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EFFECTIVENESS OF MACROPRUDENTIAL TOOLS FOR ISLAMIC BANKING

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ABOUT THE ISLAMIC FINANCIAL SERVICES BOARD (IFSB)

The IFSB is an international standard-setting organisation which was officially inaugurated on 3 November 2002 and started operations on 10 March 2003. The organisation promotes and enhances the soundness and stability of the Islamic financial services industry by issuing global prudential standards and guiding principles for the industry, broadly defined to include banking, capital markets and insurance sectors. The standards prepared by the IFSB follow a lengthy due process as outlined in its Guidelines and Procedures for the Preparation of Standards/Guidelines, which involves, among others, the issuance of exposure drafts, holding of workshops and, where necessary, public hearings. The IFSB also conducts research and coordinates initiatives on industry-related issues, as well as organises roundtables, seminars and conferences for regulators and industry stakeholders. Towards this end, the IFSB works closely with relevant international, regional and national organisations, research/educational institutions and market players.

For more information about the IFSB, please visit **www.ifsb.org**.

ACRONYMS

AMBD	Authority Monetary Brunei Darussalam
BCBS	Basel Committee on Banking Supervision
BIS	Bank for International Settlements
CAR	Capital adequacy ratio
CBB	Central Bank of Bahrain
CCB	Capital conservation buffer
CCyB	Countercyclical capital buffer
CET1	Common equity Tier 1
D-SIBs	Domestic systemically important bank
DSTI	Debt-service-to-income ratio
DTI	Debt-to-income ratio
EWI	Early warning indicators
FDR	Financing-to-deposits ratio
FSB	Financial Stability Board
FSC	Financial Stability Committee
FTV	Financing-to-value ratio
GDP	Gross domestic product
GFC	Global Financial Crisis
GLS	Generalised least squares
HLA	Higher loss absorbency
HQLA	High-quality liquid assets
IB	Islamic bank
ICAAP	Internal capital adequacy assessment process
IsDB	Islamic Development Bank
IFIs	Islamic financial institutions
IFRS	International Financial Reporting Standard
IFSB	Islamic Financial Services Board
IFSI	Islamic financial services industry
IMF	International Monetary Fund
iMaPP	Integrated macroprudential policy
IRTI	Islamic Research and Training Institute
JPC	Joint Policy Committee
LCG	Limit on credit growth
LCR	Liquidity coverage ratio
LGD	Loss Given Default
LLP	Loan loss requirements
LoanR	Loan requirements
LR	Leverage ratio

LTI	Loan-to-income ratio
LTV	Loan-to-value ratio
MaPP	Macroprudential policy
NBFI	Non-bank financial institution
NPF	Non-performing financing
NSFR	Non-stable funding ratio
OLS	Ordinary least squares
PSIFIs	Prudential and structural Islamic financial indicators
RR	Reserve requirements
RSAs	Regulatory and supervisory authorities
RWAs	Risk-weighted assets

Abstract

The paper applies both qualitative and quantitative methods to achieve its set objectives. The qualitative method includes survey findings which describe countries' experience on the conceptions of macroprudential policy along four broad categories,¹ with a focus on identifying conditions under which macroprudential policy is most effective. The paper discusses case studies of two countries – namely, Saudi Arabia, via Saudi Central Bank (SAMA), and Indonesia, via Bank Indonesia (BI) – to showcase the country-specific contexts relating to implementation of the macroprudential policy framework.

In addition, the paper presents a quantitative assessment of the effectiveness of a set of macroprudential tools/instruments/measures on household credit growth in banking environments with both Islamic banks and conventional banks. Based on the iMaPP database and information from the Islamic Financial Services Board's (IFSB's) macroprudential policy survey, a dataset of dummy-type indices of policy actions was generated to capture the tightening and loosening of the aggregate and subcategories of macroprudential measures at a monthly frequency. The data on household credit growth for Islamic banks is derived from the IFSB's PSIFIs database. The data provide a unique feature (similarity in the financing concentration of Islamic banks across selected jurisdictions), making it a suitable choice as the dependent variable.

A cross-country regression analysis was performed using static panel models as the baseline estimation and dynamic panel models for a robustness check on a dataset span over six years – 4Q2013–4Q2019 – for 10 countries. The generalised least squares (GLS) fixed-effects model is chosen as the best-fitted model to run the estimation.

The result of model estimation shows that the overall macroprudential measures (aggregate MaPP index) have a negative relationship (negative sign) with household credit growth for the fixed-effect model (best-fitted model), but that it is not statistically significant. The result is consistent with similar findings which have indicated that household credit growth is more difficult to moderate using the overall macroprudential policies, since very few instruments have relatively more variations, while the variations for many of the instruments are limited.

Similarly, the model estimation for each of the indices in the subgroup category of macroprudential measures (e.g. all-credit targeted, demand-related vs. supply-side tools) shows a decline (negative sign) in household credit growth; in this case, the coefficients are statistically significant. The estimated coefficients of each of the subgroup indices (all credit-targeted, demand-related and supply-side tools) vary, indicating the differential impact of targeted policies on household credit growth.

The empirical analysis not only suggests the impact of macroprudential tools in dampening household credit growth, but also enables a comparison of the relative effects of different instruments – aggregated and subgroup categories (e.g. all-credit related, demand-related vs. supply-side tools) on household credit growth. A tightening of any or a combination of macroprudential measures (within subgroup categories), on average, is negatively associated with household credit growth when all countries are considered. In addition, the difference in coefficients of each of the subgroup indices (all-loan, demand-related and all supply tools) signifies the differential impact on household credit growth.

Among the subgroup categories, all credit-targeted tools – those specifically intended to limit household credit growth – seem to be more effective across all countries. This implies that macroprudential tools are more effective when demand-related tools (i.e. the LTV/FTV and DSTI limits) are applied alongside those measures constraining banks' financing supply (i.e.

¹ Four broad categories include: banking system overview; definition, objectives and scope; institutional and governance arrangements; and operational considerations.

the supply-credit tools – reserve requirements, loan loss provisions and restrictions on credit growth). On the other hand, the supply-side tools² are found to have stronger impacts on household credit growth than the demand-side measures.

The statistical significance of coefficients of an unobserved variable (constant) in the model may suggest country-specific circumstances, as demonstrated in the survey findings. For instance, country-specific conditions include (among others) the quality of supervision, the phase of the credit cycle in which the instruments are implemented, and the extent to which circumvention and arbitrage are possible. Moreover, the ability of authorities to take coordinated policy actions to limit circumvention, and their responsiveness to the changed conditions, are among factors determining whether an instrument is effective when applied in a particular country.

The analysis suggests that Islamic banks also respond appropriately to the implementation of macroprudential policy tools. This demonstrates the importance of macroprudential tools for managing potential risks associated with the high financing exposure of Islamic banks. Thus, a relatively high financing exposure of Islamic banks to household credit (the real sector), which could probably make them vulnerable to macroeconomic dynamics, can be effectively controlled.

² See Appendix, Table 4, for detailed lists of subgroup categories.

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SECTION 1 INTRODUCTION

1.1 Background

The 2008–9 Global Financial Crisis (GFC) highlighted the fragility of the financial system at both the national and global levels. Consequently, it became apparent that a more systemic approach to prudential regulation was needed in order to achieve financial stability.

Regulatory and supervisory authorities (RSAs)³ entrusted with responsibility for financial stability in various jurisdictions have developed a dedicated macroprudential policy framework and institutional arrangement to control different forms of vulnerability in the banking system. Ultimately, the goal is to enable the banking system to continue to meet credit demand as economic growth continues, while maintaining financial system stability.

With the benefit of hindsight, empirical evidence on the effectiveness of different policy tools is critical to enable policymakers to appraise the effectiveness of the various policy tools deployed. In light of this challenge, international institutions such as the Financial Stability Board (FSB), the International Monetary Fund (IMF) and the Bank for International Settlements (BIS) are expanding empirical investigations to obtain evidence on the effectiveness of different policy tools. In addition, through various publications,⁴ these institutions have been documenting countries' experiences of macroprudential policy frameworks, including the establishment of a dedicated institutional arrangement responsible for the design and recalibration of these tools.

Recent data on financing exposure of Islamic banking (i.e. credit quality, the risks of financing concentration in a specific sector, and the resulting non-performing financing [NPF]) in a number of key Islamic finance jurisdictions generally show a similar trend (see Appendix, Tables 1(a) and 1(b); Chart 1 (i–ix)).⁵ In many of these jurisdictions, Islamic banks' financing is concentrated mostly in the wholesale, retail trade financing, and household sectors, driven by factors (such as favourable labour market conditions and income growth) that support households' repayment capacity.⁶ The similar pattern of financing concentration exhibited by Islamic banks across various jurisdictions illustrates the need for a study examining the behavioural responses of Islamic banks to the implementation of macroprudential policy tools (i.e. to proactively address any potential imbalances in credit growth in the banking system).⁷ Islamic banking is currently operating in at least 39 jurisdictions and has attained systemic importance in 13 jurisdictions, according to the IFSB's *IFSI Stability Report 2020*.

³ RSAs include central banks. This clarification is necessary because, in some jurisdictions, other institutions beside central banks have a mandate/authority to ensure financial stability.

⁴ IMF, FSB & BIS (2011; 2016); IMF (2011); CGFS (2012); IMF (2013); IMF (2014).

⁵ IFSB's PSIFIs database; IFSB, *IFSI Stability Report 2020*.

⁶ IFSB, *IFSI Stability Report 2020*.

⁷ Ibid.

Notwithstanding the extensive use of macroprudential tools in many jurisdictions, there seems to be a limited understanding of their efficacy, especially for the Islamic banking sector. The relatively high financing exposure of Islamic banks to the real sector makes them more vulnerable to volatility in macroeconomic dynamics. Consequently, this working paper has applied both qualitative and quantitative approaches in its investigation.

The qualitative approach includes survey discussion of countries' experience on the conceptions of macroprudential policy, with a focus on identifying conditions under which macroprudential policy is most effective. These conditions include objectives, institutional arrangements, types of tools and how they have been chosen and used. Furthermore, this working paper refers to the cases of two countries with regards to the design and calibration of macroprudential instruments, their interaction with other policies and their effectiveness. With regards to the quantitative approach, a panel regression analysis is conducted to evaluate the impact of macroprudential tools on target risk variables by comparing the introduction of an instrument with a "counterfactual" scenario where no macroprudential instrument is implemented.

1.2 Objectives

This working paper highlights the following set of objectives:

- (i) to review countries' experiences of the use of macroprudential instruments in banking environments with both Islamic banks and conventional banks;
- (ii) to assess the effectiveness of the set of macroprudential policy tools/instruments and measures on financing exposures of Islamic banks; and
- (iii) to refer to the implementation of macroprudential policy tools and other relevant issues related to Islamic banks.

The paper is intended to contribute to a better understanding of the macroprudential policy tools to be applied to banking environments where Islamic banks operate. It is related to a growing body of studies that have documented the use of macroprudential policy tools in various countries and provided empirical evidence of their effectiveness in countering the build-up of targeted exposures such as credit growth, housing credit and house prices.⁸ This paper focuses specifically on household credit growth.

This focus is consistent with the IFSB's mandate to actively seek to guide policy choices and decision making relevant to the Islamic banking sector, given the plethora of potential macroprudential policy tools and their complex interaction.

⁸ Lim et al. (2011); Acharya (2013); Crowe et al. (2011); Claessens et al. (2013); Cerutti et al. (2017)

1.3 Methodology

A survey was conducted between 6 April and 22 May 2020 using a questionnaire developed based on views expressed in recent work conducted by the IMF, FSB, BIS and Islamic Research and Training Institute (IRTI)/Islamic Development Bank (IsDB). The questionnaire was distributed to 48 IFSB RSA members responsible for macroprudential policy making in their respective jurisdictions. Sixteen institutions from 15 leading countries in Islamic finance responded to the survey. The low response rate (roughly 33%) is understandable given that the questionnaires were distributed in the wake of the COVID-19 pandemic. However, since responses were mostly from countries where Islamic banking is relatively developed, it is hoped the survey results represent the actual situation.

The survey outcomes consist of a detailed description of the macroprudential measures/tools applied by the survey respondents to mitigate key systemic risks, taking into account the country-specific factors and circumstances of their usage. The focus is to document the response of Islamic banks (i.e. credit quality, risk characteristics of the banking system's assets portfolio, and financing concentration in specific sectors) to the various macroprudential policy toolkits being deployed to limit the risk of credit quality deterioration arising from their financing behaviour. In most economies, macroprudential policy toolkits are applied equally to Islamic and conventional banks operating alongside each other.

The questionnaire listed the measures that are typically considered macroprudential. Participating institutions were asked to report the practices on the implementation of macroprudential policy framework, including institutional arrangements, the designed and actual use of each macroprudential tool. Respondents were required to tick for each tool whether it is in place (indicated with a "yes") or not in place ("no").

Moreover, the questionnaire sought information on measures that are in place, including the period (date and year) when each was introduced (and, if applicable, removed), the scope of its application, its design and calibration, along with its interaction with other policies and its effectiveness. For instance, where loan-to-value (LTV) ratio limits are in place, respondent RSAs were asked to provide details of the caps that apply to different types of financing/ loans. The tools listed in the questionnaire were grouped into broad categories, taking into account the different sources of systemic risk that are being mitigated by the macroprudential measures.

The remainder of this paper is structured as follows: Section 2 reviews country experiences with macroprudential instruments, focusing on the countries' objectives, the types of instruments used, and how they have been chosen and applied in an environment with a dual banking system. Section 3 presents the empirical analysis of panel regressions. Section 4 presents case studies of the macroprudential policy framework and implementations. Section 5 concludes by drawing lessons and policy messages, as well as, noting conditions under which the instruments appear to have been most effective with the next steps for further research and analysis.

SECTION 2 SURVEY FINDINGS

2.1 Introduction

This section presents the main findings of the survey conducted by the IFSB between April and June 2020 on macroprudential instruments and policies. The discussion provides an overview of the banking system of those jurisdictions that participated in the survey, and describes the key characteristics of the macroprudential policy frameworks implemented along four broad categories: (i) banking system overview; (ii) definition, objectives and scope; (iii) institutional and governance arrangements; and (iv) operational considerations. The focus is to identify conditions under which macroprudential policy is most effective.

2.2 Banking system overview

Understanding the structure and components of the banking system in a particular jurisdiction is fundamental to assessing the various sources of risks to which the system might be exposed. Therefore, the initial step in this report is to provide an overview of the composition of the banking system among those jurisdictions that participated in the survey. All the jurisdictions that participated in the survey are operating a dual banking system.⁹ As a result, this report highlights the composition and size of the building blocks of the entire banking system with particular reference to the size¹⁰ of Islamic banking. The size of Islamic banking relative to the entire banking sector in a jurisdiction is a factor that helps determine the extent of its interconnectedness (relative significance) within the entire system in its jurisdiction. This, in turn, could be a step in identifying the potential financial stability risks posed by Islamic banks (IBs) to the whole banking system.

An enabling regulatory and institutional framework and a level playing field for both conventional and Islamic banks is critical for the sound and stable growth of the Islamic banking sector. Moreover, the balance sheets of IBs exhibit considerable differences compared to those of conventional banks, due to the specific risks IBs face.¹¹ This fact underscores the importance of adapting regulatory and supervisory frameworks, and other supporting financial infrastructures, in countries with a dual banking system, to suit the specifics of Islamic finance in general. The extent to which a country makes progress in adapting its framework to Islamic Financing (IF) specifics will determine its ability to identify and address the potential stability risks posed by IBs.¹² Though varying across jurisdictions, all the respondent RSAs indicated that they are making progress in adapting their regulatory framework

⁹ A banking system where Islamic banks operate alongside conventional banks.

¹⁰ Share of Islamic banking assets relative to their total banking sector assets.

¹¹ Islamic financial instruments are asset-based (*murābahah*, *salam* and *istisnā'*, which are based on the sale or purchase of an asset; and *ijārah*, which is based on selling the benefits of such an asset). Such instruments may therefore involve exposure to market (price) risk in respect of the asset, as well as credit risk in respect of the amount due from the counterparty. In the case of profit-sharing contracts (*mushārakah* and *mudārabah*) used for financing purposes, an Islamic bank is exposed to the risk of losing part or all of its capital as a result of operating losses suffered by the enterprise or a fall in the value of its assets.

¹² EI -Gamal (2006); Cihak & Hesse (2010).

(prudential, consumer protection, liquidity management, safety nets and resolution frameworks) to suit the specifics of IF (see Table 1).

Flexibility in approaches to Islamic banking has also fostered greater acceptance of Islamic banking principles and their benefits. Some countries, such as Turkey and Nigeria, have branded the Islamic banking industry with neutral terms and this has facilitated industry growth. In Turkey, it is branded as “participation banking”, while in Nigeria it is known as “interest-free banking”.

Table 1 shows the share of conventional and Islamic banking assets as at 4Q2019 data in those countries that responded to the IFSB’s survey. Saudi Arabia’s Islamic banking share accounts for 24.9% of global Islamic banking assets.

Table 1 Share of conventional and Islamic banking assets as at 4Q2019

S/N	Country	Conventional banks (% share)	Islamic banks (including windows) (% share)	Regulatory and supervisory guidelines for Islamic banks (specific)
1	Afghanistan	91	9	Yes
2	Brunei*	35	65*	Yes
3	Kazakhstan	99.9	0.1	Yes
4	Jordan*	84	16*	Yes
5	Bahrain*	84	15.5*	Yes
6	Kuwait*	58	42*	Yes
7	Nigeria	99.7	0.3	Yes
8	Turkey	94	6	Yes
9	Indonesia	94	6	Yes
10	Iraq	94	6	Yes
11	Malaysia*	72	28*	Yes
12	Mauritius	99.7	0.03	Yes
13	Saudi Arabia*	31	69*	Yes
14	Philippines	99.9	0.1	No
15	Kyrgyz Republic	98.7	1.3	Yes

Source: IFSB, *IFSI Stability Report 2020*.

Note: *Jurisdiction where Islamic banking has achieved domestic systemic importance.

Saudi Arabia ranks the highest among all jurisdictions in terms of domestic share of Islamic banking assets, with a share of 69%. Kuwait and Malaysia, participants in the survey that also operate a dual banking system, have recorded market shares of 42% and 28%, respectively.

The banking sector in Kuwait consists of full-fledged IBs only, with Islamic windows not permitted. Five of the 11 locally registered commercial banks, and one of the 12 branches of foreign banks, are conducting business in accordance with Shari'ah. Kuwait's Islamic banking sector includes systemically important banks and/or banks with complex conglomerate structures. The largest IB in Kuwait accounts for 23% of the total banking system's assets, and for over 70% of Islamic banking's assets, and it has substantial cross-sector and cross-border operations.

Malaysia has 16 full-fledged IBs, of which six are foreign owned. In addition, 11 commercial banks offer Islamic financial products through windows. Most of Malaysia's IBs have complex corporate structures; thus, consolidated and cross-border supervision is essential for maintaining the financial stability of the industry. Eleven of the 16 IBs are part of banking groups that also operate as commercial banks in Malaysia. Malaysia's Islamic financial institutions (IFIs) have also been gaining a foothold in South-East Asia through investments in a number of banks across the region.

Bahrain operates both conventional and Islamic banks and has the largest concentration of Islamic banking operations among countries that operate dual banking systems. Bahrain's Islamic banking sector is made up of 19 IBs, including six retail banks, 13 wholesale banks and nine Islamic windows of conventional banks, together accounting for 15.5% of its total banking assets in 2020.¹³ The growth of Islamic banking has been remarkable, with total assets increasing from USD 1.9 billion in 2000 to USD 32.7 billion as of July 2020, a more than 17-fold increase.¹⁴ The market share of IBs correspondingly increased from 1.8% of total banking assets in 2000 to 15.5% in 4Q2019.

The Islamic banking sector in Indonesia comprises 14 stand-alone IBs and 20 Islamic windows of conventional banks, accounting for 7% of the domestic IF industry and 6% of the total banking system assets. The Islamic banking sector is highly concentrated and some of the banks have complex conglomerate structures. Two of the 14 full-fledged IBs account for about half of the industry's assets.

The IF sector in Jordan is regarded as systemically important, with the Kingdom's Islamic banking share increasing marginally to 16.2% of its total banking sector assets. Within the Central Asian region, the Islamic banking sector in Kazakhstan constitutes 70% of total Islamic finance assets; however, domestically, Islamic banking assets still account for less than 1% of the total Kazakhstan banking industry, which is worth USD 1 billion. Attention to the development of a regulatory framework for Islamic banking has also been a key focus in the Kyrgyz Republic. While there is one full-fledged IB and six Islamic banking windows in Afghanistan, the country's Islamic banking sector accounts for 11% of the domestic banking market share.¹⁵

While interest-free banking has, since inception, recorded a steady increase, it is still very small relative to the conventional banking system. As of end-2015, only three of the 25 commercial banks in Nigeria were offering interest-free finance products, including one full-fledged bank and two Islamic windows of

¹³ Central Bank of Bahrain, <https://www.cbb.gov.bh/banking/>

¹⁴ Ibid.

¹⁵ IFSB, *IFSI Stability Report 2020*.

conventional banks. The total assets and total deposits of the three banks operating on Shari'ah principles accounted for only 0.2% of the total system assets and deposits.

Only six jurisdictions where Islamic banking has achieved domestic systemic importance participated in the survey.¹⁶ Other jurisdictions with sizeable Islamic banking assets are Turkey, Indonesia, Iraq and Afghanistan (see Table 1).

The identification of systemically important institutions is a key step in managing the structural dimension of systemic risk. Generally, each respondent institution has developed an indicator-based measurement approach for assessing domestic systemically important banks (D-SIBs). Twelve indicators were used by respondents in the assessment of D-SIBs. Indicators such as size, interconnectedness and lack of substitutability aimed to characterise the channels and degree of interconnectedness between the banking sector and other financial sectors. Types of linkages, based on their potential to have a large negative impact on the financial system and the real economy, are also considered, such as funding exposures, common exposures and counterparty credit risk. The advantage of the multiple indicator-based measurement approach is that it encompasses many dimensions of systemic importance. The negative externalities associated with institutions that are perceived as not being allowed to fail due to their size, interconnectedness, complexity, lack of substitutability or global scope are well recognised.

2.3 Definition, objectives and scope

The respondent central banks and other RSAs that are responsible for macroprudential policies specifically emphasised their financial stability objectives, although each respondent used different phrases in defining their objectives and the scope of their macroprudential policy framework (Appendix, Tables 2). Twelve of the 16 respondents have a financial stability objective. AMBD Brunei, for instance, stated that its objective is “to ensure the stability of the financial system”, or “Identifying and mitigating vulnerabilities and systemic risks in the banking system, and deploying macroprudential policies”.

In many instances, financial stability objectives are embedded in the law or the central bank's charter (e.g. Brunei, Indonesia, Kazakhstan, Kyrgyz Republic, Malaysia, Philippines and Nigeria). Four of these RSAs narrowed their financial stability objectives to “ensuring the soundness of the banking sector to encourage a balanced and good quality of intermediary function”. However, the majority of the respondents do not specifically mention a macroprudential objective in their financial stability mandate because the objective is covered under the financial stability objective (e.g. Bahrain, Mauritius and Jordan).

¹⁶ According to the IFSB's *IFSI Stability Report 2020*, the Islamic financial sector is systemically important when the total Islamic banking assets in a country comprise more than 15% of its total domestic banking sector assets.

Macroprudential policy objectives stated by the majority of the respondents are clear and quantifiable objectives, and are rooted within the statutory mandate. This enables macroprudential policymakers to use the policy tools in the pursuit of financial stability and, at the same time, provides the basis for holding the designated authority accountable for achieving its objectives. According to Bank Indonesia (Regulation No.16/11/PBI/2014 on Macroprudential Regulation and Surveillance), there are three broad macroprudential policy objectives: (i) to identify and mitigate vulnerabilities and systemic risks in the banking system; (ii) to encourage a balanced and good quality of intermediary function; and (iii) to improve financial system efficiency and financial access (see Appendix, Table 2).

Other objectives highlighted by the respondents are: (i) to safeguard the legitimate interests of licensees' customers against the risks associated with the financial services industry; (ii) to ensure liquidity and solvency in the banking system; (iii) to prevent excessive maturity mismatch in banks' assets and liabilities, including currency mismatch in amortisation; (iv) to identify, mitigate and prevent excessive credit growth and leveraging in the banking sector; and (v) to identify and mitigate the adverse impact of a disorderly exit of D-SIBs on the banking sector.

As is highlighted in the literature, a fundamental aspect of the financial stability objective is the notion of systemic risk – namely, the risk of widespread failure in the provision of financial services resulting from an impairment of all or parts of the financial system, and which can cause serious negative consequences for the real economy.¹⁷ The negative externalities are the result of failure of financial institutions, markets or instruments. Systemic risk is generally recognised as having two dimensions: (i) vulnerabilities related to the build-up of risks over time (“time dimension”); and (ii) vulnerabilities from interconnectedness and the associated distribution of risk within the financial system at any given point in time (“cross-sectional” or “structural” dimension). By mitigating systemic risks, macroprudential measures ultimately aim to reduce the frequency and severity of financial crises.

Macroprudential policy objectives can be pursued effectively through appropriate and timely communication mechanisms (such as financial stability and other periodic reports, policy statements and meeting records) to help inform the public of the policy stance and to create a commitment to take action, as well as to manage public expectations about what can be achieved with those policies.

2.4 Institutional and governance arrangements

Mandate, governance and accountability

The survey highlights the important role played by a central bank in macroprudential policy, especially in harnessing its independence, expertise and incentives to take actions. Findings from the survey suggest that the existing institutional arrangements supporting a macroprudential policy framework vary among the jurisdictions of the RSA that participated in the survey, indicating there is no “one-size-fits-

¹⁷ IMF, FSB & BIS (2016); Borio (2003).

all” approach. Notwithstanding, participating institutions agreed that an effective macroprudential policy is well served by providing the relevant authorities with a clear mandate that sets out well-defined objectives as well as adequate powers for taking macroprudential policy decisions. For instance, Bank Negara Malaysia (BNM), as the regulator and supervisor of banks in Malaysia, is vested with authority under the BNM Act of 2009 to decide on measures to ensure stability in the financial system, including macroprudential instruments. The Act provides BNM with the autonomy to effectively fulfil its mandate of promoting monetary stability and grants powers to preserve financial stability conducive to the sustainable growth of the Malaysian economy.¹⁸

Governance frameworks relevant for achieving desirable outcomes of a macroprudential policy framework may be instituted through establishing dedicated financial stability units (such as a Financial Stability Committee, or FSC) within the central bank vested with the power and responsibility to conduct macroprudential policy decisions. The scope of these units’ responsibilities lies in their ability to act in the face of evolving systemic threats and in fulfilling an oversight/review function. For instance, decisions on any relevant information or course of action arising from these committee meetings would be shared with institutions within the relevant jurisdictions (e.g. AMBD, Bahrain, Malaysia, Kyrgyz Republic and Nigeria).

Broadly, macroprudential authority is vested in three different categories: (i) the central bank; (ii) a committee within the central bank; and (iii) a committee or supervisory agency outside the central bank. The majority of respondents (eight out of 12) indicated that a macroprudential mandate was assigned to more than one entity (e.g. both to the central bank and to an additional committee, such as a Joint Policy Committee, or JPC). The JPC often involves multiple authorities within a jurisdiction and acts as a coordination mechanism for measures taken by separate regulatory and supervisory bodies to pursue financial stability. Members are drawn from other sectors, including the Financial Services Commission, the Capital Market Authority and the Financial Intelligence Unit, that are members of the FSC (i.e. Saudi Arabia, Malaysia, Turkey, Mauritius and Philippines) (Appendix, Table 2). In some countries, the Ministry of Finance also participates. Such an arrangement may be intended to mitigate against political economy risks (such as delayed action) and to protect the independence of other participating authorities.

Ten countries (about 80% of all countries with a macroprudential authority) indicated that there is increased cooperation, coordination and information sharing among institutions and agencies. However, they do not share the oversight function with other institutions’ committees, indicating that the FSC within the central bank is the sole authority for macroprudential policy making. The FSC meets on an ad hoc basis to review developments pertaining to the financial sector and to oversee risks to financial stability. The JPC comprising members from different institutions meets to review overlapping issues of material importance to them (e.g. Mauritius, Bahrain and Malaysia).

¹⁸ BNM’s response to IFSB’s survey on macroprudential policies, *IFSI Stability Report 2020*.

2.5 Operational considerations

2.5.1 Identifying risks

This section of the paper considers the practices in identifying risks, and in selecting and calibrating the instruments for maintaining financial stability. Although macroprudential policy frameworks are intended to mitigate systemic financial risk and to reinforce financial stability, there is no reliable direct method for measuring the extent to which these objectives are being met.¹⁹ As a result, authorities not only track financial variables as proxies for systemic risk, but also use them as intermediate objectives for setting policy. Early warning indicators (EWIs) have also been introduced, which help in creating a risk matrix and in identifying and analysing the level of market exposure to different risks over the past period. Thus, EWIs serve as a useful starting point for determining the appropriate supervisory intervention according to the level of risk. Common risk drivers to be considered in the stress testing exercise are macroeconomic factors, such as gross domestic product (GDP) growth, change in property prices, the unemployment rate, and inflation or deflation rates, and their impact on other risk factors.

The survey shows that none of the participating institutions measured systemic risk directly, citing lack of a reliable indicator. Nonetheless, each respondent uses contemporaneous financial variables as proxies for systemic risk (i.e. various measures of credit, such as limiting credit growth, housing prices or currency volatility, and bank balance sheets – capitalisation, profitability, maturity and currency mismatches). As noted by some respondents, there is no fixed set of proxies for systemic risk because sources of systemic financial risk vary across countries and over time.

The respondents indicated that multiple indicators are generally used to assess the extent of systemic risk, since one single indicator may be imperfect in signalling a potential source of vulnerability (e.g. EWIs, financial soundness indicators, financial stability index and macro-stress tests). Virtually all respondents made mention of using metrics such as EWIs and stress tests to gauge financial risks. Country authorities typically use these metrics to assess the following sources of vulnerabilities: (i) economy-wide vulnerabilities from an excessive growth in total credit or asset prices; and (ii) sectoral vulnerabilities arising, for example, from growing credit to the household sector or from increasing exposures to the corporate sector. Financial soundness indicators are mentioned by respondents in the macroprudential policy (MaPP) framework as part of systemic risk assessment and monitoring.

Other sources of vulnerabilities assessed include: (iii) vulnerabilities from a build-up of maturity and foreign currency mismatches in the financial sector; and (iv) vulnerabilities related to the distribution of risk within the financial system at any given point in time (“cross-sectional” or “structural” dimension). Risks from linkages within and across key classes of intermediaries and market infrastructures are being monitored, as well as the impact of the failure of any of these institutions on the system as a whole.

¹⁹ Drehmann & Juselius (2013); Dell’Ariccia et al. (2011).

Stress tests stand out among the listed metrics. Practically all countries have either used or intended to use stress tests as a systemic risk indicator targeting specific sectors, regions, institutions and capital flows. The survey shows that country authorities conduct different stress tests, such as stress testing on banks to gauge the adequacy of their capital under a set of hypothetical stressed scenarios to inform their capital and risk management frameworks. Stress tests practice is based on a annual or semi-annual reference period and covers credit risk (i.e. a bank's exposure to economic activities, conglomerates and consumer loans) and market risk (movement in interest rates and foreign exchange). In the case of the Philippines, apart from acting as a pre-emptive policy measure to ensure that banks have sufficient capital for possible shocks from the real estate sector, the Real Estate Stress Test's (REST's) limits are also implemented as soft limits, such that a bank may maintain exposures to real estate for as long as it is able to demonstrate its ability to manage the risks.

Stress tests may be particularly helpful, as they are forward-looking and various extreme scenarios can be studied consistently. For this reason, stress tests are a valuable instrument for assessing specific systemic vulnerabilities – for instance, assessing the amount of capital required in response to hypothetical low-probability but high-impact macroeconomic and financial shocks. Thus, they are suitable for informing judgments and for giving rise to a “guided discretion” approach to the need for macroprudential action.

However, stress tests also have their shortcomings, such as the difficulties in meaningfully modelling the dynamics of financial distress, and in identifying risks early and sufficiently. Authorities often wait to see whether a development will have adverse consequences. This tendency may affect the timing of tightening actions during a credit boom.²⁰ This shortcoming makes stress tests less useful as a tool for identifying risks when the range of scenarios is more open. Still, they can help in assessing the immediate impact of declines in house prices and increased mortgage defaults on bank balance sheets.

Moreover, country authorities complement their macroprudential policies and mechanisms with surveillance and analytical capabilities when identifying and monitoring the build-up of systemic risks. As a result, they provide guidelines for conducting stress testing exercises and for setting realistic expectations regarding the governance process in stress testing exercises. Guidelines with respect to framework/methodology and the conduct of stress testing that is linked to the financial institution's risk appetite, business strategies, and capital management, business continuity and liquidity management plans (including a recovery plan for a D-SIB). The RSAs also articulated their expectations about how the stress testing results should feed into the internal capital adequacy assessment process (ICAAP) and the supervisory review process.

The basis for monitoring systemic risk is key to operationalising macroprudential policy. Therefore, any assessment of systemic risks needs to consider the following: (i) the growth in total credit and macroeconomic drivers of imbalances; (ii) financial linkages between the financial and domestic real sectors (household and corporate), and between each sector; and (iii) the structure of the financial system and linkages within and across key classes of intermediaries and market infrastructures. The

²⁰ Borio et al. 2014 Claessens et al. (2013).

assessment will often draw heavily on supervisory and statistical data, and make use of empirical methods, needs also to make full use of market intelligence and soft supervisory information on trends and market developments.

2.5.2 Selecting and calibrating instruments

The survey reveals that macroprudential instruments or interventions had been widely applied among the participating institutions (mostly central banks). Drawing from the findings, the paper summarises how respondents have applied macroprudential instruments targeting issues arising from the banking system and financial behaviour of market participants, at both specific sectors and aggregated or groups of institutions with systemic importance.

Following the survey being conducted, a wide range of tools was deployed, primarily targeting various types of bank credit (Appendix, Table 3). In all, 14 countries reported a total of 166 macroprudential measures, making an average number of 12 measures per country. “Measures” refers to tools/instruments that are in place indicated by a “yes” response (i.e. action has been taken) across the various types of measures listed in the survey. Essentially, these are prudential instruments with macroprudential orientations, such as restrictions on particular types of lending and capital or liquidity requirements. In addition, monetary policy instruments, such as reserve requirements and foreign exchange interventions, have been used macroprudentially.

Across the six categories of tools reported in the survey, tools for managing liquidity and foreign exchange (FX) mismatches in the banking sector are most frequently reported across the countries. This is followed by tools for managing risks from exposures to the household sector, and broad-based tools applying to all exposures (see Appendix, Table 3). Tools function through different mechanisms. Where there is a broad-based build-up of vulnerabilities, tools with the same mechanism (broad-based tools) are activated through tightening that impacts on all exposures, such as the tightening of capital and liquidity buffers.

When specific vulnerabilities are building in the absence of a broad-based credit boom, more narrowly targeted approaches may be applied to address the specific concern more efficiently. It may not necessarily be advisable for the LTV, debt-to-income (DTI) and debt burden ratios (DBR) to be used at the same time to address the concern in a targeted manner. Rather, a quantitative analytic approach should be followed to assure a structural policy response with the ability to design a dynamic countercyclical policy. For example, in the upswing, we can build countercyclical buffers and dynamic provisioning, and utilise them over the downswing according to the degree of risk and the state of the economy. Generally, these tools aim primarily to increase the borrowers’ resilience to asset price and income shocks, and in turn to limit the lenders’ credit risk. By constraining effective credit demand, they may also limit credit growth and, indirectly, house prices.

Broad-based tools

The tools in this category affect all credit exposures of the banking system and can include the Basel III countercyclical capital buffers (CCyBs), leverage ratios, and dynamic loan loss provisioning requirements.

The majority of respondents have been implementing CCyBs in phases effective from 2018, and set the rate initially at 0% of total risk-weighted assets (RWAs). The initial rate may be adjusted upward to a rate determined by the relevant authority in a jurisdiction should the systemic conditions warrant, but should not exceed 2.5% (notably, Saudi Arabia, Malaysia, the Philippines, Jordan and Kyrgyz). Buffers should not be seen as a prudential minimum capital requirement; rather, they are regarded as unencumbered capital in excess of that minimum, so that capital is available to absorb losses in times of stress.

Decisions on the application of a CCyB are based on an assessment of a set of indicators, including the credit-to-GDP gap and the growth and quality of credit, among others. A CCyB is designed to mitigate excessive growth in credit (i.e. by increasing the cost of granting new loans) – a common occurrence in boom-and-bust periods within the financial cycle either by requiring banks to set aside additional capital (increasing the CCyB requirements) during expansionary periods or by providing them with more risk capital (lowering the CCyB requirement) to deploy during times of stress.²¹ The main objective is to increase the system's resilience against adverse shocks.

Other complementary tools are forward-looking loan loss provisioning (IFRS 9, Expected Impairment Loss model) or dynamic provisioning requirements, reserve requirements, concentration limits (consolidated large exposures and exposure to connected parties), and time-varying leverage ratio caps.

Capital and provisioning requirements²² help to build a “dynamic loan loss reserve” (pool) from profits in good times which can be drawn on to cover losses realised during stress. Like the CCyB, such requirements can slow down credit growth because they increase the cost of providing credit (such as housing credit). Additionally, reserve requirements (RRs) can be used to achieve the following objectives: to extend the maturity of liabilities in order to correct maturity mismatching (maturity-based RR); to support core liabilities to balance growth and domestic savings; and to alleviate the adverse impact of capital flow volatility on the domestic economy (e.g. Turkey). In addition, RR can be used along with other tools to achieve monetary policy objectives (e.g. Kyrgyz Republic).

Leverage ratio (LR),²³ on the other hand, restricts the build-up of excessive levels of leverage in the banking sector that can have a deleterious impact on the broader financial system. The LR is intended to maintain resilience of the banking system by limiting a bank's total exposure (both on-balance sheet

²¹ BIS (2010); Dell'Ariccia *et al.* (2011).

²² Provisioning requirements for performing loans, as opposed to specific provisions for incurred losses.

²³ The Basel III leverage ratio is defined as the capital measure divided by the exposure measure.

and off-balance sheet) in relation to its equity.²⁴ It is calculated as the ratio of Tier 1 capital to the total exposures (on- and off-balance sheet), at a minimum of 3% (under Basel III). The Tier 1 capital for Basel LR is defined under existing local regulations (it mostly comprises paid-up capital, reserves and Tier 1 *sukuks*), whereas the exposure measure uses on-balance sheet, hedging instruments, securities, financing transactions and off-balance sheet items exposures. LR reinforces the risk-based capital adequacy framework with a non-risk-based backstop measure.

The capital conservation buffer (CCB), according to the survey, is the most frequently used measure (10 countries). The requirement is meant to ensure that banks build up capital buffers outside periods of stress which can be drawn down in the event of stress as losses are incurred. In Malaysia, the phased implementation of the CCB requirement over a four-year period is consistent with the Basel III framework (i.e. effective 1 January 2016 and phased in at an increasing rate of 0.625% each year, reaching 2.5% from 1 January 2019). It allowed banks to draw down on the buffers as part of the regulatory relief offered to help manage the COVID-19 pandemic. Banks are expected to restore their buffers within a reasonable period after 31 December 2020. Similarly, the BSP²⁵ adopted the CCB of 2.5%, where banks, as well as their subsidiaries, are mandated to raise the quality of their capital and to set up a CCB of 2.5% composed of CET1 capital. Banks that do not meet the 2.5% of CCB requirement are restricted from paying dividends, buying back shares and paying discretionary employee bonuses.

Where vulnerabilities arise from lending to specific sectors, and from a deterioration of lending standards, sectoral capital tools, such as sectoral capital requirements and risk-weight floors, can help maintain lenders' resilience. The BSP, for instance, set the minimum capital ratios of a 6.0% CET1 ratio, a 7.5% Tier 1 ratio and a 10.0% total capital adequacy ratio (CAR). In principle, a targeted increase in risk weights can be applied to any category of loans for which strong credit growth gives cause for concern. This can include house financing, unsecured consumer credit, or specific segments of such credit, and corporate lending or specific corporate segments, such as lending to commercial property (e.g. Mauritius). An increase in risk weights is expected to increase cost of financing/lending (loan interest rates) to the targeted sector and can also increase the resilience of lenders to a deterioration in credit quality. Generally, these tools aim primarily to increase resilience and, thereby, to help maintain the supply of credit through adverse conditions.

Household-sector tools

Among the household-sector tools, caps or restrictions on loan-to-value/financing-to-value (LTV/FTV) and debt-service-to-income (DSTI) ratios are the most frequently used to address vulnerabilities from excessive credit to the household sector. Almost all the participating jurisdictions have activated these tools, with more than half of the participants maintaining a restriction on the LTV/FTV ratio. LTV caps directly reduce the funding available to borrowers and screen marginal borrowers out of housing markets. They can thereby reduce housing demand, leading to a decrease in credit and house price

²⁴ IMF (2014a; 2014b).

²⁵ Bangko Sentral ng Pilipinas (Central Bank of Philippines).

growth; thus, they help to contain the procyclical feedback between credit and asset prices (credit demand channel). For instance, in Turkey, the maximum LTV ratio for housing loans has been maintained at 80% since September 2016, while for car loans the maximum cap remains at 70% under TRY 120,000 (USD 15,480)²⁶ and at 50% of the amount over TRY 120,000 (USD 15,480) since January 2019.

Moreover, tools such as a limited maximum LTV/FTV and DSTI have helped to curb speculative activities and to promote a sustainable property market in a number of jurisdictions (Malaysia, Indonesia, Saudi Arabia, Turkey). Banks use LTV/FTV ratios for their credit origination, enabling it to be applied unevenly to different sectors and to different segments of housing finance. For instance, in Saudi Arabia, the LTV/FTV limit set on real estate financing ranges from 70% to 90% of the value of the dwelling that is the subject of the real estate finance contract, depending on the characteristics of buyers. Similarly, a cap on debt-to-income (DTI)/debt service to income DSTI is classified according to income level.²⁷

Other household-sector tools, such as additional capital requirements on exposures to the household sector, limits on amortisation periods and restrictions on unsecured loans, are commonly used to mitigate credit risks and exposures to more risky segments, and often appear to be used in combination with LTV and DSTI ratio caps in order to improve their effectiveness.²⁸

Additional capital requirements mandate banks to hold extra capital against their exposures to a specific sector to protect against unexpected losses. The requirements can be imposed on a segment of household advances, such as residential financing, unsecured consumer credits, or foreign currency financing to unhedged households. They can take the form of either higher risk weights (or Loss Given Default (LGD) floors) or additional capital requirements on such exposures. In response, banks need to raise more capital, increasing their resilience, or reduce their RWAs. When tighter capital requirements translate into higher funding costs and lending rates, credit growth may also be restrained (credit supply channel).²⁹

Limits on DSTI ratios restrict the size of debt service payments to a fixed share of household incomes, thus ensuring affordability.³⁰ Out of 10 countries that reported having a DSTI limit, six countries also impose limits on amortisation periods. Although some of these measures are purely microprudential, they reinforce macroprudential policy by ensuring that, at the sector- or system-wide level, such exposure aggregated across financial institutions does not constitute huge sector- or system-wide concentration. Restrictions are imposed on banks not to allow loans/financing to a single customer and

²⁶ USD/TRY (7.7522) = Exchange rate @ 3Q2020.

²⁷ IFSB (2020) Islamic Financial Services Industry Stability Report 2020 <https://www.ifsb.org>

²⁸ Effectiveness is measured by tracking changes in household indebtedness as measured by personal loans and the repayment capability of households – for instance, by tracking the number of repossessed motor vehicles before and after the implementation of the tool.

²⁹ IMF (2014a; 2014b).

³⁰ DSTI limits share several transmission channels with a limit on the LTV ratio (i.e. the credit demand, expectation and resilience channel).

its associates shall not exceed 20% of its capital funds. This is aimed to reduce the concentration risk to a single customer (e.g. AMBD).

Where risks are assessed as high, increases in unsecured lending can be contained by sectoral tools, such as higher risk weights, DSTI limits or exposure caps. In 2011, the authority in the UAE imposed a limit on DSTI ratios on a borrower's total outstanding household debt rather than on house financing only.

Malaysia imposes limits on the amortisation periods and restrictions on maximum tenure for selected loans to ensure prudent expansion of credit to the household sector. For instance, housing financing with LTV/FTV ratios over 90%, and personal financing with tenure of more than five years, are risk-weighted at 100%. Similarly, restrictions were placed on the maximum tenure for the following loans and financing: nine years for motor vehicle financing, 35 years for property financing, and 10 years for personal financing.

In Nigeria, credit concentration risk has been a major area of vulnerability in the banking sector, due to the peculiarity of the Nigerian economy with few attractive sectors (oil and gas, communication, etc.). Exceeding the limits set across the banks can easily constitute a major systemic concentration risk. For instance, the outstanding exposure to any single person must not exceed 20% of equity, while the aggregate large exposure should not exceed eight times equity.³¹ Assessment and monitoring is performed regularly through top-down stress tests, where the actual position is aggregated by the largest obligors and sectors.

Corporate-sector tools

Tools used to address systemic risks arising from corporate exposures include additional capital requirements (risk weights) for those exposures and caps on credit growth or concentration limits. Compared to household-sector tools, measures used to manage risks from exposures to the corporate sector are much less commonly reported. The most frequently used tools include: additional capital requirements on financing to the corporate sector (nine jurisdictions) and caps on such lending in foreign currencies (eight jurisdictions). Borrower-based measures are relatively less utilised, even as a cap on LTV/FTV ratios for commercial real estate credit (four jurisdictions), along with limits on the DSTI ratio specifically for exposures to commercial real estate.

Additional capital requirements (risk weights) can be recommended for dealing with risks from broad or specific corporate exposures. Risk weights will, in general, help the banking system withstand corporate credit losses by building capital buffers (direct effect).³² These instruments may also increase the costs of credit and slow down the growth of corporate credit, thereby reducing the concentration of corporate exposures on bank balance sheets. For example, corporate-sector capital requirements are applied for

³¹ "Large exposure" is defined as any exposure that is 10% of equity unimpaired by losses. The limit on the largest aggregate exposure is 8% of equity.

³² IMF (2014a; 2014b).

exposure greater than 20% of total credit risk weighting of 150%. Outstanding exposure to any single obligator or group of connected obligors must not exceed 20% of equity.

Moreover, tools applied to all exposures of the banking sector (e.g. CCyB, provisioning requirements) will also affect exposures to the corporate sector. However, if exposures to the corporate sector pose a heightened risk, more targeted tools are recommended.

A number of countries also limit lending to particular industries or sectors (two jurisdictions) to curb financial imbalances. For example, Malaysia previously imposed sectoral limits in the late 1990s to address overheating in the property and equity markets and to avoid excessive concentration in sectors deemed volatile. Specifically for the property market, the requirement was such that (i) financing extended to the broad property sector, (ii) guarantees issued to finance property development, and/or (iii) corporate bonds issued to finance property development purchased by banks in the primary market cannot exceed 20% of the bank's total outstanding financing, guarantees, and/or corporate bonds holdings, respectively, in the previous quarter.

Foreign exchange (FX) lending can present an important specific vulnerability associated with corporate credits. While FX or FX-linked finances often carry lower interest rates, inducing corporate firms to borrow in FX, they can significantly increase credit risk for borrowers without a natural hedge. In the event of a sharp depreciation of the domestic currency, unhedged borrowers may become unable to service their FX loans. This will increase the non-performing loans (NPLs) of banks and reduce their capital, in turn reducing their capacity to lend and aggravating the effects of the initial shock.

Some countries also limit FX lending to particular industries or corporate sectors (three jurisdictions) to curb financial imbalances. For instance, FX lending to the corporate sector is only possible if the firm has FX income or its outstanding FX finance amount is above USD 15 million (e.g. Malaysia). Banks can only extend foreign currency credits to those with foreign currency income, and the basis of the interest rate for borrowing should be the same as that of lending; that is, there should be no mismatch of floating and fixed interest rates. Similarly, the banks can only lend in the same currency they borrowed, to avoid a currency mismatch (natural hedging).

Liquidity and FX tools

Policy tools in this category aim primarily at addressing the build-up of liquidity and FX risks associated with increasing banks' reliance on non-core funding, such as short-term, wholesale or foreign currency funding to fund illiquid assets. Liquidity and FX tools aim to mitigate systemic funding and market liquidity shocks, as well as to build up a stock of highly liquid assets. These tools can take different forms and are frequently used to manage liquidity and FX mismatches in the banking system. As reported by a majority of the survey respondents, a typical excess liquidity predicament of Islamic banks is still persistent and prevalent due to the lack of Sharī'ah-compliant avenues for liquidity management. Conversely, in some other jurisdictions, there is an issue of liquidity shortages due to macroeconomic pressures, runaway inflation rates and negative economic outlooks triggering increased deposit withdrawals.

Virtually all respondents have commenced implementation of the Basel III liquidity coverage ratio (LCR) and the net stable funding ratio (NSFR), as well as other standard liquidity tools to contain maturity mismatches (such as core funding ratios), price-based tools (such as a levy on volatile funding), and simpler designs (such as caps on the loan-to-deposit ratio). Specifically, seven jurisdictions reported the LCR. Nonetheless, based on the financing-to-deposits ratio (FDR) and liquid assets ratio, the liquidity situation in most jurisdictions is satisfactory. Many of these countries differentiate liquidity tools by currency, or maintain other constraints on FX funding – for instance, maintaining a net FX position limit in order to limit systemic risk.

LCR ensures that banking institutions hold sufficient high-quality liquid assets (HQLA) to withstand an acute liquidity stress scenario over a 30-day horizon. It is calculated as HQLA divided by net cash outflow over the next 30 days. According to SAMA, the ratio has been applicable to the Saudi banking sector effective 1 January 2015; since then, the minimum LCR threshold has been gradually increased from 60% to 100% as at January 2019.

While compliance with the LCR is required in one single currency, the Basel liquidity standard (LCR differentiated by currency) required banks and supervisors to monitor the LCR in other significant currencies. This will allow them to track any currency mismatch issues that could arise. As highlighted by a respondent, If the material currency is more than 5% of total liabilities, banks have to report LCR separately for that significant currency. In this context, foreign currency exposures (mainly USD) are almost 10% of total exposures, but the majority of total exposures are in local currency.

The total LCR limit of 60% and the FX LCR limit of 40% were introduced in Turkey in 2015 with an increase of 10% each year, reaching 100% and 80%, respectively, as of 2019. Similarly, the reserve requirement was introduced with the aim of contributing to the stabilisation of money market interest rates by giving banks an incentive to smooth the effects of temporary liquidity fluctuations. It also serves as a liquidity buffer, which the RSA may free up in times of market turmoil by reducing the rate of the minimum cash balance requirement to ease liquidity conditions and support banks' liquidity management.

NSFR (Basel III requirements) requires banking institutions to maintain a stable funding profile to support their assets and off-balance sheet activities. It should not be less than 100%. Domestic banks (not foreign bank branches) in many countries have usually been subject to NSFR requirements of 100%. For instance, in Malaysia, banks are required to comply with a minimum NSFR of 100% in all currencies on an aggregated basis. However, the minimum requirement has been lowered temporarily to 80% as part of regulatory relief offered to help manage the COVID-19 pandemic. Banks will be required to comply with the requirement of 100% from 30 September 2021.

Reserve requirements ensure that banking institutions hold certain amounts of reserves with the central bank, and can also affect broader credit conditions by changing the spread between lending and deposit rates.³³ Although RRs can be used for monetary policy purposes, countries also change the

³³ IMF (2013); Glocker & Towbin (2012).

requirements for financial stability purposes. RRs are usually applied on short-term liabilities (including deposits) and can be differentiated by type of liabilities (by maturity, and/or currency), applied on the stock or flows (marginal reserve requirements), and remunerated below the policy rate or may be unremunerated.

Structural tools

Tools may be used to address risks in the structural dimension arising from interconnectedness and the risk of contagion from the failure of individual systemic institutions (i.e. those institutions whose failure poses risks to the entire financial system). Interconnectedness can arise due to credit exposures or funding dependencies between financial institutions, such that the failure of a systemically important bank can, directly or indirectly, create contagion through spillovers between institutions and across the system. Banks and other financial institutions can be exposed to cascading effects from a solvency or liquidity shock, leading to system-wide liquidity squeezes and runs, as well as fire sales.³⁴

Many of the tools used to address risks in the structural dimension are the same as those mentioned earlier, but applied with a different objective. Most often, they take the form of additional capital surcharges for domestic systemically important financial institutions, with limits (including large exposure limits) on the exposures between financial institutions also being frequently reported.

Almost all countries reported the use of these surcharges for D-SIBs' surcharges, and large exposure limits for exposures between financial institutions. A D-SIB capital surcharge, in terms of a higher loss absorbency (HLA) surcharge, is required to hold additional capital buffers ranging from 0.5% to 1.0% at the consolidated group level using a CET1 capital instrument. The aim is to strengthen the resilience of the banking system and address the risks posed by D-SIB to the wider economy. An objective of the HLA requirement is to ensure that D-SIBs possess a higher share of their balance sheets funded by financial instruments to enhance the resilience of the institution as a going concern.

Other macroprudential measures for reducing contagion include increases in risk weights and large exposure limits, which can be used to discourage large exposures to such institutions or within the financial system more generally. Although the bulk of the measures is focused on bank credit, some of these policies are applied on a consolidated basis with their subsidiaries, such as finance, insurance and capital market-related companies (i.e. asset managers and other institutional investors). Policies taking a macroprudential perspective are being developed to address financial stability risks arising from non-bank activities and interconnectedness in market infrastructure. Similarly, a risk-based supervision policy introduced for the insurance/takaful sector has enabled RSAs to determine the category of supervisory stance for each insurer and takaful operator based on the results of the overall risk ratings calculated within the tool.

³⁴ See footnote 33.

2.5.3 Operationalising the use of tools

The key aspect involved in mapping the assessment of systemic risks to policy action to contain those risks is, basically, to design and calibrate the policy response in a manner that targets well-identified risks.

Calibrating policy responses to risks

A main question in macroprudential policy making is the decision to link systemic risk assessments and policy tools applications in either a rules-based or a discretionary manner. Efficient calibration requires a degree of judgment to enable a response to evolving risks. Findings from the survey suggest that macroprudential policy making largely depends on judgment, even though quantitative analysis is increasingly being used. A mix of rules and discretion may be optimal, depending on the instruments in question. Notably, a number of rules-based instruments were deployed to address the key dimension of systemic risk – for instance, tools such as a countercyclical surcharge aimed at constraining banks' behaviour in the upturn of a cycle and limiting the build-up of systemic risk. In addition, some discretionary policy elements would complement the rule by allowing policymakers room to apply additional measures.

Clarity about the policy target and the transmission process is a key condition for the effective calibration and communication of macroprudential measures. The difficulty in calibrating systemic risk favours this complementary approach and avoids the downside risks of relying strictly on automatic mechanisms. Discretionary interventions would also be more appropriate for dealing with unanticipated sudden systemic shocks, as well as with idiosyncratic risks affecting systemic individual institutions or market segments. Accurate calibration of tools may be impaired by a lack of data and uncertainties over the transmission process. Since a rules-based application relies on indicators to provide correct signals for target action (i.e. the build-up and release), and on the influence of policy on market participants' behaviour and expectations, quantitative approaches may at present offer limited guidance.³⁵

Evaluating the impact of macroprudential policy intervention ex post is useful to gauge the need for recalibration or additional measures.³⁶ In particular, leakage and other unintended side effects can be measured by assessing: (i) the extent to which measures have had the desired impact on resilience; and (ii) their effects on behaviour and impacts on credit growth. Such assessments can be useful for assessing whether to improve the design and calibration of tools or to take additional or corrective action as necessary.

Assessing and addressing leakage

The potential for leakages poses challenges to the effective implementation of macroprudential policy tools. "Leakages" refers to the migration of financial activity outside the scope of application and enforcement of the macroprudential tool, potentially undermining its effectiveness. Leakages can be

³⁵ CGFS (2016); Crockett (2000).

³⁶ CGFS (2012); ESRB (2014); IMF (2014a).

domestic, where activity migrates to domestic providers of financial services outside the initial scope of application of macroprudential tools. Strategies to address leakages will tend to expand the scope of application of macroprudential policy tools to non-bank and foreign providers of credit – for example, through jurisdictional reciprocity agreements or greater host control over foreign affiliates.

Findings from the survey suggest that the challenges in addressing leakages differ across macroprudential tools. For instance, leakages from tools that constrain the availability of bank credit to households (such as LTV/FTV and DSTI limits) can be more easily contained by expanding measures to non-bank providers of credit, especially when these are already within the regulatory perimeter. They can also typically be applied to foreign branches. Moreover, leakages from broad-based capital tools in the domestic economy can be effectively contained through consolidated supervision to credit provision by a non-bank. As in the case of the Philippines, the non-bank financial institutions (NBFIs) with quasi-banking (QB) functions and affiliated to universal/commercial banks are subject to the same Basel reforms (i.e. CAR, CCB, leverage, LCR, NSFR, CCyB) as that of its parent bank.

Where liquidity tools are applied to the banking system, maturity transformation can migrate to non-banks. If such migration is sizeable and occurs in parts of the system that remain connected to the banking system, actions can be taken to consolidate such activity on the balance sheet of the core system, thereby subjecting it to regulation. Liquidity tools can also be extended to non-bank providers of maturity transformation directly, even though this may require the cooperation of the relevant supervisory authorities.

Leakages can also be migrated through cross-border transactions, where activity moves to foreign-owned providers of financial services outside the scope of enforcement of the national measures. Potential cross-border effects include: positive externalities from appropriate macroprudential action; leakages that can undermine the effectiveness of domestic action; potentially undesirable spillovers of action for other countries; and migration of activities from uneven strength of action across countries.

Similarly, cross-border leakages can pose major challenges for capital-based tools, especially where foreign affiliates are established as branches, as opposed to subsidiaries, and for measures that aim to address excessive credit to the corporate sector, when local corporations are able to borrow directly from abroad and in international markets.

2.5.4 Evaluating effectiveness

Assessing the effectiveness of macroprudential tools ex-post can be guided by the objective of macroprudential policies. Macroprudential actions are effective if they ensure that the financial system remains stable and fulfils its main purposes (to allocate capital, manage risks, etc.). But this definition is probably too general to be useful when assessing the effectiveness of an individual tool. Narrower measures of effectiveness could focus on more specific objectives, such as curbing the growth of a particular form of credit or increasing the resilience of the financial system against shocks of a particular set of market participants – for instance, households or banks – or to restrain a financial boom.

The survey findings generally suggest that central banks appear to be broadly satisfied with the effectiveness of the macroprudential tools they have used. Of course, there is the likelihood of a selection bias in the responses, as most of the respondents tend to use the tools they regard as the most effective. However, their ability to employ macroprudential instruments varies across jurisdictions.

The central banks' evaluation is mostly judgmental, as formal quantification is limited. However, findings suggest that countries' RSAs are increasingly relying on quantitative analysis due to the need to quantify the impact of policy on market participants' behaviour and expectations.³⁷ Since sources of systemic risk can shift and indicators cannot capture all the available information, macroprudential policies are generally better supported by "guided discretion". Such is the case where it is necessary for countries' RSAs to apply some judgment in the setting of the buffer because of the imperfect nature of the indicators' signals.

A well-designed rules-based approach can act as an automatic stabiliser, with effective pre-commitment devices helping to reduce inaction bias, to better shape expectations and to promote accountability.³⁸ Once rules are in place, they do not require recurring justification or explicit decisions. Equally, such an approach ties policy settings to a pre-defined indicator that can overcome political economy challenges. However, rules can also be prone to arbitrage.³⁹ The design of rules is also often hampered by a lack of reliable indicators that could help automate instrument use.

A majority of survey respondents (13) have full control over macroprudential tools such as CCyB s and capital requirements, sector-specific capital requirements for the banking sector, and DSTI and LTV/FTV ratios, among others. This allows them to adjust the measures more rapidly as systemic risks recede with time, which may allow for a gradual relaxation of some macroprudential constraints. In this case, a prompt and decisive relaxation may best serve macroprudential objectives, especially where macroprudential measures are binding on the provision of credit to the economy.

As experienced in the wake of the COVID-19 pandemic, the majority of respondents announced macroprudential measures in parallel with the action taken by the monetary and fiscal authorities. Specifically, the main macroprudential instrument subject to these measures was the CCyB, which, practically across the board, was drawn down (i.e. returned to its initial level of 0%) in those countries in which it had previously been activated. The aim was to encourage banks to maintain the flow of credit to the economy. (See the IFSB's website for a detailed summary of country-by-country macroprudential measures.)

Lessons were also drawn from the experience of the crisis about the usefulness of some of the indicators used to activate macroprudential tools. This is the case with the credit-to-GDP gap. For

³⁷ CGFS (2016).

³⁸ See CGFS (2010).

³⁹ Borio (2003).

instance, as indicated by one respondent, after the pandemic broke, this indicator increased significantly and has held at values of over 2 percentage points (ppts), which is the warning threshold on the basis of which the Basel framework recommends activating the CCyB. However, the increase in the credit-to-GDP gap has been largely due to the very stimulus policies for the economy applied by the authorities and, above all, to the adverse impact on GDP of the COVID-19 shock. Events surrounding the COVID-19 shock, from a source completely external to the financial system, have demonstrated the efficacy of this approach in the use of the CCyB. Hence, in situations such as the present, the Basel framework itself acknowledges that it is necessary to complement the information provided by the indicators habitually used in upturns with other indicators offering information on the degree of materialisation of systemic tensions.

In addition, countries' RSAs monitored other indicators such as output gap⁴⁰ that measure the presence of systemic tensions in financial markets. This proved useful for identifying the start of a systemic crisis. For a number of countries, these indicators showed, in fact, a very pronounced increase in the opening months of the pandemic, but an improvement subsequently.

At the global level – in different agencies such as the Basel Committee on Banking Supervision (BCBS) and FSB, among others – various coordinated decisions in this economic policy area have been taken. One notable example was the introduction of recommendations for restrictions on the distribution of dividends by banks and on variable remuneration. Their uniform application to all banks, by financial system sector and country, conferred a significant macroprudential dimension on this action, by contributing to preserve the capital of banks as a whole. This measure has, in conjunction with other measures adopted, enabled the provision of bank lending to the productive sectors of the economy to be increased. However, decisions to relax macroprudential measures need to maintain confidence and ensure an appropriate degree of resilience against future shocks.

SECTION 3 THE PANEL REGRESSION ANALYSES

3.1 Macroprudential policy measures

This section of the paper describes in detail the data used in the analysis – the IMF's integrated macroprudential policy (iMaPP) database, which was constructed based on the macroprudential policy survey conducted in 2018.⁴¹ This database provides a comprehensive coverage in terms of instruments, countries and time periods, a good advantage over other databases.

The IMF's iMaPP database provides a detailed description of each of the policy actions for 17 macroprudential instruments (e.g. capital requirements), and their subcategories of general, household-

⁴⁰ Output gap: the difference between the actual and potential level of output, which reflects the persistence of the impact of the crisis on GDP.

⁴¹ iMaPP is based on the IMF's Annual Macroprudential Policy Survey, April 2018

sector and corporate-sector measures that allow for examining the effects of instruments that target particular sectoral exposures. In addition, the data were expanded to 4Q2019 (a more recent period) drawn from the feedback received during the similar survey conducted by the IFSB. The taxonomies of instruments in the dataset were as listed in the IMF's iMaPP database (see Appendix, Table 3).

The information on the key characteristics of each of the policy actions in the dataset drawn from the IMF's iMaPP database allows us to use uniform criteria to determine which measures to include and how to record them consistently. More importantly, the focus is on how these policy tools operate in practice. An additional benefit from this database is accurate identification of the implementation date of each policy action. The information on all the relevant policy actions obtained from the database was used to generate variables capturing the tightening and loosening of the policy instruments.⁴² However, heterogeneity is inherent in the entirety of policy actions in the database. The IFSB's survey also revealed that policy instruments are defined and implemented differently across countries, to the extent that the numerical information provided is often not comparable.⁴³ Even with the application of uniform selection criteria across countries, the specifics of policy actions differ across countries and over time. For example, the dataset includes the introduction of a maximum LTV ratio, as well as the subsequent reductions and increases in the ratio. Also, in a number of countries, total household income is used in calculating the DSTI, while in others the borrower's income is used. Including these data in a regression model therefore requires some degree of standardisation and aggregation.

Nonetheless, policy actions and changes are categorised along the lines laid out in Section 2. Macroprudential authorities often use a combination of tools, rather than a single tool, to target particular sectoral exposures.⁴⁴ When specific (e.g. sectoral) vulnerabilities are building up in the absence of a broad-based credit boom, more narrowly targeted approaches may be able to address the specific concern more efficiently. For instance, when potential systemic risk arises from households' borrowing, the use of complementary tools may mitigate such effects by addressing risks from several angles.⁴⁵ LTV/FTV, LTI and DSTI limits, for example, can address the demand for credit and promote resilience on the part of borrowers, and thereby complement capital tools that act on the supply side and promote the resilience of banks. Indeed, for this reason, many countries are using a combination of both sets of tools. In addition, DSTI limits enhance the effectiveness of an LTV/FTV cap, by tying debt burdens to income and containing the use of unsecured loans to meet the minimum down payment.⁴⁶

The goal of the empirical exercise is to answer two simple questions. First, what is the effect of a policy tool in countries where it has been introduced? Second, what would have been its effect in countries that have not actually used it? To answer these questions, a dummy variable is introduced with a value of 1 for countries and periods in which a particular instrument is used, and a value of zero otherwise.

⁴² The IMF's iMaPP database provides a complete list of all relevant policy actions.

⁴³ See footnote 29.

⁴⁴ See footnote 28.

⁴⁵ CGFS (2012); IMF (2013).

⁴⁶ IMF (2014b).

Based on the iMaPP database, a dataset of dummy-type macroprudential indices (MPI) of policy actions was generated to capture the tightening and loosening of the macroprudential measures and their subcategories at a monthly frequency. The dummy variable captures an average “treatment effect” of the instrument across countries in the sample, with countries and periods in which the instrument is not used as counterfactuals. The dummy-type policy action indices take on four discrete values: 1 for tightening, +1 for increasing tightening actions, –1 for loosening actions, and zero for no change. While we typically know the month of implementation for each macroprudential action taken, the monthly observations were summed to a quarterly frequency to match the frequency of our dependent variables. If a tool was used more than once in a quarter, we sum all changes over the quarter. This indicates that, if multiple actions in the same direction were taken within a given quarter, the variable could take on the values of 2 or –2, or even 3 and –3. On the other hand, a tightening action and a loosening action taken within the same quarter would cancel each other out. These dummy indices are based on the effective date when it differs from the announcement date, because the effective date is more widely available.

Moreover, the use of dummy-type indices has been useful in several ways. First, the dummy-type indices show policy action and direction of a policy change; thus, they provide an indication of various policy actions in use. Second, dummy indicators help to characterise the use of macroprudential policy instruments and are useful for estimating the effects of macroprudential instruments per policy action, as in previous studies.⁴⁷ Third, as mentioned earlier in this section, they help to overcome the heterogeneity inherent in the entire policy actions in the database. However, they do not provide information on the intensity of the change. In this case, a large change in these indices does not necessarily indicate large changes in the policy instruments. It is possible, for instance, that some instruments are adjusted frequently but with small changes, while other instruments are adjusted less frequently but with large changes.

Thus, calculating measures of policy intensity for various instruments could, in principle, be preferable, since only few instruments have relatively more variations, while the variation is limited for many individual instruments.⁴⁸ It may be difficult, or not feasible, to construct such measures, given the diverse nature of policy instruments.⁴⁹

The multidimensional nature of systemic risk calls for the use of a combination of various macroprudential tools so as to be able to address each of these dimensions as efficiently as possible. In line with this viewpoint, the assessment of the effect of MaPP tools is focused more generally on cumulative effect, rather than on individual instruments. Thus, the policy measures are categorised into

⁴⁷ Lim et al. (2011), Classens et al. (2013); Cerutti et al. (2017); Poghosyan et al. (201); Alam et al. (2019).

⁴⁸ For example, loan-to-value (LTV)/finance-to value (FTV) limits, debt-service-to-income (DSTI) limits, loan restrictions (LOANR), limits on bank credit growth (LCG), loan loss provisioning requirements (LLP), capital requirements (Capital), and tax measures (TAX).

⁴⁹ Alam et al. (2019).

seven different groups – namely, aggregate (all tools) and subcategories, all credit-targeted, demand-related and supply-side measures – which are divided into three subcategories, including supply-general, supply-capital and supply-credit tools (See Appendix, Table 4).

The first category encompasses the “overall aggregate” of all the 17 macroprudential instruments listed in the IMF’s iMaPP database, and “all credit targeted” measures comprised of demand-related measures (i.e. maximum FTV/LTV ratios, maximum DSTI ratios) and supply-side measures (i.e. risk weights on housing loans/financing, provisioning requirements, reserve requirements, general loan-loss provisioning ratios and specific provisioning ratios applied to housing loans) and exposure limits on banks to the housing sector). All credit-targeted measures directly target the aggregate quantity of funds available for financing. They are meant to slow down households’ credit growth and build up buffers within banks against potential losses. However, it should be noted that this distinction is not clear-cut, to the extent that reserve requirements also operate, in effect, by influencing the cost of lending.

Demand-related measures encompass policies intended specifically to limit household credit growth. Tools in this category include maximum FTV/LTV ratios and maximum DSTI ratios, both of which affect households’ demand for housing credit. Macroprudential authorities often either impose a maximum FTV/LTV ratio to home financing or lower the pre-existing maximum. The authorities may also prohibit certain types of housing financing, which is equivalent to applying a zero LTV ratio. For example, the LTV ratio limits were introduced on housing loans/financing by Malaysian authorities to curb credit-induced speculative purchases.⁵⁰

A limit on the DSTI ratio (or debt service ratio) is a frequently used measure for restricting excessive financing provision to the household sector. Typically, regulators specify a certain percentage of the borrower’s monthly income as the maximum monthly repayment on a bank loan. Less frequently, limits to the loan amount can be expressed as a multiple of household income (i.e. a maximum DTI ratio), or regulators can limit the minimum debt-repayment-to-debt ratio. Alternatively, authorities can lengthen the maximum maturity of financing contracts to ease the repayment burden for borrowers. All such measures are classified as “other lending criteria”.

Supply-side measures comprise tools that are meant to restrain the volume of banks’ financing to the household sector through affecting the cost of funds (i.e. changes in provisioning requirements, the adjustment of risk weighting). In addition, they encompass tools that affect the household credit supply (i.e. exposure limits), not through the cost of funds but through the quantitative limit on banks’ supply of household financing. A limit on house financing exposure is sometimes set as a certain percentage of

⁵⁰ Following the introduction of the FTV/LTV ratio limit of 70% for the third and subsequent outstanding housing loan (a proxy for speculative purchases), the annual growth of the number of borrowers with at least three outstanding housing loans has fallen to around 2%, from 15.8% in 2010. Housing loans settled under three years (a proxy for flipping of properties) also remained contained, at 12% of total cases. As at end-September 2016, the household debt annual growth rate slowed to 5.8%, compared to 14.2% at end-2010.

a bank's equity. By limiting banks' exposures to the household sector as a percentage of the total assets or liabilities, this type of measure aims to slow down rapid expansion of household financing by banks and also to limit the resulting losses. Supply-side measures are divided into three categories – namely, supply-general, supply-capital and supply-credit tools (see Appendix, Table 4).

Under Basel I, II or III, housing sector financing is subject to different risk weights than apply for corporate or sovereign exposures. Raising risk weights on household financing makes it more costly for banks to extend financing to the sector, given a fixed amount of bank equity. Often, risk weights are differentiated by the actual FTV/LTV ratio of individual financing. For example, the parts of the FTV/LTV ratio to the sector that are higher than a certain threshold (e.g. 80%) may carry a higher risk weight. Similar to risk weights, increases (or reductions) in general loan loss provisions and specific loan loss provisions applied to housing loans can be used to make housing loans more (or less) costly and thus help slow (or spur) growth in housing credit.

Accordingly, an aggregate dummy-type macroprudential index (MPI) and subcategory indices were constructed based on a macroprudential policy stance (i.e. a tightening action and a loosening action) for individual components within each group. Thus, the dataset comprises aggregate index and subcategory indices (e.g. all credit-targeted, demand-related and supply-side measures, further subdivided into three categories, including general, capital and credit-supply tools) for a six-year period from 4Q2013 to 4Q2019, covering 10 countries with a dual banking system. This allows us to perform empirical analysis of the behavioural responses of Islamic banks to various macroprudential policy measures that targeted particular sectoral exposures (in this case, household credit growth).

3.2 Model specifications and panel regressions analysis

3.2.1 Model specifications

This section presents a model for estimating the effectiveness of macroprudential policies in curbing household credit growth.⁵¹ Consistent with the previous studies,⁵² the empirical analysis examined how the MPI aggregate and its various sub-indices relate to the household credit growth on the dataset span over a six-year period (4Q2013–4Q2019) for 10 countries,⁵³ using a baseline static panel regression model and a dynamic model to assess the robustness of the results.

The panel regression model uses a dataset of dummy-type policy action indices as a macroprudential variable (independent variable) and a macroeconomic variable (control variable), with real GDP growth sourced from countries' central bank website. These datasets were then matched with the dependent variables' macro variables (household credit growth) available in quarterly form from the IFSB's PSIFIS

⁵¹ The model assesses the extent to which macroprudential policy is able to attain one of its intermediate objectives: to contain the build-up of systemic vulnerabilities by reducing procyclical feedback between credit and asset prices and containing unsustainable increases in leverage. (See, further, IMF 2013; IMF 2014; IMF, FSB & BIS 2016.)

⁵² Lim et al. (2011); Cerutti et al. (2017); Kuttner & Shim (2013; 2016); Alam et al. (2019).

⁵³ Specifically, countries with IFSB membership.

database (see Appendix, Table 4). This allows an empirical analysis of the behavioural responses of Islamic banks to various policy macroprudential measures. Data availability is the main constraint on the scope of this analysis. For some countries, data are available, but the time series were too short to be of any use.

Panel data modelling is widely used in econometric modelling on datasets constructed with repeated observations on the same individuals, where a large number of individuals are observed for a small time period. Thus, it offers more informative data, more variability, less collinearity among the variables, more degrees of freedom and more efficiency. These properties enable the panel data model to be used to investigate heterogeneity in adjustment dynamics between different types of individual countries.⁵⁴ As a result, it is amenable to the use of static econometric techniques such as pooled OLS and generalised least square (GLS) estimators (i.e. random effects [RE], and fixed effects [FE]), such that biases from aggregation over individual countries can be reduced or eliminated.

Basically, the static econometric techniques such as pooled OLS and GLS estimators (i.e. RE and FE) were used to investigate the extent to which the MaPP instruments limit the procyclicality of credit – a measure of systemic risk. In this case, procyclicality is captured by the respective correlation of growth in credit with GDP growth – their tendency to amplify the business cycle.⁵⁵ This specification has the advantage of showing the effect of the instruments in both the expansionary and recessionary phases of the cycle without “timing” the cycle. As is common in the literature, the study relies on a simple timing assumption to address endogeneity. Our results are in line with those in earlier studies.⁵⁶

$$\Delta_4 C_{i,t} = \alpha_i + \beta MaPP_{i,t} + \gamma X_{i,t} + \mu_t + \epsilon_{i,t} \dots \quad (1)$$

where i is country and t is time (quarter). The dependent variable, $\Delta_4 C_{i,t}$ refers to the year-on-year (y-o-y) growth rate of real household credit. The main independent variable, $MaPP_{i,t}$, is the policy change indicator for the instrument or the instrument group i at time t . This indicator records tightening actions (+1), loosening actions (–1) and no changes (0), and is cumulated over the past four quarters (and divided by four), to account for potential lagged effects. Since for many individual tools the variation is limited, the study considered indices for instrument groups, including all, loan-targeted, demand and supply measures, which are further subdivided into three categories, including general-, capital- and loan-supply tools (see Appendix, Table 5). Assessment of the effect of MaPP is focused more generally on aggregate effect, rather than on individual instruments. A vector ($X_{i,t}$) is included with GDP growth as control variables – in this case, real GDP growth when regressions focus on the effect of specific measures. Time fixed effects (μ_t) capture time-varying common factors such as global risk aversion,

⁵⁴ Baltagi (2008).

⁵⁵ Kuttner & Shim (2016).

⁵⁶ See footnote 55

while country fixed effects (α_i) capture time-invariant country-specific factors such as institutional characteristics.

Robustness checks

In order to assess the validity of our findings, this study uses as a robustness check the Arellano-Bond (1991) generalized method of moments (system GMM panel) estimator (using the “xtgdpd” command in STATA, with one lag needed in the dependent variable so that we maximise sample size). Using lagged values for the $MaPP_{i,t}$ variables and the GMM regression techniques, which are a good fit given our small T and large N sample, also mitigates important endogeneity concerns between credit expansion and the adoption of macroprudential policies. For instance, in recent years countries adopted macroprudential policies in the aftermath of financial stability concerns, and at the same time credit growth slowed as a result of weak demand and supply constraints at banks. Any negative relationship found between the contemporaneous level of the macroprudential policy and credit growth may then reflect reverse causality, but using GMM regressions mitigates some of them.

$$\Delta_4 C_{i,t} = \rho_i \Delta_4 C_{i,t-1} + \beta MaPP_{i,t-1} + \gamma X_{i,t-1} + \alpha_i + \mu_t + \epsilon_{i,t} \dots \quad (2)$$

The lagged dependent variable ($\rho_i \Delta_4 C_{i,t-1}$) is included as a regressor to account for persistence. A vector ($\gamma X_{i,t-1}$) denotes lagged macro control variables, real GDP growth, as well as macroprudential policies ($\beta MaPP_{i,t-1}$) when regressions focus on the effect of specific measures. The identification of macroprudential policy effects is based on a timing assumption – macroprudential policy does not affect macrofinancial variables (e.g. credit growth) within the same quarter. This is a rather strong assumption, and the estimated coefficient of $MaPP_{i,t}$ would be subject to the attenuation bias if the timing assumption did not hold, even as this is the typical approach taken in previous studies.⁵⁷ Time fixed effects (μ_t) capture time-varying common factors such as global risk aversion, while country fixed effects (α_i) capture time-invariant country-specific factors such as institutional characteristics.

In addition, the model also specifies interaction between these variables and $MaPP_i$ to examine how the effects vary by countries' circumstances. The coefficient of this matrix measures the change in the correlation between the risk variable and the control variable after an instrument is adopted. Countries that do not use the instrument are included as a counterfactual, where the value of the instrument is set to zero. Matrix Y represents the change in systemic risk after the introduction of an instrument. However, this specification would lead to biased results due to the presence of a lagged dependent variable and country fixed effects.

⁵⁷ Kuttner & Shim (2013); Akinci & Olmstead-Rumsey (2018).

3.2.2 Steps in the specification and panel regressions analysis

The initial step is to create indices for all macroprudential tools and subgroups of macroprudential tools that represent the independent variables in the model using Principal Component Analysis.⁵⁸ A total of seven indices were created from 187 observations and 17 macroprudential instruments – namely, MaPP index; All credit-targeted index; Demand-related index; Supply-side index; Supply-capital index; Supply-credit index; and Supply-general index.

Given the cross-countries nature of the analysis, the GDP growth (y-o-y) is selected as a proxy for fiscal policy and a control variable for country-specific characteristic. Other unobserved country-specific characteristics are accounted for by the panel regressions' fixed effect. This allows us to highlight the general impact of macroprudential instruments in the context of country-specific characteristics. As can be inferred from the literature,⁵⁹ there seems to be no direct linkage between fiscal policy and procyclicality of credit or leverage. Thus, any indirect linkage would be captured by GDP growth; at the same time, the effect of macroprudential instruments can be delineated from that of other policies. However, using other variables in addition, such as interest rate and fiscal deficit, has the disadvantage of introducing multicollinearity given its high correlation with GDP growth.⁶⁰

The dataset, which comprises independent variables such as aggregates and subgroups' indices of macroprudential tools together with GDP growth (y-o-y) as a proxy for fiscal policy and a control variable for country-specific characteristics, was then synchronised with the dependent variables' macro variables (household credit growth) available in quarterly form from the IFSB's PSIFIS database. This allows an empirical analysis of the behavioural responses of Islamic banks to various policy macroprudential measures.

Results of the static panel OLS and GLS (RE and FE) regressions suggest that the majority of the 17 instruments may be effective. Moreover, results also show that the instruments remain effective after controlling for macroeconomic policies. In addition, instruments that are rules-based have a larger effect, although there is not enough evidence to indicate whether individual or multiple instruments are more effective, due to the lack of granular data.

Further, it was tested whether GLS is necessary, or simple OLS is sufficient as the best-fitted model, using the Breusch and Pagan Lagrangian multiplier test for random effects (pooled OLS versus RE). Since the calculated value exceeds the tabulated chi-squared value, we are led to conclude that the random effect model is more appropriate than the OLS (pooled model). This indicates that there are country-specific effects in the data.

⁵⁸ The procedure for the creation of the indices is explained in this video link: [Video @Sohaib via <https://www.youtube.com/watch?v=BFdmXi>]

⁵⁹ Kuttner & Shim (2013); Akinci & Olmstead-Rumsey (2018); Cerutti et al. (2017); Alam et al. (2019). >

⁶⁰ Alam et al. (2019).

Next is the question of how to treat the country-specific effects. This was accomplished by performing the Hausman specification test to determine the appropriate model between the random effect and fixed effect GLS models. If they are uncorrelated with the regressors, the random effect estimator will deliver a consistent estimator that is also efficient; otherwise, it will be inconsistent (biased). On the other hand, the fixed effect model will be unbiased under both scenarios, although it will be inefficient if the country-specific effect is uncorrelated with the regressors. The source of this inefficiency is easy to identify: the fixed effect estimator only uses the within variation. As translated in the equation below, there are two estimators, one efficient under the null, but biased under the alternative; and another unbiased under both. This translates into:

$$\begin{aligned} H_0: \text{Cov}(\alpha_i, x_{it}) &= 0 \text{ (RE)} \\ H_A: \text{Cov}(\alpha_i, x_{it}) &\neq 0 \text{ (FE)} \end{aligned}$$

The statistically significant result of the Hausman test (i.e. a large value of *Hausman*) shows that we reject the null (H_0) in favour of the fixed effect model (H_A). Hence, the fixed effect estimator is the best-fitted model for the analysis. The fixed effect demonstrates the country-specific effect on the analysis (see Appendix, Table 7).

3.3 Main regression results

3.3.1 Descriptive statistics

Appendix, Table 5, presents the descriptive statistics for the main regression variables. The table shows large variation in the macroprudential policy index. For instance, the overall MaPP index ranges from – 0.199 to 5.012 ppts, with a standard deviation of 1 and a mean of 7.81 ppts.

A large variation is found for other groupings of MaPP variables. Country-specific differences are reflected in the variability. In terms of other policy and control variables, the variation is also large. And there is much variation also in terms of control variables – for example, real GDP growth – for the summary of the statistics (see Appendix, Table 5).

The correlations matrix for different groups of policy variables is shown in Appendix, Table 6. Most of these correlations are relatively small, indicating that there is little tendency for a country to take different kinds of policy action within the quarter. The exceptions are the 0.63 correlation between the supply-capital and all credit-targeted measures, suggesting that these policies are often used in conjunction. The correlations between policy variables are constructed by summing current and previous quarters' policy actions. This takes into consideration the possibility of co-movements between the policies that may not occur within the same quarter. The relationship between the components of supply-general and all credit-targeted variables is even stronger in this case, with a correlation of 1.00. This suggests

that changes in a component of the supply-general measure (e.g. provisioning requirements) accompany changes in the all credit-targeted measures (e.g. DSTI and LTV requirements).

This result is consistent with the finding reported earlier that most of the macroprudential instruments are estimated for their effect on procyclicality, which is defined as the correlation between growth of GDP and growth of the risk variable on the left-hand side. Some instruments may be used to reduce common exposure across institutions.

3.3.2 Results of model estimations: The effects of policy actions

The static panel regression model assessed the impact of aggregated and subgroup indices of macroprudential policy (the independent variable) on household credit growth (the dependent variable). As illustrated in the table showing the model results (Appendix, Table 7), the result of model estimation suggests that macroprudential policy variables exert a statistically significant negative effect on household credit growth. The index capturing the overall macroprudential measure (the aggregate MaPP index) shows a decline (negative sign) in household credit growth by 0.8 ppts for the fixed-effect model (best-fitted model), but it is not statistically significant. This is consistent with other findings that household credit growth is more difficult to moderate using the overall macroprudential policies,⁶¹ since only a few instruments have relatively more variations⁶² and the variation for many of the instruments is limited.

The estimated coefficients of each of the subgroup indices (all credit-targeted, demand-related and supply-side tools) vary, indicating differential impact of targeted policies on household credit growth. Among the subgroup categories, all credit-targeted measures, those specifically intended to limit household credit growth seem to be more effective across all countries in the sample. The credit-targeted tools include the demand-related tools (i.e. the LTV and DSTI limits) and those constraining bank finance supply (i.e. the supply-side tools), such as restrictions on credit growth and loan loss provisions.

On the other hand, the supply-side tools⁶³ are found to have stronger impacts on household credit growth than the demand-targeted measures. The estimated coefficient is statistically significant, indicating that a tightening event of supply-side tools is associated with an approximately 4.3 ppts decline in household credit growth, whereas a tightening action by any of the demand-related tools restricts credit growth by 3.5 ppts. In this category, the DSTI and LTV/FTV tools are negatively associated with household credit. They are specifically applied to curb excessive exposure to the household sector. This finding is consistent with previous studies (i.e. Cerutti et al., 2017; Kuttner & Shim, 2016; Alam et al., 2019). Other supply-side tools, including supply-credit, supply-capital and

⁶¹ See Cerutti et al. (2017); Kuttner & Shim (2013; 2016); Akinci & Olmstead-Rumsey (2018).

⁶² For example, loan-to-value limits (LTV)/finance-to value (FTV), debt-service-to-income limits (DSTI), loan restrictions (LOANR), limits on bank credit growth (LCG), loan loss provisioning requirements (LLP), capital requirements (Capital), and tax measures (TAX).

⁶³ See Appendix, Table 4, for detailed lists of subgroup categories.

supply-general, are found to have less potent effects in containing credit growth, with 3, 3.3 and 1.4 ppts, respectively (Appendix, Table 7).

The static panel model estimations have also helped to address the question of which macroprudential instruments have more potent effects in dampening household credit growth. As shown in Appendix, Table 7, the differences in the estimated coefficients of aggregate and subcategories of macroprudential policy tools (e.g. all credit-targeted, demand-related and supply-side tools) indicate the relative effect of each individual group. In effect, the analyses have highlighted the importance of macroprudential tools for managing risk in Islamic banking. This suggests that such tools can effectively be applied to limit exposure of Islamic banks to household credit growth that could be a potential source of vulnerability to the banking sector independently of countries' specific differences.

However, static panel model estimation of average treatment effects may be subject to biases. For instance, countries that adopt an instrument may need it the most (the so-called endogeneity problem). Thus, if countries that introduce the instrument are those that would have had, for example, excessively high credit growth, the coefficient estimated with ordinary least squares is biased upwards. Instrumental variables are needed to address endogeneity. The use of a dynamic panel – required to fully capture the time-series component of the effectiveness of the instruments – adds difficulties.

The generalised method of moments (GMM) dynamic panel addresses this problem, and is a standard choice for the estimation of panel data models with endogenous regressors. The GMM system estimator ensures orthogonality between the lagged endogenous variables, in both levels and differences, and the residual term. The lagged variables are used as instruments, appropriately weighted.

3.3.3 Robustness checks

Next, as a robust check, the Arellano-Bover-Blundell-Bond GMM regression estimation is used to measure the effect of each of the seven different groups of macroprudential policies on household credit growth for all the countries in the sample.

The dynamic panel regression results show that the (lagged) indices of aggregate and subcategories of macroprudential policies stance (e.g. all credit-targeted, demand-related and supply-side tools) is negatively, and statistically significant so, associated with household credit growth (see Appendix, Table 8).⁶⁴ The regressions passed the Arellano-Bond test for autocorrelation. However, due to the rather small number of countries in the sample, the large number of instruments used by Arellano-Bover causes the Sargan test to be weak. To further check the robustness of the results under GMM, the equation is estimated under restrictions on the lags used as instruments, as well as under ordinary least

⁶⁴ Note that the number of countries covered and observations included for the analysis are much smaller than in the base regression, due to the time-invariants of some of these measures. Appendix, Table 6, reports these regression results in summary form.

squares with fixed effects. The results are consistent, with significant coefficients of very similar magnitudes to the ones shown by the static model in the appendix. However, the estimation of a dynamic panel by OLS with fixed effects will be biased, since by construction there is a positive correlation between the lagged dependent variable and the unobserved individual-level effects.

The results in the GMM regression estimation lend support to the view that macroprudential policies are effective in curbing bank credit growth. This suggests that macroprudential policies have significant mitigating effects on Islamic banks' credit exposures to the household sector. The static panel model estimation results, which are the baseline, are qualitatively still similar to the dynamic panel estimation results, although the magnitude of the estimated effect is smaller than when estimated using the dynamic panel model.

In terms of control variables, the coefficient on GDP growth is of the same sign as in the base regression and at similar levels of statistical significance. This suggests that credit growth in these countries may be more crucially related to economic activities.

3.4 Model inferences

In this paper, the analysis was performed for both the static and dynamic panel regression models using a dataset span over a six-year period 4Q2013–4Q2019 for 10 countries. The dataset was constructed from the IMF's iMaPP database and was updated based on the information collected during the IFSB's Macroprudential Policy Survey conducted between April and June 2020. The household credit data were compiled from the IFSB's PSIFIS database, which is available in quarterly form, from where the dependent variable's macrofinancial variable (household credit growth) was drawn.⁶⁵ This provides the basis for performing empirical analysis of the behavioural responses of Islamic banks to various policy macroprudential measures that targeted the household sector. In addition, it enables a comparison of the relative effects of different macroprudential instruments groupings (e.g. all MaPP, loan-targeted, demand and supply measures, which are further subdivided into three categories, including general-, capital-, and loan-supply tools – see Appendix, Tables 7 and 8).

The results of the analysis were tested for the best-fitted model, whether simple OLS is sufficient or GLS is necessary using the Breusch and Pagan Lagrangian multiplier test for random effects (pooled OLS versus random effect). It was found that the RE model is more appropriate than OLS (39.76 (0.000) $p < 0.01$ ***),⁶⁶ indicating that there are country-specific effects in the data. The Hausman specification test is performed to determine the appropriate model between RE and FE GLS models for the treatment of country-specific effects (6.32 (0.0424) $p < 0.01$ ***]. Therefore, the FE model was chosen as the best-fitted model with an unobserved variable captured in the model. The statistically significant coefficient of the unobserved variable (constant) suggests the effect of country-specific circumstances, such as the quality of supervision, the phase of the credit cycle in which the instruments are implemented, and

⁶⁵ See Appendix, Table 3.

⁶⁶ Standard errors are in parentheses. Asterisks indicate statistical significance: *** for 1%.

the extent to which circumvention and arbitrage are possible. It also indicates that the ability of the authorities to take coordinated policy actions to limit circumvention and their responsiveness to changed conditions are among factors that determine whether an instrument is effective when applied in a particular country.

The dynamic panel model (the Arellano-Bover-Blundell-Bond system GMM estimation) estimation for robustness check of macroprudential policy stance (i.e. tightening action and a loosening action) with the timing assumption for aggregate and subcategories (e.g. loan-targeted, demand and supply measures.). The dependent variable is the annualised quarterly growth rate in household credit, while the control variable is the macroeconomic indicator GDP growth (y-o-y, including the interaction terms).

In summary, the result of the analysis suggests that Islamic banks also respond appropriately to the implementation of macroprudential policy tools (i.e. by proactively addressing any potential imbalances in credit growth in the banking system). In addition, the model also made use of the unique features of the macrofinancial variable household credit growth (available in the IFSB's PSIFIS database), which shows a similarity in the financing concentration of Islamic banks across the selected jurisdictions.

While this analysis is consistent with the previous studies, the study chooses household credit growth to represent a particular sectoral exposure (risk of financing concentration exhibited by Islamic banks in a specific sector) based on data availability and its unique feature, which shows a similar pattern across the selected jurisdictions. Alternatively, other macrofinancial variables such as housing prices, credit quality and non-performance financing can also be considered for the same purpose.

Data availability is the main constraint on the scope of this analysis. For some countries, data are available but the time series are too short to be of any use. Countries with fewer than 10 usable quarterly observations (accounting for the loss of observations from lags and differencing) are dropped from the regressions.

The short experience with macroprudential policy limits the number of observations available for a more comprehensive evaluation of its effectiveness. As a result, the study could only base its analysis on a dataset that spans a six-year period (4Q2013–4Q2019) and for a limited number of countries. Further research with longer time series and better-quality data is therefore necessary to corroborate the initial assessment and to evaluate the effectiveness of the policy instruments for Islamic banking.

SECTION 4 CASE STUDIES

4.1 Saudi Central Bank's macroprudential policy and surveillance framework

4.1.1 Systemic risk diagnosis, monitoring and treatment

One of the key objectives of the Saudi Central Bank (SAMA) is to ensure the soundness of the Kingdom's financial system. To do so, SAMA adopts a framework for macroprudential policy and surveillance that aims to: (i) assess the resilience of the financial sector; (ii) identify sources of systemic risk; (iii) predict the build-up of imbalances and vulnerabilities; and, accordingly, (iv) use appropriate policy tools to preserve financial system resilience. This framework employs three complementary surveillance systems – namely, stress testing, financial stability index, and financial soundness indicators. The framework also deploys a range of macroprudential policy tools designed to mitigate the systemic risk identified.

Stress testing

a. Overview

Stress testing has become firmly embedded in the supervisory frameworks for authorities around the world, especially since the 2008–9 Global Financial Crisis. Moreover, the use of stress testing for macroprudential purposes, which has received special attention in the last decade, added a new dimension to the exercise as a tool for assessing systemic risks in the banking sector.

The objectives of stress testing typically include assessing the resilience of individual financial institutions as well as the financial system as a whole to exceptional, extreme or simple, unexpected but plausible events; and identifying areas of vulnerability against which the financial institutions need to adopt countermeasures in order to preserve their financial health during stress periods.

The events used in designing the stress scenarios can be defined against either a specific historical scenario or a hypothetical scenario based on the analysis of past volatility and correlations or by use of other methods.

SAMA adopts both macro- and micro-stress testing frameworks, which consist of the following types of exercises:

- 1) Macro stress tests (top-down): conducted by SAMA on a quarterly basis to assess the resilience of the Saudi banking system to withstand adverse macrofinancial shocks.
- 2) Regular stress tests (bottom-up): banks are required to conduct bottom-up stress tests and to submit the results on a semi-annual basis. A bank may opt to perform further stress testing as part of its own risk management framework. In such a case, the nature and frequency of the exercise are determined by the financial institution itself.
- 3) Reverse stress tests: banks are required to conduct reverse stress tests semi-annually to identify areas of vulnerability and to assess the resilience of their business plans.

- 4) Ad hoc stress tests: conducted by banks at irregular intervals to assess the resilience of their overall portfolio or exposure to a specific business area in the backdrop of adverse market developments or abrupt changes in the external operating environment. SAMA may require banks to conduct ad hoc stress tests from time to time and report the results.

b. The macroprudential stress-testing framework

The macroprudential stress-testing framework of SAMA connects a series of satellite models to estimate the underlying relationship between macroeconomic and banking sector variables and, therefore, project the main determinants of banking profitability and capitalisation (total credit, non-performing loans, provisions, income components, risk-weighted assets and capital adequacy ratio) over a 12-quarter horizon. The current framework focuses on credit and solvency risks. However, the interest rate risk is implicitly accounted for by the satellite models for income components.

The model uses the following sets of data:

- Bank-level data: granular data related to capital, credit and income.
- Macroeconomic data: oil prices, growth of government spending, implicit lending rate, SAIBOR and Tadawul All Share Index (TASI). Oil price is a rough proxy for the external component of GDP, while government spending is considered as a driver of domestic activity.

Three scenarios are defined based on the outputs of SAMA's macroeconomic forecasting models and expert judgment:

- Baseline scenario: incorporates projections from SAMA's macroeconomic forecasting model.
- Moderate adverse scenario: assumes moderate shocks to relevant macrofinancial variables that are in line with risk developments or entertain forward-looking risks.
- Severe adverse scenario: a replication of the moderate shock with more severity tilted towards the downside, which allows the banking system's solvency to be gauged in response to unexpected severe shocks.

Based on the underlying scenario, changes in major banking variables (such as NPLs, provisions and profitability) are forecasted. And based on the estimated impact, the stressed levels of bank capital are projected.

Results of the top-down stress tests are used to better inform prudential decision making. They also serve as a benchmark for the bottom-up stress tests conducted by individual banks.

The macroprudential stress-testing framework is currently undergoing further development to add additional dynamic features, incorporate specificities of the Islamic banking sector, integrate a liquidity stress test component, and capture spillover effects from the non-bank financial sector and the real economy.

c. Financial stability index

SAMA has developed a composite financial stability index, consisting of a set of properly weighted macroeconomic and financial variables, which offers a continuous uninterrupted picture of the health and soundness of the Saudi financial system. The index is used to monitor the developments in the level of stability and to enable comparisons between different periods and sectors. Furthermore, the index is a work-in-progress and subject to future enhancements and changes.

The composite index uses 27 individual indicators, initially grouped into three categories of parameters – that is, three sub-indices. These sub-indices reflect developments in the banking sector, the capital market and the macroeconomic environment.

A specific weight is assigned to each sub-index in a way that reflects its significance to the stability of the aggregate index. These weights are determined based on expert judgment. However, within each sub-index, the equal variance weighting method is followed; that is, equal weights are attributed to all indicators within the sub-index.

The index gathers quarterly data of the aforementioned variables. And as the collected data are heterogeneous in nature, they go through a normalisation process using the statistical normalisation technique (z-score). The scaling factor is the standard deviation of the indicator. Thus, the average value of the index is zero. Values above zero suggest above-average levels of stability, whereas values that fall below zero represent a tendency towards financial instability.

The financial stability index can act as an early warning indicator of instability in the system, resulting from potential deterioration in macroeconomic and financial conditions, by utilising forecasting techniques. Therefore, following the general-to-specific modelling approach, three forecasting models were built to each sub-index and stationarity was accounted for. (Non-stationary series were differenced to be stationary.) The predictive power of each model was tested using an out-of-sample test, one-step-ahead forecasts and multiple-step-ahead forecasts. Based on the lowest mean square and absolute prediction error, the best forecasting model was selected. Three forecasting scenarios were developed for each sub-index based on the point forecast, pessimistic and optimistic (prediction intervals).

d. Financial soundness indicators

For financial stability purposes, the macroprudential function of SAMA closely monitors a set of aggregated microprudential indicators that provide early warning signals for any build-up of vulnerability. The indicators, which are quantitative in nature, are grouped into categories, following the CAMELS^{67,68} approach, as follows:⁶⁹

⁶⁷ Stands for Capital adequacy, Asset quality, Management soundness, Earnings, Liquidity, and Sensitivity to market risk.

⁶⁸ The sixth category, “management soundness”, which is qualitative in nature, is monitored by the micro-supervision function of SAMA.

⁶⁹ As of 2020.

- **Capital Adequacy**
 - Regulatory capital to risk-weighted assets
 - Tier 1 capital to risk-weighted assets
 - Common equity Tier 1 capital to risk-weighted assets
 - Tier 1 capital to total assets
 - Non-performing loans net of provisions to regulatory capital
 - Leverage ratio
- **Asset Quality**
 - Non-performing loans to total gross loans
 - Sectoral distribution of non-performing loans to total gross loans
 - Provisions to non-performing loans
 - Sectoral distribution of loans to total loans
- **Earnings and Profitability**
 - Return on assets
 - Return on equity
 - Interest margin to gross income
 - Non-interest expenses to gross income
- **Liquidity**
 - Liquid assets to total assets
 - Liquid assets to short-term liabilities
 - Loan to deposit ratio
 - Liquidity coverage ratio
 - Net stable funding ratio
- **Sensitivity to Market Risk**
 - Net open position in foreign exchange to capital

4.1.2 Policy tools employed in the macroprudential framework

Policy tools employed in the macroprudential framework include, among others:^{70,71}

- Countercyclical capital buffer (CCyB) requirement set at 0%. This requirement aims to reduce the impact of cyclical factors on system stability by requesting banks to build a risk buffer during the good times so that they can respond to shocks in downturn periods.
- Additional higher loss absorbency (HLA) capital requirements for domestic systemically important banks (D-SIBs).⁷² SAMA's methodology for assessing and designating D-SIBs, which came into effect in January 2016, is consistent with the BCBS's D-SIB assessment methodology. It uses size, interconnectedness, complexity and substitutability as selection

⁷⁰ In addition to adopting Basel III requirements such as CAR, LCR and NSFR.

⁷¹ As of 2020.

⁷² There are currently no global systemically important banks (G-SIBs) operating in Saudi Arabia.

criteria. The designation of D-SIBs, along with their capital surcharges, is undertaken on an annual basis.

- Reserve requirements are equal to 7% for demand deposits and 4% for time and saving deposits.
- Weighted-loan-to-deposit ratio of 90%.
- Two leverage ratios are used. First, the ratio of Tier 1 capital to total exposures should equal a minimum of 3%, in line with the Basel III framework. Second, a bank's deposit liabilities should not exceed 15 times its reserves and invested capital.
- Limits for total exposure of a bank, as well as for large exposures. The limits vary based on the type and size of the counterparty.
- DTI ratio⁷³ is used to determine households' eligibility for receiving finance based on their overall debt obligations. It aims at limiting the increase in household leverage and encouraging responsible lending that meets actual needs of consumers, especially those related to housing rather than consumption purposes.
- LTV ratio: stands at 90% for Saudi nationals' first mortgage. For Saudi nationals' second mortgage (and more) and for non-nationals, the loan provided by banks should not exceed the ratio of 70%. The cap on LTV is used to address the rise in household indebtedness.

Design, governance and coordination

SAMA has a dedicated Financial Stability Division (FSD) that carries out macroprudential surveillance activities and raises policy recommendations to SAMA's Financial Stability Committee (FSC) for approval. Upon approval, the FSC's decisions are communicated to the relevant micro-supervision departments, which are translated to the market usually in the form of circulars or policy guidance notes. Depending on the nature of the decisions, financial institutions may be given a grace period before the new requirements become effective.

Close and continuous coordination with relevant internal parties – such as the Monetary Policy Division, the Economic Research Department, and the Micro-supervision Departments – is an essential pillar to policy making. Regular discussions between these departments are crucial to ensure more consistent and integrated actions, at the macro and micro levels, and better-informed policy decisions.

Reference to Islamic banks' potential vulnerabilities associated with the specificities of Islamic banks

After the 2008 GFC, many regulators and policymakers began studying the effectiveness of using macroprudential policy tools in their systems to strengthen financial stability. The effectiveness of introducing separate macroprudential tools for Islamic banks is being studied and tested in many jurisdictions.

⁷³ In 2018, SAMA shifted from the use of the LTI ratio to the DTI ratio.

Saudi Arabia is endowed with a leading position in the global Islamic finance industry, with around 24.9% of global Islamic banking assets.⁷⁴ The domestic Islamic banking assets indicate a systemically important sector that represented 60.74% in 2015, and 72.31% in 2Q2020, of the total national banking industry.⁷⁵ SAMA with its supervisory roles gives high priority to financial stability, since this corresponds to its principal mandates.

Given that Saudi Arabia's Islamic banking assets account for more than 70% of the national banking industry,⁷⁶ SAMA is collaborating with international partners to share experiences with regard to regulations for banks offering Islamic services. SAMA's progress on managing Islamic banking risks includes: (1) introducing a Shari'ah Governance Framework for Islamic banking; (2) progressively adopting IFSB standards; and (3) offering liquidity management tools.

Shari'ah Governance Framework (SGF)⁷⁷

To ensure stability in the Saudi banking system, SAMA issued in February 2020 a Shari'ah Governance Framework (SGF) for banks providing Islamic banking services. The framework aims to increase confidence in the Islamic banking industry and reduce risks related to Shari'ah non-compliance, as well as to support Islamic banking's stability and growth.

The SGF specifies the roles and responsibilities of the board of directors, executive management, Shari'ah committee, risk management, compliance and internal audit department with regard to the implementation of the requirements of the SGF to assure adherence to Shari'ah principles. The SGF covers the following aspects:

- the creation of the Shari'ah Governance Framework
- roles and responsibilities of the board of directors and executive management.
- formation and appointment of the Shari'ah committee
- roles and responsibilities of the Shari'ah committee
- independence and confidentiality of the Shari'ah committee
- roles and responsibilities of the Shari'ah internal audit
- Islamic windows operations
- Shari'ah-compliant products development procedures
- roles and responsibilities of the Shari'ah compliance function.

Islamic windows

Chart 1 shows the number of conventional banks with Islamic windows compared to Islamic banks in Saudi Arabia. In 2Q2020, the number of Islamic windows stood at eight compared to four Islamic banks. Chart 2 shows that in 2Q2020, Islamic windows' asset size accounts for around 60% of the total Islamic banking assets in Saudi Arabia.

⁷⁴ IFSB, *IFSI Stability Report 2020*.

⁷⁵ SAMA.

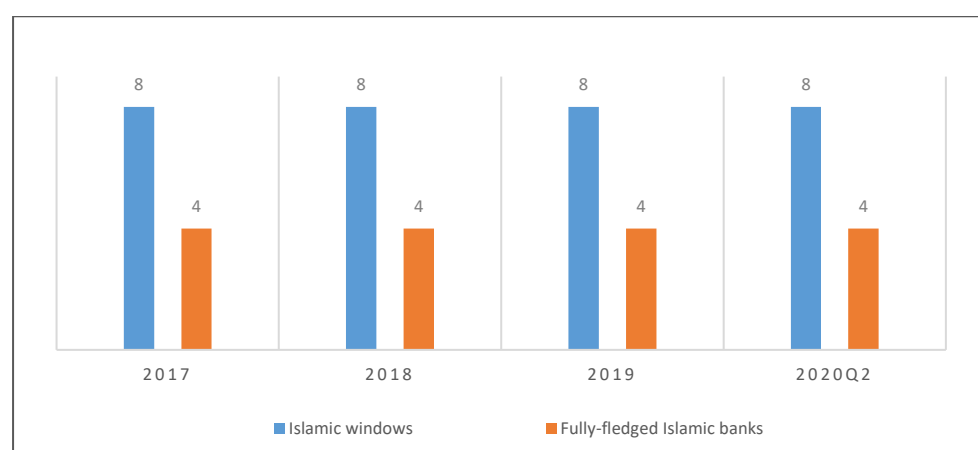
⁷⁶ SAMA, *Stability Report 2020*.

⁷⁷ The framework is available at: www.sama.gov.sa/ar-sa/Laws/BankingRules/Banking-KSA.pdf

Due to the increase in asset size of the Islamic windows, and to mitigate risks related to Shari'ah non-compliance, the recent SGF defines the relation between the conventional bank and its Islamic window. The SGF requires fund segregation for Islamic windows besides requiring the issuance of separate financial statements. Disclosures and reporting are among the requirements in the SGF, with Islamic windows required to prepare a monthly financial statement of their Islamic operations in addition to their regular financial statements. In addition, to improve reporting, Islamic windows are required to register Islamic operations in separate records, as well as to ensure they have separate book of accounts for all Islamic operations. The SGF also requires Islamic windows to conduct a yearly internal audit to ensure compliance with the requirement of segregation.⁷⁸

The SGF is expected to ensure stability in the banking sector and to enhance public confidence in Islamic banking in Saudi Arabia.

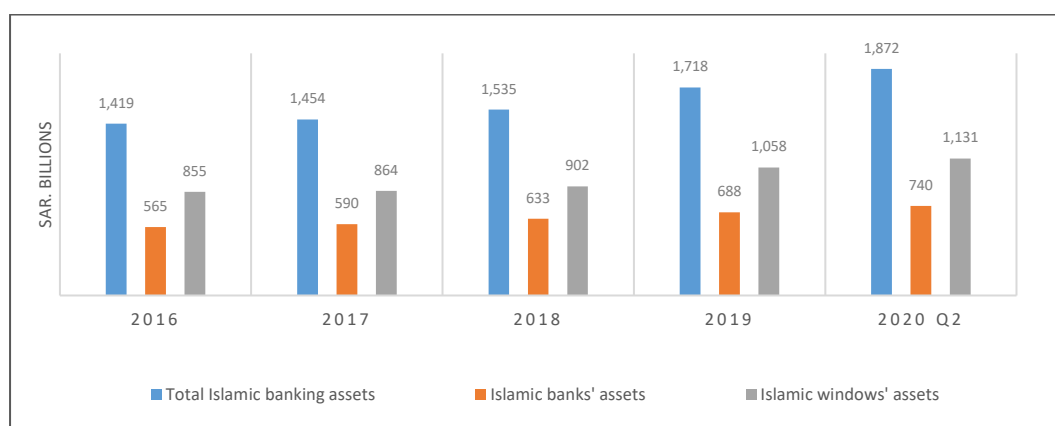
Chart 1: Number of Islamic banks vs. Islamic windows



Source: SAMA.

⁷⁸ Those requirements regarding Islamic windows are guidelines and will be mandatory for all banks with Islamic windows starting from January 2023.

Chart 2: Breakdown of Islamic banking assets



Source: SAMA.

The progressive adoption of IFSB standards

SAMA cooperates with international partners such as the World Bank, IMF, BCBS and IFSB in many aspects. One of the main aspects is the continuation of developing SAMA's prudential regulation of the banking system. The most recent Regulatory Consistency Assessment Programme (RCAP)⁷⁹ confirms that Saudi Arabia is compliant with BCBS regulatory standards.

Besides issuing the Shari'ah Governance Framework, SAMA has strengthened its alignment with international standards through its progressive adoption of the IFSB's standards. SAMA is currently working on progressively applying the IFSB's supervisory standards to support the stability of the banking sector. The implementation process of standards covers aspects related to Shari'ah governance, capital adequacy, risk management, liquidity management, etc.

4.1.3 SAMA's liquidity management framework

SAMA's liquidity management framework includes the following facilities and operations.

- **Overnight standing facilities:** These facilities enable banks to manage the liquidity of their daily operations. Standing facilities form an interest rate corridor that influences the short-term interbank interest rate to ensure it is consistent with the bank's monetary policy objective. The standing facilities are available for both conventional and Islamic banks (*murabaha* or *wakala*). The current standing facilities are:
 - **Repo:** a window that allows banks to borrow funds from SAMA overnight.
 - **Reverse repo:** a window that allows banks to deposit their extra reserves at SAMA overnight.

⁷⁹ Available at https://www.bis.org/bcbs/implementation/rcap_jurisdictional.htm?m=3%7C14%7C656%7C60

- **Open market operations:** These operations are used by SAMA as tools to inject or withdraw short-term liquidity to and from the local banking system in a way that is consistent with its mandate of maintaining monetary and financial stability in Saudi Arabia. Both conventional and Islamic banks are permitted to participate in the following operations:
 - SAMA bills/SAMA *murabaha*: a liquidity absorption tool issued weekly for maturities up to one year (seven-days, 30-days, three-months, six-months and one-year). The pricing of SAMA bills is based on the monetary conditions.
 - Term-repo: a liquidity injection tool offered on a bi-weekly basis over three different maturities – seven days, 14 days and 28 days – which together reflect the specific needs of the local banking system. The term-repo is available for Islamic banks based on *murabaha/wakala* agreements. The pricing methodology is also based on the monetary conditions.
- Intraday overdraft limit: SAMA provides intraday overdraft limits to both conventional and Islamic banks that are fully collateralised.

Summary

This case study covers the most important macroprudential tools used by SAMA to ensure the soundness and stability of the Saudi financial system. Saudi Arabia leads the global Islamic finance industry with the support of SAMA's supervisory role. Indeed, SAMA is contributing to the development momentum of the Islamic banking industry locally and globally. In addition, it will continue monitoring and assessing the needs of the local Islamic banking industry to ensure it promotes the stability of, and boosts confidence in, the financial sector.

4.2 Indonesia

The Global Financial Crisis in 2008 indicated the increasing urgency of mitigating systemic risk. Thus, macroprudential policies have become essential tools for regulatory and supervisory authorities around the world, to prevent systemic risk. In Indonesia, Bank Indonesia (BI) as a central bank has a mandate to issue such a policy. To promote financial system stability, BI has imposed a macroprudential policy framework, along with other policies, with the goals of preventing and mitigating systemic risk in the financial system.

Macroprudential policy is an integral part of Indonesia's central bank policy mix. It encompasses regulation and surveillance from a macro perspective and focuses on systemic risk with the aim of supporting financial system stability. It is implemented through a number of instruments, including LTV ratios, reserves requirements and a capital conservation buffer, and has been successful in mitigating the build-up of systemic risks to financial stability as well as in strengthening the effect of monetary policy in the pursuit of price stability.

In implementing its macroprudential policy, BI employs several macroprudential instruments, as follows:

1. *Countercyclical Buffer (CCyB)*

The CCyB is an additional capital component that is used as a buffer against possible losses occurring due to excessive financing growth that will affect the stability of the financial system. The goal of a capital buffer is to prevent the rise of systemic risk from excessive financing growth due to procyclical behaviour in financing disbursement in Indonesia whereby financing growth increases in periods of economic boom and decreases during an economic bust.

A bank is required to keep in reserve additional capital during an expansion period, which it can then use when facing distress in times of economic bust so that it can maintain the surveillance of the institution and, accordingly, maintain financial stability as a whole. This instrument has been set by PBI No.17/22/PBI/2015.

2. *Financing to Value (FTV) Ratio*

The FTV ratio is between total financing to total market price of collateral at the time of financing disbursement. It is implemented for the disbursement of property and vehicles. Nowadays, a risk that has been exposed by the financial system is property price increases. One objective of FTV is to maintain the financial system and mitigate any systemic risk arising from increases in property prices. The recent FTV ratio has been set by PBI No.21/13/PBI/2019.

3. *Sharia Macroprudential Liquidity Buffer (MLB Sharia)*

MLB Sharia are minimum liquidity reserves in rupiah that must be maintained in the form of securities in rupiah which can be used in monetary operations. The amount is determined by BI as a certain percentage of rupiah.

MLB Sharia also have flexibility features, which means that under certain conditions, these securities can be used in repo transactions to BI in open market operations at a certain percentage of deposit in rupiah. The recent MLB Sharia ratio has been set by PBI No.20/4/PBI/2018.

4. *Sharia Macroprudential Intermediation Ratio (MIR Sharia)*

MIR Sharia are macroprudential instruments aimed at managing the banking intermediation function in order to match the capacity and growth targets of the economy while still maintaining prudential principles.

An MIR Sharia policy accommodates various forms of banking intermediation by including bank investments in securities. It also encourages the establishment of a balanced and good-quality intermediation function, which is expected to prevent and reduce risk in banking behaviour, which tends to be procyclical. This macroprudential policy instrument is cyclical and can be adjusted to changes in certain economic and financial conditions.

An MIR Sharia account is a required reserve balance with Bank Indonesia, which must be maintained by the bank in order to comply with the policy. The recent MIR Sharia ratio has been set by PBI No.21/12/PBI/2019.

5. *Short-Term Liquidity Financing (STLF)*

Sharia STLF is financing based on Sharia principles from BI to banks in order to overcome a short-term liquidity shortage.

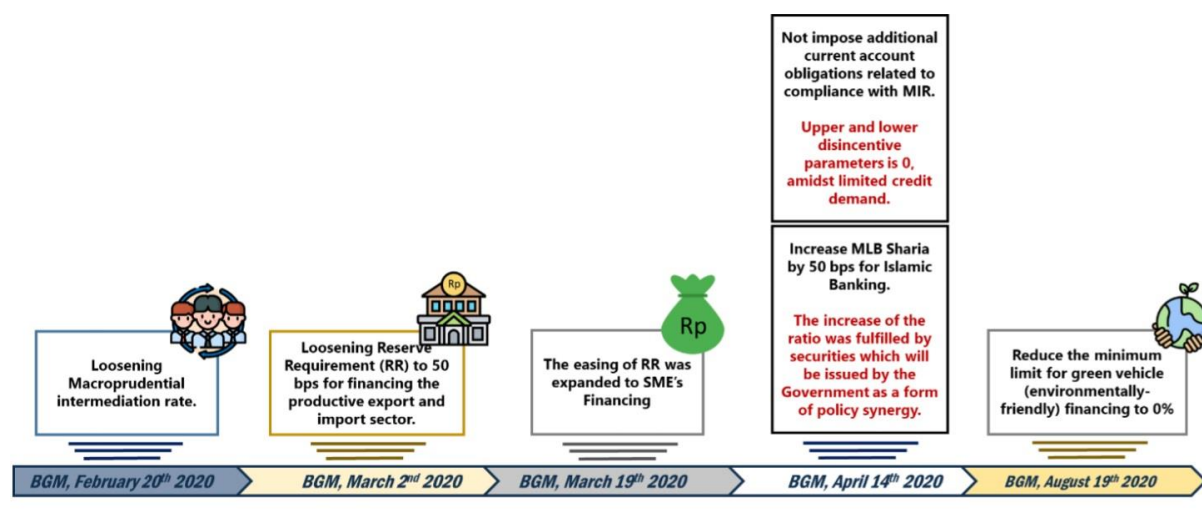
Short-term liquidity shortages are conditions experienced by banks, where they find themselves scrambling for and being unable to find the cash they require to meet their most urgent needs or to undertake their most valuable projects. In the other words, the cash-out is bigger than the cash-in. The STLF policy has been set by PBI No.20/16/PBI/2018.

6. *Reserve Requirement (RR)*

Implementation of RR is a continuation of a series of reformations of the monetary policy operational framework pursued by BI since 2016. The average RR is one of the monetary policy instruments aimed at increasing the flexibility of liquidity management by banks, encouraging the banking intermediary function, and supporting initiatives to deepen financial markets. Hopefully, these various targets will increase the effectiveness of monetary policy transmission in maintaining economic stability.

In uncertain conditions due to Coronavirus Disease 19 (Covid-19), where the economy is slowing down, regulators are challenged to establish accommodative economic and financial policies that are able to maintain financial system stability. This challenge occurs because theoretically accommodative economic policies tend not to support financial stability. Bank Indonesia as the macroprudential regulator in Indonesia formulates macroprudential instruments that can help stimulate the economy with the existing policy mix, while also maintaining financial stability. The Board of Governors, through the Board of Governors Meeting (BGM), formulates BI's macroprudential policy response which is summarised in Exhibit 1.

Exhibit 1: Bank Indonesia's macroprudential policy response



Source: Bank of Indonesia (2021).

SECTION 5 CONCLUSION AND POLICY RECOMMENDATION

This paper reviews key characteristics of macroprudential policy frameworks implemented in countries that participated in the survey with a focus on four broad categories – namely, banking system overview; definition, objectives and scope; institutional and governance arrangements; and operational considerations. Its aim is to highlight countries' experience regarding the implementation of a macroprudential policy framework, and to identify conditions under which macroprudential policy is most effective.

As far as the paper is concerned, there are shared lessons and policy messages derived from the survey of country experiences and econometric analysis of tools used to address specific risks that are considered systemic.

Financial stability is essential for the efficient functioning of every financial system, to the extent that it provides the basis for economic growth and the welfare of the population. Theoretical and empirical research appears to concur with this. Against this background, countries have designated institutions entrusted with financial stability oversight of the financial system as a whole, and, in particular, structured as a collegiate body with defining authority for macroprudential policy in relation to the banking sector. The interaction between the financial sector (specifically, the banking sector) and the real economy is one of the key characteristics that warrant and condition macroprudential policy decisions in the face of systemic risk.

The survey findings suggest that central banks appear to have a wide range of macroprudential tools available; however, in practice, only a few of the available tools have been used. Going forward, this raises important questions on challenges relating to the implementation of macroprudential policy.

First is the decision of macroprudential policymakers to link systemic risk assessments and policy tools application (i.e. either in a rules-based or discretionary manner). Lack of clarity on appropriateness of the calibration of the instruments made it imperative to further improve on the quantitative approach to macroprudential policy calibration and measurement including, measurement of macroprudential stance, and consideration of the extent to which the boundary of macroprudential regulation must be extended to non-bank financial institutions.

Second, countries have tailored the design and calibration of macroprudential policy tools to their specific circumstances, which has helped macroprudential regulators to gauge banks' idiosyncratic risks and bolster financial stability. Underpinning the foundation for effective application of macroprudential policy tools is the assumption of the quality of supervision and enforcement, and of the governance and accountability arrangements regarding macroprudential policy. This assumption raises important questions about whether existing frameworks and governance is adequate or need to be refined and improved.

The emphasis in this paper is on the need to strengthen institutional arrangements and the governance framework with well-defined and well-articulated objectives for macroprudential policies. These objectives include: clear mandates; control over tools that are commensurate with those mandates; arrangements that safeguard operational independence; and provisions to ensure accountability, supported by transparency and clear communication of decisions and decision-making processes. Such objectives will make it easier to hold policymakers accountable for pursuing them.

In addition to the above, this paper performed empirical analysis using both static and dynamic panel data model baselines and robustness checks to assess the effectiveness of macroprudential policy stances with regard to household credit growth. For this analysis, a set of macroprudential indices comprising an aggregate index and subgroup indices was developed from 17 macroprudential tools to measure the overall macroprudential policy stance in 10 countries where Islamic banks operate alongside conventional banks.

Data on household credit growth was drawn from the IFSB's PSIFIs database, which represents the dependent variable. The similarity in the financing concentration of Islamic banks, as shown by these data across the jurisdictions, makes it amenable to the analysis. Alternatively, other macrofinancial variables such as housing prices, credit quality and NPFs can also be considered for the same purpose. The short experience with macroprudential policy limits the number of observations available for a more comprehensive evaluation of its effectiveness. As a result, the study could only base its analysis on a dataset that spans a six-year period (4Q2013–4Q2019) and for a limited number of countries.

Counterfactual simulations from the model assuming that countries had not used any macroprudential measures were used to predict that average household credit growth would all have been significantly higher in the absence of macroprudential policy. The result of the analysis shows that macroprudential policies indicators comprising an aggregate index and subgroup indices are generally negatively

associated with household credit growth. This suggests that growth in Islamic banks' financing exposures could be restrained by these measures. In addition, the analysis has helped to address the question of which macroprudential tool has more potent effects in dampening household credit growth. Thus, specific targeted MaPP measures can affect the Islamic banks' exposure to the household credit sector, and could potentially be used as tools to promote financial and macroeconomic stability.

One such finding is that credit-targeted measures, those specifically intended to limit household credit growth seem to be more effective across all countries in the sample. The credit-targeted measures include the demand-related" tools (i.e., the "LTV and DSTI limits) and those constraining bank finance supply (i.e., the "supply-side" tools), such as restrictions on credit growth and loan loss provisions. On the other hand, the supply-side tools are found to have stronger impacts on household credit growth than the demand-targeted measures. Supply-side measures (reserve and liquidity requirements and limits on credit growth) affecting the supply of credit generally, by increasing the cost of providing households financing.

While the analysis is consistent with the previous studies, the study chooses household credit growth to represent a particular sectoral exposure (risk of financing concentration exhibited by Islamic banks to household sector) based on data availability and its unique feature which shows a similar pattern across the countries.

The clear evidence of the impact of macroprudential policies on household credit growth, and invariably on financial stability, is with regards to the policies' average effects in a sample of 10 heterogeneous jurisdictions. There is no reason to believe the effects will be the same everywhere, of course. A policy that is ineffective in one country may be highly effective in another, and vice versa. The essential next step is to understand how policy effectiveness is influenced by legal, institutional arrangement and developments of the housing market and, more broadly, by the financial system.

It is believed that macroprudential policymaking will continue to evolve and improve into the future based on lessons learnt over the years. Future studies on the efficacy of macroprudential policy should focus on improving the quantitative approach to macroprudential policy calibration and measurement, including measurement of the macroprudential stance, and the need to consider to what extent the boundary of macroprudential regulation must be extended to the non-bank segment of the financial system (i.e. in the area of securities markets and insurance/*takāful* companies).

Moreover, future studies can also consider assessment of the impact of macroprudential measures on growth in corporate credit, real estate credit and vehicle financing. A comparison of the impact of crises and macroprudential measures on conventional versus Islamic banks may be both interesting and useful. Shariah-based macroprudential measures and their impact can also be considered, once sufficient data are available.

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APPENDIX

Table 1(a): Sharī'ah-compliant financing by economic activity: Households' financing ('million)

	Bahrain	Bangladesh	Brunei	Indonesia	Jordan	Kuwait	Malaysia	Oman	Saudi Arabia
Q4-2013	1,218.7	10,291.1	1,115.4	–	836.4	23.0%	171,917.3	–	168,922.0
Q4-2014	1,730.1	18,828.2	1,003.0	23,712.9	930.6	23.2%	199,756.5	116,940.0	196,170.8
Q4-2015	2,188.6	92,127.0	1,077.2	21,206.6	1,018.2	24.4%	226,035.0	268,940.0	207,966.0
Q4-2016	2,693.2	109,797.1	1,172.4	32,147.0	1,076.1	26.2%	249,536.7	410,751.0	217,864.8
Q4-2017	2,836.1	97,079.6	1,202.7	36,371.9	1,150.3	27.2%	277,418.7	521,646.0	225,421.4
Q4-2018	2,454.7	91,942.2	1,154.1	41,861.0	1,180.0	28.3%	337,237.0	603,471.0	237,440.0
Q4-2019	2,560.5	110,559.3	1,140.8	50,395.3	1,244.9	25.5%	372,171.8	648,407.0	273,666.6

Source: IFSB, PSIFIs database.

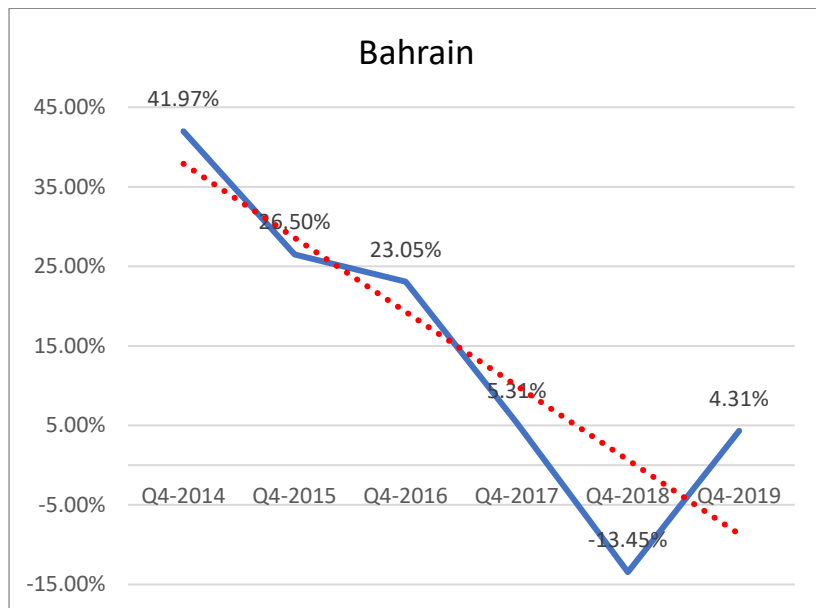
Table 1(b): Shari‘ah-compliant financing by economic activity: Households’ financing (year-on-year growth [%])

	Bahrain	Bangladesh	Brunei	Indonesia	Jordan	Kuwait	Malaysia	Oman	Saudi Arabia
Q4-2014	41.97	82.96	−10.08	–	11.26	0.81	16.19	–	16.13
Q4-2015	26.50	389.30	7.40	−10.57	9.41	5.23	13.16	129.98	6.01
Q4-2016	23.05	19.18	8.84	51.59	5.69	7.28	10.40	52.73	4.76
Q4-2017	5.31	−11.58	2.58	13.14	6.90	4.19	11.17	27.00	3.47
Q4-2018	−13.45	−5.29	−4.04	15.09	2.58	3.85	21.56	15.69	5.33
Q4-2019	4.31	20.25	−1.16	20.39	5.50	−9.89	10.36	7.45	15.26

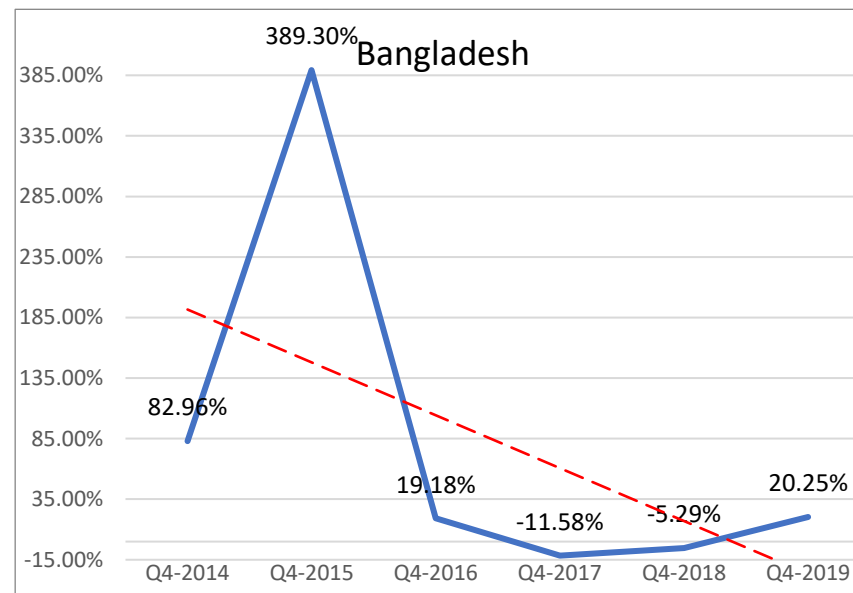
Source: IFSB, Secretariat Workings (2021).

Chart 1: Trend analysis of households' financing (year-on-year) growth by country

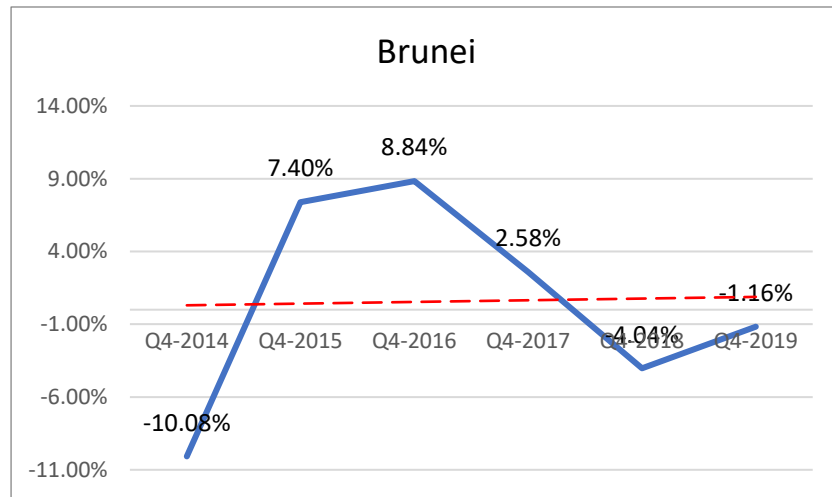
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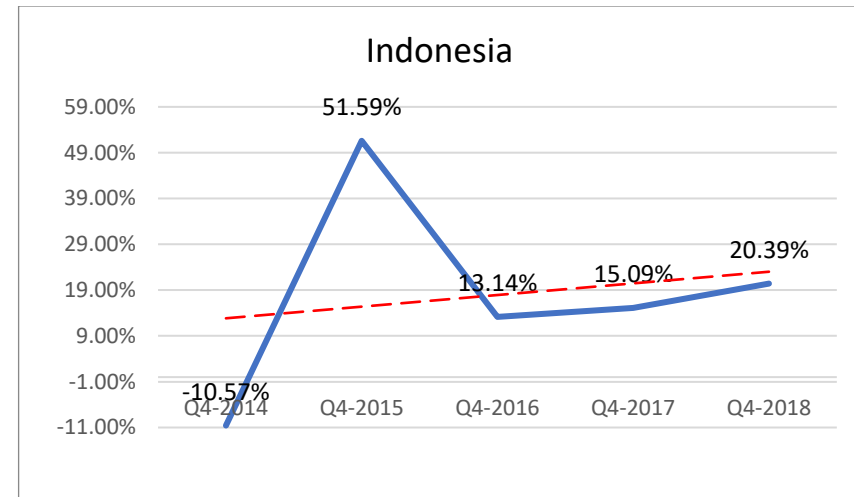
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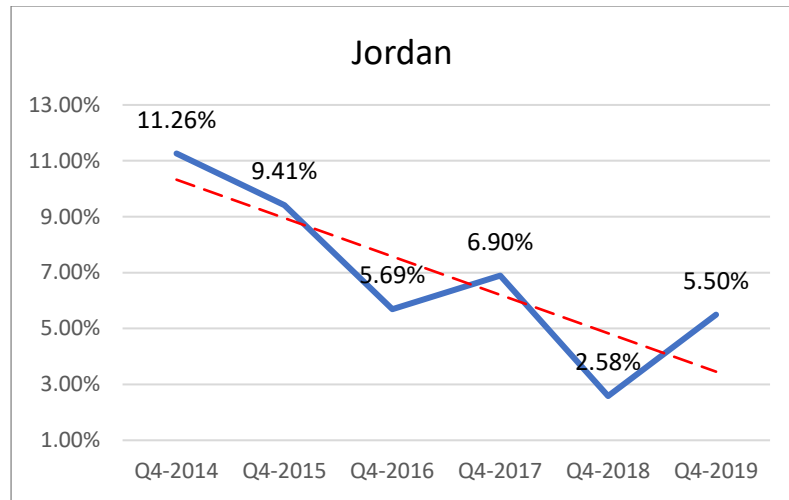
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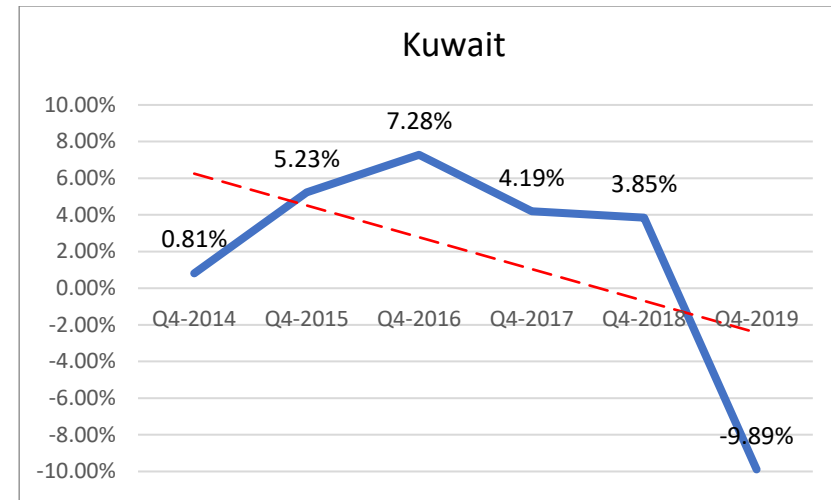
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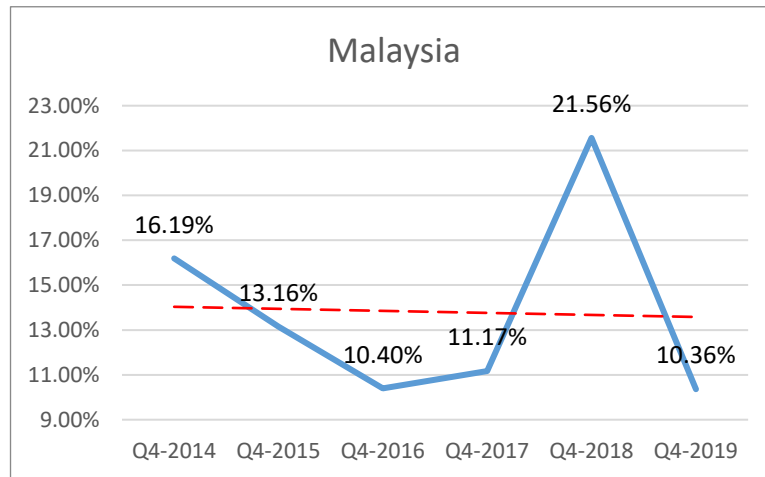
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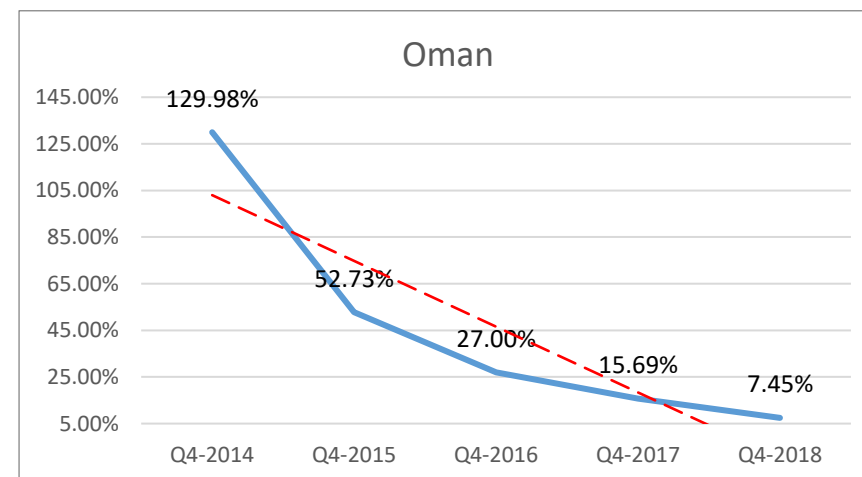
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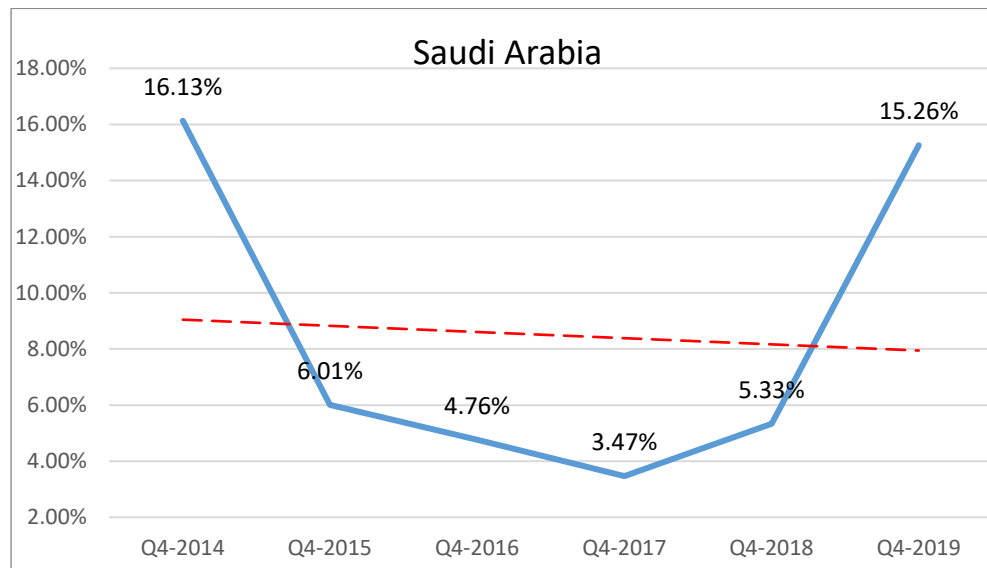


Table 2: Institutional and governance arrangements of macroprudential policy

Country	MaPP objectives	Statutory source of mandate	Scope of responsibilities of the Macroprudential Policy Committee	Mechanisms/arrangement for coordination and implementing macroprudential toolkits
Afghanistan	Nil	Nil	Nil	Nil
Brunei	AMBD, 2016	AMBD Order		
Kazakhstan	To develop and apply an effective framework for macroprudential supervision with implications for systemic risk	Policy on authorisation and supervision	Macroprudential supervision includes the analysis of macroeconomic and financial market information, and of how these data interact with each other. Macroprudential supervision operates alongside microprudential (or entity-level) supervision.	
Jordan	To ensure the stability of the banking sector and the entire financial system in the Kingdom	Central Bank of Jordan Law No. 23 of 1971 and its amendments		
Bahrain	To safeguard the legitimate interests of licensees' customers against the risks associated with the financial services industry	Articles 3 & 4 of the CBB Law	<p>Application of sound monetary and financial policies to ensure monetary and financial stability in the Kingdom of Bahrain.</p> <p>The duties of the Financial Stability Committee (FSC) are to monitor and prevent systemic risks</p>	<p>The CBB is seen as entirely responsible for creating and maintaining a MaPP.</p> <p>The FSC was created on 20 July 2017 by Resolution No. 49 of 2017.</p> <p>The arrangements offer a basis for creating a clear mandate and assignment</p>

			and to ensure the coordination of systemic risk management.	of responsibility for taking macroprudential policy decisions.
Kuwait	Nil	Nil		
Nigeria	To ensure the stability of the banking sector	Central Bank of Nigeria Act		
Turkey	To ensure the soundness and efficient functioning of the banking sector	Banking Law No. 5411		
Indonesia	To ensure the stability of the financial system	Financial Sector Regulation Act No. 21 of 2011; Bank Indonesia Regulation No.16/11/PBI/2014 on Macroprudential Regulation & Surveillance; Law of the Republic of Indonesia No. 9 of 2016 regarding Prevention & Mitigation of Financial System Crisis		
Iraq		Banking Law No. 94 of 2014		
Malaysia	To promote financial stability; more specifically, soundness of institutions and oversight of markets and their infrastructure	Central Bank of Malaysia Act 2009 (CBA 2009), Financial Services Act 2013 (FSA 2013), and Islamic Financial Services Act 2013 (IFSA 2013) to regulate and supervise the financial system	Pursuant to section 31 of CBA 2009, the Bank may specify measures, or issue an order to take such measures, which would contribute to the resilience of the financial system or limit the accumulation of any risk to financial stability, to entities engaged in financial intermediation, in the interest of	Pursuant to section 38 of CBA 2009, the Financial Stability Executive Committee (an inter-agency committee) can impose macroprudential measures or orders for financial stability on entities beyond the regulatory and supervisory purview of

			<p>preservation of domestic financial stability. Therefore, section 31 of CBA 2009 grants the Bank hard powers that give it direct control over macroprudential instruments, based on decisions made by the Financial Stability Committee (FSC) or Joint Policy Committee (JPC).</p> <p>Deliberation and decisions on macroprudential policy tools that are imposed only on BNM's regulated entities take place at the FSC and JPC. The JPC, comprising members from both the FSC and the Monetary Policy Committee (MPC) of BNM, is activated when either the MPC or FSC escalates an issue that has wider implications for both monetary and financial stability.</p>	<p>BNM, in the interest of preservation of domestic financial stability, pursuant to section 31(1) of CBA 2009.</p>
Mauritius	To ensure the stability and soundness of the financial system	Section 4(2)(b) of the Bank of Mauritius Act 2004 stipulates, inter alia, that the object of the Bank shall be to ensure the stability and soundness of the financial system of Mauritius	<p>Section 5(3)(d) of the Act requires the Bank to monitor system-wide factors that might have or potentially have a negative impact on the financial condition of financial institutions. Though it is not explicitly designated as a macroprudential authority in the Bank of Mauritius Act 2004, the Bank of Mauritius has issued guidelines on selected macroprudential measures in 2014.</p>	

Table 3: Definitions of macroprudential policy tools covered in the panel regression analysis

Countercyclical Buffers (CCB)		A requirement for banks to maintain a countercyclical capital buffer. Implementations at 0% are not considered as a tightening in dummy-type indicators.
Conservation		Requirements for banks to maintain a capital conservation buffer, including the one established under Basel III.
Capital Requirements		Capital requirements for banks, which include risk weights, systemic risk buffers and minimum capital requirements. Countercyclical capital buffers and capital conservation buffers are captured in their Balance sheets, respectively, and thus are not included here. Subcategories of capital measures are also provided, classifying them into household sector targeted (HH), corporate sector targeted (Corp), broad-based (Gen), and FX-loan targeted (FX) measures.
Leverage (LVR)	Limits	A limit on leverage of banks, calculated by dividing a measure of capital by the bank's non-risk-weighted exposures (e.g. Basel III leverage ratio).
Loan Loss Provisions (LLP)		Loan loss provision requirements for macroprudential purposes, which include dynamic provisioning and sectoral provisions (e.g. housing loans).
Limits on Growth (LCG)*	Credit	Limits on growth or the volume of aggregate credit, household-sector credit or corporate-sector credit by banks, and penalties for high credit growth. Subcategories of limits to credit growth are also provided, classifying them into household sector targeted (HH), corporate sector targeted (Corp) and broad-based (Gen) measures.
Loan (Loan R)*	Restrictions	Loan restrictions that are more tailored than those captured in "LCG". They include loan limits and prohibitions that may be conditioned on loan characteristics (e.g. the maturity, size, LTV ratio and type of interest rate of loans), bank characteristics

(e.g. mortgage banks), and other factors. Subcategories of loan restrictions are also provided, classifying them into household sector targeted (HH) and corporate sector targeted (Corp) measures. Restrictions on foreign currency lending are captured in "LFC".

Limits on Foreign Currency (LFC)	Limits on foreign currency (FC) lending, and rules or recommendations on FC loans.
Limits on the Loan-to-Value Ratio (LTV)	Limits on LTV ratios, including those mostly targeted at housing loans, but also includes those targeted at automobile loans and commercial real estate loans.
Limits on the Debt-Service-to-Income Ratio (DSTI)	Limits on the DSTI and LTI ratio, which restrict the size of debt services or debt relative to income. They include those targeted at housing loans, consumer loans and commercial real estate loans.
Tax Measures	Taxes and levies applied to specified transactions, assets or liabilities, which include stamp duties and capital gains taxes.
Liquidity Requirements	Liquidity requirements are typically in the form of a minimum ratio of highly liquid assets, such as government securities and central bank paper, to certain types of liabilities. They are prudential regulations intended to ensure a bank's ability to withstand cash outflows under stress. The main difference between liquidity and reserve requirements is that the former require the bank to keep funds at the central bank, whereas the latter oblige them to hold liquid marketable securities. The two policies are very similar in terms of their economic effect, as both influence the volume of funds available for lending to the private sector by imposing constraints on the composition of banks' balance sheets. Other measures taken to mitigate systemic liquidity and funding risks include minimum requirements for liquidity coverage ratios, liquid asset ratios, net stable funding ratios, core funding ratios, and external debt restrictions that do not distinguish currencies.

Limits on the Loan-to-Deposit Ratio (LTD)	Limits on the LTD ratio and penalties for high LTD ratios.
Limits on Foreign Exchange Positions (LFX)	Limits on net or gross open FX positions, limits on FX exposures and FX funding, and currency mismatch regulations.
Reserve Requirements (RR)*	Reserve requirements (domestic or foreign currency) for macroprudential purposes. Reserve requirements compel banks to hold at least a fraction of their liabilities as liquid reserves. These are normally held either as reserve deposits at the central bank or as vault cash. The regulation generally specifies the size of required reserves according to the type of deposits (e.g. demand, savings or time deposits), their currency (domestic or foreign currency) and their maturity. Note that this category may currently include those for monetary policy purposes, as the distinction between macroprudential and monetary policy purposes is often not clear-cut. A subcategory of reserve requirements is provided for those differentiated by currency (FCD), as they are typically used for macroprudential purposes.
Systemically important financial institutions (SIFIs)	Measures taken to mitigate risks from global and domestic SIFIs, which includes capital and liquidity surcharges.
Other	Macroprudential measures not captured in the above categories (e.g. stress testing, restrictions on profit distribution and structural measures such as limits on exposures between financial institutions).

Source: IMF, iMaPP database (2018).

Note: *Indicates that subcategories are available.

Table 4: Variable descriptions and sources

Variables	Description	Source
Real GDP	Gross domestic product; constant prices in national currency	Central bank's website
House credit growth		IFSB PSIFIS database
<i>MaPP indices</i>	<i>Components</i>	
Aggregate MaPP index	All 17 individual macroprudential measures	
All credit-targeted	Demand-related and supply-side measures	
Demand-related	Debt-service-to-income (DSTI) and loan-to-value (LTV) limits	
Supply-side	Supply general, supply capital and supply credit	
Supply-credit	Limits on credit growth (LCG), loan loss provisions (LLP), loan restrictions (LOANR), and limits on foreign currency loans (LFC)	
Supply_General	Reserve requirements (RR), liquidity requirements (LR), and limits on foreign exchange positions (LFX)	
Supply_Capital	Capital requirements (CAPITAL), conservation buffers (CONSERVATION B), the leverage ratio (LVR), capital surcharges for systemically important financial institutions (SIFIs), and countercyclical capital buffers (CCB)	

Sources: IMF, iMaPP database; IFSB, *IFSI Stability Report 2020*; Kuttner & Shim (2013); Akinci & Olmstead-Rumsey (2018); Alam et al. (2019).

Note: The macroprudential variables are presented in aggregated indices on year-on-year average (y-o-y mean).

Table 5: Summary of descriptive statistics of the independent variables (all macroprudential and subgroups)

Variable	Observation	Mean	Standard deviation	Minimum value	Maximum value
MaPP	210	-7.81e-10	1	-0.1985331	5.012959
All Loans	210	1.42e-09	1	-0.9787943	1.016805
Demand	210	1.02e-08	1	-0.5430335	1.832738
Supply	210	-3.41e-09	1	-0.6309482	1.577372
Supply_Capital	210	8.51e-09	1	-0.7905265	1.259022
Supply_Loan	210	4.54e-09	1	-0.4229884	2.352873
Supply_General	210	-8.23e-09	1	-0.9788324	1.016844

Table 6: Correlation analysis: Macroprudential policy variables

	MaPP	All Loans	Demand	Supply	Supply_Capital	Supply_Loan	Supply_General
MaPP	1.0000						
All Loans	0.0038	1.0000					
Demand	0.3656	0.3733	1.0000				
Supply	-0.1259	0.3916	0.2582	1.0000			
Supply_Capital	-0.1577	0.6315	0.3142	0.4517	1.0000		
Supply_Loan	-0.0844	0.4322	0.5265	0.4358	0.5351	1.0000	
Supply_General	0.0038	1.0000	0.3733	0.3916	0.6315	0.4321	1.0000

Table 7: Result of static panel regression analysis

Group	Dependent variable: Household credit (y-o-y growth)		
Model estimation	Pool OLS	Random effect (fE)	Fixed effect (FE)
MaPP index (all tools)	–0.010 [0.01]	–0.008 (0.01)	–0.008 [0.01]
GDP growth	0.017 [0.05]	0.012 (0.05)	0.016 [0.05]
All Loans	0.001 [0.01]	–0.008 [0.01]	–0.014* [0.01]
Demand Related	0.019*** [0.01]	–0.030*** [0.01]	–0.035 *** [0.01]
All Supply	–0.021*** [0.01]	–0.032 *** [0.01]	–0.043 *** [0.01]
Supply Capital	–0.020*** [0.01]	–0.027*** [0.01]	–0.030*** [0.01]
Supply Loan	–0.015*** [0.01]	–0.027 *** [0.01]	–0.033*** [0.01]
Supply General	0.01 [0.01]	–0.008 [0.01]	–0.014 * [0.1]
Constant	0.035*** [0.01]	0.037*** [0.01]	0.037*** [0.01]
No. of Observations	187	187	187
N (Countries)	10	10	10
R-square (average)	0.047	0.058	0.113
Adjusted R-squared	0.037	0.053	0.063

Source: IFSB Secretariat workings (2020).

P-values of the baseline estimation are reported. Standard errors are in parentheses. Asterisks indicate statistical significance: *** for 1%, ** for 5% and * for 10%.

Notes: The table reports the pool ordinary least squares (OLS), the random effect (RE) and the fixed effects (FE) baseline estimation of the macroprudential policy stance (i.e. tightening action and a loosening action) grouped into aggregate and subcategories (e.g. loan-targeted, demand and supply measures, further subdivided into three categories including general, capital and loan-supply tools). The dependent variable is annualised quarterly growth rate in household credit, while the macroeconomic indicator – GDP growth (y-o-y) – represents the control variable.

Technically, the Hausman specification test is used to determine the appropriate model between the RE and FE generalised least squares (GLS) models. The statistically significant Hausman test indicates

the individual country effect on the analysis. Our panel regression analysis suggests that macroprudential instruments have an impact on the measures of systemic risk – credit growth, using panel regressions with fixed effects as best-fitted model. Specifically, significant impacts of credit-targeted measures were found on (dependent variable) household credit.

Table 8: Result of dynamic panel regression analysis

Dependent variable: Household credit (y-o-y growth)							
	(1) HCG	(2) HCG	(3) HCG	(4) HCG	(5) HCG	(6) HCG	(7) HCG
Lag_HCG	0.608*** (0.000)	0.609*** (0.000)	0.443*** (0.000)	0.450*** (0.000)	0.652*** (0.000)	0.447*** (0.000)	0.609*** (0.000)
GDP	−0.262 (0.748)	0.147 (0.372)	0.0261 (0.429)	−0.0206 (0.574)	0.264*** (0.000)	0.0857*** (0.007)	0.147 (0.372)
MaPP index (all tools)	0.00616 (0.719)						
GDP_MaPP index (all tools)	−1.730 (0.673)						
All Loans		0.000237 (0.969)					
GDP_All Loans		−0.0667 (0.681)					
Demand Related			− 0.00563 (0.307)				
GDP_Demand Related			−0.331*** (0.000)				
All Supply				− 0.00400 (0.561)			
GDP_ All Supply				−0.357*** (0.000)			
Supply Capital					− 0.00575 (0.240)		
GDP_Supply Capital					−0.233*** (0.000)		
Supply Loan						− 0.00420 (0.434)	
GDP_Supply Credit						−0.284***	

						(0.000)	
Supply General							0.000237 (0.969)
GDP_Supply General							−0.0667 (0.681)
_cons	0.0110* (0.073)	0.00895 (0.130)	0.0232*** (0.000)	0.0242*** (0.000)	0.00671 (0.174)	0.0234*** (0.000)	0.00895 (0.130)
<i>N</i>	184	184	184	184	184	184	184
<i>AR</i> (2)	0.402	0.402	0.542	0.539	0.527	0.541	0.402

Source: IFSB, Secretariat workings (2020).

P-values of the Arellano-Bond tests for AR(2) in first differences are reported. Standard errors are in parentheses. Asterisks indicate statistical significance: *** for 1%, ** for 5% and * for 10%.

Notes: The table reports dynamic panel model (the Arellano-Bover-Blundell-Bond system GMM estimation) estimation both with the timing assumption for robustness check of macroprudential policy stance (i.e. tightening action and a loosening action) grouped into aggregate and subcategories (e.g. loan-targeted, demand and supply measures, further subdivided into three categories, including general, capital and loan-supply tools). The dependent variable is annualised quarterly growth rate in household credit, while the macroeconomic indicator – GDP growth (y-o-y) – represents the control variable, including the interaction terms.

In addition to country and time fixed effects, each specification includes the lagged dependent variable, household credit growth (lag) and control variable GDP (lag). Period sample: 4Q2013–4Q2019, covering 10 countries with a dual banking system. Results could be biased given several policy actions by countries using a few tools.