

Disentangling external flows (external shocks) and policy and regulation effects on the credit activities of banks in three emerging countries during the Great Recession¹

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Abstract

We analyze the effects of bank wholesale and retail funding swings triggered by the real economy and foreign financial flow shocks, as well as the effects of policy interventions and the regulation environment in three emerging countries (Croatia, Montenegro, and Slovenia) throughout the boom (2007–2008), bust (2009–2010), and recovery (2011–2013) periods of the Great Recession. We find evidence that supply-side factors, in particular wholesale funding, were important for the huge procyclical credit swing, and that the cyclical nature of credits to firms was amplified the most. The paper also documents that systematic procyclical policy interventions, which tolerated a credit stampede in the boom period but swiftly curbed the already falling credits in the bust and especially the recovery period, contributed to the enormous macroeconomic costs of the Great Recession in the Balkan countries. The effectiveness of macroprudential and other policies (standard macro, structural) in supporting the stability of financial systems is discussed, and external flow, policy, and regulation effects on the credit activities of banks are disentangled.

JEL classifications: G32, G31, G01

Keywords: bank lending, credit supply, credit demand, capital flows, policy and regulations environment

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1. Introduction

After the global financial and economic crisis of 2008/2009, a more elaborate liquidity channel with two crucial components, funding and market liquidity, was added to the borrower channel and the banking channel of credit crisis propagation and amplification (Diamond and Rajan, 2005; Huang and Ratnovski, 2014 for theoretical contributions; Adrian and Shin, 2009; Ivashina and Sharfstein, 2010; Cornett et al., 2011; Duygan-Bump et al., 2013; Kapan and Minoiu, 2013; Craig and Dinger, 2013 for empirical evidence on USA banks; Jimenez et al., 2010; Ciccarelli et al., 2013; Giannone et al., 2012; de Hann, van den End, and Vermeulen, 2015 for empirical evidence on EU banks; and Demirguc-Kunt and Huizinga, 2010; Jung and Kim, 2015; and Baskaya et al., 2017 for empirical evidence on banks in developing countries). The funding liquidity component, with its focus on the liability side of the bank balance sheet, is especially important for studying the development of financial crises in less developed countries. In less developed countries, banks act as crucial intermediators of funding channels (retail and wholesale), transmitting retail and wholesale fund effects caused by external shocks (i.e., capital flows and real demand) that impact lending to firms and, separately, to households. In the wholesale channel, capital flows to banks and, by extension of their credits, to households, non-financial corporations, and the government. In the retail channel, capital flows to non-financial companies and the government. After sitting on their bank accounts, banks can extend new credits to households, corporations, and the government. In the case of turnaround in foreign capital outflows (sudden stops), both channels work in reverse by first cutting credits, second by increasing deposits to banks or bank deposits to the central bank, and third by ceasing the outflow of capital (Shin, 2013).

The main objective of our paper is to present the very mechanism which transmits and amplifies the effects of external shocks (specifically, foreign capital flows and real demand)

impinging on domestic economies; however, as shown in the literature (see for example Claessens and Kose, 2014; Magud and Vesperoni, 2015), the effects of external shocks in a country are not isolated and work hand in hand with shock effects caused by the domestic policies and regulation specificities of a particular country (or group of countries). The interplay between the policy and external shock effects of domestic policies is especially pronounced in times of great instability. In “normal” times, disentangling the mentioned policy effects from external shocks effects is a particularly difficult endeavor, because both kinds of shocks are unfocused and negligible in size, which is especially true in the case of effects derived from policy system interventions. In this paper, we therefore try to disentangle those effects at the time of the Great Recession, when both kinds of shocks were interconnected, large, focused, and concentrated. Accordingly, we study retail and wholesale funding channels transmitting retail and wholesale fund effects caused by external shocks (i.e., capital flows and real demand) as well as policy and regulation specificities that impact lending to firms and, separately, to households throughout the boom (2007–2008), bust (2009-2010), and recovery (2011–2013) periods of the Great Recession in three Balkan countries: Slovenia, Croatia, and Montenegro.

There are several reasons for limiting the study to the three mentioned countries. The first reason is to better analyze the details of the transmission mechanisms and policy specification at play. According to studies on the impact of foreign financial flows on developing countries, the most common approach is to deal with the triad of the emitting (developed) country, the receiving (developing) country, and the final effect on performance (e.g., GDP increase) in the receiving country without any specification of the transmission mechanism details; that is, assuming that the difference in the relative sizes of foreign flows is the only important difference among the receiving countries. In our study we add receiving sector details as well as instrument specificities of transmission mechanism. A similar omission of transmission

mechanism details pertains also to studies of policy impacts on banking intermediation in developing countries, where only the differences in the calibration of standard policy interventions are explicitly taken into account, but not the differences in the corresponding transmission mechanisms nor the country specificities of policy interventions. This is especially true regarding specificities of system interventions (modifications).

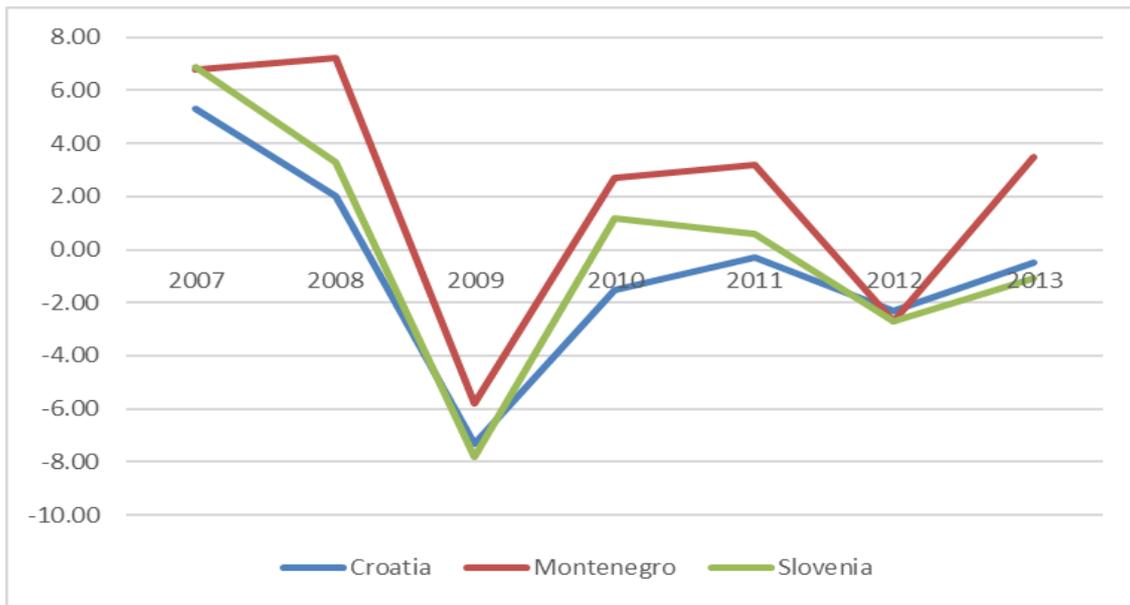
The second reason to focus only on the three selected countries is that during the Great Recession, the size and intensity of external shocks as well as the comprehensiveness of policy reactions were incomparable to what had been going on in relevant economies for decades prior. Although some advancements were made through the studying of financial crisis outcomes, the non-linearities that arise from macro-financial linkages still represent a major problem (e.g., Claessens and Kose, 2018). Our study therefore treats the Great Recession period as a natural experiment to test external shock and policy mitigation/amplification effects. In this situation, the discussed specificities of the transmission mechanism could not be neglected or aggregated because they could be quickly revealed through the drastic break in typical economic activities.

Third, studying the drawbacks of the mentioned types of transmission mechanisms in less developed countries is particularly challenging because the availability, reliability, and comparability of data (especially micro) for them is much poorer. For Balkan countries, there is ample information on the demand side of financial frictions and financial accelerators (Bole et al., 2018). A comparison is made to Mediterranean and Central European countries, showing that the late integration of Balkan economies into international trade flows (just at the onset of the financial crisis) was an important amplifier of the crisis as countries dramatically increased optimistic growth expectations; but no such evidence exists regarding the mentioned transmission mechanisms and their outcomes.

Finally, the three observed Balkan countries differ significantly in both studied crisis factors (that is, in external flows as well as policy and regulation specificities) while having similar performances in other important macroeconomic aspects. Regarding their differences, these countries faced large disparities in the increase and especially the structure of foreign financial inflows (regarding instruments and the receiving sectors) in the boom period as well as in the bust and recovery periods, when their inflows collapsed (proportionally to the boom increase). They also differ significantly in terms of policy freedom (room for maneuvers) and, hence, the focus of policy intervention in all stages of the studied period. As an EU member state, Slovenia, for example, was obliged to implement EC-designed macroeconomic policies. Croatia, as an EU candidate country, had more room for maneuvers during the boom (partially limiting capital inflows) and bust periods but not in the recovery period, while Montenegro was able to “muddle” through the whole episode.

Returning to the countries’ similarities, all three inherited similar bank-dominated financial systems (Bonin, 2004), used the euro or euro-pegged currencies, had the bulk of their banking sectors encompass branches of the same foreign banks, and their final demand was almost synchronized throughout all the phases of the Great Depression (as documented in Figure 1).

Figure 1: Real GDP growth (in percent)



Source: IMF, 2015

Methodologically, we built our empirical work on the constructed bank credit model of households and firms (see, Appendix 1). Based on the credit model, our operational model identifies supply and demand factors of credit amplifications. Controlling for other supply-side factors (the cost of impairment, size, and ownership of banks) and GDP growth (a demand-side factor) and applying the model to data on majority banks in the three countries, we were able to identify the effects of two variables of interest, wholesale and retail (deposit) funding, on the credit activity of banks. The policy and regulation specificities are derived by using factors extracted from the set of variables encompassing standard macro policy activities and structural interventions, as well as factors extracted from the set of indicators of macroprudential activity in the analyzed boom-bust-recovery episode. By using the estimated model we were able to disentangle the effects of two channels of funding from effects of policy and regulation in each country and phase of the studied episode.

The results of the study contribute to the literature on the funding liquidity of banks and its role in the propagation and amplification of financial crises. This topic is surprisingly

under-analyzed regarding the recent financial crisis (e.g. Claessens, and Kose, 2018). Our study illustrates that the high volatility of the financial flows through the bank retail (deposit) and especially wholesale funding channels contributed significantly to enormous macroeconomic costs in the Balkan countries during the Great Recession. The effects of the procyclical volatility of wholesale funding were especially high.

The paper also falls into the second strand of the literature, which pertains to policy intervention and regulations. We documented that the subtle procyclical characteristics of policy interventions, which tolerated a credit stampede in the boom period, noticeably mitigated already falling credits during the bust, but vanished almost completely in the recovery period and enabled huge procyclical external shocks (foreign financial flows). We showed that when foreign inflows are large, macro prudential policies and standard macro and structural policies must work hand in hand to stop disaster effects of external shocks to domestic economy, especially when policy follows other goals besides the stability of financial systems (i.e. using favorable conditions on the global capital markets in order to accelerate the catching-up process of the real economy or defending the value of its currency). Our model also allows us to disentangle effects of external flows and policy regulation on the credit activities of banks which is according to our knowledge the novelty in similar research.

Finally, the paper discusses the wholesale funding fragility literature (Huang and Ratnovski, 2011; Dang, Gorton, and Holmstrom, 2012; Heider, Hoerova, and Holthausen, 2015; de Haan, van den End, and Vermeulen, 2015; Jung and Kim 2015; Baskaya et al., 2017). In a severe financial crisis such as in the Balkans during the Great Recession, over-borrowing in a boom period was not solely a concern of large or domestically owned banks. The size of the banks did not play a major role in bust and recovery periods. For credit support of firms, ownership of banks was also not important in the bust and recovery periods of Great Recession.

The remainder of the paper is organized as follows. The following section briefly explains the characteristics concerning foreign inflows and policies directed on stability of financial systems in three investigated countries during the Great Recession. Section three presents the operational model and hypotheses of our empirical work. Section four explains data and variables. Section five displays the empirical results, and in the final section we draw our concluding observations.

2. External financial flows, and financial stability policies in investigated countries during the Great Recession

2.1. External financial flows in three countries during the Great Recession

Financial flows in the three observed Balkan countries during the Great Recession were highly influenced by the following items. First, the principles of a market economy prevailed in all countries at the beginning of the 21st century as the Washington consensus was accepted as a “general orientation toward market-based solutions for growth” in transitional countries. This new orientation resulted in easier access to foreign markets and, especially, easier access to cheap and abundant sources of foreign financing just at the onset of the financial crisis. Second, the main driver of the capital surge from more developed European countries to “catching-up” countries was a strategy of reducing income disparities between the developed European countries and the “catching-up economies”. The primary motive of the strategy was to increase the productivity convergence in “catching up economies”. However, as capital was not focused on activities with high marginal products of capital but rather on activities with low marginal products (i.e. banking, retail, construction, etc.), convergence in GDP per capita did not take place (Praet, 2014). Furthermore, a strong decline in interest rates during the boom period contributed to macroeconomic divergences in the Eurozone (de Grauwe, 2010). In this asymmetric world, banks from core EU countries were able to fuel credit booms in

peripheral economies, which brought “a tremendous credit expansion of mainly northern European banks to ailing banking sectors at the periphery of the Eurozone” (Hoffman and Schnabl, 2016, p. 870). Whether in the case of the banking-sector dominated FDI (which was highly present in Balkan countries before the emergence of the crisis) or in the case of direct borrowing by banks on foreign wholesale markets (which again was important in the Balkans), as argued by Shin (2013), banking sector capacity increased considerably because of the increased profitability and lowered measures of risk during the tranquil up-phase of the financial cycle. Both translate directly to an increase in bank leverage (Adrian and Shin, 2009). Third, as the total lending of banks and their liabilities to foreign financial institutions increased rapidly in the boom period, especially in developing countries, the funding requirements during the boom outweighed the growth of the domestic deposit base. This gap in deposit funding plays an important role in explaining the instability of the financial system. As the movement of liabilities of domestic banks to international banks increased in the boom to finance core bank investments-activities (i.e. the loans to non-financial firms and households, see Bole et al., 2018), they could be considered a key factor in explaining financial system vulnerability in the case of potential interruptions in the real sector (Shin, 2013). Fourth, in the sudden stop, the bank foreign debt has to be returned. The deleveraging of the banking system is therefore associated with precipitous foreign outflows and decreases in bank investment in the real sector, accompanied by high social costs. As noted by Schadler (2011), after the eruption of the financial crisis, western Balkan countries found themselves under severe pressure and have been pushed back to the periphery of Europe.

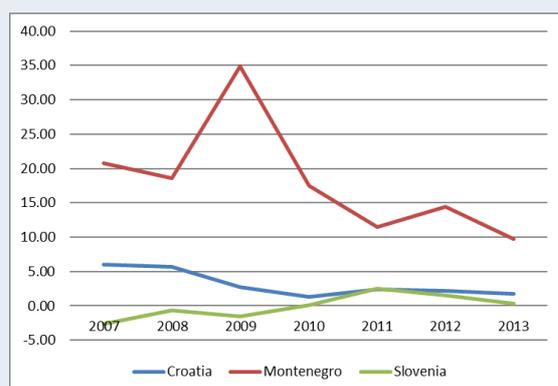
Figure 2 depicts these developments together with the mentioned differences in the three observed countries. FDI and equity investments (see Figure 2a) in the boom period were especially large in Montenegro. Croatia had a much smaller negative balance of FDI and equity investments, while Slovenia, in net terms, even had an outflow of FDI and equity

investments because domestic household and business sectors invested in foreign capital market instruments and/or acquisitions, especially in the Balkan region. In the bust period, inter-country differences in the size of equity and FDI investment considerably decreased. In Croatia and even more so in Montenegro, the negative balance improved, and in Slovenia it decreased.

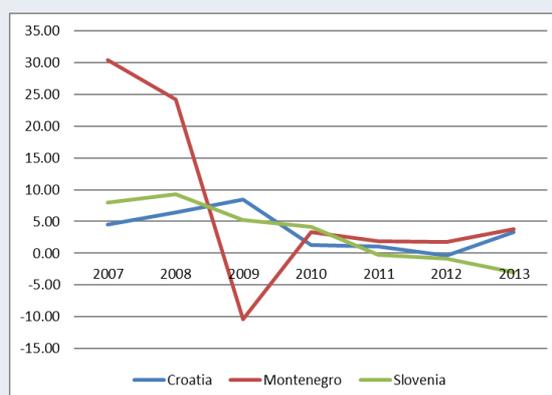
Foreign net inflows through credits and other debt instruments are shown in Figure 2b. Just as in Figure 2a, Figure 2b also shows net flows, while Figures 2c and 2d show gross inflows through credits and other instruments by sectors. The three analyzed countries exhibited substantial disparities in the receiving sector structure of gross financial flows. During the boom period, foreign financing through debt instruments in Slovenia was channeled especially to the banking sector (see Figure 2c). In contrast to Slovenian banks, foreign capital inflows affected the funding of Croatian banks mostly indirectly through the retail channel (through deposits by firms and households). The direct impact of gross capital inflow reversals on bank balance sheets (funding) was therefore much smaller in Croatia than in Slovenia. Montenegro was characterized by a huge gross (and net) inflow of equity capital and FDI in all sectors throughout the entire observed period. Just the opposite occurred with financial inflows through debt and portfolio instruments—these financial flows significantly inflated bank funding in the boom years through retail and wholesale channels, but at the very beginning of the crisis they drastically dropped in all sectors.

Figure 2: Capital flows based on financial accounts data

a. Portfolio investment (equity securities) and FDI, net inflows (percent of GDP), all sectors (percent of GDP)

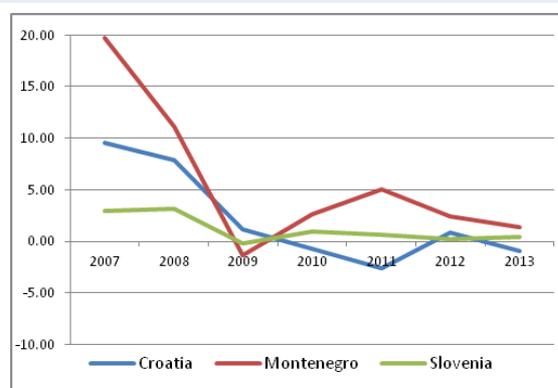


b. Portfolio investment (debt securities) and other investment, net inflows (percent of GDP), all sectors (percent of GDP)

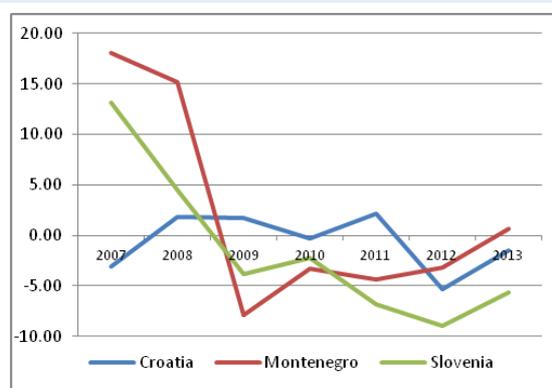


Portfolio investment (debt securities) and other investment, net incurrence of liabilities (percent of GDP)

c. Other sectors



d. Deposit-taking corporations, except the central bank



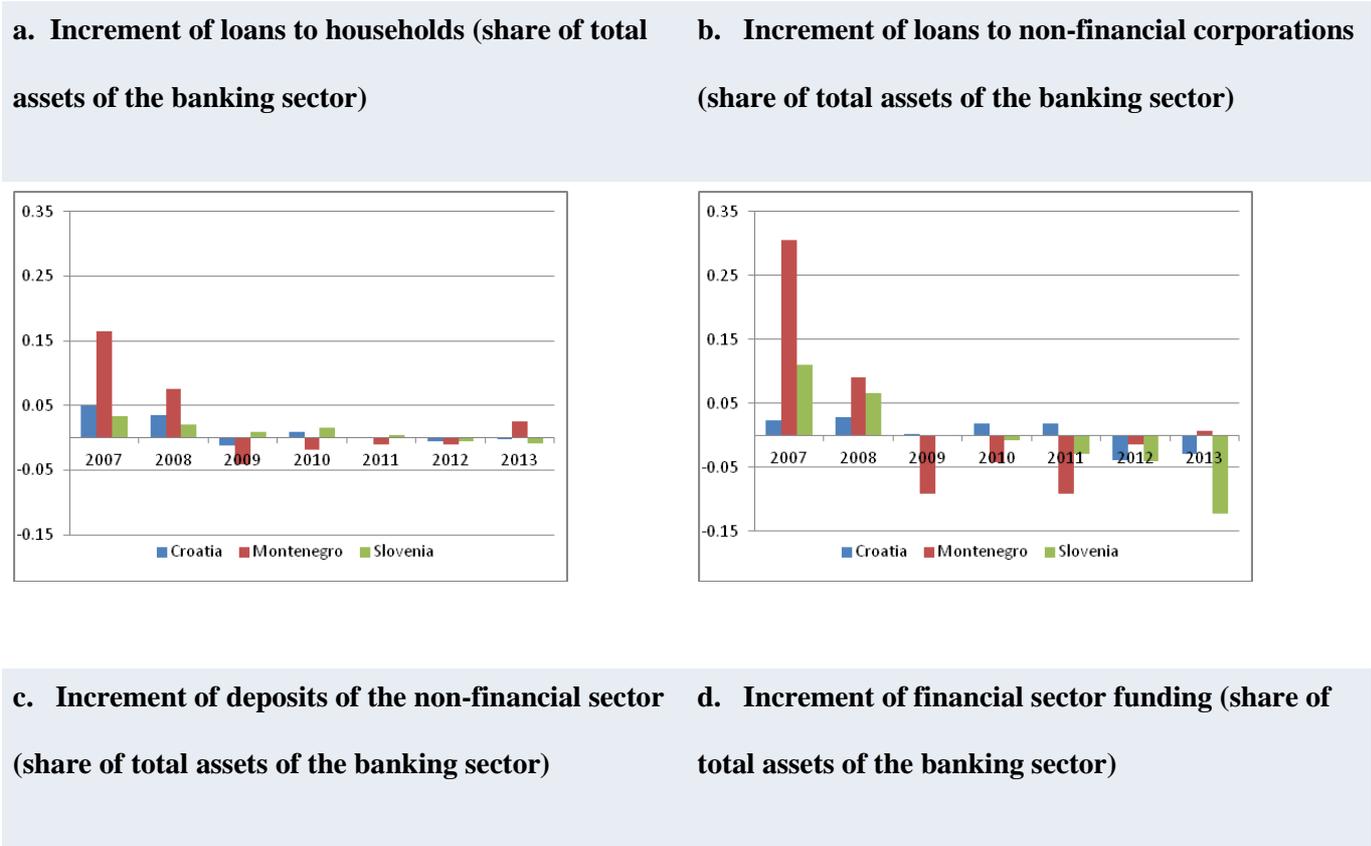
Source: IMF, 2015.

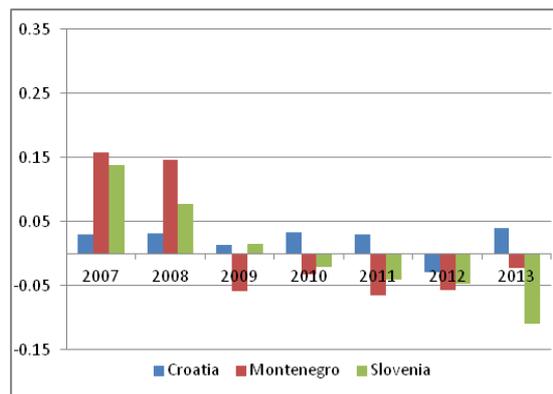
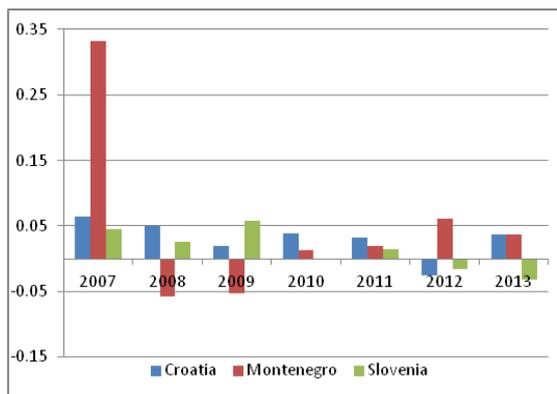
Note: All data are yearly and given in percentages of GDP; in Figure 2b, data for Croatia does not include IMF funds; other sectors include households, non-financial corporations and other financial corporations.

The banking sector performance in the boom-bust-recovery periods of the recent financial crisis is illustrated in Figure 3 for all three studied countries. In the boom period, banking activity was the highest in Montenegro. In Montenegro and Slovenia, a drop in wholesale funding (see data in Figure 3d and foreign financial outflows from banks in

Figure 2d) systematically cut the bank credit potential in the bust and recovery periods, while Croatia saw almost no visible change. After the crisis began, the dynamics of household loans became negligible in all three countries, while loans issued to firms dropped considerably in Montenegro and during the recovery period in Slovenia. In Croatia, loans to firms did not start to contract until 2012, and even then the contraction was less intense. A sudden and strong deceleration of loans (and net foreign financial inflows) considerably shrunk deposits in Montenegro in 2008 and 2009; however, the situation improved after 2010, which resulted in increasing credits to households in 2013. In Slovenia and Croatia, deposits dropped only in the recovery period (after 2011), while credits to households remained mostly stable.

Figure 3: Banking sector indicators





Sources: CNB, 2015; CBCG, 2016; BS, 2016.

Note: Data are presented as increments (value in year t less value in year t-1) in balance sheet percentages (in year t); deposits of the non-financial sector include deposits made by households, firms (non-financial corporations), and the government; wholesale funding is defined as total liabilities less deposits of the non-financial sector (households, non-financial corporations, and the government) and capital.

On the basis of the presented evidence it could be concluded that for the banking amplification of foreign shocks, swings in the bank wholesale and retail funding were crucial; therefore, swings in gross (and not net) foreign financial inflows have to be in the forefront, especially because swings in gross inflows were several times larger than swings in net inflows. Gross inflows through debt and other investments had incomparably larger amplitude than inflows through FDI and equity instruments.

2.2. Financial stability policy in three countries

2.2.1. Macroprudential policies

Macroprudential policy (regulation) has emerged in response to the widely accepted view that prevailing regulatory and supervisory regimes in the Great Recession were not properly equipped to identify and curb the systematic risks of financial system instability (Galati et al., 2011; Borio and Zhu (2012); Baker, 2012; IMF, 2013; Claessens, 2015; Adrian (2017); Svensson (2018); Bengtsson, 2019). More precisely, macroprudential policy is a subset of a broader financial policy, including also macro- and microprudential policy,

with the ultimate goal to achieve financial systems stability (Svensson, 2018). The concept is theoretically still at the early phase of development (Baker, 2015), whereas different tools of macroprudential policy are used worldwide. However, as stated by Shin (2013), the financial stability hurdles faced by emerging and developing economies are especially challenging because of the susceptibility of these economies to swings of the global capital markets during the relatively early stages of their financial system development. Accordingly, the primary aim of macro prudential policies in emerging and developing countries should be to lean against excessive asset growth during booms, and thereby achieve more sustainable long-term loan growth. In this respect, some macroprudential tools have many similar attributes to the tools used in banking capital control² which includes many aspects, but are of concern of macroprudential policy only if they relate to the stability of domestic financial systems.

Because the discussion on macroprudential policy is firmly established as a normative imperative and political priority on the level of international organizations and individual countries, several data sets have been collected with the aim of capturing policy measures of a macroprudential nature (Borio and Shim, 2007; Shim et al., 2013; IMF; 2011, Lime et al., 2011, Cerutti et al. 2015; Budnik and Kleibl; 2018). The three observed countries (Croatia, Montenegro, Slovenia) are specifically covered by Cerutti et al. (2015) and in an IMF survey on Global Macroprudential Policy Instruments (GMPI).

In our study on macroprudential policies used in Croatia, Montenegro, and Slovenia during the Great Recession, we concentrate on a more recent approach presented by Budnik and Kleibl (2018). In this approach (called “The Macroprudential Policies Evaluation Database” - MaPPeD), macroprudential policy actions in EU member states during 1995-2014 were collected via a questionnaire which has been completed in cooperation with

² See, Magud, Reinhart, and Rogoff (2011); Blanchard et al. (2015); Zeev (2019); Korinek (2018).

experts from 28 EU member national central banks and supervisory authorities of all member states. It tracks events of introduction, recalibration, and termination of 11 categories and 53 subcategories of instruments. The list of instruments includes all instruments, including some microprudential measures (e.g. loan-loss provisioning frameworks) as well as instruments of a monetary policy nature (e.g. marginal reserve requirements) or a fiscal nature (i.e. taxes on financial institutions and activities, which are commonly used by national authorities to reach macroprudential goals (Budnik, Kleibl, 2018)).

We used data on Croatia and Slovenia from this database, and produced a similar data set on Montenegro with the help of experts from the National Bank of Montenegro. We excluded from further analysis all subcategories (instruments) for which there were not at least two actions in whole analysed period for all three countries together. So, 28 subcategories (ten categories) were used in our further analysis. We then recoded original survey data. We marked tightening policy actions by -1 and policy loosening actions by 1. All other possibilities (no change, tightening, and loosening in the same year, unclear stance of the action) were denoted by 0. The results summarized for all ten categories are illustrated in Table1.

Table 1: Macroprudential interventions

Categories	Slovenia			Croatia			Montenegro		
	boom	bust	recovery	boom	bust	recovery	boom	bust	recovery
capital buffers	0	-2	0	-1	2	0	0	0	0
lending standards restrictions	-1	0	0	0	0	0	-1	0	0
limits on credit growth and volume	0	0	1	-1	3	1	-1	1	0
limits on large exposures and concentration	-1	1	0	0	-2	2	0	0	0
liquidity requirements and limits on currency and maturity mismatch	0	0	0	1	0	2	0	0	0
loan-loss provisioning	1	-1	-2	0	0	0	-4	3	0
minimum capital requirements	-1	0	0	0	-1	0	-1	1	-1
other measures	-1	0	-2	0	0	0	0	-2	0
risk weights	0	0	0	-1	1	0	0	0	0

Source: Macroprudential Policies Evaluation Database, Budnik and Kleibl (2018; own collection)

Note: Macro prudential interventions; cumulative number of loosening less number of tightening in the indicated period; 28 subcategories included ; boom (2007-2008); bust (2009-2010); recovery (2011-2013)

As seen in Table 2, Croatia's macroprudential regulation actions were, heuristically speaking, the most countercyclical of all three countries. In net terms it tightened actions in the boom phase and loosened during the bust and recovery phases. In Slovenia, macroprudential interventions were the most procyclical among all three countries, especially in the bust and recovery periods. Slovenia's reactions during the financial crisis were procyclical partly because of its own mistakes, and partly because of tough measures dictated (and enforced) by a new center of gravity (the EU), which could already command stronger, more established institutions (see, Bole, Prašnikar, Trobec, 2014). Montenegro was countercyclical like Croatia in the boom and bust periods, but procyclical in the recovery period.

2.2.2. Standard macro and structural policies

Additionally analyzed segments of policy actions encompass standard macro (fiscal and monetary) policy measures as well as structural policy interventions. Table 2 and Table 3 summarize indicators of standard macro policy measures and structural policy interventions which influence financial stability or interact with macroprudential policy interventions.

Indicators of standard macro policy measures are presented in Table 2. Because, some of the instruments of the monetary policy are already included in already presented macroprudential tools, we added to the analysed standard macro policy instruments only one monetary instrument, namely, credits of the central bank to commercial banks. Changes in policy stance are given in percentages of GDP. It is apparent that in the boom period, Montenegro had the most restrictive and Croatia the most expansionary orientation of standard macro policy measures. In the bust period, all three countries launched strong,

countercyclical standard policy measures. Just the opposite occurred during the recovery, when implemented standard policy measures turned procyclical again, especially in Slovenia and Montenegro.

Table 2: Standard macro policy measures; changes in indicators

	Slovenia			Croatia			Montenegro		
	boom	bust	recovery	boom	bust	recovery	Boom	bust	recovery
fiscal deficit	-0.45	2.75	2.55	-0.25	1.90	2.45	0.35	2.45	2.15
sales of state firms	0.05	0.10	0.05	0.00	0.00	0.00	-1.25	0.30	-0.20
government borrowing	-0.50	6.15	1.55	1.70	2.60	2.15	-0.95	-0.50	2.15
CB credits to banks	1.23	2.74	-0.68	1.09	-0.06	-1.21	-2.62	1.99	1.56

Source: Eurostat; Central banks; own collection

Note: Indicators of standard policy measures; average changes in the indicated period; in percentages of GDP; boom (2007-2008); bust (2009-2010); recovery (2011-2013).

In Table 3 analysed structural policy interventions are presented. The same logic is used to denote the stance of structural policy actions. That is, -1 denotes tightening and 1 represents loosening action, while all other possibilities are denoted by 0.

Table 3: Structural policy measures

Changes in legislation of	Slovenia			Croatia			Montenegro		
	boom	bust	recovery	boom	bust	recovery	boom	bust	recovery
wages in public sector	1	-1	-3	-1	-2	-3	2	-1	-2
privatisation	0	0	2	0	2	-1	1	1	1
labour market	0	1	-1	1	-1	-1	0	-1	-1
capital flows	1	0	1	0	2	2	2	1	-1

Source: Yearly IMF Reports (2006-2014); own collection.

Note: Cummulative number of changes (number of loosening less number of tightening) in the indicated period; boom (2007-2008); bust (2009-2010); recovery (2011-2013).

Table 3 shows the procyclical nature of the changes in legislation on structural policies in all three countries during the Great Recession. Simplifying the interpretation of the indicated policies, we could heuristically say that the stance of structural policies in the boom phase

was relaxing, mostly unchanged in the bust period, and restrictive (tightening) in the recovery period. In the boom period, the most procyclicality oriented structural policy interventions were implemented in Slovenia and Montenegro. During the bust, all three countries launched neutral or very weak expansionary structural policy interventions, while during the recovery all three countries had strong procyclical orientations in terms of structural policy interventions. Correct interpretation of the policy orientation could be, however, made only on the model estimates which encompass whole set of relevant empirical facts.

3. Operational model and hypotheses of bank credit dynamics to households and firms

The discussion so far has shown that differences among observed countries in credit trajectories through the period of the Great Recession in observed three countries resulted from differences in demand or economic activity, differences in the described exogenous shocks (direct and indirect gross foreign financial flows) to the banking sector and the real economy, as well as differences in policy interventions and regulation buildup.

The operational model to study the aforementioned specificities of the three observed countries during the Great Recession is shown in Eq. 1a and Eq. 1b. The model explicitly embraces supply and demand factors as well as policy and regulation specificities in bank credit activity. The key for this division is our credit model of an open economy, shown in Appendix 1. Two funding variables (wholesale funding and retail funding) represent supply factors, and the growth of nominal GDP demonstrates demand factors. The costs of impairment, the foreign banks dummy, and the size dummy in the operational model are additionally considered as supply factors, while policy interventions and regulation modifications are represented by corresponding factors extracted from the set of variables

indicating macro policy and structural changes as well as the set of macroprudential interventions.

$$dloans_to_househ_bil = \gamma_0 b_h + \gamma_2 dbank_fin_bil + \gamma_3 ddeposits_bil + \gamma_4 cost_impar_bil_1 + \gamma_5 g_ngdp + \gamma_6 fac_prudent1_1 + \gamma_7 fac_prudent2_1 + \gamma_8 fac_pol_struc1_1 + \gamma_{14} fmo + \gamma_{15} size + const + \varepsilon \quad (1a)$$

$$dloans_to_firms_bil = \delta_0 b_h + \delta_1 b_n + \delta_2 dbank_fin_bil + \delta_3 ddeposits_bil + \delta_4 cost_impar_bil_1 + \delta_5 g_ngdp + \delta_6 fac_prudent1_1 + \delta_7 fac_prudent2_1 + \delta_8 fac_pol_struc1_1 + \delta_{14} fmo + \delta_{15} size + const + \varepsilon \quad (1b)$$

where (*dloans_to_househ_bil*) is the yearly change in bank loans to households (per unit of the total balance sheet), (*dloans_to_firms_bil*) is the yearly change in bank loans to firms (per unit of the total balance sheet), (*b_h*) and (*b_n*) are correction factors ³, (*dbank_fin_bil*) is the wholesale (bank) funding channel (change in loans to banks per unit of the total balance sheet), and (*ddeposits_bil*) denotes total deposits (per unit of the total balance sheet), (*cost_impar_bil_1*) denotes the lagged yearly costs of impairment (per unit of the total balance sheet), and (*g_ngdp*) is the growth of GDP. Variables (*fac_prudent1_1*) and (*fac_prudent2_1*) indicate the lagged values of first two factors extracted from the set of indicators encompassing macroprudential interventions, while (*fac_pol_struc_1*) stands for the lagged value of the first factor extracted from the standard macro policy variables and indicators of policy structural interventions. Variable (*fmo*) is the dummy for a foreign-owned bank. Variable (*size*) is the dummy for the size of a bank. Finally, (*const*) is the intercept and ε is the error term.

Equations 1a and 1b permit us to test two core hypotheses about the effects of bank funding channels during the Great Recession in the Balkan countries. The first hypothesis

³ Encompassing minor differences between banks in some balance sheet items definition.

(H₁) is based on the literature on interactions between the real economy and the financial sector and the importance of credit market frictions for aggregate economic activity (see, Claessens and Kose, 2018). In particular, the Gertler and Kiyotaki (2011) and Gertler, Kiyotaki, and Prespitino (2016) studies represent a starting point in the construction of H₁. Their propositions of accelerated indebtedness of non-financial firms due to the demand side financial frictions, and simultaneously increases of bank's debts due to increased wholesale funding, followed by the sudden stop seem to be acceptable also in our case. However, the importance of international credit inflows and capital reversal is crucial for understanding the role of retail and wholesale funding channels and banks activities in providing credits to households and firms in Balkan countries. The illustration of the debt increases of non-financial firms in the Balkans due to the financial accelerator effect is offered by Bole et al. (2018). The illustration of the wholesale funding increases (foreign inter-banking markets) in the boom period in Balkan countries as well as corresponding sudden cutoffs of foreign financial inflows is provided by Hoffman and Schnabl (2016) and Hunya (2009). The latter is also reflected in our data in Chapter 2. Theoretically, hypothesis H₁ is pinned down also by our credit model in the Appendix. The second hypothesis (H₂) is built on our credit model. The H₂ hypothesis could be deducted from the Eq. 12.⁴ It is also supported by the Shin (2013) analysis of balance sheet management, and by the Huang and Ratnovski (2011) assertion that at the refinancing stage, wholesale financiers could suddenly withdraw their funds given a mere hint of negative news, which could, certainly, diminish the credit activity of banks.

⁴In particular, taking the ratio of business credits to all credits as 0,61 as was the case in our observed countries during the period 2006-2013, the ratio of deposits made by households to all deposits in banks as 0,68 and the ratio of interest rate elasticities of credits to firms to interest rate elasticities of credits to households around 0,70, as in Kakes and Sturm (2002) and Hense (2015), it is shown that wholesale funding is more important for credits given to firms than credits given to households.

H₁: The funding channel was a sizable driver of the credit trajectory throughout the Great Recession episode in the three observed Balkan countries.

H₂: The wholesale funding of banks was more important for credit activity within firms than for credit activity within households

As systematic use of macroprudential policy instruments was missing during the Great Recession in three observed countries, erratic policy interventions stimulated by the use of different instruments of macroprudential regulations (sometimes contradictory) prevailed, instead.

H₃: Erratic (unsystematic) use of macroprudential policy interventions and regulation didn't prevent destabilization of credit activity and so contributed to financial instability in the observed three countries during the Great Recession

There are other policies aimed at stabilizing financial systems, including standard macroeconomic policies (monetary, fiscal) and structural policies (i.e. public safety net, labor market policies, privatization policies, etc.) which contribute to procyclicality or work together with tools of macroprudential policy toward the countercyclicality of financial systems.

H₄: Other policy interventions and regulations (standard macroeconomic policies, structural policies) didn't mitigate destabilization of credit growth and so increased the procyclicality of the credit trajectory throughout the Great Recession.

Our setting enables us also to test the importance of bank characteristics in transmitting foreign flows to credits. There are a few studies (i.e. de Haan, van den End, and

Vermeulen, 2015; Jung and Kim 2015; Baskaya et al., 2017) that show the importance of bank characteristics in emerging economies during the Great Recession. Therefore, the hypothesis concerning the ownership structure and size of banks could be stated as follows:

H₅: Other bank characteristics (ownership and size) had significant effects on credit trajectory in the observed Balkan countries through the Great Recession

4. Data

4.1. Data on banks and variables used

Our unbalanced panel in the period from 2007 to 2013 consists of 55 banks from Croatia, Montenegro, and Slovenia. In 2010 terms, it encompasses 30 out of 33 banks in Croatia, eight out of 11 banks in Montenegro, and 17 out of 22 banks in Slovenia and accounts for more than 85 percent of the total assets of each banking sector. Foreign-owned banks represent 50 percent of the total number of banks included in the research in Croatia, 75 percent in Montenegro, and 41 percent in Slovenia. The main source of data was the Bankscope database (Bankscope, 2014), which was augmented with hand-collected data from the banks' annual reports. Due to missing data or the inability to obtain annual reports from the Bankscope database, 11 banks were not included in our panel. Instrumental variables come from different sources. Real estate prices and data on FDI inflows are taken from official statistics (IMF 2015; CNB 2015; CBCG 2016; BS 2016). Data on the number of employees, number of branches, and number of ATMs were collected from the banks' annual reports and/or websites. The variables used are described in Table 4.

Table 4: Description of the variables

Variables used	Variable description
<i>id (numeric)</i>	
<i>bank_name (text)</i>	
<i>country_code (numeric)</i>	Country ISO code
<i>year (numeric)</i>	
	Correction factors
<i>b_h (binary)</i>	Credits encompass: 0 only NFO, 1 NFO and some institutions from the government sector
<i>b_n (numeric)</i>	Gross loans in year t/ Net loans in year t
<i>fac_prudent1(numeric)</i>	First polymorphic factor from macroprudential interventions
<i>fac_prudent2(numeric)</i>	Second polymorphic factor from macroprudential interventions
<i>fac_pol_struc</i>	First polymorphic factor from macro policy variables and structural interventions
<i>fmo (numeric)</i>	1 = Foreign parent bank; 0 = other Foreign ownership larger than 50%
<i>Size (numeric)</i>	1 = Larger banks; 0= other Bank total assets are greater than “the third quartile” of particular country banks
<i>loans_to_househ</i>	No equivalent in Bankscope. This includes loans to households and non-profit organizations.
<i>loans_to_firms</i>	No equivalent in Bankscope. This includes loans to non-financial corporations.
<i>bank_fin</i>	Bank financing (due to banks + senior debt maturing after 1 year + other deposits and short-term borrowings + other funding)
<i>cost_impar</i>	Loan impairment charge
<i>Deposits</i>	Total customer deposits

<i>g_ngdp</i>	Nominal GDP growth
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4.2. Data on macroprudential policies and other policies

As documented in equations 1a and 1b, the model specification also includes factors extracted from the set of policy indicators. Factors from two sets of policy indicators figure into the model. They are separately extracted from the corresponding sets of policy indicators by factor analysis.

The first set encompasses indicators of standard macroeconomic policy measures and indicators of structural policy actions. Because indicators of standard macroeconomic policy measures are continuous, but indicators of structural actions of policy makers categorical (discrete), standard factor analysis cannot be applied. We therefore calculated a polychoric correlation matrix and applied factor analysis on the generalized correlation matrix⁵. Eigenvalues and the proportion of explained variances are illustrated in Table 5. Because the first eigenvalue is much larger than the rest of the eigenvalues and the only one greater than 1, we extracted from this set of policy indicators only the first factor. It is denoted as *fac_pol_struk*.

Table 5: Factor analysis for the common set of standard policy measures and structural policy interventions

Factor	Eigenvalue	Proportion
factor1	1.915	0.601
factor2	0.890	0.279
factor3	0.644	0.201

⁵ See, Bartholomew(1980) and Ekstrom (2011) for theory, and Kolenikov(2016) for code source.

factor4	0.142	0.045
factor5	0.094	0.029

Source: Own calculation

Note: Factor analysis for the common set of standard policy measures and structural policy interventions; Eigenvalue – eigenvalue of the correlation matrix: proportion - contribution of current factor to total variance

In the second set of policy indicators (encompassing macroprudential interventions) there are only categorical (discrete) variables. We therefore used the same procedure to implement factor analysis. Eigenvalues and the size of explained variances are illustrated in Table 6. Because the first two eigenvalues are much larger than the rest of the eigenvalues and also the only ones larger than 1, we extracted from the set of macroprudential policy indicators the two factors denoted by fac_mon1 and fac_mon2.

Table 6. Factor analysis for the macroprudential interventions

Factor	Eigenvalue	Proportion
factor1	2.877	0.379
factor2	2.617	0.344
factor3	0.734	0.097
factor4	0.643	0.085
factor5	0.504	0.066

Source: Own calculation

Note: Factor analysis for the set of macroprudential interventions; Eigenvalue – eigenvalue of the correlation matrix: proportion - contribution of current factor to total variance

5. Results

The empirical results are presented for credits to households and credits to firms in the first subchapter (Table 7). In addition to presenting the regression results of Eq. (1a) and (1b),

in the second subchapter we also present the estimated effects of wholesale and retail funding, and effects of macroprudential policy as well as effects of standard macroeconomic policies and structural policies on credits to households and credits to firms.

5.1. *Dynamics of credits to households and credits to firms*

Assuming that our key explanatory variables, retail and wholesale bank funding, are set exogenously, one can estimate equations (1a) and (1b) by ordinary least squares (OLS); but, taking into account that these two variables might be driven by factors that also drive firm and household credit, we estimated both equations with instruments (2GOLS is used). In addition to both funding variables, costs of impairment were also instrumented. The number of employees, the number of branches, the number of ATMs, prices on the real estate market, FDI inflows, real estate prices, dummies for Croatia and Montenegro, and interactions among the mentioned variables are used as instruments. We used panel estimation for the entire period to determine the most persistent effects of the funding channels throughout the whole episode, while period (policy) discontinuities are quantified by dummies.⁶

The model of credit-to-households dynamics (column 1) and the model of credit-to-firm dynamics (column 2) are presented in Table 7. The models are of acceptable statistical quality. Crucial demand and supply variables are of the correct sign and significant size. Sargen-Hansen and Anderson_Rubin statistics also confirm the quality of the instruments used.

⁶ We estimated both models also for every year separately. Although significance and signs of variables document similar conclusions to those given by the estimated panel models, we presented only results of the panel models because yearly variability of estimated parameters is pretty high because of relative small number (55) of degrees of freedom for the given number of explanatory variables (9) in the yearly models. However, the results of every year separately model show that our panel regression is very robust.

Table 7: Results of the 2GSLs estimation of loans to households

		Loans to household s (Eq.1a)	Loans to firms (Eq. 1b)
Wholesale funding	γ_2	0.189*** (0.065)	δ_2 0.936*** (0.116)
Retail (deposit) funding	γ_3	0.018 (0.0058)	δ_3 0.358*** (0.103)
Cost of impairment (lag)	γ_4	-0.526* (0.298)	δ_4 -0.900** (0.423)
Nominal GDP growth	γ_5	0.172*** (0.020)	δ_5 0.100*** (0.038)
Fac_prudential1.(lag)	γ_6	-0.003* (0.001)	δ_6 0.002 (0.003)
Fac_prudential(lag)	γ_7	0.005** (0.02)	δ_7 0.076** (0.004)
Fac_pol_struc (lag)	γ_8	0.006*** (0.003)	δ_8 0.002 (0.004)

Foreign banks	γ_9	0.151*** (0.005)	δ_9	-0.005 (0.008)
Size	γ_{10}	-0.004 (0.006)	δ_{10}	0.007 (0.009)
b_h			δ_1	-0.001 (0.009)
b_n	δ_0	-0.00619 (0.00676)	δ_0	0.000005 (0.00872)
Constant	γ_0	-0.008 (0.006)		0.039 (0.024)
Observations		338		338
Overidentification test		0.369		0.353
Sargan-Hansen J statistic (p-value)				
Underidentification test				
Anderson-Rubin Wald (p-value)		0.000		0.000

Source: Own calculations.

Notes: The IV 2GSLs method is used; the dependent variable is the yearly difference in loans to households per unit of balance sheet; panel data; standard errors are reported in parentheses; ***, **, and * denote statistically significant values at 1, 5, and 10 percent on a two-tailed test, respectively; instruments used in the 2GSLs estimation consist of the number of employees, the number of branches, the number of ATMs, FDI flows, house prices, dummies for Croatia and Montenegro and interactions among the mentioned variables. Robust tests are used for the verification of instrument quality: Sargen-Hansen statistics test for over-identifying restrictions, and Anderson-Rubin Wald tests for weak instruments.

The model of credit to households (Eq.1a) indicates that demand drove credits throughout the entire observed period. Its impact is modest ($\gamma_5 = 0.172$), which means that for each increasing or decreasing percent of the GDP, the impact of demand increased or

decreased household credits by almost 0.2 percent of the balance sheet on average. Macroprudential policy interventions as well as standard macro policy measures and structural policy interventions influenced the household credits significantly, as is documented by significance of the corresponding policy factors (fac_prudent1, fac_prudent2 and fac_pol_struk). Because factors were not being rotated (to get easy to interpret values), interpretation of their effects on credits (sign) is not straightforward. Effects could be, namely, revealed by studying complete effects of all factors for every specific set of policy indicators, that is by studying the sum of products of coefficient and corresponding factor over all factors (of this very specific set of policy indicators) acting in the model. Such complete effects are presented in tables of detailed policy effects in Chapter 5.2, which follows after the basic overview of the model results.

On the supply side, wholesale funding on average significantly influenced credits in all three countries ($\gamma_2 = 0.189$) throughout the entire observed period. On average, each percent of the increase (decrease) in wholesale funding per unit of the balance sheet resulted in a 0.19 percent increase (decrease) of credits to households per unit of the balance sheet. The impact of retail funding (deposits of non-financial entities and government entities) is not statistically significant. The coefficients in the first column of Table 7 also demonstrate that foreign-owned banks drove credits to households more intensively than domestic banks ($\gamma_{14} = 0.151$). The value of the coefficient of the impairment costs variable (per unit of the total balance sheet) is negative and significant ($\gamma_4 = -0.526$). When banks create additional costs in their income statements by underwriting losses or making reservations for future losses, their effect on credits to households is obviously negative and large. An increase in impairment costs by 1 percent of the balance sheet decreases the increment of credits to households by 0.5 percent of the balance sheet in the following year.

Turning to the model of credit to firms (Eq.1b), the effect of demand on credits to firms is positive and significant ($\delta_5 = 0.100$). The cost of impairment is far larger than the same effects for household credits ($\gamma_4 = -0.900$) and also significant. An increase of impairment costs by 1 percent of the balance sheet reduced the increase of credits to firms in the following year for almost the same quantity, specifically, for 0.9 percent of the balance sheet. Out of the factors encompassing the effects of (standard macro, structural, and macroprudential) policy variables, only one factor of macroprudential policy intervention is statistically significant. Corresponding effects on credits to firms are discussed using detailed figures in tables which are presented in Chapter 5.2. Problems with the straightforward interpretation of factors are the same as mentioned for the household credits model.

Crucial drivers (drivers with a very strong impact) of credit-to-firm dynamics are funding flows. Regression coefficients on both funding variables, retail (deposit) funding ($\delta_3 = 0.358$) and especially wholesale funding ($\delta_2 = 0.936$), are high and significant. They are much (at least two times) higher than the corresponding effects on credits to households.

Other supply-side variables (the foreign banks dummy and the size dummy) are not significant in our regression.

Comparing Eq.1a and Eq.1b, we can maintain that both funding channels (wholesale and retail (deposit) channels) are important for credit to firms, and that for credits to households only wholesale funding is an important driver (with the corresponding coefficient being positive and statistically significant). This partly confirms our hypothesis H_1 . It is also clear from both equations that effects of wholesale funding were on average more important for credits to firms than credits to households, which confirms our hypothesis H_2 . Hypothesis H_5 is only confirmed for the ownership of banks and only in the case of credits to households.

5.2. Comparing estimated credit effects of funding dynamics and policy measures

To compare and evaluate the trajectories of studied credit effects through the Great Recession episode, in the Table 8 and 9 are presented actual dynamics of credits, model estimated contributions to credits dynamics of both (wholesale and retail) components of funding and both analysed components of policy interventions, that is contribution of macroprudential interventions and actions of standard macro and structural policy. Simulated values are presented for three phases of credit dynamics, which mostly coincide with the phases of economic activity. We denoted them, therefore, as boom (2007-2008), bust (2009-2010) and recovery (2011-2011). All presented values are evaluated for median bank of specific (studied) country and phase. In Table 8 simulated effects are given for credits to households and in Table 9 for credits to firms.

Table 8: Funding and policy effects on credits to households

	Actual credit dynamics	Funding effects		Policy effects	
		Wholesale	Retail	Prudential	Macro and structural
		Boom			
Croatia	0.0329	0.0001	0.0011	-0.0030	-0.0007
Montenegro	0.1171	0.0106	0.0014	0.0021	0.0026
Slovenia	0.0270	0.0125	0.0009	-0.0044	-0.0010
		Bust			
Croatia	-0.0004	0.0000	0.0006	0.0046	0.0056
Montenegro	-0.0219	0.0003	0.0008	0.0004	0.0051
Slovenia	0.0107	-0.0018	0.0008	0.0004	0.0094
		Recovery			
Croatia	0.0017	0.0001	0.0006	0.0028	0.0022
Montenegro	0.0081	-0.0019	0.0009	-0.0013	-0.0041
Slovenia	0.0005	-0.0079	0.0001	0.0045	-0.0010

Source: Own calculations

Note: Model estimates of funding and policy effects on credits to households; increment of credits per unit of balance sheet for median bank

Table 8 clearly documents that in Montenegro and Slovenia wholesale funding was much more important (larger) determinant of household credits dynamics than retail funding. Just the opposite was the situation in Croatia, where retail funding effects were larger. Still, all those funding effects were weak (small in size) in all countries. Except in boom phase, they were, namely, in absolute terms less than 0.8 percentages of the bank balance sheet. While retail funding enabled increasing credits to household in all phases and countries, collapsing of foreign inflows curbed credits to households by cutting wholesale funding in Slovenia from the bust phase onward, and in Montenegro in the recovery phase.

In boom phase, both policy interventions (of macroprudential policy as well as standard macro and structural policy) curbed growth of credits to households in Croatia and Slovenia but not in Montenegro, even though actual growth of credits in Montenegro was already very high. But the size of all those effects was small (in absolute terms less than 10% of actual dynamics of credits to households). In the bust phase policy interventions supported household credit growth in all three countries, total policy contributions were much larger than (absolute values of) funding contributions (from 0.5 percentages in Montenegro to 1 percentage of balance sheet in Slovenia and Croatia). In recovery, only in Croatia policy interventions supported growth of credits to households; in Montenegro policy interventions curbed credit dynamics on larger scale than wholesale funding. Obviously, only in Croatia and mostly in Slovenia, but not in Montenegro, policy interventions were countercyclically oriented.

Table 9. Funding and policy effects on credits to firms

	Actual credit dynamics	Funding effects		Policy effects		
		Wholesale	Retail	Prudential	Macro and structural	
		Boom				
Croatia	0.0412	0.0004	0.0217	-0.0129	-0.0003	
Montenegro	0.1353	0.0527	0.0287	0.0077	0.0010	

Slovenia	0.0980	0.0620	0.0188	-0.0039	-0.0004
	Bust				
Croatia	0.0294	0.0000	0.0114	0.0053	0.0021
Montenegro	0.0299	0.0017	0.0160	0.0009	0.0019
Slovenia	-0.0013	-0.0089	0.0156	0.0010	0.0035
	Recovery				
Croatia	0.0281	0.0006	0.0120	0.0027	0.0008
Montenegro	-0.0101	-0.0095	0.0175	-0.0037	-0.0015
Slovenia	-0.0219	-0.0393	0.0027	0.0056	-0.0004

Source: Own calculations

Note: Model estimates of funding and policy effects on credits to firms; increment of credits per unit of balance sheet for median bank

In the boom phase, in Montenegro and Slovenia, but not in Croatia, the wholesale funding was far stronger driver of credit to firms dynamics (it accounted for around half of actual credit dynamics) relative to retail funding, similarly as for credits to households. Policy interventions (of macro prudential as well as of standard macro and structural actions) curbed increasing of credits in Slovenia and Croatia but not in Montenegro. But effects were weak (small in size), with the only exception of the macroprudential policy interventions in Croatia, which squeezed actual growth of credits to firms by more than 25%.

In the bust phase wholesale funding effects collapsed to around 0 in Montenegro and Slovenia and stayed unchanged (at 0) in Croatia, so that retail funding (which less than halved) remained the crucial driver of credits to firms. In all three countries policy interventions supported weak growth of credits in the bust phase, they were therefore countercyclical, but corresponding contributions were small, the largest (in Croatia and Slovenia) were around 0.3 to 0.5 percentages of balance sheet.

In Montenegro and especially in Slovenia, further falling of foreign financial inflows in recovery squeezed wholesale funding and through banking intermediation also credits to firms. In Croatia there was almost no visible change in wholesale funding credit effect in recovery phase. Retail funding stayed almost unchanged in Croatia and Montenegro but

dropped to almost 0 in Slovenia. Only in Croatia policy interventions systematically supported credit growth, although Croatia was the only one which didn't face deteriorated funding effects. In Slovenia, policy measures contributed to firm credit dynamics slightly less than in Croatia, around 0.35 percentages (macroprudential interventions supported credits growth much more than measures of standard macro and structural policies curbed it), while in Montenegro policy interventions were procyclically oriented and curbed firm credit dynamics for around 0.5 percentages of balance sheet.

Comparing figures in Table 8 and Table 9, it could be concluded that macroprudential interventions were more effective for credits to firms than for households, and that effectiveness of common standard macro and structural policy measures was just the opposite. However, as documented, all those effects are rather weak already in comparison with the retail, not to mention wholesale funding effects.

6. Conclusions

Our study of three countries in the Balkans during the Great Recession brought about additional insights on crisis development in emerging economies. The enormous size, simultaneous timing, and sharp focus of the shocks make the Great Recession a natural experiment for a study of crisis credit performance and corresponding policy interventions in emerging countries. Its main contribution to the literature is the demonstration that weak and unfocused policy effects as well as the large and procyclical effects of financial flows through bank retail and especially wholesale funding channels worked in sync, both contributing to the enormous crisis costs in these countries.

We have shown that foreign financial flows influenced bank retail and wholesale funding channels, and through them also credits to households and credits to firms. Wholesale funding

elasticities are much greater than in the case of retail funding for both types (firm and household) of credits. We therefore found that the wholesale funding effects were far more damaging regarding the stability of bank (firm and household) credits during the crisis than retail (deposit) funding effects. The effects of the procyclical volatility (skyrocketing in the boom period and collapsing in the bust and recovery period) of wholesale funding were especially pronounced in credits to firms, where the passthrough effect of wholesale funding is almost 1. This holds true for all three observed countries, despite considerable differences in the volume and especially the structure of their financial flows.

Interestingly enough, our analysis also shows significant but, in comparison with corresponding funding effects, almost systematically weak (small in size) effects of policy interventions and regulation on credits during the crisis in the three countries under observation. Only in Croatia during the boom phase did the policy effect on credits to firms exceeded 1 percent of the balance sheet. The large effect of the external flows but the small effect of policy interventions additionally corroborate that in emerging economies, sound credit growth could not be efficiently controlled through (indirect) macroprudential instruments as well as standard macro and structural policy interventions if capital controls are not a crucial tool of such policies.

Our study documented that crisis orientation in procyclical or countercyclical policy interventions was not systematic in our studied countries. Such erratic policy orientation probably added considerably to weak policy effects on credit dynamics. Only in the bust phase were policy interventions systematically countercyclical (but still weak) in all three countries. Croatia was otherwise the only country where policy interventions were countercyclically focused in all phases of the crisis. Costs of procyclical policy orientation were probably the highest during recovery, when policy interventions (especially through standard macro and structural policy measures) in Slovenia and Montenegro even amplified

credit decreases driven by the collapse of wholesale funding. Other policy goals and the allowance of policy maneuvers likely influenced such erratic policy interventions throughout the crisis episode. While Croatia's primary policy goal was to defend the value of its currency throughout all the periods of the crisis development (Bokan et al., 2009; Feige et al., 2002; IMF, 2014), in Slovenia and Montenegro the main policy stance during the boom was to use favorable conditions on global capital markets to accelerate the catching-up process of the real economy. In the bust and recovery regimes these policies were reversed. The reduction of credits was the main instrument used to increase banking liquidity in Montenegro in the recovery regime since no other options for maneuvers existed (Ministry of Finance of Montenegro, 2011). Erroneous sequencing, timing, and calibration of measures in Slovenia in the bust and recovery periods, partly because of its own mistakes and partly because of the measures enforced by the new center of economic gravity (the EU), created an environment in which banking credits, especially credits to firms which were driven by the collapse of wholesale funding, drastically decreased (Bole et al., 2014).

As mentioned, our study documents that in a crisis, credit effects of policy interventions are weak; but our analysis also shows that the relative size of a policy intervention's effects differs between credits to firms and credits to households. On average, macroprudential policy interventions were more effective for credits to firms, while effects of standard macro and structural actions were stronger for credits to households.

We also contribute to findings on the importance of bank characteristics in transmitting foreign flows to credits in emerging economies during the Great Recession. In contrast to a Turkish study (Baskaya et al., 2017), which showed that domestic banks expand credits to firms when wholesale funding increases (decreases) whereas foreign banks do not, our study demonstrates that both domestic and foreign banks behave similarly. As foreign subsidiaries were part of the same bank structures in all three countries, such a conclusion is especially

strong. Our study also documents that foreign-owned banks are more active in issuing credits to households than domestic banks. This finding is hardly surprising since foreign banks tried to aggressively increase their market share upon entering the market by offering more favorable credit terms. This was, however, much more difficult to achieve when attempting to grant credits to firms, for which a track record on client performance (information capital) was much more difficult to build (Feldin et al., 2009).

Compared to similar studies (i.e. de Haan, van den End, and Vermeulen, 2015; Jung and Kim 2015; Baskaya et al., 2017), which show that large banks usually issue more credits to firms when wholesale funding increases, our study does not confirm this result. Both smaller and larger banks behave similarly.

Overall, our study is a good presentation of the simultaneous workings of external (capital surge and real shocks) and internal policy factors during financial crisis amplification in the environment of capital scarcity in developing countries. It sheds some light on similar events that occurred in the past and envisages possible future developments. This is of crucial importance since, due to unstable situations around the world, it is difficult to predict when and where the next Minsky moment will happen. The lessons learned from the financial crisis of the Great Recession, as described in this paper, should therefore be taken into serious consideration to avoid the enormous social costs of the destabilization of improperly regulated financial systems.

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APPENDIX

To reconcile theory and reality, we extend the Mundell-Fleming model to include banking sector and funding of banks (wholesale, retail) into the model.

Credit model of the open economy

Considering an open economy with banking, household, and business sectors, let us suppose that credits are extended and redeemed at the end of fixed time intervals – periods. One credit extension-redemption cycle consists of the following phases. At the end of period (t-1), the banking sector extends credits using retail sources (deposits of the business and household sectors), as well as wholesale sources (credits of the central bank and external loans) available at that time. Extended credits generate deposits of the household and business sectors. In the studied period (t), those deposits could change in structure and size, depending on the economic activity and the current account developments. At the end of the studied period (t), the household and business sectors repay credits using available deposits. When deposits are too low, the unredeemed parts of the credits are revolved (increased credits demanded for the following period); if deposits are larger than the credits due, credits are redeemed in full and the credits demanded for the following period are smaller by the difference (between deposits and credits due). Immediately after credit redemption, banks extend new credits, taking into account the available (retail and wholesale) sources and the credit demand for the next period.

We assume that the demand for credits depends on the interest rate and the expected economic activity, in both cases with constant elasticity. The banking sector maximizes its profit by choosing lending interest rates separately for credits in both the household and business sectors, given the funding constraint balance.

Let us suppose that K denotes credits, D deposits, Y economic activity, F wholesale financing, and r the interest rate. Credit demand elasticity on economic activity and interest rate is denoted by parameters β and α , κ is the scale parameter, σ the share of household sector deposits, and μ the money multiplier. For all variables and parameters, subscripts b and h are used to denote business and household sectors, respectively.

We assume that lending interest rate R_a is given by:

$$R_a = R_l + r,$$

where R_a denotes the lending interest rate, r the interest margin, and R_l the bank funding rate. In a small open economy, the costs of bank funding (R_l) are determined by interest rates on the world markets, so we will assume (to make computation simpler) that both the deposit rate and the external funding rate are the same.

The model encompasses four relationships:

$$\left(K_{h,t-1} - \sigma(Y_t)D_t(Y_t) + \kappa_h Y_{t+1}^e \beta_h \right) (1 + r_{h,t} + R_{l,t})^{\alpha_h} = K_{h,t}, \quad (1)$$

$$\left(K_{b,t-1} - (1 - \sigma(Y_t))D_t(Y_t) + \kappa_b Y_{t+1}^e \beta_b \right) (1 + r_{b,t} + R_{l,t})^{\alpha_b} = K_{b,t}, \quad (2)$$

$$K_{h,t} + K_{b,t} \leq D_t(Y_t) + \mu F_t(Y_{t+1}^e), \quad (3)$$

$$\max(r_{h,t} + R_{l,t})K_{h,t} + (r_{b,t} + R_{l,t})K_{b,t} - R_{l,t}D_t - R_{l,t}\mu F_t,$$

where $\sigma > 0$; $1 - \sigma > 0$; $\alpha_h \leq -1$; $\alpha_b \leq -1$; $\beta_h > 0$; $\beta_b > 0$.

The first two relationships present the demand for household and business credits, the third one shows the supply (funding) constraint of the banking sector, and the last relationship shows (the maximization of) the profit goal function of the banking sector. To make the presentation less cumbersome, we assume in what follows that R_l is equal to zero.⁷

Because of the nonlinearity of the system, both credit variables ($K_{h,t}$ and $K_{b,t}$) could not be solved from the system as an explicit function of Y_t , Y_{t+1} , D_t (Y_t), and F_t for general values α_h and α_b . Linearized functions had to be constructed and solved. Still, it is possible to get the explicit and exact (not only linearized) form of the marginal effects of the impacts of wholesale (F_t) and retail (D_t) channels, and to disentangle supply and demand-side factors for both credit components. The same pertains to the actual and expected impacts of economic activity. To get these effects, it is necessary to perform an optimization (to get interest rates) and then to calculate the corresponding marginal effects. The procedure is described in what follows.

Taking into account the constraint maximization of the goal function of the banking sector, we construct

⁷ It is trivial to check that in the case $R_l \neq 0$, in relations (8)–(15) only r_t has to be replaced by $r_t + R_l$, while relations (4)–(7) do not change at all.

$$\mathcal{L} = r_{h,t}K_{h,t} + r_{b,t}K_{b,t} + \lambda(K_{h,t} + K_{b,t} - D_t - \mu F_t)$$

and solve

$$\frac{\partial \mathcal{L}}{\partial r_{h,t}} = 0,$$

$$\frac{\partial \mathcal{L}}{\partial r_{b,t}} = 0.$$

That gives

$$K_{h,t} + \frac{r_{h,t}\alpha_h}{1+r_{h,t}}K_{h,t} + \lambda\left(\frac{\alpha_h}{1+r_{h,t}}K_{h,t}\right) = 0,$$

$$K_{b,t} + \frac{r_{b,t}\alpha_b}{1+r_{b,t}}K_{b,t} + \lambda\left(\frac{\alpha_b}{1+r_{b,t}}K_{b,t}\right) = 0,$$

and

$$\lambda(K_{h,t} + K_{b,t} - D_t - \mu F_t) = 0.$$

The last relation is the Kuhn-Tucker condition, which takes place because the funding constraint is an inequality.

If credit dynamics are derived only by demand factors, the inequality (3) is strict and $\lambda = 0$ (from the Kuhn-Tucker condition). The corresponding (equilibrium) credit trajectory is therefore given as:

$$K_{h,t} = \left(\frac{\alpha_h}{1+\alpha_h}\right)^{\alpha_h} \left(K_{h,t-1} - \sigma D_t + \kappa_h Y_{t+1}^e \beta_h\right), \quad (4)$$

$$K_{b,t} = \left(\frac{\alpha_b}{1+\alpha_b}\right)^{\alpha_b} \left(K_{b,t-1} - (1-\sigma)D_t + \kappa_b Y_{t+1}^e \beta_b\right). \quad (5)$$

Calculating the marginal effects of wholesale funding and deposits, we get:

$$\frac{\partial K_{h,t}}{\partial F_t} = 0, \quad \frac{\partial K_{h,t}}{\partial D_t} = -\sigma \left(\frac{\alpha_h}{1+\alpha_h}\right)^{\alpha_h}, \quad (6)$$

$$\frac{\partial K_{b,t}}{\partial F_t} = 0, \quad \frac{\partial K_{b,t}}{\partial D_t} = -(1-\sigma) \left(\frac{\alpha_b}{1+\alpha_b}\right)^{\alpha_b}.$$

(7)

It is obvious that when banking intermediation operates in a demand (unconstrained funding) mood, the marginal effects of wholesale funding are zero, and the marginal effects of deposits are negative, which corresponds to the demand effects. It follows that in the empirical estimation, the insignificant coefficient of the wholesale funding channel and/or the (significant) negative coefficient of the retail channel are the appropriate indicators that credits are driven by demand factors only.

Whenever relation (3) is tight (when demand and supply factors are active which corresponds to the described situation of three Balkan countries in Great Recession), the Lagrange multiplier λ is free, so that after a trivial manipulation it follows that:

$$\frac{1+r_{h,t}}{\alpha_h} + r_{h,t} = \frac{1+r_{b,t}}{\alpha_b} + r_{b,t}. \quad (8)$$

Substituting (1) and (2) in (8) and taking logs gives:

$$\frac{1}{\alpha_h} \log K_{h,t} - \frac{1}{\alpha_h} \log(K_{h,t-1} - \sigma D_t + \kappa_h Y_{t+1}^e \beta_h) = \frac{1}{\alpha_b} \log K_{b,t} - \frac{1}{\alpha_b} \log(K_{b,t-1} - (1-\sigma)D_t + \kappa_b Y_{t+1}^e \beta_b) + \log \frac{(1+\alpha_b)\alpha_h}{(1+\alpha_h)\alpha_b} \quad (9)$$

Taking the derivatives of (9) and (3) on F, gives the system of equations (10) and (11)

$$\frac{1}{\alpha_h} \frac{1}{K_{h,t}} \frac{\partial K_{h,t}}{\partial F_t} = \frac{1}{\alpha_b} \frac{1}{K_{b,t}} \frac{\partial K_{b,t}}{\partial F_t}, \quad (10)$$

$$\frac{\partial K_{h,t}}{\partial F_t} + \frac{\partial K_{b,t}}{\partial F_t} = \mu. \quad (11)$$

After solving the system, the impact of wholesale financing on credits is as follows:

$$\frac{\partial K_{b,t}}{\partial F_t} = \frac{\mu \alpha_b K_{b,t}}{\alpha_b K_{b,t} + \alpha_h K_{h,t}}, \quad (12)$$

$$\frac{\partial K_{h,t}}{\partial F_t} = \frac{\mu \alpha_h K_{h,t}}{\alpha_b K_{b,t} + \alpha_h K_{h,t}}.$$

Obviously, the size of the impact on (business-relative-to-household) credits depends on the interest rate elasticity of credit demand and, especially, the structure of the credits. Equation (12) shows that in an economy where credits to the business sector (or increments) are larger than credits to the household sector, the impact of wholesale financing could be larger (with the same differences in elasticities). However, differences in interest rate elasticities of credit demand have just the opposite effect⁸, so that actual impact of wholesale financing on firm credits versus impact on household credits could not be deduced simply by observing only the credit structure, that is without taking into account (modeling) also interest rate structure. Moreover, taking into account equation (1), namely the impact of the current account changes on deposits D and consequently on credit demand, relationship (12) documents a falling impact of the wholesale channel financing in the case of current account improvement.

⁸ Interest rate elasticity of household credit demand could differ a lot from interest rate elasticity of firm credit demand – could be even much higher, especially for longer term credits. See, for example, Kakes and Sturm (2002), or Hense (2015) from that for firm credits

Taking the derivatives of (9) and (3) on D gives the size and structure of the impact of retail (deposit) channel financing on business and household sector credits:

$$\begin{aligned}\frac{\partial K_{b,t}}{\partial D_t} &= \frac{\alpha_b K_{b,t}}{\alpha_b K_{b,t} + \alpha_h K_{h,t}} + \frac{\sigma(1+r_{h,t})^{\alpha_h} \alpha_b K_{b,t} - (1-\sigma)(1+r_{b,t})^{\alpha_b} \alpha_h K_{h,t}}{\alpha_b K_{b,t} + \alpha_h K_{h,t}}, \\ \frac{\partial K_{h,t}}{\partial D_t} &= \frac{\alpha_h K_{h,t}}{\alpha_b K_{b,t} + \alpha_h K_{h,t}} + \frac{(1-\sigma)(1+r_{b,t})^{\alpha_b} \alpha_h K_{h,t} - \sigma(1+r_{h,t})^{\alpha_h} \alpha_b K_{b,t}}{\alpha_b K_{b,t} + \alpha_h K_{h,t}}.\end{aligned}\quad (13)$$

Comparing the effects on household and business sector credits, it has to be underlined that it is also in the case of retail channel effects that the most important drivers of the difference are interest rate elasticities and the structure of credits, since the second item in both relationships (13) is the difference between two similar factors, which are probably small in comparison with the first item if shares of deposits do not differ a lot among the business and the household sector (σ is approximately 0.5).

Using a trivial manipulation, the retail channel impact on credits could be given in terms of the wholesale impacts as follows:

$$\begin{aligned}\frac{\partial K_{b,t}}{\partial D_t} &= \frac{1}{\mu} \left\{ \frac{\partial K_{b,t}}{\partial F_t} + \left[\sigma(1+r_{h,t})^{\alpha_h} \frac{\partial K_{b,t}}{\partial F_t} - (1-\sigma)(1+r_{b,t})^{\alpha_b} \frac{\partial K_{h,t}}{\partial F_t} \right] \right\}, \\ \frac{\partial K_{h,t}}{\partial D_t} &= \frac{1}{\mu} \left\{ \frac{\partial K_{h,t}}{\partial F_t} + \left[(1-\sigma)(1+r_{b,t})^{\alpha_b} \frac{\partial K_{h,t}}{\partial F_t} - \sigma(1+r_{h,t})^{\alpha_h} \frac{\partial K_{b,t}}{\partial F_t} \right] \right\}.\end{aligned}\quad (14)$$

These relationships show very transparently that some important determinants of the relative size of the retail channel impact are the same as those of the relative size of the wholesale channel (interest elasticities and the structure of the credits), especially if the shares of deposits do not differ a lot between both sectors. In addition, relationship (14) reveals the drivers of the difference between wholesale and retail channel impacts. Since the money multiplier could drop drastically (under 1) in financial crisis⁹ relationship (14) also documents consequent crisis change in the size of the retail channel impact relative to the wholesale channel impact. After financial crisis erupted, the retail channel impact could, therefore, not only attain but also significantly exceed the wholesale channel impact, especially in the sector which has the smallest share in deposits.

Because variable F_t affects only the supply of funds (relation (3)), both marginal effects in (12) obviously present theoretical exact values of the wholesale channel supply-side effects, which figure as coefficients in variable F_t in the corresponding (linearized and estimated) empirical model. The deposit variable affects the demand and supply of credits

⁹ In US, for example, already in march 2009 multiplier dropped from 1.8 in the second half of 2008 to under 1. See, for example, Cukierman (2017).

(see relations (1), (2) and (3)), so a straightforward interpretation of deposit marginal effects is not possible. However, relation (14) enables the theoretical disentangling of the role of deposits (demand or supply) in the estimated model. After rearranging relations in (14), it follows that:

$$\frac{\partial K_{b,t}}{\partial D_t} = \frac{1}{\mu} \left\{ \frac{\partial K_{b,t}}{\partial F_t} + (1 + r_{h,t})^{\alpha_h} \frac{\partial K_{b,t}}{\partial F_t} - (1 - \sigma) \left[(1 + r_{h,t})^{\alpha_h} \frac{\partial K_{b,t}}{\partial F_t} + (1 + r_{b,t})^{\alpha_b} \frac{\partial K_{h,t}}{\partial F_t} \right] \right\}, \quad (15)$$

$$\frac{\partial K_{h,t}}{\partial D_t} = \frac{1}{\mu} \left\{ \frac{\partial K_{h,t}}{\partial F_t} + (1 + r_{b,t})^{\alpha_b} \frac{\partial K_{h,t}}{\partial F_t} - \sigma \left[(1 + r_{b,t})^{\alpha_b} \frac{\partial K_{h,t}}{\partial F_t} + (1 + r_{h,t})^{\alpha_h} \frac{\partial K_{b,t}}{\partial F_t} \right] \right\}.$$

Obviously, the marginal effects of deposits on credits can be separated into three effects. The first (positive) is a supply-factor effect, the second (positive) is also a supply-side effect but rescaled by credit rationing intensity, and the third (negative) is a demand-factor effect rescaled by the size of supply-factor effects. For the given structure of deposits, it is possible to calculate, from the estimated coefficients of the empirical model, all three effects separately. For the given D_t and F_t , the expected economic activity affects only credit demand, therefore, the corresponding marginal credit effects present demand factor effects. In the empirical model, GDP growth takes on the role of the expected economic activity, presenting demand factor effects.

By a trivial procedure,¹⁰ systems (1), (2), (3) and (8) could be linearized and solved for $(K_{h,t} - K_{h,t-1})/Bilt-1$ and $(K_{b,t} - K_{b,t-1})/Bilt-1$ as a function of $(F_t - F_{t-1})/Bilt-1$, $(Y_t - Y_{t-1})/Y_{t-1}$ and $(D_t - D_{t-1})/Bilt-1$, where $Bilt-1$ is the bank balance sheet in the previous period (that is $Bilt-1 = K_{h,t-1} + K_{b,t-1}$). The corresponding equations are presented the main text as (1a) and (1b).

It needs to be emphasized that the priority here is the considerable information available not only on the linearized but also on the exact values of the coefficients β_2 , β_3 , and β_6 in equations (1a) and (1b). Equation (12) makes it evident that the exact value of the marginal wholesale financing effects on credits, figuring in our empirical equations (1a and 1b), has the same form (that is, (8)) because both differentials (∂K and ∂F) are divided by the same quantity, namely the balance sheet $(K_{h,t-1} + K_{b,t-1})$. The same pertains to the marginal retail financing effects. From equations (13) (or (14)), it follows that the exact form of the

¹⁰ The procedure has three steps; first, equations (1) to (3) are divided by $K_{h(-1)} + K_{b(-1)}$, and (1) and (2) are logarithmized; second, (1), (2), and (3) are expanded in Taylor series (keeping only linear terms) of the (possible lagged) variables $(K_{h,t} - K_{h,t-1})/Bilt-1$, $(K_{b,t} - K_{b,t-1})/Bilt-1$, $(F_t - F_{t-1})/Bilt-1$, $(Y_t - Y_{t-1})/Y_{t-1}$, $(Y_{et+1} - Y_e)/Y_e$ and $(D_t - D_{t-1})/Bilt-1$; and third, linearized systems (1) to (4) are solved for $(K_{h,t} - K_{h,t-1})/Bilt-1$, $(K_{b,t} - K_{b,t-1})/Bilt-1$.

marginal effect on credits in our empirical equations (1a and 1b) is again identical to the values presented in (13) (or (14)) because both differentials, ∂K and ∂D , are normalized by the same quantity, namely the balance sheet ($K_{h,t-1} + K_{b,t-1}$).

While the same propositions could be made about the marginal effect of economic activity expectations, the corresponding theoretical effects are not presented since they would not be relevant to our operational model. Because of the insufficient degree of freedom in our empirical equations (1a) and (1b) (economic activity has the same value for all banks in the same country), we have not been able to separate the marginal effects of the expected Y_{t+1} and the actual Y_t of economic activity – in empirical equations 1a and 1b, both effects are merged.