

INTERNATIONAL MONETARY FUND

**Financial Soundness Indicators—Background Paper**

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## I. USING FSIs IN COUNTRY SURVEILLANCE

1. **This chapter outlines how Financial Soundness Indicators (FSIs) are used to monitor the vulnerabilities of the financial sector and its capacity to absorb losses, and are integrated into the broader framework for financial stability analysis.** FSIs monitor the current condition of the sector to use in assessing vulnerability to shocks. However, they provide limited information on how likely shocks are or their potential impact on the real economy. These latter dimensions of surveillance involve an analysis of: (i) financial market data, early warning indicators, and other data to evaluate the likelihood of such shocks; and of (ii) macro-financial linkages to assess the potential impact of the shocks on macroeconomic conditions and debt sustainability. The monitoring of financial indicators to assess risks to financial stability is an increasingly common element of surveillance, both by IMF member countries and Fund staff. An example of this trend is provided by the publication by a growing number of central banks of Financial Stability Reports, many of which report indicators that correspond to the FSIs discussed below (Box 1).

2. **This chapter is organized as follows.** Section A provides a brief overview of the role of FSIs in the broader country surveillance process. Section B discusses the choice of FSIs and institutional coverage of FSIs that is necessary to properly assess soundness. Section C explains how different FSIs are used to monitor specific vulnerability of the financial sector and its capacity to absorb losses. Section D describes how within the broader framework of country surveillance, FSIs can complement other types of data used to analyze the macro-financial linkages, which represent the different channels through which shocks affecting the financial sector ultimately impact the real economy.

### A. Overview of the role of FSIs in Country Surveillance

3. **Figure 1 illustrates the role of macro-prudential in surveillance using FSIs within the framework for financial stability analysis.** This framework also encompasses surveillance of financial market conditions and the analysis of macro financial linkages. It, in turn, is part of the broader framework for vulnerability assessment, which includes the balance sheet approach, debt sustainability analysis and monitoring of macroeconomic conditions. The figure highlights the role of different dimensions of surveillance in financial stability analysis, which include: macro-prudential surveillance using FSIs to monitor the impact of shocks on the financial sector; financial market surveillance concerned with evaluating the risk of such shocks occurring; and, surveillance of macro-financial linkages aimed at assessing the impact of the shocks transmitted through the financial sector on macroeconomic conditions. Despite their different focus, the indicators associated with these different dimension of surveillance generally need to be analyzed together. For example, the risk of a shock, such as a currency crisis (monitored using market data), is likely to be greater when the financial sector is weak (assessed using FSIs). Similarly, as discussed below, macro-financial linkages are affected by the condition of the financial sector. The figure also identifies some qualitative information that need to be take into account when analyzing the quantitative indicators. Finally, it is worth emphasizing that the figure is intended to

### Box 1. The Role of Financial Stability Reports in Financial Sector Surveillance

A large and growing number of central banks regularly publish their analysis of risks to financial stability, generally making use of a range of financial sector indicators. Within this group, a number produce stand-alone publications, typically referred to as "Financial Stability Reports"(FSRs), devoted to assessing of the condition and stability of the financial system (Table 1). The reporting of this analysis is part of a general trend among central banks aimed at developing a more transparent operational framework that includes, for example, inflation targeting on the monetary policy side. It also represents a response to experiences with financial instability in the 1990s, which highlighted the importance of a stable financial system to monetary policy. For example, Scandinavian central banks began producing FSRs relatively early as part of their crisis prevention effort growing out of their experience with banking crises in the early 1990s. This review of the role of FSRs in financial sector surveillance is based on reports published by the 10 countries in Table 1. It does not cover FSRs that have introduced very recently by some central banks nor the substantial amount of financial stability analysis reported by central banks in chapters of other publications.

Table 1. Key Features of Selected Financial Stability Reports 1/

Countries	Name of Institution	Comment	Frequency	Starting Date	Supervisory Functions
Austria	Oesterreichische Nationalbank		Semi-annually	2001	No
Belgium	National Bank of Belgium		Annually	2002	No
Brazil	Banco Central de Brazil		Semi-annually	2002	Yes
Canada	Bank of Canada		Semi-annually	2002	No
Denmark	Danmarks Nationalbank	In 2000 and 2001, part of "Monetary Review" (in second quarter).	Annually	2002	No
France	Banque de France			2002	Yes
Hungary	National Bank of Hungary		Semi-annually	2000	No
Norway	Norges Bank	In 1997-1999, part of the "Economic Bulletin"; since 1999, "Financial Stability Report".	Semi-annually	1995	No
Sweden	Sveriges Riksbank	In 1997-1998, part of "Financial Report"; since 1999 "Financial Stability Report".	Semi-annually	1997	No
UK	Bank of England		Semi-annually	1995	No

1/ The list of countries is based on a sample of FSRs available in English on the Internet as of March 1, 2003.

The publication of FSRs is aimed at strengthening financial stability but also reflects several other related objectives that vary in importance among central banks, including: (i) enhancing transparency consistent with their mandate by disseminating information on risks to financial stability; (ii) informing market participants, partly to strengthen market discipline; and (iii) developing and maintaining in-house expertise needed to assess financial sector stability. For example, the Bank of England's FSR, which was the first stand-alone FSR, gives as an explicit objective the promotion of an informed debate with market participants on potential risks to financial stability.

The development of FSRs reflects a more explicit recognition of the interdependence between monetary and financial stability. They facilitate central banks' monitoring of the financial sector aimed at assessing risks to financial stability that could constrain or disrupt monetary policy in some way, such as large scale emergency liquidity assistance to the financial sector or soundness problems in the banking sector that interfere with the monetary transmission mechanism. FSRs also inform the public and authorities in other countries about these risks so they can take them into account. The transparency of central banks' financial stability role provided by FSRs can be especially valuable for central banks that do not have a supervisory function, because of the importance of macro-prudential surveillance in fulfilling their financial stability mandate. This may account for why many of the central banks that have started to publish FSRs do not have supervisory responsibilities, as indicated in Table 1.

All the FSRs in the table review capital adequacy, asset quality, earnings and profitability and liquidity in their financial stability analysis. Most rely on a range of financial indicators to support this analysis, many of which are either equivalent or closely related to specific FSIs, reflecting the fact that they are used for essentially the same purpose. However, a couple of FSRs rely almost exclusively on a qualitative discussion (although since the central banks producing these FSRs are in the Euro area, this discussion can be supplemented using indicators provided by the ECB). The reporting of indicators in FSRs, especially when available in an electronic format, not only informs the public but also facilitates the monitoring of the country's financial system by foreign authorities as part of their analysis of risks to their own financial system, which can be especially important when internationally active banks from the first country play a major role in their financial system.

illustrate the data and indicators used in different dimensions of surveillance. It does not show the feedback from macroeconomic conditions back to the financial sector that can exacerbate the deterioration in financial sector soundness, which, in turn, magnifies the initial impact of a shock on macroeconomic conditions.

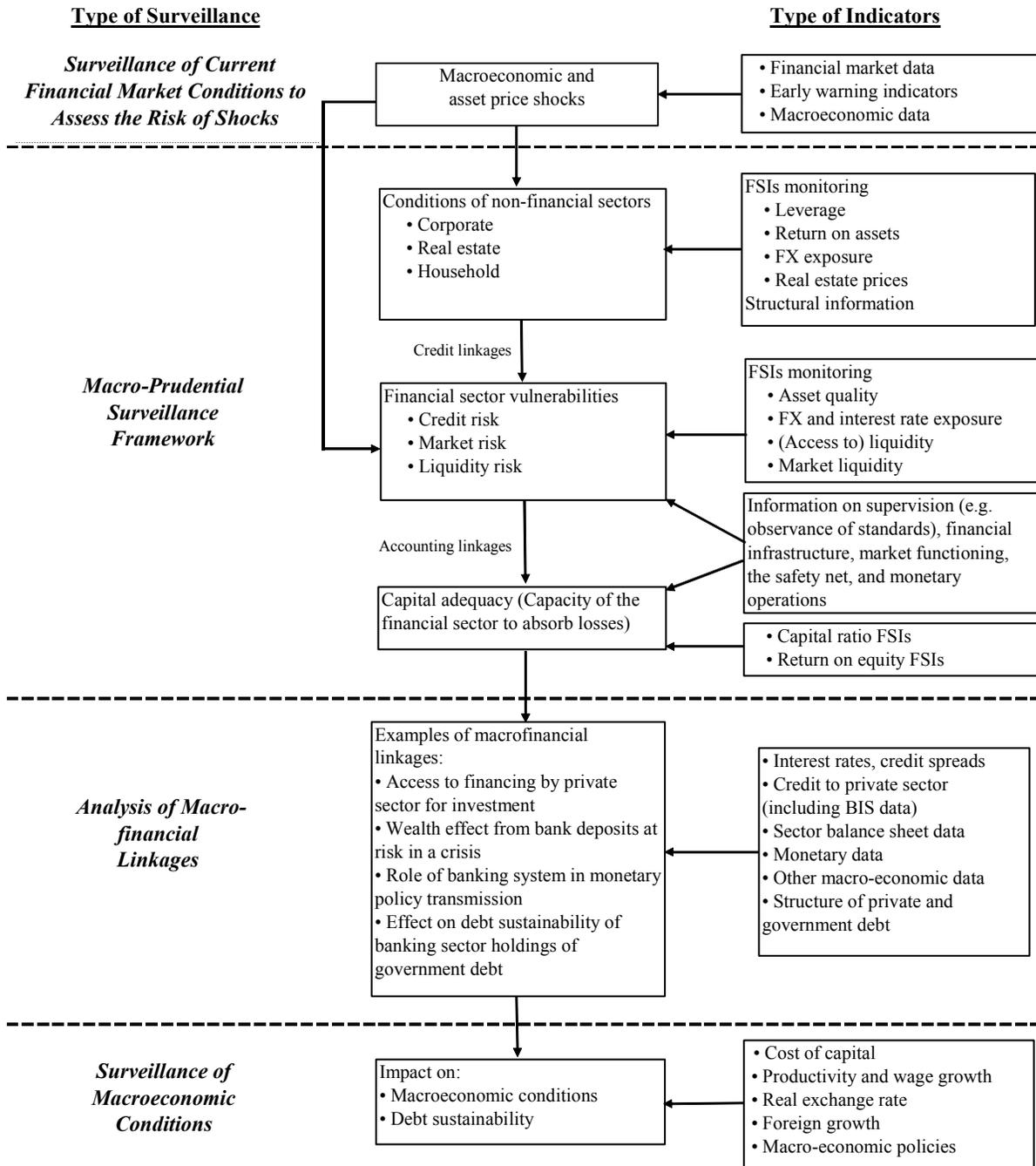
4. **The figure identifies three categories of FSIs with different roles:** assessing the condition of non-financial sectors; monitoring financial sector vulnerabilities arising from credit, liquidity and market risk; and, assessing the capacity of the financial sector to absorb losses, as measured by capital adequacy. The primary purpose of financial sector FSIs is to monitor the soundness of the financial sector. In contrast, the role of non-financial sector FSIs is largely to serve as a leading indicator to detect a deterioration in soundness at an early stage and to assess indirect sources of risk to the financial system. The figure illustrates two ways in which shocks can affect the financial sector: through non-financial sectors; and, through the direct impact on the financial sector's balance sheet. For example, an exchange rate depreciation could impose losses directly on the banking sector but also could have an indirect effect on asset quality through losses in the corporate sector.

5. **FSIs provide contemporaneous information on the vulnerability of a financial sector to shocks and its capacity to absorb the resulting losses, but do not provide much information on the risk of such shocks.** For this purpose, financial market data, early warning indicators and macroeconomic data are much more useful because they provide forward-looking information that can help assess the likelihood of such shocks. This highlights the complementary relationship between surveillance of current financial market conditions and macro-prudential surveillance of the financial sector based on FSIs, where financial market data help assess the risks of shocks and FSIs their impact.

6. **FSIs can also be useful in the analysis of macro-financial linkages aimed at assessing the potential impact of shocks through the financial sector on macroeconomic conditions and debt sustainability.** These linkages derive from the dependence of the real economy on financial intermediation and are typically analyzed in the context of the macroeconomic review of a country. The role of FSIs in this analysis is to provide an indication of the extent to which the financial sector's intermediation capacity could be reduced by a deterioration in asset quality, or market and liquidity shocks. To assess the ultimate impact of the such shocks on macroeconomic conditions, however, a separate analysis of the different macro-financial linkages in an economy using other data is needed.

7. **Macro-financial linkages derive from the many ways in which different non-financial sectors (e.g., corporate, household, and government sectors) rely on intermediation by the financial sector in order to conduct their activities.** They differ significantly across countries, but are likely to include: the dependence of non-financial sectors on financing by banks; the deposits and wealth of these sectors placed with the financial sector that would be at risk in a banking crisis; the role of the banking system on monetary policy transmission; and, the financial sector's holdings of securities issued by, and loans to, the government, such that problems in the financial sector could adversely affect debt sustainability. FSIs indicate to what extent the soundness of the

Figure 1. Framework for Financial Stability Analysis



financial sector has deteriorated, while the analysis of macro-financial linkages tells you the potential effects on macroeconomic conditions.

## **B. The Choice of FSIs and Coverage of the Financial Sector**

8. **In identifying FSIs that need to be monitored or developed, there are a number of practical issues that need to be taken into account.** These relate to the choice of FSIs to monitor; the coverage of financial institutions by the FSIs; and, the choice of peer groups that may need to be monitored separately.

### **The choice of FSIs to monitor**

9. **FSIs are divided into a core set and an encouraged set (Table 1).** The core set comprises FSIs that the IMF Board considered highly relevant in a wide range of countries due to their importance for assessing risk to financial stability and because of the underlying data are generally available, and there is a clear understanding of how they should be used. At present, these are all FSIs for the banking sector, reflecting its central role in all financial systems. However, in principle, it could be expanded to cover essential indicators for other sector where experience has shown them to be highly relevant and after consultation with IMF member countries. The encouraged set contains FSIs likely to be relevant in many countries, but where further analytic work is needed to clarify their role, making it desirable to decide whether to compile them based on country circumstances. There are, of course, other indicators not included in the two sets that may need to be monitored for macro-prudential surveillance.

10. **The specification of these two sets of FSIs could evolve over time to ensure they remain consistent with evolving surveillance priorities and needs.** This will make it possible to accommodate financial innovation, experiences with financial crises and analytic work that highlight additional sources of risk that need to be monitored. The main FSI Board paper lays out a rigorous process for reviewing and revising when necessary the specification of the two sets involving analytic and data development work and widespread consultation with member countries.

11. **The selection of encouraged FSIs to be monitored depends on the surveillance needs of a country taking into account its financial structure.** The set covers other banking sector FSIs, key market indicators useful in assessing risks to the banking sector, such as market liquidity and real estate prices, and FSIs for other financial and non-financial sectors. In bank dominated systems it may be sufficient to rely on FSIs for the banking system, but if other nonbank financial sectors are systemically significant (perhaps due to ownership linkages with the banking sector), they may also need to be monitored using FSIs. FSIs for the non-financial sectors (e.g., corporate and real estate sectors) have two main functions: they serve as an early warning indicator of banking asset quality problems and allow the monitoring of indirect sources of risk to the financial sector (e.g., the exchange rate exposure of the corporate sector representing a source of credit risk to the banking sector

Table 1. Financial Soundness Indicators: Core and Encouraged Sets

Core Set	
Deposit-taking institutions (banks)	
<i>Capital adequacy</i>	Regulatory capital to risk-weighted assets Regulatory Tier I capital to risk-weighted assets
<i>Asset quality</i>	Nonperforming loans to total gross loans Nonperforming loans net of provisions to capital Sectoral distribution of loans to total loans Large exposures to capital
<i>Earnings and profitability</i>	Return on assets Return on equity Interest margin to gross income Noninterest expenses to gross income
<i>Liquidity</i>	Liquid assets to total assets (liquid asset ratio) Liquid assets to short-term liabilities
<i>Sensitivity to market risk</i>	Duration of assets Duration of liabilities Net open position in foreign exchange to capital
Encouraged Set	
Deposit-taking institutions (banks)	Capital to assets Geographical distribution of loans to total loans Gross asset position in financial derivatives to capital Gross liability position in financial derivatives to capital Trading income to total income Personnel expenses to noninterest expenses Spread between reference lending and deposit rates Spread between highest and lowest interbank rate Customer deposits to total (non-interbank) loans Foreign currency-denominated loans to total loans Foreign currency-denominated liabilities to total liabilities Net open position in equities to capital
Market liquidity	Average bid-ask spread in the securities market 1/ Average daily turnover ratio in the securities market 1/
Nonbank financial institutions	Assets to total financial system assets Assets to GDP
Corporate sector	Total debt to equity Return on equity Earnings to interest and principal expenses Corporate net foreign exchange exposure to equity Number of applications for protection from creditors
Households	Household debt to GDP Household debt service and principal payments to income
Real estate markets	Real estate prices Residential real estate loans to total loans Commercial real estate loans to total loans

1/ Or in other markets that are most relevant to bank liquidity, such as foreign exchange markets.

(Chapter V). Due to the potential contribution of FSIs for the corporate, real estate and insurance sectors to macro-prudential surveillance, data development and analytic work has focused on developing FSIs for them.<sup>1</sup> The encouraged set of FSIs covers the main sources of risk to the financial sector that need to be monitored but more in-depth analysis may involve drawing on other indicators not included in the set.

### **Defining the coverage of FSIs**

12. **To adequately assess soundness, the coverage of financial institutions by FSIs—the institutions that should be aggregated together when an FSI is compiled—must take into account the institutional and ownership structure within the financial system.** A key distinction is between the coverage of the domestically-owned banking sector and the local branches and subsidiaries of foreign banks, which together make up a country's banking system. These generally need to be monitored separately using FSIs. For the former, the total consolidated capital and liquidity resources available to support these institutions are controlled by domestically incorporated entities and subject to the oversight of the local authorities. In contrast, the branches and subsidiaries of foreign banks need to be consolidated with their foreign parents for soundness analysis because they typically can access the capital and liquidity resources of the parent when necessary. While it is necessary for soundness analysis to monitor foreign subsidiaries in a country as part of a consolidated entity with their parent, it is often desirable to also monitor them (but not foreign branches) separately as a peer group using FSIs.<sup>2</sup> Indicators covering the domestic banking system as a whole, which cover domestic banks and the branches and subsidiaries of foreign banks (not consolidated with their parents), are generally not used for soundness analysis but provide links to macroeconomic data sets.<sup>3</sup> In particular, the capital ratio on this basis can give a misleading estimate of the capacity of the sector to absorb losses by excluding exposures held abroad by the foreign parent. While cross-border consolidated data do not distinguish between banking activities conducted in the domestic and foreign economies, data for the

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<sup>1</sup> This focus is consistent with guidance for the IMF Board (BUFF/01/94). Work on the insurance and corporate sectors is reported in Chapters III and V, respectively, while a conference is planned for September 2003 to address the problem of the lack of data on real estate prices.

<sup>2</sup> The reason is that foreign subsidiaries, unlike branches, have their own capital and independent legal identity, where their foreign parent is generally not legally obligated to support its subsidiary in a crisis. While the parent will typically provide support because of the high reputational cost of not doing so, there are situations where this may not happen, depending on specific legal, ownership and institutional features. Also, while foreign subsidiaries are usually supervised by supervisory authority in the home country of the foreign parent (under the principle of consolidated supervision in the Basel Accord), the local supervisor often has an important role, and even the lead role, depending on the Memorandum Of Understanding between the two supervisory authorities.

<sup>3</sup> Domestic banks and foreign branches and subsidiaries can be consolidated in statistical indicators used for purposes, as is done for the monetary statistics. Chapter 5 of the *FSI Compilation Guide* gives a detailed discussion of the difference between consolidation on a “domestically consolidated” basis (e.g. National Income Accounting basis), and on a cross border consolidated basis.

domestically-consolidated banking sector do not capture risks incurred through foreign branches and subsidiaries and therefore could give a misleading assessment of the soundness of the sector.

13. **One practical benefit of the consolidation of local branches and subsidiaries of foreign banks with their parent is that the authorities in a country can use the FSIs compiled by the country of the parent banks to assess the soundness of these banks.** This helps them assess the risk that these branches and subsidiaries may pose to the local economy. Since most internationally active banks come from a relatively small number of countries but account for a very large share of international banking activity, the FSIs produced by these countries have the characteristics of a public good in that they enable the authorities in countries where these banks are active to more effectively monitor the soundness of these foreign branches and subsidiaries operating in their country.<sup>4</sup> However, as emphasized below, these FSIs need to be analyzed together with other types of data to assess the impact on the local economy of foreign banking sector problems detected using the FSIs.

14. **FSIs for specific peer groups may need to be monitored when they are important enough to pose a risk to the financial system as this helps to detect sources of risk to financial stability more precisely.** The choice of peer groups can be based on an analysis of the structure of the financial system, including its ownership structure, aimed at identifying specific types of institutions that share common vulnerabilities and collectively play an important enough intermediation role to pose a risk to financial stability. Examples of common peer groups include state-owned banks, large internationally-active banks and complex groups.<sup>5</sup> In addition, it can be useful to monitor measures of dispersion computed from data used to compile FSIs. These can help determine the extent to which financial sector weakness is concentrated in a few large bank or is pervasive, affecting all banks in the sector. It also serves to check whether the FSI for the sector as a whole is concealing sources of systemic risk concentrated in a few institutions.<sup>6</sup>

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<sup>4</sup> In particular, the reporting of FSIs for peer group of large internationally active banks by the home country authorities can be particularly valuable in facilitating surveillance by other countries of these banks.

<sup>5</sup> In a complex group, banks and nonbank financial institutions that are linked through ownership are consolidated. This means that banks that are part of a group may be monitored in two contexts: on a stand-alone basis in the banking sector FSIs, in which they are aggregated with other banks; and, through the FSI covering the complex-group peer group.

<sup>6</sup> Chapter 13 of the *FSI Compilation Guide* provides guidance on how to compile peer groups and descriptive statistics.

15. **While for most countries many of the core FSIs can usually be compiled by aggregating existing data used for micro-prudential surveillance (e.g., supervisory data), the definitions and quality of these data differ significantly across countries.** For this reason, it is important to obtain and review the associated metadata to determine how well the data used to compile these FSIs measure the vulnerabilities that the FSIs are being used to monitor. This is especially important when comparing FSIs across countries and for regional surveillance involving groups of countries. Metadata also help prioritize the work to improve the quality of data needed for macro-prudential surveillance by providing an indication of the extent to which existing data available to compile many of the core FSIs meet this need and where efforts to improve the quality of these data should be focused. It can also investigate whether there are any new data that would significantly strengthen this surveillance if used to compile the FSIs. This prioritization will help guide data development efforts by the Fund, standard setters (e.g., the Basel Committee) and other international organizations, aimed at achieving greater harmonization of data and improvements in data quality across countries. The *FSI Compilation Guide* identifies data concepts and metadata that should be collected and makes an important contribution to this data development effort.

### **C. Using FSIs to Monitor Risks to Financial Stability**

16. FSIs monitor specific parts of the financial sector but need to be analyzed in combination to assess the soundness of the sector. This analysis builds on the work clarifying the linkages between different types of FSIs deriving from accounting and lending relationships within the financial sector and with other non-financial sectors (Figure 1). Since these linkages are outlined in Section V.B of the main FSI board paper, and are discussed in depth in Chapters V and VI of this paper, the present chapter will focus more on how to use specific FSIs in country surveillance. Nevertheless, to lay the basis for this analysis, it is helpful to group the different FSIs into the categories needed for the analysis. They are: capital adequacy, which measure the capacity of the sector to absorb losses, and the key sources of vulnerability—asset quality, liquidity and sensitivity to market risk, which correspond roughly to credit, liquidity and market risk. FSIs for the non-financial sectors are presented separately rather than as part of these categories since their main functions are to serve as an early warning indicator of risks to banking sector soundness and to monitor indirect sources of risk to the financial sector. Nonbank financial sector FSIs for the insurance sector are discussed separately in Chapter III. Table 2 provides a short explanation of how FSIs from the core set and the corporate sector are used.

Table 2. Role of the Core and Corporate Sector FSIs

Types of FSI		Specific FSIs	Role of FSIs in Monitoring the Financial Sector
<b>Banking Sector Financial Strength</b>	<i>Capital Adequacy</i>	Tier 1 capital ratio	Assesses adequacy of highest quality capital, such as shareholder equity and retained earnings, relative to risk weighted assets
		Regulatory capital ratio	A broader measure of capital including items giving less protection against losses, such as subordinated debt, tax credits and unrealized capital gains
	<i>Earnings and profitability</i>	Return on equity	Assesses scope for earnings to offset losses relative to capital or loan and asset portfolio
		Return on assets	
		Interest margin to gross income	Indicates the importance of net interest income to earnings and scope to absorb losses
		Non-interest expenses to income	Indicates extent to which high non-interest expenses weakens earnings
<b>Banking Sector vulnerabilities</b>	<i>Asset quality</i>	NPLs to total loans	Indicates the credit quality of banks' loans
		NPLs less provisions to capital	Shows NPLs net of provisions taken against them relative to capital
		Sectoral distribution of loans to total loans	Identifies credit exposures concentrations to particular sectors by the whole banking sector
	<i>Liquidity</i>	Liquid assets ratio	Assesses the vulnerability of the banking sector to loss of access to market sources of funding or a run on deposits
		Liquid assets to short-term liabilities	
	<i>Sensitivity to market risk</i>	Duration of assets and liabilities	Measures maturity mismatch to assess interest rate risk
		Net open foreign exchange position to capital	Measures foreign currency mismatch to assess exchange rate risk
	<b>Corporate sector</b>		Leverage ratio
Return on Equity			Indicates the extent to which earnings are available to cover losses
earnings to interest and principle payments			Reveals to what extent earnings available to cover losses are reduced by interest and principle
Net FX exposure to equity			The vulnerability of the corporate sector to exchange rate changes
Number of bankruptcies			Serves as an indicator of corporate sector distress

### **FSIs measuring the capacity of the financial sector to absorb losses**

17. **FSIs monitor the capital and earnings of a financial sector to assess its capacity to absorb losses.** The **tier 1 capital ratio** and **regulatory capital ratio**, which is a broader measure, are compiled for this purpose by aggregating the capital ratios used by supervisors to assess the capital adequacy of individual banks. Since the threshold when an individual bank fails (or is taken over) can be defined in terms of its capital ratio, a low aggregate capital ratio for the banking sector should give some indication of the potential for a systemic crisis triggered by banking failures, a bank run or general loss of access to liquidity. Capital ratio FSIs for systemically important peer groups may also need to be monitored to be able to detect situations where banking sector weakness is concentrated in such peer groups.

Similarly, FSIs monitoring **return on equity** and **return on assets** indicate the extent to which earnings are available to absorb losses before capital is impacted.

18. **In using capital ratios to assess financial strength, attention needs to be paid to the “quality” of the capital.** The reason is that the capacity of capital to absorb losses in the event of insolvency differs for different types of capital. The key distinction is between (i) capital where the full amount is certain to be available to compensate creditors—shareholder equity, retained earnings and realized reserves—that comprises tier 1 capital; and (ii) capital that may not be available for this purpose—such as junior claims on the bank (subordinated debt), tax credits and unrealized capital gains (which may prove to be illusory if asset prices fall)—which are part of tier 2 capital. Attention also needs to be paid to the definition, consolidation rules and valuation approaches used in reported capital measures, since they can differ across countries.<sup>7</sup> Of particular importance in this regard is whether in the underlying data banks’ domestic and foreign branches and subsidiaries are consolidated with the parent. Also, while the equity interest of banks in other banks is supposed to be deducted from capital ratios reported to supervisors, this is not always done and needs to be checked to avoid overestimating the capital available to absorb losses. Much of this information can be found in assessments of compliance with the Basel Core Principles.<sup>8</sup>

#### **FSIs monitoring asset quality**

19. **FSIs of asset quality monitor the loan quality and exposure concentrations of banks’ asset portfolios.** Loan quality is measured by the FSI of **NPLs to total loans**. However, NPLs are the loans that banks are required to report as non-performing to supervisors, and may not always correspond accurately to banks’ actual assessment of the quality of their loan portfolio, which may be based on a private internal rating system.<sup>9</sup> This implies that attention needs to be paid to the quality of reported NPL data, especially since banks have an incentive to under-report the actual deterioration in credit quality in order to avoid having to provision, as this reduces profits. For this purpose, it is useful to look at the supervisory regime to see to what extent banks have discretion in classifying loans, which provides greater scope to evergreen loans, or whether there may be regulatory forbearance. This information can be obtained from Assessments of compliance with the Basel Core Principles, FSAPs and other sources. The FSI **NPLs net of provisions to capital** provides an

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<sup>7</sup> Boxes 1, 2, and 4 in Chapter 6 provide an in-depth discussion of the main issues of measurement and definition of capital that need to be taken into account when assessing the capacity of bank capital to absorb losses based on reported measures of capital. Chapter 4 and 6 in the *FSI Compilation Guide* provide information on how capital is defined.

<sup>8</sup> Another measure of capital is total capital recorded in the consolidated balance sheet. It is not used as a core indicator to monitor the capacity of the financial system to absorb losses, however, because as the difference between assets and liabilities in the balance sheet, it will be affected by changes in their value, making it more volatile than tier 1 or regulatory capital.

<sup>9</sup> The *FSI Compilation Guide* provides a definition of NPLs in Chapter 4.

indication of the scale of additional provisions that may need to be taken against existing NPLs.<sup>10</sup> Since these provisions are subtracted from capital, the FSI gives an indication of the proportion by which the capital ratio could still be reduced by provisions that have not yet been made. This FSI helps detect situations of inadequate provisioning where banks have delayed addressing asset quality problems, which can become more serious over time as a result. Another source of information on asset quality are FSIs monitoring non-financial sectors, as discussed below.

**20. FSIs of the sectoral and geographic distribution of loans to total loans monitor vulnerabilities arising from concentrated lending exposures by the banking sector (and key peer groups) to particular sectors or countries.** They are compiled by aggregating banks' exposures to specific countries and sectors. The choice of sectors to monitor should cover those relevant to surveillance, corresponding to sectors defined in the *FSI Compilation Guide* (Chapter 6). A breakdown into domestic and foreign lending is also desirable for reasons given below. A country breakdown of loans for domestic banks is an encouraged FSI that needs to be reported for countries to which the banking sector has significant consolidated cross-border exposures. BIS reporting country data are already provided in aggregated form in the BIS consolidated banking statistics. The FSIs can be complemented with indicators that combine the banking sector's lending exposures with its securities exposures to different sectors and countries.<sup>11</sup> Finally, FSIs on foreign currency loans to total loans can be important indicators of the vulnerability of a banking sector's vulnerability indirect risk arising from the impact of exchange changes that make it more difficult for borrowers to repay foreign currency loans.

### **FSIs monitoring market risk**

**21. FSIs of sensitivity to market risk monitor the vulnerability of the financial sector to exchange rate, interest rate and equity market risk.** The FSI of the **net open position in foreign exchange to capital** can be compiled by aggregating the net open position of individual banks using data consolidated on a cross border basis to capture exposures incurred by foreign branches and subsidiaries. Open position measures are generally reported to supervisors, consistent with the definition given in the 1996 amendment to the Basel Accord. These measures should capture the effect of off-balance sheet forwards and futures contracts but may not accurately measure the exposures associated with more complex off-balance sheet instruments (e.g., options with non-linear payoff functions), which can be important in countries with more sophisticated financial systems. In these latter cases, stress tests involving standardized shocks applied to banks' risk management models provide a potentially more accurate approach to assessing exchange rate risk. These stress tests are often used on FSAPs for complex financial systems using a sample of the largest banks.

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<sup>10</sup> Where borrowers have provided lenders with collateral or other forms credit risk mitigation, this may need to be taken into account.

<sup>11</sup> In fact, the BIS consolidated country exposure data already combines the loan and securities exposures.

22. **The FSIs of the duration of assets and liabilities are intended to measure interest rate risk associated with the assets and liabilities, respectively, for the financial system as a whole.** There are several other closely related measures of duration that are not included in the core set of FSIs but which are needed to assess specific aspects of interest rate risk in countries where this risk is important. Specifically, it can be useful to monitor a net measure of duration equal to the difference between them giving the net interest rate exposure.<sup>12</sup>

Another such measure, likely to be relevant in dollarized economies, is the duration of the banking system's foreign currency assets and liabilities. The net foreign currency duration measure indicates its vulnerability to changes in foreign interest rates. It also serves as a measure of the maturity mismatch in the system's foreign currency book, which provides an indication of the liquidity risk arising from its vulnerability to foreign currency deposit runs.

23. **In practice, duration FSIs have seldom been compiled on FSAPs because few countries have the necessary data (Chapter IV).** Thus, alternative approaches often need to be used to compile FSIs to monitor interest rate risk. One involves using a measure of interest rate risks based on a traditional maturity gap analysis, which makes use of data generally reported to supervisors on the maturity of banks' assets and liabilities. It approximates the duration measure under a number of simplifying assumptions but can be misleading when they are not satisfied.<sup>13</sup> Another approach to assessing interest rate risk is stress testing. It has the important advantage of capturing the effect of derivatives used to hedge this risk, which are largely missed by duration measure but can substantially modify interest rate exposures in more sophisticated financial systems.<sup>14</sup> As in the case of exchange rate risk, standardized shocks applied to banks' risk management models provide an effective way to assess interest rate risk and is widely used on FSAPs.

24. **The measure of loss from market risk stress tests could in principle be used as a soundness indicator along with, or even in place of, market risk FSIs.** This is done on a one time basis on many FSAPs, and is becoming more feasible to do on an ongoing basis in sophisticated financial systems where banks conduct frequent market risk stress tests as an integral part of their risk management. Specifically, it would be relatively easy for a sample of these banks covering most of the financial system to implement standardized shocks at regular intervals that can then be aggregated by the authorities. This approach would represent an acceptable alternative to monitoring market risk FSIs because, as demonstrated in Chapter IV, market risk FSIs and stress tests are closely related at the analytic level and, thus, can provide essentially the same information. For example, the estimated loss from a stress test of an exchange rate shock can be approximated by the change in the exchange rate

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<sup>12</sup> A number of conditions need to be satisfied for this condition to be satisfied for this measure to be accurate, as outlined Chapter 4.

<sup>13</sup> Chapter 6 of the *FSI Compilation Guide* presents this approach while Chapter IV of this paper notes its limitations.

<sup>14</sup> Interest rate derivatives account for roughly 70 percent of the gross notional value of all derivative contracts.

(that is the shock) multiplied by the net open foreign exchange position to complement, or even in place of, this FSI.<sup>15</sup>

### **FSIs monitoring liquidity**

25. **FSIs of banking sector liquidity monitor liquid assets available to banks in the event of a loss of market funding or of deposits in a bank run.** They assess the vulnerability of the sector and key peer groups to a liquidity crisis. A large shock, contributing to credit or market losses, for example, could cause a loss of confidence in banking sector soundness by market participants or depositors. This can occur even when the banking sector is sound due to imperfect information about the true condition of the sector. Moreover, this liquidity crisis has the potential to push solvent banks into insolvency, because when they lose access to funding they are forced to sell assets to obtain liquidity and will at some point have to start selling illiquid assets at fire-sale prices. The resulting losses, if large enough, could drive them into insolvency (thereby validating the concerns about soundness that triggered the liquidity crisis). The FSI of **liquid assets to total assets**, also termed the liquidity ratio, reveals how vulnerable the banking sector is to a liquidity crisis by indicating how much balance sheet shrinkage it could absorb due to a loss of access to funding or a bank run before being forced to sell illiquid assets. The FSI **liquid assets to short-term liabilities** measures liquid assets relative to short-term liabilities that would have to be covered by asset sales if access to market funding is lost. For domestically-controlled banks, both these FSIs need to be compiled by aggregating banks' liquid asset on a cross-border consolidated basis to capture liquid assets held abroad. While the definition of core liquid assets is cash plus very short-term funds (e.g. T-bills), it can be broadened to include other banking systems assets if the markets for these assets are liquid.<sup>16</sup>

26. **FSIs of market liquidity monitor current liquidity conditions in markets for each of the main types of securities that make up the liquid assets of the banking sector.** While they are not in the core set of FSIs, they play an important complementary role to the liquidity FSIs, described above. By providing an indication of the liquidity of markets—defined as the volume of securities that can in a relatively short period without significant impact on their price—for securities held by banks, they help assess the liquidity banks can raise by selling these holdings.<sup>17</sup> The **bid-ask spread** FSI serves as an index of liquidity in each market, in that a narrower spread indicates a more competitive market with a larger

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<sup>15</sup> While stress testing can substitute for market risk FSIs on FSAP, it is generally not practical to do this for ongoing surveillance. However, it could become more feasible over time as an increasing number of banks rely on market risk stress tests in their risk management. This would make it relatively easy to implement standardized stress tests on a regular basis that then could be aggregated by the authorities.

<sup>16</sup> This can be assessed using FSIs for market liquidity and information on the robustness of market liquidity under stress to help decide whether more than one definition of liquidity should be monitored.

<sup>17</sup> A more complete definition of liquidity is provided in Chapter 8 of the *FSI Compilation Guide*.

number of buyers and sellers providing liquidity. The FSI of **market turnover** (gross average daily value of securities traded relative to the stock) helps assess the liquidity of banks' balance sheets by giving an indication of the volume of securities banks could liquidate in the market.

27. **These FSIs monitor banks' capacity to both access market funding on the liabilities side of their balance sheet and to obtain liquidity by liquidating securities on the asset side of their balance sheet.** To use them effectively, however, they need to be interpreted in the context of an analysis of the financial market infrastructure. Specifically, the market liquidity FSIs are limited by the fact that they only measure current liquidity and, thus, may not give a good indication of how liquidity in securities markets will hold up in a financial crisis. The robustness of market liquidity depends on the microstructure of financial markets, and can be assessed using indicators of market functioning. The financial system infrastructure also affects financial institutions' capacity to continue to access liquidity when the system is under stress.<sup>18</sup> It can be assessed using a range of information, including on safety net arrangements and central bank liquidity provision policies.<sup>19</sup>

#### **FSIs for non-financial sectors**

28. **FSIs for the corporate, household and real estate sectors monitor the financial condition and vulnerabilities of these sectors to enhance our capacity to assess risks to the financial sector.** They can serve as early warning indicators of emerging asset quality problems in the banking sector because the impact of shocks on asset quality generally occurs with a lag, and as a source of indirect risk. However, to make effective use of them for this purpose, it is necessary to, first, assess the exposure of the banking system to each sector, which can be done using FSIs of the sectoral distribution of lending; and, second, estimate how a deterioration of the financial condition of the sector, measured using FSIs, is likely to affect banking sector asset quality, which is done for corporate leverage in Chapter V. Analytic work, and experiences on FSAPs and by member countries, has highlighted the need to monitor the corporate sector, especially given its importance as a source of indirect risk to the banking sector in almost all countries. The real estate sector has also been an important source or risk but has proved difficult to monitor because of the paucity of data on real estate prices.

29. **Corporate sector FSIs monitor the financial condition of the sector and its vulnerability to shocks.** They can be compiled by aggregating data from the consolidated financial statements of public ally-listed corporations and, thus, are a direct analog of the indicators used by shareholders and market participants to monitor the financial health of corporations. For the economy as a whole, domestically consolidated data (e.g. NIA based

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<sup>18</sup> Chapter 8 of the *FSI Compilation Guide* provides a discussion of market structure and examples of the structural information typically requested on FSAPs

<sup>19</sup> The different types of information needed for this purpose are described in Section VIII of the Board paper.

data) data can be used when corporate financial statements do not provide sufficient coverage. Corporate sector FSIs help detect corporate sector vulnerabilities (e.g., exchange rate exposures) that pose an indirect risk to the financial sector because of the impact of a deterioration in the financial condition of the sector on bank asset quality. They also allow us to monitor a key channel for shocks to the banking sector and thus can provide an early warning of impending asset quality problems, which permits policy to respond in a more proactive fashion.

30. **The corporate FSIs provide a general indication of the financial condition of the sector.** The **leverage ratio**, defined as the ratio of corporate sector debt to equity, and **ROE**, **ROA** and **earnings relative to interest and principal payments**, indicating the strength of corporate earnings, all provide information on the extent to which the sector is likely to be able to absorb shocks before loan or debt repayment capacity is impaired. The **net foreign exchange open position to equity** indicates the sector's vulnerability to sharp exchange rate changes. Finally, the **number of bankruptcy applications** serves as an index of financial distress. Despite of the importance of the corporate sector to financial sector soundness, significant analytic work is still needed to assess their effectiveness as indicators that can detect risk to the financial sector at an early stage and for monitoring indirect risk (which is one reason why they are in the encouraged set). Chapter V reports econometric work indicating that the leverage ratio can function as a leading indicator of asset quality problems for a broad cross-section of countries, reinforcing comparable results for individual countries from FSAPs. In particular, more work is needed to assess the indirect risk arising from the exchange rate exposure of the corporate sector, which has proved to be a significant source of financial crises. This is likely to involve assessing other indicators of the exchange rate exposure, to complement the net open position FSI. One such indicator is the foreign currency interest coverage ratio (ratio of foreign exchange earnings to interest payments), which measure the extent to which an exchange rate change could (or has) reduced corporate foreign exchange earning needed to cover interest payments on foreign currency denominated debt. This process for assessing whether such indicators should be added to the core or encouraged sets will involve analytic work demonstrating their value of and widespread consultation with member countries, as outlined in the main FSI Board paper.

#### **D. Role of FSIs in Country Surveillance of Macroeconomic Conditions**

31. **The monitoring of financial sector vulnerabilities and capacity to absorb losses using FSIs needs to be combined with an analysis of other data on macro-financial linkages to assess the impact of shocks on macroeconomic conditions through the financial sector.** These macro-financial linkages depend on the forms and extent of financial intermediation in an economy, and are likely to be differ substantially across countries. Nevertheless, they are likely to include the reliance of non-financial sectors on financing provided by domestic and foreign banks; their deposits and wealth placed with the financial sector that could be at risk in a banking crisis; the effect on the monetary policy transmission mechanism of a deterioration in the soundness of domestically-owned banks, and of foreign banks that play an important intermediation role through their local branches and

subsidiaries; and, the banking sector's holding of government and private debt which could be relevant to the analysis of debt sustainability.

32. **A macro-financial linkage that is important in almost all countries derives from the dependence of different non-financial sectors on financing provided by banks.** An analysis of this linkages helps assess the potential impact on macroeconomic conditions of banking soundness problems in the domestically-controlled and foreign-controlled banking sectors, detected using FSIs compiled by local and foreign authorities (when available). This analysis requires data on non-financial sectors' borrowing from the domestically-controlled banking sector, and from foreign-controlled banks that are an important source of finance for the economy, by country. The data for the former are the same data used to compile the exposure concentration FSIs. In the latter case, data are available for every country on borrowing by the non-financial private and government sectors from banks headquartered in the more than 20 BIS reporting countries from the BIS consolidated banking statistics. The coverage of these data is comprehensive because almost all international banking activity is conducted by internationally-active banks from these countries. These data can be used with the FSIs compiled by the authorities in each BIS reporting country for their financial sector, while the BIS data indicates the scale of the potential reduction in financing to the domestic private and government sectors that could result from a deterioration in the soundness of the banking sector in that country. This highlights the benefit (or positive externality) of FSIs compiled by the countries with internationally active banks for surveillance in other countries where these banks play an important intermediation role.<sup>20</sup>

33. **Macro-financial linkages also derive from residents' deposits and wealth placed with domestically-owned and foreign-controlled financial institutions, which would be at risk in banking crises at home or abroad.** The importance of this linkage depends on institutional features such as the extent to which these deposits are covered by domestic and foreign deposit insurance schemes. It can be assessed using data on residents' deposit holdings, which, in principle, need to cover both (i) deposits held within the country with domestically owned banks or the local branches and subsidiaries of foreign banks, and (ii) deposits held abroad, either with domestic banks' branches and subsidiaries abroad or with foreign banks (in both domestic and foreign currency). Data from monetary statistics typically capture the first but miss the second (which can be substantial, especially in dollarized economies). Some information on the latter can be obtained from international investment position data and from the locational BIS international banking data.<sup>21</sup> In this case also, FSIs monitor the soundness of the banking sector while the data on wealth placed with

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<sup>20</sup> In the limited number of countries where banks from a non-BIS reporting country have a significant presence, other data must be used. Specifically, the local supervisory authorities may need to ask these banks to report their consolidated lending to the country (if they are not doing so already).

<sup>21</sup> The BIS locational international banking statistics are a separate set of data from the BIS consolidated banking statistics that measure banking sector assets and liabilities in foreign countries but are not consolidated on a cross-border basis.

financial institutions gives an indication of how much could be lost in the event of a banking crises (taking into account the extent of protection provided by deposit insurance schemes).

34. **Another linkage results from the impact of banking sector problems on the monetary policy transmission mechanism.** Both domestically-owned banks and branches and subsidiaries of foreign banks play a role in monetary transmission, so that a deterioration in banking sector soundness, either domestically or abroad, could alter the impact of changes in monetary policy on the real economy. This implies that it can be useful to analyze FSIs in combination with monetary data to understand how monetary policy could be affected by the condition of the financial sector. This analysis could detect situations, for example, where a deterioration in banking sector soundness could constrain a country's capacity to tighten policy or alter the impact of a monetary expansion. The analysis would have to take account of financial structure, including the relative importance of market and bank financing, the role of foreign banks in financial intermediation and central bank operating procedures.

35. **Another potential source of macro-financial linkages arises from financial institutions' holdings of government and private sector debt.** Specifically, a shock to the financial sector that results in credit or market losses and causes a drop in the capital ratio, monitored using FSIs, can lead to an adjustment in the sector's holdings of government debt.<sup>22</sup> When the financial sector's balance sheet contains a significant share of outstanding government or private debt, this effect can increase borrowing costs and make it more difficult to roll-over debt, which may have implications for debt sustainability. Banks could also be forced to reduce their debt holdings in a liquidity crisis triggered by shocks that result in increased concerns about the solvency of some banks. Banks that lose access to market sources of liquidity, or experience a loss of deposits, are forced to sell liquid assets, which typically include government and some private debt instruments. In their role assessing a banking sector's vulnerability to shocks, FSIs can be used in the analysis of the macro-financial linkages that arise in a banking crisis if the government has to bail out the banking sector (due to the contingent liability). The resulting rise in government debt in such a crisis can also affect debt sustainability. To assess the significance of these linkages, it can be useful to monitor FSIs in combination with sector balance sheet data in the context of a debt sustainability analysis.

## E. Conclusion

36. This chapter provides practical guidance on how FSIs are used in macro-prudential surveillance and their role in the broader framework for financial stability analysis and IMF country surveillance. It has outlined the key elements of this analysis covering: the choice of FSIs to monitor beyond the core set; the institutional coverage and consolidation of FSIs; how FSIs are used to monitor the capacity of a financial sector to absorb losses and its

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<sup>22</sup> This adjustment could be much larger when the capital ratio for the sector or key peer groups is close to the constraint of the minimum capital ratio. It will also be influenced by institutional factors such as how effectively supervisors enforce capital regulations.

vulnerability to different shocks; and, how to assess the potential impact of a deterioration in financial sector soundness, detected using FSIs, on macroeconomic conditions through an analysis of macro-financial linkages.

## II. AVAILABILITY OF DATA ON CORE AND ENCOURAGED FSIS

### A. Introduction

37. A Survey of the availability of data for FSIs has been undertaken by staff and can be used to gauge how many countries collected and disseminated data on the core and encouraged FSIs and to identify the gaps in coverage. Information on the data available to the authorities and whether FSI ratios are compiled from such data is also discussed.<sup>23</sup> While countries may have done additional work on FSIs since the survey was conducted, the results nonetheless provide a basis for taking stock of the availability of data on the core and encouraged FSIs (Table 1).

### B. Background

38. **The response to the compilation and dissemination part of the survey was very good and broadly based with information provided on 100 country practices in the collection, compilation, and dissemination of data on FSIs (see Table 3).** Almost all advanced economies, 62 percent of transition economies, and almost 50 percent of developing countries responded. The lowest rates of response were from African and Western Hemisphere countries (43 percent, in each case).<sup>24</sup> Overall, 38 (70 percent) of the 54 countries that participated in the FSAP program (or were about to participate) FSSA/FSAPs as of end-2002, responded to the survey.

39. **In analyzing the results of the survey, it is important to keep in mind that countries active in FSI related work are more likely to have responded to the survey, so possibly resulting in a (positive) self-selection bias.** Thus, the results presented ahead may not generalize to the entire IMF membership and confidence in drawing inferences about the general availability of FSIs is less for regions with lower response rates.<sup>25</sup>

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<sup>23</sup> See Slack (2003), *Availability of Financial Soundness Indicators*, IMF Working Paper (WP 03/58) for a detailed presentation and analysis of the results.

<sup>24</sup> Aggregation of the survey responses is necessary to maintain confidentiality of individual country responses. Country responses are grouped following the country classification of the IMF's *World Economic Outlook (WEO)*.

<sup>25</sup> Slack (2003) provides estimates of the global availability of FSIs assuming complete self selection-bias in the survey responses.

Table 3. Survey Response Rates

	Total number of countries in the WEO	Number of countries responding to the survey 1/	<i>Of which received FSAP/FSSA (end-2002)</i>	Percentage of countries responding to the survey
All countries	183	100	38	55
Advanced economies	29	26	10	90
Developing countries	128	58	19	45
Africa 2/	51	22	7	43
Asia	26	13	2	50
Middle East	16	8	3	50
Western Hemisphere	35	15	7	43
Transition economies	26	16	9	62

1/ Responses to compilation and dissemination part of the survey.

2/ Responses from regional central banks are counted as one response per member country.

### C. Core Indicators

40. Figure 2 presents information on the proportion of survey respondents that collect data series needed to compile *one or more* indicators in each core FSI category,<sup>26</sup> and distinguishes the proportion that both collect and disseminate these data series (panels 2a and 2b). It also shows the proportion of respondents that compile FSI ratios<sup>27</sup> from the data collected (panels 2c and 2d). The number of core indicators on which data series are collected by respondents is shown in Figure 3. The following salient points can be noted from the Figures:

41. **Ninety percent of respondents collect data series needed to compile at least one indicator in the core FSI categories of capital adequacy, asset quality, earnings and profitability, and liquidity.**<sup>28</sup> Fewer respondents (61 percent) collect data series on at least one core market risk FSI. A large number of countries therefore appear to have an elementary

<sup>26</sup> *Collection* of data series needed to compile an FSI is defined as the collection of both the numerator and denominator of the FSI by the national authorities (e.g., central bank, supervisory authority, national statistical office, ministry of finance). The *core FSI categories* are those shown in italics in the first column of Table 1, namely: capital adequacy, asset quality, earnings and profitability, liquidity, and market risk.

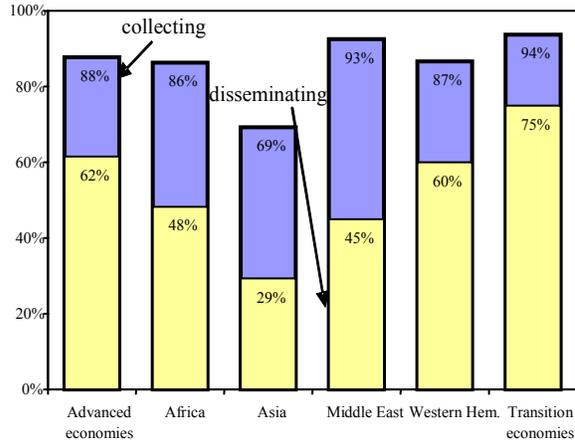
<sup>27</sup> *Compilation of FSI ratios* refers to the construction of an FSI ratio using the data series available to the national authorities.

<sup>28</sup> This does not necessarily mean that the same 90 percent of respondents collect data needed to compile at least one indicator in each FSI category.

## Figure 2. Availability of Core Financial Soundness Indicators

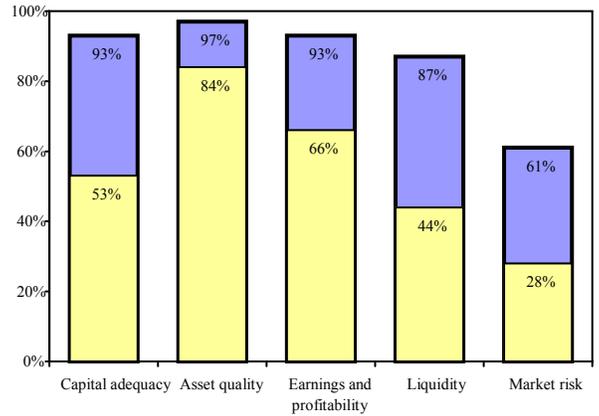
**Figure 2a. Data Collection and Dissemination, by Country Group**

*Most countries collect data on at least one indicator in each FSI category, but there is scope for disseminating more of the data collected...*



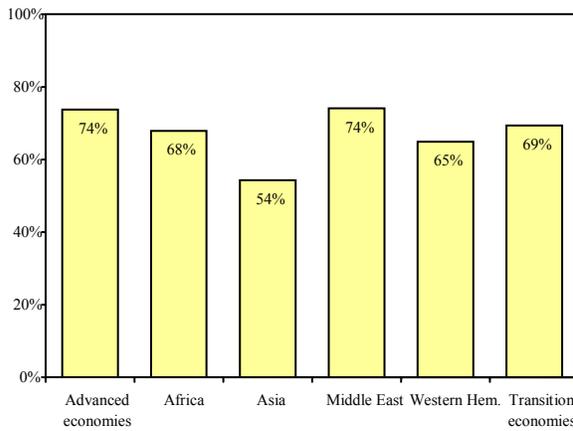
**Figure 2b. Data Collection and Dissemination, by Core FSI Category**

*...especially in the FSI categories of capital adequacy, liquidity, and market risk.*



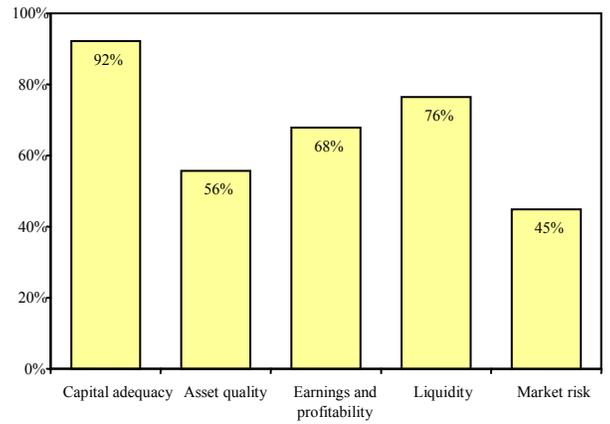
**Figure 2c. Compilation of FSI Ratios, by Country Group**

*Not all collected data series are used to compile FSI ratios...*



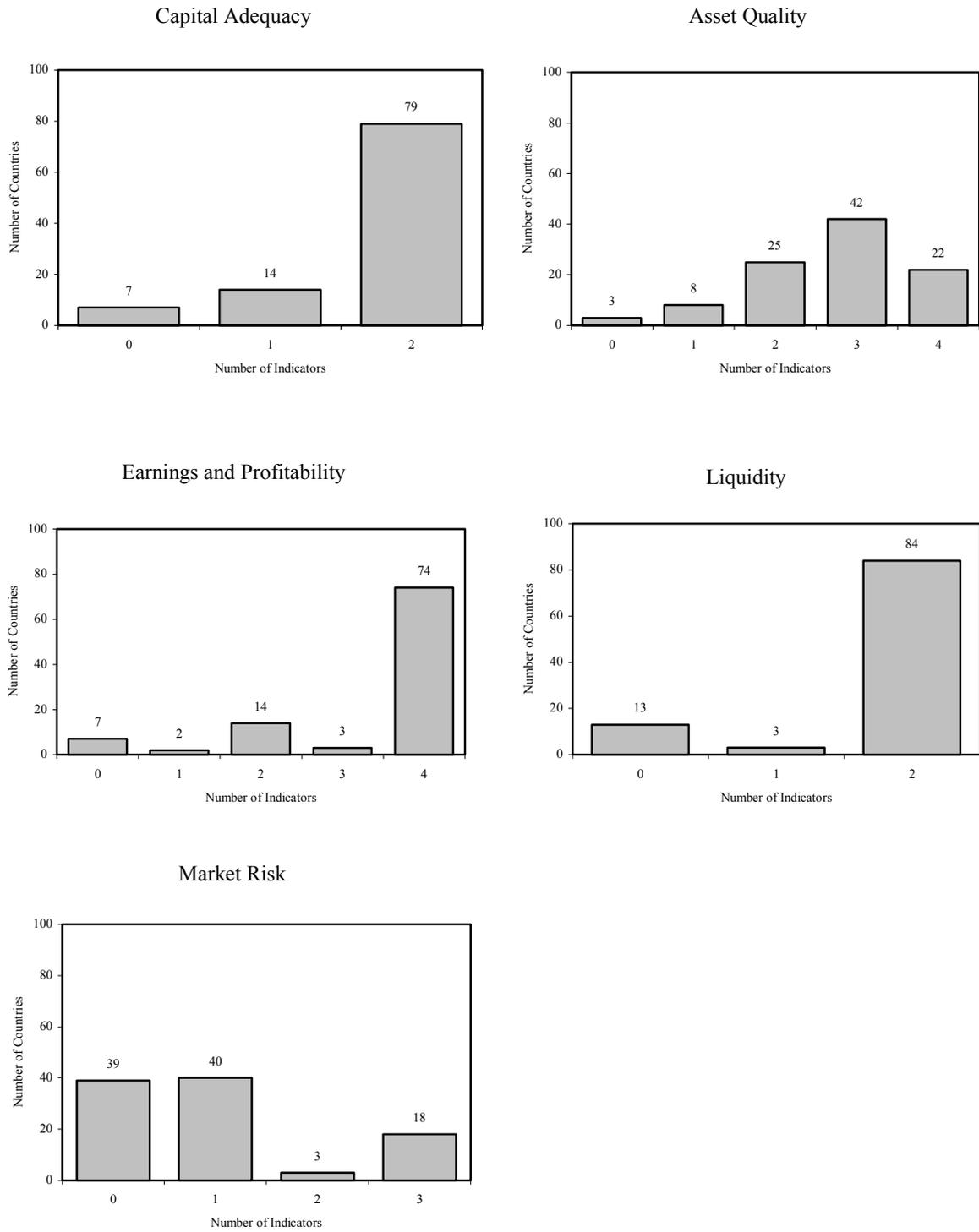
**Figure 2d. Compilation of FSI Ratios, by FSI Category**

*...especially outside of the capital adequacy indicators*



Source: IMF Survey on the Use, Compilation, and Dissemination of Macprudential Indicators.

Figure 3. Distribution of the Number of Core FSIs On Which Data Collected



Source: IMF Survey on the Use, Compilation, and Dissemination of Macprudential Indicators.

data set for monitoring the soundness of the banking sector. Nevertheless, the accounting and valuation principles that underlie these data are unlikely to be harmonized across countries and so authorities might need to develop accompanying methodological notes (metadata) to enable analysis and cross-country comparison of national FSIs.

42. **Additional data collection is needed in many countries to build a complete set of core FSIs.** Figure 3 shows the number of respondents that do not collect data series on the complete set of core FSIs is quite high in some categories: capital adequacy (21 percent); asset quality (78 percent); earnings and profitability (26 percent); liquidity (16 percent); and market risk (82 percent). In the category of asset quality, half of the respondents do not collect data series on large exposures to capital and nonperforming loans net of provisions to capital. In the category of market risk, four-fifths of the survey respondents do not collect data series on duration of assets and liabilities, and 40 percent do not collect data series on net open position in foreign exchange to capital. In addition, one-third of Asian economies collect data series on none of the core indicators (Figure 2a).

43. **Collection of data series does not equate with public availability—a much smaller data set on FSIs is made available (disseminated) to the public than is collected by official agencies.** One implication is that national agencies could make more data series on FSIs available to the public without a need for additional data collection. Nevertheless, there are differences in the eagerness to disseminate data series—both across countries and FSI categories—that might reflect the reliability (or lack thereof) of some newly collected data series, a lack of sufficient time series to enable proper interpretation of the data,<sup>29</sup> and concern about market reaction to the information encapsulated in the FSIs. In this context, it is noteworthy that transition economies disseminate the largest proportion of collected data series, followed by advanced and Western Hemisphere economies. Asian and Middle Eastern economies disseminate the smallest proportion of collected data series. There is most scope for increased dissemination of data series in the FSI categories of market risk, liquidity, and capital adequacy.

44. **The collection of the numerator and denominator data series of an FSI does not always mean that the FSI ratio is compiled.** While almost all respondents use collected data series to compile FSI ratios on the core capital adequacy indicators, up to half do not compile ratios on other core FSIs. Thus, there is scope for all respondents to compile more FSI ratios using available data series, especially in the Asian economies. Differences in extent of the compilation of FSI ratios—both across countries and FSI categories—may point to differences in the way these data are used in financial soundness analysis.

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<sup>29</sup> Because trends in FSIs can be cyclical, time series data for at least one business cycle provide a useful reference point for interpreting the current level of FSI ratios.

#### D. Encouraged Indicators<sup>30</sup>

45. Because banks generally report more data than other sectors of the economy, ahead we divide the encouraged indicators into two broad groups—those that are derived from the financial accounts of banks and those that relate to their corporate and household counterparts and the markets in which banks operate.<sup>31</sup> The first two panels of Figure 4 present information on the proportion of countries that collect data series needed to compile *one or more* encouraged indicators on the corporate and household sectors, market liquidity, and real estate markets, and distinguish the proportion that both collect and disseminate the data series. The second two panels present similar information for the encouraged indicators relating to banks. Figure 5 shows the number of encouraged indicators on which data series are collected by survey respondents. The following salient points can be noted from the figures.

46. **Fewer respondents collect data series needed to compile the encouraged than core FSIs.** Data collection for the encouraged FSIs for the corporate and household sectors and markets are scarce outside of the advanced economies—two-thirds of respondents outside of the advanced economies typically collect data on none of these FSIs. Data series for corporate net foreign currency exposure and corporate earnings to interest and principal expenses are particularly scarce.<sup>32</sup>

47. More countries collect data series needed to compile encouraged indicators relating to the banking sector. Nevertheless, three-quarters of countries typically collect data on none of the indicators of market risk, and 40 percent collect data on none of the indicators of asset quality. Compared to other respondents, proportionately fewer respondents in Asian economies collect data on the encouraged banking sector indicators.

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<sup>30</sup> Twenty of the twenty-six encouraged indicators were included in the survey. The six indicators not included in the survey were: banks' foreign currency-denominated loans to total loans, foreign currency-denominated liabilities to total liabilities; other financial corporations assets to total system assets, and to GDP; Household debt service and principal payments to income; and real estate prices. The latter is known to be particularly difficult to compile.

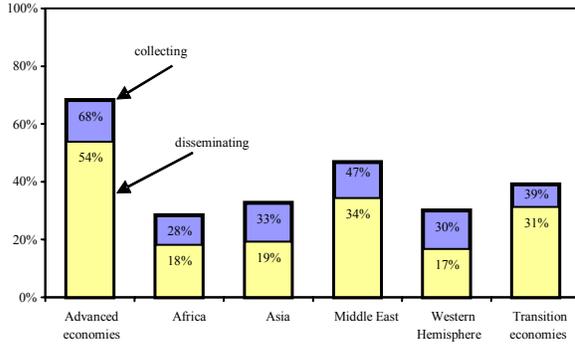
<sup>31</sup> Within these two broad groups, the encouraged FSIs that relate to banks are grouped into the same FSI categories used for the core indicators. The remaining encouraged FSIs are grouped according to the sector (corporate or household) or market (liquidity or real estate) to which they relate.

<sup>32</sup> Data series on the number of applications for protection from creditors are also reasonably scarce, but this encouraged indicator may not be relevant in all countries.

## Figure 4. Availability of Encouraged Financial Soundness Indicators

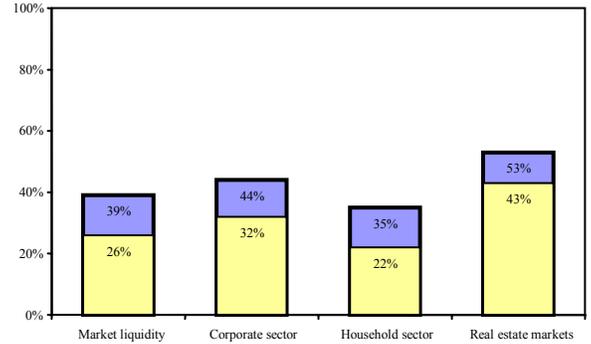
**Figure 4a. Availability of Corporate, Household, and Market FSIs, by Country Group**

*Data collection is less widespread than for the core indicators,...*



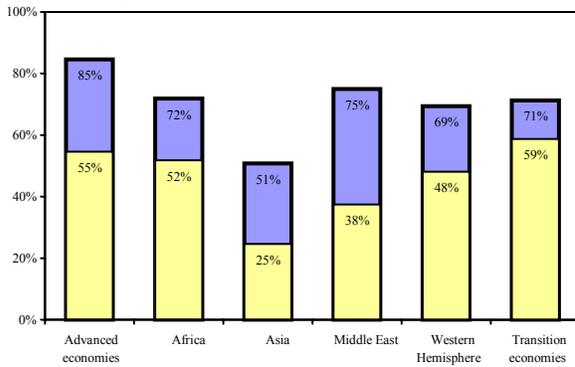
**Figure 4b. Availability of Corporate, Household, and Market FSIs, by FSI Sector**

*...and there is a paucity of data across nonbank related FSIs*



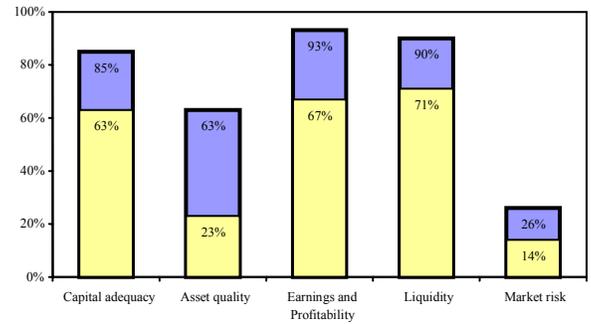
**Figure 4c. Availability of Bank Related FSIs, by Country Group**

*Data collection is more widespread than for other encouraged indicators, but is less widespread than for core indicators, especially outside the advanced economies...*



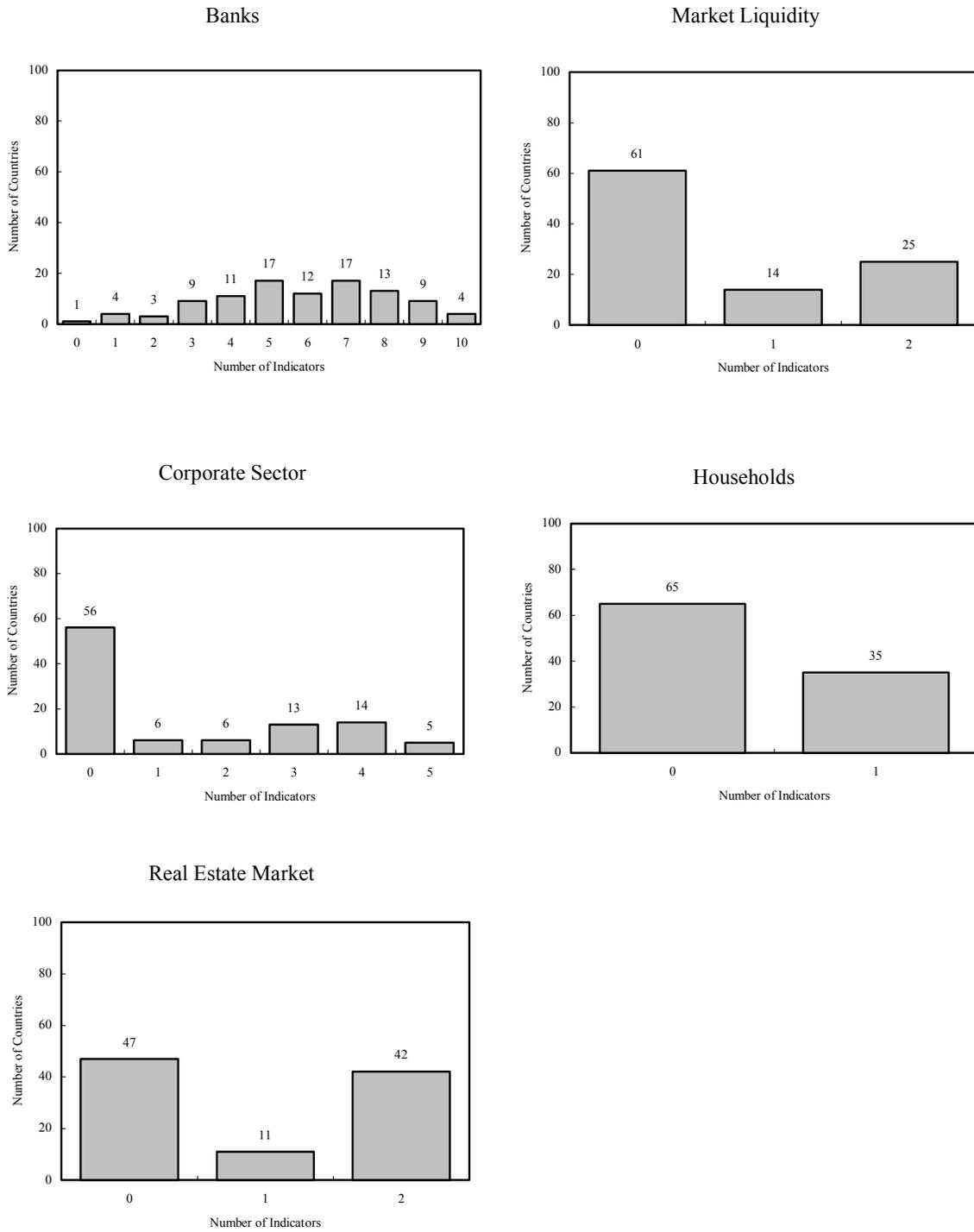
**Figure 4d. Availability of Bank Related FSIs, by FSI Category**

*...and data collection is particularly sparse for indicators of market risk.*



Source: IMF Survey on the Use, Compilation, and Dissemination of Macprudential Indicators.

Figure 5. Distribution of the Number of Encouraged FSIs On Which Data Collected



Source: IMF Survey on the Use, Compilation, and Dissemination of Macprudential Indicators

## E. Conclusions

48. A large number of countries responding to the survey collect data needed to compile at least one indicator in each core FSI category, providing an elementary dataset for monitoring soundness of the banking sector. Nevertheless, the accounting and valuation principles that underlie these data are unlikely to be harmonized across countries and so authorities might need to develop accompanying methodological notes (metadata) to enable analysis and cross-country comparison of national FSIs.

49. Many countries may need to begin collecting additional data series to build a complete set of core FSIs, particularly in the categories of asset quality and market risk. Many countries may also need to begin collecting data on relevant encouraged indicators, especially those FSIs relating to the corporate and household sectors and markets.

50. National authorities can, in the near-term, disseminate more core and encouraged FSIs by using available data. These efforts however need to take into account, among other things, possible concerns about data reliability and availability of time series, which may provide important context for market participants' interpretation of FSIs.

## III. INSURANCE FSIs<sup>33</sup>

### A. Introduction

51. **Insurance is an important and growing part of the financial sector in virtually all developed and many emerging economies.** A resilient and well-regulated insurance industry can significantly contribute to economic growth and efficient resource allocation through transfer of risk and mobilization of savings. In addition, it can reduce transaction costs, create liquidity and facilitate economies of scale in investment.

52. **The insurance sector has traditionally been regarded as a relatively stable segment of the financial system.** An absence of liquid liabilities on the balance sheets of insurers, at least as compared with banks, has saved insurance companies from contagious runs occurring in the banking sector. Nevertheless, some of the recent changes in the insurance industry increased the potential implications of insurance for financial stability. These changes include intensified links between insurers and banks. In certain countries, these links can include cross ownership, credit risk transfers, and the assimilation of banking-type products by life insurers.<sup>34</sup>

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<sup>33</sup> A more detailed discussion of the issues covered in this chapter can be found in the forthcoming Working Paper "Insurance and Issues in Financial Soundness" by Udaibir S. Das, Nigel Davies, and Richard Podpiera.

<sup>34</sup> See recent IAIS Paper on Credit Risk Transfer between Insurance, Banking and Other Financial Sectors for more information on credit risk transfers.

## B. Overview of Insurance

53. **The insurance industry is different from other financial services in that its main role is to redistribute risk within the financial system to those better able to absorb losses.** Policyholders buy protection against the occurrence of defined events and insurers set reserves against the estimated total cost of claims.<sup>35</sup> Insurance is founded on probability theory, where the price (insurance premium) is set before knowing the exact cost of the product (insurance contract, or policy).

54. **Insurance can be classified into three major categories: (i) life insurance; (ii) non-life insurance; and (iii) reinsurance.** Life insurance offers a variety of products, with different degree of protection and investment components, including pensions, savings, permanent health and term assurance policies.<sup>36</sup> The insurer's commitment may, therefore, be based on death, occurrence of a specific event (e.g., diagnosis of a specified illness), survival or inability to work due to health problems. Policies can offer guaranteed nominal or real yields or may be unit-linked and may include profit-sharing provisions.

55. **Non-life insurance is also called property and casualty insurance, property and liability insurance or general insurance.** In buying non-life insurance, the customer is buying financial protection against a specific insurable event, such as automobile accident. Policies are typically short-term (one year) indemnity contracts and normally there is no investment element or expectation of financial return. Nevertheless, some lines of business, including personal and business liability insurance, have "long-tail" liabilities as claims may occur over many years after the term of the policy has expired.

56. **Reinsurance is insurance for (primary) insurance companies.** Reinsurers protect against peak exposures and the volatility of underwriting results and the majority of their revenues comes from the non-life business. They provide both expertise and underwriting capacity to the primary market and are often systemically important to the primary insurance market.

57. **Overall, insurance penetration (gross premium as a percentage of GDP) in the OECD stood at 9.1 percent in 2000, but there were substantial differences among the OECD countries.** Countries with higher GDP per capita tended to exhibit larger insurance penetration than countries with lower GDP. While Luxembourg with over 30 percent penetration can be considered an outlier due to its small size, Japan and the United States (both over 10 percent penetration), as compared with Poland, the Slovak Republic, and Turkey (penetration between 1.5 and 3.1 percent), illustrate this point. At the same time, it

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<sup>35</sup> This statement is true in general, but the accounting treatment of reserves, provisions or other risk buffers may vary.

<sup>36</sup> In some jurisdictions, health insurance is offered by general insurers.

appears that it is mainly the life industry that develops rapidly with higher GDP per capita.<sup>37</sup> The premium volume has grown faster than GDP recently, insurance penetration in the OECD increased from 8.1 percent of GDP to 9.1 percent in 1995–2000. The growth was particularly strong in the EU, where insurance penetration jumped from 7.0 percent of GDP in 1995 to 9.2 percent in 2000.

### C. Risks Faced by Insurers and Financial Stability

58. **Recent changes in the insurance industry have increased the potential for the insurance sector to affect financial stability.** These changes include intensified links between insurers and banks. Reflecting an increased appetite of clients to save and invest in addition to buying protection, life insurers have increasingly diversified into banking-type products and asset management (unit-linked) products. Financial stability can therefore be jeopardized particularly by the failure of life insurers, even though non-life (property and casualty) insurers also play a significant role in the economy and their failures can significantly disrupt the functioning of the economy.

59. **Indeed, it was the offer of banking-type products by life insurers, combined with guaranteed rates of return on policies and risky investment strategies that was one of the causes of insurance failures in several countries.** In these countries, financial deregulation and liberalization intensified the competition among financial institutions and enabled insurance companies to offer bank-type products and thus directly compete with other financial institutions. Insurance companies introduced short-term, and/or interest-sensitive products with guaranteed rates of return and such products substantially increased their vulnerability to adverse changes of economic fundamentals.<sup>38</sup> Furthermore, insurance companies invested in rather risky and high-yielding assets, including junk bonds, in order to meet the guaranteed rates of high return on liabilities. Once the macroeconomic and market conditions deteriorated such risky investments became a heavy burden for the insurers. Financial deregulation and insufficient supervision may have also contributed to regulatory arbitrage between banks and other financial institutions, including insurance companies. Macroeconomic shocks then triggered insurance failures.

60. **The risk profiles of life insurers and banks differ. Both sectors face considerable market and credit risks, but there exist substantial differences in the structure of assets and liabilities.** In many markets, life insurers have significantly higher exposure to equities and real estate and lower exposure to direct lending to companies and households as

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<sup>37</sup> Enz (2000) examines an S-shaped relationship between per-capita income and insurance penetration. See “The S-curve Relation Between Per-capita Income and Insurance Penetration,” Swiss Re, Switzerland.

<sup>38</sup> The guaranteed rates of return have often been introduced as a result of competition with banks. In some countries, however, guaranteed returns on policies are required by regulations.

compared to banks. These exposures can mean that volatile asset prices, particularly equities, can relatively quickly erode the capital base of insurance companies.<sup>39</sup>

61. **When analyzing the market risk in the insurance industry, particular attention needs to be paid to links between the two sides of the balance sheet.** In particular, it is necessary to identify the market risk that is a part of “risk pass through” products under which the policyholder bears the risks and receives the rewards. Risk pass through products do not affect the risk profile of the life insurer (except for reputation risk). These products include unit linked products where the assets are held in the general assets of the company, group experience refund products, administration services only products and, to a certain extent, participating life insurance products.<sup>40</sup>

62. **Life insurers—with the exception of those effectively providing banking-like products—are not exposed to highly liquid and potentially unstable liabilities that can cause problems in the banking system.** On the other hand, the frequency, severity, and timing of claims or benefits are uncertain, so some degree of liquidity risk exists as well.

63. **Indeed, the liabilities life insurers face, as well as their magnitude, are uncertain. This uncertainty, or technical risk, stems from the very nature of the insurance business.** A major part of the risks to which an insurer is exposed is by the virtue of the policies it underwrites, the total of sums insured. Not all of these risks will crystallize into liabilities. Insurance liabilities are usually estimated by using actuarial or statistical techniques, which are based on probability theory using past experience and making assumptions about the future. If these calculations are incorrect, the consequences for the insurer may be significant; premiums may be insufficient and/or liabilities may be understated. Such conditions would distort insurer’s true financial condition which could result in both liquidity and solvency problems.

64. There are several examples of technical risk. Under pricing risk occurs when premiums are too low to cover claims and insurer’s expenses. Other risks include, mispricing of risk that can emerge from unforeseen or inadequately understood events,<sup>41</sup> including deviation risk, or the risk that actual development of claim frequencies such as mortality, morbidity, and interest rates will deviate from actuarial assumptions, in addition to the risk of error. Reinsurance risk occurs when there is insufficient reinsurance coverage, for example,

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<sup>39</sup> The June 2002 issue of the Global Financial Stability Report has highlighted some of the asset side risks insurers face and their role in the global financial markets.

<sup>40</sup> If there is a track record of insurers reducing dividends as a result of adverse market developments.

<sup>41</sup> There are two essential sources of underwriting pricing risk—errors in the core deterministic modeling parameters and unavoidable random error given the stochastic nature of the claims generating process. While in theory it may be possible to distinguish errors due to insufficient use of available data by the insurer from errors that are completely random or could not be foreseen, making such a distinction in practice would be very difficult.

when a “basis risk” may occur when the terms of the reinsurance coverage do not match the risk profile of the underlying business. In addition, there may be credit risk associated with the probability of failure of the reinsurer.

65. There are further risks which are specific to the financial sector and insurance industry, for example, group/conglomerate risk (conglomerates may increase the risk of contagion due to insufficient management coordination), legal risk involved with novel forms of alternative risk transfer, or special types of catastrophic events, and risks associated with electronic commerce. Other generic issues of concern are operational, economic or management risks.

#### **D. FSIs for Life Insurers**

66. Assessing financial soundness of individual insurers as well as insurance sectors as a whole is a complex task. The essential undertaking is to explore the risks to which insurers are exposed, how these risks are managed and controlled, and the sector’s ability to endure them. The overall financial position of an insurance company depends on many factors, some of which are difficult to quantify, including the quality of its management, organizational structure and systems and controls in place. An assessment of financial soundness thus needs to take into account both quantitative and qualitative indicators to achieve an acceptable degree of reliability.

67. Financial soundness indicators are an important quantitative tool, but there is little standardization in the definition and use by the authorities across countries. Starting from a relatively large number of potentially useful indicators, we have selected the most appropriate core set of financial soundness indicators, based on their analytical significance, parsimony, availability of data for compilation, and relevance under the widest range of circumstances.

68. The essential indicators cover both the current financial soundness of life insurers, in terms of capital adequacy, earnings and profitability and the potential vulnerabilities, in the categories of asset quality, reinsurance and actuarial issues, management soundness, liquidity, and sensitivity to market risks. Table 4 provides an overview of the indicators and their basic interpretation.

69. **Capital adequacy can be viewed as the key indicator of financial soundness since insurers need to have sufficient capital to absorb shocks on both asset and liability sides of their balance sheets.** Nevertheless, no internationally accepted standards for capital adequacy of insurance companies exist. Two rather straightforward indicators are included in the core set, capital/technical reserves and capital/total assets. These indicators are easy to calculate and require only information that should be readily available, but they need to be interpreted with the knowledge of the risk profile of the company or sector, including the structure of the business.

Table 4. Overview and Interpretation of FSIs for Life Insurers

Type of FSI	Aspects of financial system	Selected FSIs used to monitor different aspects of financial system	Interpretation of FSIs
<b>Financial soundness</b>	<b>Capital Adequacy</b>	<b>Capital/total assets</b>	Indicate the capacity of the sector to absorb losses relative to risk exposures; exposures measured by asset size, reserves, regulatory capital or risk models.
		Capital/technical reserves	
	<b>Earnings and profitability</b>	Expense ratio (expenses/net premium)	Compares expenses to the level of premiums generated.
		Revisions to technical reserves/technical reserves	A charge to current profits due to deviations of current experience from past actuarial assumptions.
		Investment income/investment assets	Indicates the scope of investment income to offset losses from insurance business.
<b>Return on equity (ROE)</b>	Indicates the scope for earnings to offset losses relative to capital or assets.		
<b>Insurance sector vulnerabilities</b>	<b>Asset quality</b>	(Real estate + unquoted equities + debt)/total assets	Indicates the share of illiquid and potentially volatile assets.
		Receivables/(Gross premium + reinsurance recoveries)	Assesses the credit policy of the sector and indicates potential exposure to asset quality risks.
		<b>Equities/total assets</b>	Measures the degree of exposure to equity risk.
		Non-performing loans to total gross loans	Serves as an indicator of quality of insurers' loan portfolio and of credit risk management practices.
	<b>Reinsurance and actuarial issues</b>	Risk retention ratio (net premium/gross premium)	Serves as an indicator of insurance risk management policy of insurers.
		Net technical reserves/average of net premium received in last 3 years	An indicator of adequacy of technical reserves.
	<b>Management soundness</b>	Gross premium/number of employees	Indicate the efficiency of operations of the insurance sector measured relative to the number of employees or volume of premiums. Inefficient operations suggest management problems.
		Assets per employee (total assets/number of employees)	
	<b>Liquidity</b>	<b>Liquid assets/current liabilities</b>	Identifies the vulnerability to loss resulting from the forced sale of illiquid assets.
	<b>Sensitivity to market risk</b>	Net open foreign exchange position/capital	Measures foreign currency mismatch to assess exchange rate risk.
		Duration of assets and liabilities	Measures maturity mismatch to assess interest rate risk.

Essential indicators (included in the Board Paper) are in **bold**.

70. **Earnings are the key and arguably the only long-term source of capital. Low profitability may signal fundamental problems of the insurer and may be considered a leading indicator for solvency problems.** Indicators in the area include the expense ratio (expenses/net premium) and revisions to prior year technical reserves/technical reserves, effectively a charge to current profits due to deviations of reality from past actuarial assumptions, which measures the extent to which the company or sector is able to measure output accurately. We look at investment income to investment assets as an indicator of the success of insurers' investment policy since life insurance companies function to a large extent as asset managers. Both investment income and investment assets related to risk pass-through products need to be analyzed separately. We have chosen return on equity as an indicator of the overall profitability.

71. **When exploring asset quality, we focus on the existence of potentially impaired assets, as well as on the degree of credit control the insurance company exercises.** In the core set of indicators, we look at the share of real estate (both functional and investment), unquoted equities and receivables in total assets, because these asset classes have the largest probability of being impaired. Both real estate and unquoted equities are illiquid assets, with real estate often being difficult to value in less developed economies. Receivables may expose the insurer to considerable credit risk and these assets can be easily overstated if there are insufficient provisions for collection problems.

72. **Another indicator, equities/total assets, reveals the degree of insurer's exposure to stock market risk and fluctuations of the economy.**<sup>42</sup> If the proportion of equities in total assets is significant, further examination of the portfolio composition is necessary, with special emphasis on the possible correlation of exposure on the asset and liability sides of the balance sheet. To reflect the tendency of life insurers to assimilate banking activities by direct lending to financial and nonfinancial companies, we include the most widely used indicator of loan quality—nonperforming loans to total gross loans—to the core set of indicators.

73. **In the reinsurance and actuarial issues category, the risk retention ratio (net premium/gross premium) reflects the overall underwriting strategy of the insurer in that it shows what portion of risk is passed on to the reinsurers.** Overall, insurer's capital and reinsurance cover need to be capable of covering a plausibly severe risk scenario. If the insurer relies on reinsurance to a substantial degree, it is critical that the financial health of its reinsurers is examined. The ratio of net technical reserves to average of net premium received in last three years is based on the fact that reserves should increase in step with the volume of long term business taken on, abstracting from shifts in business composition. The interpretation of this indicator needs to take into account its development over time, as well as the product mix.

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<sup>42</sup> Equity investments that are on the balance sheet of the insurer but in fact are part of risk pass-through products should be excluded.

74. **Sound management is crucial for financial stability of insurers.** It is very difficult, however, to find any direct quantitative measure of management soundness. We propose the use of two indicators of operational efficiency because the efficiency of operations is likely to be correlated with general management soundness. Unsound efficiency indicators could flag potential problems in key areas, including the management of technical and investment risks. The two indicators are gross premiums per employee and assets per employee.

75. **The frequency, severity and timing of insurance claims or benefits is uncertain, so insurers need to plan their liquidity carefully.** We have chosen one simple liquidity indicator, the ratio of liquid assets to short-term liabilities. All liabilities with maturity shorter than one year, including insurance product liabilities under which policyholders are able to surrender the policy and receive a cash payment, should be included in current liabilities. This is particularly important for life insurers that offer deposit-like products and become exposed to liquid liabilities.

76. **As for the sensitivity to market risk, two standard indicators, which measure insurer's exposure to foreign exchange and interest rate risks, are included in the core set: net open foreign exchange position to capital and duration of assets and liabilities.**

77. **Even in countries in which the insurance sector is not currently important for financial stability, supervisors should have the necessary data for the compilation of the essential set of indicators.** Nevertheless, supervisory resources are often limited and need to be focused on the key financial stability questions. Therefore, the current size and growth of the insurance sector, as well as structural considerations, including the linkages with the banking sector and the existence of any banking-type products offered by the insurers, are the main criteria for countries to consider in selecting the appropriate indicators and the frequency of compilation of the insurance FSIs.

78. **The work on a consistent and practically applicable set of FSIs for insurance has only begun.** In the absence of international standards for insurance regulation and supervision, many terms used above need to be precisely defined and interpretation guidelines developed, keeping in mind the diversity of insurance markets across countries.

#### IV. FINANCIAL SOUNDNESS INDICATORS OF SENSITIVITY TO MARKET RISK

79. **This chapter is focused on the analysis of financial soundness indicators of sensitivity to market risk ("market risk FSIs").** The set of 15 core FSIs, endorsed by the IMF Board in June 2001, included 3 market risk FSIs, measuring banks' vulnerability to the exchange rate risk (net open position in foreign exchange to capital) and the interest rate risk (duration of assets and duration of liabilities). The encouraged set included two other market risk FSIs, measuring banks' vulnerability to equity price movements (net open position in equities to capital) and corporate sector's vulnerability to the exchange rate risk (corporate

sector's net open position in foreign exchange).<sup>43</sup> This chapter summarizes the experience with collecting the market risk FSIs in FSAP missions (Section A), analyzes the relationship between the market risk FSIs and stress tests for exchange rate risk (Section B), interest rate risk (Section C), and other market risks (Section D), and presents the main conclusions and issues involved in going forward (Section E).

#### **A. Experience with Collecting Market Risk FSIs on FSAP Missions**

80. **Compared with other groups of core FSIs, the three core market risk FSIs have been collected in a smaller percentage of countries participating in the FSAP.** Only 57 percent of FSAP missions reported at least one of the market risk FSIs, as compared with 83–100 percent for the other four groups of core FSIs (capital adequacy, asset quality, earnings and profitability, and liquidity), see Table 5. The percentage was smaller for FSAP missions in developed countries (only about 40 percent) than for other FSAP missions.

81. **The two duration indicators have been the most difficult core FSIs to collect.** A satisfactory aggregate duration measure has not been reported in a single FSAP mission. Several FSAP missions reported simpler alternatives to this measure, in particular the time to repricing, but even this was reported in less than 10 percent of FSAP missions (Table 6), which was the smallest percentage of all core FSIs.

82. **A survey found that the reasons for not reporting the market risk FSIs in FSAP reports were different for developed and developing countries.** The survey was conducted among team members responsible for the collection and analysis of FSIs on the FSAP missions, with a view to understanding better the reasons why these FSIs were often not reported. The survey helped to identify the following two main reasons for not reporting the market risk FSIs:

- ***In developed economies and emerging market economies with sophisticated financial markets***, duration and net open position indicators were perceived as too crude measures that provide a less accurate measure of risk of some off-balance sheet market exposures than stress tests.
- ***In developing economies as well as in less developed transition economies***, the prevailing reason for not reporting the market risk FSIs was the absence of the necessary data, especially in the case of the duration measures. Typically, duration indicators were seen as potentially useful, but the country authorities did not have the capacity to collect the necessary information, and they felt that the additional reporting burden on the financial institutions would be too high. In several cases, banks reported detailed information on the maturity structure of assets and liabilities,

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<sup>43</sup> See Sundararajan, V., Charles Enoch, Armida San José, Paul Hilbers, Russell Kruger, Marina Moretti, and Graham Slack, 2002, "Financial Soundness Indicators: Analytical Aspects and Country Practices," Occasional Paper No. 212 (Washington, DC: IMF).

Table 5. Reporting of FSIs on FSAPs, 1999–2003  
(Percentage of FSAPs reporting the FSI 1/)

<i>Core FSIs</i>		<i>Core FSIs</i>	
<i>Capital adequacy</i> 2/	98	<i>Liquidity</i> 2/	83
Regulatory capital to risk-weighted assets	98	Liquid assets to total assets	70
Regulatory tier 1 capital to risk-weighted assets	42	Liquid assets to short-term liabilities	55
<i>Asset quality</i> 2/	100	<i>Sensitivity to market risk</i> 2/	57
Nonperforming loans to total gross loans	100	Duration or repricing period of assets	6
Nonperforming loans net of provisions to capital	40	Duration or repricing period of liabilities	8
Sectoral distribution of loans to total loans	60	Net foreign exchange position to capital	55
Large exposures to capital	23		
<i>Earnings and profitability</i> 2/	98	<b><i>Selected Encouraged FSIs</i></b>	
Return on assets	94	Banks' capital to assets 3/	53
Return on equity	91	Market liquidity 4/	40
Net interest income to gross income	64	Corporate leverage and profitability 5/	28
Noninterest expenses to gross income	58	Household indebtedness 6/	11

Source: International Monetary Fund.

1/ Includes 53 FSAPs completed or near completion by end-February 2003.

2/ The percentage of FSAPs that reported at least one indicator in the group.

3/ An encouraged FSI, but used in place of capital adequacy ratios when these were not available.

4/ FSIs of average bid-ask spread and average daily turnover ratio in the securities market.

5/ FSIs of corporate sector's total debt to equity, return on equity, and earnings to interest and principal expenses.

6/ FSIs of household debt to GDP and household debt service and principal payments to income.

Table 6. Reporting of Market Risk FSIs in FSAP Missions  
(in percent of FSAP missions)

	Duration (or repricing period) of		Net open position in foreign exchange
	assets	liabilities	
FSI reported	6	8	55
of which: stress test conducted	6	8	55
stress test not conducted	0	0	0
FSI not reported	94	92	45
of which: stress test conducted	83	81	36
stress test not conducted	11	11	9

Source: Survey on uses of market risk FSIs.

but were unable to report on time to repricing or duration. In some cases, the FSAP mission was able to observe that banks largely match maturities of assets and liabilities, but this observation was limited by the fact that the country authorities only collected very crude information on the maturity breakdown. In one case, reasons for not collecting the data included the prevalence of Islamic banking.

83. **The survey highlighted the close relationship between market risk FSIs and stress tests.** In most FSAP missions, stress testing was used as the main method of assessing vulnerability of banks to market risks. Stress testing for interest rate risk and exchange rate risk was conducted in about 90 percent of the FSAP missions (Table 6). In developed economies, stress testing was often supplemented by banks' value-at-risk models.

### B. Net Open Position in Foreign Exchange vs. the Exchange Rate Stress Test

84. **The net open position and the direct exchange rate stress test are two analytical tools that can often be viewed as substitutes.** To illustrate this, let  $F$  denote the net open position in foreign exchange,  $C$  be the capital,  $A_{RW}$  be the risk-weighted assets (all in domestic currency units), and  $e$  be the exchange rate in units of foreign currency per a unit of domestic currency. A depreciation (a decline) in the exchange rate leads to a proportional decline in the domestic currency value of the foreign exchange exposure, i.e.,  $\Delta e/e = \Delta F/F$ .<sup>44</sup> Let us assume, as is often done in stress tests in FSAP missions, that a decline in the value of the net open position translates directly into a decline in capital, i.e.,  $\Delta C/\Delta F = 1$ .<sup>45</sup> The impact of the exchange rate shock on the ratio of capital to risk-weighted assets would then be calculated as

$$\frac{\Delta[C(e)/A_{RW}(e)]}{\Delta e} \cong \frac{\frac{F}{e} A_{RW} - C \frac{\Delta A_{RW}}{\Delta C} \frac{F}{e}}{A_{RW}^2} \cong \frac{1}{e} \frac{F}{C} \frac{C}{A_{RW}} \left( 1 - \frac{\Delta A_{RW}}{\Delta C} \frac{C}{A_{RW}} \right), \quad (1)$$

where we used the fact that  $\Delta C/\Delta e = \Delta F/\Delta e = F/e$ . The operator  $\Delta$  denotes change, and the symbol “ $\cong$ ” means that the equation holds only approximately for larger than infinitesimal changes. Equation (1) can be rewritten as

$$\Delta[C(e)/A_{RW}(e)] \cong \frac{\Delta e}{e} \frac{F}{C} \frac{C}{A_{RW}} \left( 1 - \frac{\Delta A_{RW}}{\Delta C} \frac{C}{A_{RW}} \right). \quad (2)$$

85. **The straightforward relationship between the net open position and the direct exchange rate stress test holds only under certain assumptions.** Equation (2) summarizes the relationship between the basic exchange rate stress test and the respective FSIs. The term

<sup>44</sup> So long as there is a long or short net open position, i.e.,  $F \neq 0$ .

<sup>45</sup> More realistically, we could deduct the effect of the shock first from profits, and only then from capital. It would, however, make the notation more complex, without providing many additional insights.

$\Delta A_{RW}/\Delta C$  can have values from 0 to 1, reflecting the degree of co-movement of capital and the risk weighted assets. In the special case of  $\Delta A_{RW}/\Delta C=0$ , i.e., if the risk-weighted assets do not change, the change in the capital adequacy ratio (in percentage points) equals simply the exchange rate shock (in percent) times the exposure, measured as a product of the two core FSIs ( $F/C$  and  $C/A_{RW}$ ). This is sometimes used as a short-hand calculation of the direct exchange rate stress test. The calculation highlights the assumptions behind such approximations, in particular the assumption of no change in  $A_{RW}$ .<sup>46</sup> Also, equation (2) holds only as a linear approximation, which works well if foreign exchange portfolios are essentially linear, i.e., the banking sector is not very active in options markets. If banks have large positions in foreign exchange options, the relationship between the exchange rate change and the impact on capital can become highly non-linear. In such cases, stress tests based on a more detailed decomposition of banks' positions in foreign exchange would be a clearly superior analytical tool. So far, however, most stress tests in FSAP missions have not incorporated such non-linear effects.<sup>47</sup>

**86. The net open position captures the direct foreign exchange risk.** In practice, this risk tends to be rather small compared to other risks that banks face, given that the exposure is relatively easy to measure and therefore to manage or regulate by setting limits. It is typically much more difficult to monitor foreign exchange vulnerabilities of banks' counterparties, and therefore the aggregate risk that banks would face through changes in credit risk resulting from changes in the exchange rate. The corporate sector's net foreign exchange exposure to equity is one of the encouraged indicators in the set endorsed by the Executive Board in June 2001. However, no FSAP mission so far was able to provide this indicator, and only few FSAP missions were able to address the indirect foreign exchange risks in the stress testing calculation. Several FSAP missions recommended improvements in the collection of data on foreign exchange exposures in the corporate sector.

**87. It is important to incorporate the indirect exchange risk in the stability assessment.** While FSAP missions have not been able to collect comprehensive data on corporate sectors' foreign exchange exposure, several FSAP missions that analyzed the corporate sector in detail generally found that the banking sectors indirect exchange rate risk was more important than its direct one. To illustrate the significance of the indirect risk in overall banking sector risk, let us denote the corporate sector's debt, equity, and open foreign exchange position as  $D_c(e)$ ,  $E_c(e)$ , and  $F_c(e)$ , respectively.<sup>48</sup> Let us assume that, similarly to the case of bank's net open position, a percentage change in the exchange rate will translate

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<sup>46</sup> Empirically,  $\Delta A_{RW}/\Delta C$  could be estimated by a regression. In practice, FSAP stress tests have usually been based on simplifying assumptions, such as  $\Delta A_{RW}/\Delta C=1$  or 0.

<sup>47</sup> The draft Compilation Guide on FSIs encourages the identification of the component elements of the net open position, including options in bought and sold positions.

<sup>48</sup> Given the practical difficulties involved in obtaining empirical data on open positions in the household sector, we refer here for simplicity only to the corporate sector, even though the theoretical analysis would be essentially the same even if we included the household sector.

into the same percentage change in the domestic currency value of the net open position, which will in turn lead to an equivalent change in the corporate sector's equity, i.e.,  $\Delta E_c/\Delta e = \Delta F_c/\Delta e = F/e$ . The impact of the exchange rate on the corporate leverage ( $D_c/E_c$ ) is then given by

$$\frac{\Delta[D_c(e)/E_c(e)]}{\Delta e} \cong \frac{\frac{\Delta D_c}{\Delta E_c} \frac{F_c}{e} E_c - D_c \frac{F_c}{e}}{E_c^2} \cong -\frac{1}{e} \frac{F_c}{E_c} \left( \frac{D_c}{E_c} - \frac{\Delta D_c}{\Delta E_c} \right). \quad (3)$$

Thus, if the corporate sector is short in foreign exchange, a depreciation (decline) in the exchange rate would lead to an increase in its leverage. Corporate leverage is typically positively correlated with the share of banks' nonperforming loans in total loans (denoted as  $NPL/TL$ ), i.e.,  $\Delta(NPL/TL)/\Delta(D_c/E_c) = a > 0$ .<sup>49</sup> The impact of a change in the exchange rate on the  $NPL/TL$  ratio can then be expressed as

$$\Delta(NPL/TL) \cong a \Delta[D_c(e)/E_c(e)] \cong -\frac{\Delta e}{e} \frac{F_c}{E_c} a \left( \frac{D_c}{E_c} - \frac{\Delta D_c}{\Delta E_c} \right). \quad (4)$$

In the special case when  $\Delta D_c/\Delta E_c = 0$ , the change in the  $NPL/TL$  ratio would equal the exchange rate change times the respective FSI (the net open position), times the parameter  $a$ , which can be estimated empirically, as shown in Chapter V. To find the impact on capital adequacy, we can assume, as done in several FSAP missions, that the credit shock has the form of a transition of performing loans into the nonperforming category. By differentiating  $C/A_{RW}$  with respect to  $NPL/TL$ , and substituting for  $NPL/TL$  from (4), we obtain

$$\Delta(C/A_{RW}) \cong \frac{\Delta e}{e} \frac{TL}{A_{RW}} \left( 1 - \frac{C}{A_{RW}} \frac{\Delta A_{RW}}{\Delta C} \right) \pi \frac{F_c}{E_c} a \left( \frac{D_c}{E_c} - \frac{\Delta D_c}{\Delta E_c} \right), \quad (5)$$

where we assume (as many FSAP missions have done) that provisions are expressed as a fixed percentage ( $\pi$ ) of nonperforming loans, and that they are deducted directly from capital.

**88. The incorporation of the indirect effect makes the analysis—and the relationship between the FSIs and the stress test calculations—more complex and dependent on additional assumptions or regression analysis.** The presentation of the direct effect in (2) and the indirect effect in (5) may appear similar, given that in both cases, the change in the capital adequacy FSI is expressed as the shock times an FSI that characterizes the exposure (the net open position). However, the calculation of the indirect effect in (5) is perhaps the simplest possible expression for the indirect exchange rate effect, using FSIs. It relies on

<sup>49</sup> Chapter V shows that for a panel of 47 countries, a 10 percentage point rise in the corporate leverage was associated with 1.1 percentage point rise in  $NPL/TL$  after a one year lag.

additional assumptions and parameters that would need to be estimated or determined, such as the sensitivity parameter, reflecting the impact of the corporate sector on the banking sector, the provisioning rate, and the ratio of total loans to risk-weighted assets.

89. **One of the reasons adding to the complexity of the indirect exchange rate stress test is the fact that it should include the effects on stocks as well as on flows.** The calculation of the indirect effect as per (5) would need to reflect the impact of exchange rate changes on the net present value of the corporate sector, which means to take into account changes in the net present value of future earnings. For example, in export-oriented companies, a depreciation could be generally expected to increase their future earnings. In terms of the net present value, the effect would be essentially equivalent to the impact of a long position in foreign currency. However, it may be more practical to calculate the impact on flows, by estimating the elasticity of earnings to interest and principal expenses (an encouraged FSI) with respect to the exchange rate, and then to estimate the relationship between this FSI and the NPL/TL ratio. Alternatively, it would be useful to compile an indicator measuring the corporate sector's flow exposure, e.g., a ratio of foreign exchange earnings to total earnings, or (ideally) a ratio of earnings in foreign exchange to interest and principal expenses in foreign exchange. Subject to further developmental work and analysis, such an indicator could be included in the set of encouraged FSIs.

### C. The Duration Gap vs. the Interest Rate Stress Test

90. **Duration is a key indicator for the measurement of the direct interest rate risk.** The principal usefulness of duration stems from the fact that it approximates the elasticity of the market values of assets and liabilities to the respective rates of return,<sup>50</sup>

$$\frac{\Delta A(r_A)}{A(r_A)} \cong \frac{-D_A \Delta r_A}{(1+r_A)}, \quad \frac{\Delta L(r_L)}{L(r_L)} \cong \frac{-D_L \Delta r_L}{(1+r_L)}. \quad (6)$$

where  $A(r_A)$  and  $L(r_L)$  are market values of assets and liabilities of a banking system, and  $r_A$  and  $r_L$  are annual interest rates on assets and liabilities.<sup>51</sup> This feature of duration can be used to summarize the impact of changes in interest rates on banks' capital. In particular, we can define capital as  $A(r_A) - L(r_L)$ , and express it as a ratio to risk weighted assets.<sup>52</sup> Differentiating capital with respect to the interest rate on assets, and substituting from (6), the sensitivity of the  $C/A_{RW}$  ratio to interest rate changes can be expressed as

<sup>50</sup> Duration is defined as the weighted average term-to-maturity of an asset's (liability's) cash flow, the weights being the present value of each future cash flow as a percent of the asset's (liability's) full price. See the draft *Compilation Guide on FSIs* (paragraph 3.52) for a formula that could be used to calculate duration.

<sup>51</sup> Bierwag, Gerald O., 1987, *Duration Analysis*, Cambridge, MA: Harper & Row.

<sup>52</sup> The impacts can also be expressed in terms of banks' profitability, which may be useful when branches of foreign banks, which typically do not have own capital, play an important role in the local economy. Bierwag (1987) derives the impact on profits in the case of a single bank.

$$\frac{\Delta[C(r_A, r_L) / A_{RW}(r_A)]}{\Delta r_A} \cong -\frac{(L / A_{RW})}{1 + r_A} \left( D_A - D_L \frac{1 + r_A}{1 + r_L} \frac{\Delta r_L}{\Delta r_A} \right) \frac{1 - \frac{\Delta A_{RW}}{A_{RW}} \frac{C}{\Delta C}}{1 - \frac{\Delta A}{A} \frac{C}{\Delta C}}. \quad (7)$$

Assuming that the risk-weighted assets move proportionately to total assets, i.e.,  $\Delta A_{RW}/A_{RW} = \Delta A/A$ , equation (7) can be simplified into

$$\frac{\Delta[C(r_A, r_L) / A_{RW}(r_A)]}{\Delta r_A} \cong -\frac{(L / A_{RW})}{1 + r_A} GAP_D, \quad (8)$$

where  $GAP_D$  is the duration gap, defined as

$$GAP_D = D_A - D_L \frac{1 + r_A}{1 + r_L} \frac{\Delta r_L}{\Delta r_A}. \quad (9)$$

91. **The duration gap and the direct interest rate stress test are two analytical tools that can often be viewed as substitutes.** Equations (8) and (9) illustrate the relationship between the two duration FSIs and the capital adequacy FSI.<sup>53</sup> In particular, equation (8) characterizes the relationship between the “interest rate exposure FSI” and the corresponding stress test, in a similar way as it was done in equation (2) for the exchange rate risk. The “interest rate exposure FSI” is the duration gap, which is a function of the two duration FSIs. In the special case when the interest rates for assets and liabilities move simultaneously, the duration gap can be approximated as a difference of the two durations,  $D_A - D_L$ . Similarly to the exchange rate risk, the impact on capital adequacy can generally be expressed as a product of the shock and the “exposure FSI.” In both cases, however, this short-cut formula is subject to simplifying assumptions, such as the one on the relationship between total and risk-weighted assets.

92. **The duration gap is a reliable estimator of the impact of interest rate changes only for small shocks.** Durations can change with changes in interest rates. Since stress tests typically involve large changes in interest rates, it would be advisable to include second derivative terms to account for convexity. However, given the complexities involved in such calculations, FSAP stress test so far have not been able to satisfactorily reflect possible changes in duration—in fact, most FSAP missions used much simpler approaches than those based on duration.<sup>54</sup> A related issue is the calculation of a combined interest rate and exchange rate shock, when the combination of the aggregate duration and the aggregate net open position may give only an approximate indication of the overall impact. A currency

<sup>53</sup> The actual FSI may be somewhat different, as it refers to regulatory capital rather than the difference of market values of assets and liabilities.

<sup>54</sup> Only about 20 percent of FSAPs conducted a duration-based stress test (see “Financial Sector Assessment Program—Review, Lessons, and Issues Going Forward,” SM/03/77). The rest typically used simplified methods such as maturity gaps or earnings at risk

breakdown of duration would help to identify maturity mismatches by currencies. Again, this analysis was typically not done in FSAP missions, mostly due to the lack of data.

### **The duration gap vs. simple (maturity) gap calculations**

93. **The calculation of duration of total assets and total liabilities of a financial system can be a difficult computational task; however, alternative approaches are possible.** In practice, alternative and less costly approaches to measuring the interest rate risk are often used. Assets and liabilities can be lumped into groups based on common features, such as coupon rates (or comparable contractual rates), maturities, and credit risk. Within such cells, one can estimate the implied cash flow stream and the relevant market yields, and compute duration, which can then be aggregated across the cells.

94. **A simplified measure of interest rate sensitivity often used in place of duration is based on the traditional “maturity gap analysis.”** Under this approach, expected payments on assets and liabilities are sorted into “buckets” according to the time to repricing or payments are due (e.g., period until financial instruments are redeemed or the interest rates on them are reset or reindexed).<sup>55</sup> Similarly to duration, the net difference (gap) in each time bucket can be multiplied by an assumed change in interest rates to gain an indication of the sensitivity of banks’ income to changes in interest rates.

95. **Maturity gap data are useful, but they are inferior to duration measures and could conceal actual risks in the system.** Ahmed et al. (1999), using empirical data on U.S. banks in 1991–99, find that maturity gaps reported by the banks were useful in assessing the loss potential of banks’ interest rate risk positions, since there was a significant statistical relationship between the maturity gap and future changes in net interest income.<sup>56</sup> However, it is possible that the maturities of financial assets and liabilities match, but the timing of the cash flows on assets and liabilities is not matched (i.e., their durations differ) and banks are thereby open to interest rate gains or losses. Bierwag (1987) shows practical examples of banks that have zero maturity gaps, but in fact have extremely risky positions (measured by duration).

### **Indirect interest rate shock**

96. **Similarly to the net open position in foreign exchange, duration gaps capture only the direct impact of an interest rate change on the bank.** They do not reflect indirect effects, in particular the impact that an increase in lending interest rates is likely to have on the credit risk of banks’ borrowers. This risk could be approximated by using the encouraged

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<sup>55</sup> The *Draft Compilation Guide on Financial Soundness Indicators* (SM/03/92) includes a table showing how such simplified measure can be calculated. An even simpler approach would be based on the average maturity of assets and liabilities.

<sup>56</sup> Ahmed, Anwer S., Anne Beatty, and Bruce Bettinghaus, “Evidence on the Efficacy of Market Risk Disclosures by Commercial Banks,” April 1999, Syracuse University, mimeo.

FSI of corporate earnings to interest and principal expenses. In practice, however, this indicator has so far been reported relatively infrequently, even though it has been used more frequently in recent FSAP mission. Those FSAP missions that attempted to assess this type of risk typically estimated a regression model for the share of nonperforming loans to total loans, with interest rates among the explanatory variables. The panel data estimate presented in Chapter V did not find a significant relationship between interest rates and the NPL/TL ratio, although this may reflect the limitation of the data set. However, for individual countries using time series data, the slope coefficient was often significantly negative.<sup>57</sup> Similarly to the exchange rate risk, the integration of the direct and indirect interest rate risk is easier to implement with the help of stress tests.

#### **D. Other Market Risk FSIs**

97. **Non-core market risk FSIs have been reported even less frequently than the core FSIs.** The set of encouraged indicators, endorsed by the Board in June 2001, included two market risk FSIs: banks' open position in equities to capital; and, corporate sector's net open position in foreign exchange. The first indicator was reported in a limited number of FSAP reports where the equity price risk was considered important.<sup>58</sup> The analysis and stress tests conducted were very similar to those described in (1) and (2) for direct exchange rate risk. The second indicator was not collected in a single FSAP mission, despite its analytical importance (as illustrated in equation (4)). Typical problems in many countries include the fact that supervisors do not have the power to ask for data from the corporate sector; at the same time, corporate sector data collected by the statistical office are often not tailored to the needs of bank supervision and come with a long lag.

98. **Some indicators of sensitivity to market risk, which have not been included in the core and encouraged set of FSIs, can be useful in certain cases.** Authorities in countries, where banks' exposures to certain commodities are important, may consider collecting net open position in commodities to capital. The calculations and stress tests for this indicator are essentially the same as for the net open position in foreign exchange, as shown in (1) and (2). Finally, in some country cases, it might be useful to measure household sector's net open position in foreign exchange (which is not included in the existing sets of FSIs) and conduct similar stress tests as those described in equations (3) and (4). An alternative approach would be to calculate the elasticity of household debt service and principal payments to income (an encouraged FSI) with respect to the exchange rate. However, this indicator for the household sector may be even more difficult to collect than the corporate sector exchange rate exposure FSI.

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<sup>57</sup> For instance, in the case of Hong Kong SAR, it has been estimated that an increase in nominal interest rates by 1 percentage point leads to a rise in the classified loan ratio by 0.2 percentage points with a lag of 2 quarters ("The Impact of Macroeconomic Environment on the Asset Quality of Hong Kong's Banking Sector," [www.info.gov.hk/hkma](http://www.info.gov.hk/hkma)).

<sup>58</sup> The stress test for equity price risk was conducted in only about 20 percent of FSAP missions.

## E. Conclusions and Issues Going Forward

99. **Market risk FSIs and the direct stress tests for market risks are closely related and, thus, can serve as substitutes for each other.** A distinctive feature of the market FSIs is that they give a direct indication of the loss that could result from exchange rate or interest rate changes. In this sense, these FSIs and the corresponding stress tests are largely *substitutable*. In contrast, in the area of credit risk, the FSIs on loan quality and the credit risk stress test can be viewed as *complementary*, since the FSI needs to be accompanied by other pieces of information so as to arrive at the vulnerability assessment.

100. **Stress testing has a number of advantages over FSIs, as confirmed in the survey on the use of market risk FSIs.** Stress tests are more precise and more illustrative, and also more flexible with respect to various simplifying assumptions. For example, in several FSAP missions, average durations for individual banks were estimated from “maturity buckets” by making a number of assumptions based on qualitative and quantitative information obtained from interviews with banks and authorities. However, aggregate duration measures for the FSI table in the FSAP documents were not produced in this manner, because the procedure was considered too dependent on the simplifying assumptions for the calculation to be treated as “data.”

101. **Market risk FSIs have also certain advantages compared with stress tests.** They are easier to standardize and therefore to compare across countries. Also, they are less resource consuming than full-fledged stress tests. As such, they can be conducted and reported relatively frequently. Also, unlike most stress tests, dissemination of FSIs is not hampered by legal constraints on sharing of confidential information. Moreover, presenting vulnerabilities in terms of net open positions may have certain advantages in countries where it could be considered too sensitive for the authorities to explicitly report stress test results for exchange rate changes (e.g., countries with hard exchange rate pegs).

102. **The relationship between the FSIs and stress tests becomes more complex with the inclusion of indirect risks.** Less than half of all FSAP missions so far have included the indirect effects in the interest rate and exchange rate stress tests.<sup>59</sup> At the same time, the indirect risks are important—those FSAP missions that incorporated them in stress tests, typically found the indirect risks more important than the direct risks. Including the indirect effects means combining elements of market risk with elements of credit risk, which causes the relationships between the market risk FSIs and stress tests to become more complex (despite the simplifying assumptions).

103. **Despite the fact that the calculation of the three core market risk FSIs has proven to be difficult, in particular for the duration indicators, there are still**

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<sup>59</sup> See the recent FSAP review paper (SM/03/77).

**compelling theoretical reasons for collecting and reporting these indicators.**<sup>60</sup> At the same time, the following suggestions arose from the above analysis:

- ***While recognizing the necessity to adapt stress tests to country-specific circumstances, there is also a need for developing guidelines on stress testing market risk in FSAP missions.*** This would enhance the cross-country comparability of the results, and make it easier to use stress tests for market risks as substitutes for market risk FSIs. This is consistent with the suggestion of the recent FSAP review paper (SM/03/77) to identify “good practices” for methodology and operational modalities of stress tests for groups of similar countries.
- ***It can be useful to combine the two duration indicators to a single indicator that would directly show the impact in terms of aggregate net worth.*** Such an indicator is the duration gap, as defined in (9), which, in the special case that asset and liability interest rates move simultaneously, could be simplified to a difference of the two durations,  $D_A - D_L$ . This indicator applies the same approach to interest rate risk as that used for exchange rate risk and equity price risk by summarizing the exposure as a single net figure. In this sense, the duration gap is an analogous to a net open position, while the durations are analogies of gross open positions, which are not included in the core set of FSIs.
- ***It is important that the analysis of borrowers’ exposures is based both on stocks as well as on flows.*** In particular, as mentioned in the discussion of the indirect foreign exchange risk, the existing list of encouraged FSIs includes the corporate sector’s stock exposure in foreign currency, but an assessment of the foreign exchange risk in the corporate sector needs to be based also on an indicator capturing the foreign exchange flow (e.g., earnings in foreign exchange in proportion to foreign exchange interest and principal expenses). If such data are not available on a consistent basis, it could be useful for bank supervisors to consider collecting them, at least for the largest borrowers of the banking system.

104. **Monitoring of durations and net open foreign exchange positions is important in any financial system facing market risk, but the implications for data collection are somewhat different for developed economies and developing economies.** In particular:

- ***In developed economies and emerging market economies with sophisticated financial markets,*** improvements in reporting systems have in many cases already been made or are under way that should make it easier to measure the interest rate

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<sup>60</sup> This conclusion is consistent with the view that “durations of assets and liabilities are examples of indicators that are highly relevant analytically—which is why they are included in the core set—although their compilation is not widespread” (Sundararajan et al., 2002).

risk, including through duration indicators.<sup>61</sup> Other developed economies, however, would still benefit from improvements in the measurement of interest rate risk, in particular in the loan book. Also, calculation of aggregate market risk FSIs in developed economies is often subject to the general issues posed by the presence of large complex financial institutions, diversified over a number of sectors as well as financial systems, which can make the aggregation a very challenging task. In fact, these institutions often rely on stress tests or value-at-risk to monitor and manage their interest rate risk.

- ***In developing economies and some transition economies***, the basic issue is to ensure that both the supervisory agency and commercial banks have the capacity to provide the necessary data. In the context of an FSAP mission, it may be useful to review regulatory return forms before making any data request for compilation of FSIs or to conduct stress tests, in order to understand what FSIs can be produced with current data and what additional information would be needed to enhance the monitoring of market risk. In small countries or countries with less complex financial systems, the nature of the system, and the availability of data could argue for simplified approaches such as the maturity gap analysis.

## V. ESTIMATING THE LINKAGE BETWEEN CORPORATE LEVERAGE AND ASSET QUALITY

### A. Introduction

105. **This chapter analyzes the statistical relationship between corporate sector FSIs and banking sector asset quality FSIs.** It also develops and estimates a model of this relationship where the financial condition of the corporate sector is represented by the corporate leverage ratio. One purpose of the model is to provide an illustration of how this relationship can be modeled that may be useful in the context of FSAPs and for country surveillance more generally. In principle, it is desirable to develop such a model for each country, using data for that country (as has been done on a number of FSAPs). However, this chapter uses the model to estimate the relationship for a large number of countries with a panel data set composed of 47 countries and 10 years of annual data, with two main objectives: first, to establish that it is important (and statistically significant) across a large number of countries; and, second, to serve as the starting point for an analysis of the relationship in individual countries by providing an estimate that can be interpreted as an “average” relationship for many countries. The main conclusion from the estimation of the model is that banking sector soundness is dependant on the financial health of the corporate sector. Specifically, it finds that corporate sector FSIs can serve as a leading indicator of banking sector asset quality problems since a deterioration in the financial condition of the corporate sector affects the banking sector with a lag.

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<sup>61</sup> For instance, a recent FSAP to an advanced economy reported that a more detailed guideline and supervisory return were issued that allowed it to measure interest rate risk better.

106. **The chapter is organized as follows.** The next section develops the model specification. Section C provides an overview of the database and presents some statistical analysis. Section D discusses the estimation methodology and results. Section E concludes by noting the implications for surveillance.

## B. Model Specification

107. **The linkage between the financial condition of the corporate sector and banking sector asset quality derives from the credit exposures of banks resulting from their financial intermediation role.** It is modeled at the aggregate level, where asset quality, measured by the ratio of NPLs to total loans for the banking sector, is a function of the corporate leverage ratio, and a number of macroeconomic variables to control for the effect of macroeconomic conditions and policies.

108. **The model also needs to allow for the possibility that asset quality, the leverage ratio and the cost of capital are simultaneously determined due to the following inter-relationships:**

- As the corporate sector becomes more highly leveraged it is also more vulnerable to macroeconomic shocks that could precipitate corporate defaults and raise NPLs;
- The capacity of the corporate sector to build up leverage by borrowing depends partly on banking sector soundness, which is negatively affected by a rise in NPLs;
- As the corporate sector becomes more leveraged, the risk premium it has to pay rises, increasing its cost of capital and reducing its incentive to take on more leverage.

109. **To capture the interaction between these three effects, the model needs three equations, as shown below.** Equation (10) gives the direct effect of leverage on asset quality. Equation (11) gives the indirect effect of a deterioration in financial sector soundness on the capacity of the corporate sector to build-up leverage. Equation (12) captures how an increase in leverage by the corporate sector can raise its real cost of capital. This cost of capital variable provides another channel through which shocks impacting financial soundness can affect macroeconomic conditions, because a rise in the cost of capital associated with the widening of the risk premium influences the savings-investment balance and balance of payments. Each equation contains a different set of relevant exogenous variables, to control for the effects of changes in the real exchange rate, real growth, inflation, monetary policy, and corporate sector profitability.

$$npls = \alpha_0 + \alpha_1 lev + \alpha_2 reer + \alpha_3 \hat{y} + \alpha_4 \hat{p} + \alpha_4 \hat{m} + \alpha_5 rcc \quad (10)$$

$$lev = \beta_0 + \beta_1 npl + \beta_2 rcc + \beta_3 \hat{y} + \beta_4 \hat{p} + \beta_5 \hat{d} + \beta_6 roe + \beta_7 reer \quad (11)$$

$$rcc = \gamma_0 + \gamma_1 lev + \gamma_2 \hat{y} + \gamma_3 \hat{m} \quad (12)$$

**Definitions of variables**

npls – ratio of non-performing loans to total loans

lev – corporate sector leverage ratio (ratio of debt to equity plus retained earnings)

rcc – real cost of capital (weighted average of real lending rate and cost of equity)

reer – real effective exchange rate

y-hat – real GDP growth rate

p-hat – inflation rate

m-hat – growth rate of M1

d-hat – growth rate of domestic credit

roe – corporate sector return on equity

110. **The economics underlying equation (10) is as follows.** The ratio of NPLs to total loans (npls) should:

- increase with a rise in corporate leverage (lev), because this makes default more likely (although probably with a lag);
- increase with an appreciation of the real effective exchange rate (reer), because corporate defaults should rise as the sector loses competitiveness;
- decrease with economic growth (y-hat), which is usually associated with a rise in profitability, makes default less likely;
- decrease with higher inflation (p-hat), because it becomes easier to repay loans contracted at a fixed nominal value; and
- decrease with a rise in money growth (m-hat), as this increases the denominator of “npls”.

111. The effect of the real cost of capital (rcc) on “npls” is more complex because it has offsetting effects on the numerator and denominator of the ratio. A rise in the real cost of capital encourages banks to lend more, which reduces the ratio by raising the denominator, which is consistent with the interpretation of the equation as a loan supply equation. However, it also increases borrowing costs, which should contribute to a rise in NPLs in the numerator, since the equation also incorporates credit quality effects.

112. **The economics underlying equation (11) is as follows.** The leverage ratio should:

- be negatively related to the “npls,” as a higher level of NPLs contributes to banking sector weakness, which is likely to cause banks to scale back lending;
- decline with a rise in the real cost of capital (rcc), as this reduces the incentive to borrow (reflecting the interpretation of equation (11) as the corporate sector’s demand for credit);
- increase with economic growth (y-hat), as firms borrow more to invest;
- increase in inflation (p-hat), which creates an incentive to take on more debt because it reduces the real values of existing debt;
- increase with domestic credit growth (d-hat), which is associated with the financing of an increase in leverage;

- increase with corporate sector's return on equity (roe), as a higher return encourages firms to take on more debt to fund the more profitable investment; and
- declines with an appreciation in the real effective exchange rate (reer), because the loss of competitiveness reduces profits and, hence, the incentives to borrow.

113. **The economics underlying equation (12) is as follows.** The real cost of capital should:

- increase with the leverage ratio, because a rise in leverage contribute to a higher risk premium in the lending rate and rate of return on equity, which make up the real cost of capital;
- increase with economic growth, as this contributes to increased demand for credit, pushing up borrowing costs; and
- be negatively related to money growth, because an easing of monetary conditions should be associated with lower real interest rates and cost of capital (at least temporarily).

### **C. Relationship Between Corporate and Banking Sector FSIs in the Panel Data Set**

114. **This analysis was undertaken using a panel of FSIs for the banking and corporate sectors covering 47 countries and up to 10 years.** It was compiled from large private databases—Worldscope and Bankscope—that collect data from the annual audited financial statements of a large number of corporations and banks for many countries. The coverage varies across countries but is quite good for many countries in the sample. For example, the corporate leverage FSI for the United States was compiled using data from 9,000 non-financial corporations.<sup>62</sup> Scatter plots of pairs of FSIs from this panel are shown in Figures 6–13. In these figures, each point correspond to a country and a year, and the vertical axis measures the banking sector FSI while the horizontal axis gives the corporate FSI.

115. **Figures 6–13 present a preliminary statistical analysis of the relationship between these FSIs in the form of a regression line estimated for each pair of FSIs.** The regression lines in the figures show that the FSIs “NPLs/loans” and “{NPLs-provisions}/capital” are positively correlated with FSIs of corporate leverage but negatively correlated with corporate earnings, consistent with what economic theory would suggest (Figures 6–7, 9–11, and 13). These relationships proved robust to the removal of outliers from the sample. It is worth mentioning that the relationships shown in the figures are contemporaneous and may be weaker than the relationship between current corporate FSIs and lagged asset quality FSIs. Estimation of the relationship, reported below, shows that this is the case for the corporate leverage ratio and the NPLs/loans ratio.

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<sup>62</sup> These data were prepared for research purposes and should not be regarded as a substitute for those computed by the authorities in a country, which are likely to be more reliable.

116. **While these relationships are consistent with the economic theory, they need to be estimated using an econometric model in order to check that they are statistically significant.** Moreover, to be able to make effective use of this analysis for macro-prudential surveillance, estimation of a model is needed to obtain reliable point estimates and control for the effects of macroeconomic performance and financial structure. Only the relationship between the corporate leverage ratio and the NPLs/loans ratio in Figure 6 is estimated as a starting point, and subsequent econometric work will focus on the relationships shown in the other figures, especially between the earnings based FSIs and asset quality.

#### **D. Estimation Methodology and Results**

117. **The model was estimated using the panel data set covering a large number of countries so that the resulting estimates can be interpreted as the “average” relationship for these countries.** Under this interpretation, the estimate provides a useful benchmark to serve as an input into a more in-depth country analysis, where the model could be estimated using data for the country. It can also be useful in countries where data needed for such an analysis are lacking. The fixed effect term controls for differences in financial structure, macroeconomic performance and data definitions across countries and, thus, helps correct for the substantial differences in the definition of NPLs and leverage in different countries.

118. The interdependence between asset quality, corporate sector leverage and interest rates highlighted in the model suggests that estimation needs to control for simultaneous equation bias, which is done using instrumental variables. The first step involves estimating the three equations. Estimation of equation (10) yielded reasonable and statistically significant estimates. However, equations (11) and (12) did not yield statistically significant estimates for the effect of NPLs on leverage and leverage on the cost of capital.<sup>63</sup> In these regressions (not reported), almost all the explanatory power is provided by the fixed effect and time trend terms. This result could be a consequence of using the panel data, and these two specifications may perform better when time series data for individual countries are used. Nor should it be interpreted as indicating that simultaneous equation bias is not present in equation (10). Rather it may reflect the fact that in the data set the variation in the data is dominated by cross country differences in structure and other country-specific factors. For this reason, instrumental variables continued to be used even though subsequent econometric analysis focused on only the first equation. The estimation results from this analysis are presented in Table 7, which also presents OLS estimates for purposes of comparison.

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<sup>63</sup> In equation (12), the proxy for the cost of capital is focused on the cost of debt. More specifically, we used the spread between banks' lending rate and money market interest rate.

Figure 6. Correlation Between NPLs/Loans and the Corporate Leverage Ratio

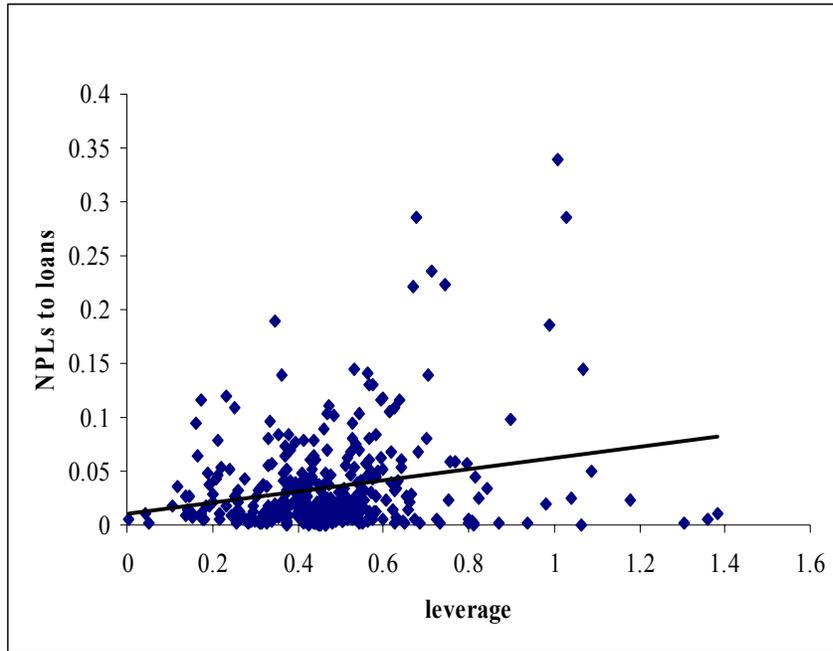


Figure 7. Correlation Between NPLs Less Provision Over Capital and the Corporate Leverage Ratio

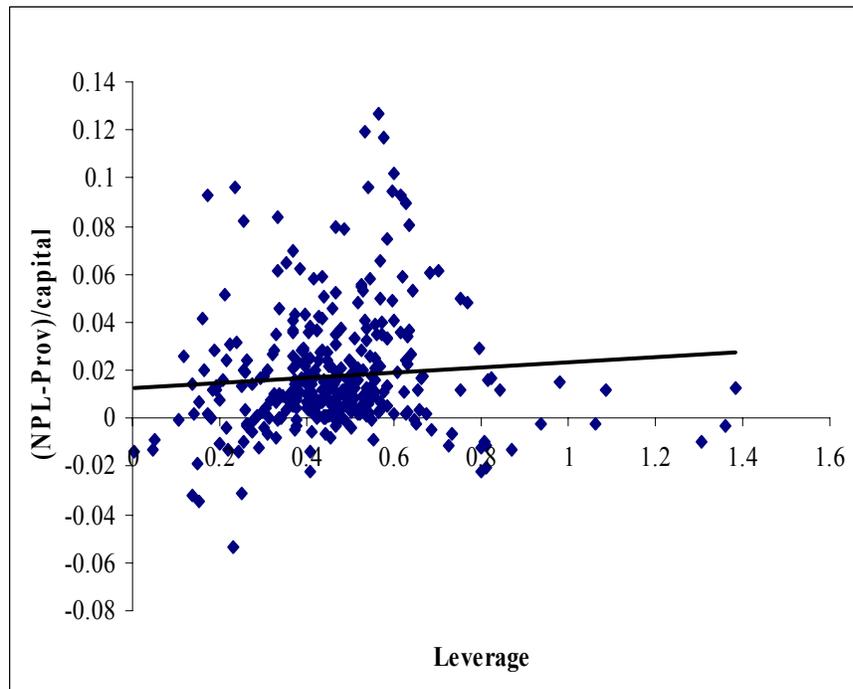


Figure 8. Correlation Between Bank Capital/Asset Ratio and Corporate Leverage Ratio

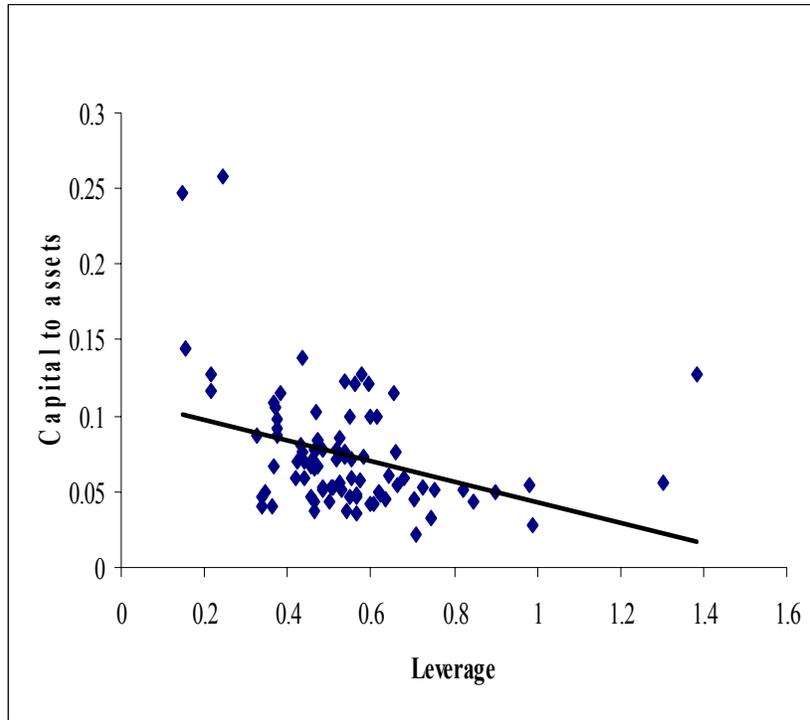


Figure 9. Correlation Between NPLs/Loans and Corporate Earnings (EBITA)/Capital

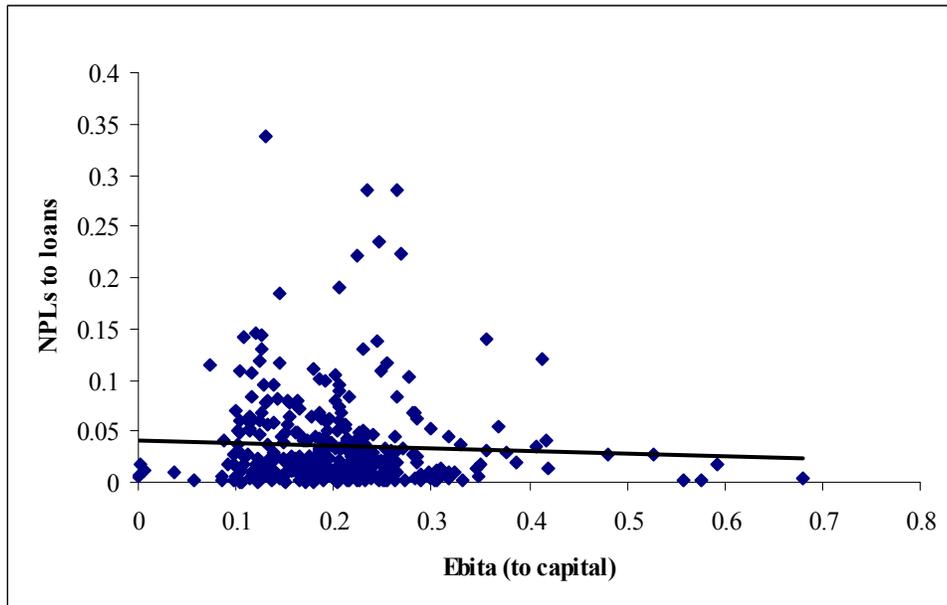


Figure 10. Correlation Between NPL/Loans and Corporate Earnings (EBIT)/Interest Payments

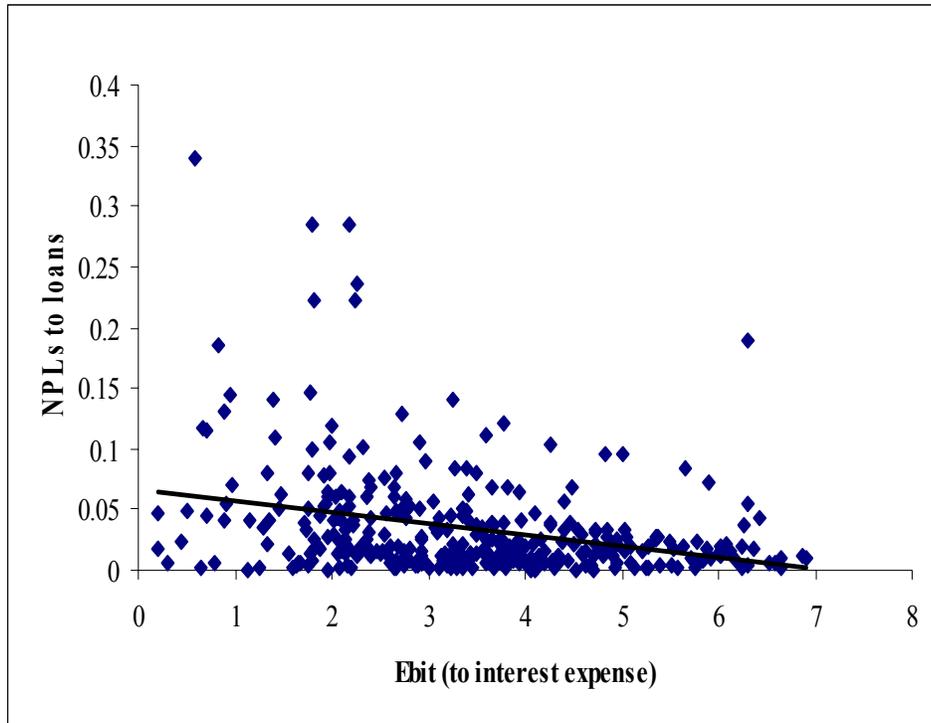


Figure 11. Correlation Between NPLs Less Provision Over Capital and Corporate Earning/Capital

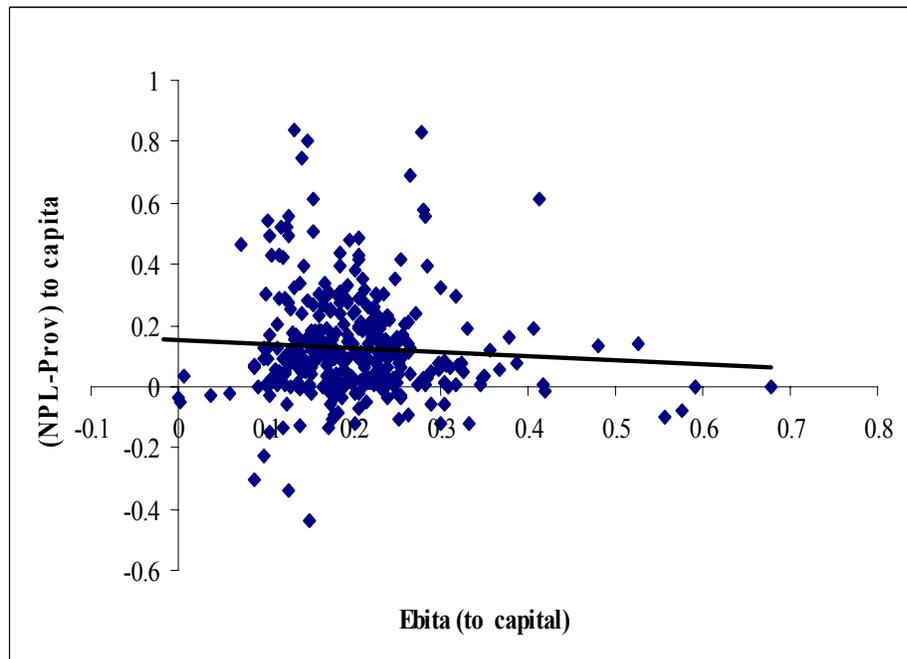


Figure 12. Correlation Between Capital to Assets and Corporate Earning/Capital

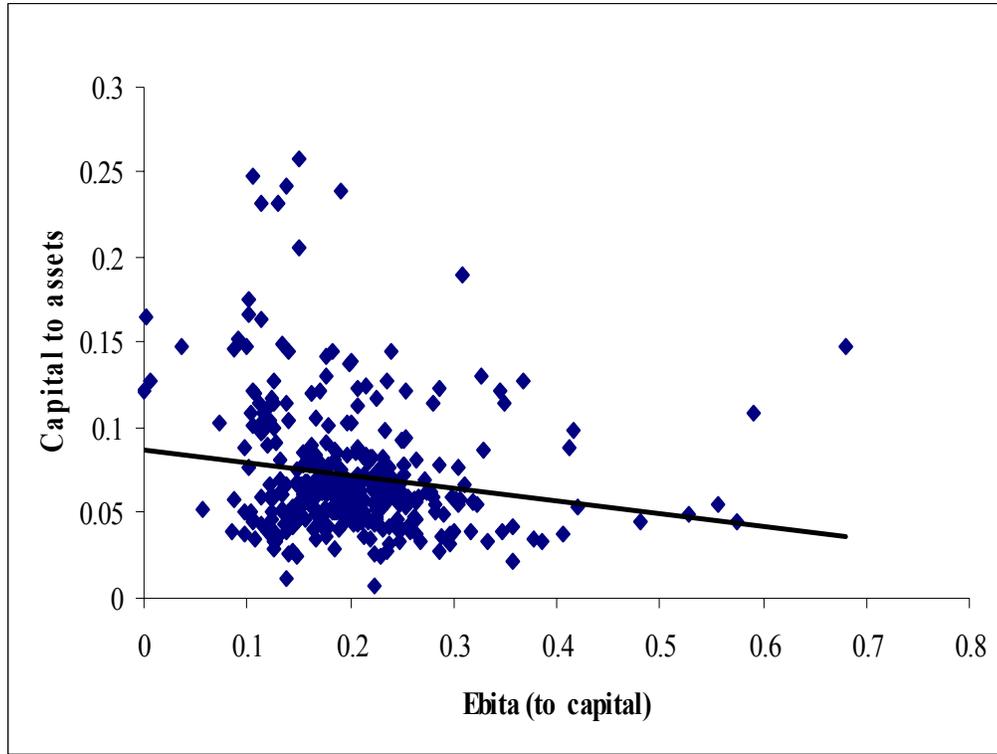
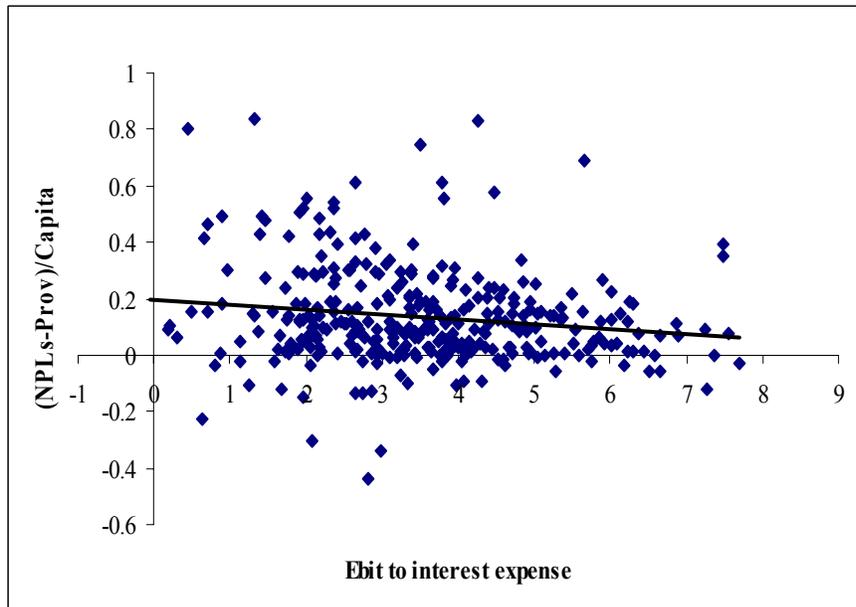


Figure 13. Correlation Between NPLs Less Provision Over Capital and Corporate Earning over Interest Expenses



119. **A general-to-specific estimation strategy was used to develop a preferred empirical specification and lag structure.** This approach involves estimating a number of related specifications starting with a general specification that includes lags on all the explanatory variables and the dependent variable and then drops insignificant terms. These different specifications are shown in Table 7, which shows that the results are quite consistent across all the specifications. In all cases, only the first lag of the leverage ratio is statistically significant, implying that it has an impact on asset quality only after one year. Also, the only explanatory variables that is consistently statistically significant in the specifications is contemporaneous real GDP growth. The estimation strategy involved the following steps: Column 1 of the table gives the general specification in which the lagged leverage ratio, GDP growth, and lagged dependent variable are statistically significant. Columns 2 and 3, report specifications in which the insignificant control variables (the real lending rate, the unemployment rate, and domestic credit growth) are dropped in two stages: first, the insignificant lagged terms are dropped, and, then, if the variable is still insignificant, it is dropped. In column 3, lagged leverage is significant, as are the first and third lags of the dependent variable and real GDP growth.<sup>64</sup> However, in panel estimation with fixed effects, including lagged dependent variables can bias point estimates. Thus, to avoid this source of bias, the model is estimated without them. The result in **Column 5 is the preferred specification.** The explanatory power of the equation is much lower, as reflected in the R<sup>2</sup> statistic, and the fixed effect term is significant as it is picking up part of the variation in the data that was captured by the lagged dependent variable. For comparison, the specifications in Columns 3 and 5 were estimated using OLS in Column 4 and 6, despite concerns about simultaneous equation bias, yielding similar results. Finally, to test whether the leverage ratio might have a non-linear effect on asset quality, the specification was estimated with quadratic terms (not reported). The results are consistent with those reported for the linear specification in Table 6, but show that the effect is stronger for higher values of the leverage ratio. Further research is planned aimed at developing and estimating a more appropriate and less restrictive non-linear specification.

### E. Implications for Surveillance

120. **From the perspective of macro-prudential surveillance, the most valuable result of the analysis is the point estimate of the effect of the lagged leverage ratio on the NPLs to loans ratio.** Since the estimate is statistically significant and has proved relatively robust across specifications, it could be considered as a possible “rule-of-thumb” or starting point

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<sup>64</sup> To ensure a smooth lag structure, current leverage and the second lagged dependent variable are not dropped even though they are insignificant.

Table 7. Dependent Variable: NPLs

	Estimate 1 IV		Estimate 2 IV		Estimate 3 IV		Estimate 4 OLS		Estimate 5 IV		Estimate 6 OLS	
Lev <sub>t</sub>	-0.10	-1.4	-0.13	-1.5	-0.09	-1.3	0.00	-0.5	-0.12	-1.2	-0.02	-1.2
Lev <sub>t-1</sub>	0.16	1.9	0.19	2.0	0.11	1.9	0.03	2.2	0.18	2.4	0.10	4.4
Lev <sub>t-2</sub>	0.01	0.3	0.01	0.4								
Lev <sub>t-3</sub>												
NPL <sub>t-1</sub>	0.75	8.5	0.74	7.8	0.82	11.9	0.84	15.6				
NPL <sub>t-2</sub>	-0.12	-1.2	-0.12	-1.1	-0.16	-1.6	-0.16	-2.1				
NPL <sub>t-3</sub>	-0.33	-2.9	-0.32	-2.8	-0.32	-3.5	-0.27	-3.8				
Real Lending Rate <sub>t</sub>	0.01	0.4	-0.01	-0.4								
Real Lending Rate <sub>t-1</sub>	-0.02	-1.1										
Real GDP Growth <sub>t</sub>	-0.24	-3.5	-0.25	-3.7	-0.24	-4.5	-0.19	-5.2	-0.26	-3.4	-0.23	-4.5
Real GDP Growth <sub>t-1</sub>	0.04	0.4										
Unemployment <sub>t</sub>	0.11	0.6	0.06	0.5								
Unemployment <sub>t-1</sub>	-0.02	-0.1										
Domestic Credit <sub>t</sub>	0.02	0.8	0.03	1.7								
Domestic Credit <sub>t-1</sub>	0.03	1.0										
Trend	0.12	0.9	0.18	1.2	0.25	2.2	0.14	2.4	0.49	4.0	0.33	4.7
Constant	-0.06	-1.7	-0.06	-2.0	-0.02	-1.3	-0.01	-1.2	-0.06	-3.5	-0.05	-3.7
R-Squared	0.40		0.42		0.68		0.74		0.14		0.12	
Number of observations	206		206		242		327		262		352	

Note: Those regressions incorporate a Fixed Effect estimate for all countries in the sample.

For each regression, the two numbers reported are the coefficient estimate and the associated T-statistics.

Bolded T-statistics indicate significance at 95 percent level.

Instrumental variables used in Estimates 2, 4, 5, and 6 are: Reserve money (as a percent of GDP), a measure of corporate capital to asset ratio and two measures of corporate profitability, namely EBIT to interest expenses and ROAE.

for the analysis of the effect in a country, using country data. The result is that the impact of the leverage ratio on asset quality happens with a one year lag, suggesting that the leverage ratio can serve as a leading indicator of asset quality. More generally, the data analysis and model estimation results confirm that the financial condition of the corporate sector is an important determinant of asset quality across a large number of countries.

121. **Specifically, the preferred specification gives the following estimates:**

- 0.18 is the elasticity of current asset quality to the lagged corporate leverage ratio.
- -0.26 is the elasticity of asset quality to current GDP growth.

122. This implies that, on average, a 10 percentage point increase in the corporate leverage is associated with 1.8 percentage point rise in NPLs relative to total loans after one year. And, a 1 percentage point rise in GDP growth results, on average, in a 2.6 percentage point decline in the NPLs to loans ratio, reflecting the fact that during periods of rapid growth fewer corporations are likely to experience problems repaying loans, or to default. It is important to recognize that these point estimates, while statistically significant, are subject to statistical error and thus must be taken into account when using them as a rule-of-thumb. Moreover, the explanatory power of the equation is low (as indicated by the low  $R^2$  statistic), reflecting the importance of country specific factors that are only partly captured by the fixed effect term. This suggests that it may be more appropriate to consider a range around these point estimates and highlights the importance of obtaining more precise estimates wherever possible by estimating the model on individual country data.

## VI. USING SUPERVISORY INFORMATION TO INTERPRET FSIs

### A. Motivation

123. **This chapter presents an analytical framework to facilitate the use of the assessments of compliance with the Basel Core Principles (BCPs) to support the analysis of core FSIs.**<sup>65</sup> The framework provides a four-step approach that: first, identifies information relevant to help interpret FSIs; second, locates criteria in the core principles for which the assessment should provide information relevant to the interpretation of FSIs; third, extracts relevant information from the core principles in a form convenient for macro-

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<sup>65</sup> BCPs are defined in Bank for International Settlements, Core Principles for Effective Banking Supervision, internet resource, [www.bis.org/publ/bcbs61.pdf](http://www.bis.org/publ/bcbs61.pdf), 1997. The methodology to assess these principles is described in Bank for International Settlements Basel Committee on Banking Supervision, Core Principles Methodology, Internet resource, [www.bis.org/publ/bcbs61.pdf](http://www.bis.org/publ/bcbs61.pdf), 1999; and guidelines on how to measure bank capital is provided in Bank for International Settlements: International Convergence of Capital Measurement and Capital Standard, Internet resource, [www.bis.org/publ/bcbs04A.pdf](http://www.bis.org/publ/bcbs04A.pdf), 1998. A summary of the assessment of compliance with BCPs is typically provided as an attachment to the Financial System Stability Assessment for a country.

prudential surveillance; and fourth, provides guidance on how this information can help interpret FSIs.<sup>66</sup>

124. **The purpose of the framework is to enhance the quality of surveillance by integrating relevant qualitative information derived from the assessments of particular core principles into the analysis of FSIs.**<sup>67</sup> The framework clarifies the link between the information available in BCPs assessments and specific vulnerabilities and risks being monitored by an FSI. FSIs are used to assess the strength and vulnerabilities of the financial sector, generally by aggregating quantitative data from individual institutions. Notwithstanding the computational simplicity of the FSIs, the uncertainties and potential differences in calculation methodologies need to be taken into account in the interpretation of these indicators. To gain a better understanding of how to interpret FSIs, it is important to complement the analysis with information describing more precisely the nature of the underlying data, the structure of the financial system and the characteristics of the institutions making up the system.<sup>68</sup> The BCPs assessments contain information on these elements.

125. **When assessing the risk associated with particular levels or movements in FSIs, it is vital to understand the basis on which the banks' financial accounts and supervisory data have been prepared.** The risk associated with a particular FSI level or deterioration depends largely on how the underlying data are defined and valued. Assessing the accuracy of the data and hence, the reliability of the FSIs involves a general knowledge of the applied standards and regulations and a view on the quality of their implementation and effectiveness. For example, differences in loan classification system can have a significant impact on a large number of FSIs.<sup>69</sup> The sensitivity of reported FSIs to the loan

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<sup>66</sup> This chapter does not provide a detailed description of individual FSI, as this discussion is already available in V. Sundararajan, et al, **Financial Soundness Indicators: Analytical Aspects and Country Practices**, IMF Occasional Paper, No. 212, International Monetary Fund: Washington, DC. (2001).

<sup>67</sup> Based on a cross-country empirical study investigating the relationship between a country's observance of standards and its near-term financial stability, Sundararajan, Marston, and Basu (2001) conclude that the relationship between compliance and financial stability is a complex one and recommend a more comprehensive stability-oriented assessment of relevant standards and codes (IMF WP/01/02 "Financial System Standards and Financial Stability: The Case of Basel Core Principles").

<sup>68</sup> See also Sean R. Craig and V. Sundararajan, "Using FSIs to Assess Financial Stability", paper presented at the Conference on Challenges to Central Banking from Globalized Financial Systems, International Monetary Fund, September 16-17, (2002).

<sup>69</sup> For further discussion on bank loan classification and provisioning practices in selected countries, see World Bank "Bank Loan Classification and Provisioning Practices in Selected Developed and Emerging Countries: A Survey of Current Practices in Countries Represented on the Basel Core Principles Liaison Group", paper presented at the Finance Forum 2002, June 19-21 (2002).

classification system is discussed in Box 2.<sup>70</sup> Typically, the BCPs assessments can help shed light on the nature of the underlying data and hence, on the information content of the FSIs.

**126. A wide range of information relevant to assessing the soundness of the banking sector can be found in the assessment of compliance with the Basel Core Principles for effective banking supervision.**<sup>71</sup> The BCPs assessments contain information relevant to all three dimensions of financial stability: specific core principles provide information on the effectiveness of supervision and the adequacy of macro-prudential surveillance, whereas information on the third pillar of financial stability, namely, the robustness of the financial infrastructure, can be found in the preconditions of the core principles.<sup>72</sup> Table 8 below lists specific BCPs that may contain relevant information to assess particular aspects of the stability of the financial system and indicates in which area of macro-prudential surveillance this information may be useful. This table suggests that many of the core principles contain information potentially relevant to the assessment of risks to the stability of the financial system.<sup>73</sup>

**127. As illustrated in Box 3, computing bank equity and hence, capital adequacy presents a number of difficulties under normal conditions.** These difficulties become much more serious under conditions of stress, when all valuation methods become increasingly uncertain. For example, the value of an institution's assets evaluated at going concern can be very different from that evaluated at liquidation. In times of widespread financial distress, liquidation values tend to fall even lower, further widening the gap between going concern and liquidation values. While the use of FSIs in period of crises is beyond the scope of this paper, it is important to recognize that FSIs may be prone to high and rapid fluctuations, especially when bank equity estimates do not represent accurately the

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<sup>70</sup> Based on Box 2 in Frécaut, Sullivan, and van der Vossen (2003), "Assessing Bank Equity", IMF Operational Paper, forthcoming.

<sup>71</sup> The present analysis, which focuses on the core set of FSIs, can be extended to cover FSIs for banks in the encouraged set. Moreover, since there are strong similarities between the core principles for banks and those for nonbank institutions, such as insurance and securities firms, a similar approach to that presented in this note could be developed to complement the analysis of financial stability with relevant information from other core principles assessments (IOSCO, CPSS, etc.).

<sup>72</sup> A joint IMF/World Bank paper "Implementation of the Basel Core Principles for Effective Banking Supervision, Experiences, Influences and Perspectives", mimeo, 2002, reviews Fund/Bank experience in conducting BCPs assessments in over 60 countries to identify the extent to which it is possible to use these assessments to investigate the effectiveness of banking supervision.

<sup>73</sup> The BCPs assessments contain two types of information: descriptive information regarding the way in which specific criteria are met; and, a rating of the degree of compliance with each core principle. The present framework will rely on the first type since it is not clear how an index of compliance (computed, for example, on the basis of four categories: compliant, partially compliant, non-compliant, and not available) could augment the analysis of FSIs.

### **Box 2. Impact of Differences in Loan Classification System on FSIs**

The FSIs are materially impacted by the uncertainties surrounding the quality of the loan portfolio in the banking sector. The risk implied by specific FSIs may vary with the degree of compliance with BCP 8, which ensures an adequate asset quality evaluation and loan loss provisions.

Cases where the BCPs assessments identify a deficiency in the loan classification system could indicate an excessively lenient classification of impaired assets and slow recognition of losses. As a result, it may be appropriate to make an adjustment to NPLs in the loan portfolio when analyzing FSIs. 1/ This would affect a number of FSIs either directly through the new loan portfolio composition or indirectly through the corresponding adjustment in capital. In particular:

- The **capital adequacy FSIs** could deteriorate in accordance to the equity adjustment;
- Two of the **asset quality FSIs** (non-performing loans to total gross loans, and non-performing loans net of provisions to capital) could be directly affected by the loan reclassification;
- The **earnings and profitability FSIs** could be affected indirectly, mainly through revisions in current year profits resulting from an adjustment to provisions;
- **Liquidity FSIs** are generally not affected directly by changes in bank equity. However, they could deteriorate if loans that are close to maturity (considered as liquid assets) are required to be reclassified as non performing loans (and hence to be treated as illiquid assets);
- Two of the **sensitivity to market risk FSIs** could be affected directly by an adjustment to NPLs: the duration of assets would rise if this adjustment increased the mismatch between assets and liabilities; the net open position in foreign exchange to capital could also increase, if the adjustment in NPLs is associated with a sharp domestic currency depreciation, which renders borrowers less able to service their foreign currency denominated loans.

By providing information on the loan classification and provisioning system, the BCPs assessments, and in particular BCP 8, help determine the source and magnitude of the possible bias in the reported estimates of non-performing loans and bank equity. This information helps evaluate the risk associated with a given level of an FSI. For example, the risk implied by given levels of capital adequacy FSIs would be different for a country that does not fully comply with BCP 8 relative to a country that complies fully with this core principle.

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1/ A definition of NPLs is provided in Chapter 4 of the *FSI Compilation Guide*.

Table 8. BCPs Containing Information Relevant to the Interpretation of FSIs

Information Relevant To Macro-Prudential Surveillance	BCPs Providing Relevant Information to Macro-Prudential Surveillance	
	BCP Number	Information Content of BCP
<b>I. Robust Financial Infrastructure</b>		
Sound and stable macro-economic policies	Precondition 1	Soundness of macro-economic policies
Well-developed public infrastructure	Precondition 2	Judicial system, accounting principles and auditing systems, payment and clearing system
Efficient bank resolution procedures	Precondition 4	Bank resolution procedures
Appropriate public safety nets	Precondition 5	Bank safety nets
<b>II. Effective Supervision</b>		
Autonomy, power and resources of supervisory authority	BCP 1(2) BCP 1(4) BCP 1(5)	Independence Enforcement powers Legal protection
Capacity to take prompt remedial actions in response to identified weaknesses	BCP 22	Remedial measures
Capacity to collect necessary information	BCP 16-19	On- and Off-site supervision
Capacity to verify data provided by banks	BCP 21	Accounting standards
Capacity to collect and verify information on cross-border activities	BCPs 1(6) BCP 23-25	Information sharing Cross-border information sharing
<b>III. Macro-Prudential Surveillance</b>		
Surveillance of FSIs of capital adequacy	BCP 6 BCP 8 BCP 20 BCP 23	Capital adequacy Loan evaluation and loan loss provisioning Consolidated supervision Globally consolidated supervision
Surveillance of FSIs of asset quality	BCP 7 BCP 8 BCP 9 BCP 10 BCP 20 BCP 23	Credit policies Loan evaluation and loan loss provisioning Large exposure limits Connected lending Consolidated supervision Globally consolidated supervision
Surveillance of FSIs of earnings and profitability	-	-
Surveillance of FSIs of liquidity	BCP 11 BCP 13	Country risk Other risks
Surveillance of FSIs of sensitivity to market risk	BCP 12	Market risk

### **Box 3. Using BCPs Assessments to Evaluate Bank Equity Figures**

Capital adequacy FSIs are computed using clearly defined supervisory measures of capital (regulatory tier 1 capital and regulatory capital). Since capital adequacy FSIs are computed as a ratio of capital to risk-weighted assets, it is important to assess the accuracy with which the components of reported bank equity (namely, assets and liabilities) have been estimated in order to assess the risk associated with particular values of or movements in capital adequacy FSIs.

Bank equity can also be estimated, or net worth, is a complex task because equity, computed as the residual of the balance sheet, is affected by a number of factors, including: valuations uncertainties regarding the assets, and to a lesser extent, the liabilities; the assumptions applied in the recognition and measurement of these assets and liabilities; and the volatility in their values, that tend to increase dramatically in times of individual or systemic crisis. To assess the accuracy of reported bank equity estimates, a number of elements need to be taken into account:

- Definitions and components of accounting equity and regulatory capital;
- Nature of accounting and auditing standards;
- Local loan classification and provisioning rules;
- Regulations on consolidation of accounts and supervision on a consolidated basis;
- Legal and regulatory framework on valuing, establishing and foreclosing on collateral;
- Features of the local real estate and security markets, including valuation rules.

The core principles assessments contain information on how these factors affect reported bank equity. For example, as shown in the Table 6, while the definition of capital and rules concerning equity valuation are discussed in BCP 6, accounting standards are reviewed under precondition 2 and BCP 21, and loan classification and provisioning rules are covered in BCP 8. Issues regarding consolidated supervision are covered in BCPs 20 and 23. Finally, features of the security markets are discussed generally in precondition 2.

resources effectively available to absorb losses. Box 4 discusses the main sources of deficiencies that can distort reported bank equity figures.<sup>74</sup>

128. More broadly, the information provided in the BCPs assessments can be used to help interpret FSIs in a number of ways:

- **BCPs assessments can clarify what is being measured by the FSIs.** By clarifying the definition of data provided by institutions and used to compute FSIs, the assessments contribute to a more precise understanding of what is being measured by the FSIs. For example, when assessing capital adequacy FSIs (Section III of Table 6), BCP 6 clarifies the definition of capital by providing information on the types of instruments that supervisors allow banks to include in capital. BCP 8 helps assess the impact of accounting and provisioning rules on reported banking sector capital ratio FSIs.
- **BCPs assessments can help establish the underlying cause of observed movements in FSIs when there are competing explanations.** For example, a decline in the risk-weighted capital ratio may reflect an FSI deterioration or improvement, depending on whether this change is driven by a rapid growth of risky assets or a remedial action that requires a higher loss recognition. Assessment of BCP 22 provides information on the extent to which supervisors take prompt remedial action to reduce risk in the financial system. This information can help distinguish cases where a decline in the capital ratio is a healthy development in response to remedial actions from cases where it signals a greater vulnerability of the financial system (e.g., due to rapid lending growth).<sup>75</sup> The former interpretation is more likely in a supervisory system where prompt remedial action is usually taken.
- BCPs assessments can indicate the responsiveness of the supervisory system to emerging financial sector problems, which reveals how quickly vulnerabilities identified by FSIs are likely to be corrected. For example, BCP 7 on the adequacy of banks' credit policies can help judging when the level of FSIs monitoring asset quality for the banking sector is high enough to warrant concern. Similarly, BCP 9, covering the restrictions on large exposures and portfolio concentrations set by supervisors, is relevant to the interpretation of FSIs monitoring sectoral loan concentrations. Finally, BCP 12, covering market risk, reveals whether the banks have the discretion to build up market exposures large enough to pose a risk to the soundness of the system.

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<sup>74</sup> For more details, refer to Frécaut, Sullivan, and van der Vossen (2003), "Assessing Bank Equity", IMF Operational Paper, forthcoming. Section IV, pp. 14–21.

<sup>75</sup> For further examples on how the BCPs can be used to identify financial sector vulnerabilities and to interpret them appropriately in the context of macro-prudential surveillance, see Göran Lind, "The BCPs as an Instrument to Identify Financial Sector Vulnerabilities", mimeo, (2001).

#### **Box 4. Deficiencies Leading to Uncertainties About Bank Capital Ratio Figures**

Even when valuation methods are appropriate and take into account market conditions, a number of deficiencies can substantially distort bank capital ratio figures (defined as regulatory tier 1 capital to risk-weighted assets or regulatory capital to risk-weighted assets), and need to be taken into account.

- **Data deficiencies:** Poor financial data on borrowers reduces banks' credit assessment capabilities and may prevent them from timely and accurate calculations of impairment losses. Inaccuracies and misreporting by banks can be a serious source of data problems, which can substantially distort bank capital ratio figures.
- **Deficiencies in accounting:** Inappropriately applied or excessively loose accounting standards reduce the ability to assess accurately the risk involved in assets, by contributing to a misstatement of bank capital ratios. Even if an appropriate accounting framework is implemented, such as IAS, the lack of qualified technical expertise makes comprehensive application of the standards difficult. Furthermore, the lack of deep and liquid secondary markets makes the objective determination of fair value for financial instruments difficult.
- **Deficiencies in prudential reporting and off- and on-site analysis:** The quality of the prudential reporting system depends largely on the capabilities of the supervisory agency, including the expertise and effectiveness of off-site and on-site analysts. If bankers know that there is little risk of detection of inaccuracies, the quality of reporting, and hence the quality of bank capital ratio estimates, is bound to deteriorate.
- **Deficiencies in supervision on a consolidated basis:** without consolidation, reported figures for capital, capital adequacy, non-performing assets can be highly misleading, and monitoring of prudential standards is substantially weakened because they exclude relevant assets and exposures.
- **Delayed recognition of asset impairment and deficiencies in loan classification:** Whether based on regulation or performed on the basis of the judgment of the banks or its auditors, an accurate asset classification is of critical importance for the calculation of bank capital ratios. Banks have an incentive not to place assets in nonaccrual status, as this affects negatively their income statements.
- **Deficiencies in provisioning:** Underprovisioning is generally the single greatest source of distortion in the calculation of bank capital ratios. Banks have an incentive to underestimate credit risk, misclassify impaired assets, and postpone the recognition of losses, to avoid large provisions which reduce the value of their loan portfolio, and depress stated performance. Underprovisioning can result from a number of factors: (i) insufficient strict rules on loan classification and provisioning that allow excessively lenient provisioning requirements; (ii) poor accounting practices and/or poor financial data that reduce bank's ability to assess accurately the risk involved in assets; (iii) poor credit assessment capability that may prevent timely and accurate calculations of impairment losses; (iv) evergreening practices, that disguise underperforming assets as performing assets; (v) weak enforcement of loan contracts and over-optimistic estimates of credit performance to connected parties; and (vi) over-optimistic valuation of collateral, that overstates the bank's assets and hence, bank capital ratios.

**Over-reliance on collateral:** Overestimating the value of and protection provided by collateral leads to underprovisioning. It may be due to poor appraisal practices, thin resale markets, unrealistic assumptions about collateral values in times of stress, and prohibitive legal and administrative difficulties in foreclosure.

- **BCPs assessments provide information on the effectiveness of banks' risk management.** This indicates how effectively the banking system is responding to the risk associated with particular values for FSIs. For example, BCP 11 provides complementary information on the adequacy of banks' management of country risk. Similarly, information from BCP 12 on limits and capital charges on market exposures and banks' market risk management can help interpret FSIs of sensitivity to market risk. Finally, BCP 13 gives information on banking sector management of liquidity risk.
- **BCPs assessments provide information on risks that cannot be captured adequately using FSIs, such as operational and legal risk.**

129. **The assessment of the BCPs provide a valuable source of information to support the analysis of FSIs.** BCPs assessment are an integral part of every FSAP, and are sometimes conducted separately also. As an increasing number of countries participate in FSAPs, over time the BCPs assessments will provide information relevant to the health of individual banks in a standardized fashion for an increasing number of countries. Moreover, since much of this information is statutory or structural in nature, it is likely to remain relevant for a relatively long period.

130. **The challenge is to establish how information derived from the assessments of the BCPs can be used to support the analysis of FSIs.** The information drawn from the BCPs assessments may not readily map into information useful to interpret FSIs. First, FSIs are quantitative measures, generally constructed by aggregating data from individual institutions, whereas most of the information derived from the BCPs assessments is presented in the form of qualitative assessments of specific criteria. Second, FSIs examine the stability of the financial system as a whole, whereas BCPs assess the adequacy of the supervisory framework to monitor the health and soundness of individual banking institutions. Thus, there is a need for a methodology that provides guidance on how to extract information from the assessments of the BCPs and incorporate this information into the analysis of FSIs. A framework outlining such a methodology is presented in the next section.

131. **The framework can help evaluate how the risk associated with specific values of FSI may vary with the degree of compliance.** The link between compliance with core principles and financial stability remains complex. It involves, for example, lags in the implementation of rules, and their ultimate effect on the health of the financial system. The descriptive information contained in the BCPs assessments can help assess how a lack of compliance with specific core principles may contribute to banking sector vulnerabilities and affect the capacity of the banking sector capital to absorb potential losses.

132. **Conversely, the framework can also help identify which BCPs need to be strengthened to reduce specific sources of risk to the financial system.** While closer compliance with some core principles (such as introducing risk management systems) could be expected to have a near-term impact on financial stability, the effects of compliance with other principles, such as those related to information disclosure, are likely to be more indirect (for example, through market discipline) and to occur with some lag. Understanding the

relationship between BCPs and FSIs can help assess how a strengthening of the supervisory system to bring specific BCPs closer to full compliance would reduce the specific vulnerabilities being monitored by FSIs.

133. **Finally, the framework highlights which particular type of information in the BCPs assessments is particularly useful to the assessment of financial stability.** This helps focus the BCPs assessments on collecting such information. Over time, this can enhance the contribution of BCPs assessments to the analysis of financial stability.

## **B. Framework For Using Supervisory Information in the Analysis of FSIs<sup>76</sup>**

### **FSI-based analysis**

134. **The Appendix presents a framework that integrates relevant qualitative and quantitative information derived from the assessments of the BCPs into the analysis of the core FSIs.** Conceptually, the framework is composed of two main parts. The first part (columns 1-2) sets up the framework by listing the fifteen core FSIs and presenting a brief interpretation of each core FSI or group of core FSIs. The core FSIs are grouped into their five broad categories: capital adequacy, asset quality, earnings and profitability, access to liquidity and sensitivity to market risk. The second part (columns 3-7) provides a four-step approach for using BCPs assessments as a tool to help interpret FSIs. It provides guidelines on how to: identify information that would help interpret FSIs (step 1); locate this information in the assessments of the BCPs (step 2); extract this information in a form convenient for macro-prudential surveillance (step 3); and interpret this information in the context of macro-prudential surveillance using FSIs (step 4). Box 5 outlines how the columns in the Appendix map into the four steps of the analysis.

135. **The first step in the analysis consists of identifying in broad terms the type of information that helps interpret each FSI, or group of FSIs.** This is done in column 3. For example, when interpreting a particular FSI related to asset quality, such as the ratio of non-performing loans to capital, column 3 indicates that it is important to collect information on the definition of the underlying data, including the way in which banks are required to classify loans, measure their capital and provision against losses. Other important information includes how collateral has been valued and whether financial institutions are supervised on a consolidated basis.

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<sup>76</sup> This section draws on a paper by Goran Lind, (2001) "The BCPs as an Instrument to Identify Financial Sector Vulnerabilities" (unpublished draft).

Box 5. Framework For Using Supervisory Information to Analyze FSIs in the Appendix		
Steps in Analysis	Columns in Table	Information Provided in Columns
1	3	Identifies information relevant to help interpret FSIs.
2	4	Locates information relevant to the interpretation of FSIs in the assessments of the Basel core principles.
3	5	Extracts relevant information from the assessments in a form convenient for macro-prudential surveillance.
4	6-7	Provides guidelines on how this information can help interpret FSIs.

136. **The second step in the analysis establishes the extent to which relevant information can be inferred from the BCPs assessments and if so, in which principle(s) this information can be found.** This is done in column 4, which lists the BCP(s) likely to provide information relevant to the interpretation of particular FSIs and identified in column 3. For example, column 4 states that information on the provisioning rules, which is a useful information when assessing asset quality, can be found in the BCP 8.

137. **The third step in the analysis consists of extracting the information from the BCPs relevant to macro-prudential surveillance for specific FSIs.** This is done in column 5. To facilitate the extraction process, column 5 provides headings describing more specifically the nature of the information that is to be found in the BCP listed in column 4 and relevant to assess the stability of the financial system. For example, assuming that an FSI requires information on the way in which capital is measured, column 5 further specifies that information should be collected on the way in which capital is defined, the type of calculation method used, the minimum capital adequacy ratio applied, and whether there are any capital discounts or capital charges. By drawing attention to points of particular relevance to macro-prudential surveillance in the BCPs, the framework makes it possible for non-experts to extract relevant country-specific information from the assessments.

138. **The last step consists of using the country-specific information collected from the core principles assessments to interpret an FSI, or group of FSIs.** Guidelines to do this are provided in column 6 and general comments are provided in column 7. For example, in the case of tax treatment to loan loss reserves, column 6 discusses how different tax regimes impact the banks' incentives to provision their impaired loans and hence, the relative accuracy of asset quality indicators.

139. In sum, incorporating information from BCPs into the analysis of financial stability involves judgment regarding the relevance of specific information in the BCPs. The

framework outlined above and represented in the Appendix provides an approach for identifying such information and assessing its importance.

### **Adequacy of supervisory regime**

140. **The framework presented above can be extended to assess the effectiveness of the supervisory regime with respect to its contribution to financial stability.** A stable financial system requires not only an adequate macro-prudential surveillance but also an adequate supervisory regime. Thus, it is useful to complement the analysis with information on the supervisory regime. This is done in the second section of the Appendix. By providing information on the effectiveness and responsiveness of the supervisory system to emerging financial sector problems, the assessments can help indicate how quickly vulnerabilities identified by FSIs are likely to be corrected.

141. Since this part of the analysis does not focus on specific FSIs, it starts in column 3 and follows the same steps than those presented above. Column 3 identifies specific characteristics of an effective supervisory regime (step 1 above). For example, to be effective, a supervisory authority must be able to work independently of political pressure. It must also have access to relevant information and have the right to collect, review and verify this information. It must also be able to take prompt remedial actions in response to identified vulnerabilities and to enforce its decisions.

142. Column 4 identifies which BCP(s) contain information relevant to the characteristics identified in column 3 (step 2 above) and column 5 provides a template to incorporate the relevant information into the analysis (step 3 above). Finally, column 6 provides guidance on how to interpret this information and general comments are given in column 7 (step 4 above).

### **C. Concluding Remarks**

143. **The approach outlined above provides a framework that uses information derived from the assessments of the BCPs to enhance the quality of macro-prudential surveillance.** First, it provides a practical framework to extract information relevant to the analysis of financial stability from the assessments of the BCPs. Second, by spelling out the kind of information that is of particular interest to financial stability analysis, the approach provides economists with a useful check-list to detect vulnerabilities in the financial system. Finally, after having collected country-specific information, the approach provides economists with guidelines on how to incorporate this information into the analysis of financial stability using FSIs.

144. **The usefulness of this framework is not limited to the analysis of FSIs by economists but extends to supervisors.** By indicating the type of information that is relevant to the analysis of financial stability and how this information relates to the strength of the financial system, the framework can help supervisors identify and take into account risks to financial stability in their work. This knowledge could help supervisors identify information that would be relevant to macro-prudential surveillance and that is currently missing from their micro-prudential assessments. The framework can also help supervisors

target their activities to areas of the banking system that may pose a risk to financial stability. Over time, this process should allow economists and supervisors to better understand each other's working tools and concerns, thereby contributing to a situation where economists and supervisors cooperate more effectively in the collection and interpretation of information on banks.

## Using BCPs Assessments to Interpret FSIs

FSIs	Interpretation of FSIs	Relevant Information for Interpretation of FSIs	BCPs Providing Relevant Information	Information to be Extracted from BCPs	Using BCPs to Interpret FSIs	Comments	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	
<b>I. ADEQUACY OF MACRO-PRUDENTIAL SURVEILLANCE</b>							
<b>II. CAPITAL ADEQUACY</b>							
1. Regulatory capital to risk-weighted assets; 2. Regulatory Tier I capital to risk-weighted assets.	These capital adequacy indicators help determine the robustness of the financial system to balance sheet-related shocks. An adverse trend may indicate an increase in risk exposure and possible capital adequacy problems. But capital adequacy ratios do not capture all aspects of financial strength and additional information may be required to put them into context.	(i) Capital measurement:	6 - Capital Adequacy	<b>Definition of capital</b> , including of tiers 1, tiers 2, tiers 3, goodwill and adjustments.	<b>Clear rules on how regulatory capital is to be defined (particularly Tier-1 capital) raises the accuracy of capital adequacy indicators.</b> The more liberty each bank has in measuring capital, the more difficult it is to interpret the aggregation of individual bank capital ratios.	In many countries, bank capital consists of different elements with varying capacity to absorb losses. If these elements are reported separately, they can serve as a more reliable indicator of bank's ability to withstand losses.	
				<b>Minimum capital adequacy ratio:</b>	Capital adequacy ratios are a stronger indicator of capital adequacy in the presence of clear rules to measure capital, a clearly defined asset classification system (see point (ii) below), strict provisioning rules (see point (iii) below), and if they apply on a consolidated basis (see point (vii) below).		
				<b>Capital charges</b> for exchange rate risk, commodity risk and equity risks.	<b>In the presence of capital charges to cover risks other than credit risk, capital provides for a stronger indicator of banks ability to withstand shocks, for a given level of bank exposure.</b>		The amendment to the 1988 Basel Accord allows for a capital charge for market risk in Tier III capital.

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(1)	(2)	(3)	(4)	(5)	(6)	(7)
		(ii) Loan classification system:	8 - Loan Evaluation and Loan-Loss Provisioning	<b>Definition of loan classification system</b>	<b>A clearly defined loan classification system increases helps assess the effective level of asset impairment.</b> Financial sector vulnerabilities stem often from late recognition of level of asset impairment. By encouraging banks to classify their loans according to their quality, the loan classification system plays a key role in obtaining meaningful indicators of asset quality, and hence, capital. In some countries, a principles-based loan classification system may be optimal, provided some preconditions are fulfilled (such as proper market discipline mechanisms and appropriate risk management by banks). In other countries, a hybrid system that combines minimum classification requirements and banks' subjective judgment on the quality of their loan portfolio, may provide a more reliable instrument to assess the effective level of loan impairment. Overall, a more accurate picture of asset impairment give a more reliable FSI on capital adequacy (FSI 1 and 2) and asset quality (FSI 3).	The lack of international consensus on loan classification categories hampers cross-border comparability.

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					If the classification of problem loans is at the discretion of banks, the measurement of asset quality differs over time (as banks may change their definition) and across banks. This lack of consistency undermines the quality of FSIs based on capital adequacy (FSI 1 and 2) and non-performing loans (FSI 3 and 4) .	
				<b>Backward-looking versus forward-looking loan classification:</b> Is the loan classification based on <i>backward-looking</i> signals of loan quality (such as the number of days a loan is past due) or <i>forward-looking</i> signals (such as the expected probability of default)?	<b>A backward-looking loan classification system provides for a poor warning system.</b> Forward-looking indicators, which focus on repayment capacity and cash flow of borrowers, can help assess the current economic value of a loan portfolio. But the accuracy of such forward-looking indicators hinges upon banks' ability to estimate the repayment capacity of borrowers, which in turn may depend on the effectiveness of the legal framework.	
				<b>Definition of loan impairment:</b>	<b>A clear definition of loan impairment helps assess more accurately the banks ability to withstand shocks.</b> A lack of clarity in the definition of loan impairment allows for a more lenient classification of problem loans and hence, undermines the quality of FSIs based on capital adequacy (FSI 1 and 2) and non-performing loans (FSI 3 and 4).	Although loan impairment is defined in the accounting rules (see IAS 39), practice varies across countries. A common definition of non-performing loans (NPL), especially for retail loans, is payment past due for "more than 90 days" and this is proposed in the draft Compilation Guide.

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(1)	(2)	(3)	(4)	(5)	(6)	(7)
				<p><b>Treatment of multiple loans:</b></p>	<p><b>A consistent treatment of multiple loans to a single debtor when this debtor defaults on one loan is important to assess banks credit risk exposure.</b> Although different loans often involve different risk profiles, difficulties with one loan could signal the deterioration of a debtor's creditworthiness and financial condition. If a limited number of large debtors play a systemic role, not accounting for the presence of multiple loans may underestimate the extent of impaired loans and hence, cause FSIs on asset quality (FSI 3, 4 and 5) and capital adequacy (FSI 1 and 2) to underestimate risk.</p>	<p>Although international accounting practice (IAS 39) considers the default of a borrower on a single loan as objective evidence of impairment on all other loans contracted by this borrower, international practice may differ across countries, hampering cross-border comparability.</p>
				<p><b>Classification of restructured troubled loans:</b></p>	<p><b>The treatment of restructured loans needs to be specified clearly and applied consistently.</b> A weak treatment of restructured loans leads to a less accurate indicator of asset quality (FSI 3 and 4) and hence, capital adequacy (FSI 1 and 2). In the absence of strict guidelines for restructuring problem loans, banks can conceal their level of loan impairment through practices such as "ever-greening" (i.e., extending credit facility in view of delaying or hiding the reporting of non-performing assets), thereby under-provisioning.</p>	<p>In situations of financial distress, figures on restructured loans and loan recovery rates indicate the level of effort or ability of financial institutions to cope with high NPL portfolios.</p>

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(1)	(2)	(3)	(4)	(5)	(6)	(7)
		(iii) Provisioning rules:	8 - Loan Evaluation and Loan-Loss Provisioning	<p><b>Nature of provisioning rules:</b> Are the provisioning rules based on <i>general principles</i> or do they specify <i>quantitative minima</i>?</p> <p><b>Purpose of provisioning rules:</b> Is the purpose of provisioning requirements to address identifiable and realized loss events (<i>backward-looking</i> losses) or to cushion for probable future losses (<i>forward-looking</i> losses)?</p>	<p><b>Clearly defined provisioning policies help interpret the soundness of the financial system.</b> Well defined and quantitative provisioning rules are a key factor in producing meaningful macro-prudential indicators of asset quality and capital adequacy. If provisioning requirements are guided by general principles, banks can exercise discretion over their respective provisioning levels. This lack of conformity across banks blurs the interpretation of FSIs on capital adequacy (FSI 1 and 2) and asset quality (FSI 4).</p> <p><b>Backward-looking provisioning rules reduce the effectiveness of corrective actions.</b> Provisioning rules that address realized loss events are likely to recognize vulnerabilities late and hence, provide less room for corrective actions.</p>	<p>According to 1988 Basel Accord, general provisions can be included in Tier II capital, up to 1.25 percent of risk-weighted assets. They are established by retaining after-tax earnings as a reserve. In contrast, specific provisions are created by an expense item. They only reduce capital if the expense is larger than its income, resulting in a loss.</p> <p>There is a concern that provisioning rules based on lagged indicators (such as interest past due) may amplify the business cycles. During a contraction, when default risk rises, banks raise their provisions, which reduces their capital and limits their ability to lend, which further contributes to economic downturn.</p>

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(1)	(2)	(3)	(4)	(5)	(6)	(7)
				Note that the purpose of general provisions is to provide a cushion against unanticipated losses, whereas the purpose of specific provisions is to ensure assets are carried at their fair value. Thus, losses are treated as an expense (via direct charge-off), while expected future losses are provisioned (via a charge against future earnings).		Note that for the sake of transparency, IAS requires an objective evidence of impairment before establishing a specific provision. This ensure that banks do not over-provision in good economic times and under-provision in bad economic times to smooth their income growth.
						Overall, well applied general accounting principles (such as IAS 39 on initial valuation and subsequent measurement) produce most reliable indicators. The problem is that these principles are not often well applied.
				<b>Scope of provisioning rules:</b> Do provisioning requirement reflect both on- and off-balance sheet exposures?	<b>Provisioning rules should cover the aggregate risk exposure.</b> Off-balance sheet exposures can contribute to a buildup of vulnerabilities and hence, need to be closely monitored and, if necessary, provisioned against. If provisioning rules account only for on-balance sheet exposures, capital ratio requirement may overestimate capital adequacy, provided banks have off-balance sheet exposures.	When losses are incurred on off-balance sheet operations, they must be recorded on the balance sheet and provisioned against. Off-balance sheet positions present particular problems due to the lack of reporting of positions, inadequate counterpart disclosures, high volatility and potential spill-over effects. Ideally, off-balance sheet exposures are expressed in terms of their on-balance sheet equivalent measure of value.

**Using BCPs Assessments to Interpret FSIs**

FSIs	Interpretation of FSIs	Relevant Information for Interpretation of FSIs	BCPs Providing Relevant Information	Information to be Extracted from BCPs	Using BCPs to Interpret FSIs	Comments
(1)	(2)	(3)	(4)	(5)	(6)	(7)
				<p><b>Treatment of provisions:</b> Are provisions allowed to be deducted from outstanding loans when computing risk-weighted assets for capital requirements?</p>	<p>When loans are net of loan loss reserves (specific provisions), capital adequacy ratios (FSI 1 and 2) tend to overestimate banks' ability to withstand shocks.</p>	<p>A deterioration in the capital adequacy ratios indicates a fall in capital adequacy, which can be driven either by a rise in risk-weighted assets, a rise in net provisioning (assuming losses exceed initial level of provisions), or a fall in regulatory capital.</p>
				<p><b>Specific provisioning rules:</b> Are there specific provisioning requirements for certain portfolio segments (i.e., small loans) or risks (i.e., country risk)?</p>		

**Using BCPs Assessments to Interpret FSIs**

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(1)	(2)	(3)	(4)	(5)	(6)	(7)
				<p><b>Tax treatment of loan loss provisions:</b> 1. The write-off approach (where loans are tax-deductible only when declared uncollectible and are written off banks' books); 2. The specific provisions approach (where specific provisions are fully or partly tax-deductible); 3. The general provisions approach (where banks can take deduction for general provisions up to predefined percentage of eligible loans).</p>	<p><b>The tax treatment of provisions is a good proxy for the bank's incentive to over- or under provision their bad loans.</b> While tax deductibility may boost the level of provisions, over-restrictive tax treatment result in inadequate loan loss reserves. The write-off approach can be restrictive, especially if legal procedures are slow. Under this approach, banks have little incentive to provision their non-performing loans and macro-prudential capital adequacy indicators (FSI 1 and 2) overestimates the true ability of the banking sector to absorb shocks. Alternatively, under the specific provisions approach, the asset quality may assess more accurately, as banks have a greater incentive to provision their loan loss reserves for tax benefits. However, under this latter approach, general provisions may continue to be taxed and thereby be discouraged.</p>	<p>International experience suggests that tax deductibility influence marginally but does not drive the level of provisions. Furthermore, tax deductibility only matters if the bank is otherwise profitable.</p>
		(iv) Valuation of guarantee and collateral:	8 - Loan Evaluation and Loan-Loss Provisioning	<p><b>Discounting requirements:</b></p>	<p><b>Indicators of capital adequacy (FSI 1 and 2) are more accurate when collateral and foreclosed assets follow strict discounting rules.</b> An excessively generous treatment of collateral and foreclosed assets leads to an inflated value of assets and hence, capital.</p>	<p>In addition, guarantees must be enforceable and collateral must be collectible.</p>
				<p><b>Foreclosure provisions:</b></p>		

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(1)	(2)	(3)	(4)	(5)	(6)	(7)
		(v) Granting procedures:	7 - Credit and Investment Policies	<b>Granting procedures:</b> Are loans granted on the basis of the debtor's collateral or cash-flow?	<b>Loans that are granted primarily on the debtor's cash-flow basis (as opposed to collateral value) reflect more accurately the debtor's repayment capacity and hence, capital adequacy (FSI 1 and 2) and asset quality (3 and 4).</b>	In practice, banks continue to grant most of their loans on the basis of collateral value rather than cash-flow analysis. A debtor's cash flow may be difficult to estimate, and to seize in the case of default. Thus, even when banks can estimate cash flow, they will accept collateral for loans.
		(vi) Disclosure rules:	21 - Accounting Standards	<b>Disclosure rules:</b>	Assessment of capital quality and hence, capital adequacy is more accurate if disclosure of financial statements is periodic, accurate, sufficiently comprehensive and timely.	
		(vii) Consolidation rules:	20 - Consolidated Supervision	<b>Consolidated supervision:</b> Is supervision consolidated on a cross-sector or cross-border basis, in the sense of including activities from affiliates and subsidiaries of both bank and nonbank activities?	<b>Supervision needs to be performed on a consolidated basis in order to assess aggregate risk exposure.</b> If supervised on a solo basis, banks with a higher risk profile can transfer risk to subsidiaries with a lower risk profile. For example, members of a group can sell loans to affiliated entities in advance of periodic reporting in order to conceal their true risk exposure. Other methods include cross subsidization, capital pooling and multiple gearing. This makes it more difficult to evaluate the aggregate risk exposure of individual banks and, depending on their systemic importance, reduces the accuracy of the capital adequacy FSIs (FSI 1 and 2).	Poor administration of company formation and shareholder registration make supervision on a consolidated basis difficult to implement

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(1)	(2)	(3)	(4)	(5)	(6)	(7)
				Are capital adequacy, lending limits, large exposure rules and risk diversification provisions provided on consolidated basis?	If taken on a solo basis, a group's risk exposure may be underestimated if a number of affiliates have dealings with the same borrower. Depending on the systemic importance of this group, this tends to reduce the accuracy of FSIs based on capital adequacy (FSI 1 and 2) and asset quality (FSI 4, 5 and 6).	In practice, the challenge seems to be more about the appropriate application of rules rather than on the rules themselves.
				<b>Treatment of "multiple gearing":</b> Are there any rules against "multiple gearing"?	<b>Strict rules against multiple gearing help better assess the banks ability to withstand shocks.</b> In the presence of strict rules exist against multiple gearing, macro-prudential indicators based on capital (FSI 1, 2, and 4) reflect more accurately asset quality and capital adequacy.	
			23 - Global Consolidation	<b>Cross-border consolidated supervision:</b> Is supervision consolidated on a cross-border basis, in the sense of including overseas activities of locally incorporated bank?	<b>In the presence of internationally active banks, supervision needs to consolidated on a cross-border basis in order to assess aggregate risk exposure.</b> In doing so, FSIs capture adequately the strength of the financial system to absorb shocks.	International differences in the treatment of loan loss provisioning, asset and liability valuation, and provisioning requirements.
<b>L.II. ASSET QUALITY</b>	Risks to solvency of financial institutions most often derive from the impairment of assets.					
3. Nonperforming loans to total gross loans;	This indicator captures the quality of loan portfolio of financial sector. A rising trend indicates a deterioration in asset quality and hence, a higher risk to the solvency of financial institutions. But this indicator may not capture all aspects of asset quality and additional information may be	(i) Loan classification system:	8 - Loan Evaluation and Loan-Loss Provisioning	See above		

### Using BCPs Assessments to Interpret FSIs

FSIs	Interpretation of FSIs	Relevant Information for Interpretation of FSIs	BCPs Providing Relevant Information	Information to be Extracted from BCPs	Using BCPs to Interpret FSIs	Comments
(1)	(2)	(3)	(4)	(5)	(6)	(7)
	required to assess the overall reliability of this indicator.	(ii) Granting procedures:	7 - Credit and Investment Policies	See above		
4. Nonperforming loans net of provisions to capital	This indicator captures the capacity of bank capital to withstand non-performing loans-related losses. A fall in the ratio of non-performing loans (net of provisions) to capital, which reflects a rise in asset quality, may indicate either a fall in non-performing assets or a rise in the overall level of provisioning. To disentangle between these two effects, it is important to consider this ratio in tandem with the share of non-performing loans to total loans (FSI 3). But this indicator may not capture all aspects of asset quality and additional information may be required to ability of the banking sector to withstand non-performing loans-related losses.	(i) Asset valuation and capital measurement	6 - Capital adequacy	<b>Valuation methodologies:</b> - market value versus book value; - replacement value versus yield-based value; - going concern value versus liquidity value;		
		(ii) Loan classification system:	8 - Loan Evaluation and Loan-Loss Provisioning			
		(iii) Provisioning rules:	8 - Loan Evaluation and Loan-Loss Provisioning			
		(iv) Valuation of guarantee and collateral:	8 - Loan Evaluation and Loan-Loss Provisioning	See above		
		(v) Granting procedures:	7 - Credit and Investment Policies	See above		
		(vi) Disclosure rules:	21 - Accounting Standards	See above		
5. Large exposures to capital	This indicator captures the extent to which a single borrower experiencing difficulties in servicing its obligations could affect the stability of the system. A large exposure to capital signals that the banking system has less capital to absorb the losses due to the default of a single large debtor. But in order to assess the extent of this vulnerability, it is important to collect additional information.	(i) Reporting requirements:	7 - Credit and Investment Policies	<b>Special reporting:</b> Is there any special reporting for large risks concentration on large debtors or particular sectors?		

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(1)	(2)	(3)	(4)	(5)	(6)	(7)
		(ii) Restrictions on lending:	9 - Large Exposure Limits  7 - Credit and Investment Policies	<b>Special reporting:</b> Is there any special reporting for the largest claims and sectoral concentration? <b>Prudential limits:</b> Are there any prudential limits on investment and credit?		The gross value of loans allocated to the largest single borrowers or sectors provides rough indication of vulnerability of financial system to a deterioration in borrower's repayment capacity.
			9 - Large Exposure Limits	<b>Restrictions:</b> Are there any restrictions on lending activities and risk diversification rules?	<b>Clearly specified restrictions on lending help reduce risk concentration,</b> which is a major potential vulnerability and is often a contributing factor in financial crises. But such restrictions should refer not only to exposures to related groups but also to counterparts, which may suffer from the same exogenous events because they are in the same geographical area or in the same economic sector.	When banking sector has large exposure to another country, country and transfer risk should also be included.
					<b>Strict regulation on connected lending help reduce bank instability.</b> Connected lending must be (a) regulated by quantitative limits on the aggregate amount of such lending (not higher than 25 percent of the bank's own capital); (b) on market terms; (c) based on transparent credit granting procedure; and (d) combined with internal controls to monitor their exposures.	The presence of connected lending, which often results in the application of lower credit standards, tends to underestimate the extent to which available capital can absorb negative shocks to the financial position of the connected borrower.

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(1)	(2)	(3)	(4)	(5)	(6)	(7)
		(iii) Provisioning rules:	8 - Loan Evaluation and Loan-Loss Provisioning	<b>Special valuation, classification and provisioning rules</b> for large credits to individual debtors or particular sector.		
		(iv) Tax treatment of large exposures:	9 - Large Exposure Limits	<b>Fiscal arrangements and preferential regulatory treatment</b> for large exposures to individual debtors or particular sectors.		
7. Sectoral distribution of loans to total loans	Capturing risk concentration when banking sector as a whole is exposed to particular source of risk. A high loan concentration to a specific economic sector or activity makes banks vulnerable to adverse developments in that sector or activity.	(i) Reporting requirements:	7 - Credit and Investment Policies	See above		
			9 - Large Exposure Limits	See above		
		(ii) Restrictions on lending:	7 - Credit and Investment Policies	See above		
			9 - Large Exposure Limits	See above		
		(iii) Provisioning rules:	8 - Loan Evaluation and Loan-Loss Provisioning	See above		
		(iv) Tax treatment of large exposures:	9 - Large Exposure Limits	See above		
		(v) Country risk:	11 - Country and Transfer Risks	<b>Policies and procedures to identify, monitor and control country risk and transfer risk.</b>		<b>While BCP 11 deals specifically with country risk, in practice, this type of risk tends not to be addressed.</b> Data on geographical distribution of credit allow monitoring of credit risk arising from exposure to particular country of group of countries and

### Using BCPs Assessments to Interpret FSIs

FSIs	Interpretation of FSIs	Relevant Information for Interpretation of FSIs	BCPs Providing Relevant Information	Information to be Extracted from BCPs	Using BCPs to Interpret FSIs	Comments
(1)	(2)	(3)	(4)	(5)	(6)	(7)
						assessing the impact of adverse events in these countries on domestic financial system.
<b>L.III. EARNINGS AND PROFITABILITY</b>						
8. Return on assets (ROA)	Extent to which profits are available to absorb losses					
9. Interest margin to gross income	Extent to which available interest-related earning help absorb losses					
10. Noninterest expenses to gross income	Extent to which available noninterest-related earning help absorb losses					
<b>L.IV. LIQUIDITY</b>	Market liquidity affects the ability of banking system to withstand shocks generated by events such as a loss of access to funding sources or a run on deposits.	(i) Guidelines to risk management:	13 - Other Risks	<b>Standards to manage risk, including credit risk, market risk, liquidity risk, interest rate risk, foreign exchange risk and operational risk:</b>		<p><b>Liquidity risks:</b> In addition to policies for liquidity management, supervisors must conduct frequent stress tests, scenario analyses and have contingency plans in the event of negative liquidity developments.</p> <p><b>Operational risk:</b> While banks require adequate arrangements to manage operational risk (IT systems break-downs, power black-outs, major fires, natural disasters), op-risks may also affect the whole banking system simultaneously, which directly affects systemic financial stability.</p>

### Using BCPs Assessments to Interpret FSIs

FSIs	Interpretation of FSIs	Relevant Information for Interpretation of FSIs	BCPs Providing Relevant Information	Information to be Extracted from BCPs	Using BCPs to Interpret FSIs	Comments
(1)	(2)	(3)	(4)	(5)	(6)	(7)
		(iii) Reporting requirements:	13 - Other Risks	<b>Identification of systemic relevant institutions:</b> Is there a special reporting requirement for institutions carrying out significant foreign currency liquidity transformation:		
		(ii) Definition of liquid assets:	13 - Other Risks	<b>Definition of bank liquidity,</b> including definition of liquid assets:		
11. Liquid assets to total assets (liquid assets ratio)	A high ratio may reflect a loss of depositors confidence and investors confidence in the long-term viability of institutions.					
12. Liquid assets to short-term liabilities	A low ratio can signal an excessive maturity mismatch in the asset portfolio and hence, the need for more careful liquidity management.					
<b>I.V. SENSITIVITY TO MARKET RISK</b>	These indicators capture the vulnerability of the financial sector arising from changes in exchange rate risk, interest risk, equity price risk or commodity price risk.					The interest rate, exchange rate, equity price and commodity price risks can be assessed by calculating the net open positions according to the methodology proposed by the Basel Committee.
13. Duration of assets; and 14. Duration of liabilities	Duration, which measures the weighted average life of an asset or liability, is an indicator of sensitivity to interest rate risk. The greater the duration, or average life mismatch between assets and liabilities, the greater is the risk.		12 - Market Risk	<b>Capital charges and quantitative limits:</b> Are there any explicit capital charges and/or quantitative limits on market risk exposures, including foreign exchange business?		Duration rises with maturity, falls with the frequency of coupon payments and falls as the yield rises.

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				<b>Risk management guidelines:</b> Are there explicit policies and procedures for risk management and monitoring, including control systems to prevent abuses?		Stress testing should be used to evaluate how some extreme events would impact the market risk exposures of banks.
15. Net open position in foreign exchange to capital	The net open position in foreign exchange is the most common measure of foreign exchange exposure.					Note that the compound nature of credit and currency risk in foreign exchange-denominated lending raises the level of risk, even in institutions with a balanced foreign exchange positions.
<b>II. EFFECTIVE SUPERVISION</b>		Independence and power of supervisory authority	1(2) - Independence	Autonomy of supervisory body	<b>Supervisory body must be independent.</b> If supervisory authority does not have full independence, political influences can supervisors to underestimate vulnerabilities until they grow out of proportion.	
			1(4) - Enforcement powers	Power to implement and enforce prudential regulations without consent of legislative bodies	<b>Supervisory body must be given the means to do its job.</b> If the supervisory authority does not have powers to enforce supervision, banks often take excessive risks and problems are not identified and corrected before they grow very large and threaten the financial stability.	

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			1(5) - Legal protection of supervisors		<b>Supervisors must benefit from legal protection.</b> Otherwise, they may be reluctant to identify and address certain vulnerabilities until they become systemic.	
		Responsiveness of supervisory body	22 - Remedial actions	Capacity to take remedial actions in response to identified weaknesses	<p><b>Ability to take timely remedial actions is crucial for effective supervision.</b> If supervisory body does not have the power, competence or resolve to take prompt corrective action, bank problems may grow out of proportion and become systemic. If banks can operate with inadequate capital for long periods of time without corrective actions, capital ratio requirements are a weak indicator of capital adequacy.</p> <p>Strict criteria for implementing and selecting remedial action can give more strength to supervisors. But overly schematic rules may miss weaknesses that take on other shapes that those anticipated.</p>	<p>A similar behavior of indicator may sometimes signal a weakness (a decline to capital ratio due to large losses) or a strength (a decline in capital ratio due to rapidly increasing amounts of assets and investments), with different implications for financial stability.</p>
						Supervisors should have broad range of remedial actions and sanctions to ensure that supervisors will apply suitable instrument to particular situation rather than not doing anything.

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		Ability to collect relevant information	16 - On- and off-site supervision	Capacity to compile and analyze both on- and off-site supervision: frequency of examination	<p><b>Supervisors must have the skills and financial means to perform their tasks adequately and on a regular basis.</b> If inadequate resources and skills to deal with new and sophisticated bank activities and instruments, potential vulnerabilities of financial system may go undetected until they grow large and threaten the financial stability.</p> <p>If infrequent cycle of bank examination, problems can go undetected for a long time, raising their correction costs and endangering financial stability.</p>	
	17 - Bank Management Contact		Capacity to maintain good relations with bank management	<p><b>Close contact with bank management support an effective supervision.</b> When supervisors maintain close contacts with bank managers and directors, bank problems are more likely to be identified at an early stage.</p>		
	18 - Off-site supervision		Capacity to collect and review necessary information on off-site basis:			

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			20 - Consolidated supervision	Capacity to collect and review necessary information on solo and consolidated basis	<b>Supervision needs to be performed on a consolidated basis.</b> All entities in banking group, financial conglomerate or mixed conglomerate must be included in the supervision process. Otherwise, problem in one part of the group may grow undetected and threaten the stability of the whole group.	
		Ability to review and verify relevant information provided by banks	19 - Validation of supervisory information	Capacity to verify data provided by banks		
			21 - Accounting standards			
		Ability to collect, review and share information on cross-border activities	1(6) - Information sharing	Capacity to collect, verify and share information on cross-border activities	<b>Information exchange needs to be fluid.</b> If supervisors face major hindrances to information exchange (such as secrecy rules), they may not detect potential destabilizing factors and produce over-optimistic assessment of strength of financial system.	
			23 - Globally consolidated supervision			
			24 - Host country supervision			
			25 - Supervision over foreign banks' establishments		<b>Supervision must cover subsidiaries and branches overseas.</b> Foreign entities may be the source of destabilizing influences, which, if left unaccounted for, can threaten not only the health of the domestic institution but also financial stability.	