sources of funding from outside the traditional banking sector. New issuance of equity, corporate bonds, warrants, and commercial paper (CP) increasingly became important sources of funding for nonfinancial firms. The new funding was supplied by both domestic savers and other nonleveraged financial institutions, such as life insurance companies who purchased the bonds and other securities issued by Japanese companies. Foreign investors also figured prominently among the new funding sources.

However, the sequencing of reforms meant that the liberalization of nonfinancial corporate funding proceeded ahead of the liberalization of the banking sector. As new funding sources opened up to large manufacturing firms, it became profitable for them to recycle liquidity and act as *de facto* financial intermediaries by raising funding in the capital markets through securities, and then depositing the funds in the banking system through time deposits. Through this channel, the financial assets of nonfinancial corporations increased dramatically together with their financial liabilities in the late 1980s (see Hattori, Shin, and Takahashi 2009 for details). Figure 1.16 illustrates the change in financial structure entailed by the recycling of liquidity.

When nonfinancial firms play the role of *de facto* financial intermediaries, the stock of M2 will see rapid increases due to the increasing deposit claims on the banking sector. Meanwhile, the banking sector itself will be under increasing pressure to find new borrowers, since its traditional customers (the manufacturing firms), no longer need funding, instead have undergone a reversal of roles and are pushing deposits into the banks, rather than receiving loans from the banks.

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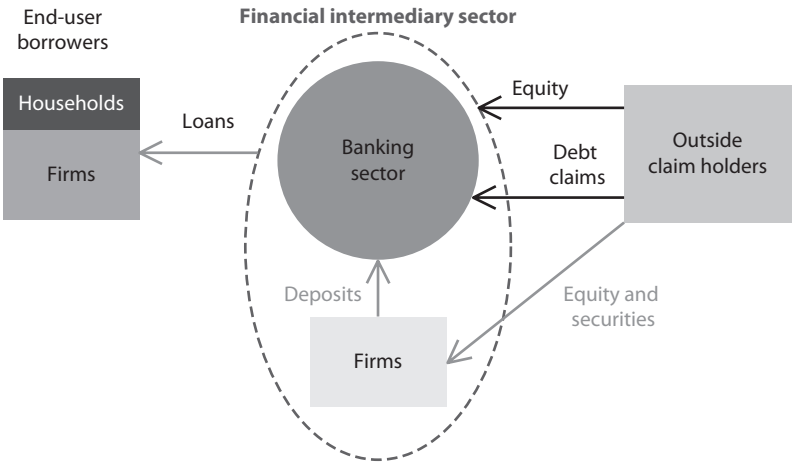
Figure 1.16 Structural Change in Financial Intermediation in Japan, 1980s



Source: Hattori, Shin, and Takahashi 2009.

Under such circumstances, the distinction between core and noncore banking sector liabilities does not coincide neatly with the distinction between deposit and nondeposit liabilities.

In many developing countries that are at an earlier stage of financial development, or are more closed to the global banking system, the principle behind the distinction between core and noncore liabilities is better expressed as the distinction between:

- The *retail deposits* of the household sector and
- The *wholesale deposits* of nonfinancial companies.

The new liquidity requirements on banks contemplated under the Basel III rules (the net stable funding ratio [NSFR] and the liquidity coverage ratio [LCR]) recognize that retail deposits are much more "sticky" and are less likely to run, whereas the wholesale deposits of corporates are more "flighty" (BCBS 2010).

Adapting Monetary Aggregates and Macro Prudential Indicators

Traditional monetary aggregates were defined around their legal form, and how liquid they are in transactions. For the reasons outlined earlier, these traditional aggregates will be less effective as a macro prudential monitoring tool without further adaptation.

The particular adaptations may be usefully summarized in the following three points:

- For countries with open capital markets, international capital flows into the banking sector will be key indicators of financial vulnerability. During a boom when bank assets are growing rapidly, the funding required outstrips the growth of the domestic deposit base, and is often met by capital flows from

the international banks, which is reflected in the growth of short-term foreign currency-denominated liabilities of the domestic banking system. As such, short-term foreign currency-denominated bank liabilities can be seen as the volatile noncore liabilities of the banking sector.

- For countries with relatively closed financial systems, where domestic banks do not have ready access to funding provided by the global banking system, a better approach would be to adapt existing conventional monetary aggregates to address financial stability concerns. The key distinction is not how *liquid* the claims are, but rather *who holds the claims*. The distinction between household retail deposits and corporate deposits in the banking sector will play a particularly important role in this regard.
- More generally, invoking the accounting principle that defines core versus noncore liabilities of the banking sector may prove useful in guiding classification exercises. Core liabilities are the claims of the household sector on the intermediary sector. Noncore liabilities are the claims of the intermediary sector on itself. There may be ambiguities in applying this principle (as exemplified by the case of 1980s' Japan).

As a practical matter, the classification into core and noncore is not clear cut. Bank deposits of a small or medium-size enterprise with an owner-manager could be seen as household deposits. However, a larger firm with access to market finance might be able to issue bonds and then deposit the proceeds of the bond sale in the banking system, as happened in Japan in the 1980s, for instance. The latter case should not be counted as a core liability, since the creditor firm is acting like an intermediary who borrows in the financial markets to lend to the banks.

Other ambiguities are presented by items such as trust liabilities of the banking sector. Much of the trust liabilities are to nonfinancial corporates and face many of the definitional hurdles. In addition, it may be better to have a more graduated distinction between core and noncore liabilities, allowing an intermediate category to take account of such ambiguities.

Nevertheless, the distinction between core and noncore bank liabilities provides a better window on the actual exposure of the banking sector to financial risk and its willingness to increase exposures. As such, the relative size of noncore liabilities can be used as a monitoring tool to reflect the stage of the financial cycle and the degree of vulnerability to potential setbacks.

Macro Prudential Tools

Macro prudential policy tools aim to mitigate the buildup of vulnerabilities to financial instability. For the reasons outlined earlier, the primary aim of macro prudential policy is to secure financial stability by leaning against permissive financial conditions (should they be deemed excessive), and to lean against excessively rapid loan growth by the banking sector. Macro prudential policies complement existing tools in banking regulation, such as minimum capital ratios.

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An important consideration in formulating macro prudential policy is the link with broader macroeconomic stabilization policy, and especially with the conduct of monetary policy. The role of monetary policy in securing financial stability has broad resonance, both in advanced and in developing and emerging countries.

In this section, we focus on the specific tools of macro prudential policy and their link to the debate on capital controls. To the extent that the external environment in the global banking system is a key determinant of the vulnerability of the economy to financial excesses, considerations of macro prudential policies cannot easily be separated from the currently active debate on the merits of capital controls. The International Monetary Fund (IMF) has recently suggested the more neutral term "capital flow management" (CFM) policies (IMF 2011), rather than the more emotive term "capital controls," reflecting the more receptive attitude by the IMF to the imposition of capital controls. Indeed, some macro prudential tools have many similar attributes to the tools used in capital controls. For this reason, it is useful to adapt the three-part taxonomy in the recent IMF report (IMF 2011, 41) on capital flows:

- *Prudential tools*. These tools encompass existing or new tools of prudential regulation that have a primarily domestic focus and are not aimed primarily at correcting capital flow distortions. Examples include LTV rules, caps on the loan-to-deposit ratio, and leverage caps.
- *Currency-based tools*. These tools are prudential measures that address vulnerabilities that originate from distortions in the external environment such as global liquidity conditions, but which restrict activity or impose costs based on currency distinctions rather than on the residency of the investor. An example is the levy on short-term foreign exchange-denominated liabilities of the banking sector implemented by Korea (the "macro prudential levy").
- *Residency-based tools*. These tools are the traditional capital control (capital flow management) tools that restrict activity or impose costs based on the residence of the investor. Examples include administrative restrictions on ownership, taxes on portfolio inflows, such as Brazil's tax on financial operations (Imposto sobre operações financeiras; IOF). Capital controls raise a complex set of issues concerning their ultimate objectives, that is, whether the objective is to hold down the exchange rate, or to limit the total volume of inflows to slow down the appreciation of the exchange rate. These issues merit a separate discussion, and will not concern us here. In this chapter, we will focus exclusively on the financial stability impact of macro prudential policies.

Prudential Tools

Capital Requirements that Adjust Over the Cycle

The balance sheet management of banks is inherently procyclical, as explained earlier in this chapter. The rise in asset values that accompanies a boom results in higher capital buffers at financial institutions, supporting further lending in the

context of an unchanging benchmark for capital adequacy. In a bust, the value of this capital can drop precipitously, possibly even necessitating a cut in lending.[4]

Capital requirements as currently constituted, therefore, can amplify the credit cycle, making a boom and bust more likely. Capital requirements that, instead, lean against the credit or business cycle, that is, rise with credit growth and fall with credit contraction, can thus play an important role in promoting financial stability and reducing systemic risk.

We have commented on some of the measurement issues associated with the implementation of countercyclical capital buffers. The framework for countercyclical capital buffers as envisaged in the Basel III framework has focused on the ratio of credit growth to GDP. There are two preconditions for the successful implementation of such countercyclical measures. First, the quantitative signals that trigger actions must reflect accurately the features (such as excessively loose lending conditions) that are being targeted by policy makers. Second, the implementation procedure should be such that policy makers can move decisively and in a timely manner in heading off the buildup of vulnerabilities. We have commented on the first point, and here we focus on the second point.

If the triggering of countercyclical capital requirements is predicated on the exercise of discretion and judgment by the authorities, the political economy problems associated with the exercise of such discretion can put the authorities under pressure from market participants and other interested parties. The political economy problem is similar to that of central banks that tighten monetary policy to head off property booms. Since private-sector participants (such as construction companies or property developers) are the beneficiaries of the short-term boom, they can be expected to exert pressure on policy makers or engage in general lobbying. The political economy problems will be more acute if there are controversies on the exact stage of the financial cycle or the degree of conclusiveness of the empirical evidence invoked by the policy authorities.

Thus, the two issues mentioned above—the accuracy of the quantitative indicators and the political economy problems—are closely related. One of the disadvantages of the countercyclical capital buffer is that it relies on triggering additional capital requirements in response to quantitative signals. Although such quantitative measures are relatively straightforward in simple theoretical models, there may be considerable challenges to smooth and decisive implementation in practice.

Forward-Looking Provisioning

Forward-looking provisioning requires the buildup of loss-absorbing buffers in the form of provisions at the time of making the loan, and shares similarities with the countercyclical capital buffer. However, a key difference between provisioning and equity is in their accounting treatment. In the case of forward-looking provisioning, the provision is not counted as bank capital, and hence is less likely to influence bank management that targets a specific return on equity (ROE) level. To the extent that the bank uses its capital as the base on which to build its total balance sheet, a larger equity base will result in a larger balance sheet,

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and hence greater use of debt to finance the assets. During the credit boom, the buildup of greater assets using debt financing will contribute to the buildup of vulnerabilities.

The accounting treatment of the loss buffer as a provision rather than as equity thus has a potentially crucial effect on bank behavior. By insisting on forward-looking provisioning, the bank's equity is reduced by the amount of the provision. During a boom, such a reduction of bank capital can play an important role in "letting off steam" in the pressure to build up the bank's balance sheet by removing some of the capital base of the bank.

Although forward-looking provisioning has been important in cushioning the Spanish banking system from the initial stages of the global financial crisis, it remains to be seen whether building up loss-absorbing buffers, by itself, can be sufficient to cushion the economy from the bursting of a major property bubble, as Spain discovered in the recent financial crisis in Europe.

Loan-to-Value and Debt-Service-to-Income Caps

When monetary policy is constrained, administrative rules that limit bank lending such as caps on loan-to-value (LTV) ratios and debt-to-income (DTI) ratios may be a useful complement to traditional tools in banking supervision. LTV regulation restricts the amount of the loan not to exceed some percentage of the value of the collateral asset. DTI caps operate by limiting the debt service costs of the borrower not to exceed some fixed percentage of verified income.

Conceptually, it is useful to distinguish two motivations for the use of LTV and DTI rules. The first is the consumer protection motive, where the intention is to protect household borrowers who may take on excessively burdensome debt relative to the reasonable means to repay them from wage income. Under this motivation, LTV and DTI rules would be similar to the rules against predatory lending to uninformed households. Although this motivation is an important topic in consumer protection policy, it is not relevant for macro prudential policy, and is not discussed in this chapter. Instead, the macro prudential rationale for imposing LTV and DTI caps is to limit bank lending to prevent the buildup of noncore liabilities to fund such loans, and also to lean against the erosion of lending standards associated with rapid asset growth.

It is important to reiterate why conventional micro prudential tools such as minimum capital requirements are insufficient to stem excessive asset growth. Minimum capital requirements rarely bite during a lending boom when bank profitability is high, and when measured risks are low.

Whereas LTV ratio caps are familiar tools, the use of DTI caps is less widespread. For Korea and some Asian economies such as Hong Kong SAR, the use of DTI ratios has been an important supplementary tool for macro prudential purposes. DTI rules have the advantage that bank loan growth can be tied (at least loosely) to wage growth in the economy. Without this fundamental anchor, an LTV rule by itself will be susceptible to the amplifying dynamics of a credit boom, which interacts with an increase in the value of collateral assets during a housing boom. Even though the LTV rule is in place, if house prices are rising

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sufficiently fast, the collateral value will rise simultaneously, making the constraint bind less hard.

In the case of Hong Kong, the use of DTI rules takes on added significance because Hong Kong's currency board is based on the U.S. dollar, and hence does not have an autonomous monetary policy. Thus, monetary policy shocks are transmitted directly to Hong Kong.

Leverage Caps and Loan-to-Deposit Caps

Caps on bank leverage may be used to limit asset growth by tying total assets to bank equity (Morris and Shin 2008). The rationale for a leverage cap rests on the role of bank capital as a constraint on new lending rather than the Basel approach of bank capital as a buffer against loss.

The experience of Korea holds some lessons in the use of leverage caps and loan-to-deposit ratio caps. In June 2010, the Korean regulatory authorities introduced a new set of macro prudential regulations to mitigate excessive volatility of foreign capital flows. Specific policy measures included explicit ceilings on foreign exchange derivatives positions of banks, regulations on foreign currency bank loans, and prudential regulations for improving foreign exchange risk management of financial institutions. These policy measures were intended to limit short-term foreign currency-denominated borrowings of banks.

Korea's leverage cap on bank FX derivative positions introduced in June 2010 was aimed at limiting the practice of banks hedging forward dollar positions with carry trade positions in Korean won funded with short-term U.S. dollar debt.

A related measure in Korea is the cap on the ratio of loans to deposits. The Korean supervisory authority announced in December 2009 that it would reintroduce the loan-to-deposit ratio regulation that had been scrapped in November 1998 as a part of the government deregulation efforts. According to the regulation, the ratio of Korean won-denominated loans to won-denominated deposits should fall to below 100 percent by 2013. The rationale for this policy was to restrict loan growth, by tying the growth of lending to the deposit base.

Since the deposit base constitutes the baseline, the definition of what qualifies as deposits has strict guidelines. For instance, negotiable certificates of deposit are not included in the measure of deposits in the denominator in computing the ratio. Although the requirement to meet the 100 percent ceiling was set for the end of 2013, banks anticipated the eventual cap and began reducing their loan-to-value ratios in anticipation of the implementation of the cap.

However, a potential weakness of the regulation is that it does not apply to the Korean branches of foreign banks. Since foreign bank branches supply a substantial amount of foreign exchange-denominated lending to Korean banks and firms, the exemption of foreign bank branches leaves a gap in the regulation. However, this gap would not have been easily plugged within the framework of a loan-to-deposit cap because foreign bank branches, by their nature, rely mostly on funding from headquarters or from wholesale funding, rather than local deposit funding.

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For domestic banks, the loan-to-deposit ratio cap has two effects. First, it restrains excessive asset growth by tying loan growth to the growth in deposit funding. Second, there is a direct effect on the growth of noncore liabilities, and hence on the buildup of vulnerabilities that come from the liabilities side of the balance sheet. In this respect, there are similarities between the loan-to-deposit cap and the levy on noncore liabilities, to be discussed later. Indeed, at the theoretical level, the loan-to-deposit cap can be seen as a special case of a noncore liabilities levy where the tax rate is kinked, changing from zero to infinity at the threshold point. However, the comparison with the noncore liabilities levy is less easy because the loan-to-deposit cap applies only to loans, not total assets or total exposures (including off-balance-sheet exposures).

Currency-Based Tools

We now turn to the currency-based tools that have been used as capital control means, as well as for prudential reasons.

Unremunerated Reserve Requirements

Perhaps the best-known traditional form of capital control has been unremunerated reserve requirements (URR), through which the central bank requires importers of capital to deposit a certain fraction of the sum at the central bank. The prevalence of the URR is largely because the central bank has been in charge of both prudential policy and macroeconomic management, and because the central bank normally has had discretion to use URR policies without going through the legislative procedures associated with other forms of capital controls, such as levies and taxes.

The recent IMF staff discussion note (Ostry and others 2011) has a comprehensive discussion of countries' experiences in their use of URRs. Most central banks impose some type of reserve requirement for deposits, especially when the deposits are under government-sponsored deposit insurance. The rationale for the reserve requirement is that it is an implicit insurance premium paid by the bank in return for deposit insurance.

The macro prudential motivation for URR is to impose an implicit tax on components of financial intermediary liabilities other than insured deposits that are likely to impose negative spillover effects. The introduction of a reserve requirement for the nondeposit liabilities of banks would raise the cost of nondeposit funding for banks, and thereby restrain the rapid growth of such liabilities during booms. In this respect, the reserve requirement on nondeposit liabilities would have a similar effect to a tax or levy on such liabilities, to be discussed later. Recent examples of the use of URR are discussed in Ostry and others (2011, 28).

Although the URR is an implicit tax on a balance sheet item, the implied tax rate itself will vary with the opportunity cost of funds, and hence with the prevailing interest rate. The variability of the implicit tax rate necessitates some adjustment of the reserve rates, and the requirements will need to be raised to a

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high level when interest rates are low. This is potentially one disadvantage of the URR relative to other measures.

Another issue is the challenges of managing the central bank's balance sheet as a consequence of URRs. The reserves would have to be held on the central bank's balance sheet as a liability, with implications for the fluctuations in the money supply in line with the private sector's use of nondeposit liabilities, and the selection of counterpart assets on the central bank's balance sheet.

Although not central, there are also differences in the revenue implications between the reserve requirement and a levy or tax. The reserve requirement would raise revenue to the extent that the net income on the assets held by the central bank that is funded by the reserves would be positive. Hence, the bigger the interest spread between the asset and liability, the larger the income.

One advantage of the reserve requirement is not shared by the levy: the banks would have access to a liquid asset in case there is a liquidity shortage or run in the financial market. In this respect, the reserve requirement has some of the features of the Basel III liquidity requirement on banks (BCBS 2010).

A disadvantage of the reserve requirement is that it applies only to banks, rather than to the wider group of financial institutions that use noncore liabilities. When faced with the possibility of arbitrage, or with structural changes that shift intermediation activity from banks to the market-based financial intermediaries, the reserve requirement would be less effective.

Levy on Noncore Liabilities

As discussed earlier, the stock of noncore liabilities reflects the stage of the financial cycle and the extent of the underpricing of risk in the financial system. A levy or tax on the noncore liabilities can serve to mitigate pricing distortions that lead to excessive asset growth. The financial stability contribution recommended by the IMF in its report (IMF 2010b) on the bank levy to the Group of Twenty Finance Ministers and Central Bank Governors (G-20) in June 2010 is an example of such a corrective tax.

The levy on noncore liabilities has several features that impact overall financial stability. First, the base of the levy itself varies over the financial cycle. The levy bites hardest during the boom when noncore liabilities are large, so that the levy has the properties of an automatic stabilizer even if the tax rate itself remains constant over time. Given the well-known political economy challenges to the exercise of discretion by regulators, the automatic stabilizer feature of the levy may have important advantages.

Second, the levy on noncore liabilities addresses financial vulnerability while leaving unaffected the essential functioning of the financial system in channeling core funding from savers to borrowers. By targeting only noncore liabilities, the levy addresses externalities associated with excessive asset growth and systemic risk arising from interconnectedness of banks. In other words, the levy addresses the "bubbly" element of banking sector liabilities, rather than the core liabilities of the banking system.

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Third, the targeting of noncore liabilities can be expected to address the vulnerability of emerging economies with open capital accounts to sudden reversals in capital flows caused by deleveraging by banks. Indeed, for many emerging economies, the levy on noncore liabilities could be aimed more narrowly at the foreign currency-denominated liabilities. Shin (2011) discusses some of the potential advantages of a levy on noncore liabilities of this sort.

The revenue raised by the levy is a secondary issue. The main purpose of the levy is to align incentives. A good analogy is with the "congestion charge" used to control car traffic in central London. Under this charge, car drivers pay a daily fee of £8 to drive into central London. The purpose of the charge is to discourage drivers from bringing their cars into central London, thereby alleviating the externalities associated with traffic congestion. In the same way, the noncore liabilities bank levy should be seen primarily as a tool for aligning the incentives of banks more closely with the social optimum. The revenue raised by the levy would be of benefit (perhaps for a market stabilization fund) but is a secondary issue.

In December 2010, Korea announced that it would introduce a *Macro Prudential Levy* aimed at the FX-denominated liabilities of banks, both domestic banks and the branches of foreign banks. The proposal passed the legislative process in April 2011, and implementation began in August 2011.[5] The rate for the Korean levy has been set at 20 basis points for short-term FX-denominated liabilities of up to one year, falling to 5 basis points for long-term liabilities exceeding five years. The proceeds from the levy will be held in a special account of the preexisting Exchange Stabilization Account, managed by the finance ministry. The proceeds may be used as part of the official foreign exchange reserves.

There is a key difference between Korea's macro prudential levy and the outwardly similar levy introduced by the United Kingdom. In the United Kingdom, the revenue goes into the government's general fiscal account, hence can be regarded as a revenue-raising measure. In contrast revenue from the Korean levy is ring-fenced for specific use in financial stabilization.

Figure 1.17 plots the recent history of capital flows to the Korean banking sector. Since Korea's June 2010 introduction of macro prudential controls, there has been a moderation of short-term flows. There have been continued outflows of short-term liabilities, as seen by the negative value of the bars for short-term flows. Longer-term liabilities have replaced the short-term liabilities. These data do not establish the success of Korean macro prudential policies, as we have not controlled for the broader backdrop in capital markets. However, Bruno and Shin (2013) show that Korea's moderation can be considered exceptional in that a more detailed panel study revealed that capital flows into Korea became less sensitive to global factors, even as capital flows to other advanced and emerging economies experienced an increased sensitivity of to global factors. This finding lends support to the hypothesis that Korea's macro prudential policies were successful in moderating the inflows of volatile short-term liabilities of the banking sector.

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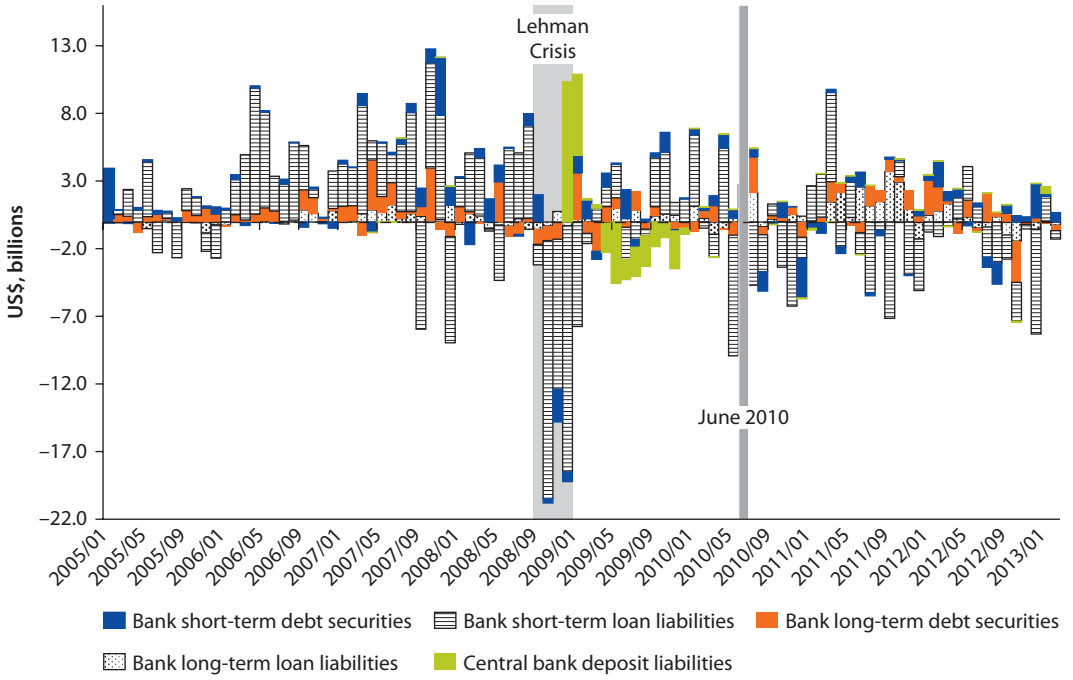
Figure 1.17 Capital Flows to Korean Banking Sector



Source: Bruno and Shin 2013, data from Bank of Korea balance of payment statistics.

Relative Merits of URR versus Levies and Taxes

The time delay in implementing the macro prudential levy in Korea offers useful lessons on the relative merits of unremunerated reserve requirements compared with levies and taxes. The legislative process required to implement a levy can entail considerable delays in the introduction and effectiveness of the policy. In Korea, the process took 18 months: initial discussions began in February 2010; announcement of implementation followed in December 2010; legislative hurdles were cleared in April 2011; and implementation was set for August 2011.

When the external environment is changing rapidly, such long delays make the new introduction of a levy cumbersome and impractical as the first line of defense. Nevertheless, as in Korea's case, alternative measures that rely on existing legislation or other temporary measures can be used in the interim until longer-term policy measures come into force.

In practice, the choice between URR and levies or taxes is driven by practical administrative expediency, rather than by matters of principle. Typically, the central bank is the best established policy institution that has direct contact with the financial markets and institutions. The long-established status of the central banks in most countries explains why URRs have been more prevalent than levies or taxes.

There are, however, exceptions to this rule. Brazil's tax on financial operations (IOF) was introduced some time ago (in 1993), and the legislation has been in effect since. Although the tax rate has been set at zero at times, the infrastructure remained in place to "dust it off" as circumstances demanded.

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Unlike a tax, a URR can usually be removed (or set to zero) more easily because the budget is not directly reliant on its revenues. Similarly, the macro prudential levy set by Korea has been designed so that the revenue does not have budgetary implications, precisely in order to forestall potential political economy concerns.

Residency-Based Tools

Capital controls have two broad rationales. The first is as a macroeconomic policy tool aimed at leaning against the appreciation of the exchange rate. The second is as a prudential tool, used for financial stability objectives. The distinguishing feature of capital control tools is that they discriminate on the basis of residence of the investor—that is, on whether the investor is domestic or foreign. The tools include inflow taxes such as Brazil's IOF, as well as administrative measures that restrict or ban certain activities or investments that foreign investors can hold.

Although capital controls have been employed to affect the pace of exchange rate appreciation, evidence of their effectiveness remains controversial. However, there is much better evidence on the financial stability implications of capital controls.

Regarding the financial stability objective, a recent IMF position paper finds a strong empirical association between capital controls on the one hand and less

Table 1.2 Taxonomy of Macro Prudential Tools

	Policy tool	*Advantages*	*Drawbacks*
Asset-side tools[a]	Loan-to-value (LTV) cap	Low administrative burden	Ineffective during rapid housing boom
	Debt-to-income (DTI) cap	Ties loan growth to wage growth	High administrative capacity needed for data on income
	Loan-to-deposit caps	Low administrative burden	Distorts bank funding Not applicable to foreign banks
	Reserve requirement	Low administrative burden	Ineffective with low interest rates, burdens central bank
Liabilities-side tools[b]	Levy on noncore bank liabilities	Price-based measure Acts on broad liability aggregates	Needs legislation. Cannot narrowly target FX vulnerability
	Levy on FX-denominated bank liabilities	Price-based measure Enhances monetary policy Counters FX risk	Needs legislation Narrow base of levy
Bank capital-oriented tools[c]	Countercyclical capital requirements	Conforms to Basel III	Difficulty in calibration Level playing field issues
	Forward-looking provisioning	Modifies bank incentives	Objections from accounting standard setters
	Leverage cap	Modifies bank incentives	Not price based Open to circumvention Vulnerable to bank FDI

a. Asset-side tools limit bank loan growth directly.
b. Liabilities-side tools limit vulnerability to liquidity crises and limit loan growth indirectly.
c. Bank capital-oriented tools limit loan growth primarily through altering incentives of banks.

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Table 1.3 Summary of Policy Priorities

	Financial liberalization/openness	
Monetary policy autonomy	*Medium/low*	*High*
None	• **Asset-side tools** • (LTV, DTI, loan-to-deposit caps)	• **Asset-side tools** • (LTV, DTI) • **Bank capital-oriented policies** (dynamic provisioning, leverage caps, countercyclical capital requirements)
Low/medium	• **Asset-side tools** (LTV, DTI, loan-to-deposit cap) • Monetary policy **combined with** • Liabilities-side tools • **(noncore liabilities levy)**	• **Asset-side tools** (LTV, DTI, loan-to-deposit cap) • Monetary policy **combined with** • Liabilities-side tools **(noncore liabilities levy)** • **Bank capital-oriented tools** (leverage cap)
High	• Monetary policy • Reserve requirements • **Bank capital-oriented tools** (dynamic provisioning, leverage caps, countercyclical capital requirements)	• Monetary policy • **Bank capital-oriented tools** (dynamic provisioning, leverage caps, countercyclical capital requirements)

severe forms of (1) credit booms and (2) FX borrowing, on the other (Ostry and others 2011, 21).

In reference to the recent global financial crisis, the authors regard it as a natural experiment for the effectiveness of capital controls, and note that the evidence is "suggestive of greater growth resilience in countries that had either capital controls (especially on debt liabilities) or prudential measures in place in the years prior to the crisis" (Ostry and others 2011, 23).

There are also important implications for monetary policy autonomy. De Gregorio and others (2000) found that capital controls allowed Chile's central bank to target a higher domestic interest rate over 6–12 months. Capital controls likely have their financial stability effects through their effect on the *composition* of capital flows, rather than on the total amount of the flows. De Gregorio and others (2000) and Cardenas and Barrera (1997) show that capital controls are likely to have shifted the composition of inflows away from short-term claims and debt claims toward longer-term claims that have more benign financial stability implications. Magud, Reinhart, and Rogoff (2011) conducted a meta-analysis of existing survey literature on the effects of capital controls. After analyzing 37 empirical studies, they found that capital controls on inflows (1) make monetary policy more independent, (2) alter the composition of capital flows, and (3) reduce real exchange rate pressures (although the evidence on this is more controversial); however, they (4) do not reduce the volume of net flows (and hence the current-account balance).

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To the extent that capital controls have an effect on the composition of capital flows and the likely pace of currency appreciation that gives some additional autonomy to monetary policy, they seem to have a role within the broader macro prudential policy framework.

Concluding Remarks

In this chapter we have given an overview of the policy options that can complement traditional tools of bank regulation and monetary policy in reining in the excesses in the financial system. Table 1.2 provides a taxonomy of macro prudential tools while Table 1.3 summarizes the policy framework within which they may be implemented.

Macro prudential policies aim to lean against excessive asset growth during booms, and thereby achieve more sustainable long-term loan growth. The mirror image of moderating asset growth is the mitigation of vulnerabilities on the liabilities side. The policy debate on macro prudential policies on the Financial Stability Board and the Basel Committee on Banking Supervision has taken place with the focus largely on the developed financial systems that were at the eye of the storm in the recent financial crisis of 2007–09. However, we have seen in this chapter that the financial stability challenges facing emerging and developing economies are perhaps even more acute because of the susceptibility of these economies to the conjuncture ruling in global capital markets and on the relatively early stage of their financial systems.

To the extent that the current global conjuncture with permissive global liquidity conditions is driven by expansive monetary policies pursued by advanced economy central banks, macro prudential policies aimed at achieving financial stability have many points of contact with capital control tools, or to use the more neutral terminology currently in fashion, capital flow management tools.

Because capital flow management tools often have broader macro objectives, such as leaning against the overly rapid appreciation of domestic currency, the dividing line between tools for financial stability and tools for macroeconomic management can be fuzzy. The same is true for the dividing line between monetary policy and policies toward financial stability. Contrary to the textbook division between the two, monetary policy has financial stability implications through changes in the size and composition of bank balance sheets, whereas prudential policies will have direct implications for credit growth and aggregate demand.

Although the study of macro prudential policy frameworks is in its infancy, there is a rapidly accumulating body of work on the subject. Based on existing literature and recent insights, this chapter has provided an analytical framework regarding the motivations for and effects of macro prudential rules on financial institutions that can be considered among a range of policy proposals.

An assessment of macro prudential policies must build on the further development of analytical tools that are better adapted to studying the interactions between institutions and markets in the broader financial system. Further experience with the use of macro prudential tools can be expected to contribute to the subsequent refinements of the framework discussed in this chapter.

Dealing with the Challenges of Macro Financial Linkages in Emerging Markets
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Notes

1. The discussion in this subsection is taken from Adrian and Shin (2011), which presents a more detailed analysis of how banking balance sheet management relates to corporate finance principles.
2. The monetary base, one of several standard measures of the money supply, is the sum of currency in circulation and reserve balances. M1 is the sum of currency held by the public and transaction deposits at depository institutions (which are financial institutions that obtain their funds mainly through deposits from the public, such as commercial banks, savings and loan associations, savings banks, and credit unions). M2 is defined as M1 plus savings deposits, small-denomination time deposits (those issued in amounts of less than $100,000), and retail money market mutual fund shares.
3. The inclusion of CDs in noncore liabilities is motivated by the fact that CDs are often held by financial institutions engaged in the carry trade, and who use CDs as an alternative to holding Korean government securities in their carry trade.
4. For example, see Kashayp and Stein (2004) and Adrian and Shin (2010).
5. IMF 2012, 50, http://www.imf.org/external/np/pp/eng/2013/012713.pdf.

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