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The Interaction Between Macroprudential Policy and Financial Stability[1]

Zoë Venter[2]

Abstract

In this paper, an index of domestic macroprudential policy tools is constructed and the effectiveness of these tools in controlling credit growth is studied using a dynamic panel data model for the period between 2000 and 2017. The empirical analysis includes two panels namely an EU panel of 27 countries and a Latin American panel of 7 countries, and the paper also looks at a case study of Chile, Colombia, Japan, Portugal and the UK. Our main results find that the cumulative index of macroprudential policy tools does not have a statistically significant impact on credit growth when considering a panel of 27 EU countries. When considering the case of Japan, a tighter capital conservation buffer leads to a decrease in the credit supply. When looking at a panel of 7 Latin American countries, our main results show that a tightening of the capital conservation buffer results in an increase in the credit supply. A tightening of the loan-to-value ratio results in a decrease in the credit supply in the panel of 7 Latin American countries. Lastly, a tightening in the overall macroprudential policy tool stance results in a decrease in credit supply in Japan and an increase in credit supply in Portugal.

JEL Classification: E58, F55, G01
Keywords: Macroprudential Policy, Credit Booms, Capital Flows, Financial Stability, Systematic Risk, EU, Latin America

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1. Introduction

The deregulation of the US financial system in the time leading up to the Global Financial Crisis (GFC) and the subsequent growth of the 'Shadow Banking' system resulted in the spurred use of complex derivatives such as credit default swaps (CDSs) and collateralised debt obligations (CDOs) as well as the rapid growth of both the US housing market and the market for subprime mortgages. When extremely high home prices were no longer supported, prices plummeted and a severe credit freeze ensued in both the US and in the global economy. European banks had substantial balance sheet exposures to the US housing market and both public and private debt in many European countries skyrocketed, Latin American commodity exporting countries were affected by the weaker US dollar and the drop in external demand severely impacted the Japanese economy. The unexpected interconnectedness, vulnerabilities and the general contagion that encompassed the GFC confirmed the idea that an alternative policy framework needed to be implemented by Central Banks in an effort to manage financial instability and the ideal solution was the implementation of a comprehensive macroprudential policy framework.

Crockett (2000), FSB/IMF/BIS (2011) and IMF (2013) state that macroprudential policy is the use of prudential tools in an effort to limit systematic risk and although macroprudential policy tools were included in the policy frameworks of emerging economies well before the crisis, macroprudential policy use is now broader as the crisis experience prompted its inclusion in policy frameworks. In 2017, Vítor Constâncio[3] said that "macroprudential policy emerged from the crisis as a new tool to deal with systemic risk in the financial sector.

Recognition that micro-supervision of individual institutions was not sufficient to ensure financial stability led to the emergence of a new policy area. A new authority was needed to be accountable and responsible for monitoring and preventing the build-up of endogenous systemic risk in the financial sector." Galati and Moessner (2011) identify two main ingredients for the implementation of a successful macroprudential policy framework. Firstly, the financial system "must be robust to external shocks" (Allen and Wood, 2006) and secondly, the financial system must be "resilient to shocks originating within the financial system" (Houben et. al., 2004).

[3] Vice-President of the ECB between June 2010 and May 2018.

The purpose of this paper is to study the impact of the impact of macroprudential policy on financial stability for both an EU panel of 27 countries and a Latin American panel of 7 countries. A case study is also considered focusing on Chile, Colombia, Japan, Portugal and the UK. An index of domestic macroprudential policy tools is constructed and the effectiveness of these tools in controlling credit growth is studied using a dynamic panel data model for the period between 2000 and 2017. A monthly index, iMaPP database constructed by Alam et al. (2019), of macroprudential policy tools implemented in the relevant countries is used as a starting point. This index is coded through 2016:Q4, and is then cross checked using the Cerutti et al. (2017) index and extended using both the 2017 IMF Macroprudential Survey and the IMF Macroprudential Data Query report. The monthly index is cumulated to create the quarterly database used in this paper.

Our main results show that the cumulative index of macroprudential policy tools does not have a statistically significant impact on credit growth when considering a panel of 27 EU countries, this result is in line with earlier literature that finds that the impact of macroprudential policy tool implementation is less significant when considering developed, open economies (Cerutti et al., 2017). When considering the case of Japan, a tighter capital conservation buffer leads to a decrease in the credit supply. A negative coefficient on the interaction term between credit growth and the macroprudential policy choice index implies that an inverse relationship exists between the growth in credit and the level of the macroprudential policy choice index. In these cases, the macroprudential policy stance should be tightened in times of financial instability in an effort to curb credit growth and hence, to stabilise credit supply. When looking at a panel of 7 Latin American countries, our main results show that a tightening of the capital conservation buffer results in an increase in the credit supply. A tightening of the loan-to-value ratio results in a decrease in the credit supply in the panel of 7 Latin American countries. The success of caps on loan-to-value ratios (LTV) is in line with previous literature, most recently Gambacorta and Murcia (2019) show that macroprudential policy tools aimed at controlling credit cycles are found to be effective at reducing credit growth, Claessens et al. (2013) find that debt-service-to-income ratio (DSTI) caps and LTV caps more effectively manage asset growth than capital requirements. Lastly, a tightening in the overall macroprudential policy tool stance results in a decrease in credit supply in Japan and an increase in credit supply in Portugal.

The rest of the paper is as follows: Section 2 surveys existing literature; Section 3 discusses the methodology and the data used; Section 4 discusses the empirical results; and Section 5 concludes.

2. Literature Review

The widespread use of macroprudential policy tools emerged in the aftermath of the GFC when Central Bankers and policy makers realised that a policy framework with a focus on constraining systematic risk was needed. Allen and Gale (2007), Schularick and Taylor (2012) and Gourinchas and Obstfeld (2012) point out that systematic crises usually occur after periods of rapid and strong credit growth instead of being random, exogenously caused events. Borio (2003) points out that an important difference between a microprudentialist and a macroprudentialist is that a microprudentialist deems it sufficient to maintain the stability of individual institutions to ensure the stability of the entire financial system while a macroprudentialist would challenge this. The Committee on Global Financial System (2010) states that macroprudential policy "complements the micro-prudential focus on safety and soundness of individual institutions" and Caruana (2010) states that the aim of macroprudential policy is "to reduce systemic risk by explicitly addressing the interconnections between financial institutions and their common exposures and the pro-cyclicality of the financial system".

Lim et al. (2011) study the role of macroprudential policy instruments in the reduction of systematic risk in 49 countries between 2000 and 2010 using a dynamic panel data model. They find that reserve requirements are indeed effective in reducing the procyclical behaviour of credit growth. Kuttner and Shim (2013) find that both the level of housing prices and the level of credit were effectively lowered after the implementation of macroprudential policy tools in 57 countries between 1980 and 2011. Borio and Drehman (2009) and IMF (2014) note that rising home prices combined with increases in credit supply (mortgage) may signal a procyclical build-up of risks in housing market. The role of the housing market in the GFC has made it pertinent to study the impact of macroprudential policy implementation on both credit growth and housing prices. Ahuja and Nabar (2011) find that caps on loan-to-value ratios had a decelerating effect on property price growth, specifically in Hong Kong, between 2000 and 2010. Ahmed and Zlate (2013) focus on both the pre and post-crisis periods and by considering capital flows to emerging markets, they find that capital controls implemented in these countries were able to manage capital flows.

Vandenbussche et al. (2012) find that higher capital ratios and marginal reserve requirements on foreign funding effectively abate increases in house prices when considering central, eastern and south-eastern Europe between the late 1990s and 2010. The Hong Kong Monetary Authority (2011) also finds that loan-to-value caps have indeed been effective at reducing systematic risk in the housing market in Hong Kong, Kim (2014) comes to the same conclusion when looking at the implementation of loan-to-value and debt-to-income caps in Korea. Kim (2014) finds that Korean loan-to-value ratios and debt-to-income ratios were successful at reducing mortgage credit supply however, these tools are accompanied by unintended side effects.

Cerutti et al. (2017) use a new database to study the impact of five types of prudential policy tools. The IBRN Prudential Instruments Database includes quarterly changes for 64 countries over the period between 2000 and 2014. The index includes changes in capital buffers, concentration limits, interbank exposures, loan-to-value ratios and reserve requirements on both foreign and domestic currency. The authors find that loan-to-value ratios experience changes in policy most frequently, loan-to-value ratios and reserve requirements also exhibit salient countercyclical properties in line with policy objectives. Akinci and Olmstead-Rumsey (2015) analyse the impact of macroprudential policy tool implementation on the real domestic credit growth rate while controlling for the level of the VIX index. They find that targeted macroprudential policy tools are indeed effective at managing real domestic credit growth in 57 emerging and advanced economies. Agénor et al. (2012) make use of a DSGE model to show that macroprudential policy in a small open economy may help with the policy tensions attached to shifts in capital flows. Tovar et al. (2012) use dynamic panel VARs to analyse the impact that reserve requirements have on real private bank credit growth and find that in the Latin American countries considered, there is a modest slowing in credit growth following policy implementation and there is a complementary relationship between conventional monetary policy tools and reserve requirements. Federico et al. (2012) also look at Latin American countries using a VAR analysis to study the effects of changes in legal reserve requirements on the macroeconomy and Baba and Kokenyne (2011) perform a qualitative assessment of the impact of capital controls in emerging markets. They find that capital controls that do not cover the majority of inflows may not have the macroeconomic impact that is expected even if they are successful at reducing targeted flows.

Lopez and Bruni (2019) note that the macroprudential policy framework implemented needs to be "an adaptable and flexible global network" and they define both the objectives and levels of impact of each of the different policy frameworks implemented by Central Banks and policy makers (see Table 1). Peydró (2016) points out that financial crises are often followed by credit crunches, the same is noted by Reinhart and Rogoff (2009) who note that long-lasting recessions with falling aggregate welfare and employment are often preceded by financial crises. Jiménez et al. (2015) analyses the impact of dynamic provisioning and countercyclical bank capital buffers on credit supply cycles in Spain. The authors find that countercyclical bank capital buffers have a mitigating effect on credit supply however, the impact of dynamic provisioning is not significant as any reduction in credit availability disappears after three quarters. Gupta et al. (2009) find that countercyclical macroprudential policy tools are able to shorten the duration of crises. Claessens (2017) notes that globalisation has resulted in a reduced ability to control domestic finance and the author shows that macroprudential policy tool implementation is less effective in developed markets.

Table 1 - Objectives and Impact of Policy Frameworks

Policy	Objective	Level of Impact
Monetary	Price stability	Macro: stable economic growth
Macroprudential	Stability of financial sector	Both macro and micro
Microprudential	Stability of financial institutions	Micro: protection of consumers

Source: Lopez and Bruni (2019).

Cerutti et al. (2017) make use of a manually coded index of the macroprudential instruments implemented in 85 countries between 1990 and 2015. The authors find that a tighter macroprudential policy stance reduces household credit supplied by banks which are more dependent on foreign sources of funding, the results are even more pronounced for foreign currency denominated credit. Cerutti et al. (2017) also find that credit growth in higher risk foreign currencies in periods of low risk aversion hence, a low level of the VIX index, as well as periods of low foreign policy rates is more effectively controlled by macroprudential policy.

Angelini et al. (2012) note that "Macroprudential policy should be concerned with the setting of the structural features of the financial system, with a view to limiting risk, reducing procyclicality and increasing resilience by building up adequate buffers in good times for use in bad times. Only if these structural parameters are properly set will there be room left for discretionary and countercyclical macroprudential policy". Montoro and Moreno (2010) consider the cases of Brazil, Colombia and Brazil and find that macroprudential policy plays a supporting role for monetary policy as policy dilemmas involving capital flows, the transmission mechanism of conventional monetary policy and lastly credit growth management are dealt with. Bruno et al. (2014) look at 12 Asia-Pacific countries and find that policies targeting the banking sector and bond market capital flows effectively manage bank inflows and bond inflows respectively. The authors also find that, in some cases, macroprudential policy implementation may be more successful when policies are implemented in such a way that they complement tighter monetary policy instead of competing policy frameworks being implemented. Agur and Demertzis (2015) find that monetary policy still has the ability to affect financial stability in the presence of macroprudential policy tools.

Macroprudential policy is implemented in an effort to target two dimensions namely, the 'time dimension' and the 'cross-sectional dimension'[4] Zhang and Zoli (2014) show that a number of capital flow measures implemented in 46 countries were effective in managing house price growth, credit growth, bank leverage and equity flows. More specifically, taxes on housing, foreign currency related measured and loan-to-value ratios were most effective. Crowe et al. (2011) and Cerutti et al. (2015) also find that loan-to-value ratios and similar measures have the greatest potential to manage real estate booms. Dell'Ariccia et al. (2012) find that macroprudential policy tool implementation has both the ability to mitigate credit booms as well as the ability to reduce the likelihood of booms leading to financial catastrophes. Dumičić (2018) look at macroprudential policy tool implementation in Central and Eastern European countries, the authors find that macroprudential policy tool implementation was more effective at decreasing credit availability to households than credit to the non-financial corporate sector. The authors also show that macroprudential policy tools are an effective measure for the alleviation of systematic crises. Lastly, Habermeier et al. (2011) show that macroprudential policy tools effectively manage capital inflows and reduce credit growth in some cases however, are unable to manage price inflation of assets.

[4]Vulnerabilities associated with the build-up of risks over time and vulnerabilities associated with the interconnectedness of the financial system respectively.

3. Methodology and Data

3.1. Methodology

An index of domestic macroprudential policy tools is constructed and the effectiveness of these tools in controlling credit growth is studied using a dynamic panel data model. A dummy variable with value +1 is assigned in the presence of a tightening of macroprudential policy, -1 is assigned when macroprudential policy is loosened and 0 is assigned when there is no change to the macroprudential stance. A cumulative index of the macroprudential policy stance is also included. When two or three macroprudential policy tools are implemented or tightened, the cumulative index takes a corresponding value of +2 or +3. In the case where a number of policy tools are loosened, the cumulative index takes a corresponding value of -2 or -3. The impact of macroprudential policy implementation on credit growth is measured while controlling for the business cycle, the level of global risk aversion and interest rate changes.

The regression equations are as follows:

$$\text{Credit\_Growth}_{it} = \varphi_i + \beta_1\text{Credit\_Growth}_{it-1} + \beta_3 i_{it-1} + \beta_4\text{VIX}_{it-1} + \beta_6\text{Macrorudential\_Index}_{it-1} + \beta_7 y_{it-1} + \varepsilon_{it}, \quad (1)$$

$$\text{Credit\_Growth}_{it} = \varphi_i + \beta_1\text{Credit\_Growth}_{it-1} + \beta_2\text{Credit\_Growth\_Macroprudential\_Index}_{it-1} + \beta_3 i_{it-1} + \beta_4\text{VIX}_{it-1} + \beta_5\text{VIX\_Macroprudential\_Index}_{it-1} + \beta_6\text{Macrorudential\_Index}_{it-1} + \beta_7 y_{it-1} + \beta_8 y\text{\_Macrorudential\_Index}_{it-1} + \varepsilon_{it}, \quad (2)$$

where, Credit_Growth_t is the quarterly year-on-year growth in the level of credit, VIX_t is the quarterly year-on-year growth in the level of the VIX index, it is the quarterly year-on-year growth in the interest rate, $\text{Macrorudential\_Index}_{it}$ is the value of the macroprudential policy index, y_{it} is the quarterly year-on-year GDP growth rate, φ_i are country fixed effects to account for unobserved cross-country heterogeneity and ε_{it} is a disturbance term satisfying standard conditions of zero mean and constant variance.

Four panel unit root tests are run to test for the presence of panel unit roots in both the panels as well as the individual country cases. Firstly, three first-generation panel unit root tests (Maddala and Wu test, the Fisher-Type Phillips-Perron test and the Fisher-Type Augmented Dickey-Fuller test) are included which assume that cross sectional units are independent while

the second-generation panel unit root test (Pesaran test) allows for cross sectional dependence. The first-generation Maddala and Wu test (Table B1 in Appendix B) tests for the presence of panel unit roots, and we fail to reject the null hypothesis of panel unit roots when considering the lagged interest rate growth for Chile, lagged GDP growth for Colombia and lagged credit growth for Portugal. The null hypothesis of all panels containing unit roots is rejected for both the Latin American panel as well as the EU panel. The first-generation Fisher-Type test (Phillips-Perron test, Table B2 in Appendix B) tests for the presence of a unit root and shows that we reject the null hypothesis of a unit root for all variables in both the Latin American panel and the EU panel. We also reject the null hypothesis of a unit root for all variables in all five country cases with the exception of the lagged GDP growth for Chile and Portugal and the lagged interest rate growth for the UK and Portugal. The first-generation Fisher-Type unit root tests therefore show that the lagged first-differenced variables have an order of integration of I(0) implying that, the lagged first differenced variables are stationary for the majority of cases with the exception of the lagged first differenced interest rate for the cases of Portugal and the UK. Although, the Phillips-Perron test for the presence of a unit root indicates that four of the series contain a unit root, when considering the Augmented Dickey-Fuller test, this result changes. The results of the ADF test indicate that the null hypothesis of a unit root is rejected in all cases and hence, none of the series contain a unit root. The Phillips-Perron test corrects for the presence of serial correlation and heteroskedasticity in the errors and it is shown that the second regression equation does indeed suffer from serial correlation for the case of Portugal, in this case, the use of the unit root test that specifically corrects for serial correlation is the most appropriate.

One should proceed with caution when analysing the results of unit root tests with small, finite samples as the results of both the Phillips-Perron unit root test as well as the results of the Augmented Dickey-Fuller test may be severely size distorted. These unit root tests may not have the ability to distinguish between persistent stationary processes and nonstationary processes although, our test regressions exclude trends and instead, only include a constant term which may improve the reliability of the above tests.

The second-generation Pesaran test (Table B3 in Appendix B) tests for the presence of panel unit roots allowing for cross sectional dependence, we fail to reject the null hypothesis of all panels containing unit roots when considering the lagged growth in VIX for both the Latin American panel as well as the EU panel.

The problem of endogeneity may also present itself in the analysis as one may assume that the macroprudential policy stance of Central Banks and hence, the macroprudential policy tool index studied in this paper may be subject to some cross-correlation between the index and the error term or a reverse causality. A reverse causality is evident in many empirical analyses dealing with financial development, output growth and financial stability with an example being the relationship between banking sector development and output growth as discussed by Peia and Roszbach (2015), a reverse causality between inequality and financial development is also discussed by Bazillier and Hericourt (2016).

Therefore, in this paper, a reverse causality may exist between the macroprudential policy tool index and the level of credit growth. It is highly likely that the level of credit growth would influence the macroprudential policy stance of policy makers and Central Banks as the macroprudential policy stance is directly related to the policy makers' view of the financial stability (as proxied by credit growth in this paper) of the system at any given point in time. The macroprudential policy tool index is indeed cointegrated with the level of credit growth and a post-regression estimation test indicates that granger causality does indeed exist between the two variables. In Nier et al. (2012), it is proposed that lagged variables should be included in the empirical analysis in an effort to mitigate the endogeneity problem and the lagged regression results should then be compared with those of the unlagged variables in an effort to identify any issues caused by the relationship between the potentially affected variable and the error term. Further work could be conducted in an effort to identify a measure of financial stability that does not exhibit a reverse causality with the macroprudential policy tool index however, the chance of identifying such a variable is slim.

Endogeneity may lead to biased and inconsistent coefficient estimates and the issue of endogeneity usually presents itself because of a reverse causality between the dependent and independent variables. Endogeneity is also more likely to be an issue when considering macro analyses (in comparison to micro analyses) as it is more difficult to isolate the individual effects of the observable variables. To account for endogeneity in the model, one would need to include an IV estimator that is correlated with the endogenous variable however, uncorrelated with the error term. It is unlikely that one would find a variable that meets these requirements when focusing on the macroprudential policy tool index. Hence, the macroprudential policy tool index is lagged by one period which should mitigate the effect of endogeneity as discussed

in Nier et al. (2012). To err on the side of caution and in line with Nier et al. (2012), the estimated coefficients are interpreted based on significance and sign instead of the value thereof. Bruno and Shin (2013) lag all quarterly variables in the analysis by one quarter in an effort to mitigate endogeneity issues that may present themselves and in this paper, all variables are also lagged by one quarter. The lagging of all of the explanatory variables should mitigate any other endogeneity issues that may arise in the analysis.

To add to the robustness of this paper, an additional regression is run (Table C1 in Appendix C) that includes an IV estimator. Regulatory quality, which "reflects perceptions of the government to formulate and implement sound policies and regulations that permit and promote private sector development" (Kaufmann et al., 2010), is included as an IV estimator to account for any endogeneity in the model caused by the potentially endogenous variable, the macroprudential policy tool index. Regulatory quality is chosen as an appropriate IV estimator due to the likely correlation with the macroprudential policy tool index as the quality of regulation undoubtedly has an influence on the level of macroprudential policy intervention. Regulatory quality is unlikely to directly impact credit growth and instead, impacts credit growth through the macroprudential policy tool index while being uncorrelated with the error term.

The Wooldridge test for autocorrelation (Table B4 in Appendix B) in panel data shows that both the Latin American panel as well as the EU panel do indeed suffer from serial correlation, the Modified Wald test for heteroskedasticity (Table B5 in Appendix B) shows that both panels also suffer from the presence of heteroskedasticity, the main results (Table 3 to Table 7) therefore include regression results with corrections for both heteroskedasticity and serial correlation. The sum of macroprudential policy choices is the relevant variable for the statistical tests however, the results hold for capital conservation buffers, countercyclical capital buffers, loan-to-value ratios as well as reserve requirements. The Modified Wald test for heteroskedasticity is not an issue in the individual country cases, the Durbin-Watson test for autocorrelation shows (Table B4 in Appendix B) that there is no first order correlation for the case of Colombia for all macroprudential policy choices analysed as well as the sum of macroprudential policy choices.

There is no serial correlation present for the case of the UK for all cases except when considering loan-to-value ratios for both regression equation 1 and 2 and reserve requirements

for the second regression equation. For the Chilean case, the result of the Durbin-Watson test is inconclusive due to the test statistic falling between the lower and upper bound for all cases except the loan-to-value ratio for the first equation. For the Portuguese case, the result is inconclusive when considering reserve requirements for both regression equations and the second regression equation when considering the sum of macroprudential policy choices. Lastly, for the Japanese case, the result is inconclusive for all cases as the test statistic falls between the lower and upper bounds of the Durbin-Watson test in all cases. The final results for the country cases therefore include corrections for serial correlation when considering reserve requirements (both equation 1 and 2) as well as the sum of macroprudential policy choices (regression equation 2) for Portugal. The correction for serial correlation is included when considering loan-to-value ratios (both equation 1 and 2) and reserve requirements (regression equation 2) for the UK. The correction is included for all cases for Japan and for all cases except the first regression equation when considering loan-to-value ratios for Chile. In the remaining cases, notably all regressions for Colombia, no serial correlation is present and hence, standard fixed effects regression results are included.

3.2. Data

Allen and Gale (2007), Schularick and Taylor (2012), Gourinchas and Obstfeld (2012) and Borio (2018) note that credit growth is often a precursor of financial crises. Credit growth is thus included as a proxy for financial stability. A monthly index, iMaPP database constructed by Alam et al. (2019), of macroprudential policy tools implemented in the relevant countries is used as a starting point. This index is coded through 2016:Q4, this index is then cross checked using the Cerutti et al. (2017) index and extended using the 2017 IMF Macroprudential Survey. The extension through 2017:Q4 is cross checked using the IMF Macroprudential Data Query Report. The 2017 IMF survey is used as the deciding source and hence, when policy choices are reflected in the Data Query Report but not in the 2017 IMF Survey, these policy choices are not included. The monthly iMaPP index is cumulated to create the quarterly database used in this paper. The impact of macroprudential policy tool implementation on credit growth is studied for the period 2000:Q1 to 2017:Q4. The relevant countries are identified in Table 2.

The relevant variables are as follows:

- Credit growth as a proxy for financial stability (BIS total credit statistics and IMF);
- The growth in the level of the VIX index is included as a proxy for the level of global risk aversion (Federal Reserve Economic Data);

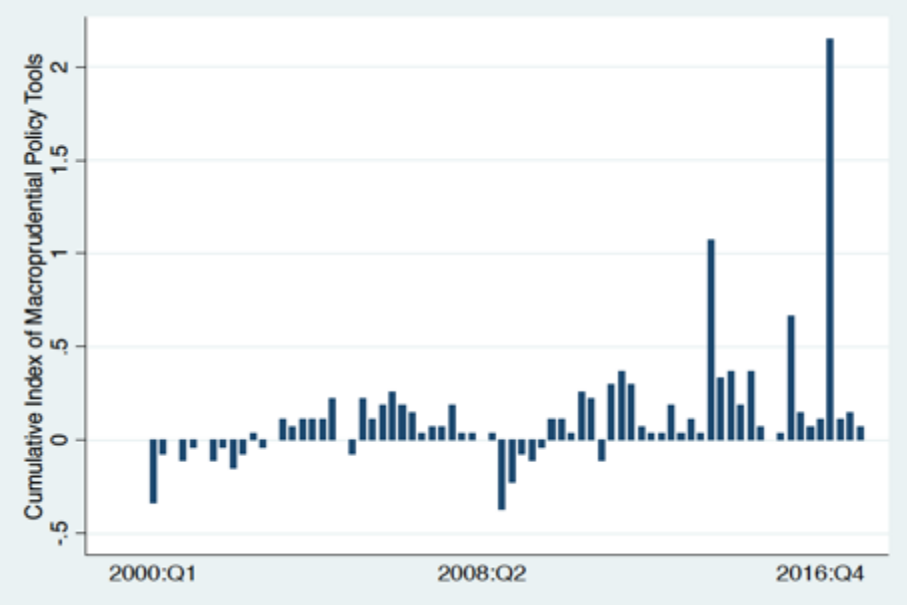
- The GDP growth is included as a proxy for the business cycle (Federal Reserve Economic Data and OECD Stats);
- The interest rate growth is included as a proxy for the cost of borrowing (World Development Indicators, International Financial Statistics and Central Bank of Argentina);

Table 2 - Countries Included in the Analysis

Countries		
EU Panel	Latin American Panel	Country Cases
Austria	Argentina	Chile
Belgium	Brazil	Colombia
Bulgaria	Chile	Japan
Croatia	Colombia	Portugal
CzechRepublic	Mexico	The UK
Denmark	Peru	
Estonia	Uruguay	
Finland		
France		
Germany		
Greece		
Hungary		
Ireland		
Italy		
Latvia		
Lithuania		
Luxembourg		
Malta		
Netherlands		
Poland		
Portugal		
Romania		
SlovakRepublic		
Slovenia		
Spain		
Sweden		
The UK		

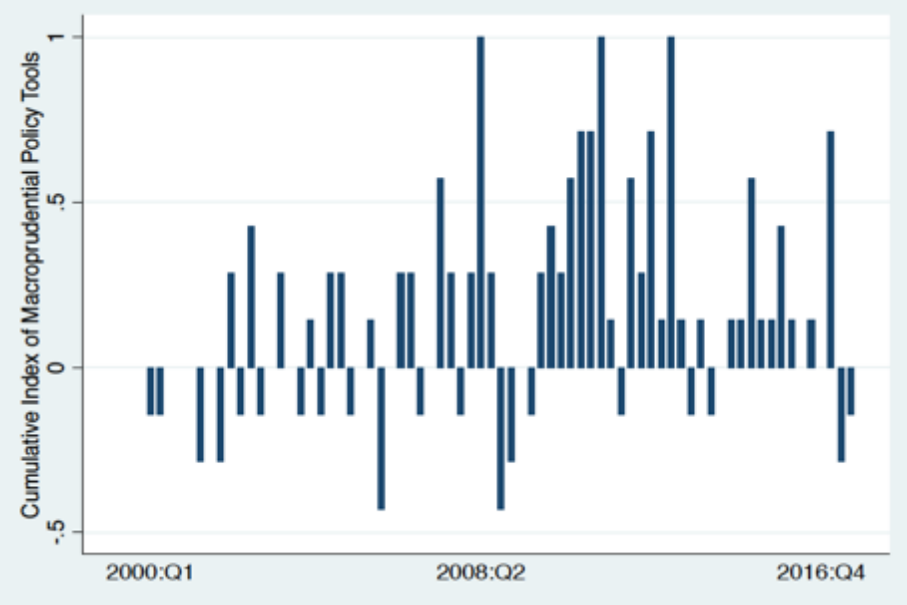
Figure 1 shows the cumulative index of macroprudential policy tools implemented in 27 European countries between 2000:Q1 and 2017:Q4 while Figure 2 shows the cumulative index of macroprudential policy tools implemented in 7 Latin American countries between 2000:Q1 and 2017:Q4. The graphs below show that the number of instances where macroprudential policy tools were implemented or the stance was tightened increased between 2000:Q1 and 2017:Q4 in the European panel, in the case of the Latin American panel, it is evident that the number of instances where macroprudential policy tools were either implemented or tightened increased in the time around the GFC. The macroprudential stance of Latin American countries became more active in the time around the GFC.

Figure 1 - Cumulative Index of Macroprudential Policy Tools Implemented in 27 European Countries



Source: Author's Index based on Alam et al. (2019), Cerutti et al. (2017) and IMF (2018, 2019).

Figure 2 - Cumulative Index of Macroprudential Policy Tools Implemented in 7 Latin American Countries

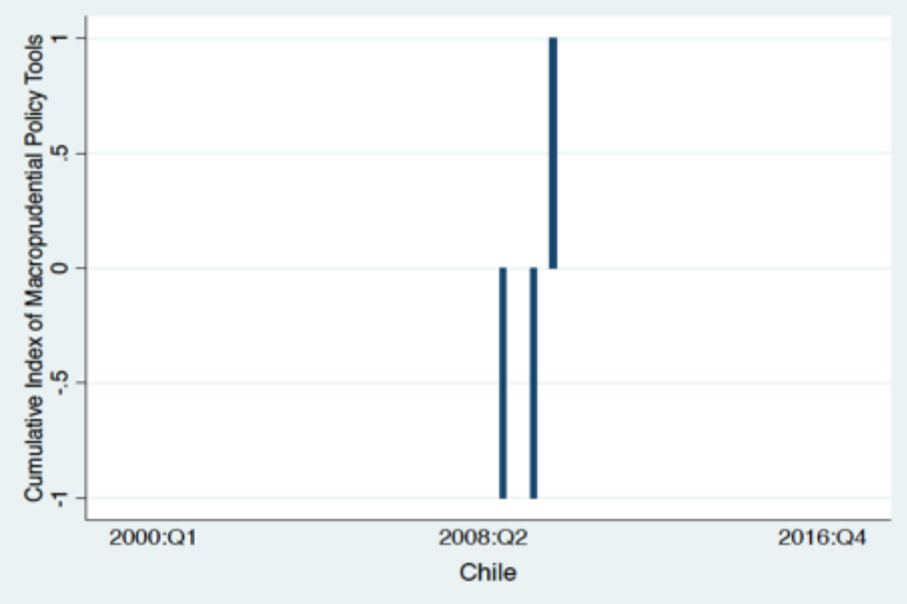


Source: Author's Index based on Alam et al. (2019), Cerutti et al. (2017) and IMF (2018, 2019).

Figure 3 shows the cumulative index of macroprudential policy tools implemented in Chile between 2000:Q1 and 2017:Q4, Figure 4 shows the cumulative index of macroprudential policy tools implemented in Colombia between 2000:Q1 and 2017:Q4 and Figure 5 shows the cumulative index of macroprudential policy tools implemented in Japan between 2000:Q1 and

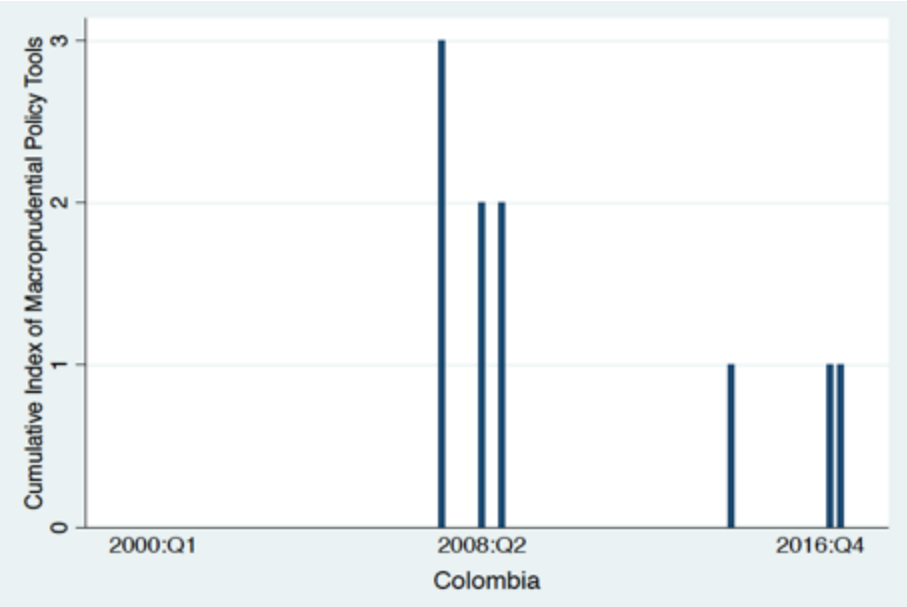
2017:Q4. Figure 6 shows the cumulative index of macroprudential policy tools implemented in Portugal between 2000:Q1 and 2017:Q4 while Figure 7 shows the cumulative index of macroprudential policy tools implemented in the UK between 2000:Q1 and 2017:Q4. The graphs below show that the macroprudential stance of Chile has been somewhat limited with the only adjustment to the policy stance occurring in the time around the GFC. Figure 4 shows that the macroprudential policy stance in Colombia became more active in the time around the GFC and again in 2016. The macroprudential policy stance in Japan has become more active in recent years and the same applies to Portugal. Lastly, Figure 7 shows that the macroprudential policy stance became more active in the case of the UK in the period after the GFC while, the policy stance has once again been active since 2016.

Figure 3 - Cumulative Index of Macroprudential Policy Tools Implemented in Chile



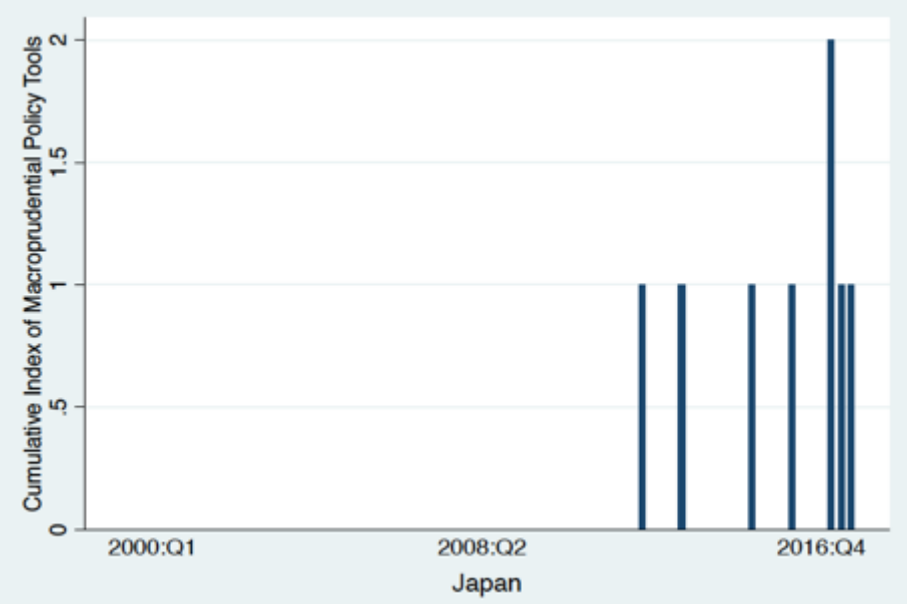
Source: Author's Index based on Alam et al. (2019), Cerutti et al. (2017) and IMF (2018, 2019).

Figure 4 - Cumulative Index of Macroprudential Policy Tools Implemented in Colombia



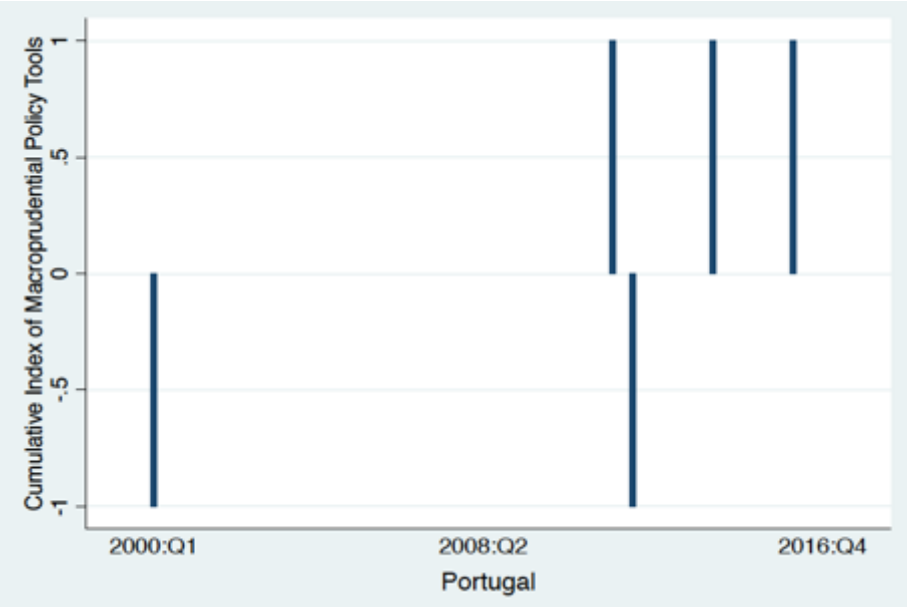
Source: Author's Index based on Alam et al. (2019), Cerutti et al. (2017) and IMF (2018, 2019).

Figure 5 - Cumulative Index of Macroprudential Policy Tools Implemented in Japan



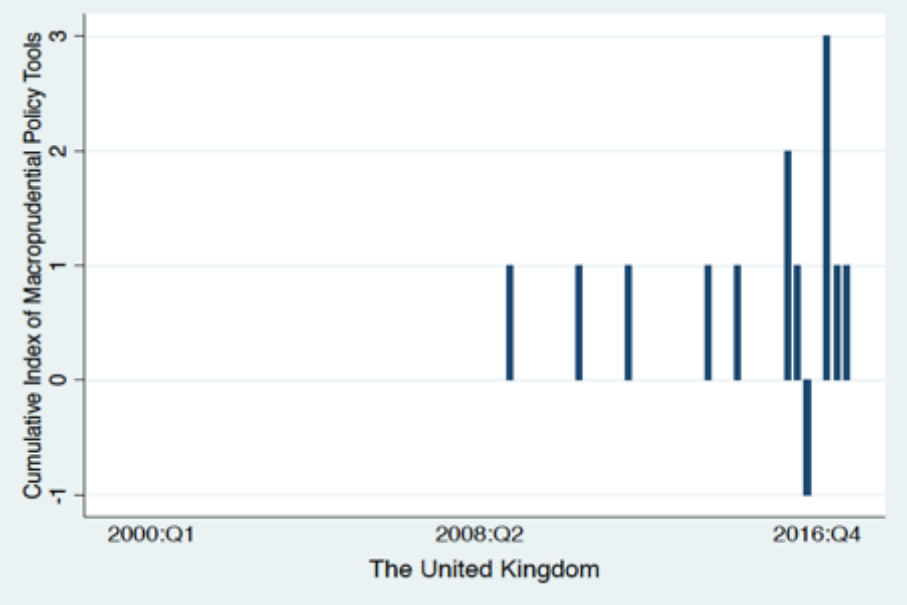
Source: Author's Index based on Alam et al. (2019), Cerutti et al. (2017) and IMF (2018, 2019).

Figure 6 - Cumulative Index of Macroprudential Policy Tools Implemented in Portugal



Source: Author's Index based on Alam et al. (2019), Cerutti et al. (2017) and IMF (2018, 2019).

Figure 7 - Cumulative Index of Macroprudential Policy Tools Implemented in The United Kingdom



Source: Author's Index based on Alam et al. (2019), Cerutti et al. (2017) and IMF (2018, 2019).

4. Results

4.1. Regression Results: Capital Conservation Buffer

Table 3 shows the results o regressing credit growth on its lagged value, the lagged value of the macroprudential policy choice index, lagged GDP growth and the lagged level of VIX (with country fixed effects). Table 3 focuses on the capital conservation buffer and the value of the macroprudential policy choice index is therefore indicative thereof. The coefficient on the lagged credit growth is positive and statistically significant when considering the Latin American panel and the five country cases in both the first and the second regressions. The coefficient on the interaction term between credit growth and the macroprudential policy choice index, in this case the capital conservation buffer, is positive and statistically significant when considering the Latin American panel however, the coefficient is negative and statistically significant in the case of Japan.

Table 3 - Regression Results for Capital Conservation Buffer

Regression Results: Capital Conservation Buffer									
Regression Equation	Coefficient	Variable	EU Panel 2000-2017	Latin American Panel 2000-2017	Chile 2000-2017	Colombia 2000-2017	Japan 2000-2017	Portugal 2000-2017	The UK 2000-2017
I	β_1	$Credit\_Growth_{t-1}$	0.0069 (0.0043)	0.8066 (0.0458)***	0.2439 (0.1097)**	0.9015 (0.0808)***	0.8096 (0.0640)***	0.7778 (0.0803)***	0.8300 (0.0770)***
	β_2	$Policy\_Rate\_Growth_{t-1}$	0.0439 (0.0589)	-0.0028 (0.0026)	-0.0070 (0.0061)	-0.0334 (0.0128)**	-0.0004 (0.0014)	0.0046 (0.0065)	0.0172 (0.0081)**
	β_3	VIX_Growth_{t-1}	-0.0020 (0.0028)	0.0002 (0.0001)*	0.0003 (0.0001)***	0.0002 (0.0001)*	0.0000 (0.0000)	0.0001 (0.0001)	0.0002 (0.0001)**
	β_4	$Macroprudential\_Index_{t-1}$	-0.2601 (0.2486)	-0.0080 (0.0122)	0 .	0 .	0.0013 (0.0054)	-0.0320 (0.0225)	0.0128 (0.0231)
	β_5	GDP_Growth_{t-1}	0.0041 (0.0037)	-0.0004 (0.0016)	-0.0072 (0.0033)**	0.0002 (0.0019)	-0.0033 (0.0005)***	-0.0032 (0.0014)**	-0.0027 (0.0014)*
		Constant	0.2177 (0.0266)***	0.0057 (0.0078)	0.0436 (0.0053)***	0.0034 (0.0093)	0.0051 (0.0013)***	0.0106 (0.0049)**	0.0128 (0.0046)**
	R^2		-0.0027	0.6643	0.3004	0.7331	0.8284	0.7202	0.6993
	Observations		1695	347	61	47	57	62	70
	P-Value		0.0001	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000
Regression Equation	Coefficient	Variable	EU Panel 2000-2017	Latin American Panel 2000-2017	Chile 2000-2017	Colombia 2000-2017	Japan 2000-2017	Portugal 2000-2017	The UK 2000-2017
II	β_1	$Credit\_Growth_{t-1}$	0.0068 (0.0044)	0.8083 (0.0456)***	0.2439 (0.1097)**	0.9015 (0.0808)***	0.8297 (0.0607)***	0.7778 (0.0803)***	0.8387 (0.0788)***
	β_2	$Credit\_Growth\_Macroprudential\_Index_{t-1}$	2.8946 (2.4117)	0.2569 (0.0620)***	0 .	0 .	-0.7602 (0.3512)**	0 .	0.1543 (0.2653)
	β_3	$Policy\_Rate\_Growth_{t-1}$	0.0466 (0.0619)	-0.0029 (0.0026)	-0.0070 (0.0061)	-0.0334 (0.0128)**	-0.0002 (0.0013)	0.0046 (0.0065)	0.0188 (0.0085)**
	β_4	VIX_Growth_{t-1}	-0.0021 (0.0028)	0.0002 (0.0001)*	0.0003 (0.0001)***	0.0002 (0.0001)*	0.0000 (0.0000)	0.0001 (0.0001)	0.0002 (0.0001)**
	β_5	$VIX\_Growth\_Macroprudential\_Index_{t-1}$	0.0059 (0.0059)	-0.0003 (0.0001)**	0 .	0 .	0 .	0 .	0 .
	β_6	$Macroprudential\_Index_{t-1}$	0.3282 (0.3082)	0.0036 (0.0073)	0 .	0 .	-0.7602 (0.3512)**	-0.0320 (0.0225)	0.0118 (0.0132)
	β_7	GDP_Growth_{t-1}	0.0048 (0.0036)	-0.0003 (0.0016)	-0.0072 (0.0033)**	0.0001 (0.0019)	-0.0033 (0.0005)***	-0.0032 (0.0014)**	-0.0028 (0.0014)*
	β_8	$GDP\_Growth\_Macroprudential\_Index_{t-1}$	-0.1600 (0.1419)	-0.0036 (0.0017)*	0 .	0 .	0 .	0 .	0 .
		Constant	0.2161 (0.0255)***	0.0054 (0.0076)	0.0436 (0.0053)***	0.0034 (0.0093)	0.0048 (0.0013)***	0.0106 (0.0049)**	0.0106 (0.0047)**
	R^2		-0.0045	0.6623	0.6640	0.7331	0.8458	0.7202	0.6961
	Observations		1695	347	61	47	57	62	70
	P-Value		0.0004	.	0.0001	0.0000	0.0000	0.0000	0.0000

Note: The R^2 value quoted is the adjusted R^2 value, the p-value quoted is associated with an F-test. The value quoted for each variable is the coefficient value with the value in parenthesis being the standard error.
* Represents statistical significance at 10%, ** at 5% and *** at 1%. (0, .) indicates results omitted due to cointegration.

4.2. Regression Results: Countercyclical Capital Buffer

Table 4 shows the results of regressing credit growth on its lagged value, the lagged value of the macroprudential policy choice index, lagged GDP growth and the lagged level of VIX (with country fixed effects). Table 4 focuses on the countercyclical capital buffer and the value of the macroprudential policy choice index is therefore indicative thereof. The coefficient of the lagged value of credit growth is positive and statistically significant in all cases except that of the EU panel where the sign is positive however, not statistically significant for both regressions. The coefficient on the macroprudential policy choice index is negative and statistically significant in the case of the UK for the first regression equation.

Table 4 - Regression Results for Countercyclical Capital Buffer

Regression Results: Countercyclical Capital Buffer									
Regression Equation	Coefficient	Variable	EU Panel 2000-2017	Latin American Panel 2000-2017	Chile 2000-2017	Colombia 2000-2017	Japan 2000-2017	Portugal 2000-2017	The UK 2000-2017
I	β_1	$Credit\_Growth_{t-1}$	0.0069 (0.0043)	0.8068 (0.0457)***	0.2439 (0.1097)**	0.9015 (0.0808)***	0.8071 (0.0628)***	0.8060 (0.0785)***	0.8326 (0.0719)***
	β_3	$Policy\_Rate\_Growth_{t-1}$	0.0435 (0.0583)	-0.0028 (0.0026)	-0.0070 (0.0061)	-0.0334 (0.0128)**	-0.0004 (0.0014)	0.0072 (0.0064)	0.0120 (0.0076)
	β_4	VIX_Growth_{t-1}	-0.0020 (0.0027)	0.0002 (0.0001)*	0.0003 (0.0001)***	0.0002 (0.0001)*	0.0000 (0.0000)	0.0001 (0.0001)	0.0002 (0.0001)***
	β_5	$Macroprudential\_Index_{t-1}$	-0.0558 (0.0505)	0 .	0 .	0 .	0 .	0 .	-0.0317 (0.0118)***
	β_7	GDP_Growth_{t-1}	0.0043 (0.0036)	-0.0004 (0.0016)	-0.0072 (0.0033)**	0.0001 (0.0019)	-0.0033 (0.0006)***	-0.0033 (0.0014)**	-0.0022 (0.0013)
		Constant	0.2143 (0.0241)***	0.0056 (0.0077)	0.0436 (0.0053)***	0.0034 (0.0093)	0.0051 (0.0013)***	0.0093 (0.0048)*	0..0090 (0.0043)**
	R^2		-0.0028	0.6652	0.3004	0.7331	0.8266	0.7152	0.7256
	Observations		1695	347	61	47	57	62	70
	P-Value		0.0001	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000
Regression Equation	Coefficient	Variable	EU Panel 2000-2017	Latin American Panel 2000-2017	Chile 2000-2017	Colombia 2000-2017	Japan 2000-2017	Portugal 2000-2017	The UK 2000-2017
II	β_1	$Credit\_Growth_{t-1}$	0.0069 (0.0043)	0.8068 (0.0457)***	0.2439 (0.1097)**	0.9015 (0.0808)***	0.8072 (0.0628)***	0.8060 (0.0785)***	0.8330 (0.0725)***
	β_2	$Credit\_Growth\_Macroprudential\_Index_{t-1}$	1.5270 (3.4620)	0 .	0 .	0 .	0 .	0 .	0.4410 (2.6451)
	β_3	$Policy\_Rate\_Growth_{t-1}$	0.0436 (0.0584)	-0.0028 (0.0026)	-0.0070 (0.0061)	-0.0334 (0.0128)**	-0.0004 (0.0014)	0.0072 (0.0064)	0.0115 (0.0082)
	β_4	VIX_Growth_{t-1}	-0.0020 (0.0027)	0.0002 (0.0001)*	0.0003 (0.0001)***	0.0002 (0.0001)*	0.0000 (0.0000)	0.0001 (0.0001)	0.0002 (0.0001)***
	β_5	$VIX\_Growth\_Macroprudential\_Index_{t-1}$	0.0015 (0.0011)	0 .	0 .	0 .	0 .	0 .	0
	β_6	$Macroprudential\_Index_{t-1}$	-0.1415 (0.3774)	0 .	0 .	0 .	0 .	0 .	-0.0557 (0.1443)
	β_7	GDP_Growth_{t-1}	0.0043 (0.0036)	-0.0004 (0.0016)	-0.0072 (0.0033)**	0.0001 (0.0019)	-0.0033 (0.0006)***	-0.0033 (0.0014)**	-0.0021 (0.0014)
	β_8	$GDP\_Growth\_Macroprudential\_Index_{t-1}$	0.0386 (0.1227)	0 .	0 .	0 .	0 .	0 .	0 .
		Constant	0.2144 (0.0243)	0.0056 (0.0077)	0.0436 (0.0053)***	0.0034 (0.0093)	0.0051 (0.0013)***	0.0093 (0.0048)*	0.0089 (0.0044)**
	R^2		-0.0045	0.6652	0.3004	0.7331	0.8266	0.7152	0.7214
	Observations		1695	347	61	47	57	62	70
	P-Value		.	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000

Note: The R^2 value quoted is the adjusted R^2 value, the p-value quoted is associated with an F-test. The value quoted for each variable is the coefficient value with the value in parenthesis being the standard error.
* Represents statistical significance at 10%, ** at 5% and *** at 1%. (0, .) indicates results omitted due to cointegration.

4.3. Regression Results: Limits on Loan-to-Value Ratios

Table 5 shows the results of regressing credit growth on its lagged value, the lagged value of the macroprudential policy choice index, lagged GDP growth and the lagged level of VIX (with country fixed effects). Table 5 focuses on limits on loan-to-value ratios and the value of the macroprudential policy choice index is therefore indicative thereof. The coefficient on the lagged value of credit growth is once again both positive and statistically significant for all cases except that of the EU panel for both regression equations. The coefficient on the interaction term between VIX and the macroprudential policy choice index, in this case limits on loan-to-value ratios is positive and statistically significant when considering the Latin American panel in the second regression equation, the coefficient on the macroprudential policy choice index is also positive and statistically significant in the second regression equation when considering the Latin American panel. Finally, the coefficient on the interaction term between credit growth and the macroprudential policy choice index is negative and statistically significant for the second regression equation for the Latin American panel.

Table 5 - Regression Results for Limits on Loan-to-Value Ratios

Regression Results: Limits on Loan-to-Value Ratios									
Regression Equation	Coefficient	Variable	EU Panel 2000-2017	Latin American Panel 2000-2017	Chile 2000-2017	Colombia 2000-2017	Japan 2000-2017	Portugal 2000-2017	The UK 2000-2017
I	β_1	$Credit\_Growth_{t-1}$	0.0069 (0.0043)	0.8069 (0.0454)***	0.7390 (0.0763)***	0.9015 (0.0808)***	0.8071 (0.0628)***	0.8060 (0.0785)***	0.7430 (0.0923)***
	β_2	$Policy\_Rate\_Growth_{t-1}$	0.0437 (0.0584)	-0.0029 (0.0026)	0.0007 (0.0041)	-0.0334 (0.0128)**	-0.0004 (0.0014)	0.0072 (0.0064)	0.0163 (0.0097)*
	β_3	VIX_Growth_{t-1}	-0.0020 (0.0027)	0.0002 (0.0001)*	0.0004 (0.0001)***	0.0002 (0.0001)*	0.0000 (0.0000)	0.0001 (0.0001)	0.0002 (0.0001)**
	β_4	$Macroprudential\_Index_{t-1}$	-0.0546 (0.0451)	0.0106 (0.0130)	0.0300 (0.0352)	0 .	0 .	0 .	0 .
	β_5	GDP_Growth_{t-1}	0.0041 (0.0036)	-0.0004 (0.0016)	-0.0023 (0.0024)	0.0001 (0.0019)	-0.0033 (0.0006)***	-0.0033 (0.0014)**	-0.0030 (0.0018)*
		Constant	0.2154 (0.0245)***	0.0056 (0.0077)	0.0113 (0.0111)	0.0034 (0.0093)	0.0051 (0.0013)***	0.0093 (0.0048)*	0.0134 (0.0041)***
	R^2		-0.0028	0.6643	0.7900	0.7331	0.8266	0.7152	0.5520
	Observations		1695	347	62	47	57	62	69
	P-Value		0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Regression Equation	Coefficient	Variable	EU Panel 2000-2017	Latin American Panel 2000-2017	Chile 2000-2017	Colombia 2000-2017	Japan 2000-2017	Portugal 2000-2017	The UK 2000-2017
II	β_1	$Credit\_Growth_{t-1}$	0.0069 (0.0043)	0.8082 (0.0465)***	0.2504 (0.1104)**	0.9015 (0.0808)***	0.8071 (0.0628)***	0.8060 (0.0785)***	0.7430 (0.0923)***
	β_2	$Credit\_Growth\_Macroprudential\_Index_{t-1}$	-0.4428 (0.5061)	-0.0368 (0.0179)*	0 .	0 .	0 .	0 .	0 .
	β_3	$Policy\_Rate\_Growth_{t-1}$	0.0441 (0.0588)	-0.0031 (0.0026)	-0.0070 (0.0061)	-0.0334 (0.0128)**	-0.0004 (0.0014)	0.0072 (0.0064)	0.0163 (0.0097)*
	β_4	VIX_Growth_{t-1}	-0.0020 (0.0027)	0.0002 (0.0001)*	0.0003 (0.0001)***	0.0002 (0.0001)*	0.0000 (0.0000)	0.0001 (0.0001)	0.0002 (0.0001)**
	β_5	$VIX\_Growth\_Macroprudential\_Index_{t-1}$	-0.0007 (0.0010)	0.0017 (0.0004)***	0 .	0 .	0 .	0 .	0 .
	β_6	$Macroprudential\_Index_{t-1}$	-0.0338 (0.0537)	0.0336 (0.0044)***	-0.0279 (0.0251)	0 .	0 .	0 .	0 .
	β_7	GDP_Growth_{t-1}	0.0042 (0.0036)	-0.0004 (0.0016)	-0.0070 (0.0251)	0.0001 (0.0019)	-0.0033 (0.0006)***	-0.0033 (0.0014)**	-0.0030 (0.0018)*
	β_8	$GDP\_Growth\_Macroprudential\_Index_{t-1}$	-0.0031 (0.0078)	0 .	0 .	0 .	0 .	0 .	0 .
		Constant	0.2149 (0.0243)***	0.0058 (0.0078)	0.0423 (0.0052)***	0.0034 (0.0093)	0.0050 (0.0013)***	0.0093 (0.0048)*	0.0134 (0.0041)***
	R^2		-0.0045	0.6628	0.2970	0.7331	0.8266	0.7152	0.5520
	Observations		1695	347	61	47	57	62	69
	P-Value		0.0001	.	0.0002	0.0000	0.0000	0.0000	0.0000

Note: The R^2 value quoted is the adjusted R^2 value, the p-value quoted is associated with an F-test. The value quoted for each variable is the coefficient value with the value in parenthesis being the standard error.
* Represents statistical significance at 10%, ** at 5% and *** at 1%. (0, .) indicates results omitted due to cointegration.

4.4. Regression Results: Reserve Requirements

Table 6 shows the results of regressing credit growth on its lagged value, the lagged value of the macroprudential policy choice index, lagged GDP growth and the lagged level of VIX (with country fixed effects). Table 6 focuses on reserve requirements and the value of the macroprudential policy choice index is therefore indicative thereof. The coefficient on lagged credit growth is once again positive and statistically significant in all cases except that of the EU panel for both regression equations. The coefficient on the macroprudential policy choice index, in this case reserve requirements, is negative and statistically significant when considering the first regression equation for the case of Portugal.

Table 6 - Regression Results for Reserve Requirements

Regression Results: Reserve Requirements									
Regression Equation	Coefficient	Variable	EU Panel 2000-2017	Latin American Panel 2000-2017	Chile 2000-2017	Colombia 2000-2017	Japan 2000-2017	Portugal 2000-2017	The UK 2000-2017
I	β_1	$Credit\_Growth_{t-1}$	0.0069 (0.0045)	0.8052 (0.0490)***	0.2439 (0.1097)**	0.8869 (0.0828)***	0.8071 (0.0628)***	0.6476 (0.1105)***	0.8465 (0.0751)***
	β_2	$Policy\_Rate\_Growth_{t-1}$	0.0631 (0.0699)	-0.0029 (0.0027)	-0.0070 (0.0061)	-0.0321 (0.0129)**	-0.0004 (0.0014)	0.0012 (0.0082)	0.0154 (0.0078)*
	β_3	VIX_Growth_{t-1}	-0.0039 (0.0046)	0.0002 (0.0001)*	0.0003 (0.0001)***	0.0002 (0.0001)	0.0000 (0.0000)	5.96e-06 (0.0001)	0.0002 (0.0001)**
	β_4	$Macroprudential\_Index_{t-1}$	-3.0602 (33.1814)	0.0021 (0.0064)	0 .	-0.0122 (0.0142)	0 .	-0.0458 (0.0182)**	0 .
	β_5	GDP_Growth_{t-1}	0.0319 (0.0291)	-0.0005 (0.0017)	-0.0072 (0.0033)**	0.0003 (0.0019)	-0.0033 (0.0006)***	-0.0038 (0.0021)*	-0.0025 (0.0014)*
		Constant	0.0543 (0.1490)	0.0058 (0.0080)	0.0436 (0.0053)***	0.0036 (0.0093)	0.0051 (0.0013)***	0.0132 (0.0041)***	0.0096 (0.0045)**
	R^2		0.0081	0.6643	0.3004	0.7314	0.8266	0.4901	0.6995
	Observations		1695	347	61	47	57	61	70
	P-Value		0.0003	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000
Regression Equation	Coefficient	Variable	EU Panel 2000-2017	Latin American Panel 2000-2017	Chile 2000-2017	Colombia 2000-2017	Japan 2000-2017	Portugal 2000-2017	The UK 2000-2017
II	β_1	$Credit\_Growth_{t-1}$	0.0138 (0.0033)***	0.8054 (0.0503)***	0.2439 (0.1097)**	0.8394 (0.0879)***	0.8071 (0.0628)***	0.6452 (0.1127)***	0.7430 (0.0923)***
	β_2	$Credit\_Growth\_Macroprudential\_Index_{t-1}$	-19.9461 (23.9268)	-0.0067 (0.0887)	0 .	-3.7815 (3.2495)	0 .	-0.0265 (1.2111)	0 .
	β_3	$Policy\_Rate\_Growth_{t-1}$	-0.1346 (0.1236)	-0.0027 (0.0026)	-0.0070 (0.0061)	-0.0318 (0.0130)**	-0.0004 (0.0014)	0.0012 (0.0086)	0.0163 (0.0097)*
	β_4	VIX_Growth_{t-1}	0.0032 (0.0020)	0.0002 (0.0001)**	0.0003 (0.0001)***	0.0002 (0.0001)**	0.0000 (0.0000)	5.50e-06 (0.0001)	0.0002 (0.0001)**
	β_5	$VIX\_Growth\_Macroprudential\_Index_{t-1}$	0.0526 (0.0492)	0.0003 (0.0001)	0 .	0.0007 (0.0005)	0 .	0 .	0 .
	β_6	$Macroprudential\_Index_{t-1}$	-2.5842 (3.4745)	0.0036 (0.0103)	0 .	-0.2880 (0.2085)	0 .	-0.0265 (1.2111)	0 .
	β_7	GDP_Growth_{t-1}	0.0212 (0.0194)	-0.0004 (0.0017)	-0.0072 (0.0033)**	-0.0008 (0.0020)	-0.0033 (0.0006)***	-0.0038 (0.0021)*	-0.0030 (0.0018)*
	β_8	$GDP\_Growth\_Macroprudential\_Index_{t-1}$	0.1740 (0.3446)	-0.0005 (0.0007)	0 .	0.0293 (0.0237)	0 .	0 .	0 .
		Constant	0.1038 (0.1076)	0.0061 (0.0081)	0.0436 (0.0053)***	0.0113 (0.0104)	0.0051 (0.0013)***	0.0113 (0.0041)***	0.0134 (0.0041)***
	R^2		0.1482	0.6655	0.3004	0.7321	0.8266	0.4785	0.5520
	Observations		1695	347	61	47	57	61	69
	P-Value		0.0000	.	0.0001	0.0000	0.0000	0.0000	0.0000

Note: The R^2 value quoted is the adjusted R^2 value, the p-value quoted is associated with an F-test. The value quoted for each variable is the coefficient value with the value in parenthesis being the standard error.
* Represents statistical significance at 10%, ** at 5% and *** at 1%. (0, .) indicates results omitted due to cointegration.

4.5. Regression Results: Sum of Macroprudential Policy Choices

Table 7 shows the results of regressing credit growth on its lagged value, the lagged value of the macroprudential policy choice index, lagged GDP growth and the lagged level of VIX (with country fixed effects). Table 7 focuses on the sum of macroprudential policy choices and the value of the macroprudential policy choice index is therefore indicative thereof. The coefficient on lagged credit growth is positive and statistically significant for all cases in the second regression and positive and statistically significant for all cases except that of the EU panel when considering the first regression equation.

Table 7 - Regression Results for Sum of Macroprudential Policy Changes

Regression Results: Sum of Macroprudential Policy Choices									
Regression Equation	Coefficient	Variable	EU Panel 2000-2017	Latin American Panel 2000-2017	Chile 2000-2017	Colombia 2000-2017	Japan 2000-2017	Portugal 2000-2017	The UK 2000-2017
I	β_1	$Credit\_Growth_{t-1}$	0.0064 (0.0046)	0.8052 (0.0455)***	0.2372 (0.1104)**	0.8716 (0.0844)***	0.8071 (0.0629)***	0.7766 (0.0749)***	0.8521 (0.0780)***
	β_2	$Policy\_Rate\_Growth_{t-1}$	0.0724 (0.0893)	-0.0030 (0.0027)	-0.0074 (0.0061)	-0.0310 (0.0129)**	-0.0005 (0.0014)	0.0061 (0.0060)	0.0164 (0.0085)*
	β_3	VIX_Growth_{t-1}	-0.0036 (0.0042)	0.0002 (0.0001)*	0.0003 (0.0001)**	0.0002 (0.0001)*	0.0000 (0.0000)	0.0001 (0.0001)	0.0002 (0.0001)**
	β_4	$Macroprudential\_Index_{t-1}$	-0.9763 (0.9889)	0.0014 (0.0019)	-0.0104 (0.0161)	-0.0079 (0.0067)	-0.0023 (0.0027)	-0.0280 (0.0100)***	0.0012 (0.0043)
	β_5	GDP_Growth_{t-1}	0.0073 (0.0062)	-0.0004 (0.0016)	-0.0074 (0.0033)**	-0.0002 (0.0019)	-0.0033 (0.0006)***	-0.0035 (0.0014)**	-0.0025 (0.0014)*
		Constant	0.3156 (0.1233)**	0.0055 (0.0076)	0.0447 (0.0052)***	0.0072 (0.0098)	0.0055 (0.0013)***	0.0104 (0.0046)**	0.0094 (0.0046)**
	R^2		0.0047	0.6644	0.2869	0.7355	0.8258	0.7456	0.6952
	Observations		1695	347	61	47	57	62	70
	P-Value		0.0041	0.0000	0.0002	0.0000	0.0000	0.0000	0.0000
Regression Equation	Coefficient	Variable	EU Panel 2000-2017	Latin American Panel 2000-2017	Chile 2000-2017	Colombia 2000-2017	Japan 2000-2017	Portugal 2000-2017	The UK 2000-2017
II	β_1	$Credit\_Growth_{t-1}$	0.0170 (0.0046)***	0.7958 (0.0568)***	0.1744 (0.1153)	0.8598 (0.0886)***	0.8513 (0.0683)***	0.1382 (0.1314)	0.8986 (0.0889)***
	β_2	$Credit\_Growth\_Macroprudential\_Index_{t-1}$	-24.7925 (20.6433)	0.0231 (0.0425)	-0.2011 (0.3219)	0.1266 (0.3403)	-0.3313 (0.1750)*	0.8500 (0.3086)***	-0.2652 (0.3213)
	β_3	$Policy\_Rate\_Growth_{t-1}$	-0.0879 (0.0909)	-0.0031 (0.0037)	-0.0078 (0.0061)	-0.0325 (0.0134)**	-0.0001 (0.0014)	-0.0245 (0.0105)**	0.0185 (0.0098)*
	β_4	VIX_Growth_{t-1}	0.0007 (0.0010)	0.0002 (0.0001)*	0.0004 (0.0002)***	0.0002 (0.0002)*	0.0001 (0.0000)	-0.0001 (0.0001)	0.0002 (0.0001)**
	β_5	$VIX\_Growth\_Macroprudential\_Index_{t-1}$	0.0049 (0.0068)	0.0000 (0.000)	0.0004 (0.0002)	0.0000 (0.0002)	0.0000 (0.0001)	0.0016 (0.0006)***	-0.0002 (0.0004)
	β_6	$Macroprudential\_Index_{t-1}$	0.0341 (0.7788)	-0.0029 (0.0040)	-0.0042 (0.0234)	-0.0113 (0.0218)	0.0033 (0.0050)	-0.0394 (0.0129)***	0.0118 (0.0016)*
	β_7	GDP_Growth_{t-1}	0.0141 (0.0221)	-0.0008 (0.0019)	-0.0071 (0.0033)**	-0.0007 (0.0021)	-0.0031 (0.0006)***	-0.0048 (0.0024)*	-0.0028 (0.0016)*
	β_8	$GDP\_Growth\_Macroprudential\_Index_{t-1}$	0.0334 (0.1817)	0.0006 (0.0006)	0 .	0.0013 (0.0039)	0.0001 (0.0035)	0.0004 (0.0033)	-0.0024 (0.0070)
		Constant	0.1650 (0.0885)*	0.0069 (0.0083)	0.0442 (0.0049)***	0.0098 (0.0111)	0.0046 (0.0013)***	0.0243 (0.0026)***	0.0086 (0.0050)*
	R^2		0.3507	0.6638	0.2706	0.7206	0.8153	0.3426	0.6877
	Observations		1695	347	61	47	57	61	70
	P-Value		0.0000	0.0000	0.0010	0.0000	0.0000	0.0032	0.0000

Note: The R^2 value quoted is the adjusted R^2 value, the p-value quoted is associated with an F-test. The value quoted for each variable is the coefficient value with the value in parenthesis being the standard error.
* Represents statistical significance at 10%, ** at 5% and *** at 1%. (0, .) indicates results omitted due to cointegration.

The coefficient on the macroprudential policy choice index is negative and statistically significant for the case of Portugal when considering both the first regression equation as well as the second regression equation and the coefficient is positive and statistically significant for the case of the UK when considering the second regression equation. The interaction term

between credit growth and the macroprudential policy choice index is positive and statistically significant for the case of Portugal in the second regression, the interaction term between VIX and the macroprudential policy choice index is also positive and statistically significant when considering the case of Portugal in the second regression equation.

The results of a number of robustness checks[5] are similar to those of the main results discussed, noticeably, the coefficient on the macroprudential policy choice index is negative and statistically significant for the EU panel for both regressions, where the correction for heteroskedasticity and serial correlation is not included, when considering reserve requirements. The interaction term between credit and the macroprudential policy choice index is also negative and statistically significant in the second regression when considering reserve requirements for the EU panel, the same is true when considering the sum of macroprudential policy choices for the EU panel when the correction for heteroskedasticity and serial correlation is not included.

The interaction term between credit growth and the macroprudential policy choice stance is negative in the majority of cases however, the regression results are only statistically significant in a small number of cases. An inverse relationship between credit growth and the macroprudential policy choice index, as can be seen a negative coefficient on the interaction term between credit growth and the macroprudential policy choice index, would imply that higher levels of credit growth are associated with lower levels of the macroprudential policy choice index and hence, a looser macroprudential policy stance results in higher credit availability. A tightening of the capital conservation buffer results in a decrease in the credit supply when looking at the case of Japan, in Latin America, a tightening of the capital conservation buffer results in an increase in the credit supply. A tightening of the loan-to-value ratio results in a decrease in the credit supply in Latin America. Lastly, a tightening in the overall macroprudential policy stance results in an increase in the credit supply in Portugal and a decrease in the credit supply in Japan.

[5] Regression results of robustness checks available on request.

5. Conclusion

In the aftermath of the GFC, policy makers around the world came to the realization that traditional prudential policy frameworks with monetary policy as a prioritized policy tool lacked the scope to prevent financial crises and the financial turmoil that often accompanies these. The US housing bubble had severe effects on both the US economy as well as the global economy and although, the Federal Reserve and other Central Banks were unable to contain the turmoil, macroprudential policy frameworks emerged with the aim of achieving both financial and economic security and stability going forward as well as ensuring that bubbles never again grow to the disproportionately dangerous levels experienced prior to the GFC.

This paper studies the impact of macroprudential policy on financial stability for both an EU panel of 27 countries and a Latin American panel of 7 countries. A case study looking at the cases of Chile, Colombia, Japan, Portugal and the UK is also included. A monthly index, iMaPP database constructed by Alam et al. (2019), of macroprudential policy tools implemented in the relevant countries is used as a starting point. This index is coded through 2016:Q4, this index is then cross checked using the Cerutti et al. (2017) index and extended using the 2017 IMF Macroprudential Survey and the IMF Macroprudential Data Query report. The monthly index is cumulated to create the quarterly database used in this paper. The extended and updated index is then used to study the effectiveness of macroprudential policy tools in controlling credit growth using a dynamic panel data model for the period between 2000:Q1 and 2017:Q4.

Our main results find that the impact of the cumulative macroprudential index of policy choices is not statistically significant when considering a panel of 27 EU countries, this result is in line with earlier literature that finds that the impact of macroprudential policy tool implementation is less significant when considering developed, open economies (Cerutti et al., 2017). An inverse relationship between credit growth and the macroprudential policy choice index, as can be seen a negative coefficient on the interaction term between credit growth and the macroprudential policy choice index, would imply that higher levels of credit growth are associated with lower levels of the macroprudential policy choice index and hence, a looser macroprudential policy stance results in higher credit availability. A tightening of the capital conservation buffer results in a decrease in the credit supply when looking at the case of Japan. When looking at a panel of 7 Latin American countries, our main results show that a tightening of the capital conservation buffer results in an increase in the credit supply. A tightening of the

loan-to-value ratio results in a decrease in the credit supply in the panel of 7 Latin American countries. The success of caps on loan-to-value ratios (LTV) is in line with previous literature, most recently Gambacorta and Murcia (2019) show that macroprudential policy tools aimed at controlling credit cycles are found to be effective at reducing credit growth, Claessens et al. (2013) find that debt-service-to-income ratio (DSTI) caps and LTV caps more effectively manage asset growth than capital requirements. Lastly, a tightening in the overall macroprudential policy tool stance results in a decrease in credit supply in Japan and an increase in credit supply in Portugal. In light of these results, policy makers should tighten both their overall macroprudential policy stance as well as their capital conservation buffers in Japan in times of financial stress and in an effort to curb surges in credit supply. Policy makers should tighten their loan-to-value ratios in times of financial stress and credit abundance in Latin America however, in contrast, policy makers should loosen their capital conservation stance in times of credit abundance in an effort to stabilise credit supply. Lastly, the overall macroprudential policy stance should be loosened in Portugal in times of financial instability.

Appendix A

A.1. Variable Sources

Table A1 - Sources of Variables

Data Sources						
Variable	Countries	Code	Source	Frequency	Initial Date	End Date
Credit		BIS_TC2	BIS total credit statistics	Quarterly	01/01/1999	31/12/2017
Credit	Peru, Uruguay, Malta, Bulgaria, Slovakia, Slovenia, Estonia, Latvia	FS.AST.PRVT.GD.ZS	International Monetary Fund. International Financial Statistics estimates, and data files. and World Bank and OECD GDP	Annual	01/01/1999	31/12/2017
Credit_Growth_YOY			Author's own calculations using Credit	Quarterly	01/01/2000	31/12/2017
Credit_Growth_QOQ			Author's own calculations using Credit	Quarterly	01/01/2000	31/12/2017
Policy_Rate			International Financial Statistics (IFS)	Quarterly		
Policy_Rate	Argentina	BCRA_LEBAC	Central Bank of Argentina	Weekly	16/10/2002	19/09/2018
Policy_Rate	Croatia	FR.INR.RINR	World Development Indicators	Annual	01/01/1999	31/12/2014
Policy_Rate	Romania	FR.INR.RINR	World Development Indicators	Annual	01/01/1999	31/12/2017
Policy_Rate_Growth_YOY			Author's own calculations using Policy_Rate	Quarterly		
Policy_Rate_Growth_QOQ			Author's own calculations using Policy_Rate	Quarterly		
VIX_YOY		VIXCLS_PC1	Federal Reserve Economic Data	Quarterly	01/01/1999	31/12/2017
VIX_QOQ		VIXCLS_PCH	Federal Reserve Economic Data	Quarterly	01/01/1999	31/12/2017
GDP	Peru	MKTGDPPEA646NWDB	Federal Reserve Economic Data	Annual	01/01/1999	31/12/2017
GDP	Uruguay	RGDPNAUYA666NRUG	Federal Reserve Economic Data	Annual	01/01/1999	31/12/2017
GDP	Malta	MKTGDPMTA646NWDB	Federal Reserve Economic Data	Annual	01/01/1999	31/12/2017
GDP	Croatia	MKTGDPHRA646NWDB	Federal Reserve Economic Data	Annual	01/01/1999	31/12/2017
GDP_YOY	Peru, Uruguay, Malta, Croatia		Author's own calculations using GDP	Quarterly	01/01/2000	31/12/2017
GDP_QOQ	Peru, Uruguay, Malta, Croatia		Author's own calculations using GDP	Quarterly	01/01/2000	31/12/2017
GDP_YOY		GYSA	OECD Stat	Quarterly	01/01/1999	31/12/2017
GDP_QOQ		GPSA	OECD Stat	Quarterly	01/01/1999	31/12/2017

A.2. Variable Definitions

Table A2 - Definitions of Variables

Variable	Description
Credit	Credit to Non financial sector from All sectors at Market value - Percentage of GDP - Adjusted for breaks
Credit	Domestic credit to private sector refers to financial resources provided to the private sector by financial corporations. such as through loans. purchases of nonequity securities. and trade credits and other accounts receivable. that establish a claim for repayment. For some countries these claims include credit to public enterprises. The financial corporations include monetary authorities and deposit money banks. as well as other financial corporations where data are available (including corporations that do not accept transferable deposits but do incur such liabilities as time and savings deposits). Examples of other financial corporations are finance and leasing companies. money lenders. insurance corporations. pension funds. and foreign exchange companies.
Credit_Growth_YOY	Growth Rate in Credit. Change from previous quarter.
Credit_Growth_QOQ	Growth Rate in Credit. Change from same quarter in previous year.
Policy_Rate	Financial, Interest Rates, Monetary Policy-Related Interest Rate, Percent per annum
Policy_Rate	30-day LEBAC Interest Rates, % a.n.
Policy_Rate	Real interest rate is the lending interest rate adjusted for inflation as measured by the GDP deflator. The terms and conditions attached to lending rates differ by country, however, limiting their comparability.
Policy_Rate	Real interest rate is the lending interest rate adjusted for inflation as measured by the GDP deflator. The terms and conditions attached to lending rates differ by country, however, limiting their comparability.
Policy_Rate_Growth_YOY	
Policy_Rate_Growth_QOQ	
VIX_YOY	CBOE Volatility Index: VIX, Percent Change from Year Ago, Quarterly, Not Seasonally Adjusted
VIX_QOQ	CBOE Volatility Index: VIX, Percent Change, Quarterly, Not Seasonally Adjusted
GDP	Gross Domestic Product for Peru, Current U,S, Dollars, Annual, Not Seasonally Adjusted
GDP	Real GDP at Constant National Prices for Uruguay, Millions of 2011 U,S, Dollars, Annual, Not Seasonally Adjusted
GDP	Gross Domestic Product for Malta, Current U,S, Dollars, Annual, Not Seasonally Adjusted
GDP	Gross Domestic Product for Croatia, Current U,S, Dollars, Annual, Not Seasonally Adjusted
Credit_Growth_YOY	Growth Rate in GDP. Change from previous quarter.
Credit_Growth_QOQ	Growth Rate in GDP. Change from same quarter in previous year.
GDP_YOY	B1_GE: Gross domestic product - expenditure approach, Growth rate compared to the same quarter of previous year, seasonally adjusted
GDP_QOQ	B1_GE: Gross domestic product - expenditure approach, Growth rate compared to previous quarter, seasonally adjusted

A.3. Summary Statistics

Table A3 - Summary Statistics for Chile, Colombia, Japan, Portugal and the UK

Summary Statistics: Country Cases					
Variable	**Obs**	**Mean**	**Std. Dev**	**Min**	**Max**
Chile					
credit_growth	72	0.0237933	0.0725398	-0.1035242	0.2180905
policyrate_growth	62	0.2582208	1.211512	-0.9393939	6.44
vix_growth	72	1.816385	38.58628	-60.6284	165.9843
gdp_growth	72	3.815703	2.462696	-3.253929	9.164399
Colombia					
credit_growth	72	0.0237035	0.0529635	-0.0794393	0.17322
policyrate_growth	72	0.0002539	0.3244296	-0.6315789	0.6666667
vix_growth	72	1.816385	38.58628	-60.6284	165.9843
gdp_growth	48	4.121399	2.257974	0'.239044	8.677079
Japan					
credit_growth	72	0.0109938	0.022135	-0.0224187	0.0895571
policyrate_growth	59	0.1840373	1.045202	-0.6686391	4.485109
vix_growth	72	1.816385	38.58628	-60.6284	165.9843
gdp_growth	72	0.9447101	2.222137	-8.675353	5.51386
Portugal					
credit_growth	72	0.0329917	0.0437809	-0.0583215	0.1302149
policyrate_growth	62	-0.1414389	0.4729607	-1	0.8
vix_growth	72	1.816385	38.58628	-60.6284	165.9843
gdp_growth	72	0.7078997	2.261377	-4.52805	4.362598
The UK					
credit_growth	71	0.0277876	0.031222	-0.0415013	0.0983468
policyrate_growth	71	-0.1157729	0.3299229	-1	0.3571429
vix_growth	72	1.816385	38.58628	-60.6284	165.9843
gdp_growth	72	1.901558	1.930302	-5.806636	4.805865

Table A4 - Summary Statistics for the European Panel and the Latin American Panel

Summary Statistics: Panels					
Variable	**Obs**	**Mean**	**Std. Dev**	**Min**	**Max**
Euro Area					
credit_growth	1,914	0.191729	6.450008	-1.799857	279.2292
policyrate_growth	1,743	-0.1334895	0.6516293	-15.30976	4
vix_growth	1,944	1.815278	38.32681	-60.6	166
gdp_growth	1,944	3.250558	2.842606	-0.1414702	29.17192
Latin America					
credit_growth	504	0.020933	0.1698064	-0.4397933	1.71199
policyrate_growth	377	0.0735467	0.6787663	-1	6.44
vix_growth	504	1.815278	38.35502	-60.6	166
gdp_growth	480	3.352823	4.828629	-15.21974	22.10265

Appendix B

B.1. Maddala and Wu Test (Maddala and Wu, 1999) for the Presence of Panel Unit Roots

Table B1 - Results of Fisher Type Unit Root Tests

Maddala and Wu Test (Maddala and Wu, 1999) for the Presence of a Unit Root H0: Presence of a Unit Root							
	Observations	Statistic	P-Value		Observations	Statistic	P-Value
Latin Panel				**The UK**			
Credit_Growthit-1	504	59.050	0.0000	Credit_Growthit-1	72	6.874	0.032
iit-1	377	85.119	0.0000	iit-1	71	5.815	0.055
Macrorudential_Indexit-1	504	181.012	0.0000	Macrorudential_Indexit-1	72	38.920	0.0000
yit-1	480	64.091	0.0000	yit-1	72	19.397	0.0000
vixt-1	504	65.053	0.0000	vixt-1	72	9.289	0.010
EU Panel				**Japan**			
Credit_Growthit-1	1914	223.166	0.0000	Credit_Growthit-1	72	13.223	0.001
iit-1	1743	210.896	0.0000	iit-1	59	8.637	0.013
Macrorudential_Indexit-1	1944	746.022	0.0000	Macrorudential_Indexit-1	72	17.796	0.0000
yit-1	1944	322.162	0.0000	yit-1	72	17.197	0.0000
vixt-1	1944	250.920	0.0000	vixt-1	72	9.289	0.010
Chile				**Portugal**			
Credit_Growthit-1	72	4.781	0.092	Credit_Growthit-1	72	3.360	0.186
iit-1	62	3.511	0.173	iit-1	62	7.498	0.024
Macrorudential_Indexit-1	72	56.656	0.0000	Macrorudential_Indexit-1	72	49.631	0.0000
yit-1	72	9.338	0.009	yit-1	72	5.284	0.071
vixt-1	72	9.289	0.010	vixt-1	72	9.289	0.010
Colombia							
Credit_Growthit-1	72	4.900	0.086				
iit-1	72	17.669	0.0000				
Macrorudential_Indexit-1	72	22.305	0.0000				
yit-1	48	2.234	0.327				
vixt-1	72	9.289	0.010				

Note: First generation Maddala and Wu Test for panel unit roots (Maddala and Wu, 1999) results based on: Ho: All panels contain unit roots and Ha: At least one panel is stationary. The results of an Inverse Chi-squared (2) test are presented in the above table with both the Test Statistic as well as the p-value being quoted. The presence of a unit root is rejected for the cases where the p-value < 0.1. Statistical test results based on regression equations with sum of the macroprudential policy choices included as the index value.

B.2. First Generation Fisher Type Tests (Phillips–Perron Test) for the Presence of Panel Unit Roots

Table B2 - Results of Fisher Type Unit Root Tests

Fisher Type Tests (Phillips–Perron Test) for the Presence of a Unit Root H0: Presence of a Unit Root							
	Observations	Statistic	P-Value		Observations	Statistic	P-Value
Latin Panel				**The UK**			
Credit_Growthit-1	504	36.3021	0.0009	Credit_Growthit-1	72	5.6787	0.0585
iit-1	377	26.1996	0.0244	iit-1	36	0.8215	0.6631
Macrorudential_Indexit-1	504	337.0854	0.0000	Macrorudential_Indexit-1	72	55.6207	0.0000
yit-1	480	26.9912	0.0193	yit-1	72	7.6394	0.0219
vixt-1	504	100.2856	0.0000	vixt-1	72	14.3265	0.0008
EU Panel				**Japan**			
Credit_Growthit-1	1914	232.9835	0.0000	Credit_Growthit-1	72	7.8962	0.0193
iit-1	1743	145.7935	0.0000	iit-1	71	6.0848	0.0477
Macrorudential_Indexit-1	1944	1432.4526	0.0000	Macrorudential_Indexit-1	72	53.1736	0.0000
yit-1	1944	235.4274	0.0000	yit-1	72	5.3232	0.0698
vixt-1	1944	386.8160	0.0000	vixt-1	72	14.3265	0.0008
Chile				**Portugal**			
Credit_Growthit-1	72	4.8906	0.0867	Credit_Growthit-1	72	8.0162	0.0182
iit-1	72	6.4431	0.0399	iit-1	51	2.8464	0.2409
Macrorudential_Indexit-1	72	57.6126	0.0000	Macrorudential_Indexit-1	72	50.7685	0.0000
yit-1	72	4.9550	0.0840	yit-1	72	4.4974	0.1055
vixt-1	72	14.3265	0.0008	vixt-1	72	14.3265	0.0008
Colombia							
Credit_Growthit-1	72	5.0408	0.0804				
iit-1	72	5.3437	0.0691				
Macrorudential_Indexit-1	72	59.3230	0.0000				
yit-1	48	1.6222	0.4444				
vixt-1	72	14.3265	0.0008				

Note: First generation Fisher Type test for panel unit roots (Phillips–Perron test) results based on: Ho: All panels contain unit roots and Ha: At least one panel is stationary. The results of an Inverse Chi-squared (2) test are presented in the above table with both the Test Statistic as well as the p-value being quoted. The presence of a unit root is rejected for the cases where the p-value < 0.1. Statistical test results based on regression equations with sum of the macroprudential policy choices included as the index value.

B.3. Second Generation Pesaran Test (Pesaran, 2007) for the Presence of Panel Unit Roots

Table B3 - Results of Fisher Type Unit Root Tests

Pesaran Test (Pesaran, 2007) for the Presence of a Unit Root H0: Presence of a Unit Root							
	Observations	Statistic	P-Value		Observations	Statistic	P-Value
Latin Panel				**The UK**			
Credit_Growthit-1	504	-2.627	0.004	Credit_Growthit-1	71	4.821	1.000
iit-1	377	-2.790	0.003	iit-1	71	4.824	1.000
Macrorudential_Indexit-1	504	-8.649	0.0000	Macrorudential_Indexit-1	72	4.824	1.000
yit-1	480	-3.568	0.0000	yit-1	72	4.824	1.000
vixt-1	504	12.764	1.0000	vixt-1	72	4.824	1.000
EU Panel				**Japan**			
Credit_Growthit-1	1914	-6.705	0.0000	Credit_Growthit-1	72	4.824	1.000
iit-1	1743	-13.182	0.0000	iit-1	59	4.772	1.000
Macrorudential_Indexit-1	1944	-19.806	0.0000	Macrorudential_Indexit-1	72	4.824	1.000
yit-1	1944	-9.944	0.0000	yit-1	72	4.824	1.000
vixt-1	1944	24.851	1.0000	vixt-1	72	4.824	1.000
Chile				**Portugal**			
Credit_Growthit-1	72	4.824	1.0000	Credit_Growthit-1	72	4.824	1.000
iit-1	72	4.772	1.0000	iit-1	62	4.772	1.000
Macrorudential_Indexit-1	72	4.824	1.0000	Macrorudential_Indexit-1	72	4.824	1.000
yit-1	72	4.824	1.0000	yit-1	72	4.824	1.000
vixt-1	72	4.824	1.0000	vixt-1	72	4.824	1.000
Colombia							
Credit_Growthit-1	72	4.824	1.0000				
iit-1	72	4.824	1.0000				
Macrorudential_Indexit-1	72	4.824	1.0000				
yit-1	48	4.670	1.0000				
vixt-1	72	4.824	1.0000				

Note: Second generation Pesaran test for panel unit roots (Pesaran, 2007) results based on: Ho: All panels contain unit roots and Ha: At least one panel is stationary. The results of an Inverse Chi-squared (2) test are presented in the above table with both the Test Statistic as well as the p-value being quoted. The presence of a unit root is rejected for the cases where the p-value < 0.1. Statistical test results based on regression equations with sum of the macroprudential policy choices included as the index value.

B.4. Wooldridge Test for Autocorrelation in Panel Data and Durbin Watson Test for Autocorrelation:

Table B4 - Results of Wooldridge Test for Autocorrelation in Panel Data and Durbin Watson Test for Autocorrelation

Wooldridge Test for Autocorrelation in Panel Data H0: No First-Order Autocorrelation							
	Observations	Statistic	P-Value		Observations	Statistic	P-Value
Latin Panel				**EU Panel**			
I	347	88.946	0.0001	I	1695	64653.336	0.0000
II	347	104.161	0.0001	II	1695	3.705	0.0652

Durbin Watson Test for Autocorrelation H0: No First-Order Autocorrelation				
	Observations	Statistic	dL	dU
Chile				
I	62	1.5158	1.248	1.598
II	62	1.6586	1.144	1.726
Colombia				
I	47	2.0061	1.111	1.583
II	47	1.9914	0.974	1.768
The UK				
I	70	1.6521	1.313	1.611
II	70	1.7255	1.223	1.716
Japan				
I	58	1.4861	1.248	1.598
II	58	1.4870	1.144	1.726
Portugal				
I	62	1.7361	1.248	1.598
II	62	1.5910	1.144	1.726

Note: Wooldridge Test for Autocorrelation results based on: Ho: No First-Order Autocorrelation and Ha: First Order Autocorrelation. The results of the F-test and the corresponding p-values are presented in the above table. The null hypothesis of no first-order autocorrelation is rejected for the cases where the p-value < 0.1. Durbin Watson test for Autocorrelation results based on: Ho: No Autocorrelation and Ha: Positive Autocorrelation or Inconclusive Results. The Durbin Watson Test Statistic is quoted in the table above, the upper and lower Durbin Watson bounds from Savin and White at a 1% Confidence Interval are also quoted in the above table. Test Statistic values above the upper bound result in the null hypothesis not being rejected and hence, no positive serial correlation is present. A Test Statistic below the lower bound results in the assumption that positive serial correlation is present and a Test Statistic within the bounds results in an inconclusive result. Statistical test results based on regression equations with sum of the macroprudential policy choices included as the index value.

B.5. Modified Wald Test for Heteroskedasticity:

Table B5 - Results for Modified Wald Test for Heteroskedasticity

Modified Wald Test for Heteroskedasticity **H0: sigma(i)^2 = sigma^2 for all i**							
	Observations	Statistic	P-Value		Observations	Statistic	P-Value
Latin Panel				**The UK**			
I	347	283.22	0.0000	I	70	0.00	0.9437
II	347	273.53	0.0000	II	70	0.01	0.9404
EU Panel				**Japan**			
I	1695	1.2e+07	0.0000	I	58	0.01	0.9281
II	1695	1.4e+07	0.0000	II	58	0.01	0.9305
Chile				**Portugal**			
I	62	0.13	0.7219	I	62	0.01	0.9184
II	62	0.12	0.7245	II	62	0.01	0.9183
Colombia							
I	47	0.01	0.9283				
II	47	0.01	0.9263				

Note: Modified Wald Test for Heteroskedasticity results based on: Ho: No Heteroskedasticity present and Ha: Heteroskedasticity present. The results of a Chi-squared (1) test are presented in the above table with both the Test Statistic as well as the p-value being quoted. The absence of Heteroskedasticity is rejected for the cases where the p-value < 0.1. Statistical test results based on regression equations with sum of the macroprudential policy choices included as the index value.

Appendix C

C.1. Additional Regression Results: Sum of Macroprudential Policy Choices with Instrumental Variables

Table C1 shows the results of regressing credit growth on its lagged value, the lagged value of the macroprudential policy choice index, lagged GDP growth and the lagged level of VIX. Table C1 focuses on the sum of macroprudential policy choices and the value of the macroprudential policy choice index is therefore indicative thereof. An instrumental variable (Regulatory Quality) is included to account for any measurement error, omitted variable bias or simultaneity bias that may occur due to the endogeneity of the macroprudential policy tool index. The coefficient on lagged credit growth is positive and statistically significant for the cases of the Latin American panel, Chile, Japan and Portugal in the second regression and positive and statistically significant for all the cases of the Latin American panel, Chile and Japan when considering the first regression equation. The sign on the interaction term between credit growth and the macroprudential policy tool index is negative and statistically significant for the case of Japan. This result is in line with the results in Table 7 where an instrumental variable is not included in the regression. The sign on the credit growth remains positive throughout in both regressions when moving from a regression with no instrumental variable to a regression including an instrumental variable with the exception of Portugal in the first regression.

Table C1 - Regression Results for Sum of Macroprudential Policy Changes with Instrumental Variables

Regression Results: Sum of Macroprudential Policy Choices									
Regression Equation	Coefficient	Variable	EU Panel 2000-2017	Latin American Panel 2000-2017	Chile 2000-2017	Colombia 2000-2017	Japan 2000-2017	Portugal 2000-2017	The UK 2000-2017
I	β_1	$Credit\_Growth_{n,t}$	0.0475	0.7445	0.8347	-3.4483	0.8239	-0.4831	1.4174
			(0.4433)	(0.3000)**	(0.1609)***	(27.3464)	(0.0426)***	(10.0712)	(0.9616)
	β_3	$Policy\_Rate\_Growth_{n,t}$	-2.5562	-0.0098	0.0058	0.3198	-0.0004	-0.0402	0.1161
			(25.6052)	(0.0336)	(0.0076)	(2.1981)	(0.0007)	(0.4571)	(0.1884)
	β_4	VIX_Growth_{t}	0.1452	0.0003	0.0013	0.0019	0.0000	0.0006	0.0002
			(1.4452)	(0.0006)	(0.0012)	(0.0124)	(0.0000)	(0.0046)	(0.0002)
	β_6	$Macroprudential\_Index_{n,t}$	87.9976	0.0557	0.4261	-1.1463	0.0011	-1.2291	0.1281
			(863.9345)	(0.2651)	(0.7022)	(7.4736)	(0.0079)	(9.6134)	(0.2074)
	β_7	$GDP\_Growth_{n,t}$	-0.2719	-0.0021	-0.0051	-0.0507	-0.0035	-0.0137	-0.0062
			(2.7695)	(0.0081)	(0.0116)	(0.3508)	(0.0005)***	(0.0846)	(0.0094)
		Constant	-8.9296	0.0022	0.0229	0.5619	0.0047	0.0597	-0.0099
			(89.8005)	(0.0168)	(0.0585)	(3.6548)	(0.0014)***	(0.3638)	(0.0319)
	R^2		.	0.3268	.	.	0.8964	.	.
	Observations		1695	347	62	47	58	62	70
	P-Value		1.0000	0.0000	0.0000	0.9986	0.0000	0.0084	0.0078
Regression Equation	Coefficient	Variable	EU Panel 2000-2017	Latin American Panel 2000-2017	Chile 2000-2017	Colombia 2000-2017	Japan 2000-2017	Portugal 2000-2017	The UK 2000-2017
II	β_1	$Credit\_Growth_{n,t}$	0.0206	0.8069	0.8060	3.7951	0.8651	0.7012	-0.4377
			(0.0578)	(0.0442)***	(0.0836)***	(13.5968)	(0.0539)***	(0.1104)***	(2.9311)
	β_2	$Credit\_Growth\_Macroprudential\_Index_{n,t}$	-27.9128	-0.0163	-2.3448	-15.0816	-0.2947	-5.9981	11.6455
			(43.2892)	(0.1008)	(2.2956)	(72.0871)	(0.1397)**	(5.1609)	(26.4411)
	β_3	$Policy\_Rate\_Growth_{n,t}$	-0.0534	-0.0038	0.0029	-0.2513	-0.0001	0.0553	-0.1542
			(0.5642)	(0.0042)	(0.0036)	(1.1199)	(0.0009)	(0.0311)*	(0.3937)
	β_4	VIX_Growth_{t}	0.0131	0.0002	0.0008	0.0023	0.0000	0.0000	0.0001
			(0.1728)	(0.0001)***	(0.0003)**	(0.0097)	(0.0000)	(0.0001)	(0.0002)
	β_5	$VIX\_Growth\_Macroprudential\_Index_{n,t}$	0.0199	0.0000	0.0008	-0.0215	0.0001	-0.0124	0.0144
			(0.2083)	(0.0001)	(0.0008)	(0.1007)	(0.0001)	(0.0122)	(0.0325)
	β_6	$Macroprudential\_Index_{n,t}$	14.8211	0.0163	0.2501	3.2948	0.0100	0.3212	-0.7174
			(205.07)	(0.0461)	(0.2400)	(15.5061)	(0.0289)	(0.3129)	(1.6166)
	β_7	$GDP\_Growth_{n,t}$	0.3511	-0.0002	0.0006	0.1136	-0.0033	-0.0136	0.0000
			(4.6741)	(0.0014)	(0.0034)	(0.5452)	(0.0006)***	(0.0058)**	0.0090
	β_8	$GDP\_Growth\_Macroprudential\_Index_{n,t}$	-2.4075	-0.0009	0	-0.5489	-0.0028	-0.0217	0.2596
			(33.8521)	(0.0037)	.	(2.5808)	(0.0137)	(0.0486)	(0.5837)
		Constant	-1.6460	0.0032	-0.0062	-0.7142	0.0041	0.0305	0.0411
			(25.1180)	(0.0095)	(0.0159)	(3.4183)	(0.0019)**	0.0128	(0.0729)
	R^2		.	0.6520	0.5952	.	0.9044	.	.
	Observations		1695	347	62	47	58	62	70
	P-Value		0.0000	0.0000	0.0000	0.9997	0.0000	0.0000	0.4526

Note: The R^2 value quoted is the adjusted R^2 value, the p-value quoted is associated with an F-test. The value quoted for each variable is the coefficient value with the value in parenthesis being the standard error.
* Represents statistical significance at 10%, ** at 5% and *** at 1%. (0, .) indicates results omitted due to cointegration.

Appendix D

D.1. Policy Instruments

Table D1 - Summary of Various Macroprudential Policy Instruments

		Definition
1	Countercyclical Buffers (CCB)	A requirement for banks to maintain a countercyclical capital buffer. Implementations at 0% are not considered as a tightening in dummy-type indicators.
2	Conservation	Requirements for banks to maintain a capital conservation buffer, including the one established under Basel III.
3	Capital Requirements*	Capital requirements for banks, which include risk weights, systemic risk buffers, and minimum capital requirements. Countercyclical capital buffers and capital conservation buffers are captured in their sheets respectively and thus not included here. Subcategories of capital measures are also provided, classifying them into household sector targeted (HH), corporate sector targeted (Corp), broad-based (Gen), and FX-loan targeted (FX) measures.
4	Leverage Limits (LVR)	A limit on leverage of banks, calculated by dividing a measure of capital by the bank's non-risk-weighted exposures (e.g., Basel III leverage ratio).
5	Loan Loss Provisions (LLP)	Loan loss provision requirements for macroprudential purposes, which include dynamic provisioning and sectoral provisions (e.g. housing loans).
6	Limits on Credit Growth (LCG)*	Limits on growth or the volume of aggregate credit, the household-sector credit, or the corporate-sector credit by banks, and penalties for high credit growth. Subcategories of limits to credit growth are also provided, classifying them into household sector targeted (HH), corporate sector targeted (Corp), and broad-based (Gen) measures.
7	Loan Restrictions (LoanR)*	Loan restrictions, that are more tailored than those captured in "LCG". They include loan limits and prohibitions, which may be conditioned on loan characteristics (e.g., the maturity, the size, the LTV ratio and the type of interest rate of loans), bank characteristics (e.g., mortgage banks), and other factors. Subcategories of loan restrictions are also provided, classifying them into household sector targeted (HH), and corporate sector targeted (Corp) measures. Restrictions on foreign currency lending are captured in "LFC".
8	Limits on Foreign Currency (LFC)	Limits on foreign currency (FC) lending, and rules or recommendations on FC loans.
9	Limits on the Loan-to-Value Ratio (LTV)	Limits to the loan-to-value ratios, including those mostly targeted at housing loans, but also includes those targeted at automobile loans, and commercial real estate loans.
10	Limits on the Debt-Service-to-Income Ratio (DSTI)	Limits to the debt-service-to-income ratio and the loan-to-income ratio, which restrict the size of debt services or debt relative to income. They include those targeted at housing loans, consumer loans, and commercial real estate loans.
11	Tax Measures	Taxes and levies applied to specified transactions, assets, or liabilities, which include stamp duties, and capital gain taxes.
12	Liquidity Requirements	Measures taken to mitigate systemic liquidity and funding risks, including minimum requirements for liquidity coverage ratios, liquid asset ratios, net stable funding ratios, core funding ratios and external debt restrictions that do not distinguish currencies.
13	Limits on the Loan-to-Deposit Ratio (LTD)	Limits to the loan-to-deposit (LTD) ratio and penalties for high LTD ratios.
14	Limits on Foreign Exchange Positions (LFX)	Limits on net or gross open foreign exchange (FX) positions, limits on FX exposures and FX funding, and currency mismatch regulations.
15	Reserve Requirements (RR)*	Reserve requirements (domestic or foreign currency) for macroprudential purposes. Please note that this category may currently include those for monetary policy as distinguishing those for macroprudential or monetary policy purposes is often not clear-cut. A subcategory of reserve requirements is provided for those differentiated by currency (FCD), as they are typically used for macroprudential purposes.
16	SIFI	Measures taken to mitigate risks from global and domestic systemically important financial institutions (SIFIs), which includes capital and liquidity surcharges.
17	Other	Macroprudential measures not captured in the above categories—e.g., stress testing, restrictions on profit distribution, and structural measures (e.g., limits on exposures between financial institutions).

Source: Alam et al. (2019)

Note: * indicates that subcategories are available and included in the iMaPP Database.

D.2. iMaPP Database and Other Existing Databases

Table D2 - Summary of Data Sources and Coverage of the iMaPP Database, constituting Databases as well as Other Macroprudential Databases

	Sources	Sample Period	Country Coverage	Instruments[1/]	Frequency	Text Info	MaPP Indexes[2/]
The iMaPP database	Databases 1-6 below, national sources, IMF official documents, and websites of the BIS and the FSB.	1990M1-2016M12	138	27	M	Yes	- Average LTV limit - T/L indexes by instrument
Databases Integrated in the iMaPP Database							
1 Lim et al. (2011)	IMF Financial Stability and Macroprudential Policy Survey, 2010	1990-2011	49	10	As reported	Yes	-
2 Lim et al. (2013)	National sources	2000M1-2013M7	39	12	M	Yes	- Institutional arrangement indexes
3 Global Macroprudential Policy Instrument (GMPI, 2013)	IMF survey to authorities	2013 and history	133	17	As reported	Yes	-
4 Shim et al. (2013)	National sources, and data from published papers when they are verified at national sources.	1990M1 - 2012M6	60	8	M	Yes	- T/L indexes by instrument
5 ESRB database	Country authorities	2013M1-latest	28 (Europe)	18	M	Yes	-
6 IMF's Annual Macroprudential Policy Survey	Country authorities	2016 and some history	141	69	As reported	Yes	-
Other Databases							
7 Crowe, Dell'Ariccia, Igan, and Rabanal (2013)	The IMF survey of central bankers and bank regulators.	2010 and history	36	3	A	Yes	-
8 Vandenbussche et al (2015)	National sources, IMF papers, and academic papers	late '90 - 2010	16 (Europe)	29	Q	Yes	- Intensity-adjusted T/L indexes by instrument
9 Dimova, Kongsamut, and Vandenbussche (2016)	Vandenbussche et al. (2015) and national sources.	2002Q1-2012Q4	4 (Europe)	6	Q	Yes	-
10 Kuttner and Shim (2016)	Extended Shim et al. (2013) for 1980M1-1989M12 and added housing taxes and subsidies	1980Q1-2012Q2	60	9	M	Yes	- T/L indexes by by instrument
11 Zhang and Zoli (2016)	Lim et al. (2013), and national sources	2000Q1-2013Q4	46	-	Q	No	- Aggregate T/L index
12 Bruno, Shim, and Shin (2017)	Shim et al. (2013) and national sources	2004Q1-2013Q4	12	-	Q	No	- Aggregate T/L indexes
13 Cerutti et al. (2017a)	The GMPI and official documents, cross-checking with Kuttner and Shim (2016), Crowe et al. (2011), and other surveys	2000-2013	119	12	A	No	- Number of instruments in place - Indicator of the use by instr.
14 Cerutti et al. (2017b)	The GMPI and national sources	2000Q1-2014Q4	64	9	Q	Yes	- T/L indexes by by instrument
15 Akinci and Olmstead-Rumsey (2018)	Lim et al. (2011), supplemented with Shim et al. (2013), national sources, the GMPI (2013), and Cerutti et al. (2017a,b)	2000Q1-2013Q4	57	7	Q	No	- T/L indexes by instrument
16 Budnik and Kleibl (2018)	Country authorities	1995-2014	28 EU member states	64	M	Yes	- NA, while tightening/loosening tags are available
17 Richter, Schularick, and Shim (2018)	Extended Shim et al. (2013), adding an intensity-adjusted LTV index	1990Q1-2012Q2	56	7	Q	Yes	- Intensity-adjusted LTV change index - T/L indexes by instrument

Source: Alam et al. (2019)

Note (As Defined by Alam et al. 2019):

1.) The classification of instruments differs across databases. The column "Instruments" shows the number of categories, including subcategories, available in each dataset, without standardizing classification.

2.) "T/L indexes" is the dummy-type indexes for tightening and loosening actions of macroprudential policy measures.

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