35

THE INTERACTION AMONG FINANCIAL DEVELOPMENT, MACROPRUDENTIAL POLICY AND ECONOMIC GROWTH

A Cross-Country Perspective

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35.1 Introduction

In the wake of the 2007–2009 Global Financial Crisis, the question of safeguarding financial stability along with maintaining price stability has come to the forefront of academic research. Macroprudential policy is aimed at decreasing systemic risk in the financial sector, thereby stabilizing the situation in the face of an upcoming crisis. Advanced economies and emerging markets have intensified the use of macroprudential policy instruments since 2010, though the question of their effectiveness still remains largely open.

On the one hand, there is a strand of research that provides evidence for the pro-growth effect of macroprudential regulation. The mechanics of the stimulating effect on GDP is described as follows: macroprudential regulation contributes to financial stability in the long run; in its turn, a well-functioning financial sector being effective in transforming savings into investments positively impacts the country's GDP growth. On the other hand, macroprudential regulation as any kind of prudential regulation is associated with curbing financial depth and constraining innovations. This hampers financial development (FD) and potentially can slow down economic growth.

Thus, the impact of macroprudential regulation on GDP is linked to a country's FD. According to the IMF, there are different dimensions of the country's FD: financial depth, access and efficiency. Based on the literature, we conjecture that macroprudential policy first and foremost decreases the depth component, while increasing stability.

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This chapter aims to study lead–lag relationships in the following tangle of variables: GDP growth (GDP), FD and macroprudential regulation (IMAPP) for a sample of 126 countries. To conduct this research, we build a Bayesian panel vector autoregression (VAR) (BPVAR) model. Then, we extend the baseline methodology by introducing different components of FD instead of the aggregate index and also split macroprudential policy index into two sub-indices, thereby capturing measures targeted at borrowers and financial institutions.

Our results provide evidence for the bidirectional linkages between macroprudential policy and FD, mainly its components capturing depth and access to finance. We find that an increase in financial depth or access leads to tougher macroprudential restrictions. Meanwhile, stricter macroprudential policy leads to a decrease of depth and access components.

However, the results for advanced economies, emerging markets and low-income countries exhibit certain differences. In advanced economies, there is no evidence of macroprudential policy affecting FD, though there is a direct linkage from macroprudential policy to GDP growth. In low-income countries, the only relationship identified runs from FD to macroprudential policy. For the group of emerging markets, the results are the same as for the whole sample.

Our study contributes to the literature in two ways. First, we identify the linkage between macroprudential policy and growth conditional not only on the overall level of a country's FD but also on its components of depth, access and efficiency. Second, we examine the difference in the relationship between growth and macroprudential sub-indices. Thus, our study provides a more granular view on how growth, macroprudential policy and FD interact and could help policymakers develop more targeted measures to manage financial and business cycles.

This chapter proceeds as follows: in Section 35.3, we describe the data, while Section 35.4 covers the methodology used. We discuss the results in Section 35.5 and provide robustness checks in Section 35.6. Section 35.8 concludes.

35.2 Literature review

Before exploring the relationship among FD, economic growth and macroprudential policy, we review the literature on bivariate linkages between these variables.

35.2.1 Financial development and economic growth

Does FD contribute to a country's economic growth? Historically, we can identify four streams of thought in the literature related to the question.

The first one is represented by research that dates back to the 1980s (Lucas and Robert, 1988). It argues that the role of finance as a determinant of growth is very much exaggerated. The second group of theories supports the idea that FD is an important driver of economic development (Bagehot, 1873; Schumpeter, 1911; Bencivenga and Smith,1991; King and Levine, 1993; Levine et al., 2000; Calderon and Liu, 2003). The positive impact on growth is related to a more efficient resource allocation, reduction of agency costs, better risk-sharing and enhanced conditions for innovations facilitated by the financial system. The third strand of research promotes the idea that FD simply follows economic development (Robinson, erest and Other Essays. London: Macmillan."1952). Finally, there are theories that emphasize the risks stemming from FD, i.e. the possibility of financial crises and resource misallocation in favor of the fast-developing financial sector (Kindleberger, 1978; Andersen and Tarp, 2003; Allen and Carletti, 2006; Philippon, 2010).

Thus, we can identify two channels through which financial sector affects economic activity. The positive effect comes from intermediary functions performed by the financial sector: decrease in transaction costs, better capital and risk allocation and, as a result, increased investment. The negative effect arises from competition between the financial sector and other industries for capital and labor, which leads to an unbalanced growth and higher odds of financial crises.

Recent empirical findings support the view that there is an optimal level of FD. There is a consensus that the relationship is mainly nonlinear and time-varying and takes on the form of an inverted U-shape curve (time-varying relationship is described in Loayza and Ranciere, 2006; Rousseau and Wachtel, 2011; Beck et al., 2014; nonlinear dependence[1] – Deidda and Fattouh, 2002; Cecchetti and Kharroubi, 2012, Manganelli and Popov, 2013). Thus, at low levels of FD, increased finance is good for growth. But at some point, a larger financial system starts to hamper economic development. The challenge is to identify a country-specific threshold after which the financial system becomes excessively complex, less efficient, and starts to undermine growth in the non-financial sector.

35.2.2 Financial development and macroprudential policy

In contrast to the research on finance–growth nexus, there are a limited number of studies examining the relationship between a country's level of FD and the effectiveness of macroprudential policies. Researchers mainly focus on the impact of macroprudential measures on growth, while FD itself serves as a control variable.

Lim et al. (2011) were the first to highlight the importance of FD for the choice of macroprudential policy instruments.

Başkaya (2016) wrote about the difference in the effectiveness of price-based and quantity-based macroprudential tools, taking into account the level of a country's FD. While the quantity-based tools are effective irrespective of the level of FD, the price-based tools turn out to be successful only in terms of advanced economies that have deeper financial systems. Thus, in an economy where the financial sector is less developed, borrowers are insensitive to changes in loan interest rates, because the availability of loanable funds matters more in this economy than their price. Naceur et al. (2019) confirm this evidence.

Most of the macroprudential tools target the banking sector. There is scarce evidence that instruments are efficient in a bank-based or market-based financial system. Still, Neuberger and Rissi (2012) show that market-based financial systems benefit more not from capital or liquidity regulations (strictly speaking, the main instruments of macroprudential policy), but from a ban on proprietary trading (Volcker rule). Given the shift from bank loans to a more active use of market-based finance around the globe, it seems that the broad set of conventional macroprudential instruments may be soon limited, while policymakers will have to develop new tools capturing risks beyond the banking sector.

Agénor et al. (2018) analyze the relationship among prudential regulation, FD, financial openness and economic growth and conclude that regulation can contribute to growth only if it is aimed at promoting FD.

Bernier and Plouffe (2019) examine financial innovation–economic growth nexus and test how macroprudential policy can affect this relationship. The research provides evidence of the positive linkage between innovations and gross capital formation, while macroprudential policy is found to have little impact on the former.

Thus, different studies concur that the effectiveness of macroprudential tools depends on the level of FD. In our study, we also assume that the relationship may equally run in the opposite direction, i.e. the level of FD (in particular, the indicators of depth and access) depends on how restrictive macroprudential policy is.

35.2.3 Economic growth and macroprudential policy

The relationship between macroprudential policy and GDP growth is still an open question in the literature.

On the one hand, macroprudential policy can bring benefits for the economy. The main advantage stems from the reduction of systemic risk and a lower probability of financial crises. On the other hand, macroprudential restrictions can increase the costs of intermediation and curb credit supply, eventually hindering economic growth. The adverse impact of macroprudential policy is translated into the real activity through the decline in financial depth and inclusion.

The empirical literature partially supports both parties of the debate.

Boar et al. (2017) document a positive impact of macroprudential policy on growth. They find that the countries that are more active in applying macroprudential measures experience higher GDP per capita growth rates and reduced economic volatility. Still, these effects are sensitive to a country's financial openness and its level of FD.

Behn et al. (2016) emphasize the importance of banks' reaction to introduced macroprudential measures. They study the effect of additional capital requirements on GDP growth and conclude that if the requirements are met through raising equity, it will not hinder economic growth. Andries and Melnic (2019) show that the type of macroprudential measures used also matters: instruments which target financial institutions have greater impact on real economic activity than borrower-based measures. Moreover, macroprudential policy tends to be less effective in contributing to economic growth in the countries that are very financially open or financially developed.

Kawata et al. (2013) build a theoretical model, showing that macroprudential instruments can negatively impact growth in normal times, but this effect is rather small. The increase in growth due to a lower likelihood of financial crises is higher, so that macroprudential policy in the end creates net benefits for the economy.

In contrast, Sanchez and Rohn (2016) conclude that the use of additional macroprudential instruments is associated with a reduction in the quarterly GDP growth by 0.1% points. Slovik and Cournede (2011) demonstrate that if capital requirements are met through rising lending spreads, GDP growth will decline in the range between −0.05 and −0.15% per annum. The results are confirmed by Angelini et al. (2015).

To sum up, the effect of macroprudential policy on the real economy is ambiguous. The result is conditional on the type of macroprudential instruments used and such structural characteristics of the economy as the level of FD and openness.

Taking all the evidence into account, we propose the following scheme (Figure 35.1) capturing possible relationship among economic growth, FD and macroprudential policy.

35.3 Data

We use three variables in our empirical analysis: FD index from the IMF database by Svirydzenka (2016), GDP growth rate (GDP) borrowed from the World Development Indicators and the macroprudential policy index (IMAPP) coming from Alam et al. (2019). Descriptive statistics of the data are presented in Table 35.1.

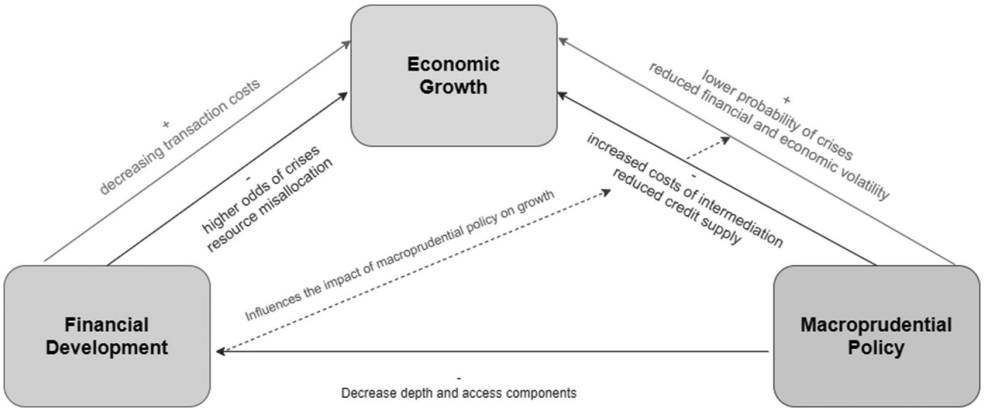

Figure 35.1 Theoretical relationships among economic growth, financial development and macroprudential policy.

Table 35.1 Descriptive statistics

Variable	*Variable definition*	*Obs*	*Mean*	*Std. Dev.*	*Min*	*Max*
GDP	GDP growth rate	3402	3.47	5.09	−44.90	88.96
IMAPP	Macroprudential policy index	3402	0.21	1.03	−9.00	13.00
IMAPP_BOR	Macroprudential policy sub-index responsible for borrow-targeted measures	3402	0.04	0.30	−2.00	4.00
IMAPP_FI	Macroprudential policy sub-index encompassing the instruments targeted at financial institutions	3402	0.18	0.92	−8.00	12.00
FD	Financial development index	3402	0.33	0.23	0.00	1.00
FI	Index of financial institutions' sub-index	3402	0.42	0.23	0.00	1.00
FM	Index of financial markets' sub-index	3402	0.24	0.25	0.00	1.00
FID	Financial institutions' depth index	3402	0.24	0.25	0.00	1.00
FIA	Financial institutions' access index	3402	0.34	0.29	0.00	1.00
FIE	Financial institutions' efficiency index	3402	0.62	0.19	0.00	0.94
FMD	Financial markets' depth index	3402	0.23	0.27	0.00	1.00
FMA	Financial markets' access index	3402	0.24	0.28	0.00	1.00
FME	Financial markets' efficiency index	3402	0.25	0.33	0.00	1.00

Furthermore, to investigate how different components of FD, namely financial depth, access to finance, the efficiency of financial intermediaries, are linked to economic growth, we consider the FD index alongside its sub-indices. The data on individual components of FD is also taken from the IMF database. Besides, we split the macroprudential policy index into two parts: the sub-index responsible for borrower-targeted macroprudential instruments (captures the changes in Loan-to-Value (LTV) and Debt Service-to-Income (DSTI) ratios together in a particular country) and the second sub-index encompassing the instruments targeted at financial institutions. The latter summarizes the dynamics of the remaining 15 macroprudential instruments represented in the database by Alam et el. (2019).

35.4 Methodology

Our methodology consists in specifying a BPVAR model and then validating the results we get from its impulse-responses by running the Dumitrescu-Hurlin panel causality test.

Bayesian panel vector autoregression' models allow considering the interaction between different variables as conventional VARs do, but they also impose a cross-sub-sectional structure on the model. The approach owes to Canova and Ciccarelli (2013).

A standard panel VAR model describes the evolution of γ_{it} – the vector of G dependent variables for each country $i \in (1, \ldots, N)$ at time $t = 1, 2, \ldots, T$ with p lags.

The unrestricted PVAR is defined as:

$$Y_t = AY_{t-1} + u_t, \tag{35.1}$$

where $Y_t = (\gamma'_{1t}, \ldots, \gamma'_{Nt})'$ is a $NG \times 1$ vector of endogenous variables,

$u_t \sim (0, \Sigma)$ with Σ a full $NG \times NG$ matrix. It is assumed that $cov(u_{it}, u_{jt}) = \Sigma_{ij} \neq 0$, where Σ_{ij} denotes the covariance matrix between the errors of country i and country j.

The unrestricted panel VARs very often suffer from computational problems due to a large number of parameters that should be estimated ($p*(NG^2)$ autoregression coefficients and $NG*(NG+1)/2$ parameters in the error covariance matrix). Koop and Korobilis (2016) describe three possible categories of restrictions that can be imposed on the unrestricted panel VAR:

- $N(N-1)$ dynamic interdependencies that occur when the dynamics of one country's variables affect another country's lagged variables, i.e. $A_{i,j} \neq 0$ for $i, j = 1, 2, \ldots, N$; $i \neq j$.
- $N(N-1)/2$ static interdependencies, i.e. the innovations $u_{t,i}$ can be correlated across units, i.e. $\Sigma_{i,j} \neq 0$ for $i, j = 1, 2, \ldots, N$; $i \neq j$.
- cross-unit (sub-sectional) heterogeneity – the two countries have VARs with different coefficients, i.e. $A_{ii} \neq A_{jj}$ for $i, j = 1, 2, \ldots, N$; $i \neq j$.

In this chapter, we employ an unrestricted panel VAR and rely on a Bayesian inference to deal with the "curse of dimensionality": for a limited number of observations, we have to estimate a large number of coefficients. Thus, we need to specify the priors on the parameter space. We opt for a standard normal-Wishart prior with default hyperparameter values.[2] This prior assumes that the model parameters (both panel VAR coefficients and the residual covariance matrix) are unknown, and in this respect, it is superior to the Minnesota (Litterman) prior, which assumes that the residual covariance matrix is known. As the objective of our empirical exercise is to infer average dynamic responses to the shocks of interest, we use a pooled

estimator, which is a Bayesian counterpart of the mean-group estimator for a simple panel regression and implies that the coefficients are homogeneous across countries.

35.5 Results

Based on the impulse-response functions derived from the Bayesian VAR (Figure 35.2) built for the sample of 126 countries, we observe that in general increased FD (and its sub-indices reflecting financial market depth and financial market access components – FMD and FMA) leads to tougher macroprudential restrictions (higher value of the IMAPP index) and decreases GDP growth, which is in line with Ductor and Grechyna (2015) as well as Loayza and Ranciere (2006). This holds for both measures of macroprudential policy: targeted at financial institutions and at borrowers.[3] In terms of FD sub-indices, we not only find similar links for financial markets' depth and access components but also observe the inverse linkage running from the IMAPP index to the FMD and FMA, testifying to the effectiveness of macroprudential policy.

We also consider whether there are any nuances in our results for different country sub-groups: advanced economies, emerging markets and low-income countries. The sub-groups are compiled based on the IMF country classification.

First, for the group of advanced countries, the baseline relationship – higher FD (and its depth and access components measured both for financial institutions and markets) leading to a stricter macroprudential regulation – still holds. However, we do not observe the inverse linkage running from macroprudential policy to FD sub-indices as for the whole sample. At the same time, the IMAPP index directly contributes to GDP growth, which accords with the results derived by Boar et al. (2017), Stolbov et al. (2021) and Bonciani et al. (2021). Thus, we conclude that macroprudential measures in advanced economies impact the business cycle in the first place leaving financial indicators mainly unaffected (Table 35.2). This relationship pattern is true for the aggregate IMAPP index and for the IMAPP sub-index targeted at

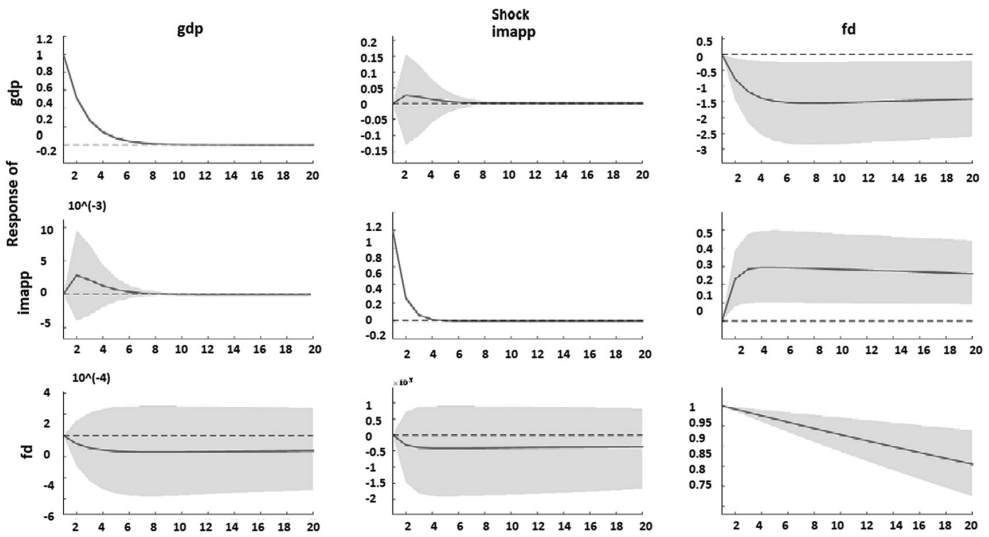

Figure 35.2 Impulse responses from Bayesian panel VAR with three variables: GDP growth, the financial development index and the IMAPP index.

Table 35.2 Linkages among GDP, IMAPP and FD and their sub-indices in a Bayesian panel VAR for advanced countries

Aggregate IMAPP index	*IMAPP_FI*	*IMAPP_BORROWER*
↑ IMAPP →↑ GDP	↑ IMAPP _ *FI* →↑ GDP	↑ FIA →↓ GDP
↑ FD →↑ IMAPP	↑ FD →↑ IMAPP _ FI	↑ GDP →↑ FIA
↑ FID →↑ IMAPP	↑ FID →↑ IMAPP _ FI	↑ GDP →↑ FIE
↑ FIA →↓ GDP	↑ FIA →↓ GDP	↑ FME →↓ GDP
↑ GDP →↑ FIA	↑ FM →↑ IMAPP _ FI	
↑ GDP →↑ FIE	↑ FMD →↑ IMAPP _ FI	
↑ FM →↑ IMAPP	↑ FMA →↑ IMAPP _ FI	
↑ FMD →↑ IMAPP	↑ FME →↓ GDP	
↑ FMA →↑ IMAPP		

financial institutions, while the IMAPP capturing borrower-based measures appears neutral to GDP and FD, as no linkages between them are found.

As for the emerging markets, the results are analogous to those for the whole sample (Table 35.3): we observe the linkages running from the FD index to the IMAPP index and from the IMAPP index to FMD and FMA sub-indices. However, we do not find evidence of the IMAPP directly impacting GDP growth in contrast to the group of advanced countries. Thus, we conclude that macroprudential policy in emerging markets turns out to be more targeted, impacting the financial sector without transmitting its influence on the real economy. We also note that the number of linkages in the group of emerging markets is biased toward the IMAPP sub-index comprising measures targeted at financial institutions. Thus, our analysis indicates that in both groups of countries measures impacting institutions turn out to be more effective than borrower-based instruments, which is corroborated by Andries and Melnic (2019).

Table 35.3 Linkages among GDP, IMAPP and FD and their sub-indices in a Bayesian panel VAR for emerging markets

Aggregate IMAPP index	*IMAPP_FI*	*IMAPP_BORROWER*
↑ FD →↑ IMAPP	↑ *FD* →↑ IMAPP _ *FI*	↑ GDP →↑ *FD*
↑ GDP →↑ *FD*	↑ GDP →↑ *FD*	↑ GDP →↑ FID
↑ FID →↑ IMAPP	↑ GDP →↑ *FID*	↑ FIA →↓ *GDP*
↑ GDP →↓ *FID*	↑ FIA →↓ GDP	↑ FIE →↑ GDP
↑ FIA →↓ *GDP*	↑ IMAPP _ FI →↑ *FIA*	↑ GDP →↑ *FM*
↑ IMAPP →↑ FIA	↑ FIE →↑ *GDP*	↑ IMAPP _ BOR →↓ *FM*
↑ FIE →↑ *GDP*	↑ GDP →↑ *FM*	↑ FMD →↑ GDP
↑ GDP →↑ *FM*	↑ FMD →↑ GDP	↑ GDP →↑ *FMA*
↑ GDP →↑ *FMD*	↑ FMD →↑ IMAPP _ FI	↑ FME →↑ IMAPP _ BOR
↑ IMAPP →↓ *FMD*	↑ IMAPP _ FI →↓ *FMD*	↑ GDP →↑ *FME*
↑ GDP →↑ *FMA*	↑ GDP →↑ *FMA*	
↑ IMAPP →↓ *FMA*	↑ IMAPP _ FI →↓ *FMA*	
↑ GDP →↑ *FME*	↑ GDP →↑ *FME*	

Table 35.4 Linkages among GDP, IMAPP and FD and their sub-indices in a Bayesian panel VAR for low-income countries

Aggregate IMAPP index	*IMAPP_FI*	*IMAPP_BORROWER*
↑ IMAPP →↑ FIA	↑ IMAPP _ *FI* →↑ *FIA*	↑ FD →↑ *IMAPP _ BOR*
↑ FIE →↑ *GDP*	↑ FIE →↑ GDP	↑ FI →↑ *IMAPP _ BOR*
↑ FM →↑ IMAPP		↑ FID →↑ *IMAPP _ BOR*
		↑ FIA →↑ *IMAPP _ BOR*
		↑ FIE →↑ *GDP*
		↑ FM →↑ *IMAPP _ BOR*
		↑ FMD →↑ *IMAPP _ BOR*
		↑ FMA →↑ *IMAPP _ BOR*
		↑ FME →↑ *IMAPP _ BOR*

Finally, in low-income countries, the largest number of relationships is associated with borrower-based macroprudential instruments (Table 35.4). Therefore, higher values of the FD index, together with the markets and institutions sub-indices, lead to a more tightened borrower-based macroprudential measures. The inverse relationship is not found.

To sum it up, our main finding boils down to the fact that macroprudential policy in all country group accounts for the level of a country's FD, especially those indicators that capture financial depth and access to finance. In advanced countries, macroprudential policy exerts a direct impact on GDP growth, while in emerging markets, it primarily influences financial sector. There is no evidence of the effect of macroprudential regulation either on the financial sector or the real economy in low-income countries.

35.6 Robustness checks

We apply the Dumitrescu-Hurlin panel causality test with individual coefficients to check the robustness of our results. Under the null hypothesis in this test, we assume that there is no causal relationship for any of the units of the panel. The alternative hypothesis is that there is a causality relationship from *X* to *Y* for at least one cross-sectional unit. The results are provided in Table 35.5 for the whole sample.

Table 35.5 Dumitrescu-Hurlin panel causality test results

Null hypothesis	*W-Stat.*	*Zbar-Stat.*	*Prob.*
IMAPP does not homogeneously cause FD	**1.45**	**−3.48**	**0.00**
FD does not homogeneously cause IMAPP	2.54	1.43	0.15
GDP does not homogeneously cause FD	**3.02**	**3.62**	**0.00**
FD does not homogeneously cause GDP	**4.05**	**8.25**	**0.00**
GDP does not homogeneously cause IMAPP	2.15	−0.32	0.75
IMAPP does not homogeneously cause GDP	2.39	0.75	0.45

If the p-value is less than 0.05, we reject the Null hypothesis and consider the alternative hypothesis to be true. In the table we indicate in bold the cases, where we reject the Null hypothesis and, thus, accept the statement about one variable granger causing another one.

The test statistics indicate that the IMAPP index granger causes the FD index and there is a bidirectional relationship between GDP growth and FD. Qualitatively, this supports the results based on the BPVAR.

35.7 Policy implications

Our findings have some implications for policymakers.

First, we conclude that the effect of macroprudential policy on growth is conditional on how developed the financial sector is. Thus, when discussing the implementation of new policy measures and their effects on growth, policymakers should take into account the country's level of FD. In advanced countries with well-developed financial markets, the effect of macroprudential policy on economic growth will be direct and presumably faster. In emerging markets, where the relationship between the three variables is more consistent with the theory, i.e. macroprudential policy affects in the first place financial system and then contributes to economic growth, the effect of newly introduced restrictions will manifest itself with some lag. In low-income countries, macroprudential policy, based on the findings, will not affect growth at all.

Second, for the whole sample of countries, we find that higher FD is associated with lower GDP growth. We hypothesize that this result can be impacted by the composition of our sample: there are a sufficiently large number of advanced economies, which may have already passed the threshold after which further FD is regarded as the increase in system's complexity and has a negative effect on real activity. In terms of sub-indices, this effect is due to the increase in depth and access components. For the country groups, there are some differences. In advanced economies, the decrease in GDP comes from the shock of access to services provided by financial institutions, in the emerging markets – also from the Financial Institutions Access (FIA) sub-index. But at the same time in the emerging markets, an increase in financial depth contributes to GDP growth. This calls for special macroprudential measures in emerging markets, which constrain access from less reliable borrowers to financial institutions, while keeping depth indicators unaffected.

Finally, we find that in advanced and emerging market economies the largest number of linkages comprises the IMAPP sub-index targeted at financial institutions, while in the low-income countries – the sub-index capturing borrow-based measures. This suggests that in rich and middle-income countries policymakers should rely more on instruments impacting excess loan supply, while in low-income countries, measures curbing excess demand will be more effective in curtailing an unbalanced credit growth.

35.8 Conclusions

Our research deals with the linkages between three variables capturing the stance of macroprudential policy, FD and economic growth. By estimating BPVAR for a panel of 126 countries, we demonstrate that tighter macroprudential policy on average is observed in the countries with higher levels of FD. In its turn, a more restrictive policy leads to the decrease in financial depth and inclusion indicators, whose increased levels are usually associated with credit and asset price bubbles.

We find certain differences in the results for country sub-groups. In case of advanced countries, we additionally observe that macroprudential policy tightening contributes to economic growth, presumably through a more stable and efficient financial system in the long run. In emerging markets, there is no impact of macroprudential policy on real activity. In both sub-groups, the number of statistically significant linkages between the variables is biased toward macroprudential policy sub-indices targeting financial institutions. Finally, there are very few significant relationships found for low-income countries.

Notes

1 Nonlinear dependence is a term used in statistics to describe the relationship between the variables when there is no direct correlation between them; in other words, the change in the independent variable does not provide an obvious corresponding change in the dependent variable. A linear relationship, when plotted on the graph, represents a straight line, while nonlinear relationship is characterized by a curvy line.
2 We estimate the Bayesian panel VAR using the BEAR-toolbox devised by Alistair Dieppe and Bjorn van Roye (2016) for MATLAB. The standard hyperparameter values used by default for the normal Wishart prior are as follows: autoregressive coefficient equal to 0.8; overall tightness equal to 0.1; cross-variable weighting – 0.5; lag decay – 1.
3 For brevity, we do not present all the impulse-response plots. Additional plots for the financial development and the IMAPP sub-indices can be provided upon request.

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