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Research Article

Are Macroprudential Policies Effective Tools to Reduce Credit Growth in Emerging Markets?

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Macroprudential policies (MPPs) were relatively less used around the world before the 2008 global financial crisis (GFC). In the aftermath of the GFC, they have become popular both in advanced and emerging market countries. Through time, the accumulation of new data across countries has led to a growing body of literature investigating the effectiveness of such policies. In this paper, using a data set of 30 developing and emerging market countries and panel VAR approach with GMM estimation, we contribute to this literature, first, by testing whether MPPs are effective in controlling domestic credit growth after a global liquidity shock. Second, we test whether MPPs are more effective when a combination of MPPs are used to control credit growth. Results indicate that MPPs are effective tools to limit domestic credit growth, especially during the expansion phase of the credit cycle. Second, the number of MPP tools does matter to manage the magnitude and duration of the domestic credit growth effectively. We argue that the insufficient number of MPP implementations is unable to prevent leakages in the system and reduce the effectiveness of MPPs under a global liquidity shock.

JEL codes: E43, E58, G18, G28

Keywords: Macroprudential policies, Credit growth, Global liquidity, Credit cycle, Panel VAR

1 Introduction

Macroprudential policies (MPPs) have long been known as a policy instrument to mitigate the adverse effects of domestic and global shocks.[1] The main motivation of policymakers has been either to create a safety net for financial intermediaries to increase their resilience during downturns or to support financial stability during significant asset price corrections.

After the 2008 global financial crisis (GFC), quantitative easing policies of advanced country central banks helped to ease external financial conditions for emerging markets and developing countries. Large capital inflows have created internal and external imbalances in those countries through lower interest rates and the appreciation of the domestic currency.

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[1] For a detailed history of the term macroprudential, see Clement (2010).

One of the responses of these countries to limit these imbalances is to employ various kinds of MPP tools. Evidently, the average number of MPPs implemented in emerging market and developing economies was less than 2.5 in 2007 but reached 3.5 in 2014 (Cerutti et al., 2017).

Following the rising popularity of MPPs, a growing body of literature has emerged in investigating the costs and benefits of such policies. While a strand of literature uses theoretical models like general equilibrium models, others use various empirical methodologies.

Galati & Moessner (2018) divides theory-based models into three groups: Banking and finance models, dynamic stochastic general equilibrium (DGSE) models and infinite horizon general equilibrium macro models. Among the theoretical modeling attempts, Brunnermeier & Sannikov (2014) has added financial frictions into a standard macroeconomic model. In their model, the risk is endogenous, and the system is more prone to systemic volatility spikes due to leverage build-ups in tranquil times. They show that exogenous risk is better shared by agents when there are securitization and derivative contracts, yet they lead to higher endogenous systemic risk. Ünsal (2013) uses an open economy DSGE model to investigate the effectiveness of MPPs to mitigate the adverse effects of capital inflows and shows that MPPs fully complement monetary policy when dealing with the adverse effects of capital inflows. In addition, the author argues that shock specific flexibility is needed in MPP implementation since MPP tools are not perfect substitutes for each other. Hence, their effectiveness could be different under different shocks. Perotti & Suarez (2011) analyzes the effectiveness of price-based and quantity-based MPPs in banks' short term funding. They show that depending on the heterogeneity across banks, stable funding ratio or liquidity coverage ratio is optimal as a complement to Pigouvian tax to reduce short term funding of banks. Bianchi & Mendoza (2010), Chari & Kehoe (2016), Gertler et al. (2012), and Gertler & Kiyotaki (2015) use models assuming that individual borrowers do not take into account the vulnerability of the whole system when deciding their leverage. In other words, they could borrow more than the social optimum. In this way, they show that MPPs on capital requirements are necessary to offset the distortionary effects of over-borrowing. All in all, theoretical models first, have helped us to understand the dynamics that led to building up of risks and second, have shown that MPPs could be used effectively to limit the build-up of risks during tranquil times. In addition, models show that when risks are realized MPPs can mitigate the adverse effects of financial shocks.

On the empirical side, there are two major difficulties in the estimation of the effects of MPPs on other variables. The first one is that there is no complete theoretical model to connect MPPs, the financial sector and the real economy to follow during empirical estimation. The second one is an endogeneity problem. Almost all empirical papers address such issues and try to overcome these difficulties as much as possible. The most common empirical methodologies used are cross-country panel regression analysis with different estimation techniques, microdata analysis and event studies. Bruno et al. (2017) analyzes the effectiveness of MPPs to manage capital flows for 12 Asia-Pacific countries. They find that MPP tools can be used successfully to reduce cross-border banking sector and bond market flows. In addition, they show that the effects of such policies are more powerful when they complement monetary policy in the same direction. For 13 Asian and 33 other economies Zhang & Zoli (2016) finds that MPP measures help to curb housing price growth, equity flows, aggregate credit growth and bank leverage. Kuttner & Shim (2016) shows that tightening debt to income ratio limits reduces housing credit by around 4 to 7 percent, while

tightening loan to value ratio limits reduces housing credit by around 1 percent. Crowe et al. (2013) finds that loan to value ratio limit prevents the build-up of financial imbalances. As an example of microdata analysis, Claessens et al. (2013) uses bank-level data from 2800 banks across 48 countries to analyze if MPPs can help to reduce the build-up of banking sector vulnerabilities. As microdata analysis is less prone to endogeneity problem, whether the results of Claessens et al. (2013) support results of cross-country panel regression results is rather important. They find that MPP measures reduce growth in bank leverage, assets and non-core/core liabilities ratio during boom times and that their effectiveness strengthens with the cycle. Using a novel and unique data set covering 119 countries, Cerutti et al. (2017) shows that MPPs are correlated with lower credit growth, especially in emerging market economies.

One of the possible consequences of MPPs is the substitution of activities, subject to new MPP measures, to areas not subject to MPP measures and this substitution is called "leakage" in the literature. In fact, Goodhart & Hofmann (2008) and Aiyar et al. (2014) mention that MPPs may lead to shifting activities to foreign entities and shifting risks to non-bank entities (shadow banking). Cizel et al. (2019) finds that MPP implementations reduce the credit growth of the banking sector substantially higher than the total credit growth. Their result implies that there is a substitution from bank-based financial intermediation to non-bank intermediation. Reinhardt & Sowerbutts (2015) states that the effectiveness of MPP tools depends on the availability of regulatory arbitrage, and MPP measures on domestic banks' capital increase foreign borrowings. Similarly, Cerutti et al. (2017) shows that cross-border activities of domestic banks increase after MPP measures taken.

De Nicolo et al. (2012), Kim (2014), Galati & Moessner (2018) argue that each MPPs has pros and cons; therefore, they should be used as a complement to each other to be more effective. Korean experience is a good example of the successful implementation of a sufficient combination of MPPs to curb credit growth and enhance financial stability (Kim, 2014). Korea has started to implement MPPs to tackle procyclicality of household and corporate lending and control credit growth. Korean authorities had imposed "Loan to Value (LTV)" cap in 2002 to control house price boom and curb bank lending. However, it had been realized that this policy had limitations to control credit growth. During boom periods, the collateral value of real estates rises as house prices increase and hence, borrowers could borrow more. As a complement to LTV cap, the authorities had imposed a cap to debt to income ratio. However, this policy had also limited effect on loan growth, and the response of banks to DTI cap had increased funding liquidity risk in the financial system. The reason is that, as a response to DTI cap, banks had extended the maturity of loans to meet the demand for loans, although their funding maturity has stayed constant. Finally, in December 2009, the authorities had imposed a cap to loan to deposit ratio in order to control loan growth and limit interconnectedness, caused by heavy reliance on wholesale funding for expanding asset size, among financial institutions. According to Kim (2014), each MPP measure has contributed to financial stability to a certain degree; hence, they should be considered as complements to each other.

Galati & Moessner (2018) reviews the recent literature on MPPs and argues that cross-country panel studies, estimated with the general method of moments (GMM) and controlled for local and global factors, are the most promising approach to set up a model and limit the endogeneity problem when measuring the effects of MPPs. Therefore, we use a fixed effects dynamic panel and panel VAR approach with GMM estimation to investigate the

effectiveness of MPPs on credit growth in case of a positive global liquidity shock. While fixed effect and dynamic panel approaches provide evidence on how MPPs affect credit growth on average, panel VAR approach with GMM estimation enables us to see the response of credit growth to MPP shocks through time. From the policymakers point of view, not only the magnitude of the response but its persistence is also important. In addition, having considered the leakage literature, we test whether the number of MPPs in effect changes the degree of the effectiveness of MPPs to reduce credit growth. Therefore, the novelty of this paper is to split the sample according to the number of MPPs in effect at a given time to test whether the degree of effectiveness of MPPs depends on the variety of MPPs implemented.

Consistent with the literature, fixed effects panel regression results show that when the state of the credit cycle is taken into account, MPPs are effective tools to curb the domestic credit growth. Panel VAR results are supporting this result by showing that MPPs reduce credit growth significantly when the credit cycle is in an expansionary phase. Impulse-response results show that countries employing a higher number of MPPs observe lower credit growth rates on average compared with countries implementing a lower number of MPPs. In addition, the persistence of credit growth is lower in countries where the number of MPPs implemented is high. As a result, we argue that the number of MPPs implemented does matter to control credit growth against global liquidity shocks; hence, complementarity argument about the MPPs is valid. As a robustness check, we try various domestic and global factors as control variables and different liquidity measures; however, results do not change.

The rest of the paper is organized as follows. Section 2 presents the data and the methodology. Section 3 summarizes the results and Section 4 provides robustness check analysis. Section 5 concludes.

2 Data and Methodology

2.1 Data

We analyze the impact of global liquidity and the role of MPPs on credit growth using a sample covering annual data for 30 countries from 2000 to 2013, as depicted in Figure 1 and the country list is shown in Appendix B. We do not include advanced countries in the sample due to the fact that global liquidity stems mostly from these countries and the identifying assumption on the exogeneity of external shocks, in this case, the global liquidity, may not hold for advanced economies. Since the time span of the data set is relatively short, we try to include every country where MPPs are in effect in order to keep our sample size relatively large. We excluded countries in which there is no continuous credit or financial flow data. The definitions of variables used in the regression analyses are as follows.

- ***Global Liquidity:*** Bank for International Settlements (BIS) defines global liquidity as the ease of funding in global financial markets (CGFS, 2011). Similar to the BIS, Bruno & Shin (2015) and Domanski et al. (2011) define global liquidity as the availability of ample and low-cost funding, whereas Cerutti et al. (2017) states that global liquidity is a set of global factors associated with worldwide financial conditions. Therefore, to capture both worldwide and domestic financial conditions, total claims and international cross-border claims of both banks and non-banks for

each country are used as a global liquidity indicator in this study.

- ***Macroprudential Policies:*** We use the database of IMF's Global Macroprudential Policy Instruments constructed by IMF (2014) and Cerutti et al. (2017). The database is very detailed and covers several instruments: General Countercyclical Capital Buffer/Requirement (CTC); Leverage Ratio for banks (LEV); Time-Varying/Dynamic Loan-Loss Provisioning (DP); Loan-to-Value Ratio (LTV); Debt-to-Income Ratio (DTI); Limits on Domestic Currency Loans (CG); Limits on Foreign Currency Loans (FC); Reserve Requirement Ratios (RR); and Levy/Tax on Financial Institutions (TAX); Capital Surcharges on SIFIs (SIFI); Limits on Interbank Exposures (INTER); and Concentration Limits (CONC). Those measures and subset measures such as LTV_CAP have been aggregated into the following two categories: those aimed at borrowers' leverage and financial positions (LTV_CAP and DTI ratios); and those aimed at financial institutions' assets or liabilities (DP, CTC, LEV, SIFI, INTER, CONC, FC, RR_REV, CG, and TAX). To consider the possible complementarity of, or substitution between, using the two borrower-oriented measures authors also created a borrower union index, which takes the value of 1 if LTV_CAP or DTI is used and 0 otherwise. Similarly, a borrower intersection index takes the value of 1 if LTV_CAP and DTI are used and 0 otherwise. Then, an overall macroprudential index (MPI), which is just the simple sum of the scores on all 12 policies has been created. Instruments are each coded for the period they were actually in place, i.e., from the date that they were introduced until the day that they were discontinued. MPI works as a simple binary measure of whether or not the instruments were in place.
- ***Credit Growth:*** Credit growth is defined as the year-on-year percentage change in the domestic credit to the private sector. Credit data are collected from the World Bank's World Development Indicators (WDI) database. Domestic credit to private sector refers to financial resources provided to the private sector by financial corporations, such as through loans, purchases of non-equity securities, trade credits and other accounts receivable, that establish a claim for repayment. Graph of credit growth in each country is shown in Figure 1.
- ***National Accounts:*** Gross domestic product (GDP) series are taken from the IMF World Economic Outlook (WEO) database.
- ***Real Interest Rates:*** Real interest rates are collected from The World Bank (WB) database. As the real interest rate series in WB database for Turkey does not cover the whole period, we construct the real interest rate series for Turkey by subtracting consumer price inflation from the benchmark Treasury bill interest rate.
- ***DXY Index:*** In order to check whether our results depend on the global liquidity indicator, we use DXY as another proxy for global liquidity. DXY index shows the value of the US dollar against a basket of currencies. As indicated by Avdjiev et al. (2018) and many others, capital flows to emerging markets are negatively correlated with the dollar index. In other words, when the US dollar appreciates (depreciates), flows to emerging markets decline (increase). Time series data of DXY is obtained from Bloomberg.

Figure 1: Global Liquidity and Credit Growth

2.2 Methodology

We analyze the effectiveness of MPPs on credit growth in two stages. In the first stage, by exploiting the cross-section nature of the data, we estimate the average response of the credit growth to MPPs. Therefore, we start our analysis by estimating the following base regression model, including panel fixed effects. Equation (1) is augmented with an interaction between the state of the credit cycle and lagged MPP to see whether the state of the credit cycle is important for the effectiveness of MPPs.[2]

$$\begin{aligned}\Delta Cr_{it} = \rho\ \Delta Cr_{it-1} + \delta\ \Delta GDP_{it} + \beta_1\ \Delta GL_{it} + \beta_2\ MPP_{it-1} + \\ \beta_3\ CC_{it} + \beta_4\ CC_{it} * MPP_{it-1} + \gamma_i + \varepsilon_{it}\end{aligned} \tag{1}$$

$$i \in \{1, 2, \ldots., 30\} \quad and \quad t \in \{2000, \ldots, 2013\}$$

where $\Delta \mathrm{Cr}_{\mathrm{it}}$ is annual total credit growth in country i at time t, $\Delta \mathrm{GDP}_{\mathrm{it}}$ is annual growth of the gross domestic product, $\Delta \mathrm{GL}_{\mathrm{it}}$ is the annual growth rate of global liquidity, $\mathrm{CC}_{\mathrm{it}}$ is the state of the credit cycle, and it takes the value of 1 if the credit cycle is in an expansion period and 0 if the credit cycle is in contraction period. It is used to compute the peak and through points of credit level for each country. CC takes the value of one at time t if the credit cycle is in the expansion period and γ_i stands for the constant term. Harding & Pagan

[2] Stationarity tests are conducted for the variables by employing Im et al. (2003)'s Panel Unit Root Test for lag 1, and Pesaran (2007)'s Cross-Sectional Augmented IPS (CIPS) Test for lag 0. The results of both tests indicate that variables included in the estimations are stationarity.

(2002)'s yearly algorithm is used to compute the peak and trough points of credit level for each country. A local peak (through) in Cr_{it} occurs at time t if $\Delta Cr_{it} <(>) \Delta Cr_{it+k}$ where k is the minimum duration of a phase. Expansion period is defined as the period between trough and peak points. $\mathrm{MPP}_{\mathrm{it}}$ is the number of macroprudential policy tools implemented by country i at time t. MPP is included in the model with one lag in order to mitigate the possible endogeneity problem between credit growth and MPP implementations.

In equation (1), while GDP growth is included to control domestic economic conditions, global liquidity is included to control for global financial conditions. As indicated in Cerutti et al. (2017) and Başkaya et al. (2017), the effectiveness of MPPs could change depending on the state of the credit cycle. Therefore, we also include $\mathrm{CC}_{it} * MPP_{it-1}$ term to investigate the interaction between the credit cycle and the effectiveness of macroprudential policies. In the next stage, we are interested in mapping out the response of credit growth to global liquidity shocks and how MPP implementations affect such responses in order to study dynamic linkages. Hence, we employed a panel vector autoregression (PVAR) model. In order to estimate the impulse-responses the following first-order PVAR is estimated.

$$\mathrm{Z}_{\mathrm{it}} = \Gamma_0 + \Gamma_1 Z_{it-1} + f_i + e_{it} \tag{2}$$

where, Z_{it} is the four-variable vector of $\{\Delta\mathrm{GL}_{\mathrm{it}}\ \mathrm{MPP}_{\mathrm{it}}\ \Delta\mathrm{GDP}_{\mathrm{it}}\ \Delta\mathrm{Credit}_{\mathrm{it}}\ \}$. GL is the annual change of global liquidity indicator, Credit is the annual change of domestic credit, MPP is macroprudential policy index developed by Cerutti et al. (2017), f_{i} is a vector of country specific effects, and e_{it} is the vector of idiosyncratic errors. As in the previous case, global liquidity is included for controlling global financial and domestic GDP growth is included for controlling domestic economic conditions. During robustness check estimations we have tried alternative variables for controlling domestic and global conditions.

Identification and Estimation

The Cholesky decomposition of the variance-covariance matrix of residuals is used in the estimation. This specification assumes that while global liquidity shocks have a contemporaneous effect on credit growth, MPP and GDP growth in country i, global liquidity channelled to country i is affected from these variables by one lag. In other words, cross-border flows are assumed to be exogenous and determined globally at time t, but at time $(t+1)$ they are determined according to domestic conditions at time t. It is also assumed that credit growth depends on MPP tools and GDP growth contemporaneously while MPP and GDP growth responds to the credit growth by one lag. Love & Zicchino (2006) states that in order to impose a restriction to have the same underlying structure for each cross-sectional unit, fixed effects (f_{i}) are included in the panel VAR model. The country fixed effects are controlled to overcome the individual heterogeneity problem. However, as Nickell (1981) mentions, fixed effects estimator in auto-regressive panel data models is inconsistent since fixed effects are correlated with the regressors due to lags of dependent variables. Grossmann et al. (2014) states that to avoid the bias problem, they employ forward mean differencing, also known as "Helmert Procedure", which preserves orthogonality between transformed variables and the lagged regressors. Thus, following Love & Zicchino (2006), Grossmann et al. (2014) and Abrigo & Love (2016) GMM estimation is used. To remove the fixed effects Helmert Procedure is employed. This kind of transformation allows us to preserve orthogonality between the transformed variables and lagged regressors so that we

can use lagged regressors as instruments and estimate by GMM procedure.

Endogeneity

One of the difficulties when analyzing the effects of MPPs on other variables is the possible endogeneity of the policies themselves. As stated by Bruno et al. (2017), implementation of MPP takes time due to initial discussions among the government, central bank and other public authorities. Hence, the introduction of MPP could coincide with the late stages of the credit boom. Therefore, following Claessens et al. (2013), Zhang & Zoli (2016), Cerutti et al. (2017), we employ GMM methodology to mitigate the possible endogeneity problem mentioned in the literature as it includes lagged regressors as instruments.[3]

3 Results

Fixed effects panel estimation results of equation (1) are shown in Table 1. In the first column, credit growth is explained by its lag, current GDP growth, number of MPP in effect with a lag, credit conditions and global liquidity (growth of international claims). While the global liquidity controls for the global financial conditions, GDP is there to control domestic conditions. In the second column, we extend the model by using real interest rates as another control variable for domestic credit conditions. In the third and fourth columns,

Table 1: Country Fixed Effects Estimation Results

Dependent variable: $\triangle Credit$	(1)	(2)	(3)	(4)
$\triangle Credit_{it-1}$	0.237***	0.230***	0.270***	0.262***
	[0.027]	[0.030]	[0.037]	[0.037]
$GDPGrowth$	0.016***	0.016***	0.019***	0.018***
	[0.003]	[0.003]	[0.003]	[0.003]
MPP_{it-1}	-0.018*	-0.022*	-0.012	-0.014
	[0.009]	[0.011]	[0.012]	[0.014]
CC_{it}	0.209***	0.201***	0.232***	0.223***
	[0.030]	[0.034]	[0.038]	[0.043]
$CC_{it} * MPP_{it-1}$	-0.002	-0.001	-0.006	-0.005
	[0.010]	[0.010]	[0.012]	[0.013]
Int. Clm. Growth	0.146***	0.141***		
	[0.020]	[0.021]		
Real Interest Rate		-0.001		-0.001
		[0.001]		[0.001]
$\triangle DXY$			-0.002**	-0.002**
			[0.001]	[0.001]
Observations	409	395	415	401
R-squared	0.695	0.695	0.657	0.657
Number of id	30	29	30	29
Wald Tests:	$\beta_3 + \beta_5 = 0$	$\beta_3 + \beta_5 = 0$	$\beta_3 + \beta_5 = 0$	$\beta_3 + \beta_5 = 0$
p-values	0.01	0.01	0.02	0.03

Note: Robust standard errors in brackets. ***, **, and * stand for 1%, 5%, and 20% significance level.

instead of international claims, we use the change in the dollar index (DXY) as a proxy for global liquidity condition. Estimation results indicate that GDP growth is highly significant in explaining credit growth without depending on global liquidity measures. MPP tools

[3] It is assumed that E[e_{it}]=0, E[e_{it}'e_{it}]=0 for t>s. In addition, the Granger causality test is conducted among global liquidity and MPP indicators, and it is concluded that no causality among these two variables.

reduce credit growth at 10 percent significance level in first and second models, whether we control for the credit cycle or not. On the other hand, in third and fourth models, according to Wald test findings, MPP tools reduce credit growth at 1 percent significance level only when the credit cycle is in an expansion phase. State of the credit cycle is highly significant in all cases as expected. For all estimations, the interaction between the credit cycle and MPP implementations is statistically significant. It means that if MPP tools are put in place during an expansion phase of the credit cycle, their effect on reducing credit growth is higher. The real interest rate is not significant in all models indicating that it does not add much explanatory power to models.

Secondly, equation (1) is estimated by using Arellano & Bond (1991) GMM estimator with one lag in the dependent variable, and the estimation results are reported in Table 2. As stated in the literature, using lagged values for the MPP measures and the GMM

Table 2: Estimation Results with GMM

Dependent variable: $\triangle Credit$	(1)	(2)	(3)	(4)
$\triangle Credit_{it-1}$	0.248***	0.249***	0.236***	0.206***
	[0.015]	[0.021]	[0.019]	[0.020]
$GDPGrowth$	0.011***	0.014***	0.015***	0.017***
	[0.001]	[0.001]	[0.001]	[0.001]
MPP_{it-1}	-0.020***	-0.023***	-0.023***	-0.028***
	[0.006]	[0.006]	[0.008]	[0.008]
CC_{it}	0.231***	0.208***	0.255***	0.200***
	[0.013]	[0.014]	[0.017]	[0.021]
$CC_{it} * MPP_{it-1}$	-0.004	-0.000	-0.014***	-0.004
	[0.004]	[0.004]	[0.004]	[0.005]
Int. Clm. Growth	0.137***	0.121***		
	[0.011]	[0.012]		
Real Interest Rate		0.000		0.001
		[0.001]		[0.001]
$\triangle DXY$			-0.002***	-0.003***
			[0.000]	[0.000]
Observations	409	395	415	401
R-squared	0.695	0.695	0.657	0.657
Number of id	30	29	30	29
Chi-Square Tests:	$\beta_3 + \beta_5 = 0$	$\beta_3 + \beta_5 = 0$	$\beta_3 + \beta_5 = 0$	$\beta_3 + \beta_5 = 0$
p-values	0.001	0.001	0.001	0.001
AR(1)	-3.42 ***	-3.25***	-3.47***	-3.15***
AR(2)	0.26	0.13	-0.17	-0.10
Sargan Test	25.197***	25.737***	27.155***	21.689***

Note: Robust standard errors in brackets. ***, **, and * stand for 1%, 5%, and 20% significance level. Findings indicate that there is first order autocorrelation in errors and no higher order autocorrelation for error terms. In addition, according to Sargan test, the chosen instruments are valid.

estimation mitigates the endogeneity concerns among variables. Similar to previous findings, GDP growth is highly significant in explaining credit growth without depending on global liquidity measures. GMM estimations indicate that MPP tools reduce credit growth at 5 percent significance level regardless of the phase of the credit cycle, while on the expansion phase, the impacts of MPP tools are higher on reducing credit growth. In addition, while we include DXY index instead of cross-border claims of banks as a global liquidity indicator, our findings do not change significantly. Again, real interest rates are not significant in explaining credit growth in all models.

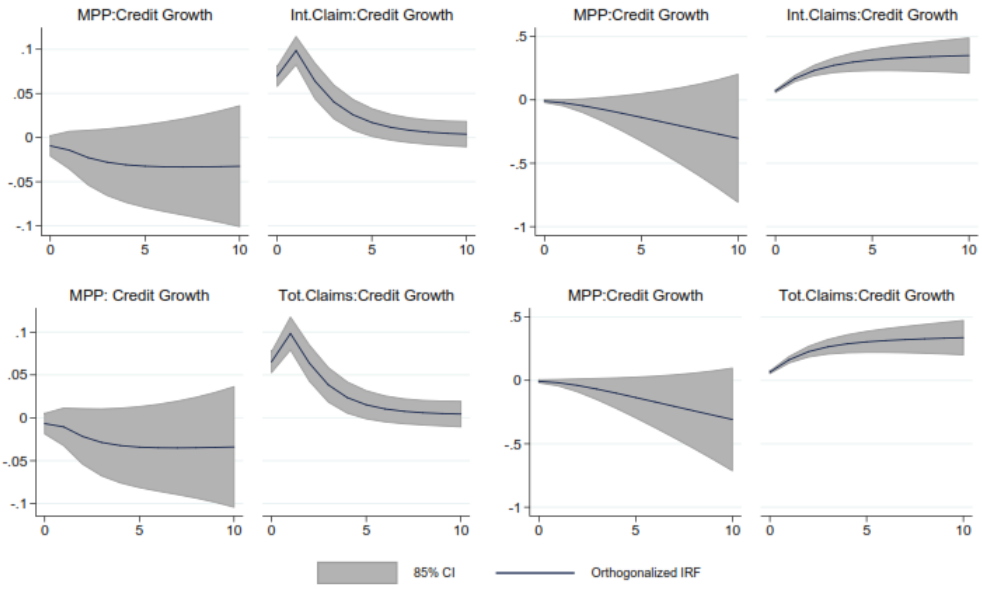

Figure 2: Positive Global Liquidity Shock, No Control of Credit Cycle

Fixed effects panel estimation gives us a general idea about the effectiveness of MPPs and when they are particularly effective. In the next stage, we estimate a panel VAR model in equation (2) to map out the response of credit growth to a global liquidity shock, Figure 2.[4] While the left panel shows the responses of variables to a one standard deviation shock to global liquidity, the right panel shows the cumulative responses. Note that the state of the credit cycle is not controlled in this experiment. Domestic credit growth gives a positive and significant response to both global liquidity measures for about five years. However, MPP implementation has no significant dampening effect on domestic credit growth.

We re-estimate the equation (2) by controlling the credit cycle, hence $CC_{it} = 1$ if the credit cycle is in the expansion phase. As shown in Figure 3, MPP implementation significantly reduces credit growth rates for about eight years when the credit cycle is in the expansion phase. Our results are consistent with Başkaya et al. (2017), Fendoğlu (2017) and Epure et al. (2018). However, unlike their work, our approach enables us to observe the duration of decline in credits in the aftermath of the MPP decision.

In the next step, we aim to test whether a combination of MPPs is more effective to control credit growth as argued in Kim (2014). The question at this point is that how should we set a threshold to split our data set into two groups? In order to set a threshold for MPPs, we calculate the weighted average MPPs implemented for the whole sample and find that it is approximately 2. Therefore, the first group of the dataset consists of data where MPP<3 and the second group dataset consists of data where MPP>2. We should note that MPP=2 is not a magic number. Rather, it shows the average number of MPPs used in our sample. Therefore, if a country uses more than two MPPs, then this country uses MPPs more aggressively compared to the average, and hence we assume that it can better manage

[4] Impulse response functions confidence bands are calculated by Monte Carlo simulations.

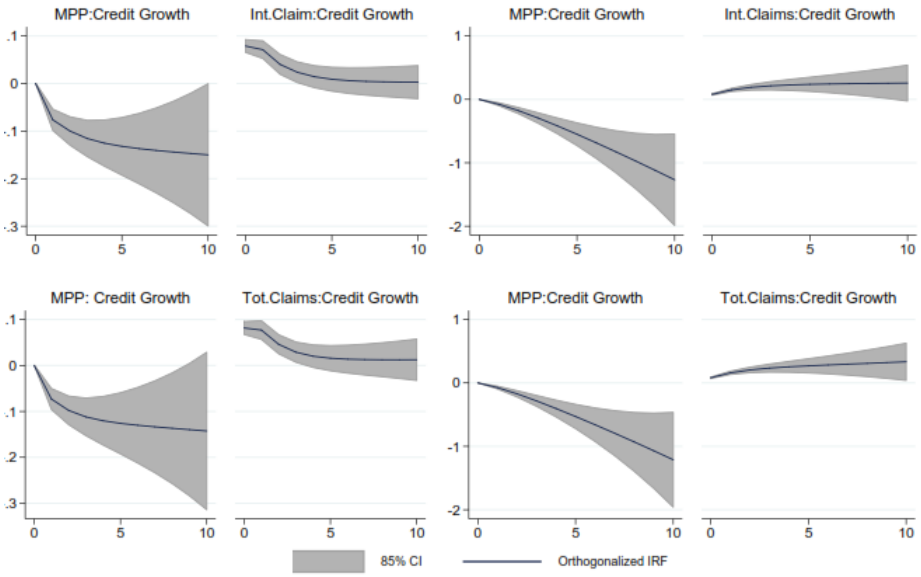

Figure 3: Positive Global Liquidity Shock, Credit Cycle is in Expansion Phase

credit growth by exploiting complementarity of MPPs.

Figure 4 shows that if the number of MPPs is less than three, the effects of global liquidity shock on credit growth last about six years. However, if the number of MPPs in implementation is higher than 2, then the effects of global liquidity shock last about four years.

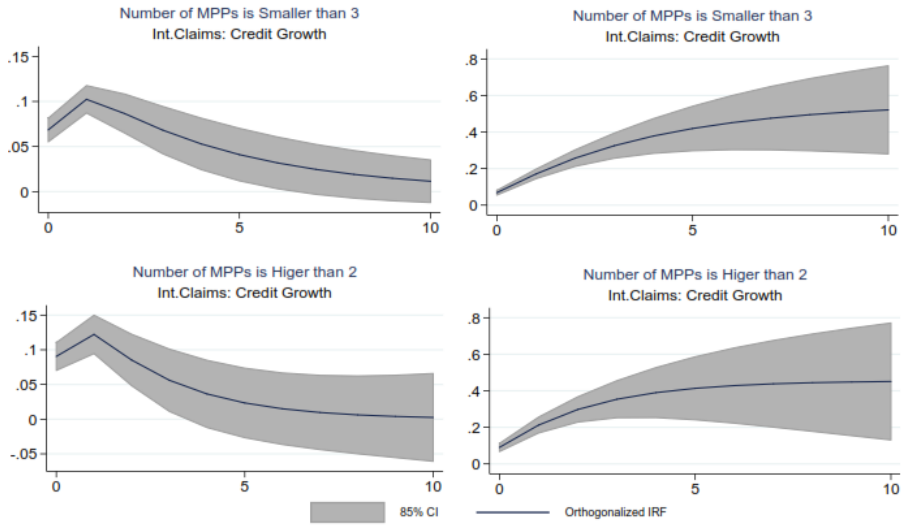

Figure 4: Positive Global Liquidity Shock, MMP>2 vs MPP<3

In other words, MPPs are effective tools to reduce the persistence of credit growth after a global liquidity shock. In addition, cumulative impulse response results show that the total credit growth is significantly lower on average when the number of MPPs is greater than 2. Therefore, our results support the view that MPPs are complements to each other, and their combination can better mitigate the adverse effects of shocks. Our findings do not change whether we use international cross-border claims or total cross-border claims.

4 Robustness Checks

In this section, we re-estimate (1) by either adding a new variable into the model or changing the variable with an alternative one to check whether our results are robust or not. First, we test the robustness of our results by including real interest rates in our VAR framework. Bu doing this our aim is to check whether GDP is enough to control domestic conditions. Therefore, PVAR model in equation (1) is modified as follows:

$$Z_{it} = \Gamma_0 + \Gamma_1 Z_{it-1} + f_i + e_{it} \tag{3}$$

where, (Z_{it}) is extended to five variable vector of $\{\Delta GL_{it}$ MPP_{it} $RealRate_{it}$ $\Delta Credit_{it}$ $\Delta GDP_{it}\}$. Impulse response results are given in Figure A.1. Results when controlling for real interest rate are similar to the previous results. Domestic credit growth has no significant response to MPP measure if the credit cycle is not controlled. When the credit cycle is in the expansion phase, domestic credit growth decreases as a response to the implementation of MPPs.

In the second robustness check, we test whether our results change when we measure global liquidity with another liquidity measure. We select the dollar index as a global liquidity indicator due to the fact that an increase in the dollar index considered as tightening in global financial conditions. Findings are reported in Figure A.2. Impulse response analysis shows that alternative liquidity measure does not change results significantly.

5 Conclusion

The number of countries using MPPs to control credit growth has risen especially in the aftermath of the 2008 financial crisis. Therefore, the new empirical literature has been flourishing on the effectiveness of such policies. This paper contributes to this literature by answering questions on whether MPPs are effective tools to control credit growth in emerging market countries and if so, when they are particularly effective. Fixed effects panel data and panel VAR estimation results show that MPPs are effective tools to control credit growth during the expansionary phase of the credit cycle. We also show that the complementarity of MPPs argument is valid. In other words, poor design of MPPs could lead to leakages in the financial system; hence, the desired reduction in credit growth cannot be reached. Therefore, a combination of MPPs should be used to control credit growth effectively.

We believe that combined with previous findings in the literature; our findings have important implications for policymakers. The first one is that MPPs are clearly effective to control credit growth during the expansion phase of the credit cycle. This result also implies that expansionary MPP measures when the global liquidity is getting tight will have limited effect on credit growth. Therefore, policymakers should establish safety nets when the global liquidity conditions are loose to support financial stability and economic growth

during the tight global liquidity environment. The second implication is that policymakers should consider MPPs as complements to each other, not substitutes. Hence, they should design MPP implementations to control all possible leakages in the system. In other words, an MPP should be seen as a complement to other policy tools, and sufficient number of MPPs should be employed to be successful in controlling credit growth. Last but not least, our results show that the persistence of the response of credit growth to global liquidity is also important for controlling leverage in the system. Therefore, if a rapid result is needed a combination of MPPs should be implemented to reduce credit growth in the system swiftly.

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Appendices

Appendix A: Figures for Robustness Check

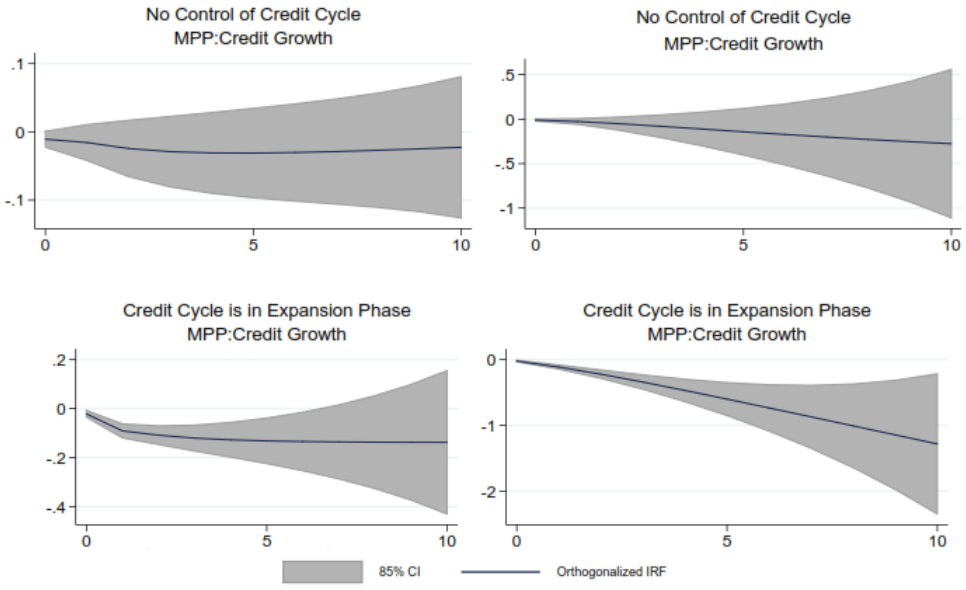

Figure A.1: Real Interest Rate Included

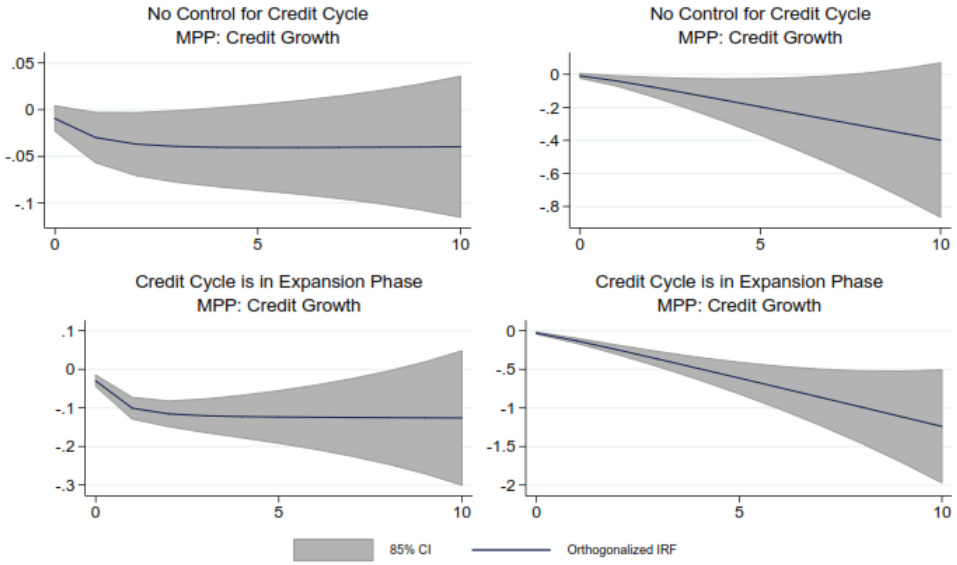

Figure A.2: DXY is Used Instead of Cross Border Capital Flows

Appendix B: List of Countries

Argentina	India	Romania
Brazil	Indonesia	Russia
Chile	Israel	Serbia
China	Korea, Rep.	Singapore
Colombia	Latvia	Slovak Rep.
Croatia	Malaysia	Slovenia
Czech Republic	Mexico	South Africa
Estonia	Peru	Thailand
Hong Kong	Philippines	Turkey
Hungary	Poland	Ukraine