Effectiveness of macroprudential policies in Central and Eastern European countries

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Article**
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Abstract

This paper extends the available datasets on the use of macroprudential policies in CEE countries, and provides an econometric assessment of the effectiveness of these policies in mitigating financial stability risks associated with excessive credit growth before the global financial crisis. The model results imply that macroprudential policies were more effective in slowing credit to households than credit to the non-financial corporate sector, mainly because the latter had access to non-bank and cross-border credit in addition to domestic bank credit.

Keywords: macroprudential policy, financial stability, credit growth, systemic risk, CEE countries

1 INTRODUCTION

Despite the growing interest in macroprudential policy, we know very little about its effectiveness in preserving financial stability and mitigating systemic risks. This is largely because only a small number of countries have practical experience in conducting macroprudential policy, particularly during the boom stage of the cycle. Central and Eastern European (CEE) countries belong to the relatively small group that did use macroprudential policy in the run-up to the global financial crisis. As they are also relatively homogeneous in terms of financial sector structure, notably in the importance of foreign-owned banks as suppliers of credit to the private sector, CEE countries are an excellent case study for the analysis of macroprudential policy effectiveness.

Most empirical analysis that have considered CEE countries' macroprudential policies so far did so within larger country samples, and without analysing the impact of such policies on credit to specific sectors. Table A1 in the appendix summarises the findings of the main studies, which differ significantly in terms of analytical focus, data coverage, empirical frameworks and their most important findings. This paper examines CEE countries only, and distinguishes between credit to households and to non-financial corporate sectors. The sample covers 11 countries – Bulgaria, Croatia, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia and Slovenia – over the period from Q1 2000 to Q3 2013. Due to the small number of country relative to time observations, we estimate panel regressions using the OLS method and cross-section SUR panel-corrected standard errors, as suggested by Beck and Katz (1995).

To conduct this analysis, we compiled a dataset on the use of macroprudential policies in CEE countries. We supplemented data from official sources with findings from a central bank questionnaire specially designed for this purpose and several research papers dealing with these countries. Because of the great variety of macroprudential tools within and across countries, we had to construct special variables to capture the timing and intensity of the use of such tools.

Our main finding is that, in the run-up to the global financial crisis, macroprudential policies were probably more successful in slowing down credit growth to

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households than to the non-financial corporate sector. The reason is that household credit growth was more significantly affected by a larger number of macroprudential tools than the growth of credit to non-financial corporations. For the latter, it was also much easier to get funding from sources that were not subject to macroprudential measures, such as non-bank financial institutions and direct cross-border credit.

Considering the relatively risky lending policy in some of the CEE banks in the observed period, these findings also imply that their active macroprudential policies helped these countries to preserve the stability of their banking systems. This additionally confirms the relevance of macroprudential measures for mitigating systemic crisis episodes. From the public policy perspective, this is especially important because such episodes usually result in huge fiscal costs, which in some cases could exceed 55% of GDP (Laeven and Valencia, 2012), while the average decline in GDP per capita amounts to 11.5% (Reinhart and Rogoff, 2014). In that context, another important aspect of countercyclical macroprudential policy is that it also reduces the duration of crisis episodes (Gupta, Mulas-Granados and Baldacci, 2009).

The paper is divided in four parts. Section 2 describes data sources and model variables, in particular macroprudential variables constructed for panel regressions. Section 3 lays out the empirical framework and discusses the estimation results. Section 4 concludes.

2 MODEL VARIABLES AND DATA

The variable whose behaviour we are trying to explain is credit to the private sector in CEE countries. We look separately at total credit to households and total credit to the non-financial corporate sector. Total credit to individual sectors includes not only domestic bank credit but also that provided by domestic non-bank financial institutions and banks from other countries. For households, domestic banks provide the bulk of credit, while for the corporate sector the latter two sources are also important. These variable are expressed as either quarterly rates of change (in real terms and seasonally adjusted), or as ratios to GDP.

The main variables with which we are trying to explain credit growth are lagged credit growth, GDP growth, changes in interest rates, and the use of various macroprudential tools, which are the focus of this study. Lagged credit growth accounts for inertia in the evolution of credit; GDP growth is a proxy for fundamental determinants of credit growth such as real income; interest rates are a proxy for the price of credit; and macroprudential tools are exogenous regulatory interventions aimed at limiting the pace of credit growth for financial stability reasons. We expect higher credit growth in the past and stronger GDP growth to be positive correlates of credit growth, and higher interest rates and tighter macroprudential tools to be negative correlates. We collected the macroeconomic data from central banks (official sources and direct communication), the ECB, Eurostat and the IMF.

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Unlike monetary policy instruments such as interest rates, macroprudential tools come in a much greater variety. Most are not continuously adjusted over time. Using them in an empirical analysis therefore requires two related tasks: first, constructing time series for different macroprudential instruments that would reflect, to the greatest extent possible, their "intensity"; and second, aggregating instruments of disparate nature into a small number of composite indicators that affect economic behaviour on similar margins.

Underlying this exercise is the even deeper issue of the availability of information and data on different macroprudential tools, many of which were not even known under this name ten or more years ago. To overcome this initial problem, we collected information through direct communication with central banks, asking them to fill a questionnaire on the use of different macroprudential tools through time from Q1 2000 to Q1 2013. The starting point for designing the questionnaire was the database presented by Lim et al. (2011) that asked questions about the time of introduction, tightening, loosening, other adjustments and termination of different tools, meaning that we obtained the information about these measures through time. We requested information specifically about instruments such as loan-to-value ratios, debt-to-income ratios, limits on foreign currency lending, credit growth restrictions, maturity mismatch restrictions, general reserve requirements, other reserve requirements, capital requirements, risk weights, and provisioning requirements. According to Lim et al. (2011, 2013) and our own analysis of macroprudential policy in individual CEE countries, these measures are the ones that been most often used for preventing systemic risks and increasing financial systems' resilience. Finally, we supplemented the questionnaire answers with data from the IMF, central banks' annual reports and the analysis by Lim et al. (2011) and Geršl and Jašova (2014).

To use these data in panel regressions, we identified similar measures from different countries and created three groups of indicators:

1) Binary variables, which take on the value of 1 in periods when a given measure is used, and 0 otherwise. If all countries use a given measure, the variable takes the value of 1 when a given measure is "tighter" than average, and 0 otherwise. One shortcoming of this approach is that it cannot differentiate the intensity of a measure beyond a binary above/below average value. Another is that it cannot account for tightening or loosening of measures.
2) "Step function" variables, which increase or decrease depending on whether a given measure is getting tighter or looser. For instance, for minimum reserve requirements (RR) we set the value of the step function at zero for $RR \leq 2\%$, which is a typical value in CEE, and then increase it in steps of 25 basis points for each percentage point increase in the minimum RR set by authorities. For capital adequacy ratios (CAR), we set the value of the step function at zero for $CAR \leq 8\%$, and then increase it in steps of 50 basis points for each percentage point increase in the minimum CAR. The resulting step function is a relatively good proxy for the intensity of given macroprudential measures. Medas et al. (2013) used a similar approach.

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3) Actual values, in percent or percentage points, for prudential tools such as general reserve requirements, loan-to-value, or debt-to-income ratios.

A further complication in comparing macroprudential tools across countries is the varying scope, calculation basis, and other features of different instruments. For instance, the coverage, allocation basis, calculation method and other details differ greatly for reserve requirements, and even more so for capital adequacy ratios. To reduce the bias these subtle but important differences might induce in regression estimates, the panels assessing the impact of macroprudential tools on credit growth use binary and step function variables (table 1), while the panels assessing the impact of macroprudential tools on different types of credit use the step variables and actual values of individual tools (table 2).

In addition to constructing the variables assessing the intensity of macroprudential tools by type, we aggregated them in individual countries in order to assess how the total intensity of macroprudential policy may have evolved over time. Instruments included in the calculation were administrative credit growth restrictions, capital requirements, limitations on foreign currency lending, limits on maturity mismatches, marginal reserve requirements, general reserve requirements, and provisioning requirements. In the panels assessing the impact of macroprudential policy on credit to households, we also included loan-to-value ratios and debt service ratios.

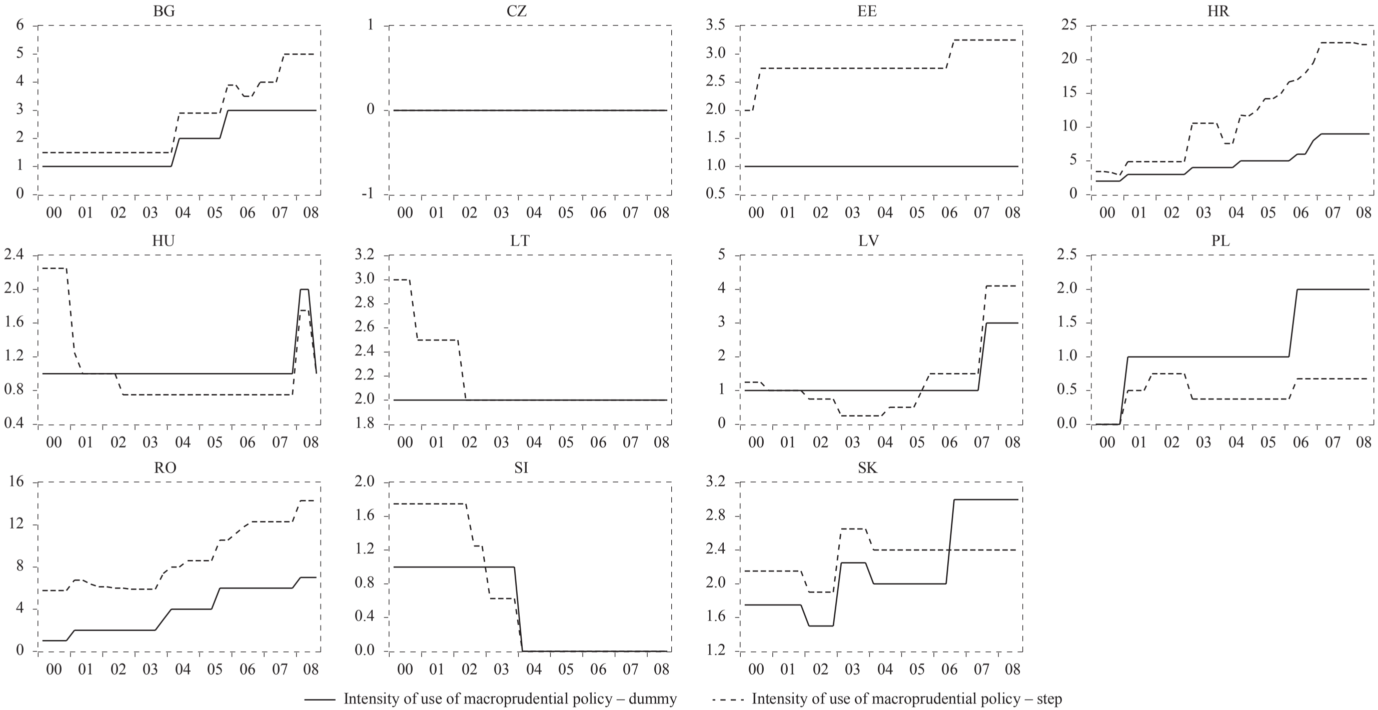
We constructed two aggregate indicators of macroprudential policy intensity: first a simple sum of the values of binary variables, indicating the number of measures used at a given point in time (solid line in figure 1); and second, a sum of the step function variables, indicating changes in overall intensity of underlying measures (dashed line). In the pre-crisis period, Croatia leads in terms of both categories, followed by Bulgaria, Hungary and Romania. The Czech Republic used no macroprudential instruments in this period, while Slovenia only used the reserve requirement higher than 2% before adopting the euro in 2007.

The same picture emerges from other databases on macroprudential policy, such as the one based on the IMF's Financial Stability and Macroprudential Policy Survey presented by Lim et al. (2011).

Greater use of macroprudential policies in CEE than elsewhere in Europe can be largely explained by the financial sector structure and the overall level of financial development in this region. The financial sector in CEE is characterised by foreign ownership of domestic banks: foreign bank subsidiaries account for up to 95% of domestic banking sector assets. This share increased rapidly in the late 1990s and the early 2000s. Prior to that, banks in CEE had little experience with risk assessment and financial markets were repressed or non-existent. Financial liberalisation, which included banking deregulation (or, in some countries, the establishment of commercial banking in the first place) and the removal of capital controls, led to a surge in credit growth. For countries in the sample, credit to the private sector increased on average by 13-47% per annum from 2000 to 2008.

FIGURE 1

Aggregate indicators of macroprudential policy intensity in CEE, 2000-13



Note: BG = Bulgaria, CZ = Czech Republic, EE = Estonia, HR = Croatia, HU = Hungary, LT = Lithuania, LV = Latvia, PL = Poland, RO = Romania, SI = Slovenia, SK = Slovak Republic.

Source: Author's calculations.

As domestic saving rates were low and credit demand was high due to rapid economic growth, much of the credit was sourced from parent banks in Western Europe. According to the BIS consolidated banking statistics, gross cross-border bank flows to CEE countries in the sample thus amounted on average to 9% of GDP per year during 2002-07, or, in cumulative terms, 38% of GDP on average over this period. Apart from being attracted by the relatively strong economic activity in these countries, foreign banks were willing to supply so much credit to the region also partly because CEE countries were in the process of EU accession, which strengthened investors' confidence in local legal systems and economic policies.

Large capital inflows in an environment of shallow financial markets quickly led to macroeconomic and financial stability imbalances, including high current account deficits (often in the range of 10-15% of GDP) and very rapid growth of property prices (Rohatinski, 2009). The solution was to try to control credit growth with alternative tools, ranging from administrative credit controls, to reserve requirements or to prudential measures aimed at specific groups of borrowers. Macroprudential policy in CEE was thus born out of necessity, to manage a credit boom rapidly getting out of hand.

3 EMPIRICAL FRAMEWORK AND ESTIMATION RESULTS

Unlike traditional panels, where the country sample is large and time period short, our panels are longitudinal, as they have more period than country observations. According to Beck and Katz (1995), using the FGLS to estimate parameters in such cases can result in a significant underestimation of parameter variability, i.e. "overconfidence". Following their approach, we estimate our panels using the OLS method and calculate cross-section SUR panel-corrected standard errors, which are more reliable than standard errors computed using the FGLS method.

Two other econometric problems were the use of a lagged dependent variable and country fixed effects. The standard tests commonly used for panels with a larger number of cross-sections are not reliable for longitudinal panels. The literature dealing with this type of panel (i.e. Kristensen and Wawro, 2003; and Beck and Katz, 2004) shows that in such cases it is appropriate to apply the lagged variable as the method for removing serial correlation, while the problem of accounting for the unobserved heterogeneity across countries and controlling for omitted, time-invariant macroeconomic variables that may differ from country to country could be solved by using fixed effects and calculating panel-corrected standard errors.

The main estimating equation is:

$$y_{i,t} = \alpha + \mu_i + X_{it}\beta + \varepsilon_{i,t}, \quad (1)$$

where

y = quarterly growth rate of household or non-financial corporate sector credit;
i = 1...11 countries;
t = Q1 2000 – Q3 2008;

μ = country fixed effects;
α = constant term;
$\boldsymbol{X}_{it}$ = matrix of control variables, with
x_1 = lagged credit growth (households or corporate sector);
x_2 = GDP growth (quarterly rate);
x_3 = interest rate on loans (households, or corporate sector), change of quarterly average;
x_4 = macroprudential variables (level and/or step variables described above);
ε = error term.

Any attempt to explain dynamics of credit growth with adjustments in interest rates and macroprudential measures raises the issue of endogeneity, as policy adjustments depend on the evolution of credit growth. To mitigate this problem, we lagged interest rate and macroprudential variables by one quarter and compared coefficients from regressions with and without lagged macroprudential variables, as proposed by Nier et al. (2012). The signs, levels and significance of estimated coefficients did not differ much. We interpret these results as evidence that endogeneity between credit growth and adjustments of macroprudential instruments is not a major problem in our sample. Nevertheless, following Nier et al. (2012), we interpret the estimated coefficients on macroprudential variables with caution, paying greater attention to their sign than magnitude, especially in the case of composite indicators.

Regression results are presented in tables 1 and 2, and tables A2 and A3 in the appendix.

Table 1 presents estimates of the overall impact of macroprudential policy on credit growth. The estimated coefficients on lagged credit growth and real GDP growth are both positive and statistically significant, in line with theoretical predictions. The coefficients on lagged interest rates are negative but not statistically significant. In other words, past changes of interest rates do not seem to be significant determinants of current credit growth. To measure the overall impact of macroprudential policy on credit growth we used the binary and step function variables described above. When macroprudential policy was tighter than average in the past quarter (i.e. the binary variable took on the value of 1), credit growth slowed significantly only in the case of household loans. When macroprudential policy was tightening in the previous quarter (i.e. the step function was increasing), credit growth slowed significantly in the case of household loans.

Table 2 presents estimates of the impact of individual macroprudential tools on credit growth. We consider nine macroprudential tools: administrative limits on credit growth, capital requirements, limits on currency mismatches, marginal reserve requirements, provisioning requirements, general reserve requirements, increased risk weights, debt-to-income ratios, and loan-to-value ratios. With the exception of risk weights and capital and provisioning requirements, which enter

the regression as step variables as they are difficult to compare due to their specific nature, the remaining six macroprudential tools are used in levels (i.e. per cent or percentage points). Growth of credit to households responds, with varying degrees of significance, to changes in administrative limits on credit growth, general reserve requirements, debt-to-income ratios, and loan-to-value ratios. Growth of credit to the non-financial corporate sector responds significantly to changes in administrative limits on credit growth, limits on currency mismatches, as well as provisioning and general reserve requirements.

Table 1

Impact of overall macroprudential policy on credit growth

	Loans to household sector		**Loans to corporate sector**	
	Spec. 1	**Spec. 2**	**Spec. 3**	**Spec. 4**
Constant	3.1541 (0.8938)**	2.9472 (0.7543)*	2.8112 (0.5792)*	2.8919 (0.5257)**
Loan (–1)	0.6637 (0.0681)*	0.6655 (0.0701)*	0.2618 (0.0669)*	0.2602 (0.0669)**
GDP	0.4432 (0.1567)*	0.3302 (0.1140)*	0.7261 (0.2003)*	0.7290 (0.2000)**
Interest rate (–1)	–1.1239 (0.4253)*	–1.0660 (0.4292)**	–0.1613 (0.2490)	–0.1763 (0.2490)
Total level of macroprudential policy – d (–1)	–0.4958 (0.2277)**		0.1538 (0.0572)	
Total level of macroprudential policy – step (–1)		–0.1694 (0.0775)**		0.0660 (0.0572)
Observations:	264	264	332	332
R^2:	0.75	0.75	0.33	0.33
F-statistic:	55.8	55.68	10.98	10.98

Note: Total level of macroprudential policy – d represents the sum of binary variables or the number of used macroprudential measures and instruments in a given moment. Total level of macroprudential policy – step represents the sum of constructed step indicators for individual macroprudential measures. All estimations are made using OLS; period SUR panel-corrected standard errors in parentheses.

** significant at 1%, ** significant at 5%, *** significant at 10%.*

Source: Author's calculations.

These results suggest that macroprudential policy was probably more effective in slowing the growth of credit to households than the growth of credit to non-financial corporations before the crisis: as can be seen from table 3, household credit growth responded significantly to a larger number of macroprudential measures. These findings are in line with findings presented by Cerutti, Claessens and Laeven (2015) who also show that the negative relationship between macroprudential policies is stronger for households than for the corporate sector. This result is not surprising when one considers that households in CEE generally had access predominantly to bank credit, while other sources of funding, such as domestic

non-bank financial institutions and banks in other countries, were much more easily available to non-financial corporations. In particular, domestic subsidiaries of foreign banks, which were subject to macroprudential regulation, often directed their corporate customers in CEE to their parent banks in home countries in Western Europe, or to domestic non-bank financial institutions in CEE, which were often established as separate entities operated by parent banks.

Table 2

Impact of individual macroprudential measures on credit growth

	Credit growth limit – level (–1)	Capital requir. – level (–1)	Limited currency mismatch – level (–1)	Marginal reserve require. – level (–1)	Increas. provis. requir. – step (–1)	General reserve requir. – level (–1)	Increas. risk weights – step (–1)	DSI – level (–1)	LTV – level (–1)
Loans to household sector	–0.0780 (0.0440)***	–0.6255 (1.5199)	–1.3082 (0.8867)	0.0011 (0.0131)	–0.5950 (0.5827)	–0.2438 (0.1424)***	–0.2339 (0.4523)	–0.0920 (0.0397)**	–0.0360 (0.0108)*
Loans to corporate sector	–0.0956 (0.0561)*	–0.2122 (0.7119)	3.2680 (1.3952)*	0.0201 (0.0144)	0.9993 (0.4000)**	0.0268 (0.0691)	0.6130 (0.5168)		

Note: This table presents only the estimated coefficients on macroprudential variables; for complete results see appendix tables A2 and A3.
Level presents the actual value of a specific instrument (i.e. general reserve requirement of 2%).
All estimations are made using OLS; period SUR panel-corrected standard errors in parentheses.
** significant at 1%, ** significant at 5%, *** significant at 10%.*

Source: Author's calculations.

4 CONCLUSION

Findings in this paper indicate that, contrary to the widespread belief that they have limited practical experience with macroprudential policy, countries in CEE used a wide variety of macroprudential tools before the global financial crisis – and before these tools were even known as "macroprudential". To show this, we compiled a quarterly database of macroprudential measures used in 11 CEE countries from 2000 to 2013, and compared it with existing macroprudential policy databases for other European countries.

The main motivation for the use of macroprudential tools in CEE was to slow credit growth in an environment of heavy capital inflows and monetary policy frameworks largely focusing on exchange rate stability. In the language of the external policy "trilemma", with free capital flows and not always very flexible exchange rates, many CEE countries could not use domestic interest rates to try to offset the macroeconomic and financial stability effects of capital inflows, and therefore had to rely on alternative, more direct tools to control credit growth.

In using macroprudential tools, CEE countries seem to have been more successful in slowing credit growth to the household sector than to non-financial corporations. The main reason seems to be that the latter could turn to financial institutions other than banks, which were not affected by restrictive credit growth meas-

ures, or to banks abroad. Both these sources were often institutionally related to foreign-owned bank subsidiaries in CEE. This points to the issue of financial institutions' attempts to circumvent macroprudential measures through less regulated segments of the financial system. To be effective, macroprudential tools would thus have to cover comprehensively all key segments of the domestic financial system, and would even require some international cooperation by relevant policymakers.

Disclosure statement

No potential conflict of interest was reported by the author.

APPENDIX

TABLE A1
Summary of the empirical literature on the effectiveness of macroprudential policies

Study	Sample	Period	Research questions	Main findings
Lim et al. (2011)	49 countries actively using macroprudential instruments	2000-10	Effectiveness of macroprudential instruments in achieving their objectives. Factors affecting the choice of instruments. Circumstances in which instruments are used.	Many instruments can effectively reduce systemic risk in the financial sector. Their effectiveness does not necessarily depend on the stage of economic development or the type of exchange rate regime. Emerging markets with fixed exchange rate regimes or managed floats use macroprudential measures more often. Emerging markets facing large capital inflows, with shallow financial markets, and those with bank-centric systems also use macroprudential tools more often. Macroprudential instruments can be just as effective when used in advanced economies with flexible exchange rate regimes.
Quereshi et al. (2011)	51 EMEs	1995-2008	Can macroprudential policy and capital controls help enhance financial stability in periods of large foreign capital inflows? Construct new indices for macroprudential measures dealing with currency risk and capital controls for the financial sector.	Macroprudential policy and capital controls reduce the riskiness of external borrowing and domestic foreign currency lending. Policies that do not discriminate on the basis of currency or residency can also be effective in mitigating excessive credit growth.
Schou-Zibell, Albert and Song (2012)	41 EMEs in Asia, Latin America and Europe, plus 18 advanced economies	1993-2008	Identify most important determinants of financial soundness and stability (capital adequacy, asset quality, earnings, profitability) in EMEs.	The relationship between financial soundness indicators and macroeconomic indicators varies depending on the stage of economic and financial development.

Study	Sample	Period	Research questions	Main findings
Tovar, Garcia-Escribano and Martin (2012)	Five Latin American economies	January 2003 – April 2011	Effectiveness of reserve requirement in reducing credit growth. Construct a composite indicator of reserve requirements used in different countries. Study how credit to the private sector, market and policy interest rates, and exchange rates react to changes in average reserve requirements, marginal reserve requirements and other macroprudential instruments.	Reserve requirements and other macroprudential instruments led to a slowdown in growth of bank credit to the private sector. Panel data VAR including a binary macroprudential policy variable, industrial production and private credit growth also suggests that macroprudential tools limit credit growth.
Vandenbussche, Vogel and Detragiache (2012)	16 countries in Central, Eastern and Southeastern Europe	Early 2000s – 2011 Q1	On a panel of 16 countries, the authors explore the impact of macroprudential policy measures on housing price inflation.	Tightening of minimum capital adequacy requirements and nonconventional measures used to guarantee liquidity, such as marginal reserve requirements on foreign funding sources and excessive credit growth, contributed to a slowdown in housing prices.
Nier et al. (2012)	15 developed economies and 21 emerging market economies		How macroprudential measures affect credit activity, house prices, economic activity and capital inflows? How these effects depend on the stages of economic cycle?	Capital requirements and reserve requirements contribute to a slowdown in credit growth. Loan-to-value and debt-to-income ratios effective in EMEs.
Medas et al. (2013)	25 economies	2000-11	Effectiveness of loan-to-value and debt-to income ratios; greater risk weights; and higher provisioning requirements in restraining credit growth and real estate prices. Construct variables that reflect the intensity of use of individual macroprudential measures as these are tightened or loosened.	Greater risk weights and higher loan-to-value and debt-to income ratios are successful in dampening growth of credit and real estate prices.
Cerutti, Claessens and Laeven (2015)	119 countries	2000-13	Relationship between the use of macroprudential policies and developments in credit and housing markets. Effectiveness of macroprudential policies in dampening financial cycles.	Emerging countries use macroprudential policies more often, especially FX related measures, while advanced countries primarily rely on borrower-based measures. These policies generally result with lower credit growth, primarily for households. Macroprudential policies can help manage financial cycles, but they work better in the boom than in the bust phase.

Table A2

Impact of macroprudential measures on credit to households

Dependant variable	Total loans to households, quarterly rate of change											
Independent variables	**Spec. 1**	**Spec. 2**	**Spec. 3**	**Spec. 4**	**Spec. 5**	**Spec. 6**	**Spec. 7**	**Spec. 8**	**Spec. 9**	**Spec. 10**	**Spec. 11**	**Spec. 12**
Constant	2.1445 (0.6331)***	7.3095 (12.6094)	3.2270 (0.7506)***	2.1130 (0.6504)***	3.4908 (0.7629)***	2.0969 (0.6423)***	2.7606 (0.7940)***	4.8425 (1.6484)*	2.1485 (0.6482)*	3.6955 (0.7852)*	3.1541 (0.8936)*	2.9472 (0.7544)**
Total bank loans to households (–1)	0.689206 (0.0691)***	0.6818 (0.0697)***	0.60624 (0.0731)***	0.6875 (0.0684)***	0.6208 (0.0705)***	0.6880 (0.0691)***	0.6865 (0.0691)***	0.6392 (0.0712)*	0.6886 (0.0691)*	0.6017 (0.1100)*	0.6637 (0.0681)*	0.6655 (0.0701)**
GDP	0.3231 (0.1178)***	0.3250 (0.1159)***	0.3263 (0.1127)***	0.3293 (0.1172)**	0.3087 (0.1105)**	0.3296 (0.1171)**	0.3326 (0.1179)**	0.3644 (0.1165)*	0.3244 (0.1188)*	0.3104 (0.4110)**	0.4432 (0.1567)*	0.3303 (0.1140)**
Interest rate (–1)	–1.1365 (0.4285)***	–1.1136 (0.4309)**	–1.0755 (0.4182)**	–1.1424 (0.4365)*	–1.0422 (0.4123)**	–1.1470 (0.4283)*	–1.1531 (0.4275)*	–0.9861 (0.4294)**	–1.1264 (0.4406)**	–1.0315 (0.4706)*	–1.1239 (0.4253)*	–1.0660 (0.4292)
Credit growth limit – level (–1)	**–0.0780 (0.0444)****											
Capital requirements – level (–1)		–0.6254 (1.5199)										
DSI – level (–1)			**–0.09203 (0.0396)****									
Limited currency mismatch – level (–1)				–0.0681 (1.4510)								
LTV – level (–1)					**–0.0360 (0.0107)*****							
Marginal reserve requirement – level (–1)						0.0011 (0.0130)						
Increased provisioning requirement – step (–1)							–1.3082 (0.8867)					
General reserve requirement – level (–1)								–0.2438 (0.1423)***				
Increased risk weights – step (–1)									–0.2339 (0.4523)			

Dependant variable	Total loans to households, quarterly rate of change											
Independent variables	**Spec. 1**	**Spec. 2**	**Spec. 3**	**Spec. 4**	**Spec. 5**	**Spec. 6**	**Spec. 7**	**Spec. 8**	**Spec. 9**	**Spec. 10**	**Spec. 11**	**Spec. 12**
LTV – DSI – step (–1)										–1.5683 (0.4706)*		
Total level of macroprudential policy – d (–1)											–0.4958 (0.2277)**	
Total level of macroprudential policy – step (–1)												–0.1695 (0.0775)**
Observations:	264	264	264	264	264	264	264	264	264	264	264	264
R2:	0.7561	0.7559	0.7620	0.7554	0.7653	0.7555	0.7559	0.7615	0.7556	0.7663	0.7579	0.7559
F-statistic:	55.1444	55.0802	56.9440	54.9450	58.0034	54.9443	55.0799	59.7977	54.9866	58.3142	55.6793	55.6801
Prob(F-statistics)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

All estimations are made using OLS; period SUR panel-corrected standard errors in parentheses.
** significant at 1%, ** significant at 5%, *** significant at 10%.*

Source: Author's calculations.

Table A3

Impact of macroprudential measures on credit to the non-financial corporate sector

Dependant variable	**Total loans to corporate sector, quarterly rate of change**								
Independent variables	**Spec. 1**	**Spec. 2**	**Spec. 3**	**Spec. 4**	**Spec. 5**	**Spec. 6**	**Spec. 7**	**Spec. 8**	**Spec. 9**
Constant	3.1887 (0.4945)*	4.8499 (5.7966)	2.9284 (0.4770)*	3.0756 (0.4851)***	3.0066 (0.4817)*	2.8570 (0.8403)*	3.0828 (0.5016)*	2.8113 (0.5792)*	2.8920 (0.5257)*
Total loans to corporate sector (–1)	0.2611 (0.0690)*	0.2662 (0.0676)*	0.2566 (0.0663)*	0.2619 (0.0669)***	0.2512 (0.0671)*	0.2625 (0.0667)*	0.2519 (0.0692)*	0.2618 (0.0670)*	0.2602 (0.0669)*
GDP	0.7025 (0.2058)*	0.7105 (0.1999)*	0.7101 (0.1986)*	0.7196 (0.1994)*	0.7179 (0.1981)*	0.7161 (0.1997)*	0.7152 (0.2567)*	0.7261 (0.2003)*	0.7290 (0.2000)*
Interest rate (–1)	–0.2158 (0.2474)	–0.2166 (0.2481)	–0.0398 (0.2496)	–0.1995 (0.2476)	–0.1454 (0.2465)	0.1867 (0.2503)	0.2017 (0.2587)	0.1613 (0.2521)	0.1763 (0.2490)
Credit growth limit – level (–1)	–0.0956 (0.0561)***								
Capital requirements – level (–1)		–0.2122 (0.7119)							
Limited currency mismatch – level (–1)			3.2680 (1.3952)**						
Marginal reserve requirement – level (–1)				0.0201 (0.0144)					
Increased provisioning requirement – step (–1)					0.9993 (0.4000)**				
General reserve requirement – level (–1)						0.0268 (0.0691)			
Increased risk weights – step (–1)							0.6130 (0.5168)		
Total level of macroprudential policy – d (–1)								0.1538 (0.1617)	
Total level of macroprudential policy – step (–1)									0.0660 (0.0572)

Dependant variable	Total loans to corporate sector, quarterly rate of change								
Independent variables	**Spec. 1**	**Spec. 2**	**Spec. 3**	**Spec. 4**	**Spec. 5**	**Spec. 6**	**Spec. 7**	**Spec. 8**	**Spec. 9**
Observations:	332	332	332	332	332	332	332	332	332
R2:	0.3272	0.3252	0.3436	0.3265	0.3322	0.3254	0.3313	0.3264	0.3264
F-statistic:	11.0096	10.9180	11.8549	10.9770	11.2630	10.9201	10.9329	10.9763	10.9726
Prob(F-statistics)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

All estimations are made using OLS; period SUR panel-corrected standard errors in parentheses.
** significant at 1%, ** significant at 5%, *** significant at 10%.*

Source: Author's calculations.

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