

MACROPRUDENTIAL TOOLS, CREDIT GROWTH, AND FINANCIAL STABILITY: LESSONS FROM CENTRAL AND EASTERN EUROPEAN COUNTRIES

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Abstract

The turbulences that banking systems confronted over the past decades emphasized the importance of a sound macroprudential policy. Therefore, our study analyses the use and the types of macroprudential tools adopted by the authorities, in Central and Eastern European countries, from 2000 to 2018. Our findings reveal a degree of asymmetry within the regulatory framework. More exactly, the frequency, but also the nature of prudential instruments was not symmetrical in the Central and Eastern European countries. The heterogeneity also stands out from a time-varying perspective. We attribute this pattern to the different levels of financial stress that banking systems have been subjected to. Generally, we notice that the macroprudential tools aimed at taming the financial cycle.

Keywords

Prudential framework, macroprudential tools, credit growth, Central and Eastern Europe, financial crisis

JEL Classification

E58, G01, G21

Introduction

The global financial crisis (GFC) and the European debt crisis (EDC) have highlighted major deficiencies threatening the financial stability. These extreme events brought forth issues such as over-indebtedness, and the pro-cyclical nature of lending that generated, and upraised systemic risk. Under these conditions, a process of disintermediation has begun in most Member States of the European Union (EU). This process has been more obvious in the emerging countries of the Central and Eastern Europe (CEE). To mitigate

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negative effects, regulators committed to financial stability through several channels, i.e., financial assistance packages, quantitative easing, and strengthening of the prudential framework.

The obvious underestimation of systemic risk in 2008 has determined authorities to shift their attention from the microprudential to the macroprudential dimension of regulation. The financial crisis represented a turning point for the global prudential conduct, when macroprudential policy became the main tool for strengthening financial stability. Several attempts have been made at establishing an universal definition of macroprudential policy. In 2011, the Financial Stability Board, the Bank for International Settlements, and the International Monetary Fund drew up the Report on Macroprudential Policy Tools and Frameworks, took on the effort to establish a definition (FSB, 2011). Following the definition provided, macroprudential policy resorts to prudential tools to limit systemic risk and avoid disruptions in the provision of financial services. In other words, macroprudential tools (i) reduce financial imbalances and temper financial cycles; and (ii) address the sources of contagion that jeopardize the functioning of the financial system. The macroprudential and microprudential approaches are complementary to each other. Broadly put, the macroprudential perspective adds the system-wide stability objective to the microprudential individual safety – base.

The apparent novelty of the macroprudential policy triggered a wave of interest from academia. A consistent body of studies dealt with the effects and usefulness of macroprudential instruments for risk mitigation. Two strands of literature prevail. On one hand, some studies test the effects of macroprudential policies on credit growth, and, on the other, several works deal with the interactions between macroprudential policies and other variables. The former group of studies built on the negative effects of the excessive credit growth on systemic risk (Claessens et al., 2013; Aikman et al., 2014; De Jonghe et al., 2016; Deli and Hasan, 2016; Gómez et al., 2017; Banerjee and Mio, 2017; Choi et al., 2018; Alam et al., 2019; Akinci and Olmstead-Rumsey, 2018). According to these studies, the effectiveness of macroprudential instruments is time-varying and hinges on bank characteristics. Among the authors investigating the prudential policies in the CEE states we mention: Gersl and Jasova (2014), Epure et al. (2017), Dumičić (2018), and Vandenbussche et al. (2018). The latter addresses the interactions between macroprudential policies and several other variables. Most studies reveal that macroprudential tools are effective in limiting bank risks: Ezer (2019), Hoque et al. (2015), Altunbas et al. (2017), Pfeifer et al. (2017), Lim et al. (2011), Angelini et al. (2012), and Texeira et al. (2014).

As we notice, the literature acknowledges the importance of the prudential framework. Specifically, the prudential tools ensure the resilience and stability of banking systems. They limit the accumulation of excessive risks by credit institutions, increase the security of depositors' funds, promote market discipline and the stability of the banking system as a whole.

Considering the importance of the prudential policy, our paper has several objectives. First, we examine the dynamic nature of the overall prudential and macroprudential policy in the CEE region. We use a large prudential dataset (Budnik and Kleibl, 2018), on the basis of which we construct two prudential indicators. Second, we analyse the specific macroprudential tools adopted by each CEE country. Third, we emphasize how and if

macroprudential tools curbed credit growth. Our paper is closer to those of Pochea and Nițoi (2021), Geršl and Jašová (2014), Vandenbussche et al. (2018), and Dumičić (2018), who also investigated the macroprudential policy in the CEE region.

The rest of the paper is organized as follows. Section 2 unveils the data and the methodology framework. Section 3 presents and discusses the results. We conclude in the latter section.

1. Data and methodology

In order to achieve our goals, we construct two indicators, i.e., the overall prudential index and the macroprudential index. To build these indicators, each regulatory measure adopted by the authorities will receive the value of one, if it is a tightening measure, and minus one, if it is an easing measure. We cumulate the monthly values to obtain time-varying indices in the following way:

$$\delta_{i,j} = \sum_{i,j=1}^n \alpha_{i,j} + \beta_{i,j} \quad (1)$$

where δ is the overall prudential index, α represents a tightening measure, and β represents an easing measure. The macroprudential index is computed in a similar manner. Afterwards, the prudential and the macroprudential indices will be plotted alongside the credit to non-financial sector's annual growth rate.

In order to analyse each country's macroprudential tools, we will depict the monthly number of the tightening tools and the monthly number of the easing instruments. The character and number of macroprudential measures will be highlighted in a figure, in correspondence with the dynamics of credit to the non-financial sector and with the tensions generated by the GFC and the EDC over the period of August 2007 to July 2012. The regulatory measures are hand-collected from the Budnik and Kleibl (2018) database. Over the last decade, numerous studies have built macroprudential databases (Lim et al., 2011; Alam et al., 2019; Lombardi and Siklos, 2016; Cerutti et al. 2016). However, we choose Budnik and Kleibl (2018) database from several reasons. First, it covers all the European Union countries. Second, by and far, it covers a large number of prudential instruments over the period from 1995 to 2018, compared to other databases. Third, the database describes each measure and its objective.

From the Budnik and Kleibl (2018) database, we select all the prudential instruments and the tools that have a macroprudential character, in accordance with the reports of the national authorities. The monthly dynamics of credit to the non-financial sector is based on data extracted from the International Monetary Fund Financial Statistics. The analysed period spans from January 2000 to December 2018. In addition, in order to get a more accurate picture of the prudential policy, we will make brief references to the general characteristics of the microprudential policy as well.

2. Results and discussion

Prudential indices paths in CEE

The CEE countries implemented a large number of prudential tools over the period from 2000 to 2018. More precisely, they adopted 576 prudential instruments, of which 376 tightened the framework, and 200 eased it (Budnik and Kleibl, 2018). In comparison, the countries of the old EU Member States used fewer prudential instruments, namely 392, of which 114 were implemented in Greece. Out of these, 289 were meant to tighten the regulatory framework, and 103 were meant to ease it. With the exception of Greece, which is an atypical case, given the unprecedented problems it has faced, we note that the old EU countries have been much less dynamic in taking prudential action compared to the CEE countries. We can explain this phenomenon from the perspective of them having more developed and stable financial systems, than those belonging to emerging economies.

Hereinafter, Figure no. 1 highlights the dynamic nature of the prudential and macroprudential indices and plots the credit to non-financial sector growth. Generally, the findings reveal significant differences in how our country sample resorted to prudential tools. In Bulgaria, 52 prudential measures have been implemented. Out of these, 25 were macroprudential. The dynamics of the cumulative prudential indices indicate a series of turning points (Fig. 1). In the first part of the interval, i.e., 2000-2004, the authorities did not use prudential instruments. Between 2004 and 2006, we can see a tightening of regulations. The tightening was determined by the credit boom, when annual growth rates reached peak values of about 70%. Starting with the first part of 2006, we notice an easing tendency of the prudential framework. During the GFC and the EDC, the dynamics of the indices is marked by a few turning points. At the beginning of the crisis period, we see a tightening of the indices, followed by a period of easing, and in the last part of the crisis, the indices stagnate. Between 2014 and 2018, the trend of the prudential framework reveals tougher requirements. The dynamics of credit to the non-financial sector indicates a sharp decline in early 2006, driven by internal factors, i.e., a more restrictive macroprudential framework (see Fig. 2). The second period of decline begins in 2008, caused by the turmoil in the financial markets. Since 2010, the credit dynamic is negative.

In Croatia, the authorities have made extensive use of prudential instruments. During the analysed period, 102 measures were initiated. Out of these, 58 were macroprudential. The dynamics of cumulative indices can be delimited in several periods (Fig. 1). From 2003 to 2008, we observe an accentuated tightening pattern. A turning point occurs in 2008, which indicates an easing of regulations. In general, this trend is maintained for the macroprudential index until 2012. Starting with 2012, the dynamics of the macroprudential indices reveals a status quo. The prudential index indicates several turning points after 2009. The credit to non-financial sector growth rate reveals a significant upward path until 2002. Between 2002 and 2008, we notice a V-shaped pattern for the credit growth. During and after the GFC, the growth rate narrows significantly.

Czechia has implemented 24 prudential policies, 13 of which were macroprudential. With one exception, all measures have been taken in order to tighten the regulatory framework. The dynamics of cumulative indices is extremely relevant in this regard (Fig. 1). The macroprudential index does not indicate any change until 2014. The prudential index reveals an upward trend until 2014, a trend which, correlated to the macroprudential index, indicates tightening microprudential measures. Starting with 2014, we observe, for the three indices, a strong upward trend, which pinpoints the adoption tightening measures. Compared to other countries, the dynamics of credit to the private sector growth rate does not reflect such a sharp rise and fall cycle. The maximum point is reached in 2007, when growth rates reach about 20% and the decrease caused by financial turmoil reaches a minimum threshold close to 0%. At the end of the analysis period, starting with 2014, we see a slight increasing of the credit growth rate. Considering that the prudential framework has tightened, we can consider this trend sustainable.

The Estonian authorities have resorted to prudential instruments only to a small degree. During the analysed period, 14 prudential measures were adopted, of which four were of a macroprudential nature. Surprisingly, the dynamics of indices reflect a tendency to relax prudential requirements during the GFC and the EDC, especially with regard to microprudential instruments (Fig. 1). The dynamic of the non-financial credit brings forth some interesting episodes. More exactly, from annual growth rates of about 20% in 2004, we can see that, at the end of 2006, growth rates reach 80%. Subsequently, starting with 2007, we observe a strong downward dynamic, as the growth rates become negative at the beginning of 2009. Starting with this moment, with small variations, the annual rates stagnate around values close to zero. The dynamics of the period 2004 - 2008, of accentuated growth, followed by a major collapse, is specific to a boom-bust cycle.

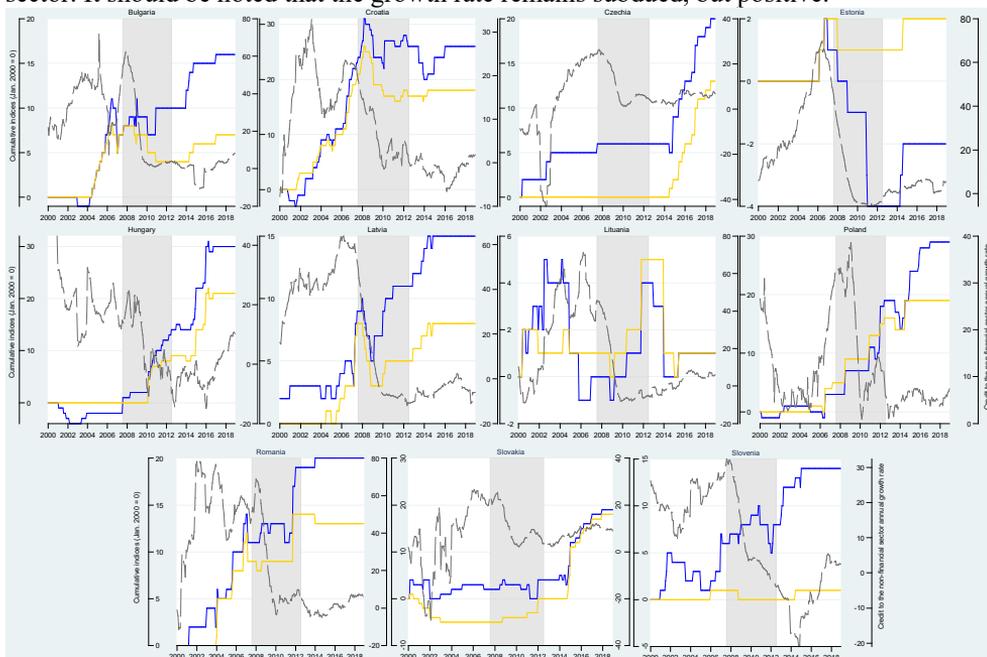
In Hungary, 68 prudential measures have been adopted. Some of the measures had both a microprudential and macroprudential nature. In Hungary, the dynamics of the cumulative prudential indices can be delimited in two periods (Fig. 1). Between 2000 and 2007, prudential policy did not undergo major changes. Since 2007, the evolution of the indices indicates a tightening of regulations. We highlight that the tightening is much more prominent after 2010, for both the prudential and macroprudential indices. Over the period from 2010 to 2017, the annual dynamics of credit to the private sector is negative and indicates a high degree of volatility. We assume that the numerous prudential measures adopted during this period have a pivotal role in the credit growth volatility.

The Latvian authorities have taken a more active approach to prudential instruments. During the analysed period, 43 prudential measures were adopted. The dynamics of the indices reflect a tightening of prudential requirements during 2004 - 2008. Subsequently, we observe a turning point, when prudential requirements are eased. In 2010, the regulatory framework is tightened again, both from a macroprudential and microprudential perspective. The dynamics of credit to the private sector follow a pattern similar to Estonia, i.e., annual growth rates of over 60% between 2004 and 2007, a sudden decrease until 2009, and stagnation around a range close to zero from 2010 to 2018.

In Lithuania, 45 prudential measures were adopted between 2000 and 2018. Out of these, 19 were macroprudential. The dynamics of cumulative prudential indices, presented in Fig. 1, reveals numerous turning points for the prudential and macroprudential index,

which indicates measures that tighten the prudential framework, followed by easing measures.

Poland has made an extensive use of prudential instruments. Specifically, during the analysed period, 67 prudential measures were adopted, of which 29 were macroprudential. The dynamics of cumulative indices clearly indicates the tightening of the prudential framework (Fig. 1). Prudential restrictions have been applied more intensively since 2006. Most likely, these measures have been taken to counter the credit boom. During the GFC and the EDC, the regulatory framework was consolidated. At the end of 2014, we see a turning point in the dynamics of indices. Overall, both indices follow a similar dynamic. As we observe, the turmoil caused by the GFC and the EDC has led to a sharp and rapid decline in the annual growth rate of credit to the non-financial sector. It should be noted that the growth rate remains subdued, but positive.



Notes: the dynamics of prudential indices is shown on the left axis, and the credit to the non-financial sector growth ratio, on the right axis; the shadowed area corresponds to the tensions of the GFC and the EDC; blue reflects the prudential index; yellow reflects the macroprudential index; magenta reflects the credit index; the gray dotted line reflects the annual growth rate of credit to the non-financial sector.

Figure no. 1: Dynamics of cumulative prudential indices in the EU Member States of CEE

In Romania, the authorities adopted 52 prudential measures. Some of the measures were both microprudential and macroprudential. The dynamics of cumulative prudential indices reflects a tightening of regulations during 2003–2007 (Fig. 1). Most likely, this tightening was countercyclical, given that the annual growth rate of credit to the non-financial sector was over 70%. At the beginning of 2007, we notice a turning point that

indicates an easing of prudential regulation. During the GFC and the EDC, changes in prudential framework were minor. In 2011, the authorities adopted a series of measures in order to tighten prudential requirements. In Romania, the credit to non-financial sector growth rate followed an upward trend from 2000 to 2003, reaching peak values of about 80% per annum. Between 2003 and 2008, the growth rates remain high, but we notice some turning points. We relate this pattern to the prudential framework. During the GFC, the growth rates decrease significantly and remains subdued after 2010.

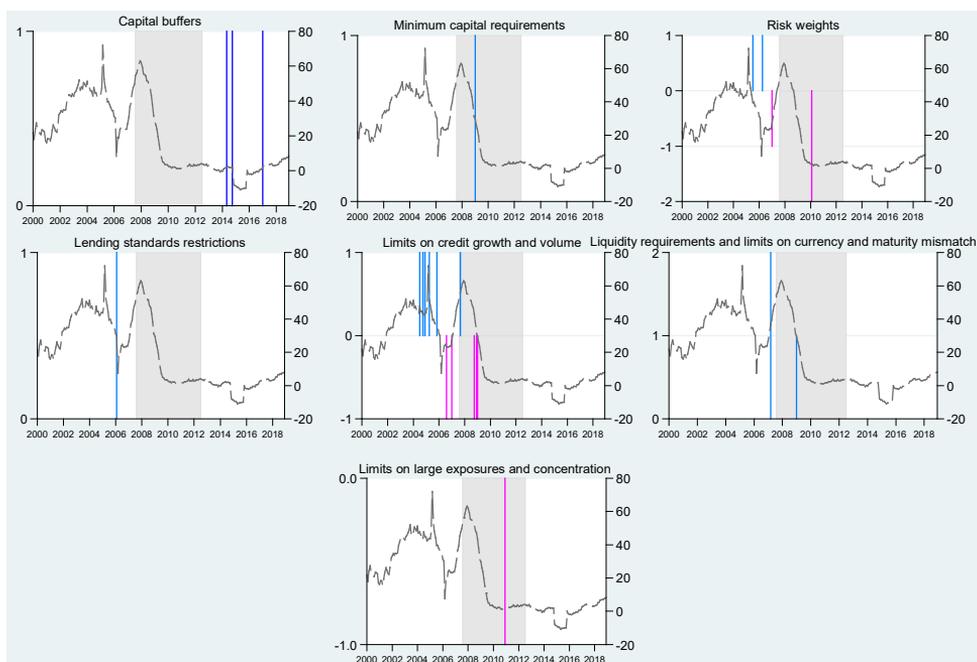
Slovakia adopted about 73 prudential measures during the sample period. The dynamics of the cumulative indices reflects differences in the prudential conduct, correlated to the analysed interval (Figure no. 1). At the beginning of the period, we observe a series of measures that eased loan requirements. Most likely, these decisions were determined by the negative growth rates of credit. Subsequently, the dynamics of the macroprudential index stagnated. A substantial change in prudential policy takes place in 2014. From now on, the dynamics of the prudential indicators reflect a major upward trend, which shows a tightening of the prudential framework, both from a macroeconomic and microeconomic perspective. After 2004, the dynamics of credit to the private sector does not reflect such a sharp rise and fall cycle. The maximum point is reached in 2007, when growth rates reach about 20% and the decrease caused by financial turmoil reaches a minimum threshold close to 0%. At the end of the analysis period, starting with 2014, we notice a slight increasing trend of the credit reaching annual rates of 10%. Considering that the prudential framework has tightened we can consider this trend sustainable.

In Slovenia, 48 prudential measures have been adopted. Out of these, only three were macroprudential. These observations also emerge from the dynamics of cumulative indices. Specifically, the prudential index has an upward trend, while the macroprudential index and has a static dynamic. Since 2006, the prudential policy has continued to tighten. This trend continued even after global and European financial tensions eased. In fact, although private sector credit growth rates have not reached a high level as in the Baltic countries, i.e., the maximum rate was about 30%, at the end of 2006, the decline cycle is very steep. The downward trend begins at the end of 2007 and holds until the end of 2014. The situation can be explained by endogenous factors to the Slovenian banking system. It faced a banking crisis (OECD, 2013), with non-performing loans reaching a maximum of 17.4% in 2013 (IMF, 2014). In this context, the authorities preferred microprudential instruments.

Macroprudential tools adopted in CEE countries

Hereinafter, we deepen our analysis. Specifically, we analyse the macroprudential measures adopted by each of our sample countries. As we can see in Figure no. 2, the Bulgarian authorities have used numerous tools to target macroprudential objectives. In 2014 banks were required to set up reserves to conserve capital and cover systemic risk. In addition, in January 2017, the authorities imposed additional buffers for 10 systemically important institutions in the banking system. With regard to minimum capital requirements, in order to strengthen the robustness of the banking system, banks were advised to maintain a rate of capital over 10%. The use of risk weights indicates a

countercyclical nature of lending. In Bulgaria, the most widely used category of macroprudential instruments concerned limits on credit growth and volume. These measures have been taken to tame the credit cycle. Initially, in 2004, the minimum reserves requirements related to banks' liabilities were increased. Subsequently, in April 2005, reserve requirements were extended to banking assets. The central bank required banks that expand their credit portfolios by more than 6% in a quarter to open an unpaid deposit with the central bank twice the amount above the aforementioned threshold. These requirements were tightened in November 2005. The sharp decline in the dynamics of credit led the authorities to abandon bank asset requirements in January 2007. The tightening episode of September 2007 involved higher requirements related to banks' liabilities. Similarly, the last two easing episodes of December 2008 and January 2009 aimed at easing the minimum reserves applied to bank liabilities. In order to correlate maturity positions, liquidity requirements have been tightened. Macroprudential instruments have mainly targeted banks' capital and liquidity. Restrictions were also imposed on banks in terms of profit distribution between 2009 and 2012, in order to reduce capital outflows.

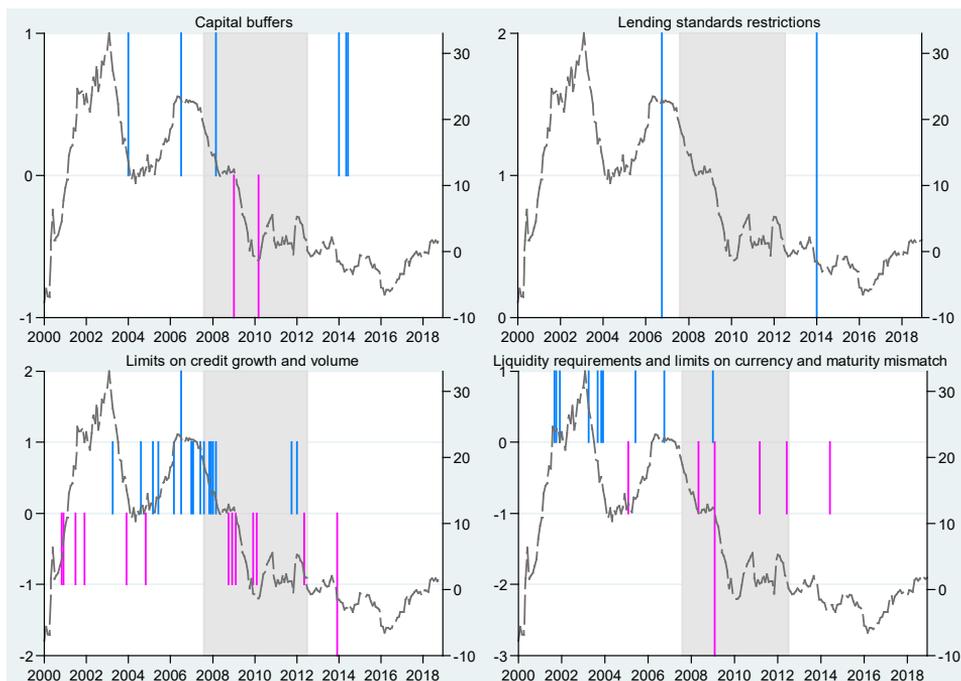


Notes: the left axis shows the monthly number of macroprudential measures adopted, and the right axis, the credit to the non-financial sector growth ratio; the positive/negative values correspond to the tightening/easing episodes; the shadowed area corresponds to GFC and EDC.

Figure no. 2: Macroprudential tools implemented in Bulgaria

From a macroprudential perspective, in Croatia, the authorities used instruments that targeted banks' capital, assets and liquidity (Figure no. 3). In January 2004, banks with

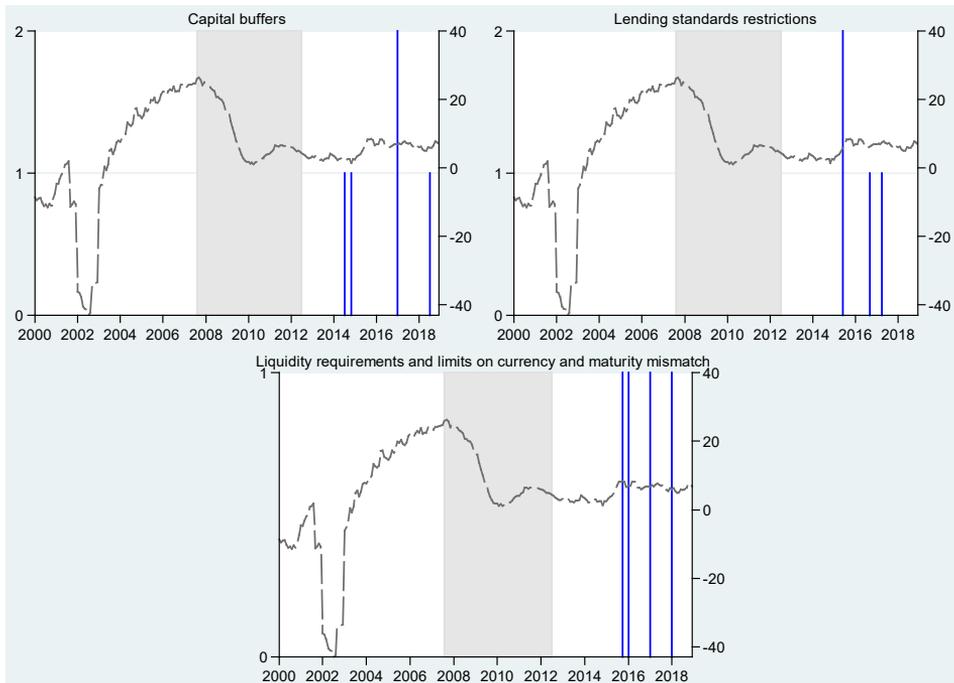
high growth rates, i.e., of more than 20% for certain balance sheet items, where requested to establish capital buffers. Similarly, in March 2008, additional capital requirements over the 12% rate were introduced for banks whose investments exceeded certain limits. These restrictions were lifted in January 2009 and March 2010, respectively. In 2014, the authorities imposed banks to set up capital conservation and systemic risk buffers. The restrictions on lending standards were aimed at introducing limits on the LTV and DSTI ratios in October 2007. In January 2014, limits were set on interest rates charged by banks on mortgages and consumer loans. As we see in Fig. 3, the most used instruments by the Croatian authorities concern minimum reserves related to bank liabilities and assets. At the beginning of the analysis period, the authorities eased, in four consecutive decisions, the minimum reserves related to banks' liabilities from 28.5% to 19%. The main purpose of these decisions was to increase bank liquidity. In April 2003, the authorities decided to impose restrictions on banks' assets. Specifically, the authorities have required banks whose growth rate of loan portfolios exceeds 16% to invest in central bank securities. Given the strong countercyclical effect of this measure on credit, these restrictions were abandoned in December 2003. Between 2005 and 2006, the authorities used only the tightening of minimum reserves related to banks' liabilities to counter the positive credit cycle. In 2007, reserves related to banking assets were reintroduced. Following the bankruptcy of Lehman Brothers, restrictions on capital buffers were removed and minimum reserves related to bank liabilities were reduced. The two measures that increased the minimum reserves related to liabilities were determined by depreciation pressures. The latter measures, in 2012 and 2014, aimed at reducing the minimum required reserves related to bank liabilities. Liquidity measures were mainly aimed at setting up reserves to cover foreign currency exposures. For example, between 2001 and 2005, these requirements increased from 10% to 50%. The last measures aimed at easing liquidity conditions. Microprudential instruments have targeted banks' capital and liquidity.



Notes: the left axis shows the monthly number of macroprudential measures adopted, and the right axis, the credit to the non-financial sector growth ratio; the positive/negative values correspond to the tightening/easing episodes; the shadowed area corresponds to GFC and EDC.

Figure no. 3: Macprudential tools implemented in Croatia

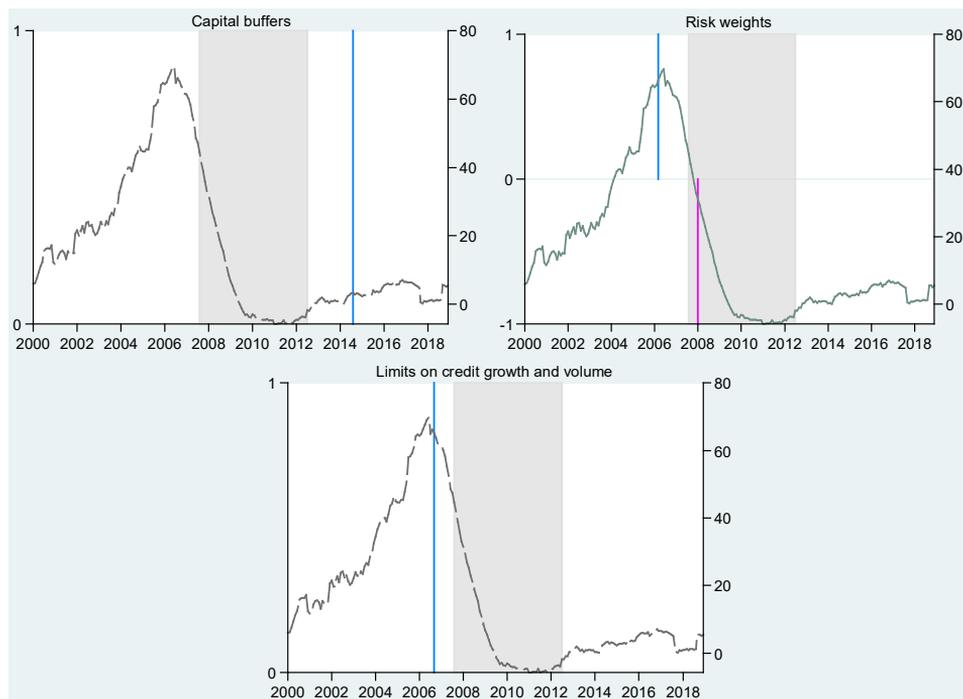
As we see in Figure no. 4, in Czechia, macroprudential objectives were achieved using instruments from three categories. With regard to capital buffers, the authorities have introduced requirements for the establishment of capital conservation and systemic risk buffer. Banks were also asked to set up countercyclical buffers. The measures on lending standards aimed at establishing limits on the LTV ratio for real estate and mortgage loans. Given the credit dynamics, the measures were not adopted countercyclically, but to strengthen the resilience of the banking system. Liquidity requirements have been gradually tightened, starting with October 2015. Specifically, the authorities have imposed limits on the liquidity coverage ratio (LCR). The microprudential measures mainly concerned capital targeting instruments, i.e., minimum capital requirements, loan-loss provisions and risk weights, as well as limits on large exposures and concentration.



Notes: the left axis shows the monthly number of macroprudential measures adopted, and the right axis, the credit to the non-financial sector growth ratio; the positive/negative values correspond to the tightening/easing episodes; the shadowed area corresponds to GFC and EDC.

Fig. 4: Macroprudential tools implemented in Czechia

In Estonia, as we see in Figure no. 5, the authorities have tightened the requirements regarding capital buffers. Specifically, in 2016, banks set up capital reserves to cover systemic risk. The risk weights reflect a countercyclical trend against non-financial credit growth. In March 2006, the risk weight for real estate loans, used to calculate capital adequacy, increased from 50% to 100%. In December 2008, in hindsight of the significant slowdown in annual non-financial sector credit growth rates, the authorities reduced the risk weight from 100% to 60%. The decision of the central bank to increase the minimum reserve requirements from 13% to 15% is also included in the category of macroprudential measures. Microprudential instruments involved minimum capital requirements, high exposures limits, and risk weights.

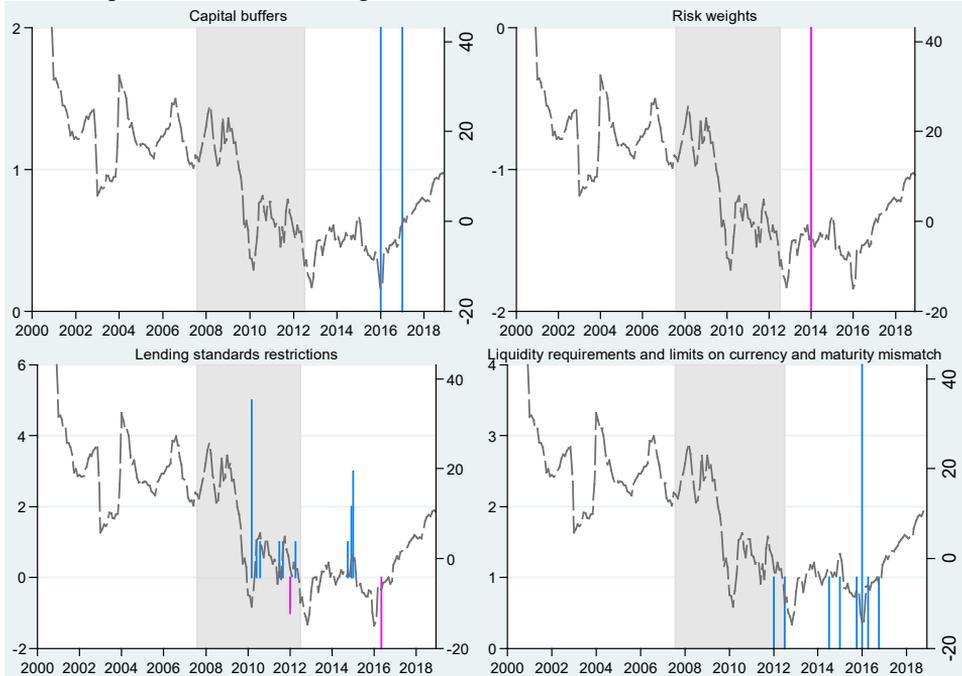


Notes: the left axis shows the monthly number of macroprudential measures adopted, and the right axis, the credit to the non-financial sector growth ratio; the positive/negative values correspond to the tightening/easing episodes; the shadowed area corresponds to GFC and EDC.

Figure no. 5: Macprudential tools implemented in Estonia

In Hungary, similar to the majority of the sample countries, capital reserve requirements were adopted (Figure no. 6). Banks used capital buffers to cover systemic risk and to conserve capital. For reasons of harmonization with the Capital Requirements Regulation, the risk weights for capital adequacy were eased in early 2014. A much more dynamic approach stands out in terms of lending standards and liquidity requirements. In 2010, a number of measures were taken to tighten lending standards. Specifically, in March 2010, limits on the LTV ratio were adopted for both domestic and foreign currency loans. In June 2010, limits on the DSTI ratio were also adopted. In August 2010, the authorities banned foreign currency lending. The measure was reversed in July 2011. In September 2011, debtors were allowed to repay mortgages in foreign currency at preferential exchange rates. At the beginning of 2012, LTV limits were relaxed for domestic currency loans. As we see, an important objective of the prudential measures adopted to change lending standards was to target foreign currency loans and foreign exchange risk. At the end of 2014 and the beginning of 2015, the limits for the LTV and DSTI ratio were tightened again. A number of changes were put in place in May 2016. On the one hand, LTV limits were relaxed, on the other, DSTI limits were tightened. Analysing, the prudential policy measures against the annual credit dynamics, we observe movements of the credit at the moments when certain decisions were adopted. Liquidity requirements

were exclusively aimed at tightening regulations. These requirements covered short-term liquidity, the liquidity of foreign exchange positions, the liquidity coverage rate, as well as the financing rate of mortgages. Microprudential instruments have mainly targeted capital. In this respect, in general, the minimum capital requirements, risk weights and loan-loss provisions have been tightened.

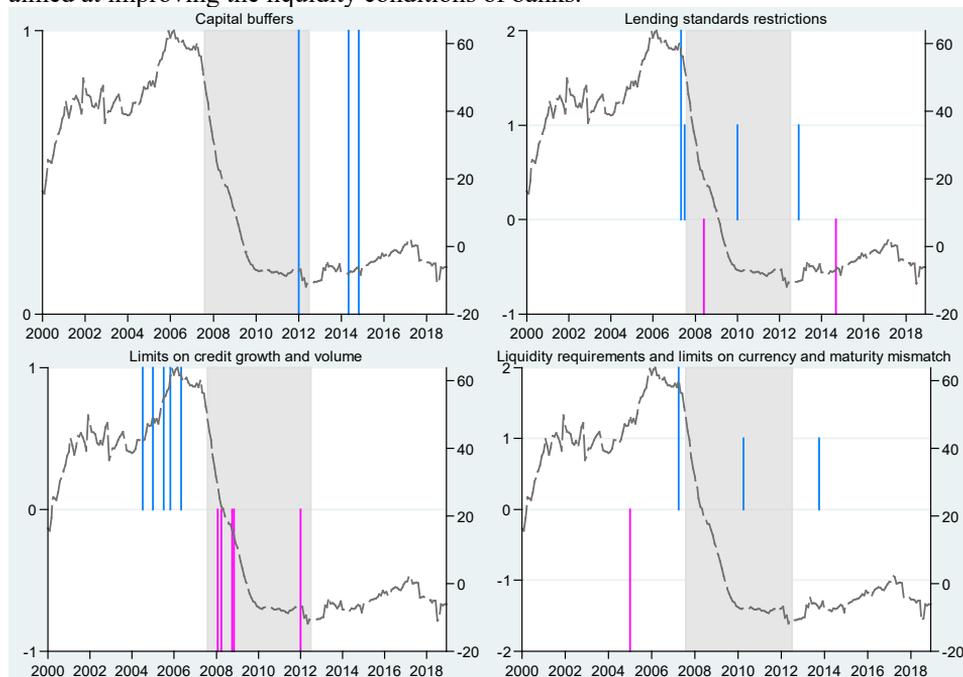


Notes: the left axis shows the monthly number of macroprudential measures adopted, and the right axis, the credit to the non-financial sector growth ratio; the positive/negative values correspond to the tightening/easing episodes; the shadowed area corresponds to GFC and EDC.

Figure no. 6: Macprudential tools implemented in Hungary

From a macroprudential perspective, the Latvian authorities required banks to set up capital conservation buffers. Additional reserves have also been imposed on banks undertaking activities with non-residents. The measures were adopted in 2012 and 2014 (Figure no. 7). Most likely, the dynamics of credit to the non-financial sector have been the trigger for the macroprudential measures taken to change lending standards and increase lending. In the category of measures aimed at changing lending standards, the authorities have implemented loan-to-value (LTV) and debt service-to-income (DSTI) limits. In the category of limits on credit growth and volume, the authorities resorted to increasing/decreasing the reserves requirements related to banks' liabilities. During the period of credit boom, authorities have tried through various means to limit credit growth. The last category of macroprudential instruments concerns liquidity requirements. In a first stage, in 2005, the requirements for banks' euro foreign exchange positions were

eased, and put back in place in 2007. The last two measures, adopted in 2010 and 2013, aimed at improving the liquidity conditions of banks.

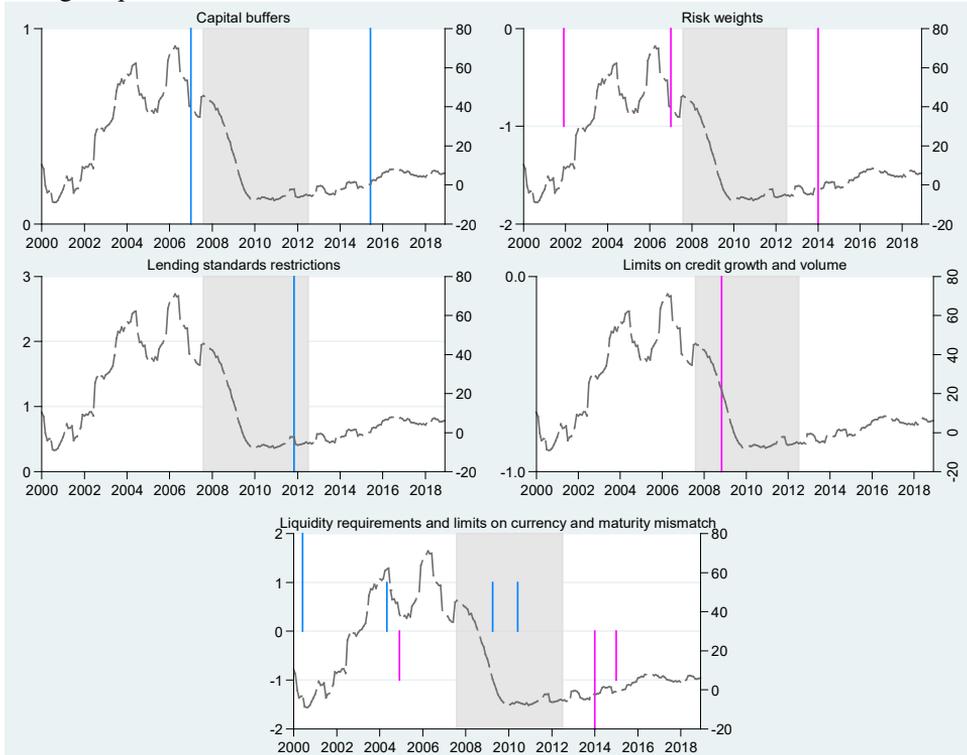


Notes: the left axis shows the monthly number of macroprudential measures adopted, and the right axis, the credit to the non-financial sector growth ratio; the positive/negative values correspond to the tightening/easing episodes; the shadowed area corresponds to GFC and EDC.

Figure no. 7: Macprudential tools implemented in Latvia

Figure no. 8 depicts the macroprudential instruments used by the Lithuanian authorities. Regarding capital targeting instruments, we observe divergent approaches. While capital buffers were tightened, risk weights were relaxed. The authorities tightened their lending standards, by introducing limits on LTV and DSTI ratios, at the end of 2011. Given that these measures were adopted at a time when the dynamics of credit was negative, we presume that the measure aimed to strengthen the robustness of the banking system. At the end of 2008, when tensions generated by the GFC reached their peak and liquidity in banking systems narrowed considerably, the authorities reduced the level of minimum reserves requirements for banks' liabilities. Liquidity requirements were tightened at the beginning of the analysis period. A similar trend is observed during the GFC, when in 2009 and 2010, requirements for liquidity risk management were introduced and, respectively, banks were required to set up liquidity reserves to cover the liquidity gap in times of crisis. The latest measures to ease liquidity conditions regarding open currency positions have been adopted as a result of the Capital Requirements Directive, i.e., Directive 2013/36/EU. In the case of microprudential instruments, the authorities used

instruments that targeted minimum capital requirements, loan loss provisions, and limits on high exposures and concentration.

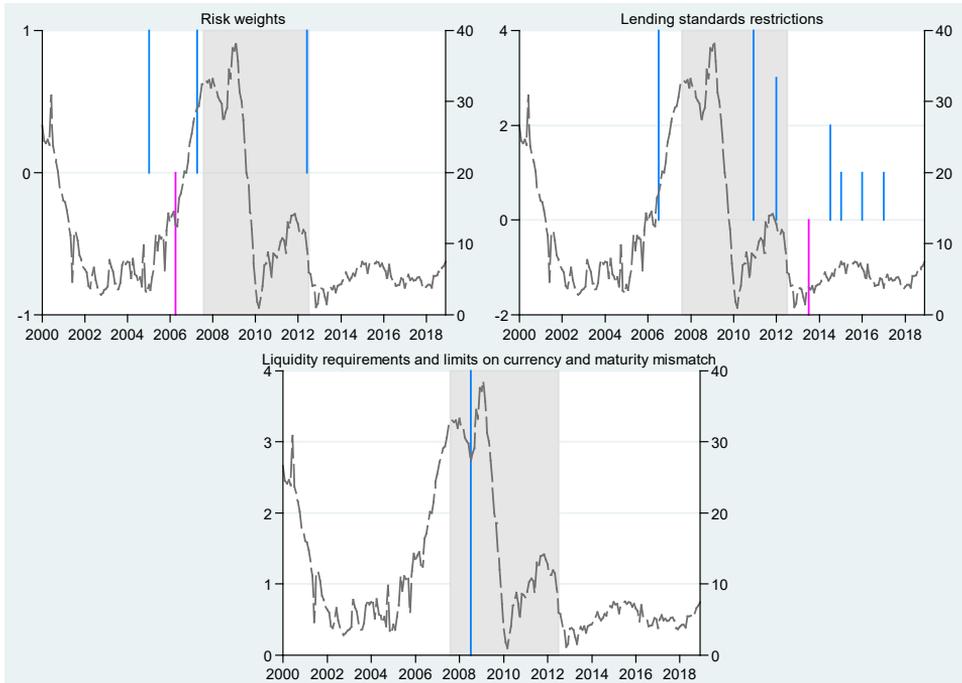


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Figure no. 8: Macprudential tools implemented in Lithuania

Three categories of tools were used by the Polish authorities to achieve the macroprudential objectives (Figure no. 9). At the beginning of 2005, the risk weights used for capital adequacy for mortgages were tightened. About a year later, in March 2006, the authorities allowed banks to set their own LTV limits for mortgages, which allowed for an easing of risk weights. In April 2007, the authorities tightened the weights for foreign currency loans to persons with income in a currency other than that in which the loan was granted. The last measure in this category, adopted in June 2012, aimed to establish a 100% weight for foreign currency mortgages. Similar to Hungary, these measures have been taken to limit foreign currency loans and, implicitly, currency exposure. As we see in Fig. 9, restrictions on lending standards have generally been tightened. The first such measures were adopted in June 2006. Authorities asked banks to set their own limits for the LTV ratio. Also, in calculating the DSTI ratio for loans granted in a currency other

than the one in which the income is received, the banks had to take into account three scenarios: (i) a 20% depreciation of the Polish zloty; (ii) an interest rate equivalent to that of a similar zloty loan; (iii) the amount of the loan is 20% higher than the requested amount. The measures adopted in June 2006 also required banks to carry out regular stress tests to take into account a 30% depreciation of the national currency and an increase in the interest rate by 400 basis points. Despite these measures, we can see that the annual credit growth rate has increased sharply. In December 2010, the authorities adopted four more measures that tightened lending standards. All four measures imposed tougher requirements for foreign currency loans. In January 2012, minimum thresholds on the LTV ratio for banks were imposed. Limits have also been imposed on the DSTI ratio for foreign currency loans. These restrictions were countercyclical in nature, leading to a decrease in the annual credit growth rate (Fig. 9). In June 2013, some of the standards on foreign currency loans were relaxed, i.e., banks were allowed to set their own limits on the DSTI ratio, and the stress requirements for determining this ratio were changed. As of January 2014, the authorities have imposed a limit on the LTV ratio, i.e., 95% for newly granted loans, and DSTI. LTV limits were gradually tightened until 2017, when they reached 80%. Additionally, the LTV ratio could be 100 basis points higher if the loan is collateralized with bank deposits or treasury bonds. Liquidity requirements were tightened through four measures adopted in July 2007. Two of these measures aimed at imposing minimum long-term liquidity requirements and two aimed at tighter short-term liquidity requirements. Microprudential measures targeted, in particular, capital measures, i.e., minimum capital requirements, capital buffers, loan-loss provisions, risk weights, as well as limits on large exposures and concentration. It should be noted that between 2011 and 2015, the Polish authorities imposed restrictions on the distribution of profits to banks. These restrictions were established according to the capital adequacy ratios and the weight of foreign currency loans in the portfolio.

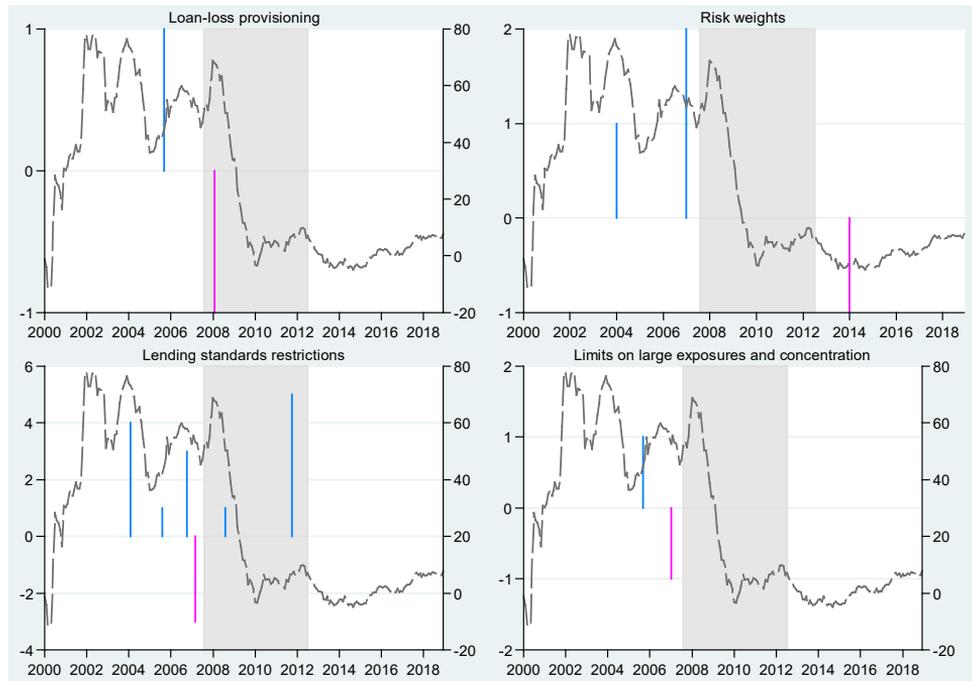


Notes: the left axis shows the monthly number of macroprudential measures adopted, and the right axis, the credit to the non-financial sector growth ratio; the positive/negative values correspond to the tightening/easing episodes; the shadowed area corresponds to GFC and EDC.

Figure no. 9: Macprudential tools implemented in Poland

The macroeconomic instruments used by Romanian authorities are highlighted in Figure no. 10. In September 2005, loan-loss provisions were tightened, taking into account the currency exposure for debtors with loans in foreign currencies. These restrictions were lifted in February 2008. In general, the risk weights were tightened, i.e., in 2004 and 2007. In January 2014, risk weights related to mortgages, were eased in order to comply with the Regulation on Capital Requirements no. 575/2013. Romanian authorities have used restrictions on lending standards to counter the credit boom. In 2004, Romania was among the first countries in the region to introduce limits on the LTV and DSTI ratios. Thus, the central bank imposed an LTV limit of up to 75% for mortgages, 35% for the DSTI ratio for mortgages and 30% for the DSTI ratio for consumer loans. DSTI limits were tightened in August 2005 and October 2006. In March 2007 (Fig. 10), the authorities relaxed lending standards, lifted LTV and DSTI limits and allowed banks to set their own limits. In October 2011, limits for LTV and DSTI reports were set up again. LTV limits were differentiated, depending on the credit currency, i.e., lower thresholds for foreign currency loans. For example, the LTV ratio for foreign currency loans has been set at 60%, while for domestic currency loans the limit has been set at 85%. The restrictions were procyclical, considering the credit dynamics of that period. However, the goal of

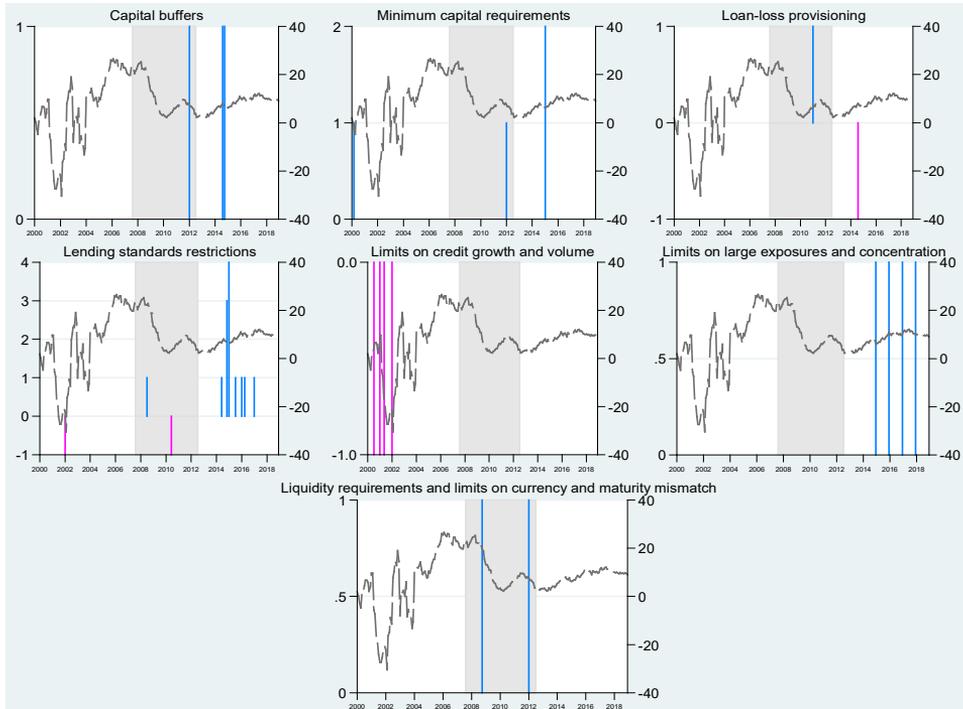
these decisions was rather the resilience of the banking system. Microprudential instruments focused on banks' capital and liquidity.



Notes: the left axis shows the monthly number of macroprudential measures adopted, and the right axis, the credit to the non-financial sector growth ratio; the positive/negative values correspond to the tightening/easing episodes; the shadowed area corresponds to GFC and EDC.

Figure no.10: Macroprudential tools implemented in Romania

As we see in Figure no. 11, the Slovak authorities used seven categories of instruments to achieve their proposed macroprudential objectives. Most of the decisions were aimed at tightening regulations. In 2012, the authorities imposed restrictions on the distribution of banks' profits. For example, banks with a Tier 1 capital ratio were prohibited from distributing the profit. In 2014, capital conservation buffer requirements of 2.5% of total exposures were introduced. Similarly, the minimum capital requirements were tightened in 2000, 2012 and 2015. The two measures adopted in 2015 aimed to harmonize conditions with the provisions of the Regulation on capital requirements.



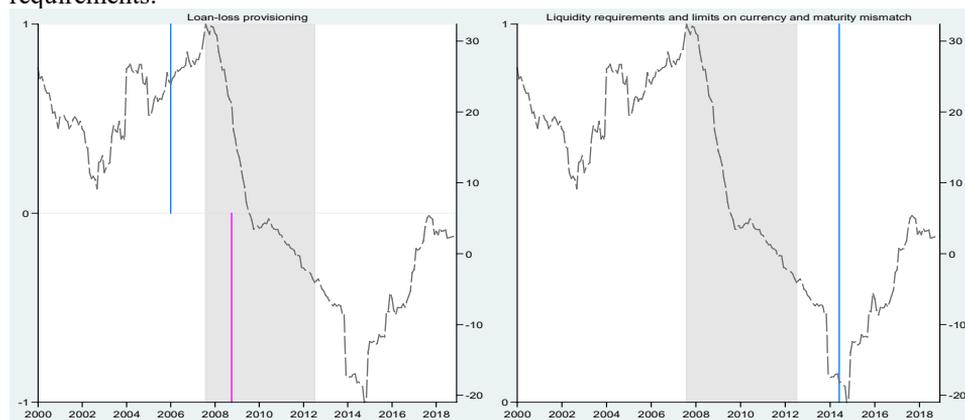
Notes: the left axis shows the monthly number of macroprudential measures adopted, and the right axis, the credit to the non-financial sector growth ratio; the positive/negative values correspond to the tightening/easing episodes; the shadowed area corresponds to GFC and EDC.

Figure no. 11: Macroprudential tools implemented in Slovakia

Very interesting aspects emerge from the analysis of lending standards restrictions. In 2002, the authorities decided to ease the requirements on the LTV ratio. This decision was taken in order to stimulate credit dynamics, which had reached a minimum point in 2002. In July 2008, limits were imposed on the annual interest rates charged on loans. Specifically, the annual interest rate on loans granted could not be more than twice the average annual interest rate on loans with similar characteristics (volume, maturity and guarantees) nor four times the average total interest rate in a given quarter. This decision was quickly reversed in June 2010. As we see in Figure no. 11 - restrictions on lending standards, in the period 2014-2017, followed a series of measures that tightened conditions. Again, limits were set on interest rates on consumer loans. In addition, LTV limits have been tightened several times in a row, 2014, 2015, 2016 and 2017, and additional limits have been imposed on the DTI ratio. If we analyse limits on credit growth and volume, we see that this instrument was intensively used at the beginning of the analysis period, i.e., 2000 - 2002, most likely in order to stimulate bank liquidity and credit dynamics. This instrument aimed at reducing the minimum reserves requirements related to banks' liabilities. During the GFC and the sovereign debt crisis, liquidity

requirements were tightened. In October 2008, a new short-term liquidity indicator was adopted, requiring banks to cover potential liquidity outflows within a month from liquidity resources with similar maturity, i.e., one month. In January 2012, loan-to-deposit (LTD) limits were adopted. Specifically, the ratio could not exceed 110%. Finally, during 2014-2017, the limits on large exposures and concentration were tightened. The objectives of these measures were to reduce the connections and, implicitly, the degree of contagion.

In Slovenia, loan loss provisions tightened in January 2006 (Fig. 12). The measure was reversed at the end of 2008 to temper the negative effects of the GFC. In what concerns liquidity requirements, in 2014, the authorities included LTD limits. In the case of microprudential instruments, the authorities have used numerous instruments, i.e. capital buffers, restrictions on lending standards, limits on large exposures and concentration, minimum capital requirements, liquidity requirements, loan-loss provisions and risk weights. In particular, in the case of capital buffers, in 2009 banks were prohibited from distributing the profit and including it in the capital. The measures on credit standards aimed at tightening the conditions for foreign currency loans. A large number of microprudential measures have been taken in terms of large exposures, concentration and liquidity management. Finally, the measures concerning capital, i.e., the minimum capital requirements, loan-loss provisions and risk weights were aimed at tightening the requirements. In Slovakia, microprudential policies involved instruments that targeted capital and liquidity, i.e., minimum capital requirements, risk weights, and liquidity requirements.



Notes: the left axis shows the monthly number of macroprudential measures adopted, and the right axis, the dynamics of credit to the non-financial sector; the positive/negative values correspond to the tightening/easing episodes; the shadowed area corresponds to GFC and EDC.

Figure no. 12: Macropprudential tools implemented in Slovenia

Conclusions

This paper investigated the characteristics and dynamics of macroprudential policies in CEE countries. Their prudential approach has been intense and diversified throughout our sample period, providing us with a suitable ground for our analysis.

We found that some interesting patterns stand out. We observe heterogeneities in the dynamics of prudential policy between EU Member States, with greater differences between developed countries and emerging CEE countries. First of all, CEE countries have used a lot more prudential instruments compared to EU-14. We attribute this phenomenon to their emerging and less stable financial systems than those belonging to developed markets. Second, a degree of asymmetry stands out even between CEE countries. As we have seen, the frequency and nature of prudential tools differed in the CEE countries

From a dynamic perspective, the macroprudential indices also depict heterogeneous results for CEE countries. This characteristic is probably an effect of the different levels of financial stress that their banking systems have been subjected to. This pinpoints the existence of strong endogenous factors that dominate their banking systems. For example, countries such as Poland, Romania, Bulgaria, Croatia, and Latvia, have resorted regularly to macroprudential instruments, either to moderate credit growth before the GFC and EDC or to mitigate systemic imbalances throughout the crisis. Hungary or Lithuania used macroprudential instruments more intensively during the GFC. Czechia and Slovakia resorted to macroprudential instruments at the end of the analysis period, while Slovenia and Estonia made little use of macroprudential policy. Most macroprudential decisions have been taken to tighten the regulatory framework. In general, the credit index followed comparable dynamics with the macroprudential index. Accordingly, we acknowledge that the macroprudential governance has targeted the dynamics of the financial cycle. Furthermore, we should emphasize that some instruments were more effective in taming credit cycle. Our findings show that bank assets restrictions, LTV, and DSTI limits are more prone to flatten the credit cycle.

Based on the way the credit growth reacts to certain types of measures, we learn some relevant aspects. The simultaneous application of the micro- and macroprudential approaches can generate tensions, which are likely to occur at certain stages of the credit cycle. These tensions are caused by the fact that macroprudential policy seeks to flatten the financial cycle and enhance the resilience of the financial system, while microprudential instruments can be procyclical. In this respect, it is essential to combine the micro and the macroprudential dimension in order to assess the appropriate adjustment of the capital and liquidity buffers according to the phase of the financial cycle. The exchange of information, joint risk analysis and dialogue between micro and macroprudential authorities are of utmost importance. However, if the conflict between the objectives of these two policies cannot be avoided, the macroprudential objectives should prevail.

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References

- [1] Aikman, D., Nelson, B., & Tanaka, M. (2015), Reputation, risk-taking, and macroprudential policy. *Journal of Banking & Finance*, 50, 428-439.
- [2] Akinci, O., & Olmstead-Rumsey, J. (2018), How effective are macroprudential policies? An empirical investigation. *Journal of Financial Intermediation*, 33, 33-57.
- [3] Alam, Z., Alter, M. A., Eiseman, J., Gelos, M. R., Kang, M. H., Narita, M. M., & Wang, N. (2019), *Digging Deeper-Evidence on the Effects of Macroprudential Policies from a New Database*. International Monetary Fund.
- [4] Altunbas, Y., Manganelli, S., & Marques-Ibanez, D. (2017), Realized bank risk during the great recession. *Journal of Financial Intermediation*, 32, 29-44.
- [5] Angelini, P., Nicoletti-Altimari, S., & Visco, I. (2013), Macroprudential, Microprudential and Monetary Policies: Policies, Complementarities and Trade-Offs. In *Stability of the Financial System*. Edward Elgar Publishing.
- [6] Banerjee, R. N., & Mio, H. (2018), The impact of liquidity regulation on banks. *Journal of Financial Intermediation*, 35, 30-44.
- [7] Budnik, K. B., & Kleibl, J. (2018), *Macroprudential regulation in the European Union in 1995-2014: introducing a new data set on policy actions of a macroprudential nature*. ECB Working Paper Series No. 2123, European Central Bank.
- [8] Cerutti, M. E., Correa, M. R., Fiorentino, E., & Segalla, E. (2016), *Changes in prudential policy instruments—A new cross-country database*. International Monetary Fund.
- [9] Choi, M. S. M., Kodres, M. L. E., & Lu, J. (2018), *Friend or Foe? Cross-Border Linkages, Contagious Banking Crises, and “Coordinated” Macroprudential Policies*. International Monetary Fund.
- [10] Claessens, S., Ghosh, S. R., & Mihet, R. (2013), Macro-prudential policies to mitigate financial system vulnerabilities. *Journal of International Money and Finance*, 39, 153-185.
- [11] De Jonghe, O., Dewachter, H., & Ongena, S. (2016), *Bank capital (requirements) and credit supply: Evidence from pillar 2 decisions*. National Bank of Belgium Working Paper No. 303.
- [12] Deli, Y. D., & Hasan, I. (2017), Real effects of bank capital regulations: Global evidence. *Journal of Banking & Finance*, 82, 217-228.
- [13] Dumičić, M. (2018), Effectiveness of macroprudential policies in Central and Eastern European countries. *Public Sector Economics*, 42(1), 1-19.
- [14] Epure, M., Mihai, I., Minoiu, C., & Peydró, J. L. (2018), *Household credit, global financial cycle, and macroprudential policies: credit register evidence from an emerging country*.
- [15] Ezer, M. (2019), *The Effectiveness of Macroprudential Policy on Bank Risk*. Mimeo.
- [16] FSB. (2011), *Macroprudential policy tools and frameworks: Update for G20 finance ministers and central bank Governors*. Available at: <https://www.imf.org/external/np/g20/pdf/021411.pdf>
- [17] Geršl, A., & Jašová, M. (2014), Measures to tame credit growth: are they effective?. *Economic Systems*, 38(1), 7-25.

- [18] Gómez, E., Lizarazo, A., Mendoza, J., & Murcia, A. (2017), *Evaluating The Impact Of Macprudential Policies In Colombia's Credit Growth*. Banco de la República Working Paper Series, (980),
- [19] Hoque, H., Andriosopoulos, D., Andriosopoulos, K., & Douady, R. (2015), Bank regulation, risk and return: Evidence from the credit and sovereign debt crises. *Journal of Banking & Finance*, 50, 455-474.
- [20] International Monetary Fund. (2014), *Republic of Slovenia, January 2014*. IMF Country Report no. 14/11.
- [21] Lim, C. H., Costa, A., Columba, F., Kongsamut, P., Otani, A., Saiyid, M., & Wu, X. (2011), *Macprudential policy: what instruments and how to use them? Lessons from country experiences*. IMF working papers, 1-85.
- [22] Lombardi, D. & Siklos, P. (2016), Measuring resilience to financial instability: A new dataset. *Journal of Financial Stability*, 27, 35-49.
- [23] OECD. (2013), *OECD Economic Surveys Slovenia*, April 2013.
- [24] Pfeifer, L., Holub, L., Pikhart, Z., & Hodula, M. (2017), *Leverage ratio and its impact on the resilience of the banking sector and efficiency of macroprudential policy*.
- [25] Pochea, M. M., & Nițoi, M. (2021), The impact of prudential toolkits on loan growth in Central and Eastern European banking systems. *Economic Systems*, 45(1), 100767.
- [26] Teixeira, J., Silva, F., Fernandes, A. & Alves, A. (2014), Banks' capital, regulation and the financial crisis. *North American Journal of Economics and Finance*, 28, 33–58.
- [27] Vandebussche, J., Kongsamut, P., & Dimova, D. (2018), Macroprudential Policy Effectiveness: Lessons from Southeastern Europe. *Journal of Banking and Financial Economics*, 1(9), 60-102.