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What Can We Learn from Financial Stability Reports?

by Fabio Comelli and Sumiko Ogawa

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What Can We Learn from Financial Stability Reports?[1]

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Abstract

This paper reviews the approaches to systemic risk analysis in 32 central bank financial stability reports (FSRs). We compare and contrast the systemic risk analysis in FSRs with the IMF Article IV staff reports, noting that Article IV staff reports and FSRs frequently pick up analytical content from each other. All reviewed FSRs include a systemic risk assessment, which has not always been the case in Article IV staff reports. Also, compared to Article IV staff reports, on average, FSRs tend to cover a wider range of financial risks and vulnerabilities and tend to have more extensive discussions of the policy mix to mitigate systemic risk. In these assessments, FSRs utilize sophisticated analytical tools, such as stress tests and growth-at-risk, more frequently than Article IV staff reports. We emphasize that a central bank FSR typically presents a rich resource that IMF country teams can leverage, as already done by some, in forming their independent view about systemic risk.

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Contents

I. INTRODUCTION

The COVID-19 pandemic has shown how sudden and deep recessions can have severe consequences not only on the real economy, but also on the financial system, by putting financial stability at risk. This highlights the importance of analyzing macrofinancial linkages in macroeconomic surveillance. In addition, an important lesson from the global financial crisis is that, given the strong interlinkages of the financial sector with the rest of the economy, sound macrofinancial analysis is key for effective macroeconomic surveillance. In response, many central banks and governments have been expanding their work on macrofinancial analysis, including through the publication of financial stability reports (FSRs). The number of jurisdictions publishing FSRs rose to close to 120 in 2020, from less than ten in the late 1990s.

Greater availability of FSRs attracted the attention of researchers, and a branch of the academic literature focused on the quality of FSRs, and on how central banks communicate on financial stability issues. Some contributions assessed the quality of FSRs. Čihák (2006) (i) surveys FSRs published by central banks and other agencies in charge of financial stability and (ii) proposes a framework for assessing FSR quality. Lim and others (2017) apply the framework proposed in Čihák (2006) to assess the quality of FSRs in Latin America and the Caribbean. Other contributions attempted to assess if FSR communication is linked with financial stability. Čihák and others (2012) found that higher quality FSRs tend to be associated with more stable financial environments. Born and others (2014) found that central bank communication through FSR generally reduces financial market volatility.

In parallel with central banks' efforts to step up their financial stability work, the IMF has been strengthening macrofinancial analysis in the context of Article IV surveillance. IMF initiatives in this area include the release of the Staff Guidance Notes on Macroprudential Policy (IMF 2014a), and the launch of the Mainstreaming Macrofinancial Initiative to improve the integration of macrofinancial issues in Article IV surveillance.[2] More recently, in 2019 the IMF Independent Evaluation Office (IEO) issued an evaluation of IMF financial surveillance, which found progress in integrating macrofinancial analysis, but called for further improvement. Finally, the IMF Policy Paper on *Systemic Risk and Macroprudential Policy Advice in Article IV Consultations* (IMF 2021) found significant, but uneven, progress in the depth and integration of systemic risk analysis and macroprudential policy advice in Article IV consultations, calling, inter alia, for expanding the pool of macrofinancial talent.

A key motivation for our paper is that broad availability of high-quality FSRs can help in the IMF's efforts to strengthen macrofinancial surveillance across the membership. The IMF has at its disposal in-depth assessment tools such as those used in the Financial Sector Assessment Program (FSAP). Those assessments entail a comprehensive and in-depth examination of a country's financial sector, including systemic risk analysis. This is a

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[2] The initiative to mainstream macrofinancial issues in surveillance started with 24 pilot jurisdictions in 2015. It expanded to 67 and 128 jurisdictions in 2016 and 2017, respectively, and the full membership in 2018. IMF (2017a) provides an initial assessment of the initiative.

significant input to enrich IMF country teams' macrofinancial surveillance, but due to resource limitations, financial stability assessments under the FSAP usually take place only once in 5 or more years and tend to concentrate on a subset of the membership. The FSAP risk analysis also tends to be data and resource intensive, often relying on confidential supervisory data, while country teams typically rely on publicly available data. To compensate for these constraints, IMF country teams often rely on external research – including FSRs – to form their own view on systemic risk.

To help IMF country teams extract information from FSRs for macrofinancial surveillance, this paper examines IMF Article IV staff reports and FSRs for 32 jurisdictions. Our analysis concentrates on differences in the approach to systemic risk analysis, and explores opportunities to further expand the toolkit available to IMF country teams in the assessment of systemic risk. To this end, we review selected central banks' FSRs to learn how these reports identify vulnerabilities in key sectors (such as nonfinancial corporates and nonbank financial institutions), how FSRs use composite systemic risk indicators to assess systemic risk, and how they formulate macroprudential policy advice anchored on systemic risk.

Central questions of the paper include whether FSRs and IMF Article IV staff reports contain a clear statement on systemic risk, how systemic risks and vulnerabilities are identified, and how macrofinancial linkages are discussed. We find that, unlike IMF Article IV staff reports, all reviewed FSRs include a *well-articulated view on systemic risk* (as defined in Section II), cover a wider range of systemic risks and vulnerabilities, and discuss more the macroeconomic policy mix (monetary, fiscal, and macroprudential policy) to mitigate systemic risks. In addition, we find that FSRs tend to rely more on analytical tools, such as banks' stress tests and growth-at-risk to assess systemic risk than IMF Article IV staff reports. Despite these differences, IMF Article IV staff reports and FSRs frequently pick up analytical content from each other: while some IMF Article IV staff reports rely on stress test results published in FSRs to assess systemic risk, some FSRs use growth-at-risk—first used in the *Global Financial Stability Report* (IMF 2017b)—to assess the risks to future economic growth deriving from changes in financial conditions.

The paper also offers practical advice to IMF country teams, drawing on FSRs approaches to systemic risk that could be considered to enhance financial surveillance in Article IV Consultations. Many FSRs use composite indicators to gauge evolution and identify potential sources of systemic risks; and in addition to discussions on macrofinancial spillovers and transmission channels, some FSRs utilize empirical analyses (such as vector autoregression models) to quantify the paths and the magnitude of impact to inform forward-looking assessment. Some FSRs also conduct stress tests of nonbank financial institutions, nonfinancial corporates, and households, given their increasing importance and the significant economic shock and uncertainty from the COVID-19 pandemic. FSRs are also used by central banks to communicate macroprudential policy decision or recommendations, explain rationale behind it, and assess its effectiveness. A comparison of pre- and post-COVID-19 FSRs indicates changes in macroprudential policy and forward-looking stance. Summing up, FSRs may offer materials for the IMF country teams to draw on to complement

their analyses of systemic risk, especially in areas where granular data is not available or publicly accessible. It is important, however, that IMF country teams form their own independent views on systemic risk when drawing on analyses of FSRs.

An important consideration in interpreting the results of the analysis is that FSRs and IMF Article IV staff reports have different areas of focus. While FSRs concentrate entirely on risks to financial stability, the IMF Article IV staff reports cover macroeconomic and financial sector policies to *'promote present and prospective balance of payments stability, as well as global economic and financial stability'* (IMF 2015). The Article IV staff reports therefore tend to be broader in scope than FSRs but the two publications have a common element: financial stability. In addition, IMF Article IV staff reports summarize views from IMF staff and country authorities, as well as discussions on macroeconomic policies in the context of IMF Article IV consultations. By contrast, central bank FSRs normally present the central bank's assessment of financial stability. Nevertheless, observing how financial sector issues are covered in FSRs provides a useful input for IMF country teams' assessment of systemic risk, and it can be useful in strengthening the discussion on systemic risk and macroprudential policy in IMF bilateral surveillance.

The paper is organized as follows. Section II covers the sample and methodology, while section III illustrates the differences between Article IV staff reports and FSRs. Section IV covers examples from selected FSRs, and section V concludes.

II. SAMPLE AND METHODOLOGY

Our analysis concentrates on the discussion of systemic risks and vulnerabilities and analytical tools used in FSRs. Box 1 provides an overview of FSRs. We examine whether the reports include discussions on following time-varying and structural sources of systemic risks: [3] (i) credit risks, (ii) liquidity/funding risks, (iii) macroeconomic risk, (iv) mispricing/market risk, (v) solvency risk, (vi) contagion risks (cross-border, cross-sector, or within the financial system), and (vii) concentration risks. We considered FSRs to cover these risks if they provide clear assessment on systemic risk (including level and the direction of change), rather than only a description of recent developments. In addition, we looked at the sectoral dimension of the risks covered in FSRs—the banking sector, nonbank financial institutions, households, nonfinancial corporates, and the public sector—and whether FSRs spell out real-financial interlinkages. Furthermore, we took stock of the coverage of other sources of risks that are becoming increasingly important: risks related to cyber, technologies, and climate change.

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[3] IMF (2014) provides guidance on IMF staff's advice on macroprudential policy in IMF surveillance, including the systemic vulnerabilities to be considered in assessing the build-up of risks over time, and mapping vulnerabilities to macroprudential policy tools. These risk categories reflect systemic vulnerabilities provided in the guidance: (i) economy-wide vulnerabilities from an excessive growth in total credit; (ii) sectoral vulnerabilities arising from growing credit to the household sector; (iii) sectoral vulnerabilities arising from growing credit to the household sector; and (iv) vulnerabilities from excessive maturity and foreign exchange (FX) mismatches within the financial sector.
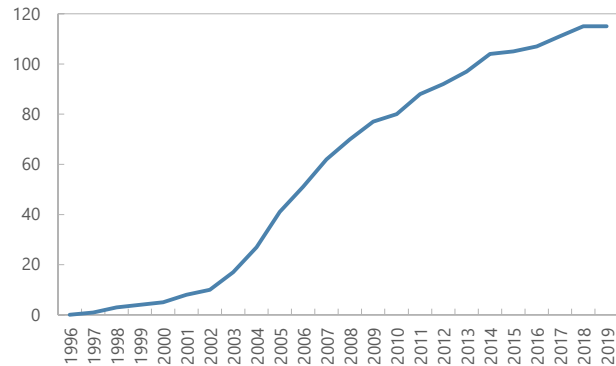

Box 1. Financial Stability Reports

Financial stability reports (FSRs) have become a widely adopted tool for country authorities to communicate their assessment of the financial sector and financial stability. The number of jurisdictions that publish FSRs has increased from less than ten in late 1990s to about 80 by mid-2000s, including emerging market and developing economies (Čihák and others 2012), reaching close to 120 in 2020.

FSRs are typically published annually or semi-annually by central banks, or in some cases by other agencies in charge of supervision or financial stability, covering wide range of issues relevant to financial stability. Many are structured around discussions of domestic and global macrofinancial environment; developments and performance of financial markets and institutions; assessment of risks in and resilience of the financial sector; and regulatory and supervisory developments. Some reports take a more topical approach, providing in-depth analysis of emerging vulnerabilities. While the banking sector tends to be the focus of the assessment of the financial sector resilience, reflecting its dominant role in many financial systems, the coverage of developments and vulnerabilities in the nonbank financial sector (for example, insurance and investment funds) as well as the households and nonfinancial corporate sectors has been increasing.

Box Figure 1. Number of Jurisdictions Publishing FSRs

Source: Čihák and others (2012); Lim and others (2017); and author's calculations.

With its principal focus on financial stability and the broad coverage of relevant macrofinancial environment and linkages, FSRs could provide useful resource for the IMF's bilateral surveillance in understanding financial stability landscape and identify areas where closer assessment of vulnerabilities is warranted.

Following IMF (2021), we define an IMF Article IV staff report or a central bank FSR as having a "**well-articulated view about systemic risk**" if the document includes a statement or view on any of the following: (i) level of systemic risk, or its change; (ii) the overall vulnerabilities in the financial system and its resilience to aggregate shocks; or (iii) how shocks could cause an impairment of all or parts of the financial system, which can cause serious negative consequences for the real economy (IMF/FSB/BIS 2009, Box 1).

Box 2. Definitions of Systemic Risk and Financial Stability

IMF/FSB/BIS (2009) defines systemic risk as a risk of disruption to financial services that is (i) caused by an impairment of all or parts of the financial system and (ii) has the potential to have serious negative consequences for the real economy. The disruption could result from shocks originating from within the financial system, or from outside the financial system that impact on it; and have significant spillovers to the real economy.

FSRs do not always provide clear definition of financial stability. Čihák and others (2012), based on an in-depth case study of FSRs of eight jurisdictions, found financial stability is defined consistently in half the cases. Similarly, Lim and others (2017), based on a review of FSRs issued by 20 countries in Latin America and the Caribbean, found that majority do not provide definition of financial stability. When defined, it tends to relate to the financial sector's role to intermediate funds, promote an efficient allocation of resources, and contribute to macroeconomic stability and growth. In some cases, the definition includes resilience to shocks. Examples include:

- *Brazil.* "The BCB defines financial stability as the regular operation, over time and in any economic scenario, of the system responsible for the financial intermediation among households, nonfinancial corporations and the government" (Banco Central do Brasil 2019).

- *Chile.* " The Central Bank's focus in the area of financial stability is centered mainly on the well-functioning of the system and the Chilean economy's access to international financial markets. In this context, financial stability is said to exist when the financial system is able to operate normally or without significant disruptions, even in the face of adverse situations." (Banco Central de Chile 2020)

- *Ireland.* "A resilient financial system is one that is able to provide services to Irish households and businesses, both in good times and in bad. The Central Bank's policy actions seek to ensure that the financial system is able to absorb, rather than amplify, adverse shocks" (Central Bank of Ireland 2019).

- *Korea.* "Financial stability refers to a condition in which the financial system works smoothly with all of its key components satisfactorily performing their roles: financial institutions carrying out their financial intermediary functions, market participants maintaining a high level of confidence in their financial market, and the financial infrastructure being well developed" (Bank of Korea 2019).

- *South Africa.* "Financial stability is not an end in itself but is regarded as an important precondition for sustainable economic growth and employment creation. Financial stability refers to a financial system that espouses confidence through its resilience to systemic risks and its ability to efficiently intermediate funds", (South African Reserve Bank 2019).

Using this definition, we examine how FSRs and IMF Article IV staff reports approached systemic risk assessments. FSRs typically apply a wide range of approaches to identify systemic risks and underpin their assessment. The approaches can be broadly categorized into (i) stress tests, (ii) indicator-based approaches, (iii) other empirical analyses, and (iv) qualitative approaches. In most cases, the stress tests involve testing the resilience of the banking sector to large negative shocks in terms of solvency and liquidity based on macro scenarios. However, some apply stress tests and sensitivity analyses to nonbank financial institutions, and the household and corporate sectors, as well as contagion analyses. Indicator-based approaches include heatmaps and composite indices of vulnerabilities by sector and market, as well as indicators on the cross-sectional dimension of the financial system (for example, its degree concentration).[4] Examples of empirical approaches used to capture cyclical systemic risks include financial conditions index and growth-at-risk, credit-to-GDP gaps and financial cycles, and network analysis. When it is difficult to quantify vulnerabilities, FSRs often utilize qualitative approaches such as risk assessment matrices and surveys (such as on risk and sentiment of market participants and financial institutions).

Our examination covers FSRs published by central banks in 32 jurisdictions (Table 1), comprising 12 advanced economies (AEs) and 20 emerging market and developing economies (EMDEs). The sample was selected to have a balanced representation of economies in terms of income levels, financial system complexity, and geographic location. We reviewed the latest available FSRs as of mid-2020. We also examined other more recently issued FSRs, when feasible, for comparison and consistency of coverage and approaches used for systemic risk analysis. In the following section, we present the results of

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[4] See IMF, FSB, BIS (2016).

the FSR examination and compare them with the examination of IMF's 2019 Article IV staff reports for the same set of jurisdictions conducted by IMF (2021).[5]

Table 1. Sample of FSRs Examined

Jurisdiction	Issued by	Frequency	Latest issue	Issues reviewed
Australia	Reserve Bank of Australia	semi-annual	Oct 2020	Oct 2019 and Apr 2020
Bangladesh	Bangladesh Bank	annual	2019	2019
Brazil	Banco Central do Brasil	semi-annual	Oct 2020	Apr 2020
Cambodia	National Bank of Cambodia	annual	2019	2019
Canada	Bank of Canada	annual	2020	2020
Chile	Banco Central de Chile	semi-annual	2H 2020	2H 2019 and 1H 2020
Colombia	Banco de la República	semi-annual	2H 2020	2H 2019 and 1H 2020
Denmark	Danmarks Nationalbank	semi-annual	2H 2020	2H 2019 and 1H 2020
Germany	Deutsche Bundesbank	annual	2020	2019 and 2020
Ghana	Bank of Ghana	Bimonthly (Banking Sector Report)	May 2020	March 2020
Hong Kong, SAR	Hong Kong Monetary Authority	semi-annual	Sep 2020	Sep 2019 and Mar 2020
Hungary	Magyar Nemzeti Bank	semi-annual	Nov 2020	Dec 2019 and May 2020
India	Reserve Bank of India	semi-annual	Jan 2021	Jul 2020
Indonesia	Bank Indonesia	semi-annual	Sep 2020	Mar 2020
Ireland	Central Bank of Ireland	semi-annual	2020:II	2019:II and 2020:I
Italy	Banca d'Italia	semi-annual	2020 No.2	2019 No.2 and 2020 No.1
Japan	Bank of Japan	semi-annual	Oct 2020	Apr and Oct 2020
Korea	Bank of Korea	semi-annual	Dec 2020	Dec 2019 and Jun 2020
Malaysia	Bank Negara Malaysia	semi-annual	2H 2020	1H 2020
Mauritius	Bank of Mauritius	semi-annual	Dec 2020	Oct 2019 and Jun 2020
Mexico	Banco de México	semi-annual	2H 2020	2H2019 and 1H 2020
Romania	National Bank of Romania	semi-annual	Jun 2020	Dec 2019 and Jun 2020
Russia	Central Bank of Russian Federation	semi-annual	2020 Q2-Q3	2019 Q4-2020 Q1 and 2020 Q2-Q3
Rwanda	National Bank of Rwanda	annual	2019/20	2019/20
Saudi Arabia	Saudi Central Bank	annual	2020	2019 and 2020
Seychelles	Central Bank of Seychelles	annual	2019	2019
Singapore	Monetary Authority of Singapore	annual	2020	2019 and 2020
South Africa	Reserve Bank of South Africa	semi-annual	2nd edition 2020	2nd edition 2019 and 1st edition 2020
Sweden	Riksbank	semi-annual	2020:2	2019:2 and 2020:1
Switzerland	Swiss National Bank	annual	2020	2019 and 2020
Thailand	Bank of Thailand	annual	2019	2019
Turkey	Turkish Central Bank	semi-annual	Nov 2020	Nov 2019 and May 2020

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[5] For the methodology and detailed findings, see IMF (2021).

III. DIFFERENCES BETWEEN ARTICLE IV STAFF REPORTS AND FSRS

FSRs and IMF Article IV staff reports fulfill different purposes, but they share coverage of financial stability and policies. Hence, finding how financial sector issues are covered in FSRs not only presents more options to country teams to assess systemic risk, but can also be useful to strengthen the discussion on systemic risk and macroprudential policy in IMF bilateral surveillance.

The assessment identifies four main differences between IMF Article IV staff reports and FSRs. These include (i) the presence of a well-articulated systemic risk assessment, (ii) the identification of risks to financial stability (specifically, the time-varying and structural sources of systemic risk, and new risks to financial stability such as those related to cyber, technologies and climate change), and sectoral vulnerabilities, (iii) the discussion on the policy mix to mitigate systemic risk, and (iv) the tools used to assess systemic risk.

A. Differences Between Article IV Staff Reports and FSRs: Systemic Risk Assessment, Identification of Risks and Vulnerabilities, and Discussion on the Policy Mix

Figures 1–3 show the main differences between Article IV staff reports and FSRs in terms of systemic risk assessment, identification of risks and vulnerabilities, and discussions on the policy mix. Unlike IMF Article IV staff reports for emerging market and developing economies (EMDEs), most of the advanced economies' (AEs) staff reports contained a well-articulated view on systemic risk (Figure 1).[6] By contrast, all FSRs included a well-articulated view on systemic risk. Furthermore, while FSRs cover a wide range of systemic risks and sectoral vulnerabilities, IMF Article IV staff reports tend to focus mainly on credit risk and vulnerabilities in the banking sector.[7] Finally, for both AEs and EMDEs, FSRs are more likely than IMF Article IV staff reports to contain a discussion on the policy mix (monetary, fiscal, and macroprudential policy) needed to mitigate systemic risks.

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[6] As discussed in IMF (2021), the difference between AEs and EMDEs reflects a combination of factors, including often larger and systemic financial systems in AEs that warrant more scrutiny; more analytical material available to AEs country teams to draw on (such as GFSR and external analyses); a still developing macroprudential policy frameworks in some EMDEs; greater data availability in AEs; and more urgent and different policy priorities.

[7] The broad coverage of risks and vulnerabilities in FSRs shows that central banks assess that systemic risks can build up across a range of nonbank financial institutions, as also argued by Cecchetti and others (2020).

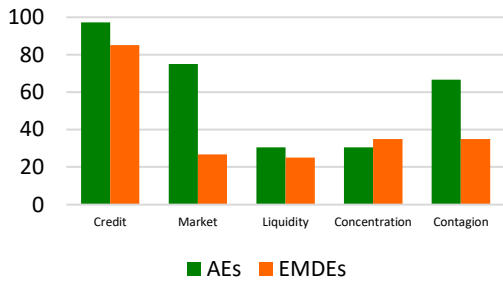**Figure 1. Systemic Risk in Article IV Staff Reports and FSRs**

Article IV staff reports with a well-articulated view on systemic risk.
(Percent of AIV staff reports in each country group, 2019)
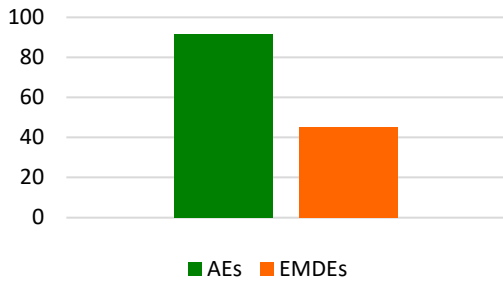
Financial Stability Reports with a well-articulated view on systemic risk.
(Percent of FSRs in each country group, 2019-2020)
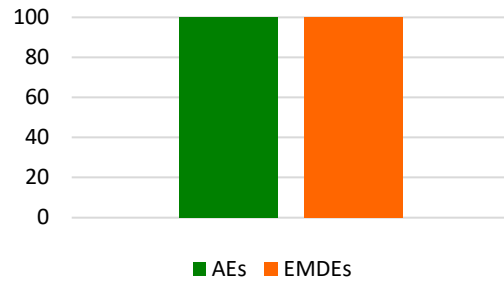
Sources of cyclical and structural systemic risks assessed in Article IV staff reports.
(Percent of AIV staff reports in each country group, 2019)

Sources of cyclical and structural systemic risks assessed in Financial Stability Reports.
(Percent of FSRs in each country group, 2019-2020)
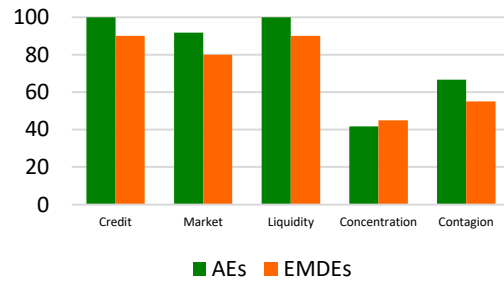
Sources of emerging risks to financial stability (cyber, digital technologies and climate change) assessed in Article IV staff reports.
(Percent of AIV staff reports in each country group, 2019)

Sources of emerging risks to financial stability (cyber, digital technologies and climate change) assessed in Financial Stability Reports.
(Percent of FSRs in each country group, 2019-2020)

Sectoral vulnerabilities assessed in Article IV staff reports.
(Percent of AIV staff reports in each country group, 2019)

Sectoral vulnerabilities assessed in Financial Stability Reports.
(Percent of FSRs in each country group, 2019-2020)

Discussions on the policy mix in Article IV staff reports.
(Percent of AIV staff reports in each country group, 2019)

Discussions on the policy mix in Financial Stability Reports.
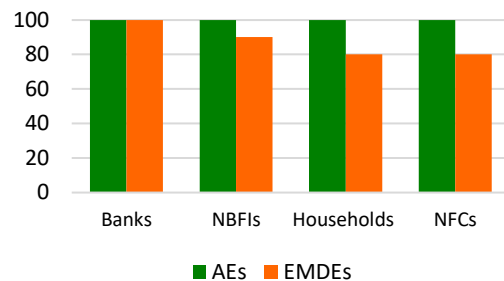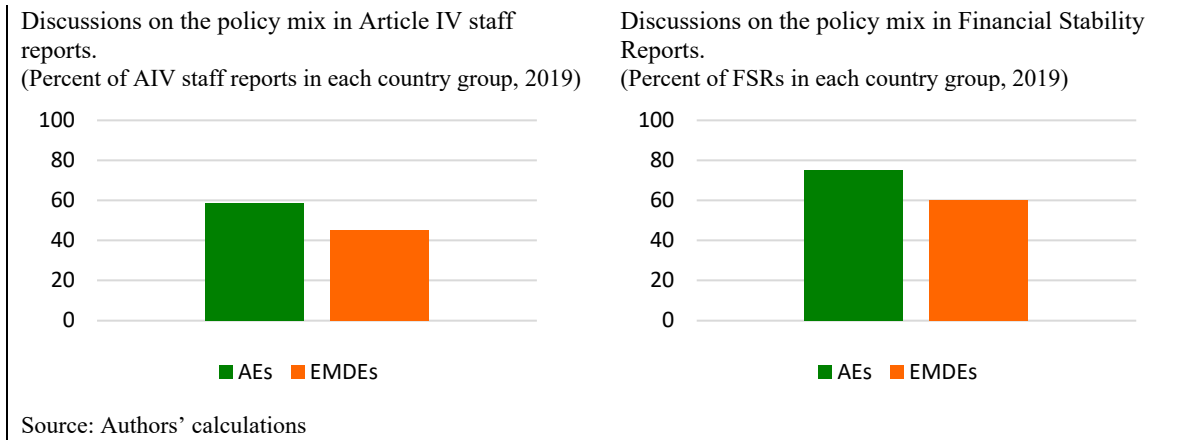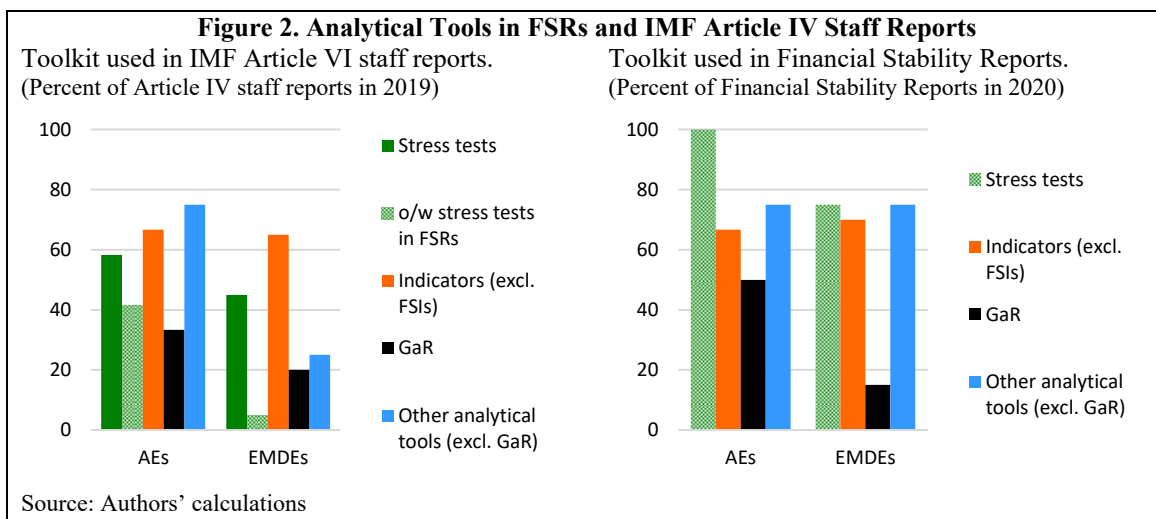(Percent of FSRs in each country group, 2019)

Source: Authors' calculations
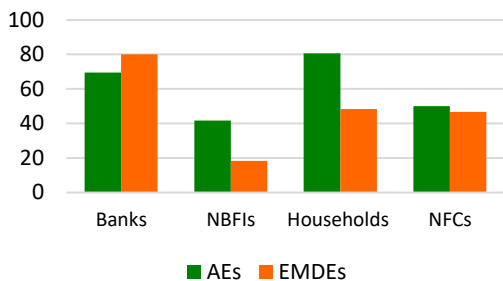
B. Analytical Tools Used in Article IV Staff Reports and FSRs to Identify Vulnerabilities

Figure 2 shows that the use of analytical tools is more frequent in FSRs than in IMF Article IV staff reports, particularly in the EMDEs country group. This possibly reflects greater macrofinancial data availability in the AEs country group, which would facilitate application of quantitative approaches. We also find that IMF Article IV staff reports and central bank FSRs pick up analytical content from each other to assess systemic risk and analyze macrofinancial linkages. Specifically, IMF Article IV staff reports often draw on central banks' stress tests in FSRs to assess systemic risk—around 40 percent of the AE staff reports reviewed draw on the conclusions of the stress tests in FSRs. On the other hand, more than a third of the AE FSRs incorporate the growth-at-risk framework introduced in the Global Financial Stability Report (IMF 2017b) and frequently used in IMF Article IV staff reports to assess risks to future GDP growth from a tightening in financial conditions.

Figure 2. Analytical Tools in FSRs and IMF Article IV Staff Reports

Toolkit used in IMF Article VI staff reports.
(Percent of Article IV staff reports in 2019)

Toolkit used in Financial Stability Reports.
(Percent of Financial Stability Reports in 2020)

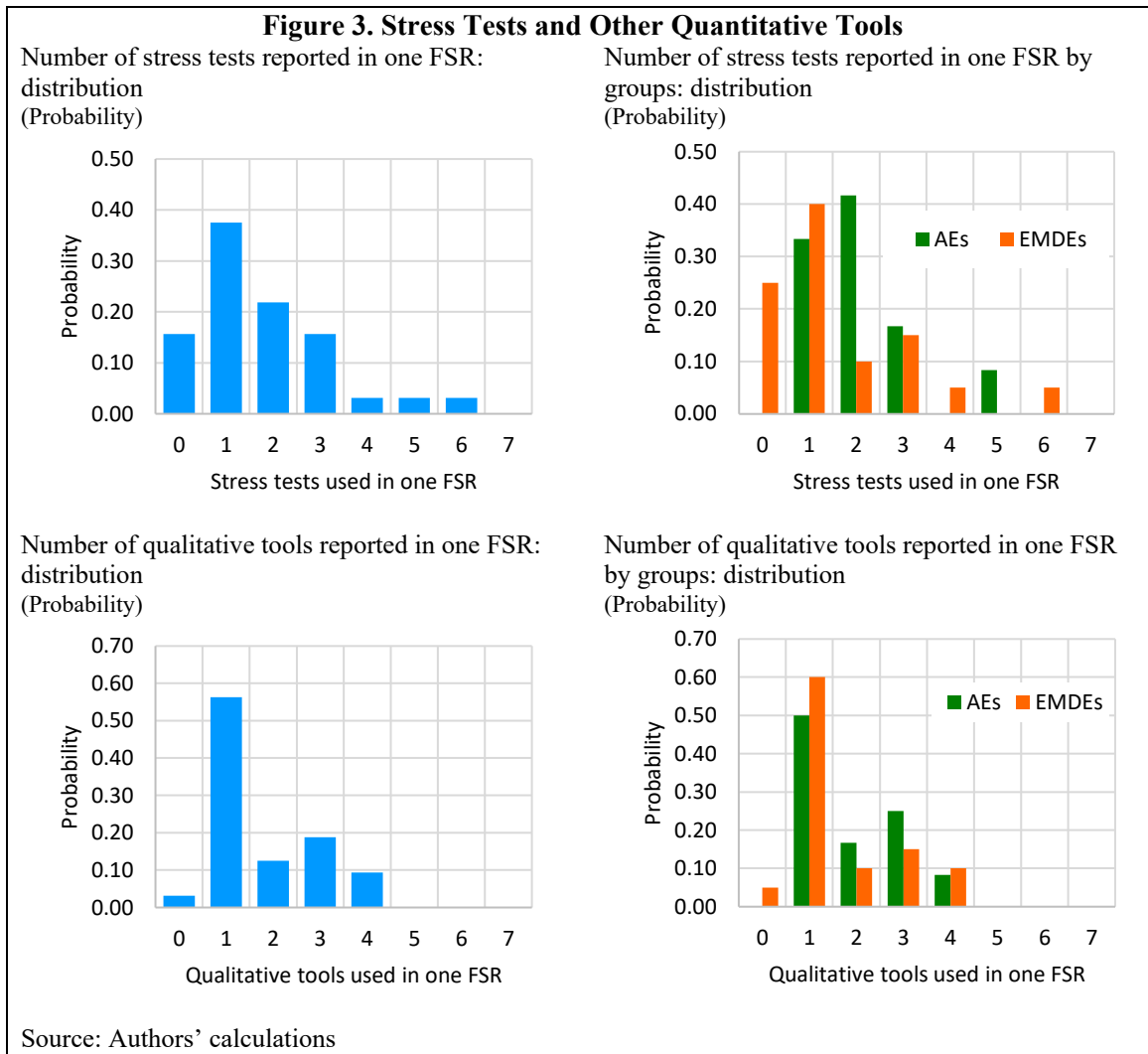Source: Authors' calculations

Among the analytical tools used to assess systemic risk in FSRs, stress tests are the most frequently used tool to assess systemic risk. 84 percent of all the FSRs reviewed contains at least one stress test (Figure 3). By country groups, all AE FSRs reviewed contain at least one stress tests to assess systemic risk, while the share is lower in the EMDE group (75 percent).

There is, however, a high degree of heterogeneity among stress tests used in FSRs in terms of type and magnitude of shocks which characterize the underlying assumptions, and by analytical complexity. For proper interpretation, country teams using these results should have an in-depth look into the assumptions behind the stress tests, as well as how credit losses are estimated.

Both IMF Article IV staff reports and FSRs often make use of indicator-based approaches. In addition to financial stability indicators, which all of the staff reports included, roughly 2/3 of both staff reports and FSRs assessed used indicator-based approaches. These approaches include heatmaps based on individual or composite indicators representing different aspects of the financial system and the real economy (for example, markets, financial institutions, pricing and indebtedness); composite indicators on financial conditions, systemic risk and market stress; and indicators on structural systemic risks (for instance, concentration and contagion risk). to measure systemic risk. While indicator-based approaches help track the changes in systemic risk and vulnerability over time, assessment on the level of risk can be difficult to pinpoint empirically. Furthermore, composite indicators could be complicated when various underlying indicators point to different levels or directions.

To assess systemic risk, in addition to quantitative tools, FSRs make use of qualitative tools, such as risk assessment matrices and surveys (bottom charts in Figure 3). Risk assessment matrices (RAMs) typically include information on key risk to financial stability, namely possible shocks which may hit the financial system. IMF's staff reports include RAMs, which discuss relative likelihood of risks and their potential impact throughout the economy. They often feature risks related to the financial sector or spillovers to and from the financial sector and the real economy. Some staff reports integrate these risks into the discussion of financial stability risks. Some of the surveys presented in FSRs record the expectations of households and nonfinancial corporations about economic activity, and the lending expectations of banks. Other surveys include the expectations of risk managers about the main risks they expect for financial stability. There is a high share of FSRs employing at least one qualitative tool to assess systemic risk, including all AE FSRs. The frequent use of these qualitative approaches suggests that central banks tend to supplement quantitative assessment of systemic risk with qualitative approaches, for example to gauge forward-looking perception that is difficult to quantify or when data is not readily available.

Figure 3. Stress Tests and Other Quantitative Tools

Number of stress tests reported in one FSR:
distribution
(Probability)

Number of stress tests reported in one FSR by
groups: distribution
(Probability)

Number of qualitative tools reported in one FSR:
distribution
(Probability)

Number of qualitative tools reported in one FSR
by groups: distribution
(Probability)

Source: Authors' calculations

IV.   EXAMPLES FROM FSRS

In this section, we present selected examples extracted from the reviewed FSRs. Examples
include: (i) use of composite systemic risk indicators, (ii) treatment of macrofinancial
linkages, (iii) analytical tools used for nonbank financial institutions and nonfinancial
sectors, and (iv) macroprudential policy advice in FSRs.

A.   Composite Systemic Risk Indicators

In this subsection, we present one example of composite indicators to measure systemic risk
used in FSRs. While composite systemic risk indicators are frequently used in the FSRs, we

focus on the systemic risk indicator used in the Riksbank's FSR.[8] The Riksbank uses a composite systemic risk indicator to track risks and vulnerabilities in different sectors and markets: the household sector, the nonfinancial corporate sector, the banking sector and the property market, and the external sector. For each of these sectors, it first constructs sectoral indicators by standardizing and aggregating underlying indicators that represent various dimension of each sector. Then, the information contained in these five sectoral indicators is aggregated into a single overall systemic risk indicator (Figure 4).[9]
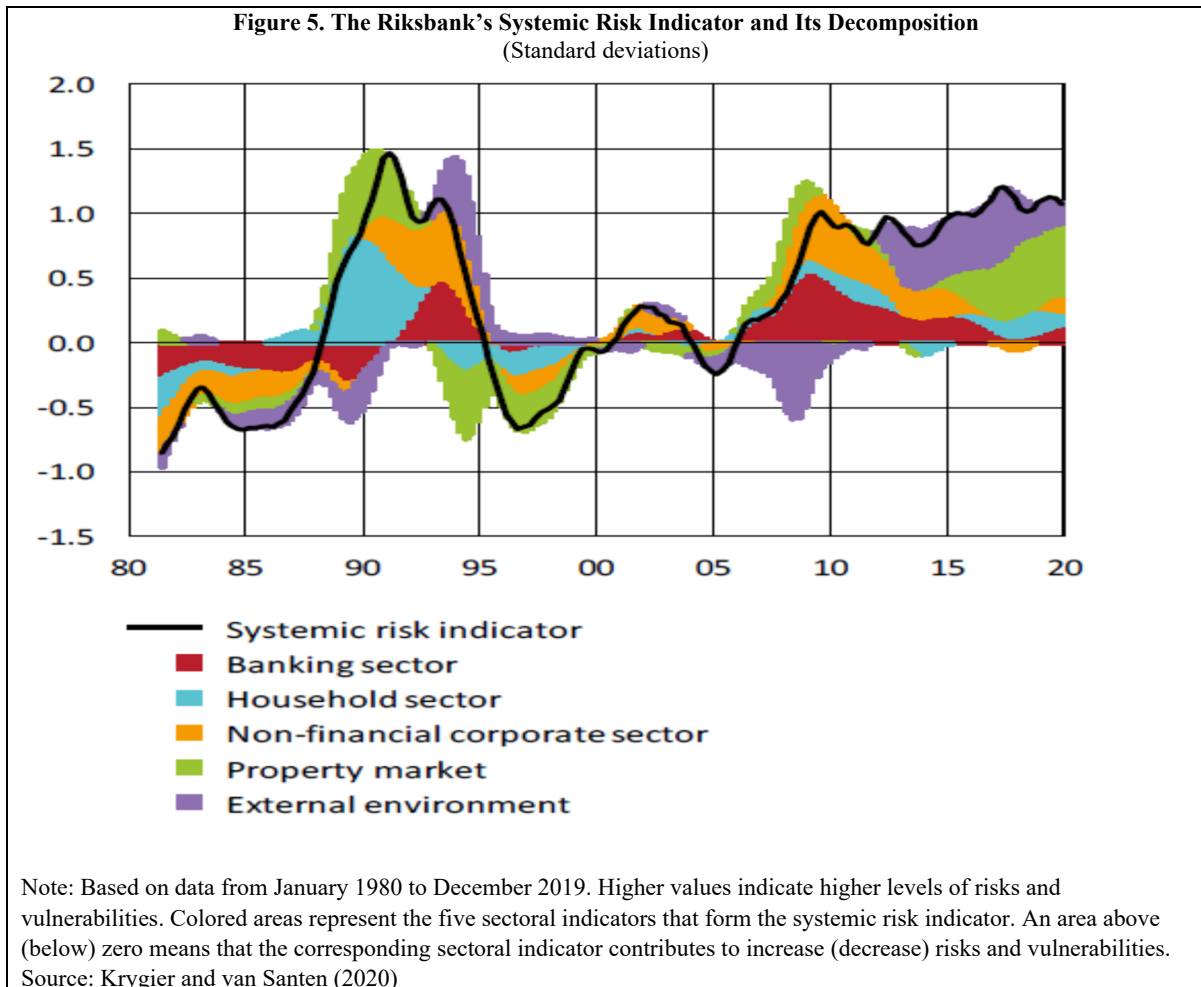
Figure 4. Structure of the Riksbank's Systemic Risk Indicator

Note: Below each sectoral indicator are input variables that are used when creating the sectoral indicators. The numbers in brackets signal that the variable is constructed from several similar variables that have been weighed together.
Source: Krygier and van Santen (2020)
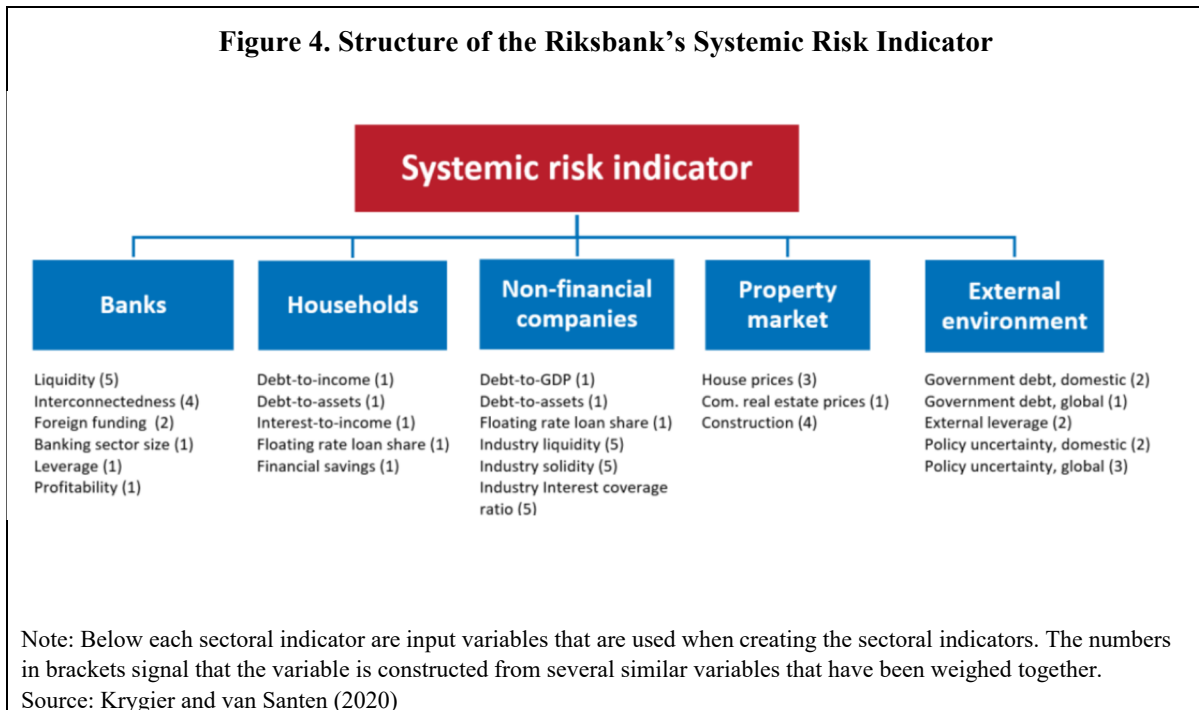
In addition to the overall level of systemic risk, the subindices show how developments in the specific parts of the financial system contribute to the overall level of systemic risk in Sweden (Figure 5).

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[8] Other examples include FSRs published by central banks of Bangladesh, Brazil, Chile, Colombia, Germany, Hungary, India, Indonesia, Ireland, Italy, Japan, Korea, Mexico, Malaysia, Mauritius, Romania, Seychelles, Singapore, South Africa, Switzerland, and Turkey.

[9] Krygier and van Santen (2020) provide details on the construction of the Riksbank's systemic risk indicator.

Figure 5. The Riksbank's Systemic Risk Indicator and Its Decomposition
(Standard deviations)

Note: Based on data from January 1980 to December 2019. Higher values indicate higher levels of risks and vulnerabilities. Colored areas represent the five sectoral indicators that form the systemic risk indicator. An area above (below) zero means that the corresponding sectoral indicator contributes to increase (decrease) risks and vulnerabilities.
Source: Krygier and van Santen (2020)

Composite risk indicators have the advantage of presenting a summary measure of the state of systemic risk that is easy to follow and visualize changes over time. Indicators on individual segment also help identify which part of the financial sector is contributing to the overall level of systemic risk. However, aggregate risk metrics may underestimate or overestimate systemic risk in different phases of the cycle (Iossifov and Dutra 2021). They may also mask underlying emergence of vulnerabilities, especially when various underlying indicators are moving in different directions and offset each other in the process of aggregation. This could be mitigated to some extent by monitoring developments at more granular level (for example, sectoral sub-indices and underlying indicators). The later would also be a better guide in formulating a targeted policy response to mitigate the build-up of vulnerabilities, which requires identifying appropriate macroprudential policy tools and calibration. In addition, vulnerabilities arising from interconnectedness, weakness in financial supervision, integrity and market infrastructure are difficult to capture in a timely fashion with aggregate risk metrics.

B. Treatment of Macrofinancial Linkages

Macrofinancial linkages are typically discussed in multiple layers in FSRs, including from the perspective of global and domestic macrofinancial environment, effects and interaction of policies in other areas such as government financing and housing, developments in the household and corporate sectors, and in terms of specific vulnerabilities and potential spillovers. They are often discussed in qualitative terms, for example, spelling out the amplification mechanism of the decline in house prices to the real economy and the need for policies in areas in addition to macroprudential policy to mitigate systemic risk (***Sweden's FSR***); a macrofinancial risk assessment matrix that discuss possible sources of risks and potential impact on financial stability (***Mauritius' FSR***); and bank-sovereign nexus posing threats to financial stability (FSRs of ***Germany, Ireland, South Africa,*** and ***Sweden***). With significant and wide-spread impact of COVID-19 on economic activities, FSRs published in 2020 have increased focus on spillovers from harder-hit sectors on credit quality through loss of revenue and employment and resulting decline in repayment capacity of borrowers (FSRs of ***Brazil, Chile, Germany, Hungary, Ireland, Romania***, ***Sweden,*** and ***Turkey***).

Some FSRs use econometric approaches for identifying the channels and quantifying the magnitude of transmission of shocks, to inform forward-looking assessment. Vector auto regression (VAR) models are one example, employed in ***Germany's FSR*** to examine the impact of global financial stress on the domestic financial system and the economy more broadly. ***Hong Kong SAR's FSR*** uses the quantile regression model and VAR to assess the impact of the exchange rate on local currency and hard currency bond fund flows. ***Mexico's FSR*** estimates impulse response of delinquency rate by type of credit to various macro variables, including inflation, salaries and economic activities. The results were used to forecast the delinquency rate going forward, taking into account the shock due to the pandemic and decline in oil prices. Finally, ***Turkey's FSR*** uses filtering methods to identify episodes of credit booms and busts in Turkey.

Chile's FSR provides a good example of quantitative analyses of two-way interlinkages between the real economy and the financial sector. On the shock transmitted from the real economy to the financial sector, it notes the close relationship between the decline in sales and default of firms with local bank financing and constructs a measure of firm vulnerability. On the financial-to-real transmission, the FSR examines the effect of availability of credit to firms on growth in jobs, sales and investment. It also examines the interaction and feedback mechanisms between banks and firms using the dynamic stochastic general equilibrium model, calibrated for Chile and incorporating a financial module.

C. Analytical Tools/Approaches Used for Nonbank Financial Institutions, Nonfinancial Corporates and Households

Nonbank Financial Institutions

Stress tests of nonbank financial institutions are less common and tend to be covered in FSRs in a more ad-hoc manner than for banks, in part owning to less established or standardized approach and less significance of these institutions in the financial sector. That said, there are

some examples of FSRs that conduct stress tests of different sub-segment of nonbank financial institutions when relevant. ***India's FSR***, for example, tests resilience of cooperative banks and nonbank lenders to increase in nonperforming assets, and liquidity stress tests of cooperative banks to increases in cash outflows. It also conducts contagion analysis to banks from failure of nonbank financial institutions, as well as among banks. ***Korea's FSR*** uses its Systemic Risk Assessment Model for Macroprudential Policy to analyze the resilience of the financial sector to multiple simultaneous shocks, including deterioration of global trade conditions and instability in the financial markets. The model takes into consideration the impact from contagion, in addition to the first-round losses to financial institutions, and cover six sectors (banks, insurance companies, securities companies, mutual credit cooperatives, mutual savings banks, and credit card companies). ***Canada's FSR*** stress tests bond mutual funds to a rapid increase in interest rates, in which their asset sales are found to have larger effects on market prices and liquidity, given their increased presence than in the past. ***Italy's FSR*** draws on the result of the stress tests of insurance companies conducted by the European Insurance and Occupational Pension Authority and discusses that the risks related to a low-for-long interest rates are limited than those for other European insurers. ***Germany's FSR*** stress tests the investment fund sector to assess how large-scale sales of commonly held securities by investment funds could amplify an initial shock in the form of an abrupt decline in global equity and bond prices, leading to losses in the funds' securities portfolios. ***Malaysia's FSR*** provides a qualitative assessment on the impact of the pandemic outbreak on systemic nonbank financial institutions.

Network analysis is also used to capture interconnectedness within the domestic financial sector, and with the rest of the economy. It tends to reflect a static snapshot of linkages at a point in time and may not indicate where shocks may originate or the magnitude of spillover they may generate. However, it could be a useful tool to identify potential channels of propagation of shocks, and changes over time could shed light on where vulnerabilities are emerging. ***Cambodia's FSR*** uses balance sheet analysis to examine financial interconnectedness of domestic economic sectors and the external sector, and between different segments of the financial sector. Based on the structure of mutual transactions, ***Korea's FSR*** tracks default contagion risks within the banking sector and across financial sectors.

Singapore's FSR provides interesting examples of quantitative assessments of emerging risks. Its 2019 FSR features cyber risk stress tests for banks and insurers, in which stress scenarios involve direct and indirect attacks for banks and cyber insurance coverage claims for insurers. ***Germany's FSR*** uses a survey to show that a large number of financial institutions are not yet factoring in climate-related risks into their risk analyses.

Nonfinancial Corporate Sector

In light of the significant economic impact from the COVID-19 shock, many FSRs covered vulnerabilities in the nonfinancial corporate sector. Some present granular data on sector-level firm performances and bank exposures to the more affected sectors (such as the FSRs of ***Hungary*** and ***Indonesia***). The FSRs of ***Korea*** and ***Japan*** conduct corporate stress tests

with differentiated sales shocks by sector on liquidity shortfalls and assessed the impact of policy measures introduced in response. The FSR of **Brazil** reports COVID-19 stress tests, in which the shock impact companies and propagated through the interconnection between them. The resulting credit shock in turn is applied to the financial system, supplemented by interbank contagion, to evaluate the impact on bank capital. The approach was used even prior to the pandemic, for example, the FSR of **Singapore** conducts stress tests and reverse stress tests of publicly listed Asian corporates on an ad-hoc basis, and on a more regular basis, also conducts stress tests on publicly listed corporates in Singapore**.** The stress tests assess the impact of earnings and interest shocks on debt-at-risk.

Chile's FSR looks into ownership network of corporate groups and the relation between default of individual firm and others in the same corporate group, which could be relevant in considering concentration risk at group level. **Hungary's FSR** examines the transmission of shocks from firms in sectors vulnerable to the COVID-19 to those in other sectors, based on the data on value added tax.

Household Sector

Scenario-based stress tests and sensitivity analysis are often used to assess resilience of households. Sources and magnitude of shocks are calibrated to reflect relevant vulnerabilities. For example, FSRs of **Australia** and **Hungary** examine the impact of the decline in housing prices to the share of borrowers with negative equity; *Sweden* conducts stress tests on debt payment ability of a random sample of new mortgage borrowers under various scenario, including unemployment and the rise in interest rate. FSRs of **Chile**, **Korea** and **Thailand** examine the impact on debt-at-risk or liquidity shortage from loss of employment and income shock. **Malaysia's FSR** noted the increase in retail participation in the equity market. It conducted a sensitivity analysis of shock to equity market equivalent to that during the Asian financial crisis to household liquid financial asset cover.

Housing-related risks receive prominent attention in a number of FSRs. The FSR of **Ireland** uses a model-based approach to estimate misalignment of house prices from economic fundamentals. **Germany's FSR** conducts a survey to gauge household expectations on the future development of real estate prices. **Turkey's FSR** uses a vector autoregressions model to analyze the effects of unemployment and credit developments on asset quality.

D. Macroprudential Policy Decisions and Advice

Discussions on the policy mix needed to maintain financial stability vary greatly across FSRs. In some cases, when the central bank has macroprudential policy setting responsibilities, FSRs are used to communicate the macroprudential policy decision and the rationale behind it. In other cases, when the central bank is not responsible for setting macroprudential policy, it uses the FSR to convey its views on the needed policy mix to maintain financial stability, and to formulate macroprudential policy recommendations.

In this context, we have selected two examples (Tables 2 and 3) to show how central banks use FSRs to communicate their policy decisions – if they have macroprudential policy setting responsibilities – or policy advice – if they do not have macroprudential policy setting

responsibilities. In each example, we show how post-COVID macroprudential policy decisions and advice change with respect to those pre-COVID.

Table 2. Macroprudential Policy Discussion in FSR: Examples		
	Pre-COVID-19	**Post-COVID-19**
Macroprudential policy decision	Maintenance of Countercyclical Capital Buffer (CCyB) rate at 1%.	Reduction of CCyB rate to 0%.
Connection with systemic risk	Measure consistent with central bank's risk assessment, **reflecting continued build-up of cyclical systemic risk**, both domestically and globally.	Measure aims at maintaining sustainable credit supply, **limiting scope for the banking system to amplify exogenous shock**.
Forward-looking component of the policy advice	Central bank stands ready to adjust CCyB in either direction as appropriate.	No increase in CCyB to be announced in Q1-21, at the earliest.
Source: authors, based on the surveyed FSRs		

Several differences emerge between the pre-COVID-19 and post-COVID-19 macroprudential policy advice in Table 2. Before the pandemic outbreak, the central bank decides to maintain the Countercyclical Capital Buffer (CCyB) rate at 1 percent, highlighting its concern with rising systemic risk. Looking forward, the central bank maintains a neutral bias, by signaling that the CCyB rate may be modified in either direction. Post-COVID-19, the central bank decides to reduce the CCyB rate to zero to support the ability of the banking system to supply credit to the economy. In terms of the forward-looking component of the macroprudential policy advice, the central bank adopts an easing bias, as it signals it will not increase the CCyB rate before the end of Q1-21. These examples show how the central bank motivates its decision by connecting it to its systemic risk assessment and provides a sense of the direction of its future macroprudential policy decisions.

Table 3. Macroprudential Policy Advice in FSRs: Examples		
	Pre-COVID-19	**Post-COVID-19**
Macroprudential policy recommendation.	If housing and tax policy measures are not implemented and debt increases at a faster rate, macroprudential policy measures may need to be tightened.	• Further measures (fiscal, monetary and macroprudential) may be needed to support credit supply and safeguard financial stability.
Connection with systemic risk.	Important to continuously assess effects of macroprudential policy measures, and act if **risks and vulnerabilities associated with rising household indebtedness increase**.	Macroprudential policy easing necessary to improve banks' **ability to supply credit to households and firms**.
Forward-looking component of the policy recommendation.	Tighten if household indebtedness increases.	Support measures may lead to moral hazard if maintained indefinitely.
Source: authors, based on the surveyed FSRs		

We also observe a change in macroprudential policy recommendations following the pandemic outbreak in the case where the central bank does not have macroprudential policy setting responsibilities. While the policy recommendation involves the policy mix both pre- and post-pandemic, in the post-COVID-19 policy recommendation the central bank stresses that the effectiveness of macroprudential policy to mitigate systemic risk can be strengthened if accompanied by appropriate fiscal and monetary policies. The latter implies that the policy effort to mitigate rising systemic risk should not fall entirely on macroprudential policy, but rather it should be distributed across all policy areas. In both pre- and post-pandemic cases, the macroprudential policy recommendation is connected with the central bank's systemic risk assessment and has a forward-looking component.

V. CONCLUSIONS

The COVID-19 shock and the global financial crisis raised to the surface the strong interlinkages and feedback loops to and from the financial sector and the rest of the economy. In response, both country authorities and the IMF have made efforts to enhance macrofinancial analysis and assessment of systemic risk. There has been much progress in improving the depth and the quality of the analysis in IMF's Article IV staff reports, but IMF staff reports are often constrained by broader range of policy issues they are mandated to cover, varying degree of availability of data and analytical materials, and resource constraints to build-up macrofinancial expertise (IMF 2021). While the FSAP provides significant inputs to systemic risk analysis in IMF's staff reports, resource limitations prevent conducting assessments under the FSAP at annual frequency for the entire IMF membership. Moreover, the FSAP analysis often relies on supervisory data that Article IV country teams typically do not have access to. In this context, FSRs, which many country authorities use to communicate their assessment of financial stability, could be a useful resource with their comprehensive discussion of financial sector-related risks and granular analyses.

We reviewed selected FSRs to assess whether they include a clear statement on systemic risk, the types of risks covered and analytical approaches used to identify these risks, and how macrofinancial linkages are discussed, and compared the findings with those in IMF Article IV reports. We find all FSRs reviewed include a well-articulated view on systemic risk, and more often cover a wider range of risks and vulnerabilities and discuss macroeconomic policy mix and interactions than Article IV staff reports. Furthermore, FSRs tend to utilize a greater variety of analytical tools, including stress tests and indicator-based analyses, as well as qualitative approaches such as surveys. There is "cross-fertilization" between the IMF Article IV staff reports and FSRs, where the staff reports drawing on analyses presented in FSRs (such as stress test results) and FSRs adopting analytical tools developed by the IMF (such as growth-at-risk). This cross-fertilization helps improve the quality of the dialogue between the IMF teams and country authorities on systemic risk.

The FSRs reviewed provide useful examples of quantitative and qualitative approaches that can be considered by the IMF Article IV surveillance to enhance analyses of vulnerabilities beyond the banking sector and credit risk. Many FSRs use composite indicators to gauge

evolution and identify potential sources of systemic risks; and in addition to discussions on macrofinancial spillovers and transmission channels, some FSRs utilize empirical analyses (such as VAR models) to quantify the paths and the magnitude of impact to inform forward-looking assessment. FSRs conduct stress tests of nonbank financial institutions, nonfinancial corporates and households in some cases, given their increasing importance and the significant economic shock and uncertainty from the COVID-19 pandemic. FSRs are used by central banks to communicate macroprudential policy decisions, explain their rationale, and assess their effectiveness. A comparison of central banks FSRs pre-COVID and during COVID indicates changes in macroprudential policy stance.

The assessment and the examples identified in this review indicate that FSRs offer rich analysis that IMF's Article IV teams can draw on, especially in areas where granular data is not available or publicly accessible. The relevance and the applicability of the focus and the analytical toolkits would depend on country-specific circumstances, and this paper aimed to provide useful examples and references. It is important, however, that IMF country teams form their own independent views on systemic risk when drawing on analyses of FSRs.

Finally, the analysis of this paper could be extended in several directions. First, in terms of central bank communication, it would be interesting to assess – possibly through text mining techniques – if changes in the central bank's assessment on systemic risk tend to be reflected or not in the tone used by the central bank when setting or formulating recommendations on macroprudential policy. For example, rising concerns about systemic risk may give central banks a sense of urgency about the need to implement mitigating measures to preserve financial stability. Relatedly, an interesting policy question is whether central banks tend to rely primarily on the macroprudential policy tool, or they would also deploy a mix of policy tools (namely monetary, fiscal, exchange rate, capital flow management measures). Finally, further research could study how and to what extent systemic risk is quantified in macrofinancial surveillance, given the challenges associated to the measurement of systemic risk.

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