

As discussed in Chapter 1, the COVID-19 pandemic is impacting emerging markets through an unprecedented mix of domestic and external shocks whose combined effects are very hard to predict. Among these, emerging markets are confronting a sharp tightening in global financial conditions. Against this backdrop, this chapter asks whether, based on historical experience, countries that have adopted a more stringent level of macroprudential regulation—aimed at strengthening financial stability—are better placed to withstand the impact of global financial shocks on domestic macroeconomic conditions. The analysis finds that a tighter level of macroprudential regulation can significantly dampen the effects of global financial shocks on GDP growth in emerging markets. Furthermore, macroprudential regulation tends to reduce the effects of global financial shocks on credit growth and the exchange rate. However, maintaining a tight level of macroprudential regulation is not costless. Although macroprudential regulation supports GDP growth in the face of adverse global financial shocks, it also lowers economic activity when global financial conditions are favorable. This symmetric effect calls for further research on how to adjust macroprudential regulation optimally. The analysis also finds that macroprudential regulation allows monetary policy to respond more countercyclically to global financial shocks, which could be an important channel through which macroprudential regulation enhances macroeconomic stability. Finally, the chapter examines potential side effects of macroprudential regulation on average GDP growth or through cross-country spillovers. The analysis finds no evidence of detrimental effects on average GDP growth, but more research is needed before definitive conclusions are drawn. Regarding spillovers, there is some evidence that tighter macroprudential regulation in one country tends to enhance resilience in other countries as well, possibly because greater domestic stability supports more stable financial and trade flows.

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Introduction

Fluctuations in global financial markets have historically significantly influenced financial and macroeconomic conditions in emerging markets. Under buoyant global financial conditions, emerging markets have enjoyed stronger economic growth supported by abundant foreign capital inflows. Conversely, when global financial conditions tightened—most notably during the global financial crisis—economic activity in emerging markets was severely affected.¹ The tightening in global financial markets caused by the COVID-19 pandemic is again placing emerging markets under severe distress. As documented in the April 2020 *Global Financial Stability Report*, capital flows to emerging markets are rapidly receding while global risk aversion has spiked. This is compounding the challenges faced by emerging markets that are also confronting the dramatic consequences of the domestic diffusion of the virus.

According to conventional macroeconomic theory, emerging markets should be able to largely offset the impact of global financial shocks by relying on exchange rate flexibility. Indeed, exchange rate flexibility appears to soften the effects of foreign financial shocks (Obstfeld, Ostry, and Qureshi 2019), but it falls short of providing full insulation.² Global financial conditions affect credit markets and macroeconomic conditions, even in countries with flexible exchange rates (Rey 2015, 2016).

The fact that exchange rate flexibility does not fully insulate emerging markets from global financial shocks has fueled recurring debates about whether policymakers should deploy additional policy tools. The discussion often focuses on the role of capital flow

¹See, for example, Canova (2005); Maćkowiak (2007); Georgiadis (2016); Choi and others (2017); Dedola, Rivola, and Stracca (2017); Kirti (2018); Iacoviello and Navarro (2019); Vicendoa (2019), and Bräuning and Ivashina (forthcoming).

²Recent models show that exchange rate flexibility may not fully absorb foreign shocks in the presence of financial frictions (Ottonello 2015; Farhi and Werning 2016; Akinci and Queralto 2018; Aoki, Benigno, and Kiyotaki 2018; Cavallino and Sandri 2020) and trade invoicing in US dollars (Egorov and Mukhin 2019, Gopinath and others 2019).

management measures and foreign exchange intervention because these tools directly target international financial transactions. However, awareness is growing that macroprudential policies can themselves play an important role in stabilizing credit markets, despite considerable heterogeneity in effectiveness among instruments (Box 3.1).

Considering this background, the chapter analyzes whether, based on past experience, emerging markets that have adopted a tighter level of macroprudential regulation—which involves a broad range of policy measures to contain the buildup of systemic vulnerability and protect financial stability—may be able to withstand more effectively the macroeconomic impacts of global financial shocks. The premise underpinning the analysis is that, by reinforcing balance sheets, restricting risk taking, and limiting foreign currency exposures, macroprudential regulation strengthens the domestic financial sector’s resilience and thus enhances macroeconomic stability.

Ostry and others (2012) provides early evidence favoring this hypothesis, showing that macroprudential regulation enhanced resilience during the global financial crisis of 2008–09. Similarly, Neanidis (2019) finds that stronger bank supervision reduces the negative impact of volatile capital flows on economic growth.³ This chapter examines the dampening effects of macroprudential regulation against global financial shocks more systematically by analyzing the experience of 38 emerging markets between 2000 and 2016 based on data availability.⁴

During that period, emerging markets were exposed to highly volatile global financial conditions driven by large swings in US policy rates, global risk

aversion—proxied here by the Chicago Board Options Exchange Volatility Index (VIX)—and capital inflows (Figure 3.1, panels 1 and 2).⁵ Global financial volatility significantly affected emerging markets. Panels 3 and 4 of Figure 3.1 show that domestic credit and GDP in emerging markets grew strongly during the buoyant years before the global financial crisis and sharply contracted during the crisis.

Meanwhile, emerging markets have gradually tightened macroprudential regulation. The IMF’s integrated Macroprudential Policy (iMaPP) database records tightening and loosening actions for various macroprudential policy instruments between 1990 and 2016 (Alam and others 2019). These include measures to boost bank capital and liquidity, limit foreign exchange mismatches, and prevent risky lending to leveraged borrowers.

Panel 1 of Figure 3.2 shows the average number of macroprudential tightening actions per country in emerging markets since 2000. By cumulating the tightening and loosening actions for each country since 1990, it is possible to construct an approximate measure of the stringency of macroprudential regulation. Panel 2 of Figure 3.2 shows that macroprudential regulation in emerging markets has tightened considerably over the years, especially since 2005. The global financial crisis led to a temporary loosening in macroprudential regulation, but emerging markets returned to tightening macroprudential regulation during the subsequent recovery. Panel 2 also illustrates a substantial dispersion in the level of macroprudential regulation across countries.

In this context, this chapter asks three main questions:

- Can a more stringent level of macroprudential regulation dampen the effects of global financial shocks on macroeconomic conditions in emerging markets?
- Regarding possible channels through which macroprudential regulation affects resilience, does monetary policy respond more countercyclically to global financial shocks when macroprudential regulation is tighter?
- Does macroprudential regulation have side effects on average economic growth and via cross-country spillovers?

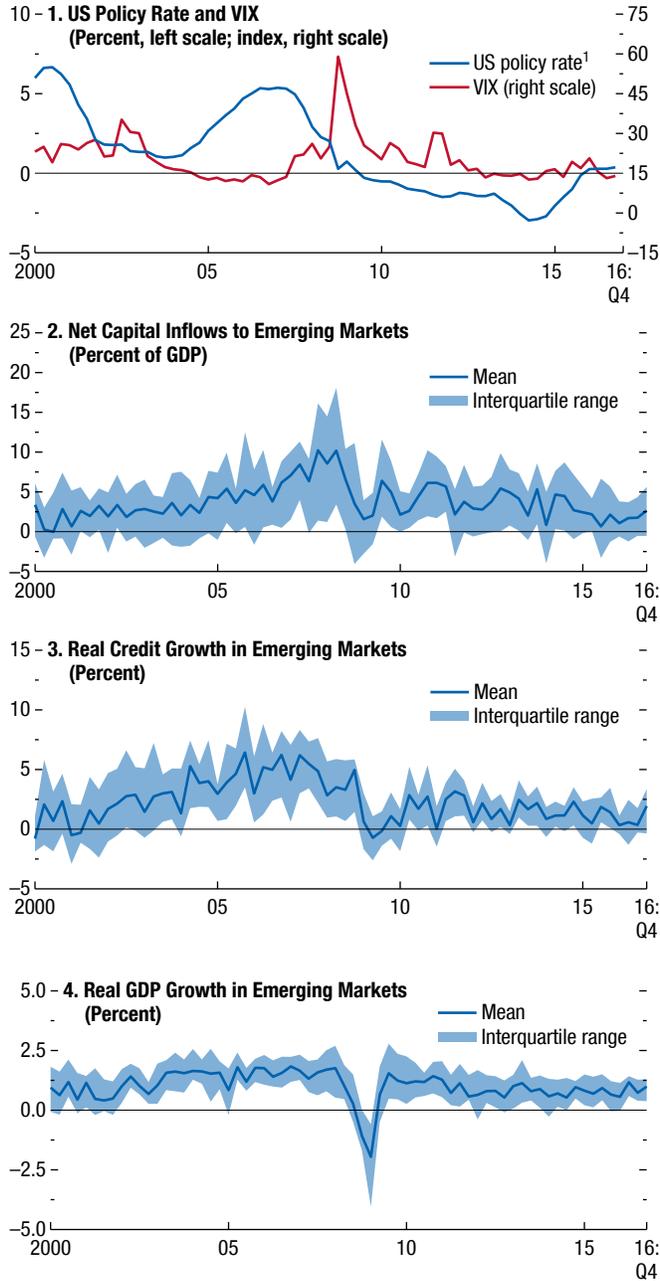
⁵Emerging markets’ cross-border financial positions increased considerably as a share of GDP until the global financial crisis and have remained broadly stable since then (Lane and Milesi-Ferretti 2018). The VIX captures the market’s expected volatility in the Standard & Poor’s 500 index over the coming 30 days.

³Brandao-Marques and others (forthcoming) analyzes the role of macroprudential policies in affecting the full distribution of future GDP growth. Examining the effectiveness of changes in macroprudential regulation, the study finds that these policies can dampen downside risk to growth from external financial shocks. See also Galán (2020) for a related analysis.

⁴The country sample includes Albania, Argentina, Belarus, Bosnia and Herzegovina, Brazil, Bulgaria, Chile, China, Colombia, Costa Rica, Croatia, the Dominican Republic, Ecuador, El Salvador, Georgia, Hungary, India, Indonesia, Jamaica, Jordan, Kazakhstan, Malaysia, Mexico, Morocco, North Macedonia, Pakistan, Paraguay, Peru, the Philippines, Poland, Romania, Russia, Serbia, South Africa, Thailand, Turkey, Ukraine, and Uruguay. The sample period ends in 2016—the last year in the iMaPP database—and excludes extreme crises characterized by a “freely falling” exchange rate, according to the classification of Ilzetzki, Reinhart, and Rogoff (2019). For details on the sample selection and all data sources used in the analysis, see Online Annex 3.1. All annexes are available at <http://www.imf.org/en/Publications/WEO>.

Figure 3.1. Global Financial Conditions and Emerging Markets

Global financial conditions can significantly influence credit markets and economic activity in emerging markets.



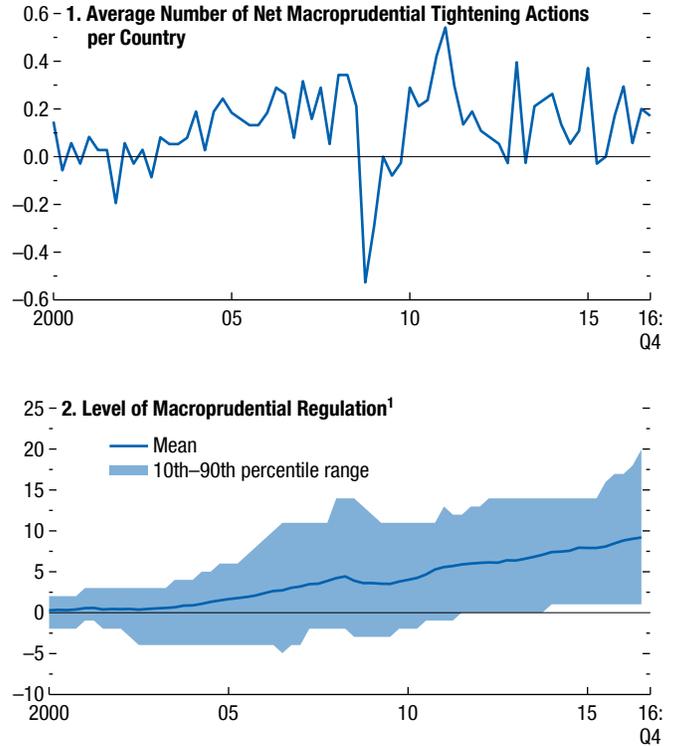
Sources: Bank for International Settlements; Haver Analytics; IMF, *Balance of Payments and International Investment Position Statistics*; IMF, *International Financial Statistics*; Wu and Xia (2015); and IMF staff calculations.

Note: VIX = Chicago Board Options Exchange Volatility Index.

¹The US policy rate is the federal funds rate except during the zero lower bound period, which uses the implied rate from Wu and Xia (2015).

Figure 3.2. Macroprudential Regulation in Emerging Markets

Emerging markets have tightened macroprudential regulation over the years, but considerable variation remains across countries.



Sources: IMF, integrated Macroprudential Policy (iMaPP) database; and IMF staff calculations.

¹The level of macroprudential regulation is calculated by cumulating the net tightening actions for each country since 1990, the first year in the iMaPP database.

By exploiting the time-series and cross-country variation in macroprudential regulation, the analysis first shows that macroprudential regulation can strengthen emerging markets’ resilience to swings in global financial conditions. Specifically, a more stringent level of macroprudential regulation reduces the sensitivity of GDP growth in emerging markets to global financial shocks.⁶ These results are robust to a broad set of endogeneity tests to alleviate concerns about reverse causality and omitted variables.

⁶It is important to emphasize that the analysis does not examine how *changes* in macroprudential regulation affect macroeconomic conditions, which is the focus of most of the existing literature. It instead investigates whether a tighter *level* of macroprudential regulation—which is expected to strengthen financial resilience—dampens the effects of global financial shocks on domestic macroeconomic conditions.

The dampening effects of macroprudential regulation show decreasing marginal returns. Therefore, when regulation is already more stringent, further macroprudential tightening becomes less effective in strengthening resilience. This decrease in effectiveness is consistent with concerns about circumvention, whereby excessive macroprudential regulation may push financial activities outside the regulatory perimeter and increase cross-border lending.⁷

No particular set of tools seems to drive the dampening effects of macroprudential regulation. A broad range of macroprudential measures can contribute to enhancing resilience to global financial shocks, including macroprudential tools that boost bank capital and liquidity, limit foreign exchange exposures, and prevent forms of credit that are too risky. However, these tools have heterogeneous dampening effects that depend on the type of global financial shock hitting the economy.

Macroprudential regulation also appears to reduce domestic credit's sensitivity to global financial shocks, in line with the hypothesis that stronger bank balance sheets lead to steadier credit supply. Furthermore, macroprudential regulation tends to stabilize nominal and real exchange rates, possibly because a safer financial system reduces the volatility of currency risk premia.

However, maintaining a high level of macroprudential regulation at all times is not costless because regulation involves symmetric dampening effects. A higher level of macroprudential regulation supports GDP growth when global financial shocks are adverse, but it lowers economic activity when global financial conditions are favorable. This observation calls for further analysis on how to adjust macroprudential policies optimally to dampen the effects of negative global financial shocks without unduly constraining economic activity when financial conditions are supportive.⁸ Such analysis should also take into account the need to adjust macroprudential policies based on domestic systemic vulnerabilities (IMF 2014).

Regarding possible channels through which macroprudential regulation may strengthen macroeconomic

resilience, the chapter examines whether a tighter level of regulation allows central banks to respond more countercyclically to global financial shocks. This question is important because emerging markets are often reluctant to cut policy rates when global financial conditions tighten, possibly to stabilize exchange rates and capital flows.⁹

Similar dynamics appear to be at play during the ongoing global crisis, with central banks confronting a challenging trade-off between domestic and external stability. Emerging markets face a severe decline in both domestic and foreign demand, which calls for extraordinary monetary easing. But such actions could exacerbate destabilizing capital outflows and lead to even sharper exchange rate depreciations that further imperil financial stability. And, indeed, emerging market central banks have generally reduced policy rates less than the United States so far, despite not being constrained by the zero lower bound.¹⁰

The empirical results show that macroprudential regulation allows monetary policy to respond more countercyclically to global financial shocks. For example, in countries with tighter macroprudential regulation, central banks tend to cut policy rates more aggressively when global risk aversion spikes, thus supporting domestic demand. A possible interpretation is that macroprudential regulation alleviates concerns about financial stability and thus allows monetary policy to focus more squarely on macroeconomic stabilization.

Finally, the chapter studies potential side effects of macroprudential regulation. As mentioned previously, macroprudential regulation has symmetric dampening effects, thus reducing economic growth when global financial conditions are favorable. Besides those negative effects, there could be a deeper concern that a more stringent level of macroprudential regulation may reduce the average level of economic growth throughout the economic cycle. The analysis finds no evidence of such a negative impact. However, given that endogeneity concerns are more severe in this context, more research is needed to reach definitive conclusions.

⁷See, for example, Aiyar, Calomiris, and Wieladek (2014); Reinhart and Sowerbutts (2015); Cerutti, Claessens, and Laeven (2017); Ahnert, Forbes, Friedrich, and Reinhart (2018); Bengui and Bianchi (2018); Braggion, Manconi, and Zhu (2018); and Cizel and others (2019).

⁸Box 3.2 shows that policymakers in emerging markets tend to adjust macroprudential regulation in response to global financial shocks, but more research is needed to understand whether these responses are optimal.

⁹Obstfeld, Shambaugh, and Taylor (2005); Aizenman, Chinn, and Ito (2016, 2017); Han and Wei (2018); Cavallino and Sandri (2018); and Bhattarai, Chatterjee, and Park (forthcoming) document similar findings. Monetary policy appears to respond procyclically, even after controlling for expected inflation.

¹⁰Between March 1 and April 10 2020, the United States has reduced the policy rate by 150 basis points while the emerging markets considered in the analysis have, on average, lowered rates by about 55 basis points.

Macroprudential regulation may also raise concerns about negative cross-country spillovers. If a country shields itself against global financial volatility, other countries may face more exposure to such volatility. The analysis finds no evidence of such negative spillovers. Rather, it finds some evidence of positive spillovers, given that a higher level of macroprudential regulation in one country tends to enhance macroeconomic stability in other countries in the face of capital flow shocks. Macroprudential regulation may thus reduce the propagation of global financial shocks, possibly because enhanced resilience at the level of individual countries leads to more stable cross-border trade and financial flows, even though more research is needed to better understand these transmission channels.

An important caveat to the analysis is that current indicators of macroprudential regulation are subject to several measurement drawbacks, for example because they do not account for the intensity of changes in regulation. Further efforts are needed to improve the measurement of macroprudential regulation and assess the robustness of the findings presented in the chapter. The robustness of the chapter's findings will also need to be tested in richer empirical frameworks that allow for dynamic effects and a fuller interplay between policy tools. This is particularly important, given that policy tools can interact in complex and nontrivial ways.

Can Macroprudential Regulation Dampen the Effects of Global Financial Shocks?

Macroprudential regulation involves a broad set of policy tools that aim to contain the buildup of systemic vulnerabilities and strengthen financial sector resilience, including measures to increase bank capital and liquidity, reduce leverage in the household and corporate sectors, and prevent currency mismatches. The hypothesis motivating this chapter's analysis is that, by buttressing financial sector stability, macroprudential regulation should also enhance macroeconomic resilience to global financial shocks. For example, a banking sector that is better capitalized and more liquid should cope more easily with a sudden withdrawal of foreign capital, firms that are less leveraged should better withstand a sudden increase in foreign borrowing costs, and bank and corporate balance sheets that are less exposed to currency mismatches should be

less vulnerable to swings in exchange rates.¹¹ Does the empirical evidence support this logic?

To address this question, the empirical framework uses a panel regression of real GDP growth in emerging markets over a vector of global financial shocks and their interactions with the stringency of macroprudential regulation. The regression coefficients on the interaction terms capture whether the level of macroprudential regulation mediates the impact of global financial shocks on emerging markets' GDP. The regression also includes interaction terms of the global financial shocks with the squared level of macroprudential regulation to account for possible nonlinear effects. Furthermore, the regression includes country fixed effects to capture time-invariant country-specific factors and various controls, similar to the approach of Obstfeld, Ostry, and Qureshi (2019).¹²

The analysis considers three sources of global financial shocks: US monetary policy shocks to measure variations in international risk-free rates, the VIX to capture changes in global risk premia, and net capital inflows (in percent of GDP) to account for changes in the quantity supply of foreign funds.¹³ Following Blanchard and others (2017), net capital inflows to a

¹¹While this chapter examines whether the level of regulation affects the transmission of global financial shocks to GDP, there is also a large literature that analyzes the effects of changes in macroprudential regulation on the economy. As discussed in the recent review of the literature in Galati and Moessner (2018), "the transmission mechanisms of macroprudential policy tools are not yet well understood." However, there is growing evidence that borrower-based tools transmit to the economy by affecting household credit and house prices.

¹²These include lagged GDP growth, the lagged log of real GDP per capita, institutional quality, and a linear trend. The regression also controls for the lagged output gap (to capture growth dynamics over the business cycle) and commodity terms of trade because several emerging markets are large importers or exporters of commodities. Online Annex 3.2 reports the econometric specification and details of the analysis.

¹³Most studies in the literature analyze only one of these three shocks. Including all shocks at once helps in considering all major sources of global financial shocks and trying to disentangle the components associated with risk-free rates, risk premia, or the quantity supply of foreign capital. The monetary policy shocks are the ones in Iacoviello and Navarro (2019), extended to the end of 2016 and computed as the residuals from a regression of the federal funds rate on US inflation, US log GDP, US corporate spreads, and the log of foreign GDP. The regression uses net capital flows, given that gross outflows offset part of the volatility in gross inflows (Broner and others 2013; Jeanne and Sandri 2020). Capital flows are normalized by the Hodrick-Prescott-trend component of GDP to avoid introducing volatility due to high-frequency movements in GDP. See the April 2020 *Global Financial Stability Report* for an analysis of the sensitivity of capital flows to global and domestic factors.

given country are instrumented using the sum of gross capital inflows to other emerging markets. This is to isolate the component of capital flows driven by global push factors rather than domestic developments.

The stringency of macroprudential regulation is measured by cumulating the net tightening actions for each country since 1990, the first year in the iMaPP database.¹⁴

The first three panels of Figure 3.3 illustrate the impact of global financial shocks on GDP in emerging markets as a function of the stringency of macroprudential regulation on the horizontal axis. At a low level of macroprudential regulation, an increase in global risk aversion (proxied by the VIX) or an outflow of capital considerably reduces economic growth in emerging markets. Given that quarterly GDP growth in the sample of analysis averages 1 percent, a 60 percent spike in the VIX, or a capital outflow equal to 2 percent of GDP, can push emerging markets with the lowest levels of macroprudential regulation into recession. Once the VIX and net capital flows are controlled for, shocks to US policy rates appear not to have statistically significant effects on emerging markets' economic growth.¹⁵

The figure further illustrates that the VIX and capital outflows have fewer damaging effects in countries with tighter macroprudential regulation. Therefore, macroprudential regulation dampens the impact of global financial shocks on economic activity in emerging markets. If the level of regulation is sufficiently tight, the VIX and net capital outflows no longer have statistically significant effects on emerging markets' GDP.

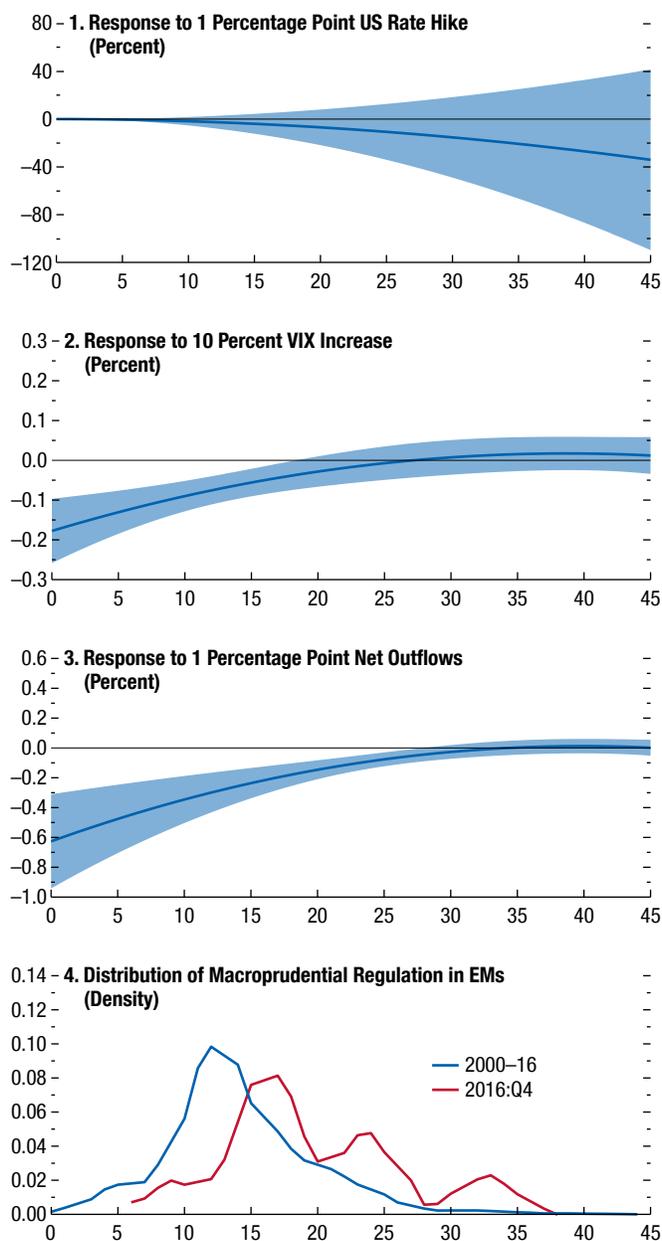
Panel 4 of Figure 3.3 shows the distribution of macroprudential regulation in emerging markets during 2000–16 and at the end of 2016. Emerging markets have generally tightened macroprudential policies over time, as evidenced by the shift of the distribution to the right. Yet, various countries are still at levels of

¹⁴The econometric analysis rescales the cumulated macroprudential indices across all countries so that values are always positive because the regression specification includes squared values of these indices.

¹⁵This lack of a statistically significant effect does not imply that US monetary policy has no impact on emerging markets, but it does imply that the effects materialize through changes in risk premia and capital flows rather than in risk-free rates. Indeed, if the regression does not control for the VIX and capital flows, a tightening of US monetary policy negatively affects economic growth in emerging markets. Kalemli-Özcan (2020) also documents the importance of risk premia in affecting emerging markets.

Figure 3.3. GDP Response in Emerging Markets to Global Financial Shocks

A higher level of macroprudential regulation dampens the impact of global financial shocks on GDP in emerging markets.



Source: IMF staff calculations.

Note: The x-axis denotes the level of macroprudential regulation. See Online Annex 3.1 for data sources and country coverage. Panels 1–3 show the GDP response to global financial shocks for different levels of macroprudential regulation; panel 4 shows the probability density function of macroprudential regulation in the sample; see Online Annex 3.2 for details. Net capital outflows are scaled by the HP-trend of GDP. The coefficients on the interaction terms between the shock and macroprudential regulation are statistically significant in panel 2 and panel 3, but not in panel 1. The shaded areas correspond to 90 percent confidence intervals computed with Driscoll-Kraay standard errors. EMS = emerging markets.

macroprudential regulation at which further tightening can strengthen resilience to global financial shocks. Nonetheless, gains from further tightening appear modest. Panels 2 and 3 of Figure 3.3 point to nonlinearities in the dampening effects of macroprudential regulation: a tightening in macroprudential regulation becomes progressively less effective in strengthening resilience to global financial shocks.

These nonlinearities may be consistent with problems of circumvention. As the stringency of regulation increases, domestic borrowers have stronger incentives to seek credit in the unregulated shadow financial market or from international lenders. Credit from these sources is likely to be more sensitive to global financial conditions and thus could weaken the dampening effects of macroprudential regulation.

Robustness Tests

The analysis has an important caveat: the index of macroprudential regulation constructed by cumulating net tightening actions is subject to several measurement concerns. First, countries may have started with a different level of macroprudential regulation in 1990 (the first year in the iMaPP database), thus confounding cross-country rankings. Second, the iMaPP database records when macroprudential policies are tightened or loosened, but not the intensity of those changes (except in the case of loan-to-value limits). Third, the cumulated index used in the baseline analysis gives equal weight to tightening actions across a broad range of macroprudential measures recorded in the iMaPP database, even though they may have heterogeneous effects on resilience.

These measurement problems could affect the estimates' accuracy but are unlikely to drive the results on the dampening effects of macroprudential regulation. In fact, they should bias the analysis against finding significant effects associated with macroprudential policies, as Akinci and Olmstead-Rumsey (2018) and Forbes (2018), for example, discuss. It is also reassuring that the results are robust to using different time-series and cross-sectional variation in the data and considering subcomponents of the macroprudential index, as the rest of the chapter describes. Nonetheless, the chapter's findings will need to be reexamined when more precise measures of macroprudential regulation become available.

Another possible concern with the analysis is that the level of macroprudential regulation may respond

to changes in GDP growth, in which case reverse causality would bias the results. This concern is partly attenuated by the fact that the level of macroprudential regulation is persistent and much less volatile than quarterly fluctuations in GDP growth. In fact, because the level of macroprudential regulation is obtained by cumulating all past tightening and loosening macroprudential actions, it is largely predetermined with respect to the realization of global financial shocks and the associated GDP response. Besides, macroprudential policies seem not to be systemically adjusted in reference to GDP growth developments, as Richter, Schularick, and Shim (2019) documents in the case of loan-to-value ratios.¹⁶

Nonetheless, to alleviate concerns about reverse causality further, the dampening effects of macroprudential regulation are reestimated under various robustness tests. These tests include excluding periods with negative GDP growth—when macroprudential policies are more likely to be adjusted in reference to domestic macroeconomic developments—and lagging the level of macroprudential regulation by one quarter and one year. Furthermore, to rule out reverse causality concerns, the regression is estimated using the average level of macroprudential regulation for each country during 2000–16. In this specification, the dampening effects of macroprudential regulation are identified by exclusively relying on cross-country heterogeneity in the stringency of macroprudential regulation. Table 3.1 shows that the dampening effects of macroprudential regulation on GDP relative to VIX and capital flow shocks remain statistically significant in each of the robustness tests. Online Annex 3.2 reports details of the underlying analysis.

Finally, omitted-variable bias could affect the results. More precisely, the dampening effects identified in the regression could be driven by country characteristics or policy actions that are correlated with macroprudential regulation and have been omitted from the analysis. To address these concerns, the regression specification is augmented with interaction terms between global financial shocks and various factors that may affect resilience. These factors include country structural characteristics, such as institutional quality

¹⁶Using a narrative approach, Richter, Schularick, and Shim (2019) finds that of 92 changes in loan-to-value ratios in a sample of 56 economies during 1990 and 2012, only 3 were motivated by developments in GDP, inflation, or other real variables.

Table 3.1. Robustness to Reverse Causality: Dampening Effects on GDP

	Global Financial Shocks		
	US Rate	Ln VIX	Net Outflows
Baseline	n.s.	✓	✓
Excluding Negative GDP Growth	n.s.	✓	✓
Macroprudential Regulation, One Quarter Lagged	n.s.	✓	✓
Macroprudential Regulation, One Year Lagged	n.s.	✓	✓
Average Macroprudential Regulation	n.s.	✓	✓

Source: IMF staff calculations.

Note: See Online Annex 3.1 for data sources and country coverage. Check marks denote a statistically significant dampening effect (captured by the coefficient on the interaction term between the shock and the level of macroprudential regulation) at the 10 percent significance level, computed with Driscoll-Kraay standard errors. The columns denote the shocks, and the rows list the test performed; see Online Annex 3.2 for details. n.s. = nonsignificant dampening effect. VIX = Chicago Board Options Exchange Volatility Index.

and financial development;¹⁷ fiscal variables, such as gross public debt (in percent of GDP), gross public debt in foreign currency (in percent of total public debt), and the cyclically adjusted fiscal balance (in percent of GDP); and monetary policy variables, such as the monetary policy rate and the anchoring of inflation expectations (Bems and others 2018). The omitted-variable tests also control for the exchange rate regime, distinguishing between fixed and floating exchange rates (Ilzetzki, Reinhart, and Rogoff 2019). Finally, the regression is augmented to include the stringency of capital controls (Fernandez and others 2016) and the stock of official reserves (in percent of GDP), which can allow countries to directly affect capital flows and the exchange rate. A systematic analysis of the interplay among macroprudential measures, capital controls, and foreign exchange intervention is left for future research.

Table 3.2 shows that the dampening effects of macroprudential regulation remain significant after including any of the additional interaction terms previously described above, thus alleviating concerns

¹⁷The analysis uses the IMF's Financial Development Index, which measures the development of financial institutions and financial markets in terms of depth, access, and efficiency. The data display no significant cross-country correlation between financial development and macroprudential regulation. Furthermore, during the period of analysis, most emerging markets experienced both gradual financial deepening and macroprudential tightening. These observations suggest that tighter macroprudential regulation does not undermine financial development. Online Annex 3.1 provides additional details on the definition and data sources of the other variables used in the robustness tests.

Table 3.2. Robustness to Omitted Variables: Dampening Effects on GDP

	Global Financial Shocks		
	US Rate	Ln VIX	Net Outflows
Baseline	n.s.	✓	✓
Institutional Quality	n.s.	✓	✓
Financial Development	n.s.	✓	✓
Gross Public Debt	n.s.	✓	✓
Gross Public Debt in Foreign Currency	n.s.	✓	✓
Cyclically Adjusted Balance	n.s.	✓	✓
Monetary Policy Rate	n.s.	✓	✓
Inflation Expectation Anchoring	n.s.	✓	✓
Fixed Exchange Rate Regime	n.s.	✓	✓
Capital Controls	n.s.	✓	✓
Official Reserves	n.s.	✓	✓
Time Fixed Effects	n.s.	✓	✓

Source: IMF staff calculations.

Note: See Online Annex 3.1 for data sources and country coverage. Check marks denote a statistically significant dampening effect (captured by the coefficient on the interaction term between the shock and the level of macroprudential regulation) at the 10 percent significance level, computed with Driscoll-Kraay standard errors. The columns denote the shocks, and the rows list the additional controls that enter the specification, along with their interactions with the shocks; see Online Annex 3.2 for details. n.s. = nonsignificant dampening effect. VIX = Chicago Board Options Exchange Volatility Index.

about omitted-variable bias. Furthermore, the results are robust to the inclusion of time fixed effects, which absorb any comovement in GDP growth among emerging markets.¹⁸ Even though these tests alleviate concerns about omitted-variable bias, it will be important to test for the robustness of the results using empirical frameworks that allow for dynamic effects and a richer interplay between policy tools and country characteristics.

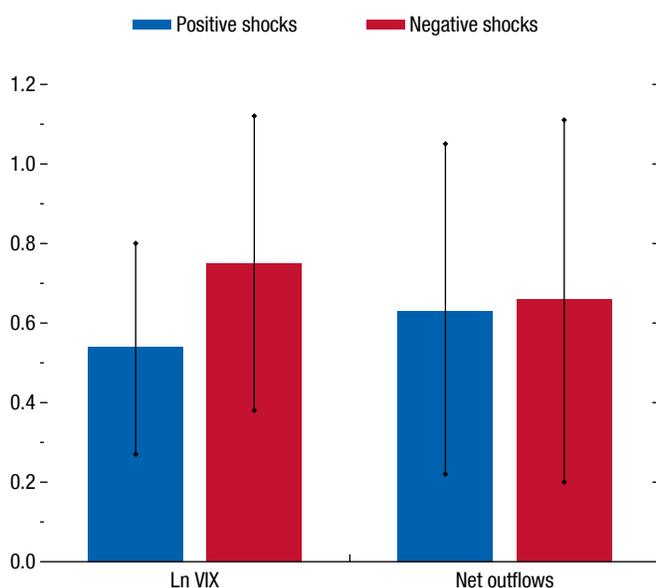
Further Analysis on the Dampening Effects of Macroprudential Regulation

The previous analysis found that macroprudential regulation reduces the sensitivity of GDP growth in emerging markets to global financial shocks. Are these dampening effects at play against both positive and negative shocks? To address this question, the regression specification is extended to include dummies that differentiate between an increase and a decrease in the shock variables.

¹⁸When time fixed effects are included, the regression must exclude US monetary shocks and the VIX (because they are common to all countries) but can retain their interactions with macroprudential regulation. This specification makes it impossible to estimate these shocks' overall impact on GDP (as illustrated in Figure 3.3) but still allows measurement of the dampening effects of macroprudential regulation.

Figure 3.4. Symmetric Dampening Effects of Macroprudential Regulation on GDP Growth (Percent)

Macroprudential regulation dampens the effects of both positive and negative global financial shocks.



Source: IMF staff calculations.

Note: See Online Annex 3.1 for data sources and country coverage. The blue (red) bars show the point estimate for the coefficient on the triple interaction term among the shock, the level of macroprudential regulation, and a dummy that identifies positive (negative) shocks, respectively; see Online Annex 3.2 for details. The level of macroprudential regulation is divided by 10 to make visualization of the coefficients easier. In the case of Ln VIX, the shock is a 1 percent increase in the VIX; for net outflows, the shock consists of a 5 percentage point increase in net outflows. The *x*-axis depicts the shocks. The vertical lines correspond to 90 percent confidence intervals computed with Driscoll-Kraay standard errors. VIX = Chicago Board Options Exchange Volatility Index.

Figure 3.4 plots the regression coefficients on the interaction terms between the global financial shocks and the level of macroprudential regulation, distinguishing between positive and negative shocks. It shows that macroprudential regulation entails symmetric dampening effects of a similar magnitude. A Wald test confirms that the dampening effects against positive and negative global financial shocks are not statistically different from one another. This lack of a statistically significant difference implies that, although a tighter level of regulation supports economic growth in cases of negative financial shocks, it also lowers economic activity when global financial shocks are positive.

Maintaining a high level of macroprudential regulation is, thus, not costless because it implies forgoing

growth opportunities when global financial conditions are favorable. This does not imply that policymakers should wait to tighten macroprudential regulation until global financial conditions deteriorate. Constraining excessive risk taking and credit provision when financial conditions are loose is indeed a key channel through which macroprudential regulation ensures greater resilience at times of financial distress. Nonetheless, the symmetric dampening effects of macroprudential regulation call for further analysis of how to adjust regulation optimally to dampen the effects of negative shocks without excessively constraining economic activity when financial conditions are supportive.

Up to this point, the analysis has used an overall index of macroprudential regulation that combines a broad range of specific measures recorded in the iMaPP database. Do any of these specific measures drive the dampening effects of macroprudential regulation? To shed light on this issue, the analysis is replicated using more disaggregated groups of macroprudential regulation, including measures targeted at bank capital and liquidity, credit demand (such as loan-to-value ratios), credit supply (such as limits on credit growth), and foreign currency exposure.¹⁹

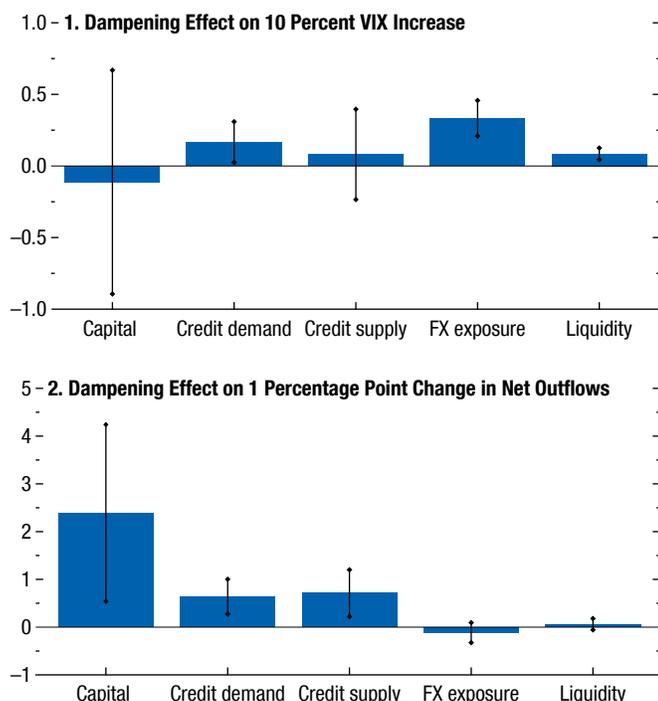
Figure 3.5 displays the dampening properties of each of these macroprudential categories in reference to the VIX (panel 1) and net capital outflows (panel 2). All macroprudential components play some role in dampening the effects of global financial shocks, but the effects are heterogeneous and depend on the type of shock. Measures targeted at credit demand, foreign currency exposure, and liquidity offer protection against fluctuations in the VIX. Macroprudential regulation targeted at bank capital, credit demand, and credit supply protects against shocks to net capital flows.

These results suggest that enhancing resilience to global financial shocks requires a well-rounded macroprudential framework, rather than a narrow focus on a few specific tools. Furthermore, the analysis shows that the dampening effects of macroprudential regulation are not limited to measures targeted at foreign currency exposures that could operate similarly to capital flow

¹⁹See Online Annex Table 3.1.3 for a description of each category. The analysis estimates different regressions for each group of macroprudential measures. It is not advisable to include all groups in the regression at once, given that each group has to be interacted with three global financial shocks, and the interaction terms with net capital inflows have to be instrumented.

Figure 3.5. Dampening Effects on GDP Growth, by Categories of Macroprudential Measures
(Percent)

A broad range of macroprudential measures contribute to dampening the effects of global financial shocks.



Source: IMF staff calculations.
Note: See Online Annex 3.1 for data sources and country coverage. The bars show the point estimate for the coefficient on the interaction term between the shock and the level of macroprudential regulation; see Online Annex 3.2 for details. The level of macroprudential regulation is divided by 10 to make visualization of the coefficients easier. The x-axis depicts five categories of macroprudential measures. The vertical lines correspond to 90 percent confidence intervals computed with Driscoll-Kraay standard errors. FX = foreign exchange; VIX = Chicago Board Options Exchange Volatility Index.

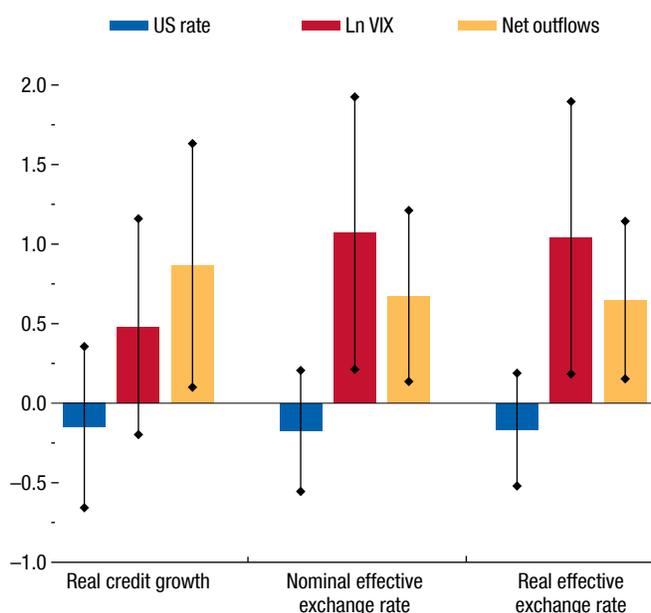
management measures.²⁰ Macroprudential regulation that ensures adequate capital and liquidity and prevents excessive risk taking in credit provision also plays an important role in fostering resilience to global financial shocks.

Finally, the dampening properties of macroprudential regulation are not limited to the effects on

²⁰For the country sample used in the analysis, the IMF 2019 Taxonomy of Capital Flow Management Measures identifies only nine macroprudential tightening or loosening actions that are also classified as capital flow management measures because they are designed to limit capital flows. Out of these, the iMaPP database records seven. The results in the chapter are robust to excluding those measures.

Figure 3.6. Dampening Effects of Macroprudential Regulation on Credit and Exchange Rates
(Percent)

Macroprudential regulation tends to dampen the effects of global financial shocks on domestic credit and exchange rates as well.



Source: IMF staff estimates.
Note: See Online Annex 3.1 for data sources and country coverage. The bars show the point estimate for the coefficient on the interaction term between the shock and the level of macroprudential regulation; see Online Annex 3.2 for details. In the case of net outflows, the shock is equal to a 5 percentage point increase in net outflows. The level of macroprudential regulation is divided by 10 to make visualization of the coefficients easier. The x-axis depicts three dependent variables. The vertical lines correspond to 90 percent confidence intervals computed with Driscoll-Kraay standard errors. VIX = Chicago Board Options Exchange Volatility Index.

GDP growth. Figure 3.6 shows that macroprudential policies also weaken the effects of capital flow shocks on the real growth of bank credit.²¹ This finding is consistent with the idea that, by boosting bank capital and liquidity as well as reducing currency mismatches, macroprudential regulation makes the banking sector less susceptible to fluctuations in the supply of foreign funds.

The analysis also finds that macroprudential regulation tends to dampen the effects of VIX and capital flow shocks on the nominal and real effective

²¹The regression finds that shocks to US monetary policy and the VIX do not influence credit growth once capital flow shocks are controlled for, regardless of the level of macroprudential regulation.

exchange rates.²² A possible interpretation is that, by curbing risk taking in the domestic economy, macroprudential regulation reduces the volatility of currency risk premia. Lower volatility in currency risk premia, in turn, may contribute to more stable economic growth by weakening the damaging effects of currency mismatches and allowing monetary policy to respond more countercyclically, as the next section analyzes.

Can Macroprudential Regulation Support a More Countercyclical Monetary Policy Response?

According to the Mundell-Fleming trilemma, countries open to capital flows can retain monetary independence if they have a flexible exchange rate (Fleming 1962; Mundell 1963). Monetary independence is broadly interpreted as monetary policy's ability to set interest rates and stabilize domestic macroeconomic conditions, independent of swings in global monetary and financial conditions. In line with the trilemma, the empirical literature documents that policy rates in countries with flexible exchange rates respond less to US monetary policy and the VIX than those in countries with fixed exchange rates (Obstfeld 2015).

However, even among emerging markets with flexible exchange rates, several central banks tend to increase policy rates in response to a US monetary tightening or a spike in the VIX, even after expected inflation is controlled for (Obstfeld, Shambaugh, and Taylor 2005; Aizenman, Chinn, and Ito 2016, 2017; Han and Wei 2018; Cavallino and Sandri 2020; Bhattarai, Chatterjee, and Park forthcoming). This is possibly to limit fluctuations in exchange rates and capital flows that may undermine financial stability. In these situations, monetary policy appears to operate procyclically, exacerbating the negative effects of tighter global financial conditions on domestic economic growth.

To enhance monetary independence, the trilemma calls for using capital controls to restrain free capital mobility.²³ Could macroprudential regulation also

²²Once the VIX and capital flow shocks are controlled for, emerging markets' exchange rates are not sensitive to US monetary policy shocks. The dampening effects of macroprudential regulation on the exchange rate become border-line insignificant (except for the impact of the VIX on the real effective exchange rate) when adding controls for the interactions of global financial shocks with the level of official reserves. The interactions with official reserves are not statistically significant.

²³Foreign exchange intervention may also play a role in enhancing monetary independence by helping central banks to stabilize the exchange rate in case of disorderly market conditions.

support a more countercyclical response of monetary policy? By mitigating financial stability concerns, macroprudential policy could allow monetary policy to focus more squarely on domestic economic conditions. Furthermore, as the previous analysis documents, macroprudential regulation can limit exchange rate fluctuations and, thus, central banks' need to respond procyclically to stabilize the currency.

To shed light on this issue, the analysis examines whether macroprudential regulation affects monetary policy's response to global financial shocks in emerging markets. It considers only periods when countries had flexible exchange rates and, thus, retained control of monetary policy. Policy rates are regressed on the set of global financial variables—US monetary policy, the VIX, and instrumented net capital outflows—and their interactions with the stringency of macroprudential regulation.²⁴ The regression includes country fixed effects and various control variables, such as the domestic output gap, expected inflation, real credit growth, and commodity terms of trade.

Figure 3.7 illustrates the results. Panels 1 and 2 show that, at low levels of macroprudential regulation, emerging markets tighten monetary policy in response to a hike in US monetary policy or increase in the VIX. A more stringent level of macroprudential regulation dampens this procyclical response. In fact, a sufficiently high level of macroprudential regulation allows central banks in emerging markets to react countercyclically by lowering policy rates especially in response to an increase in the VIX.²⁵

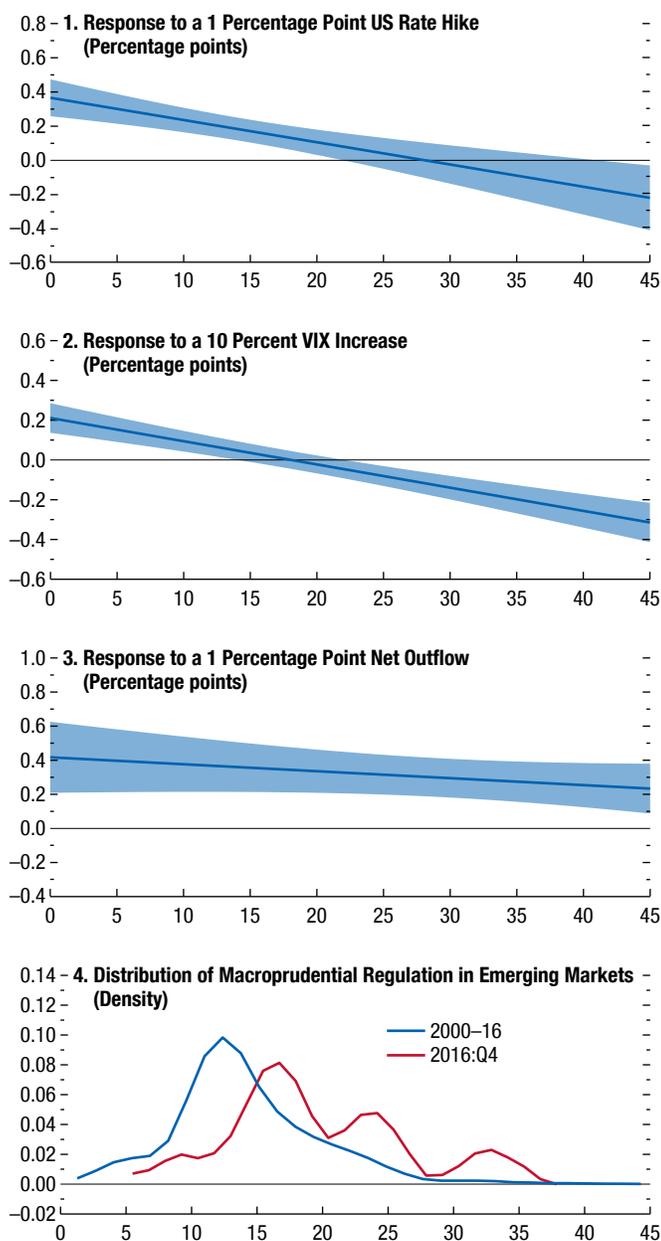
However, macroprudential regulation has no statistically significant effect on the response of monetary policy to capital outflow shocks (Figure 3.7, panel 3). Capital outflows appear to trigger a monetary tightening in emerging markets, independent of the macroprudential regulation level. This suggests that,

²⁴Unlike in the analysis of macroprudential regulation's dampening effects, the regression includes actual US policy rates rather than unexpected shocks, in line with the empirical literature on the trilemma and also because the empirical analysis shows that emerging markets in the sample tend to adjust policy rates in reference to actual US policy rates rather than to the unexpected component only. The US policy rate is adjusted for the effect of unconventional monetary policy during the zero-lower-bound period using the implied rate calculated in Wu and Xia (2016).

²⁵This evidence is consistent with Aizenman, Chinn, and Ito (2017), which shows that macroprudential regulation can reduce the comovement of policy rates between peripheral and center economies. Relatedly, Manu and Sgherri (2020) finds that macroprudential policies and capital flow measures strengthen the responsiveness of monetary policy to expected inflation.

Figure 3.7. Policy Rate Responses in Emerging Markets to Global Financial Shocks

Macroprudential regulation allows monetary policy in emerging markets to respond more countercyclically to global financial shocks.



Source: IMF staff calculations.

Note: The x-axis denotes the level of macroprudential regulation. See Online Annex 3.1 for data sources and country coverage. Panels 1–3 show the estimated policy rate response to global financial shocks for different levels of macroprudential regulation; panel 4 shows the probability density function of macroprudential regulation in the sample; see Online Annex 3.3 for details. The coefficients on the interaction terms between the shock and macroprudential regulation are statistically significant in panel 1 and panel 2, but not in panel 3. The shaded areas correspond to 90 percent confidence intervals computed with Driscoll-Kraay standard errors. VIX = Chicago Board Options Exchange Volatility Index.

even in countries with tight macroprudential regulation, central banks continue to face important policy trade-offs in responding to sharp fluctuations in capital flows and that additional policy tools might be required, such as foreign exchange intervention in case of disorderly market conditions.

Are the effects of macroprudential policies on the monetary policy response robust to endogeneity tests? A first concern is that the macroprudential regulation level could be adjusted in reference to domestic policy rates, thus leading to reverse causality problems. In the regression sample, macroprudential regulation does indeed tend to be loosened when monetary policy is tightened.

To ensure that reverse causality does not drive the results, the regression analysis is replicated using lagged—by one quarter and one year—values of macroprudential regulation, as well as the average level of regulation in each country, in which case the identification is purely cross-sectional. Table 3.3 shows that, across all these specifications, macroprudential regulation continues to support a more countercyclical response of monetary policy to global financial conditions. The only difference from the baseline specification is when average levels of macroprudential regulation are used, in which case regulation supports a more countercyclical response to capital flow shocks rather than to changes in US monetary policy. Online Annex 3.3 reports details of the analysis.

With regard to concerns about omitted-variable bias, the regression specification is augmented to include, one at a time, the interactions of global financial shocks with various country characteristics and policy

Table 3.3. Robustness to Reverse Causality: Supporting Countercyclical Monetary Response

	Global Financial Shocks		
	US Rate	Ln VIX	Net Outflows
Baseline	✓	✓	n.s.
Macroprudential Regulation, One Quarter Lagged	✓	✓	n.s.
Macroprudential Regulation, One Year Lagged	✓	✓	n.s.
Average Macroprudential Regulation	n.s.	✓	✓

Source: IMF staff calculations.

Note: See Online Annex 3.1 for data sources and country coverage. Check marks denote significantly more counter-cyclical response at the 10 percent significance level, computed with Driscoll-Kraay standard errors. The columns denote the shocks, and the rows list the test performed; see Online Annex 3.3 for details. n.s. = nonsignificant effect on monetary policy response. VIX = Chicago Board Options Exchange Volatility Index.

Table 3.4. Robustness to Omitted Variables: Supporting Countercyclical Monetary Response

	Global Financial Shocks		
	US Rate	Ln VIX	Net Outflows
Baseline	✓	✓	n.s.
Institutional Quality	✓	✓	n.s.
Financial Development	✓	✓	n.s.
Gross Public Debt	✓	✓	n.s.
Gross Public Debt in Foreign Currency	✓	✓	n.s.
Cyclically Adjusted Balance	✓	✓	✓
Inflation Expectation Anchoring	✓	✓	n.s.
Capital Controls	✓	✓	n.s.
Official Reserves	n.s.	✓	n.s.
Time Fixed Effects	✓	✓	n.s.

Source: IMF staff calculations.

Note: See Online Annex 3.1 for data sources and country coverage. Check marks denote significantly more counter-cyclical response at the 10 percent significance level, computed with Driscoll-Kraay standard errors. The columns denote the shocks, and the rows list the additional controls that enter the specification, along with their interactions with the shocks; see Online Annex 3.3 for details. n.s. = nonsignificant effect on monetary policy response. VIX = Chicago Board Options Exchange Volatility Index.

variables, such as institutional quality, financial development, gross public debt, gross public debt in foreign currency, the cyclically adjusted fiscal balance, the anchoring of inflation expectations, capital controls, and the level of official reserves. Table 3.4 shows that macroprudential regulation continues to support a more countercyclical response of monetary policy to changes in US policy rates and the VIX across all these specifications. The only exception is that macroprudential regulation no longer affects the monetary policy response to changes in US policy rates when the level of official reserves is controlled for.²⁶ The results of the effects of macroprudential regulation on the monetary policy response are also robust to the inclusion of time fixed effects.

Are There Side Effects of Macroprudential Regulation on Average Growth or via Cross-Country Spillovers?

The empirical evidence presented so far suggests that macroprudential regulation can dampen the macroeconomic effects of global financial shocks and can allow

²⁶Annex Table 3.3.3 shows that a higher stock of official reserves supports a more countercyclical response of monetary policy in emerging markets to changes in US policy rates, possibly because it allows for more decisive foreign exchange intervention. The robustness tests cannot easily control for foreign exchange intervention because the decision to intervene is highly endogenous as it depends on global financial shocks and their expected impact on the economy.

monetary policy to respond more countercyclically. Do these benefits come at the cost of negative side effects—for example, lower average economic growth or harmful cross-border spillovers?

Effects on Economic Growth

The analysis finds that macroprudential regulation has symmetric dampening effects, which implies that the gains from greater economic growth, when global financial shocks are adverse, come at the cost of foregone economic activity when financial conditions are supportive. Beyond these symmetric effects, there could be a concern that tight macroprudential regulation might lower the average rate of economic growth if regulation excessively constrains credit provision or leads to a suboptimal level of risk taking.

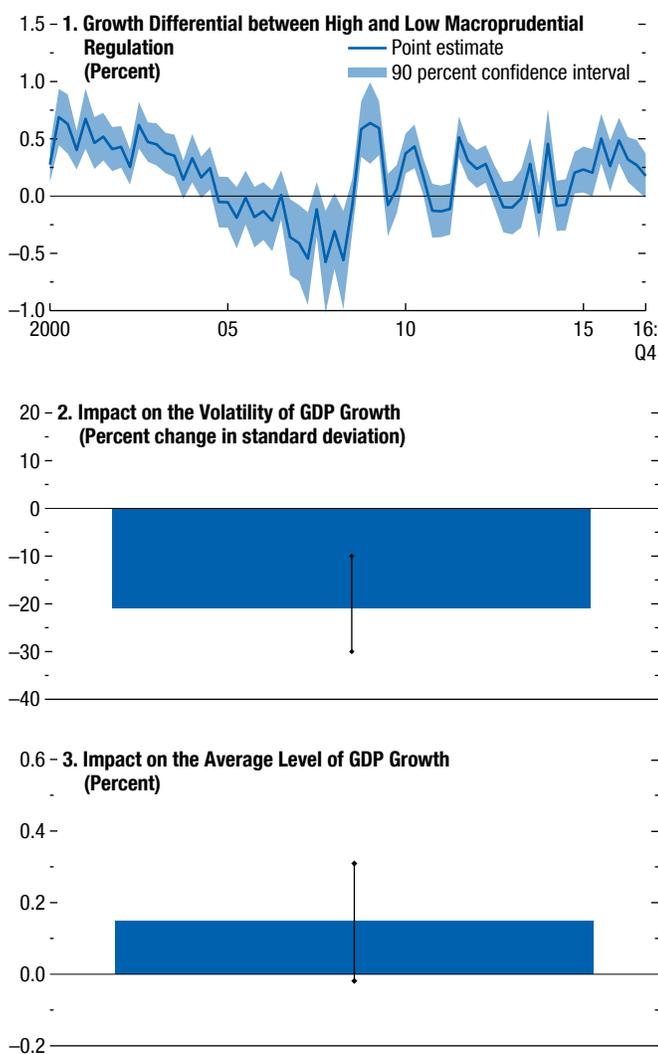
Nonetheless, macroprudential regulation might also have positive effects on average economic growth by ensuring a more efficient allocation of credit, mobilizing savings, and reducing the permanent GDP losses associated with financial crises (Agénor 2019; Ma 2020). The empirical literature documents a variety of results. Some studies show that tightening macroprudential policies leads to a temporary decline in GDP (Eickmeier, Kolb, and Prieto 2018; Kim and Mehrotra 2018; Richter, Schularick, and Shim 2019). Others focus on longer-term effects, finding that macroprudential policies tend to boost economic growth (Boar and others 2017; Agénor and others 2018; Neanidis 2019).

The empirical approach used to analyze the dampening effects of macroprudential regulation can also shed some light on the effects of regulation on average GDP growth. Using the estimated regression coefficients, it is possible to predict the rate of GDP growth that a country would have experienced during 2000–16 if it had a high or low level of macroprudential regulation. These levels are based on the 75th and 25th percentiles, respectively, of the distribution of macroprudential regulation in the sample of analysis.

Panel 1 of Figure 3.8 plots the differential in the GDP growth rate between a high and a low level of macroprudential regulation. Higher levels of regulation would have delivered significantly stronger economic growth in the early 2000s and during the global financial crisis, when global financial conditions were adverse. For example, higher levels of macroprudential regulation would have increased quarterly GDP growth by about 0.6 percent between the fourth quarter of

Figure 3.8. Effects of Macroprudential Regulation on GDP Growth

Macroprudential regulation can reduce the volatility of GDP growth. The analysis does not detect effects of regulation on the average level of GDP growth.



Source: IMF staff calculations.

Note: See Online Annex 3.1 for data sources and country coverage. Panel 1 shows the growth differential between a country with macroprudential regulation set at the 75th percentile of the sample distribution and one with macroprudential regulation set at the 25th percentile; panel 2 shows the point estimate of the impact of macroprudential regulation on the volatility of GDP growth; and panel 3 shows the impact of macroprudential regulation on average GDP growth; see Online Annex 3.4 for details. The vertical lines correspond to 90 percent confidence intervals computed with Driscoll-Kraay standard errors.

2008 and the second quarter of 2009. However, higher levels of macroprudential regulation would also have lowered economic growth considerably in the years before the global financial crisis, when global financial conditions were buoyant. Thus, macroprudential

regulation reduces the amplitude of economic fluctuations by sustaining growth in the face of adverse shocks while lowering economic activity when global financial conditions are supportive.

In line with the dampening effects documented earlier in the analysis, these results imply that a more stringent level of macroprudential regulation reduces the volatility of GDP growth. As shown in panel 2 of Figure 3.8, a higher level of macroprudential regulation at the 75th percentile of the sample distribution would have reduced the standard deviation of GDP growth during 2000–16 by about 20 percent relative to a lower level of regulation at the 25th percentile.

Do the gains from lower GDP volatility come at the cost of lower average GDP growth? The analysis finds no evidence that macroprudential regulation has detrimental effects on average economic growth. Panel 3 of Figure 3.8 shows that, during 2000–16, a higher level of regulation would have had no statistically significant effect on average GDP growth.²⁷

The lack of evidence regarding negative effects of macroprudential regulation on average GDP growth comes with important caveats. First, negative effects on average economic growth could materialize at a higher level of regulation than that observed during the analysis period. Second, reverse causality could affect the results, whereby country authorities may systematically tighten macroprudential regulation when economic growth is greater and vice versa. The stickiness in the level of regulation and policymakers' tendency not to use macroprudential policies to respond to GDP developments attenuate concerns regarding reverse causality (Richter, Schularick, and Shim 2019).²⁸ Further analysis is needed to reach more definitive conclusions on the causal effects of macroprudential regulation on average GDP growth.

²⁷Analyzing the derivative of GDP growth with respect to the level of macroprudential regulation yields similar results. The regression estimates show that macroprudential regulation does not generally have significant effects on GDP growth, except when financial conditions are tight, in which case regulation appears to marginally increase economic growth.

²⁸Concerns about reverse causality are less severe in the previous analysis of the dampening effects of macroprudential regulation because the results are robust to using the average level of macroprudential regulation for each country. In that case, the dampening effects are estimated based on whether global financial shocks affect countries with higher macroprudential regulation less. A similar exercise is not possible for the analysis of the effects of macroprudential regulation on GDP growth because country fixed effects absorb cross-country differences in the average level of macroprudential regulation.

Cross-Country Spillovers

Another possible concern with macroprudential regulation is that, if a country protects itself from swings in global financial conditions through tight macroprudential regulation, it could expose other countries to greater volatility.²⁹ For example, measures that curb risk taking in a given country could lead to the relocation of risky financial activities to other countries (Houston, Lin, and Ma 2012; Ongena, Popov, and Udell 2013; McCann and O’Toole 2019), thus making those countries more susceptible to global financial shocks.

However, macroprudential regulation may also entail positive cross-country spillovers. If a country uses macroprudential regulation to strengthen its resilience to global financial shocks, other countries may enjoy greater stability through less volatile trade and financial flows with the country using macroprudential regulation.

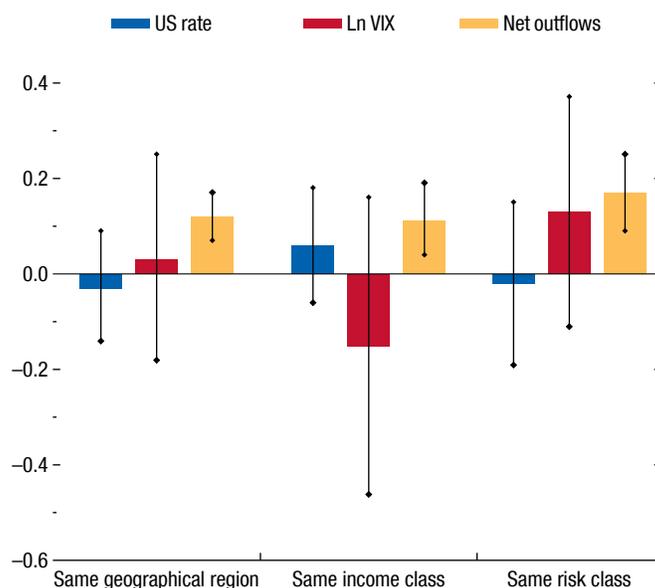
The regression framework used to analyze the dampening effects of macroprudential regulation in a given country can be extended to capture the presence and nature of cross-country spillovers. Besides interacting the global financial shocks with the level of macroprudential regulation in a given country, the regression is expanded to include interaction terms of the shocks with the average level of regulation in other emerging markets. These new interaction terms capture whether the level of macroprudential regulation in other countries affects the sensitivity of GDP growth in a given country to global financial shocks.

Spillovers are likely to occur across emerging markets that share similar characteristics. The analysis groups countries into three alternative categories based on geographic region, income level, and risk class. Regarding income level, countries are grouped depending on whether their GDP per capita is above or below the median of the emerging market sample in any given year. The same procedure is followed to differentiate countries according to their risk class, based on a composite risk index that Giordani and others (2017)

²⁹Similar arguments have been raised regarding capital flow management measures (Lambert, Ramos-Tallada, and Rebillard 2012; Forbes and others 2016; Giordani and others 2017). As in previous sections of the chapter, the analysis looks at possible spillovers associated with how global financial shocks interact with the *level* of macroprudential regulation. This is different from analyzing the cross-border effects of *changes* in macroprudential regulation, for example, whether tightening capital requirements reduces foreign lending.

Figure 3.9. Cross-Country Spillovers from Macroprudential Regulation (Percent)

Macroprudential regulation appears to generate positive cross-country spillovers by strengthening resilience to capital flow shocks.



Source: IMF staff estimates.

Note: See Online Annex 3.1 for data sources and country coverage. The bars show the point estimate of the coefficient, and the vertical lines correspond to 90 percent confidence intervals computed with Driscoll-Kraay standard errors; see Online Annex 3.4 for details. VIX = Chicago Board Options Exchange Volatility Index.

uses to analyze spillovers from capital flows management measures.

Figure 3.9 shows the regression coefficients on the interaction terms of the global financial shocks with the average level of macroprudential regulation in other emerging markets within the same geographic, income, and risk category. The average level of regulation is computed by weighting countries according to the size of gross capital inflows that they receive. Positive coefficients on the interaction terms indicate positive spillovers, so GDP growth in a given country is higher in the face of adverse global financial shocks if other countries have tight macroprudential regulation. Regardless of the country group categories, the analysis finds no evidence of spillovers associated with shocks to US monetary policy and the VIX because the regression coefficients on these interactions are statistically nonsignificant. However, the results point to the presence of positive spillovers associated with

shocks to net capital flows. This finding is consistent across all three types of country groupings.³⁰

Therefore, the analysis finds no evidence of negative cross-country spillovers, thus alleviating concerns that tighter macroprudential regulation in a given country could exacerbate macroeconomic instability in other countries. On the contrary, there is some evidence of positive cross-country spillovers, consistent with the idea that macroprudential regulation in a given country may also benefit other countries by supporting more stable trade and financial links. More research is needed to better understand these transmission channels.

Conclusion

The key result of the analysis in this chapter is that macroprudential regulation can dampen the macroeconomic impacts of global financial shocks on emerging markets. More specifically, a tighter level of macroprudential regulation reduces the sensitivity of GDP growth in emerging markets to fluctuations in risk premia and changes in foreign capital flows.

The dampening effects of macroprudential regulation do not seem to be driven by a specific set of tools; instead, a broad range of macroprudential measures targeting liquidity, capital, foreign exchange exposures, and risky forms of credit all appear to play a role in enhancing macroeconomic resilience. However, the dampening effects of different tools are heterogeneous and depend on the particular type of global financial shock hitting an economy. Macroprudential regulation can also help stabilize real credit growth and the nominal and real exchange rates.

However, maintaining a permanently high level of macroprudential regulation is not costless because macroprudential regulation has symmetric dampening effects: it attenuates the negative impact on GDP from a tightening in global financial conditions, but also limits GDP growth when financial conditions are loose. This finding calls for more research on how to adjust macroprudential regulation optimally depending on domestic and external financial conditions.

One possible channel through which macroprudential regulation may strengthen macroeconomic

resilience is by allowing monetary policy to respond more countercyclically to global financial shocks. The empirical evidence suggests that, at low levels of macroprudential regulation, central banks in emerging markets tend to increase policy rates when global financial conditions tighten, possibly because of financial stability concerns arising from movements in exchange rates and capital outflows. However, at higher levels of macroprudential regulation, central banks tend to respond more countercyclically, especially by lowering policy rates when the VIX increases, thus cushioning the impact of adverse financial shocks on domestic economic growth.

This implies that countries that entered the global pandemic with a more stringent level of macroprudential regulation should be able to ease monetary policy more decisively, despite the sharp increase in global risk aversion. This is particularly important in the current juncture given the extraordinary contraction in domestic and foreign demand caused by the COVID-19 pandemic. At the same time, the empirical analysis shows that macroprudential regulation does not seem to have tangible effects on the response of monetary policy to capital flow shocks, which remains procyclical. Additional policy tools may, thus, be needed to support monetary policy in those countries dealing with extreme capital outflows.

Regarding possible side effects associated with macroprudential regulation, the analysis does not find detrimental effects of regulation on average GDP growth. However, this result should be interpreted with caution, given endogeneity challenges. The analysis also finds no evidence of negative cross-country spillovers. On the contrary, a higher level of macroprudential regulation in a given country appears to strengthen resilience to capital flow shocks, even in other countries, possibly as a result of more stable trade and financial links.

The empirical results presented in this chapter are subject to important caveats. First, the indexes of macroprudential regulation used in the analysis suffer from several measurement limitations. Therefore, this chapter's empirical findings will need to be reexamined as the quality of macroprudential data continues to improve. Second, it is important to test for the robustness of the results using empirical frameworks that allow for dynamic effects and for a richer interplay of macroprudential regulation with other policy tools and country characteristics. These issues will be covered in upcoming work by the IMF that will develop

³⁰There is no evidence of negative spillovers, even if the regression controls for time fixed effects. In this case, spillovers remain positive on capital flow shocks when countries are grouped by geographic location and risk class.

a framework to analyze the complex interactions among various policy tools, namely, monetary policy, macroprudential regulation, capital flow management measures, and foreign exchange intervention.

The analysis suggests various avenues for future research. First, given the symmetric dampening effects of macroprudential regulation against both positive and negative global financial shocks, more research is needed to better understand how to optimally adjust regulation in line with domestic and external developments. Second, the chapter's analysis has considered whether a higher level of macroprudential regulation—which is expected to enhance financial resilience—can dampen

the effects of global financial shocks on domestic macroeconomic conditions. Future research could explore whether policymakers could also offset the impact of global shocks by promptly adjusting macroprudential regulation, for example, by easing regulation when an adverse shock hits. Finally, the analysis has identified possible channels through which macroprudential regulation may dampen global financial shocks, for example, by stabilizing credit growth or the exchange rate and by allowing monetary policy to respond more countercyclically. More research is warranted to improve the characterization of these transmission channels and link them to specific macroprudential measures.

Box 3.1. Macroprudential Policies and Credit: A Meta-Analysis of the Empirical Findings

A growing body of empirical literature attempts to shed light on the effectiveness of macroprudential policy, focusing mostly on whether macroprudential policies are effective in controlling credit growth—a key issue because credit is the single best predictor of banking crises (Schularick and Taylor 2012). Drawing on 58 empirical studies encompassing cross-country and microlevel studies, Araujo and others (forthcoming) builds a repository of the empirical findings and synthesizes them using a meta-analysis framework. Meta-analysis techniques combine the results of several studies quantitatively to provide an overview of the results in the literature (Stanley 2001).

The meta-analysis uses the following regression framework:

$$\hat{\beta}_j = \theta_B MPM_j^B + \theta_H MPM_j^H + \theta_L MPM_j^L + \gamma X_j + \varepsilon_j \quad (3.1.1)$$

In this framework, the dependent variable $\hat{\beta}_j$ is the standardized effect of tightening macroprudential policy on domestic credit growth corresponding to result j in a particular research study.¹ MPM_j^B , MPM_j^H , and MPM_j^L are dummy variables that denote whether the macroprudential tightening analyzed involves broad-based, housing, or liquidity and other structural measures.² The coefficients on these dummy variables (θ) represent the average effect of each measure on credit. X_j is a set of control variables, which, in

The author of this box is Manasa Patnam.

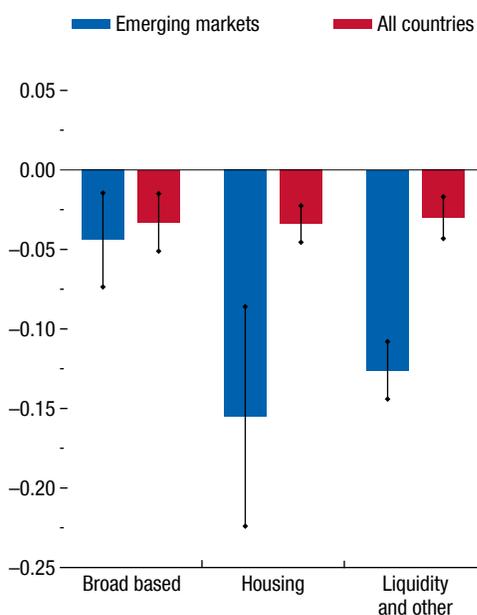
¹To ensure the comparability of results across studies, the selected coefficients on macroprudential policy impacts and their standard errors are standardized. In the sample of estimates, credit is typically measured as the nominal or real growth rate of bank credit to households and the private sector or total credit in the economy. Araujo and others (forthcoming) examines a broad range of effects in addition to those on credit, including effects on other outcome variables, effects of each individual tool, and effects at different time horizons.

²The regression specification equation (3.1.1) follows the predominant strand of the literature, which measures macroprudential policy in discrete changes taking the values of -1, 0, and 1 to indicate loosening, neutral, and tightening policy actions, respectively. The samples are restricted to estimated effects within a one-year horizon. The classification of tools into the categories (broad-based, housing, liquidity and other) is from IMF (2014). Equation (3.1.1) is estimated using a weighted-least-squares procedure with weights proportional to each estimate's precision because the specification is heteroscedastic to a degree determined by the estimate's standard error.

line with the standard practice in the meta-analysis literature, includes a publication bias correction based on the standard error of the estimate (Stanley and Doucouliagos 2012) and a dummy that identifies robust results within a study.

Figure 3.1.1 shows the average effects of macroprudential tightening on credit, differentiating between estimates based exclusively on emerging markets and those from mixed samples including low-income countries, emerging markets, and advanced economies. Overall, macroprudential policy tightening has

Figure 3.1.1. Average Effects of Macroprudential Tightening on Credit Growth (Percent)



Source: IMF staff estimates.

Note: The figure reports results from a metaregression in which the dependent variable is the standardized effect on credit. The reported point estimates (bar height) with 90 percent confidence intervals correspond to coefficients on dummy variables identifying the macroprudential measures analyzed. Standard errors are clustered by research study to account for possible dependence across results from the same study. The analysis also adjusts for study overweighting, since some studies report many more results than others. For more details on the specification and methodology, see Araujo and others (forthcoming).

Box 3.1 (continued)

statistically significant effects on credit, reducing it by 0.04 standard deviation, on average.³ The magnitude of these effects varies depending on the specific macroprudential measure and country sample. Housing and liquidity-based measures appear to have larger average effects in emerging markets, although with wider confidence bands, reflecting the substantial heterogeneity of individual estimates found in this setting.

Araujo and others (forthcoming) also documents that studies using microlevel data find stronger effects of macroprudential policies on credit than studies using aggregate data, which also holds true in the emerging markets context. This could be explained by

³A standardized effect of -0.04 corresponds to about a 0.6 percentage point reduction in year-over-year growth of real credit (measured at quarterly frequency), based on the average standard deviation of this variable (13 percent) in the sample.

the stronger identification power provided by microlevel data, or the existence of leakages that reduce the transmission of the microlevel effects of macroprudential policy on bank lending to aggregate credit.

Indeed, using the same meta-analysis framework, Araujo and others (forthcoming) finds that macroprudential tightening tends to be associated with leakages, mainly through increases in cross-border or non-bank lending. This association is consistent with the hypothesis that international banks or other unconstrained institutions may fulfill domestic lending needs when local banks become constrained (Reinhardt and Sowerbutts 2015; Ahnert, Forbes, Friedrich, and Reinhardt 2018). However, a few studies suggest that, even after possible leakages are factored in, macroprudential tightening still tends to constrain credit growth (for example, Aiyar, Calomiris, and Wieladek 2014; Ahnert, Forbes, Friedrich, and Reinhardt 2018).

Box 3.2. Do Emerging Markets Adjust Macroprudential Regulation in Response to Global Financial Shocks?

This box explores whether policymakers in emerging markets adjust macroprudential regulation in response to global financial shocks. The analysis is based on the following panel regression:

$$\Delta MPru_{i,t} = \alpha_i + \beta \cdot S_{i,t} + \gamma \cdot C_{i,t} + \varepsilon_{i,t}$$

in which $\Delta MPru_{i,t}$ is the number of macroprudential net tightening actions in a given quarter. The vector $S_{i,t}$ includes the three global financial shocks examined in the chapter: US monetary policy shocks, the Chicago Board Options Exchange Volatility Index (VIX), and net capital outflows, instrumented in line with the analysis in the chapter. The regression also includes country fixed effects, α_p , and several control variables, $C_{i,t}$, namely, expected inflation, the output gap, real credit growth, and commodity terms of trade, $TOT_{i,t}$, from Gruss and Kebhaj (2019).

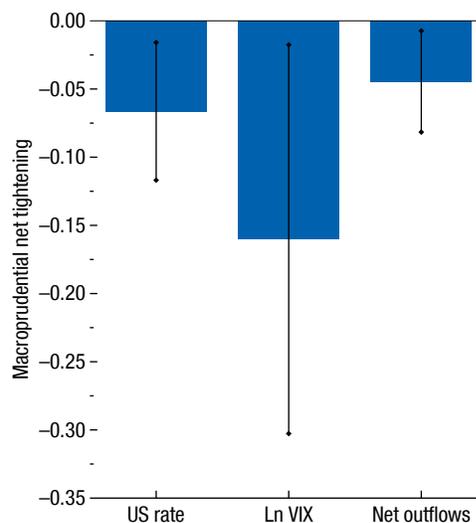
The regression results reveal that emerging markets do tend to adjust macroprudential regulation in response to external financial developments. Figure 3.2.1 shows that the regression coefficients on shocks to US monetary policy, the VIX, and net capital outflows are all negative and statistically significant. These results are robust to excluding macroprudential measures targeted at foreign currency exposures. Online Annex 3.5 reports the regression details.¹

Therefore, the analysis suggests that policymakers in emerging markets tend to loosen macroprudential policies when global financial conditions tighten, or conversely, they tend to tighten regulation when global financial conditions ease. A similar pattern is taking

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¹All annexes are available at <http://www.imf.org/en/Publications/WEO>.

Figure 3.2.1. Global Financial Shocks and Changes in Macroprudential Regulation



Source: IMF staff calculations.

Note: See Online Annex 3.1 for data sources and country coverage. The bars show the point estimates of the coefficients, and the vertical lines correspond to 90 percent confidence intervals computed with Driscoll-Kraay standard errors. VIX = Chicago Board Options Exchange Volatility Index.

place during the COVID-19 pandemic, with most emerging markets easing macroprudential regulation as global risk aversion spikes and capital flows recede. More research is needed to determine whether these responses are optimal and which other domestic and external factors should drive decisions to adjust macroprudential regulation.

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