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Challenges for Systemic Risk Assessment in Low-Income Countries*

Mario Catalán and Dimitri G Demekas

Abstract

Assessing and monitoring systemic risk is a challenge for policy-makers and supervisors in all countries. It particularly challenging in low-income countries (LICs), owing to a number of characteristics shared to a greater or lesser extent by most of them. This paper discusses these common characteristics and how they shape the nature of systemic risk in LICs, and concludes with some practical lessons for policy-makers and financial supervisors that can help improve the effectiveness of systemic risk assessment and mitigation in these countries.

Keywords: financial stability, stress testing, systemic risk, low-income countries, macroprudential policy, IMF

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I. INTRODUCTION

Traditional policy frameworks that rely only on monetary, fiscal, and micro-prudential policies failed to contain the systemic risks that led to the recent global financial crisis. In his now classic 2008 intervention, US Federal Reserve Chairman Ben Bernanke called for an expansion of the “field of vision” of regulators and supervisors to incorporate systemic risk.¹ One of the early lessons from the crisis was thus the need to develop policy frameworks that continuously assess systemic risk and attempt to manage it, using not only the “traditional” policy toolkit but also macro-prudential policies.² Since then, regulators, policy-makers, standards setters, and international organizations have worked jointly to develop such enhanced policy frameworks.

These efforts have naturally focused on advanced economies (AEs), which were at the center of the crisis. But systemic risk affects all countries. This paper discusses the special challenges for systemic risk assessment faced by low-income countries (LICs), a topic that has until recently received scant attention.³ Proper systemic risk assessment and mitigation in LICs can help dampen macroeconomic volatility and promote sustainable financial development and growth in a large part of the world, with substantial concomitant welfare gains.

Section II provides a primer on systemic risk assessment in general. The development of a conceptual, analytical, and operational framework to assess and contain systemic risk has proved challenging in all countries (advanced, emerging market, or low-income). Major progress has been achieved but much remains to be done. Most importantly, the effectiveness and robustness of the new frameworks can only be tested during real crises and ascertained with the passage of time. Section III discusses the special economic and financial characteristics of LICs and their implications for systemic risk. Section IV concludes by outlining lessons for policy-makers in these countries.

II. WHAT DO WE KNOW ABOUT SYSTEMIC RISK?

The Two Dimensions of Systemic Risk

The standard definition of systemic risk is the risk of disruption to the provision of financial services that is caused by an impairment of all or parts of the financial system, and can cause serious negative consequences for the real economy.⁴ Risk assessment from a systemic perspective focuses on how the failure or impairment of individual institutions or markets can induce losses on other parts of the financial system, as well as on the broader economy, through all possible spillover channels. Thus the central task of systemic risk assessment is to complement the risk evaluation of individual institutions and markets with an account of possible negative externalities and general equilibrium effects. Channels of contagion across institutions and markets include both direct linkages (such as interbank exposures) and indirect linkages (such as common exposures to assets and markets in which institutions raise and place funds). The scope of systemic risk assessment, however, should in principle extend even further: it should also involve an analysis of the behavioral responses of institutions to initial shocks, the collective impact of these responses on the overall economy, and the subsequent macrofinancial feedback loops.

Systemic risk comes in two “flavors”: the cross-sectional and the time dimensions.⁵ The cross-sectional dimension refers to how risk is distributed in the financial system at a given point in time—including through direct inter-linkages and common exposures to assets and markets—and how losses are likely to be transmitted across institutions and markets in the event that adverse shocks materialize. The time dimension focuses on how systemic risk evolves over time through macrofinancial linkages and procyclicality—the phenomenon of amplifying feedbacks between the financial system and the macroeconomy.

The main policy question along the time dimension is how to dampen procyclicality, mitigate its impact on risk-taking, and increase the system’s resilience in the presence of it.⁶ Broad-based prudential tools, such as countercyclical capital buffers or dynamic provisions, are available to contain a generalized increase in risk (for example, a credit boom affecting many sectors of the economy), while more targeted tools can be used to limit risk build-up in

specific sectors. Along the cross-sectional dimension, the key focus is on how to address the too big—or too important—to fail problem and, more broadly, how to limit contagion and joint failures of institutions that, albeit small, may add up to a significant portion of the system. This includes safeguarding key infrastructures (such as payments systems) and maintaining a smooth operation of key markets during stress episodes. Instruments include capital and liquidity surcharges for systemically important institutions, and measures to control interlinkages in funding and derivatives markets.

Challenges for Systemic Risk Assessment

As the foregoing discussion makes clear, monitoring and assessing the degree of systemic risk in its two dimensions is far from easy. First, it demands a set of data that go beyond the templates of “traditional” macroeconomic policy-making and micro-prudential supervision. Secondly—and more importantly—it requires enhanced analytical approaches and a special “mindset” to combine these data sources into a coherent judgment about something intangible: the level of risk facing the system. And lastly, once the capability to assess and track systemic risk is in place, it requires a special (macroprudential) policy toolkit that can be deployed to mitigate it. Leaving the last aspect aside,⁷ the assessment of systemic risk poses a number of specific challenges, including the following:

Filling information and data gaps. Assessing systemic risk along the time dimension requires data on the evolution of overall credit, credit to specific sectors, and credit in different currencies, and various asset prices (real estate, stocks, and bonds). In addition, leverage and debt service capacity in the corporate and household sectors must also be carefully monitored to evaluate sustainability. These data are generally available, and often monitored, in most countries. Assessing systemic risk along the cross-sectional dimension, however, is another story. It requires detailed data on interbank exposures (e.g., matrices of domestic and cross-border exposures, including those between institutions of the same group and between foreign parent institutions and their domestic subsidiaries). It also requires data on common exposures to specific counterparts, assets classes, and sectors of the economy. Assessing funding risks in the system’s network requires knowledge of the maturities of claims and

contingent contracts, as well as the extent to which markets will remain liquid and operational in a stress situation. Filling all these information demands can be a challenge for different reasons: in advanced financial systems, where interconnections are more complex, the relevant body of data is massive, and the attendant costs of compliance (for financial institutions) and collection and interpretation (for the systemic risk supervisor or macropudential policy-maker) are not trivial; in emerging markets and LICs, where the infrastructure is less developed, some of these data may not be available in a usable form.

Development of analytical tools. Again, there is a number of well-understood tools to interpret the data available to assess systemic risk along the time dimension. These tools explain how developments in the banking system impact aggregate credit, asset prices (notably real estate and stock prices), and leverage in the household, corporate, and sovereign sectors. Standard statistical and time series techniques can be used to assess these macro-financial linkages.⁸ Interpreting risk indicators along the cross-sectional dimension is more challenging. Available tools rely either on balance sheet data or on information extracted from assets prices. The latter tools extract default probabilities, expected shortfalls, and stress dependencies embedded in asset prices;⁹ however, they can only be used in countries where markets are sufficiently liquid. Network models that use as input balance sheet data are likely to be most useful for LICs, where assets markets tend to be illiquid and shallow.¹⁰ These tools provide a mean of measuring and tracking the evolution of systemic risks posed by individual (or groups of) institutions, and the quantitative analysis can help guide the numerical calibration of surcharges for too-big-to fail institutions.

Adjustment of supervisory resources and skills. The traditional skills used in bottom-up supervision differ from the skills needed to conduct top-down systemic risk assessment. New skills—staff trained in statistics and econometrics, macroeconomic and financial modeling, and stress testing—have to be brought to the task of effectively identifying and monitoring externalities across institutions, and macro-financial linkages. The required capabilities are not always available in traditional supervisory agencies, so inter-agency coordination—or coordination between different departments when supervision is housed in the central bank—is needed.

III. WHAT IS SPECIAL ABOUT LIC FINANCIAL SYSTEMS?

In recent decades, LICs have participated in the process of financial globalization (Figure 1). Their financial systems have also deepened (Figure 2), albeit with significant heterogeneity across countries and regions (Figure 3). It is increasingly harder to generalize about such a large and diverse group of countries, identify a “typical” LIC, and describe exactly how it differs from AEs and EMs. Nevertheless, most LICs share certain characteristics that affect *both* the nature of risks facing their financial sectors *and* the ability of regulators and policy-makers to assess it and monitor it on a continuous basis. This section presents a few facts about LICs that highlight these common characteristics, and draws the implications for systemic risk and systemic risk assessment. These can be classified into two groups: “structural” factors that affect the economy as a whole, and factors specific to the financial sector.

Figure 1

Figure 2

Figure 3

It should be emphasized that these are stylized facts: they do not provide a comprehensive characterization of LICs as a group, much less of each and every individual LIC. They are at best a caricature. But this caricature may be useful as a starting point for a discussion of the special challenges facing systemic risk assessment in LICs.

Structural Factors

Less diversified economies, higher volatility. The economies of LICs tend to be less diversified compared to advanced economies (AEs). Regardless of what sectors production is concentrated in (e.g. commodities, industries that use traditional technologies, etc.), this pattern of specialization—which is also present in many emerging markets (EMs) and some AEs—makes these economies more prone to economic volatility. Volatility can arise from either domestic (e.g., natural disasters, disruption of productive capacity) or external shocks (e.g., terms of trade shifts, technological shocks). In either case, these shocks are likely, other

things being equal, to generate higher economic losses and require greater adjustments than in more diversified economies.

Lower institutional quality. Gaps in the legal framework, especially as regards the protection of property rights; poor business environment (heavy regulatory burden, distortionary taxes); and inefficient judicial systems are major obstacles in many LICs. They introduce rigidities that can hamper the reallocation of resources across sectors in response to shocks. Economic policy-making institutions are also less well established, often have a shorter track record, and are less credible in LICs than in AEs. Political interference, insufficient operational independence, staffing and resource limitations, and legal constraints are common, and have a particularly pernicious impact on financial regulatory and supervisory agencies. Taken together, these factors handicap the reach and effectiveness of LIC policy-makers and regulators.

Less effective economic policy frameworks. Even when economic policy-makers manage to overcome these obstacles, research has shown that economic policies in LICs tend to be less effective than in AEs in managing the economic cycle. For example, fiscal policy in LICs tends to be pro-cyclical, exacerbating instead of dampening output volatility.¹¹ Nominal exchange rates tend to be fixed or rigid, making real exchange rate adjustments more difficult and sluggish and hampering LICs' ability to reallocate resources across industries in response to external shocks. And monetary policy transmission tends to be less effective due to poorly developed or nonexistent money and interbank markets, shallow secondary markets for government securities, and insufficient competition in the banking sector.¹² Last but not least, policy regime switches are more frequent in LICs than in AEs and often result in drastic monetary, fiscal, and trade policy reversals. Frequent changes in rules and "structural" breaks in the policy environment in turn exacerbate the challenge of identifying and separating cyclical and trend developments in the economy.

Factors Specific to Financial Sectors

Shallow financial markets. Equity, corporate bond, and derivatives markets are shallow in most LICs (Figure 4). Interbank and money markets are also less well developed, increasing the costs of interbank transactions and impeding liquidity flows from surplus to deficit institutions. From a system-wide perspective, these factors have manifold effects: they widen interest rate margins (Figure 5),¹³ encourage liquidity hoarding, and reduce the effectiveness of monetary transmission (see above). Moreover, as government securities are often the only relatively liquid asset class domestically, banks in LICs tend to have large holdings of government paper, increasing their exposure to sovereign risk.

Figure 4

Figure 5

Bank-dominated financial systems. As a result of the dearth of other forms of finance, the banking sector accounts for over 80 percent of financial system assets in the median LIC.¹⁴ Hence, corporate borrowers—as well as governments—tend to depend heavily on banks for finance, while banks have fewer opportunities to diversify into other asset classes. Very small institutions, such as microfinance institutions and credit cooperatives, often emerge to fill the gaps in financial access and inclusion. While beneficial, the large number and small size of these institutions often pose a challenge for supervisors.

Concentration of credit portfolios. Wealth and ownership of corporations and means of production are often very concentrated in LICs. In these cases, effective credit diversification is more difficult, and many banks tend to have common exposures to the same economic sectors and even borrowers.

Conglomeration. Many individual financial institutions in LICs form part of local or regional financial groups. These groups often dominate the financial landscape and are systemically important in the countries in which they operate. They can also have enough political clout to shape regulations and influence supervisory practice.

Foreign banks. Prior to the 1990s, financial systems in many LICs were dominated by state banks. Since the mid 1990s, however, many countries embarked in privatizations that eased the entrance of foreign banks, either as subsidiaries or—less commonly—branches (Figure 6). As the recent crisis has shown, a large presence of foreign banks can generate substantial cross-border contagion risks. In some cases, for instance, deleveraging attempts by parent banks (in response to pressures in their home countries) led to a reduction of direct funding to their subsidiaries, which were in turn forced to sell assets in illiquid markets.

Figure 6

Financial dollarization. Developing countries often find it difficult to borrow abroad in their own currencies, which results in financial dollarization and currency mismatches. These mismatches are found either in the banking system itself or among bank borrowers. For those without a natural hedge (e.g., exporters), foreign exchange risk can be a significant additional source of risk.

Mutually-Reinforcing Patterns

It is important to realize that many of these characteristics are mutually reinforcing. For example, insufficient institutional depth and less effective policy frameworks exacerbate the impact of external shocks on the economy, which, due to credit concentration, translates into the potential for higher system-wide bank losses. Insufficient financial depth can contribute to the pro-cyclicality of fiscal policy because thin debt markets provide a less stable source of funding for the government, reducing its capacity to issue debt during cyclical downturns. Uncertainty about the stance of fiscal policy, in turn, can lead to a shortening of the maturity profile of government debt, making it more difficult to develop a reliable yield curve that can be used as a benchmark to price other assets, thus increasing system-wide market risk for financial institutions and other market participants.¹⁵

IV. IMPLICATIONS FOR LIC POLICY-MAKERS AND SUPERVISORS

The preceding discussion outlined a number of characteristics shared, to a greater or lesser extent, by most LICs, and their likely impact on the nature of systemic risk and systemic risk assessment. The next question is: what should policy-makers and supervisors in these countries do?

If identifying common characteristics and making broad-brush generalizations about the LICs as a group is tricky, providing a recipe book for policy-makers in individual countries would be even more questionable. Instead, this Section attempts to draw some common threads and summarize a few lessons that may be useful for those charged with monitoring and containing systemic risk in LICs. These lessons are not intended to be a comprehensive manual, but rather a menu of pointers, some of which may be more relevant than others in individual countries. And they reflect as much the theoretical considerations summarized in the previous sections as the authors' own practical experience working with policy-makers in a wide range of countries.

Focus on the most likely sources of systemic vulnerability. In an environment of constrained resources, information gaps, and institutional weaknesses, common in many LICs, policy-makers and financial supervisors charged with the task of monitoring and mitigating systemic risk should focus their efforts on the sectors and markets where systemic risk is most likely to arise and, within these, on the most serious potential risk factors. In almost every case, this means the banks: systemic risk arising from stock and bond markets or non-bank financial entities (e.g., insurance) is likely to be low in LICs—unless these markets and sectors are closely linked to banks.

- On the time dimension of systemic risk, rapid credit growth episodes are more likely to arise in LICs than AEs, and their sustainability is more difficult to assess. The process of financial deepening spurs rapid credit and asset price cycles of uncertain duration. The higher inherent volatility and frequent changes in policy regimes observed in LICs often make it difficult to disentangle healthy financial deepening from unsustainable booms. Closely monitoring credit growth and various indicators

of credit sustainability⁸ may well be the single most important task for systemic risk policy-makers, supervisors, and macroprudential authorities.

- On the cross-section dimension of systemic risk, as a result of less diversified production and other factors (weak accounting standards, lack of credit information infrastructure), banks in LICs usually extend credit only to a limited number of creditworthy clients, who often operate in the same economic sectors. Large exposures and limited diversification exacerbate credit risk for individual institutions, while common—or highly correlated—exposures across institutions can turn individual risk systemic. Strictly enforcing large exposure limits and related party lending regulations is thus a crucial—and often overlooked—supervisory task in these countries. Also, direct and indirect foreign currency risk is likely to arise in highly dollarized LICs. Direct risk originates in net open foreign exchange positions: these are relatively easy to monitor and are typically limited in most regulatory frameworks. But foreign currency risk for banks can arise even when their own foreign current positions are closed, when foreign currency credit is extended to unhedged borrowers. Because derivatives markets are less well developed in LICs, buying foreign exchange hedge may be prohibitively expensive for domestic corporate borrowers. In case of a sudden depreciation of the domestic currency, the banks—and their supervisors—may thus be surprised to discover that their credit portfolios are significantly exposed to indirect foreign currency risk.
- At the same time, there are sources of systemic risk that are less relevant in many LICs. For example, wholesale funding tends to be insignificant for most banks, posing no material systemic risk in LICs. This is in sharp contrast to most AEs, where wholesale funding risk is high. Also, because banks in LICs tend to hoard liquidity (often in the form of large portfolios of government securities, because they can be pledged as collateral for access to central bank liquidity facilities), the risk of contagion through interbank exposures—a major source of concern in AEs—tends to be less relevant. Lastly, because banks in LICs tend to undertake less intense maturity transformation than in AEs, the shorter average maturity of fixed-rate loans, the prevalence of loans with adjustable rates, and the shorter duration of the securities

portfolios held by banks reduce their vulnerability to interest rate risk (although it should be noted that interest rate shocks in LICs can be larger and more volatile than in AEs).

Keep it simple. Monitoring and assessing systemic risk is a technical undertaking. There is sometimes the tendency to want to use the latest tools or import the latest model from AEs. While there is, of course, nothing wrong with sophisticated tools, experience has shown that investing in this technology without adequate supporting infrastructure and skills is often a misallocation of limited resources. The types of risks most prevalent in LICs—discussed above—can be monitored with a range of analytical tools, some of which are fairly simple. Instead of trying to implement the latest models—often with technical assistance from well-meaning donors—policy-makers and supervisors in LICs might be better off starting off with simple indicators and focusing their efforts on building a deep and sustainable pool of human resources and expertise. Over time, this may be a better investment for systemic risk assessment and monitoring.

Watch your perimeter. This advice is typically addressed to supervisors in AEs and some EMs, where financial intermediation is migrating away from the closely regulated banking sector toward other types of financial intermediaries—the so-called “shadow banks”. This is less of a concern in LICs. But watching the perimeter of regulation is still important in many of these countries given the extensive presence of microfinance institutions, which generally tend to be much more lightly supervised. While these institutions are very small and not systemic, they have grown rapidly in recent years, and today they collectively represent a large share of intermediation in some LICs. If risks migrate between the regulated and non-regulated parts of the system, leading a significant expansion of (correlated) risk-taking by the latter, this may give rise to systemic risk. In such a case, the regulatory perimeter should be expanded to eliminate regulatory arbitrage and enhance the effectiveness of micro- and macroprudential policy.

Build stress testing capability. Most simple systemic risk indicators are coincident or lagging: they provide information about the level of risk that reflects at best a current snapshot of the system or, very often, a snapshot of the system a few weeks, months, or

quarters ago. Macroprudential stress testing is the only tool that allows policy-makers and supervisors a “peak into the future”. Although this is done under simplifying scenarios and restrictive assumptions, it is still an invaluable tool for systemic risk assessment. Principles for stress test design and implementation are well established,¹⁶ and a growing body of experience—particularly for stress testing banks—is available at the IMF and many AE central banks and supervisory agencies. Implementing effective stress tests in LICs can be a challenge: stress testers must construct “extreme but plausible” adverse macroeconomic scenarios, but this may be difficult to do in LICs, given the absence of long time series and the frequency of structural breaks in their recent economic history; the granular bank portfolio data required for adequate mapping of adverse macroeconomic scenarios to bank losses may not be available or reliable; and modeling contagion in liquidity stress testing is complicated. Despite these challenges, LICs should start (or continue) working on the development of stress testing frameworks. Once a basic framework is set up, the complexity and sophistication can be gradually enhanced. As a first step, LIC authorities could undertake simple sensitivity exercises based on bank balance sheet data. Second, they can assemble larger and more granular historical datasets to build reliable satellite models of credit risk and undertake scenario-based solvency tests. Third, they can gather bank-level data on the temporal structure of cash-flows generated by assets and liabilities to undertake liquidity stress tests. And fourth, as interbank exposures become larger and more complex, they can include network models of contagion into the framework.

Be aware of new risks emerging from the process of financial deepening. Sustained financial development is key for long-term economic growth in LICs. Our understanding of the pre-conditions for, and management of, successful financial development has evolved over several decades.¹⁷ One of the lessons is that this process also creates new risks and reveals new data and analytical skills gaps that must be continuously and filled to ensure the continued effective monitoring of these risks. The following are just some illustrations of the constant challenge this process can create for supervisors.

- Sustainable financial deepening is often accompanied by macroeconomic stabilization and domestic economic liberalization. As fiscal dominance is eliminated, sustainability is restored, and inflation is reduced, foreign capital inflows often flood

the country. This can distort interest rates and encourage excessive risk-taking. For one thing, inflow of funds into banks, as well as reduced demand for funds from the public sector, stimulate an extension of bank credit to new private sector borrowers (e.g., SMEs, households). Supervisors must continuously adapt to understand the evolution of credit risk taken by banks and to facilitate information-sharing through creation of credit registries or bureaus.

- As external funding received by banks is likely to come in the form of foreign currency credit lines, preventing significant direct or indirect currency mismatches in the banking system, as discussed above, can be a growing challenge.
- Improved public finances facilitate the development of repo markets collateralized by government securities. This eases the flow of liquidity, and banks are able to reduce their liquid buffers, expand their interbank borrowing, and further increase lending to the private sector. At this stage, banks become more interconnected through direct linkages, and a new aspect of cross-section systemic risk emerges, to which supervisors must adapt.

Ensure the operational independence of the microprudential supervisor. It might seem surprising to conclude a discussion of the challenges for systemic risk assessment and monitoring with a reference to microprudential supervisory capacity. But in fact, sound microprudential oversight is the foundation for effective macroprudential policy. For one thing, if risks at the individual institution level go undetected—or the supervisor is unable to take action—they will most likely remain undetected if they grow to system-wide level. But there is also another reason why effective microprudential supervision is crucial in LICs. In AEs, where asset markets are liquid and banks rely on them for wholesale funding, market prices convey useful information and investors can exert discipline on banks. Indeed, in certain cases, investors are more demanding than supervisors (see, for example, the market reaction to EU-wide stress tests). In LICs, however, this market discipline is typically absent. Hence, the role of traditional supervision in the assessment of risk is particularly important. Ensuring the operational independence of the supervisor has several different aspects: ensuring adequate human and financial resources; providing legal protection for supervisors’

actions in the conduct of their duty; safeguarding the legal independence of the central bank or supervisory institution; providing political coverage for controversial decisions affecting powerful conglomerates; and refraining from political interference in the conduct of supervision. All these elements are crucial in ensuring not only sound microprudential supervision but also the foundation for adequate systemic risk assessment and mitigation.

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¹ Bernanke (2008).

² See Caruana (2010) and Hanson et al. (2011).

³ After the global financial crisis, the FSB/IMF/World Bank report to the G20 Finance Ministers and Central Bank Governors (2011) was the first comprehensive attempt to discuss financial stability issues that are of particular interest to emerging market and developing economies. A subsequent IMF (2012) paper reviewed the nexus between financial development and macro-financial stability and drew lessons for enhancing financial sector surveillance in low-income countries.

⁴ FSB, IMF, and BIS (2009).

⁵ For an early discussion of the two dimensions of systemic risk, see Borio (2003).

⁶ The financial sources of procyclicality are varied. Macroprudential policies can only aim at limiting procyclicality but it cannot eliminate it. The financial sources of procyclicality include: asymmetric information and financial acceleration; risk misperception due to agents' behavioral biases; risk mismanagement (e.g., flaws inherent to the application of Value-at-Risk techniques based on historical data); asset bubbles; and regulations. For further details, see Borio (2003).

⁷ The challenges in establishing a macroprudential policy toolkit have been discussed in detail elsewhere, see Global Financial Stability Report (2011), and IMF (2013).

⁸ For instance, three simple approaches have been proposed to identify credit booms that are likely to end up triggering a crisis. A credit-to-GDP gap above 10 percent—calculated as the difference between the credit-to-GDP ratio and its long run trend based on a Hodrick-Prescott filter—provides a strong early warning signal of a crisis in many economies (Drehmann et al., 2012, 2014). Also, annual growth of credit-to-GDP ratio at or above three percent—particularly if sustained for a number of years—can signal danger (Global Financial Stability Report, 2011). Barajas et al. (2013) propose a risk measure based on a large change in the structural private credit gap—calculated as the difference between a benchmark and the actual level of private credit-to-GDP, where the benchmark is the predicted value of a regression of private credit to GDP on structural country characteristics.

⁹ Global Financial Stability Report (2009a) and (2009b).

¹⁰ For an example of a model that is increasingly used by many central banks to analyze vulnerabilities associated with the network of domestic and cross-border exposures, see Espinosa-Vega and Sole (2010).

¹¹ This reflects a number of factors on both the revenue (narrow and more volatile tax base compared to that in AEs) and the expenditure side, analyzed in detail in Talvi and Vegh (2005).

¹² See Mishra et al. (2012).

¹³ As Figure 5 shows, average net interest margins in LICs, and their variation within and across regions, have declined in the last two decades; however, they still remain high relative to those observed in EMs and AEs.

¹⁴ IMF (2012a).

¹⁵ For more examples, see Chami et al. (2009).

¹⁶ IMF (2012b).

¹⁷ McKinnon (1973) and Shaw (1973) are the seminal contributions in the field.