Global Financial Cycle, Household Credit, and Macroprudential Policies^{*}

Mircea Epure Irina Mihai Camelia Minoiu

José-Luis Peydró

September 4, 2021

We show that macroprudential policies dampen the impact of global financial conditions on local credit cycles. For identification, we exploit exogenous variation in the U.S. VIX and household and business credit registers in a small open economy, where banks depend on foreign funding and macroprudential measures vary over a full boom-bust cycle. When the VIX is low, tighter macroprudential policies (i) reduce household lending, notably for riskier (FX and high DSTI) loans and by banks dependent on foreign funding, (ii) increase local currency lending to real-estate firms, and (iii) dampen house prices and economic activity in areas with higher FX-loans.

Keywords: macroprudential policies, global financial cycle, boom-bust credit cycle, household and business credit, foreign funding, banks **JEL codes:** G01, G21, G28, F30, E58

^{*}Affiliations: Mircea Epure: Universitat Pompeu Fabra, Barcelona School of Economics, and UPF-Barcelona School of Management, mircea.epure@upf.edu; Irina Mihai: National Bank of Romania, irina.mihai@bnro.ro; Camelia Minoiu: Federal Reserve Board, camelia.minoiu@frb.gov (Corresponding author. Address: 20th St. & Constitution Avenue NW, Washington DC 20006, U.S.A. Phone: +1-202-560-4268); José-Luis Peydró: Imperial College London, ICREA-Universitat Pompeu Fabra, CREI, Barcelona School of Economics, jose.peydro@gmail.com. We are grateful for useful comments and suggestions from Adrian Alter, Jon Bridges, Mai Dao, Giovanni Dell'Ariccia, Charles O'Donnell, Ariadna Dumitrescu, Christian Eufinger, Xavier Freixas, Filippo Ippolito, Sebnem Kalemli-Ozcan, Tumer Kapan, Christina Kinghan, Andrea Presbitero, Matt Pritsker, Claudio Raddatz, Alessandro Rebucci, Rafael Repullo, Farzad Saidi, Enrique Sentana, Hyun Song Shin, Javier Suarez, Tibor Szendrei, Judit Temesvary, Francesc R. Tous, Jerome Vandenbussche, Xavier Vives, Paul Willen, Andrei Zlate, and participants at numerous seminars and conferences. We thank Ria Sonawane for help with proofreading the paper. Mircea Epure acknowledges support from the Spanish Government grant PID2020-115660GB-I00, and from the Serra Húnter program. This project received funding from the European Research Council under the European Union's Horizon 2020 research and innovation programme (grant no. 648398). José-Luis Peydró acknowledges financial support from the PGC2018-102133-B-I00 (MCIU/AEI/FEDER, UE) grant. Both authors thank the Spanish Ministry of Economy and Competitiveness through the Severo Ochoa Programme for Centres of Excellence in R&D (CEX2019-000915-S). Camelia Minoiu is grateful to the University of Pennsylvania for hosting her during the early development of this project. The views expressed in this paper are those of the authors, and should not be attributed to the National Bank of Romania, the Federal Reserve System, their Executive Boards, or policies.

Credit booms financed with foreign liquidity tend to precede systemic banking crises, with severe real effects (Laeven and Valencia, 2013; Gourinchas and Obstfeld, 2012; Bernanke, 2018). This phenomenon highlights the impact of global financial conditions on the local economic cycle (Rey, 2016, 2015; Schularick and Taylor, 2012; Jordà, Schularick and Taylor, 2011), which is often driven by credit to households (Müller and Verner, 2021; Mian, Sufi and Verner, 2017; Mian and Sufi, 2015).

There is broad agreement among policymakers and academics that macroprudential policies should be part of the macroeconomic and regulatory toolkit.¹ Indeed, many countries used macroprudential policies in the recovery and boom following the 2008–2009 financial crisis (Dell'Ariccia *et al.*, 2012). More recently, the onset of the COVID-19 pandemic led to spikes in volatility and uncertainty, triggering a global risk-off episode.² In response, policymakers relaxed macroprudential policies to support the flow of bank credit to the real sector (BIS, 2020; Liang, 2020). According to Yale University's COVID-19 Financial Response Tracker, by June 2020 more than 50 countries had eased macroprudential policies following the onset of the pandemic (Benediktsdottir, Fedlber and Liang, 2020). While the domestic effects of macroprudential policies have been studied previously, much less is known about these policies' ability to insulate the local economic cycle from global financial shocks.

In this paper, we study the role of macroprudential policies in dampening the impact of global financial conditions on local credit and the real economy over a full boom-bust cycle. For identification, we use data from Romania, a small open economy in the European Union (EU) that is exposed to global financial conditions through a banking system that depends on foreign funding and that grants risky foreign currency (FX) loans to the household sector. A wide range of macroprudential policies deployed during the boom-bust cycle around the

¹See, e.g., Coimbra, Kim and Rey (2021); Forbes (2021); Jeanne and Korinek (2020, 2019); Bianchi and Mendoza (2018); Adrian (2017); Farhi and Werning (2016); IMF-FSB-BIS (2016); Claessens (2015); Freixas, Laeven and Peydró (2015); Williams (2015); Dell'Ariccia, Laeven, Igan, Tong, Bakker and Vandenbuss-che (2012); Hanson, Kashyap and Stein (2011); Bianchi (2011); IMF (2009) and Brunnermeier, Crockett, Goodhart, Persaud and Shin (2009).

²In March 2020, the CBOE Volatility Index (VIX) spiked to levels comparable to its earlier peak during the 2008–2009 financial crisis; other indicators of financial distress showed similar patterns (Altig, Baker, Barrero, Bloom *et al.*, 2020).

2008–2009 global financial crisis (GFC) allows us to compare the effects of macroprudential policies during the global boom and bust. To this end, we use two confidential credit registers with detailed information on all loans extended by the banking sector to households and firms, and examine the effects of the global financial cycle on household lending, business lending, house prices, and real economic activity, depending on ex ante macroprudential policies.

We exploit exogenous variation (to Romania) in global financial conditions—which we capture with changes in the U.S. VIX (Rey, 2016, 2015; Borio, 2014)—to analyze the response of total and risky lending to households and firms (for instance in FX or to leveraged borrowers) to lagged macroprudential policy. Furthermore, we exploit the National Bank of Romania's (NBR) many macroprudential instruments between 2004 and 2012, which include limits on credit exposures in foreign currencies (largely extended to unhedged borrowers), minimum reserve requirements on local and foreign currency deposits (a key source of foreign bank funding), time-varying ceilings on loan-to-value (LTV) and debt-service-to-income (DSTI) ratios for household loans, changes in capital requirements, and loan provisioning rules. The high frequency and large number of such measures make it very difficult to isolate the effect of individual policy events (see, e.g., Akinci and Olmstead-Rumsey (2018)). Instead, we capture macroprudential policy conditions by collecting information from all the introductions, modifications, and removals of macroprudential instruments into one index. Following Cerutti, Claessens and Laeven (2017), we classify each policy event as a tightening (+1) or an easing (-1) and define macroprudential policy index (MPP) as the cumulative sum of these values from 2004 onwards, such that each policy instrument is reflected in the index throughout the entire time it is in place and until it is discontinued.

Our data come from two loan-level administrative datasets—a household and a business credit register—coupled with additional information at the bank-, household-, firm-, county- and macro level. The household credit register includes the universe of bank loans to individuals during the 2004–2012 period, at quarterly frequency. We have information on about 2,750,000 household loans (both residential mortgages and consumer loans) from 42 commercial banks. The household dataset contains key characteristics such as loan amount, type, currency, and borrower DSTI. The business credit register includes all bank loans to nonfinancial firms over the same period and same frequency, for close to 380,000 loans. The datasets are matched with quarterly supervisory information on bank balance sheets and with annual data on firm financials. We also gather quarterly data on economic activity— namely house prices, building permits, and nightlights—across counties. We measure the global financial cycle with the market prices-implied uncertainty (VIX) index, a common indicator of market expectations of volatility and investor risk appetite.

We present three main results. First, we show that when the VIX is low, tighter ex ante macroprudential conditions are associated with a slowdown in household lending,³ notably for riskier loans—denominated in FX, to leveraged (high-DSTI) borrowers, and from banks more reliant on foreign funding.⁴ Further, when the VIX is low, a tightening of macroprudential policies is associated with a shift in household lending from FX-denominated loans to local currency loans. By contrast, when the VIX is high, these effects are smaller or statistically insignificant, suggesting a greater potency of macroprudential policies to dampen the effects of the global financial cycle during the boom than the bust.

³We lag the MPP index in relation to the VIX (i.e., macroprudential policy does not react to VIX). This allows us to identify the effects of the VIX, which is exogenous with respect to the local credit cycle, on bank credit depending on the predetermined macroprudential environment. We use either a dummy of low VIX or the continuous VIX, and we use a lag of up to half a year between VIX and MPP. Moreover, macroprudential policies generally tighten in response to higher risk (higher credit growth), so—if anything— the reverse causality bias is *positive*, which works against us finding a negative effect. Hence, our results can be interpreted as a lower bound on the effects of VIX on credit depending on ex ante MPP. In addition, we control for potential macro confounders of macroprudential policies. Specifically, in all regressions we include interaction terms between real GDP growth (the only robust macro determinant of macroprudential policy) and the variables with which we interact the MPP index to ensure that the estimated coefficients on the MPP index do not pick up changes in local business cycle. Furthermore, we control for unobserved changes in the macro environment or dynamics of specific loan markets (e.g., mortgages or consumer loans) by exploiting the granularity of our data and further including interacted fixed effects such as bank×time, borrower's county×time, and loan-type×time fixed effects.

⁴We also find the same results after tightening of macroprudential policies (i.e., for all the periods). However, effects are quantitatively stronger when global financial conditions are softer, proxied by low VIX. In addition, when using the continuous measure of VIX (rather than a low VIX dummy for high global risk appetite), the result on foreign versus more local bank funding becomes identical. That is, this result as compared to the others is not robust across all specifications.

Second, we analyze whether banks reallocate some of the lending capacity released by tighter constraints on household leverage to the (less regulated) business sector, especially when the VIX is low.⁵ We find that a tightening in household-targeting macroprudential policies is associated with more lending to real-estate and construction firms, but only in local currencies. These effects are weaker or statistically insignificant for firms outside the real estate sector, for local-currency loans, or in periods of high VIX. Despite this rebalancing effect, we also find that when the VIX is low, tighter ex ante macroprudential policies are associated with less total lending (to households and firms) and with a lower share of FX loans at the local level, suggesting a compositional shift toward (less risky) local currency loans.

Third, our results suggest that, when the VIX is low, the real effects of ex ante macroprudential policies are relatively stronger. Economic regions more exposed to macroprudential policies through a higher prior share of FX loans on local banks' books experience relatively lower house price growth and economic activity (measured by approvals of building permits and nightlights), with estimates consistently larger when the VIX is low. Taken together, these findings suggest that macroprudential policies are more effective at dampening credit growth during the boom than they are at reviving it during the bust and point to a previously undocumented asymmetry in the potency of macroprudential regulation to dampen global financial shocks.

Our estimates are economically significant. When the VIX is low, a tightening of macroprudential policy by half a standard deviation (SD) is associated with FX loan volumes lower by 17.7%. This effect is larger for high-DSTI borrowers compared to low-DSTI borrowers by 2.4 percentage points (ppts) and for banks with high versus low exposure to foreign funding by 3.5 ppts. Turning to real effects, when the VIX is low and ex ante macroprudential policies tighten by half an SD, areas with high ex ante share of FX loans experience lower growth rate of building permits, house prices, and nightlights by between 0.9 and 1.9 ppts

⁵Macroprudential policies in Romania, as in many other countries, target household leverage and banks, not nonfinancial firms.

compared to 0.3 and 0.7 ppts for low exposure areas. These effects are smaller or statistically insignificant when the VIX is high. Overall, these magnitudes underscore a quantitatively significant dampening effect of macroprudential policies on the global financial cycle both for bank credit, risk-taking, and the real economy.

Contributions to the Literature Our paper contributes to two strands of literature in international finance. First, the paper is related to the literature on the effects of capital flows and the global financial cycle on domestic lending and the real sector (Forbes and Warnock, 2012). Previous studies analyze the cross-border spillovers of global financial conditions on bank lending and risk-taking (Coimbra and Rey, 2018; Bruno and Shin, 2015a,b; Giannetti and Laeven, 2012a,b; Schnabl, 2012) through the activities of international banks (Cetorelli and Goldberg, 2012, 2011).⁶ Bräuning and Ivashina (2019) find a strong link between U.S. monetary policy and credit cycles in emerging markets, with the U.S. monetary easing cycle increasing USD-denominated bank lending to firms in emerging markets much more than for developed markets. Moreover, this effect is stronger for riskier countries and, within countries, for riskier firms. Morais, Peydró, Roldán-Peña and Ruiz-Ortega (2019) show that European and U.S. banks subsidiaries in Mexico transmit monetary policy shocks in home countries to local firms through an international bank lending and risk-taking channel of global monetary policy.⁷ Baskaya, Di Giovanni, Kalemli-Özcan, Peydró and Ulu (2017) and Baskaya, Giovanni, Kalemli-Özcan and Ulu (2021) document significant financial and real impacts of capital inflows on credit to Turkish firms. We add to these studies new evidence that local macroprudential policies can serve as a counteracting force to the transmission of global financial conditions to the local credit cycle in emerging markets.

Second, the paper adds to the literature on the transmission of macroprudential poli-

⁶An earlier literature in international finance focused on co-movements of credit flows and international asset prices, with implications for the level and volatility of international capital flows (Karolyi, 2003).

⁷See Dell'Ariccia, Laeven and Suarez (2017); Drechsler, Savov and Schnabl (2017); Jiménez, Ongena, Peydró and Saurina (2014) for empirical studies of monetary policy transmission; and Wang, Whited, Wu and Xiao (2020), Whited, Wu and Xiao (2020), Dell'Ariccia, Laeven and Marquez (2014), and Diamond and Rajan (2012) for theoretical contributions on the risk-taking channel of monetary policy.

cies to the local cycle through banks, notably by exploring the efficacy of macroprudential policies at mitigating the transmission of global financial conditions to the local economy over a full boom-bust cycle. Some studies take a cross-country perspective,⁸ and find that macroprudential policies are generally associated with lower growth in domestic credit and economic aggregates.⁹ Acharya, Bergant, Crosignani, Eisert and McCann (2020) show that a tightening of household-targeted prudential ratios (such as LTV and LTI) in Ireland leads banks to reallocate mortgage credit to high-income borrowers and cool housing markets; to invest in riskier securities, and lend more to firms. Our results echo their findings by showing that tighter household-targeted macroprudential policies are associated with more lending to riskier (real-estate) firms. Different from this paper, we examine the impact of global financial liquidity shocks, proxied by the VIX, on the credit cycle depending on ex ante local macroprudential policy. Relatedly, we analyze credit reallocation effects of macroprudential policies over a full economic cycle around the 2008–2009 financial crisis and find that the effects of macroprudential are relatively stronger in booms (proxied by low VIX). Jiménez, Ongena, Peydró and Saurina (2017) document a positive effect of dynamic loan loss provisioning in Spain—a policy targeting lenders—on business credit during a crisis. Contrary to this paper, we find strong effects of macroprudential policy during a boom, while the authors find very weak effects during a boom and strong effects during a bust. Our differing results come from an analysis of macroprudential policies targeting not only bank leverage but also

⁸For a non-exhaustive list of contributions, see Bergant, Grigoli, Hansen and Sandri (2020); Takáts and Temesvary (2019); Cerutti, Claessens and Laeven (2017); Vandenbussche, Vogel and Detragiache (2015); Akinci and Olmstead-Rumsey (2018); Claessens, Ghosh and Mihet (2013); Ostry, Ghosh, Chamon and Qureshi (2012); Lim, Costa, Columba, Kongsamut, Otani, Saiyid, Wezel and Wu (2011) and Crowe, Dell'Ariccia, Rabanal and Igan (2011).

⁹See, e.g., DeFusco, Johnson and Mondragon (2020) and Benetton (2021) for the effects of macroprudential policies aimed at limiting household leverage on mortgage credit availability. Other studies examine the effects of stress tests and supervision (see, e.g., Kandrac and Schlusche (2021) and Calem, Correa and Lee (2019) and Gropp, Mosk, Ongena and Wix (2019)) and those of bank capital regulation (Basten, 2020; Begenau, 2020; Dell'Ariccia, Laeven and Suarez, 2017; Auer and Ongena, 2016; Behn, Haselmann and Wachtel, 2016; Acharya, Engle and Pierret, 2014; Admati, DeMarzo, Hellwig and Pfleiderer, 2013). There is also a related household finance literature on the dynamics of household credit and debt, e.g., Mian and Sufi (2017); Keys, Piskorski, Seru and Yao (2014); as well as Bhutta and Keys (2016) and Skimmyhorn (2016)). Compared to all these papers, we add the international dimension, and we show how local macroprudential policies can mitigate the impact of the global financial cycle on local credit and the economy. Furthermore, we document stronger effects during global booms (when VIX is low).

household leverage, and we examine the dynamics of *both* household and business credit.

The remainder of the paper is organized as follows. Section 1 describes the macroeconomic background of the analysis. Section 2 discusses our approach to measuring changes in macroprudential policies. Section 3 presents the data and empirical specifications. Sections 4 and 5 discuss our results for bank credit and the real economy. Section 6 concludes.

1 Macroeconomic Background

In this section we describe the boom-bust cycle experienced by Romania during the period of analysis. Like other European countries, Romania is a bank-dependent emerging market economy where a large portion of the banking sector is foreign-owned, and as a result banks rely heavily on cross-border funding, especially in the form of deposits from parent banks. Furthermore, a significant share of household credit is extended in foreign currencies (especially EUR and CHF). These factors expose the domestic economy to potential spillovers from the global financial cycle.

Boom-Bust Cycle around Global Financial Crisis Between 2004 and 2012 Romania experienced a full boom-bust cycle. In the years leading to EU accession (in 2007), the economy was booming. GDP grew at an average of 7.3% during 2004–2008 and bank credit was fueled by large capital inflows and the entry of foreign-owned banks (mostly Austrian and French banks). Over this period, bank credit (including in foreign currencies) grew at a real rate of 23% on average (Figure A2), resulting in a tripling of the credit-to-GDP ratio in just four years, reaching 40% of GDP in 2008. The 2008–2009 global financial crisis triggered a steep economic slowdown followed by a modest recovery. Real GDP fell by 7.8% during 2009–2010 and averaged 1.5% in 2011–2012. Post-crisis banking system credit exposures at end-2012 were only four-fifths of their pre-crisis peak level. In addition, the large share of FX loans extended before the crisis coupled with currency depreciation led to a significant

rise in non-performing loans (NPLs), slowing down balance sheet recovery and credit growth (Everaert *et al.*, 2015).¹⁰ Like other countries in Eastern Europe, Romania benefitted from the "Vienna Initiative" in the early stages of the crisis, where West European banking groups with significant credit exposures to East European economies committed to maintain credit flow to the region (De Haas *et al.*, 2015).

Banking Sector Characteristics Over the sample period, the banking system comprises 42 banks, of which 30 private commercial banks, two state-owned and development banks, and 10 foreign-owned banks. The banking sector is fairly concentrated, with the largest five banks accounting for almost 80% of total banking sector assets (see also Duenwald, Nikolay and Andrea (2005)). There was significant foreign bank entry during the boom period, especially from West European banking groups.¹¹ The average share of foreign funding (mostly nonresident foreign currency deposits from parent banks) to total assets is 19%.

Household credit (comprising mortgages and consumer loans) represents half of total private credit and more than half of outstanding bank loan claims are in FX. Between 2005 and mid-2008 household debt increased at a staggering average annual rate of 77%. Household debt rose in parallel with unhedged FX exposures for banks, as local wages are largely denominated in local currency (IMF, 2010). Figure A4 shows household credit by type and currency based on loan originations in the household credit register. By number, residential mortgages represent a little more than 10% while consumer loans account for almost 90%. Residential mortgages are larger so by volume they account for 40% while consumer loans for 60% of total credit volume. The housing market is largely priced in EUR, therefore mortgages tend to be denominated in foreign currency (81% of loans in

 $^{^{10}\}mathrm{In}$ the household credit register, 4% of loans originated during 2004–2012 were restructured or rescheduled and 9.7% were non-performing.

¹¹There were one merger and 12 bank mergers & acquisitions between 2004 and 2012, which we treat as follows. Banks that end up in a merger are kept as distinct banks until the year of the merger and the bank resulting from the merger is kept subsequent to the merger. When a bank ends up being acquired by another bank, that bank appears as a distinct bank until the year of the acquisition. Furthermore, most foreign banks are subsidiaries, yet opportunities for regulatory arbitrage were limited because both branches and subsidiaries were subject to the same reserve requirements and macroprudential policies, with the exception of capital requirements during 2007–2011, which only applied to subsidiaries.

EUR, 7% of loans in CHF, and the rest in USD, GBP, and YEN). Furthermore, about one-fifth of consumer loans are extended in FX (mainly EUR).

2 Measuring Macroprudential Policies

A key ingredient to our analysis is a measure of macroprudential policy conditions. During the period we analyze, the NBR adopted a wide range of macroprudential measures to manage the financial risks associated with the credit cycle, similar to other countries in the region (Dimova, Kongsamut and Vandenbussche, 2016). In this section we describe NBR's macroprudential policies in detail and our approach to constructing a macroprudential policy index (MPP).

In the early 2000s, NBR's supervisory and prudential policies had the goal of limiting the impact of strong capital inflows on domestic credit. According to the 2003 Annual Report, policies targeted a "steady improvement of supervision" given the rapidly evolving banking landscape and what it had identified as "possible flaws in commercial banks' management of banking risks" (see NBR (2003), p. 87). In the 2004 Annual Report, the NBR discussed potential tensions between the goal of supporting a high growth rate of financial intermediation while simultaneously preserving banking system stability, and called for strong bank risk management given the fast growth of household credit (NBR, 2004).

During 2004–2006, the NBR started targeting the level and composition of domestic lending directly by gradually raising reserve requirements on FX deposits and cutting those on local currency deposits.¹² In 2005, it instituted an outright limit on FX credit exposures to unhedged individuals and firms (in percent of shareholder own funds). To further discourage risky borrowing and constrain household debt, the NBR imposed ceilings on LTV ratios for mortgages and DSTI ratios for all loans. Subsequently, the DSTI ceiling was lowered even further and redefined relative to borrowers' total debt as opposed to each individual loan.

¹²Before 2004 there were two changes in reserve requirement ratios, namely a reduction in reserve requirements in domestic currency in 2002:Q4 and an increase in reserve requirements in foreign currency in 2002:Q4. Therefore, the starting level for the macroprudential policy index at the start of 2004 is 0.

During this period, no measures specifically targeted foreign-owned banks.

In 2007 Romania joined the EU and began harmonizing its regulations, which in practice meant that some macroprudential policies were eased. For instance, banks were allowed to set LTV and DSTI ceilings based on internal risk management models (as opposed to being directly specified by the NBR), FX credit exposure limits were removed, and the minimum regulatory capital ratio was reduced from 12% to 8%.¹³ At the same time, the standardized approach for risk weights was adopted and operational risk management was tightened as part of the Basel II regulatory framework.

When the financial crisis became global in late 2008, leading to a sudden stop in many emerging market economies, the BNR eased regulatory constraints to support the flow of credit and improve the country's resilience to the crisis. Reserve requirements were lowered for all bank deposits regardless of currency. Mortgage lending to first-time home buyers was supported through a government subsidy program launched in 2009 which, among others, exempted new mortgages from LTV limits. In 2011 the NBR set new currency-specific LTV and DSTI ceilings (Neagu, Tatarici and Mihai, 2015).

This discussion shows that the NBR implemented many macroprudential measures every quarter during the period of analysis (Figure A1), which makes it very difficult to estimate the effect of each measure without opening the door to potentially confounding effects. Instead, we follow Cerutti, Claessens and Laeven (2017) and measure macroprudential policy conditions using an index (MPP) representing the cumulative sum of the measures. Table A1 lists the macroprudential instruments together with a variable that codes each instrument as +1 for a tightening and -1 for an easing in the period in which the instrument is in place (starting with the quarter when it is introduced until the quarter when it is removed, if within the sample period). The simultaneous introduction of two or three measures is coded as +2 or +3. The MPP is computed as the cumulative sum of this variable starting in 2004:Q1, with higher values indicating tighter macroprudential policy conditions. The

 $^{^{13}{\}rm We}$ explore the implications of this unexpected easing of macroprudential policy conditions at the peak of the credit cycle in Table A5.

index ranges between 0 and 12, with a mean of 6.1 and standard deviation of 3.557. Figure 1 shows the evolution of the index during the period of analysis.

To examine the link between macroprudential policies and corporate credit, we use a similar approach and also construct two MPP indices that capture measures which specifically target household leverage (e.g., changes in LTV and DSTI limits) and, respectively, bank leverage (e.g., changes in reserve requirements, provisioning rules, and regulatory capital). The detailed assignment of macroprudential measures to these indices is shown in Table A1.

Figure 1: Household Credit Growth and Macroprudential Policy



Notes: The figure plots the real growth rate of bank credit to households (year-on-year) and the macroprudential policy index (MPP) during 2004–2012. The MPP index is constructed following the approach in Cerutti, Claessens and Laeven (2017) by coding introductions and changes in macroprudential instruments employed by the NBR as a tightening (+1) or an easing (-1). The index is defined as the cumulative sum of these values such that each macroprudential instrument is reflected in the index throughout the entire time it is in place until it is changed or discontinued. Higher values of the index indicate a tightening of macroprudential conditions. Household credit is deflated by the CPI 2005 = 100. Source: National Bank of Romania.

3 Data and Empirical Strategy

3.1 Data

To study the linkages between the global financial cycle, macroprudential policies, and local credit, we need microdata on the lending activities of banks, coupled with bank- and borrower-level financial information. Such data would allow for specifications that control for unobservables with granular fixed effects and explore the channels by exploiting bank and firm heterogeneity. We also need local economic data to study real effects of the policies. We are able to assemble the data with the help of leading government agencies, notably the National Bank of Romania, the Ministry of Public Finances, and the National Institute of Statistics.

We draw on the following key data sources: (a) two administrative credit registers with loan-level data on household and business lending, on quarterly frequency, and (b) detailed geographic information on house prices and economic activity (proxied by building permits and nightlights), also quarterly. For the main analysis, we use the household credit register with information on individual loans originated by banks to households, matched with quarterly bank balance sheet information. For additional results, we use the business credit register with loans originated to companies, matched with yearly firm-level financial information. All key data sources, described in detail below, cover the 2004:Q1-2012:Q4 period. Descriptive statistics for regression variables are shown in Table 1; and variable sources and definitions in Table A2.

Household Credit Register Data on individual loans to households and firms come from the NBR's "Central Credit Register," which collects, stores, and compiles information on all the loans granted by reporting banks. The data come from the filings of depository financial institutions to the NBR. The minimum reporting threshold is RON 20,000 (approximately USD 4,500). For each loan we observe the issuing bank, loan type, amount, currency, and

Table 1: Descriptive statistics for selected regression variables

	Obs	Mean	St. Dev.	Median
A. HOUSEHOLD CREDIT REGISTER				
Loan amount (in local currency: RON)	2,753,494	68,500	209,633	37,455
Log (loan amount, in local currency: RON)	2,753,494	9.856	2.724	10.530
% foreign currency loan (FX)	2,753,494	0.344	0.475	0.000
% local currency loan (RON)	2,753,494	0.656	0.475	1.000
Debt-service-to-income ratio (DSTI)	1,999,534	0.621	0.567	0.430
D MACDO VADIADIES				
US VIY	2 753 404	23 160	7 515	22 500
Overall MDD	2,753,494	23.100	2 557	22.300
Usussheld termeted MDD (MDDHH)	2,100,494	0.100	0.974	2.000
D L (L MDD (MDDBANK)	363,003	2.394	0.874	2.000
Bank-targeted MPP (MPP ^{DIMM})	383,603	3.950	3.109	5.000
C. BANK VARIABLES				
Bank size	2.753.494	23.500	1.133	23.720
Bank capital (%)	2,753,494	7 663	3 033	7 258
Bank liquidity (%)	2,753,494	2 637	1 741	2.147
Bank BOA	2,753,494	1 070	1 894	1.245
Bank NPL (%)	2,753,494	2 896	4 226	0 793
Bank rick profile (BWA /assets)	2,753,494	64 520	10.330	64 410
Bank foreign funding (%)	2,753,494 2,753,494	19,000	23 980	15510
Foreign bank	2,753,494	0.806	0.396	1.000
I Storga South		0.000	0.000	1.000
D. BUSINESS CREDIT REGISTER				
Loan amount (in local currency: RON)	383,603	427,315	$2,\!627,\!000$	56,010
Log (loan amount, in local currency: RON)	383,603	10.830	2.344	10.930
Real estate firm	$383,\!603$	0.113	0.316	0.000
Firm size (log-assets, in RON)	$383,\!603$	14.640	1.912	14.470
Firm tangibility (fixed assets/total assets)	$383,\!603$	0.374	0.244	0.350
Firm cash ratio (cash/total assets)	$383,\!603$	0.073	0.127	0.026
Firm ROA	383,603	0.137	0.590	0.083
E. REAL EFFECTS				
Total (FX and RON) lending ($\#$ loans)	1,512	2,315	3,203	1,527
Log (total (FX and RON) lending)	1,512	7.365	0.809	7.332
Total FX lending	1,512	735	1,430	369
Log(total FX lending)	1,512	6.015	0.979	5.914
% FX lending	1,512	0.286	0.129	0.261
Building permit growth	1,302	0.104	0.461	0.010
House price growth	316	-0.067	0.087	-0.056
Nightlights	378	0.081	0.370	-0.051

Notes: This table reports summary statistics for selected variables in the regression sample for the 2004–2012 period. MPP represents the macroprudential policy index (defined in Section 2), where higher values indicate a tightening of macroprudential conditions. MPP^{HH} and MPP^{BANK} are household- and lender-targeted macroprudential policy indices, discussed in Section 3.2. Loan amount is expressed in local currency (*Romanian New Leu*, or RON). The DSTI is available for both mortgages and consumer loans and is trimmed at a maximum value of 300%. Loan, bank and firm variables are winsorized at the 1%. Panels A-C refer to summary statistics in the household credit register dataset. Panel D and the household- and lender-targeted MPP indices in Panel A refer to the business credit register dataset. Panel E refers to data at the county-quarter level. All credit register, balance sheets, and macro data are available over the sample period 2004–2012. Building permit data start in 2005:Q1, nightlights in 2008:Q1, and house prices in 2009:Q2. See Table A2 for variable definitions and data sources.

maturity.¹⁴ We also observe borrower age and county of residence (for 42 counties), and

¹⁴The interest rate is available starting in 2015, which precludes its analysis in this paper. However, we observe the DSTI, that is, the debt service (payments) to income ratio.

DSTI ratios at origination. The clean dataset contains 2,753,494 individual loans over 2004–2012 extended by 42 banks to about 1.4 million borrowers. Figure A4 shows the composition of lending by type (mortgages versus consumer loans) and currency (EUR, CHF, RON, and other). The average loan amount is approximately USD 44,000 for mortgages and USD 11,000 for consumer loans.

The household credit register is matched to bank balance sheet data on a quarterly basis, which includes standard variables (total assets, risk-weighted assets, capital, liquidity, profitability, asset quality, foreign ownership, and reliance on foreign funding). Bank's reliance on foreign funding—defined as the share of nonresident foreign currency deposits in total deposits—captures the bank's exposure to global funding conditions.¹⁵

Corporate Credit Register This data set (also maintained by the BNR as part of the "Central Credit Register") contains detailed information on quarterly loan originations to nonfinancial firms (with the same reporting threshold as the household credit register), for which we observe headquarters location (county) and industry. We match the data by unique tax identification code to a confidential dataset from the Ministry of Public Finances with firm's annual financial information (including total assets, fixed assets, cash ratios, and profitability). The clean dataset contains 383,603 loans (mostly credit lines) granted by 31 banks to 82,871 unique firms during 2004–2012, of which 43,262 loans are granted to firms from the real estate and construction sectors (comprising about 11% of all firms and of particular interest given the pre-GFC housing boom). The average business loan is USD

¹⁵More than 90% of foreign funding comprises nonresident deposits from parent banks and less than 5% are loans from international development banks such as the European Bank for Reconstruction and Development and the European Investment Bank. Foreign funding is heavily denominated in EUR: during 2009–2016 about 43% of nonresident deposits were short term (maturity less than 2 years). More than 70% of nonresident deposits were denominated in EUR, 20% in RON, and the remainder in other foreign currencies. We construct the foreign funding measure to reflect the banks' exposure to foreign liquidity targeted by FX regulations as precisely as possible. Before 2005, FX reserve ratios applied to short-term FX funding (with a maturity of less than 2 years) while during 2005:Q1–2009:Q1 reserve requirements were tightened to affect all FX funding regardless of maturity. This measure was reversed in 2009Q2. In line with this sequence of policies, the variable refers to nonresident short-term FX deposits (with maturity <1 year, instead of <2 years, due to data availability) during 2004–2005, total FX non-resident deposits during 2005:Q1–2009:Q1, and again nonresident short-term FX deposits (with maturity<2 years) during 2009:Q2–2012:Q4.

142,000 (and USD 171,000 for real-estate firms). About 17% of business loans are granted in FX (mostly EUR).¹⁶

Global Financial Cycle–VIX The global financial cycle refers to the comovement of key financial variables such as risky asset prices and credit aggregates around the world. Miranda-Agrippino and Rey (2020) show that a single global factor explains a large share of the variation of risky asset prices induced by core-country monetary policy shocks, and that this factor strongly correlates with implied volatility indices such as the U.S. VIX and the European VSTOXX. By capturing both the price and quantity of risk, these indices reflect expectations about future realized volatility as well as risk appetite. Following the literature (see, e.g., Rey (2016, 2015); Borio (2014)), we measure global financial conditions with the U.S. VIX, where lower values of the VIX reflect lower volatility and risk aversion (Figure A2). Given the very high correlation between the two indices, our results are virtually unchanged if we use the European VSTOXX.

Local Economic Activity We assemble data on three measures of economic activity that vary at the county-quarter level. Specifically, we use the growth in residential building permits from the National Institute of Statistics. This is a widely-used predictor of local economic activity and has been shown to correlate strongly with income growth across U.S. states (Calomiris and Mason, 2003). We obtain local data on house prices from the Romanian property website www.imobiliare.ro. Finally, we collect data on nighttime luminosity (nightlights)—a common proxy for economic activity at the subnational levels (Pinkovskiy and Sala-i Martin, 2016; Henderson, Storeygard and Weil, 2012). Nightlights are computed using data from satellite images from the National Oceanic and Atmospheric Administration (NOAA) of the U.S. Department of Commerce.

 $^{^{16}}$ The household and corporate credit registers have near-universal coverage of total bank credit. In 2012, combined coverage was 91.2% (see NBR (2012), p. 63).

Other Macro Variables We measure domestic monetary policy with the seven-day report rate at which the NBR conducts open market operations on the secondary government securities market. Other macro controls on real GDP growth, CPI inflation, and the nominal exchange rate are sourced from the IMF's International Financial Statistics (IFS).

3.2 Empirical Specifications

Household Lending The baseline specifications examine the effects of the global financial cycle (captured by the U.S. VIX) on household credit depending on ex ante macroprudential policies. The data are at the bank-borrower-loan-quarter level. We use the following specification:

$$LENDING_{ijklt} = \beta_1 MPP_{t-z} \times RISK \times LOW VIX + + \beta_2 MPP_{t-z} \times RISK \times HIGH VIX + + CONTROLS + \alpha_{it} + \eta_{kt} + \xi_{lt} + \epsilon_{ijklt},$$
(1)

where $LENDING_{ijkt}$ is the log(amount) of each loan l extended by bank i to individual borrower j in county k in quarter t. The coefficients of interest are β_1 and β_2 on the triple interaction terms of MPP×RISK with the VIX. Depending on the specification, VIX enters either as continuous variable, or as dummy variables LOW (HIGH) VIX taking value one for below (above) the sample mean, which roughly corresponds to the global boom and bust around the GFC (Figure A2). In the main analysis, macroprudential policies enter with lag zrepresenting the average over the past two quarters. Given that policy implementation takes time, this means that the MPP is effectively lagged relative to the VIX. Moreover, in the appendix we show that the results are robust to the MPP index entering the specifications with even deeper lags relative to the VIX. To capture the riskiness of lending (RISK), we use (i) an indicator for FX loans, (ii) an indicator for high leverage measured by above-median DSTI at origination,¹⁷ and (iii) an indicator for high (above-median) bank reliance on foreign

¹⁷This measure of risk is preferable to expost measures such as loan delinquencies because it only reflects

funding.¹⁸ For all specifications, we test that $\beta_1 = \beta_2$ against the alternative hypothesis, based on theory and policy, that the effects are stronger when risk-taking is high (i.e., the VIX is low).

Controls include macroeconomic variables (quarterly domestic monetary policy rate, GDP growth, and CPI inflation), bank characteristics (bank size (log-assets), capital and liquidity ratios, return on assets (ROA), the NPL ratio, risk profile (risk weighted assets divided by total assets), the share of foreign funding in total assets, and an indicator taking value one for foreign-owned banks), and borrower and loan characteristics (borrower age, an indicator for FX loans, and an indicator for loans granted under the first-home mort-gage program). All regressions include loan-type×year fixed effects (ξ_{lt}) (where loan types are residential mortgages or consumer loans) to make sure the results are not driven by systematic differences in the dynamics of mortgage and consumer loan markets. We add bank×year fixed effects (α_{it}) that control for yearly bank characteristics with a potential impact on lending outcomes, and borrower county×year fixed effects (η_{kt}) that control for yearly macroeconomic shocks at the county level.¹⁹

We take several steps to mitigate potential endogeneity concerns. We analyze the impact of the global financial cycle on lending based on the macroprudential environment. Therefore, in our baseline specifications, the MPP index is lagged (predetermined) in relation to the VIX, which is exogenous with respect to the local credit cycle. Moreover, we use a dummy of low VIX or the continuous VIX, and we lag the MPP index with respect to VIX up to six months. In addition, macroprudential policies generally tighten in response to higher credit growth, so the reverse causality bias is *positive*, making it harder to identify a negative effect. Therefore, our results can be interpreted as a lower bound on the true effects of VIX on lending depending on ex ante MPP. Furthermore, we control for the most likely

the bank's assessment of risk and is not contaminated by events affecting loan performance after the granting of the loan (see, Dell'Ariccia, Laeven and Suarez (2017) and Jiménez, Ongena, Peydró and Saurina (2014)).

 $^{^{18}}$ The sample median of DSTI is 43% and the sample median of foreign funding share is 15.5% (Table 1).

¹⁹Note that we cannot include borrower×year fixed effects given that the vast majority of individuals only take out one mortgage or consumer loan and therefore only appear once in the dataset.

confounders, which we identify by regressing the MPP on the domestic monetary policy rate, GDP growth, inflation, nominal exchange rate, and VIX. As shown in Table A3, the only statistically significant determinant of MPP is the GDP growth rate. Therefore, *all* our specifications include GDP growth interactions (in a horserace between MPP and GDP growth).²⁰ Furthermore, we include different granular fixed effects related to time, such as bank×time fixed effects, borrower's county×time fixed effects, and loan-type×time fixed effects, which control for a large set of unobservables.

Business Lending We use a modified version of Equation (1) to examine the potential spillovers of macroprudential policies on business credit and interactions with the VIX:

$$LENDING_{ijklt} = \beta_1 MPP^{HH}_{t-z} \times RISK \times LOW VIX + + \beta_2 MPP^{HH}_{t-z} \times RISK \times HIGH VIX + + CONTROLS + \alpha_{it} + \eta_{kt} + \xi_{lt} + \gamma_i + \epsilon_{ijkt},$$
(2)

where $LENDING_{ijkt}$ is the log(amount) of loan l extended by bank i to nonfinancial firm j in county k in quarter t, and z refers to the average over the last two quarters. RISK captures the riskiness of business lending and is an indicator for firms in the real estate and construction sector. In some specifications we also distinguish between FX and local currency loans. Macroeconomic and bank controls are the same as in Equation (1). We further add firm's characteristics (size (log-assets), tangibility ratio, cash ratio, return on assets (ROA) all lagged one year, and industry) and loan characteristics (FX dummy and maturity). In the most complex specifications we include bank×year fixed effects (α_{it}), county×year fixed effects (η_{kt}), loan-type×year fixed effects (where loan types are commercial real estate loans, business lines of credit, and other loans) (ξ_{lt}); and firm fixed effects (γ_j).

The coefficients of interest are β_1 and β_2 on triple interactions of MPP^{HH} with RISK

 $^{^{20}\}text{That}$ is, every specification that includes the interaction MPP×FX×VIX also controls for the term GDP growth×FX×VIX and labels the specification as having "GDP growth interactions." The specifications include as many interactions with GDP growth as there are with MPP.

and the VIX. Positive coefficients would indicate that a tightening of MPP^{HH} is associated with spillovers from policies targeting household leverage to corporate lending. We also show specifications that include lender-targeted policies MPP^{BANK} as an additional control to make sure it does not confound the effects of MPP^{HH}.

Real Effects We test for aggregate lending and real effects of macroprudential policies—in interaction with the VIX—in data at the county-quarter level. We use two specifications—for lending and real sector outcomes, respectively. For lending outcomes, we estimate:

$$LENDING_{kt} = \beta_1 MPP_{t-z} \times LOW VIX + + \beta_2 MPP_{t-z} \times HIGH VIX + + CONTROLS + \eta_k + \tau_t + \epsilon_{kt},$$
(3)

where $LENDING_{kt}$ is a lending outcome in county k in quarter t, representing total loan volume, FX loan volume, or the share of FX loans (both for household and all loans). The key covariates are the interactions of MPP with the high and low VIX dummies, which allow for differential efficacy of macroprudential policies during the global boom and the bust. We control for year fixed effects τ_t and county fixed effects η_k . Furthermore, we include the same macroeconomic variables as in Equations (1)-(2) and additionally the average characteristics of banks in each county (bank size, capital, liquidity, ROA, NPL, risk profile, share of foreign funding, and foreign bank dummy).²¹

The second specification is for measures of real economic activity. We construct a countylevel measure of exposure to MPP defined as the lagged share of FX loans and we interact it with MPP and with high/low VIX. The intuition is that counties with a higher ex ante share of FX loans should be relatively more affected by a tightening of macroprudential policies and should experience a larger decline in economic activity (allowing for potentially different

²¹These county-level variables are aggregated from bank-level data at the county level by weighting the bank-level characteristics by the banks' market shares in each county. Market shares are calculated as the share of total household credit extended by a given bank in a given county and quarter relative to total household credit in that county over the entire sample period).

affects in the boom and bust phases of the cycle). The specification is given by:

$$REAL \ OUTCOME_{kt} = \beta_1 FX \ SHARE_{kt-z} \times MPP_{t-z} \times LOW \ VIX +$$
$$+ \beta_2 FX \ SHARE_{dt-z} \times MPP_{t-z} \times HIGH \ VIX +$$
$$+ \gamma FX \ SHARE_{kt-z} + CONTROLS + \eta_k + \tau_t + \epsilon_{dt},$$

where $REAL \ OUTCOME_{kt}$ is growth rate of building permits, house prices, or nightlights. We allow macroprudential policies to have a more delayed impact on the real economy and show regressions with a lag of two quarters. We also examine the dynamic effects with lags of three and four quarters and report on those results in Section 5.2. The level effect of MPP_{t-z} and other macro variables is absorbed by quarterly fixed effects τ_t . Specifications also include the following controls: lagged bank characteristics in the county (the same as in Equation (3)), GDP interactions (with the same lag structure as the MPP term), and county fixed effects η_k . The FX loan share is lagged two quarters to reduce the risk of endogeneity. If borrowers are constrained in switching to alternative sources of funding—as is the case for bank-dependent borrowers in the presence of frictions (James and Smith, 2000)—we expect that a slowdown or contraction in lending would dampen real sector activities, and the coefficients β_1 and β_2 would be negative. The statistical significance and magnitude of these key coefficients will inform us on whether the potency of macroprudential policies differs during the boom-bust cycle.

We estimate all regressions with the Ordinary Least Squares (OLS) estimator. In lending regressions with credit register data (Equations (1)-(2)), we cluster the standard errors at the bank and county-quarter level. We also show that our key lending specifications with VIX interactions are robust to very conservative triple clustering on bank, county, and quarter. In lending and real effects regressions at the county-quarter level (Equations (3)-(4)), we double-cluster the standard errors at the county and quarter level.

4 Bank Credit Effects

4.1 VIX, Household Credit, and Macroprudential Policies

Table 2 presents a first set of regressions exploring the link between macroprudential policies and household credit (without VIX interactions). We start with a simple specification in column 1 which only includes MPP and macro, bank, borrower, and loan controls (see Table A4 for regression results showing coefficient estimates for all covariates). In this specification we exploit within-year variation in macroprudential policies across quarters to estimate the relation between the MPP index and household credit. The estimated coefficient on MPP is negative and statistically significant, suggesting that a tightening of macroprudential policy is associated with lower household loan growth. In column 2 we examine the link between MPP and the currency composition of household credit and find that tighter macroprudential policies are associated with lower FX lending (significant at the 1% level).

In column 3 we use borrower DSTI at loan origination as our measure of loan risk. The baseline coefficient on MPP remains negative and statistically significant, but the interaction with DSTI is insignificant. In column 4 we break down this nil effect to see if it hides heterogeneity by currency: the negative coefficient estimate on the FX term and the positive one on the RON term suggest tighter macroprudential policies are associated with lower FX lending and higher local-currency lending.²² The third and final measure of risk is bank's reliance on foreign funding. As shown in column 5, tighter macroprudential policies are negatively related to FX lending by banks more reliant on foreign funding. Moreover, this differential effect across FX versus local-currency loans is not driven foreign bank ownership (column 6).²³

Overall, the regression results in Table 2 suggest that tighter macroprudential policies

²²Our results are robust to the potential concern that high-debt borrowers are more likely to take up FX loans. In an unreported regression of the FX loan dummy on borrower DSTI, we find no systematic sorting of high-DSTI borrowers into FX loans, controlling for loan characteristics (amount and interest rate), with or without interacted (bank×year, county×year, and loan-type×year) fixed effects.

²³Bank size does not drive this result either. In unreported regressions, additional interactions of MPP with bank size and loan currency are insignificant and do not affect the results for foreign funding.

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable:		Hou	sehold loan	amount (lo	og)	
MPP	-0.0531^{***}		-0.0430^{**}	-0.0397^{**}	-0.0349	-0.1478^{**}
MPP×FX	(0.010)	-0.0705***	(0.010)	(0.010)	(0.021)	(0.000)
MPP×RON		(0.017) -0.0388 (0.024)				
MPP×DSTI			-0.0068			
MPP×DSTI×FX			(0.006)	-0.0396^{***} (0.009)		
MPP×DSTI×RON				0.0111**		
DSTI			0.7393^{***}	(0.005) 0.7285^{***} (0.068)		
${\rm MPP}{\times}{\rm Foreign}~{\rm funding}{\times}{\rm FX}$			(0.010)	(0.000)	-0.0019**	-0.0021**
$MPP \times Foreign funding \times RON$					(0.001) -0.0001 (0.001)	(0.001) -0.0001 (0.001)
$MPP \times Foreign \ bank \times FX$					(0.001)	0.1437**
$MPP \times Foreign \ bank \times RON$						(0.059) 0.1540^{**} (0.065)
Observations R^2	$2,753,494 \\ 0.219$	$2,753,494 \\ 0.219$	1,999,534 0.252	$1,999,534 \\ 0.254$	2,753,494 0.219	2,753,494 0.220
Other controls	Yes	Yes	Yes	Yes	Yes	Yes
GDP growth interactions	V	Yes	Yes	Yes	Yes	Yes
Bank×Year FE County×Year FE	Yes	Yes Voc	Yes	Yes	Yes	Yes
Loan-type×Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Table 2: Macroprudential Policies and Household Credit

Notes: This table shows baseline effects of macroprudential policies on household credit. The data are at the bank-borrowerloan-quarter level over 2004–2012. The dependent variable is loan amount (log) extended by a given bank to a given individual borrower in a given county and quarter. MPP represents the macroprudential policy index (defined in Section 2), where higher values indicate a tightening of macroprudential conditions. Other controls refer to macro variables (local monetary policy, GDP growth, inflation, and the U.S. VIX), bank variables (size, capital, liquidity, ROA, NPL, risk profile, share of foreign funding, and foreign bank dummy), borrower age, and loan variables (dummy for FX loans and first-home mortgages). Lower-level interactions and level variables are also included. GDP growth interactions refer to GDP growth×FX and GDP growth×RON in column 2, GDP growth×DSTI in column 3, GDP growth×FX×DSTI and GDP growth×RON×DSTI in column 4, GDP growth×FX×Foreign funding and GDP growth×RON×Foreign funding in column 5. The latter terms are also included in column 6 which further adds GDP growth×FX×Foreign-bank and GDP growth×RON×Foreign-bank. All macro and bank variables taken as averages over the last two quarters. See Table A4 for coefficient estimates on the full set of covariates in column 1. Standard errors are reported in parentheses and are clustered at the bank and county-quarter level. *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level. Source: See Table A2 for variable definitions and sources.

are associated with lower household loan growth, especially for riskier loans (in FX, to high-DSTI borrowers, and from banks reliant on foreign funding). In robustness tests we check that the results are not driven by any particular macroprudential policy event,²⁴ and that

 $^{^{24}}$ To check this, we recalculate the MPP index by leaving out the policies implemented in any given quarter, then re-estimate the specification in column 1 of Table 2, and collect the coefficient estimates on MPP. We plot the distribution of these estimates in Figure A5, which shows that the procedure delivers estimates centered on -0.05—the value corresponding to the full MPP index. The histogram shows that

they hold up in a narrow window around the EU entry.²⁵

Next we explore the role of macroprudential policies in mitigating spillovers from the global financial cycle, proxied by the VIX. The results are reported in Table 3, where we gradually build toward the specification in Equation (1). In column 1 we interact macroprudential policy with the continuous VIX index. The coefficient estimates indicate that a decline in the VIX is associated with higher household credit growth, but the effect is lower if ex ante macroprudential policy tightens. In column 2, we break down the interacted effect MPP×VIX by currency and obtain positive coefficients for both FX and RON loans. However, a one-sided t-test shows that the effect for FX loans is larger than for RON loans (p-value=0.011), suggesting that when global financial conditions soften, proxied by a declining VIX, ex ante tighter macroprudential policy implies a shift in the currency composition of household credit away from FX toward local currency loans.

In column 3 of Table 3 we investigate this effect further by splitting the effect of macroprudential policies across currencies and low/high values of the VIX (Equation (1)). We find that macroprudential policies are associated with *lower* loan growth in FX when the VIX is low compared to when it is high or compared to loan growth in local currency. Once again, testing the statistical validity of this result, p-values for t-tests indicate that the coefficients on the triple interaction MPP×Low VIX×FX are indeed larger in absolute value (more negative) than those on the interaction MPP×Low VIX×RON (p-value=0.009) and the interaction with high-VIX (p-values are 0.000 for both tests). These findings suggest

results are not driven by any particular policy or set of tools.

 $^{^{25}}$ One might worry that the significant easing of macroprudential policies around Romania's entry into the EU (January 1, 2007)—when the macroprudential policy index and credit become strongly negatively correlated (as seen in Figure 1)—is driving our full-sample results. To alleviate this potential concern, we allow for distinct effects in a 9-month period centered on the EU entry and outside of this period. We choose nine months for the window around EU entry because the easing of macroprudential policies was expected as the country was negotiating the *Aquis Communautaire* and the realignment of its prudential and financial policies with the Basel II Accord. We estimate the specifications in columns 1–2 of Table 2, with and without GDP growth interactions, and report the results in Table A5. In column 1 we see that the main coefficient on MPP is virtually the same in the window around EU entry and outside this window. In column 2, we find a statistically significant negative relationship between MPP and household credit in all windows considered: pre-EU entry, 9-month window centered on EU-entry, and afterwards. Regression coefficients in columns 3-4 further confirm that no particular period is driving the differential currency results, either.

greater effectiveness of macroprudential policies in dampening the effects of global liquidity on risky FX-denominated household credit during the boom phase of the cycle.

In columns 4–5 of Table 3 we explore two additional dimensions of risk—borrower DSTI and bank reliance on foreign funding. Given the statistical significance of the triple interaction term MPP×Low VIX×FX in column 3, we unpack this term by high/low DSTI and foreign funding reliance (both defined as above/below sample median). The estimated coefficients on these interacted terms are negative and statistically significant, with t-tests confirming that macroprudential policies have quantitatively stronger dampening effects of the global financial cycle on high-risk household credit (captured by high-DSTI loans and loans from banks with high foreign funding, with p-values of 0.005 and 0.026, respectively). Tables A7-A8 show that the regression estimates are robust (except for bank reliance on foreign funding) to replacing the high/low VIX dummies with the continuous VIX variable, as well as to using different lags of the VIX.

Taking stock of all specifications in Table 3, the estimates suggest that macroprudential polices are more "effective" at dampening risky credit growth when global financial conditions are soft (low VIX). Furthermore, these effects are statistically different even with very conservative triple clustering of standard errors on bank, county, and time (see Table A6).

The coefficient estimates are also economically meaningful. Using the estimates in columns 3–5, when the VIX is low, a tightening of macroprudential policy by half an SD is associated with FX loan volumes lower by 17.7% and RON loan volumes lower by 10.7%.²⁶ The dampening effect on FX lending is larger by 2.4 ppts for a high-DSTI borrower compared to a low-DSTI borrower (where high/low DSTI refers to mean DSTI \pm half an SD). Similarly, this effect it is lager by 3.5 ppts for banks with high versus low exposure to foreign funding (where high/low exposure refers to mean share of foreign funding \pm half an SD).

²⁶We obtain these estimates by taking the coefficients in column 3, multiplying them by 1.778 (half an SD of MPP), then taking the exponential. For instance, for the effect on FX loan volumes we have $(-0.1096) \times 1.778 = -0.195$. We calculate the FX loan volume decrease as 1 - exp(-0.195) = 17.7%.

	(1)	(2)	(3)	(4)	(5)
Dependent variable:		Househo	ld loan amo	unt (log)	
MPP	-0.2216^{***}	-0.2300^{***}			
VIX	-0.0401^{*}	-0.0413^{**}	-0.0010	-0.0014	-0.0009
MPP×VIX	(0.020) 0.0069^{***} (0.002)	(0.020)	(0.009)	(0.010)	(0.009)
$MPP \times VIX \times FX [1]$		0.0081^{***}			
$MPP \times VIX \times RON \ [2]$		(0.002) 0.0066^{***} (0.002)			
MPP×Low VIX×FX [3]		. ,	-0.1096^{***}		
MPP×Low VIX×RON [4]			(0.023) -0.0639^{*} (0.034)	-0.0544^{*} (0.030)	-0.0651^{*} (0.034)
MPP×High VIX×FX [5]			-0.0138	-0.0302**	-0.0127
$MPP \times High ~VIX \times RON ~[6]$			(0.017) -0.0394 (0.028)	(0.013) -0.0302 (0.021)	(0.015) -0.0406 (0.028)
MPP×Low VIX×FX×High DSTI [7]			(0.020)	-0.1115***	(0.020)
MPP×Low VIX×FX×Low DSTI [8]				(0.023) -0.0955*** (0.024)	
MPP×Low VIX×FX×High Foreign Funding [9]				(0.024)	-0.1136***
MPP×Low VIX×FX×Low Foreign Funding [10]					(0.024) -0.0903*** (0.022)
p-value t-test Ha: $ 1 > 2 $		0.011			
p-value t-test Ha: $ 3 > 4 $ p-value t-test Ha: $ 3 > 5 $			0.009 0.000		
p-value t-test Ha: $ 3 > 6 $			0.000		
p-value t-test Ha: $ 7 > 8 $ p-value t-test Ha: $ 9 > 10 $				0.005	0.026
$\frac{\text{Observations}}{R^2}$	$2,753,494 \\ 0.220$	$2,753,494 \\ 0.220$	$2,753,494 \\ 0.220$	$1,999,534 \\ 0.253$	$2,753,494 \\ 0.220$
Other controls	Yes	Yes	Yes	Yes	Yes
GDP growth interactions Bank×Year FE	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes
County×Year FE	Yes	Yes	Yes	Yes	Yes
Loan-type×Year FE	Yes	Yes	Yes	Yes	Yes

Table 3: VIX, Macroprudential Policies, and Household Credit

Notes: This table shows baseline effects of macroprudential policies on household credit in interaction with the U.S. VIX. The data are at the bank-borrower-loan-quarter level over 2004–2012. The dependent variable is loan amount (log) extended by a given bank to a given individual borrower in a given county and quarter. MPP represents the macroprudential policy index (defined in Section 2), where higher values indicate a tightening of macroprudential conditions. Other controls refer to macroeconomic variables (local monetary policy, GDP growth, and inflation), bank variables (size, capital, liquidity, ROA, NPL, risk profile, share of foreign funding, and foreign bank dummy), borrower age, and loan variables (dummy for FX loans and first-home mortgages). Lower-level interactions and level variables are also included. GDP growth interactions refer to GDP growth×VIX in column 1, and to GDP growth×VIX×FX and GDP growth×VIX×RON in columns 2–5. High/low DSTI and high/low foreign funding variables are defined as above/below sample medians. All macro and bank variables are taken as averages over the last two quarters. Standard errors are reported in parentheses and are clustered at the bank and county-quarter level. Table A6 shows that the results are robust to triple-clustering on county, bank, and quarter. *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level. Source: See Table A2 for variable definitions and sources.

4.2 Spillovers to Business Credit

Do banks respond to tighter regulatory constraints by taking more risk in less-regulated areas of the balance sheet, and does this behavior vary over the boom-bust cycle? To answer these qustions, in this section we test for potential spillovers from macroprudential policies targeting household leverage on business credit.

We turn to the corporate credit register and relate loan amounts to household-targeted MPP index without VIX interactions (MPP^{HH} is defined in Section 2 and see Table A1 for the precise measures captured by this index). Table 4 reports our estimates. Column 1 shows that a tightening of household-targeted macroprudential policies is accompanied by higher business lending (with a full set of controls and basic fixed effects). In column 2 we add more demanding firm fixed effects and find that the spillover coefficient (on MPP^{HH}) is no longer significant. However, this effect conceals crucial heterogeneity by industry, which we explore in column 3, where we find a statistically significant coefficient for firms in the real estate and construction sectors but not for other firms, pointing towards a spillover effect. The remaining specifications examine the robustness of this result. Columns 4–5 show that the estimate on MPP^{HH}×Real estate firm is robust to controlling for macroprudential policies that restrict *lenders*' balance sheets (MPP^{BANK}) and more granular fixed effects. In columns 6–7 we explore heterogeneity in this effect by currency and find that the coefficient on MPP^{HH}×Real estate firm is significant only for loans in local currencies. Overall, these results suggest that tighter regulatory limits on household leverage are associated with more lending to real estate firms, albeit in local currency. Economically, the coefficients in columns 5–6 indicate that an increase in the MPP^{HH} index by half an SD is associated with more lending to real estate firms by 4.6% overall and 5.1% in RON.

Using the specification in Equation (2), we analyze the role of the global financial cycle by estimating specifications with high/low VIX interactions. The regression coefficients, reported in Table 5, show that the spillover effect discussed above is driven mainly by the low-VIX global boom period (see columns 1–2, with estimates that are statistically significant

Table 4: Macroprudential Policies and Business Credit—Spillover Effects

Observations R^2	$383,603 \\ 0.372$	$353,\!634 \\ 0.590$	$353,634 \\ 0.590$	$353,632 \\ 0.608$	$353,\!632 \\ 0.608$	$353,\!632 \\ 0.609$	$353,632 \\ 0.609$
Other controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
GDP growth interactions			Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes				
County FE	Yes	Yes	Yes				
Industry FE	Yes	Yes	Yes				
Year FE	Yes	Yes	Yes				
Loan-type FE	Yes	Yes	Yes				
Bank×Year FE				Yes	Yes	Yes	Yes
$County \times Year FE$				Yes	Yes	Yes	Yes
Loan-type×Year FE				Yes	Yes	Yes	Yes
Firm FE		Yes	Yes	Yes	Yes	Yes	Yes

Notes: This table shows spillover effects of household-targeted macroprudential policies on business credit. Data are at the bankfirm-quarter level over 2004–2012. The dependent variable is loan amount (log) extended by a given bank to a given borrowing firm in a given county and quarter. Real-estate firm is an indicator for firms in the real estate and construction sectors. MPP^{HH} refers to household-targeted macroprudential policies, while MPP^{BANK} refers to lender-targeted macroprudential measures (see Table A1). Other controls refer to macro variables (local monetary policy, GDP growth, inflation, and the U.S. VIX), bank variables (size, capital, liquidity, ROA, NPL, risk profile, share of foreign funding, and foreign bank dummy), firm variables (size, tangibility ratio, cash ratio, and ROA), and loan variables (FX dummy and loan maturity). GDP growth interactions refer to interaction terms between the macroprudential indices, and real estate firm or currency (FX, RON) dummies; loan-type FEs include dummies for loans for commercial real estate purposes, business lines of credit, and other loans. Lower-level interactions and level variables are also included. All macro and bank variables are taken as averages over the last two quarters; firm variables are lagged one year. Standard errors are reported in parentheses and are clustered at the bank and county-quarter level. *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level. Source: See Table A2 for variable definitions and sources.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dependent variable:			Corpora	ate credit v	olume (log)		
$MPP^{HH} \times Low VIX$	0.1308**	0.0980^{*}					
$MPP^{HH} \times High VIX$	(0.049) -0.0023	(0.050) -0.0206					
$\rm MPP^{\rm HH} \times Real \ estate \times Low \ VIX$	(0.050)	(0.039)	0.1264***	0.1067^{***}	0.1078***		
$\rm MPP^{\rm HH} \times Real~estate \times High~VIX$			(0.046) 0.0841^{**}	(0.037) 0.0746^{**}	(0.039) 0.0766		
$MPP^{HH} \times Other firm$			(0.034) 0.0745	(0.033) 0.0636	(0.054) 0.0677		
$MPP^{BANK} \times Real estate$			(0.051)	(0.040)	(0.049) 0.0011		
$\mathrm{MPP}^{\mathrm{BANK}} \times \mathrm{Other~firm}$					(0.020) -0.0022		
$\rm MPP^{\rm HH} \times Real \ estate \times FX$					(0.018)	-0.0089	0.0380
$\rm MPP^{\rm HH} \times Real \ estate \times RON \times Low \ VIX$						(0.041) 0.1164^{***}	(0.038) 0.1244^{***}
$\rm MPP^{\rm HH} \times Real~estate \times RON \times High~VIX$						(0.042) 0.0823^{**}	(0.039) 0.0923^*
$\mathrm{MPP^{HH}}{\times}\mathrm{Other~firm}{\times}\mathrm{FX}$						(0.035) 0.0060	(0.050) 0.0509
$\rm MPP^{\rm HH} \times O ther \ firm \times RON$						(0.036) 0.0705	(0.045) 0.0776
$\mathrm{MPP}^{\mathrm{BANK}} \times \mathrm{Real} \ \mathrm{estate} \times \mathrm{FX}$						(0.042)	(0.047) -0.0357
$\mathbf{MPP}^{\mathbf{BANK}} \times \mathbf{Real} \ \mathbf{estate} \times \mathbf{RON}$							$(0.029) \\ 0.0021$
$MPP^{BANK} \times Other firm \times FX$							(0.023) - 0.0407^*
$MPP^{BANK} \times Other firm \times RON$							$(0.024) \\ 0.0014$
							(0.018)
Observations R^2	$383,603 \\ 0.372$	$353,634 \\ 0.590$	$353,634 \\ 0.590$	$353,632 \\ 0.608$	$353,632 \\ 0.608$	$353,632 \\ 0.609$	$353,632 \\ 0.609$
Other controls GDP growth interactions	Yes	Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes
Bank FE	Yes	Yes	Yes				

Table 5: VIX, Macroprudential Policies, and Business Credit—Spillover Effects

County FE	Yes	Yes	Yes				
Industry FE	Yes	Yes	Yes				
Year FE	Yes	Yes	Yes				
Loan-type FE	Yes	Yes	Yes				
Bank×Year FE				Yes	Yes	Yes	Yes
County×Year FE				Yes	Yes	Yes	Yes
Loan-type×Year FE				Yes	Yes	Yes	Yes
Firm FE		Yes	Yes	Yes	Yes	Yes	Yes
Notes This table combras the inte		11	6 1 1 1	1.1.4		. 1	1

Notes: This table explores the interaction between spillover effects of household-targeted macroprudential policies on business credit and the U.S. VIX. Data are at the bank-firm-quarter level over 2004–2012. The dependent variable is loan amount (log) extended by a given bank to a given borrowing firm in a given county and quarter. All variables and controls are as in Table 4. Lower-level interactions and level variables are also included. Low/high VIX refer to periods of below/above mean values of the VIX index (corresponding to the pre/post GFC period, see Figure A2). Standard errors are reported in parentheses and are clustered at the bank and county-quarter level. Table A9 shows that the results are robust to triple-clustering on county, bank, and quarter. *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level. Source: See Table A2 for variable definitions and sources.

only for MPP^{HH}×Low VIX). Next we zoom in on the heterogeneous effects for real estate firms once again by high/low VIX periods. Across all specifications in columns 3–7, the coefficient estimates on low-VIX interactions are statistically significant (at the 1% level). By contrast, the effects are either weaker or statistically insignificant for firms outside the real estate sector, for local-currency loans, and for high-VIX periods. Moreover, these results are robust to very conservative triple clustering on bank, county, and quarter (see Table A9).

Taken together, the analysis of corporate loans suggest that banks respond to tighter constraints on household lending by reallocating to corporate loans especially during the global boom when the VIX is low.

5 Local Economy Effects

In the previous section we showed that tighter macroprudential policies are associated with less risky lending to households and with more lending to real-estate firms. This relation is especially present when, proxied by low VIX, global financial conditions are softer. Here we examine if these bank credit effects translate into local economic effects. We start with total credit and its currency composition at the local level, followed by measures of housing market activity—building permits house prices—and overall economic activity captured by nightlights.

5.1 Local Credit and Its Composition

Regression results from specifications that link macroprudential policies to local credit and its composition (Equation (3)), together with VIX interactions, are shown in Table 6. The estimates in column 1 show that tighter macroprudential policy is negatively related to household credit (Panel A) and total credit (Panel B), suggesting that the positive spillover effect of tighter MPP^{HH} on business credit (documented in the previous section) do not offset the dampening effects on household credit. In columns 2–3 we find that tighter macroprudential policies are associated with lower FX lending and even lower FX share of lending, suggesting a shift in credit composition away from risky FX lending.

Columns 4–6 of Table 6 break down this effect over the global boom-bust cycle and show that the key coefficient estimates on MPP×VIX interactions are statistically significant mostly when the VIX is low. Formally, p-values of t-tests of coefficient equality for low versus high VIX interactions with MPP against the alternative hypothesis of larger coefficients during low-VIX period indicate—for five out of six specifications—that the dampening effect of macroprudential policies is quantitatively stronger when the VIX is low. Economically, the estimates in columns 4–5 in Panel A indicate that a tightening of the MPP by half an SD is associated with household credit volume lower by 12.7% and FX credit volume lower by 16.9%. Note also that these estimates from county-level regressions are very close the estimate we obtained in the household credit register, namely 16.9% in county-level data (Table 6, column 4) compared to 17.7% in loan-level data (Table 3, column 3).

5.2 Housing and Economic Activity

Our final specifications focus on the relation of the global financial cycle and MPP with the real economy. We employ three real sector outcomes: building permit growth, house price growth, and nightlights. Further, we exploit cross-sectional variation in ex ante county-level exposure to changes in macroprudential policy conditions with the (lagged) share of FX loans extended to households by local banks. For a given change in the MPP index, the specifications determine if relatively more exposed counties experience a greater decline in economic activity (see Equation (4)).

The estimates are reported in Table 7. The specifications in columns 1–3 show that the interaction of macroprudential policy and ex ante FX loan share has a negative and statistically significant coefficient (at the 15% level for building permits, 1% level for house prices, and 10% for nightlights) after two quarters.²⁷ This suggests that tighter macroprudential

²⁷In unreported regressions, we also examine the dynamic effects with lags of three and four quarters and

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variables:	Total Lending Volume	FX Lending Volume	FX Lending Share	Total Lending Volume	FX Lending Volume	FX Lending Share
			A. House	hold Credit		
MPP	-0.0451^{*} (0.026)	-0.0831^{***} (0.030)	-0.0133^{**} (0.005)			
MPP \times Low VIX [1]	~ /		~ /	-0.0766^{***} (0.021)	-0.1041^{***} (0.028)	-0.0170^{***} (0.006)
MPP \times High VIX [2]				-0.0011 (0.027)	(0.0537) (0.039)	-0.0106^{*} (0.005)
p-value t-test Ha: $ 1 > 2 $ Observations R^2	$\begin{array}{c} 1,428\\ 0.942\end{array}$	$1,428 \\ 0.926$	$1,428 \\ 0.923$	$0.003 \\ 1,428 \\ 0.947$	$0.072 \\ 1,428 \\ 0.928$	$0.066 \\ 1,428 \\ 0.924$

Table 6: VIX, Macroprudential Policies, and Local Lending

MPP	-0.0458^{*} (0.023)	-0.0758^{***} (0.026)	-0.0077 (0.005)			
$MPP \times Low VIX [1]$	()	()	· · · ·	-0.0702***	-0.0953***	$-0.0077^{\#}$
				(0.019)	(0.024)	(0.005)
$MPP \times High VIX [2]$				-0.0117	-0.0485	-0.0077
				(0.025)	(0.034)	(0.006)
p-value t-test Ha: $ 1 > 2 $ Observations R^2	$1,428 \\ 0.907$	$\begin{array}{c} 1,428\\ 0.917\end{array}$	$1,428 \\ 0.818$	$0.013 \\ 1,428 \\ 0.911$	$0.074 \\ 1,428 \\ 0.919$	$0.494 \\ 1,428 \\ 0.818$
Macro controls	Yes	Yes	Yes	Yes	Yes	Yes
County controls	Yes	Yes	Yes	Yes	Yes	Yes
GDP growth interactions				Yes	Yes	Yes
County FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Notes: This table shows the local credit effects of macroprudential policies and interactions with the U.S. VIX. Data are at the county-quarter level for 42 counties over 2004–2012. The dependent variables refer to log-total lending (columns 1–2), log of FX lending (columns 3–4), and the share of FX lending in total (columns 5–6). Lending is measured with the number of loans. MPP represents the macroprudential policy index (defined in Section 2), where higher values indicate a tightening of macroprudential conditions. In panel A, variables refer to household lending. In panel B, variables refer to total (household and business) lending. All specifications include macro controls (local monetary policy, GDP growth, inflation, and the U.S. VIX), county controls (computed from bank variables at the county-level by weighing the bank-level characteristics from previous regressions by their market shares: size, capital, liquidity, ROA, NPL, risk profile, share of foreign funding, and share of foreign banks; and market shares are calculated based on household lending extended by a given bank in a given county relative to total bank lending in that county over the entire sample period), county and year fixed effects. Standard errors are reported in parentheses and are double clustered on county and quarter. *** indicates significance at the 1% level, ** at the 5% level, * at the 10% level, and # at the 15% level. Source: See Table A2 for variable definitions and sources.

B. Total (Household and Corporate) Credit

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable:	Building Permits	House Prices	\mathbf{Night} -lights	Building Permits	House Prices	Night- lights
	0.0050#	0.00-0+++				
MPP \times FX loan share	$-0.2378^{\#}$	-0.2658***	-0.6647*			
MPP \times FX share \times Low VIX [1]	(0.170)	(0.065)	(0.294)	-0.4660*	-0.3298***	-0.7071**
				(0.233)	(0.100)	(0.282)
MPP \times FX share \times High VIX [2]				0.0041	-0.2275^{***}	-0.0598
				(0.242)	(0.065)	(0.212)
FX loan share	0.3333	0.8054	1.1924	0.3337	0.9163^{*}	0.8469
	(1.379)	(0.545)	(1.009)	(1.392)	(0.495)	(0.886)
p-value t-test Ha: $ 1 > 2 $				0.017	0.134	0.050
Observations	1,302	316	378	1,302	316	378
R^2	0.290	0.658	0.840	0.298	0.660	0.842
County controls	Yes	Yes	Yes	Yes	Yes	Yes
GDP growth interactions	Yes	Yes	Yes	Yes	Yes	Yes
County FE	Yes	Yes	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes

Table 7: VIX, Macroprudential Policies, and Economic Activity

Notes: This table shows the real effects of macroprudential policies after two quarters and their interactions with VIX. Data are at the county-quarter level for 42 counties and sample period depends on the outcome variable (See Section 3.1). The dependent variables are residential building permit, house price, and nightlights growth. MPP represents the macroprudential policy index (defined in Section 2), where higher values indicate a tightening of macroprudential conditions. "FX share" is the fraction of FX-denominated household loan volume in a given county-quarter and is lagged two quarters. All specifications include lagged county controls (computed from bank variables at the county-level by weighing the bank-level characteristics from previous regressions by their market shares: size, capital, liquidity, ROA, NPL, risk profile, share of foreign funding, and share of foreign banks; and market shares are calculated based on household lending extended by a given bank in a given county relative to total bank lending in that county over the entire sample period), GDP interactions, county and quarter fixed effects. Low/high VIX refers to periods of below/above mean values of the VIX index. Standard errors are reported in parentheses and are double clustered on county and quarter. *** indicates significance at the 1% level, ** at the 5% level, * at the 10% level, and # at the 15% level. Source: See Table A2 for variable definitions and sources.

policy is consistently associated with lower economic activity in counties with higher FX exposure. Are these relationships stronger during the boom, consistent with our previous findings for bank credit? In columns 4–6 we estimate the high/low VIX specification in Equation (4) and find that macroprudential policies are better able to mitigate the transmission of global financial conditions to the local economy when the VIX is low. Economically, the estimates in columns 4–6 indicate that when the VIX is low and macroprudential policies tighten by half an SD, if we compare areas with high versus low exposure (i.e., with lagged share of FX loans at the mean \pm half an SD), then high exposure areas experience a reduction in real activity growth after two quarters of between 0.9 and 1.9 ppts compared to

find declining effects over time.

0.3 and 0.7 ppts for low exposure areas. Notably, these effects are weaker or statistically insignificant when the VIX is high (p-values of t-tests indicate that the coefficients on the triple interaction MPP×FX share×Low VIX are larger in absolute value than those on the interaction MPP×FX share×High VIX at least at 15% confidence level).

Overall, these findings underscore the critical role of macroprudential policies in reducing the sensitivity of the real economy to the global financial cycle, and point to a previously undocumented asymmetry in the potency of local macroprudential regulation to dampen global financial shocks.

6 Conclusions

Macroprudential perspectives on regulation and supervision have gained significant ground since the global financial crisis. In response to the COVID-19 shock, many countries relaxed macroprudential policy tools to help sustain the flow of credit and to prevent bank deleveraging. In a world of boom-bust credit cycles, understanding how macroprudential instruments affect the interplay between the global and the local financial cycles—in particular to what extent they can insulate the local credit cycle from cross-border spillovers—is crucial for theory and policy design. Yet, there is no systematic evidence on this issue, as most previous studies conduct difference-in-differences analyses of individual policies and do not examine whether macroprudential policies diminish the impact of the global cycle on the local economy via the credit channel. Our contribution is to bring the international dimension and to analyze the full boom-bust global cycle, focusing on asymmetric effects. We exploit exogenous variation in external financial conditions facing an open emerging market economy and rely on extensive data from confidential household and corporate credit registers.

Our results suggest that, especially when the VIX is low, tighter ex ante macroprudential policies reduce household lending—notably for riskier (FX and high DSTI) loans and for loans granted by banks dependent on foreign funding—and increase local currency lending to realestate firms. Furthermore, when the VIX is low, the real effects of ex ante macroprudential policies—notably, lower construction activity, house price growth, and nightlights growth in areas with higher initial share of FX lending after macroprudential tightening—are relatively stronger. Taken together, the results suggest that macroprudential policy is consistently more effective at "taming" riskier credit booms (with higher credit and especially risky credit, such as in FX and with high DSTI) during the boom phase of the cycle, when global financial conditions are soft and risk appetite is high.

Overall, our findings support the notion that macroprudential policies mitigate international spillovers from the global financial cycle to local credit growth in emerging markets, and thus may have stabilizing macroeconomic effects. The key result of our paper is that we identify a crucial role for macroprudential policies of dampening the build-up of financial stability risks during the boom phase of the global cycle. Our results also have important implications for policymakers in open emerging markets where national monetary policies are constrained by the global financial cycle, even when they pursue flexible exchange rate policies.

References

- ACHARYA, V., ENGLE, R. and PIERRET, D. (2014). Testing macroprudential stress tests: The risk of regulatory risk weights. *Journal of Monetary Economics*, **65**, 36–53.
- ACHARYA, V. V., BERGANT, K., CROSIGNANI, M., EISERT, T. and MCCANN, F. (2020). The Anatomy of The Transmission of Macroprudential Policies: Evidence From Ireland. *Journal of Finance (forthcoming)*.
- ADMATI, A. R., DEMARZO, P. M., HELLWIG, M. F. and PFLEIDERER, P. C. (2013). Fallacies, irrelevant facts, and myths in the discussion of capital regulation: Why bank equity is not socially expensive. *Max Planck Institute for Research on Collective Goods*, 23, 13–7.
- ADRIAN, T. (2017). Macroprudential policy and financial vulnerabilities. Speech at the European Systemic Risk Board Annual Conference (September 22 2017).
- AKINCI, O. and OLMSTEAD-RUMSEY, J. (2018). How effective are macroprudential policies? An empirical investigation. *Journal of Financial Intermediation*, **33**, 33–57.
- ALTIG, D., BAKER, S., BARRERO, J. M., BLOOM, N. et al. (2020). Economic uncertainty before and during the COVID-19 pandemic. *Journal of Public Economics*, **191**, 104274.
- AUER, R. and ONGENA, S. (2016). The countercyclical capital buffer and the composition of bank lending. *BIS Working Papers No 593*.
- BASKAYA, Y. S., DI GIOVANNI, J., KALEMLI-ÖZCAN, Ş., PEYDRÓ, J.-L. and ULU, M. F. (2017). Capital flows and the international credit channel. *Journal of International Economics*, 108, S15–S22.
- —, GIOVANNI, J. D., KALEMLI-OZCAN, S. and ULU, M. F. (2021). International spillovers and local credit cycles. *The Review of Economic Studies (forthcoming)*.
- BASTEN, C. (2020). Higher Bank Capital Requirements and Mortgage Pricing: Evidence from the Counter-Cyclical Capital Buffer. *Review of Finance*, **24** (2), 453–495.
- BEGENAU, J. (2020). Capital requirements, risk choice, and liquidity provision in a businesscycle model. *Journal of Financial Economics*, **136** (2), 355–378.
- BEHN, M., HASELMANN, R. and WACHTEL, P. (2016). Procyclical capital regulation and lending. *The Journal of Finance*, **71** (2), 919–956.
- BENEDIKTSDOTTIR, S., FEDLBER, G. and LIANG, N. (2020). What macroprudential policies are countries using to help their economies through the COVID-19 crisis? *Brookings* Report (April 8 2020).
- BENETTON, M. (2021). Leverage regulation and market structure: A structural model of the UK mortgage market. *Journal of Finance (forthcoming)*.
- BERGANT, K., GRIGOLI, F., HANSEN, N.-J. and SANDRI, D. (2020). Dampening Global Financial Shocks: Can Macroprudential Regulation Help (More than Capital Controls)? *IMF Working Paper No. 20/106.*
- BERNANKE, B. (2018). The real effects of the financial crisis. Brookings Papers on Economic Activity.
- BHUTTA, N. and KEYS, B. J. (2016). Interest rates and equity extraction during the housing boom. *American Economic Review*, **106** (7), 1742–74.
- BIANCHI, J. (2011). Overborrowing and systemic externalities in the business cycle. American Economic Review, 101 (7), 3400–3426.
- and MENDOZA, E. G. (2018). Optimal time-consistent macroprudential policy. Journal

of Political Economy, **126** (2), 588–634.

- BIS (2020). Annual Economic Report 2020: Editorial. Annual Report.
- BORIO, C. (2014). The financial cycle and macroeconomics: What have we learnt? Journal of Banking & Finance, 45, 182–198.
- BRÄUNING, F. and IVASHINA, V. (2019). U.S. monetary policy and emerging markets credit cycle. *Journal of Monetary Economics*, **112**, 57–76.
- BRUNNERMEIER, M., CROCKETT, A., GOODHART, C. A., PERSAUD, A. and SHIN, H. S. (2009). *The fundamental principles of financial regulation*, vol. 11. ICMB, Internat. Center for Monetary and Banking Studies.
- BRUNO, V. and SHIN, H. S. (2015a). Capital flows and the risk-taking channel of monetary policy. *Journal of Monetary Economics*, **71**, 119–132.
- and (2015b). Cross-border banking and global liquidity. The Review of Economic Studies, 82, 535–564.
- CALEM, P., CORREA, R. and LEE, S. J. (2019). Prudential policies and their impact on credit in the United States. *Journal of Financial Intermediation*, p. 100826.
- CALOMIRIS, C. W. and MASON, J. R. (2003). Consequences of bank distress during the Great Depression. *American Economic Review*, **93** (3), 937–947.
- CERUTTI, E., CLAESSENS, S. and LAEVEN, L. (2017). The use and effectiveness of macroprudential policies: New evidence. *Journal of Financial Stability*, 28, 203–224.
- CETORELLI, N. and GOLDBERG, L. S. (2011). Global banks and international shock transmission: Evidence from the crisis. *IMF Economic Review*, **59** (1), 41–76.
- and (2012). Banking globalization and monetary transmission. Journal of Finance, LXZ11 (5), 1811–1843.
- CLAESSENS, S. (2015). An overview of macroprudential policy tools. Annual Review of Financial Economics, 7, 397–422.
- —, GHOSH, S. R. and MIHET, R. (2013). Macro-prudential policies to mitigate financial system vulnerabilities. *Journal of International Money and Finance*, **39**, 153–185.
- COIMBRA, N., KIM, D. and REY, H. (2021). Central Bank Policy and the Concentration of Risk: Empirical Estimates. *NBER Working Paper No. 28907.*
- and REY, H. (2018). Financial cycles and credit growth across countries. In AEA Papers and Proceedings, vol. 108, pp. 509–12.
- CROWE, C. W., DELL'ARICCIA, G., RABANAL, P. and IGAN, D. (2011). Policies for Macrofinancial Stability: Options to Deal with Real Estate Booms. Staff Discussion Note SDN/11/91, International Monetary Fund.
- DE HAAS, R., KORNIYENKO, Y., PIVOVARSKY, A. and TSANKOVA, T. (2015). Taming the herd? Foreign banks, the Vienna Initiative and crisis transmission. *Journal of Financial Intermediation*, **24** (3), 325–355.
- DEFUSCO, A. A., JOHNSON, S. and MONDRAGON, J. (2020). Regulating household leverage. *The Review of Economic Studies*, 87 (2), 914–958.
- DELL'ARICCIA, G., LAEVEN, L., IGAN, D., TONG, H., BAKKER, B. B. and VANDEN-BUSSCHE, J. (2012). *Policies for macrofinancial stability: How to deal with credit booms*. Staff Discussion Note SDN/12/16, International Monetary Fund.
- —, and MARQUEZ, R. (2014). Real interest rates, leverage, and bank risk-taking. *The Journal of Economic Theory*, **149**, 65–99.
- —, and SUAREZ, G. A. (2017). Bank Leverage and Monetary Policy's Risk-Taking

Channel: Evidence from the United States. The Journal of Finance, 72 (2), 613–654.

- DIAMOND, D. W. and RAJAN, R. G. (2012). Illiquid banks, financial stability, and interest rate policy. *The Journal of Political Economy*, **120** (3), 552–591.
- DIMOVA, D., KONGSAMUT, P. and VANDENBUSSCHE, J. (2016). Macroprudential Policies in Southeastern Europe. *IMF Working Paper No. 16/29*.
- DRECHSLER, I., SAVOV, A. and SCHNABL, P. (2017). The deposits channel of monetary policy. *The Quarterly Journal of Economics*, **132** (4), 1819–1876.
- DUENWALD, C., NIKOLAY, G. and ANDREA, S. (2005). Too Much of a Good Thing? Credit Booms in Transition Economies: The Cases of Bulgaria, Romania, and Ukraine. *IMF Working Paper No. 05/128.*
- EVERAERT, E., CHE, N., GENG, N., GRUSS, B., IMPAVIDO, G., LU, Y., SABOROWSKI, C., VANDENBUSSCHE, J. and L, Z. (2015). Does Supply or Demand Drive the Credit Cycle? Evidence from Central, Eastern, and Southeastern Europe. *IMF Working Paper* No. 15/15.
- FARHI, E. and WERNING, I. (2016). A theory of macroprudential policies in the presence of nominal rigidities. *Econometrica*, **84** (5), 1645–1704.
- FORBES, K. J. (2021). The international aspects of macroprudential policy. *Annual Review* of Economics, 13.
- and WARNOCK, F. E. (2012). Capital flow waves: Surges, stops, flight, and retrenchment. Journal of International Economics, 88 (2), 235–251.
- FREIXAS, X., LAEVEN, L. and PEYDRÓ, J.-L. (2015). Systemic risk, crises, and macroprudential regulation. MIT Press.
- GIANNETTI, M. and LAEVEN, L. (2012a). The flight home effect: Evidence from the syndicated loan market during financial crises. *Journal of Financial Economics*, **104(1)**, 23–43.
- and (2012b). Flight home, flight abroad, and international credit cycles. *American Economic Review*, **102(3)**, 219–224.
- GOURINCHAS, P.-O. and OBSTFELD, M. (2012). Stories of the twentieth century for the twenty-first. American Economic Journal: Macroeconomics, 4 (1), 226–65.
- GROPP, R., MOSK, T., ONGENA, S. and WIX, C. (2019). Banks response to higher capital requirements: Evidence from a quasi-natural experiment. *The Review of Financial Studies*, 32 (1), 266–299.
- HANSON, S. G., KASHYAP, A. K. and STEIN, J. C. (2011). A macroprudential approach to financial regulation. *Journal of Economic Perspectives*, **25** (1), 3–28.
- HENDERSON, J. V., STOREYGARD, A. and WEIL, D. N. (2012). Measuring economic growth from outer space. *American Economic Review*, **102** (2), 994–1028.
- IMF (2009). Lessons of the Financial Crisis for Future Regulation of Financial Institutions and Markets and for Liquidity Management. *IMF Policy Paper*.
- (2010). Romania: Financial Sector Stability Assessment. IMF Country Report No. 10/47.
- IMF-FSB-BIS (2016). Elements of Effective Macroprudential Policies: Lessons from International Experience. *Joint Report*.
- JAMES, C. and SMITH, D. C. (2000). Are banks still special? New evidence on their role in the corporate capital-raising process. *Journal of Applied Corporate Finance*, **13** (1), 52–63.
- JEANNE, O. and KORINEK, A. (2019). Managing credit booms and busts: A Pigouvian taxation approach. *Journal of Monetary Economics*, **107**, 2–17.

- and (2020). Macroprudential regulation versus mopping up after the crash. *The Review* of *Economic Studies*, **87** (3), 1470–1497.
- JIMÉNEZ, G., ONGENA, S., PEYDRÓ, J. and SAURINA, J. (2014). Hazardous times for monetary policy: What do twenty-three million bank loans say about the effects of monetary policy on credit risk? *Econometrica*, **2** (82), 463–505.
- —, —, and SAURINA, J. (2017). Macroprudential policy, countercyclical bank capital buffers, and credit supply: Evidence from the spanish dynamic provisioning experiments. *Journal of Political Economy*, **125** (6), 2126–2177.
- JORDÀ, Ò., SCHULARICK, M. and TAYLOR, A. M. (2011). Financial crises, credit booms, and external imbalances: 140 years of lessons. *IMF Economic Review*, **59** (2), 340–378.
- KANDRAC, J. and SCHLUSCHE, B. (2021). The Effect of Bank Supervision and Examination on Risk Taking: Evidence from a Natural Experiment. *The Review of Financial Studies*, **34** (6), 3181–3212.
- KAROLYI, G. A. (2003). Does international financial contagion really exist? International Finance, 6 (2), 179–199.
- KEYS, B. J., PISKORSKI, T., SERU, A. and YAO, V. (2014). Mortgage rates, household balance sheets, and the real economy. *NBER Working Paper No. 20561*.
- LAEVEN, L. and VALENCIA, F. (2013). Systemic banking crises database. *IMF Economic Review*, **61** (2), 225–270.
- LIANG, N. (2020). Three important questions to answer about U.S. financial stabilization policies amid the coronavirus recession. *Brookings Report (April 8 2020)*.
- LIM, C. H., COSTA, A., COLUMBA, F., KONGSAMUT, P., OTANI, A., SAIYID, M., WEZEL, T. and WU, X. (2011). Macroprudential policy: What instruments and how to use them? Lessons from country experiences. *IMF Working Paper No.* 11/238.
- MIAN, A. and SUFI, A. (2015). House of debt: How they (and you) caused the Great Recession, and how we can prevent it from happening again. University of Chicago Press.
- and (2017). Household debt and defaults from 2000 to 2010: The credit supply view. Evidence and innovation in housing law and policy, pp. 257–288.
- —, and VERNER, E. (2017). Household debt and business cycles worldwide. *The Quarterly Journal of Economics*, **132** (4), 1755–1817.
- MIRANDA-AGRIPPINO, S. and REY, H. (2020). World asset markets and the global financial cycle. *The Review of Economic Studies*.
- MORAIS, B., PEYDRÓ, J.-L., ROLDÁN-PEÑA, J. and RUIZ-ORTEGA, C. (2019). The international bank lending channel of monetary policy rates and QE: Credit supply, reachfor-yield, and real effects. *The Journal of Finance*, **74** (1), 55–90.
- MÜLLER, K. and VERNER, E. (2021). Credit allocation and macroeconomic fluctuations. Available at SSRN 3781981.
- NBR (2003). National Bank of Romania Annual Report 2003.
- (2004). National Bank of Romania Annual Report 2004.
- (2012). National Bank of Romania Monthly Bulletin December 2012.
- NEAGU, F., TATARICI, L. and MIHAI, I. (2015). Implementing loan-to-value and debtservice-to-income measures: A decade of Romanian experience. *NBR Occasional Paper No. 15.*
- OSTRY, J. D., GHOSH, A. R., CHAMON, M. and QURESHI, M. S. (2012). Tools for managing financial-stability risks from capital inflows. *Journal of International Economics*,

88 (2), 407–421.

- PINKOVSKIY, M. and SALA-I MARTIN, X. (2016). Lights, camera... income! Illuminating the national accounts-household surveys debate. *The Quarterly Journal of Economics*, **131** (2), 579–631.
- REY, H. (2015). Dilemma not Trilemma: The global financial cycle and monetary policy independence. *NBER Working Paper No. 21162*.
- (2016). International channels of transmission of monetary policy and the Mundellian trilemma. *IMF Economic Review*, 64 (1), 6–35.
- SCHNABL, P. (2012). The International Transmission of Bank Liquidity Shocks: Evidence from an Emerging Market. *The Journal of Finance*, **67** (3), 897–932.
- SCHULARICK, M. and TAYLOR, A. M. (2012). Credit booms gone bust: Monetary policy, leverage cycles, and financial crises, 1870–2008. *The American Economic Review*, **102** (2), 1029–1061.
- SKIMMYHORN, W. (2016). Assessing Financial Education: Evidence from Boot Camp. American Economic Journal: Economic Policy, 8 (2), 322–43.
- TAKÁTS, E. and TEMESVARY, J. (2019). How does the interaction of macroprudential and monetary policies affect cross-border bank lending? *Journal of International Economics* (forthcoming).
- VANDENBUSSCHE, J., VOGEL, U. and DETRAGIACHE, E. (2015). Macroprudential policies and housing prices: A new database and empirical evidence for Central, Eastern, and Southeastern Europe. *Journal of Money, Credit and Banking*, **47** (S1), 343–377.
- WANG, Y., WHITED, T. M., WU, Y. and XIAO, K. (2020). Bank market power and monetary policy transmission: Evidence from a structural estimation. *Journal of Finance (forthcoming)*.
- WHITED, T., WU, Y. and XIAO, K. (2020). Low interest rates, deposit market power, and bank risk-taking. *Journal of Monetary Economics (forthcoming)*.
- WILLIAMS, J. C. (2015). Macroprudential policy in a microprudential world. *Federal Reserve* Bank of San Francisco Economic Letter, **18**, 1–7.



Figure A1: Components of the Macroprudential Policy Index

Notes: The figure depicts the composition of the macroprudential policy (MPP) index, constructed following the approach in Cerutti, Claessens and Laeven (2017) by coding introductions and changes in macroprudential instruments employed by the NBR as tightenings (+1) or loosenings (-1). The index is defined as the cumulative sum of these values such that each macroprudential instrument is reflected in the index throughout the entire time it is in place until it is changed or discontinued. Higher values of the index indicate a tightening of macroprudential conditions. The components are given by changes in reserve requirements, capital requirements, DSTI and LTV limits, provisioning rules, FX credit exposure limits, Basel adoption-related measures to harmonize Romania's regulations to the EU "Aquis Communautaire" (aiming at the full enforcement of the Basel II regulatory framework, including by adopting the standardized approach for risk weights and tightening operational risk management), and Other measures (concerning the regulation of nonbank institutions). Source: National Bank of Romania.





Notes: The figure shows the U.S. VIX during 2004–2020, which estimates implied volatility of 3-month options on the S&P500 Index (CBOE S&P 500 3-Month Volatility Index). Lower values of the VIX reflect lower volatility and risk aversion. The shaded bars indicate periods of business recession as defined by the National Bureau of Economic Research: December 2007-June 2009 (corresponding to 2007:Q4-2009:Q2 in the chart). Source: CBOE S&P 500 3-Month Volatility Index.



Figure A3: Household and Business Credit Growth

Notes: The figure plots the year-on-year real growth rate of household and business credit. Credit is deflated by the CPI (2005=100). Source: National Bank of Romania.



Figure A4: Household Credit by Type and Currency

Notes: The figure plots total bank credit by type (mortgages versus consumer loans) and currency (RON, EUR, CHF, and other currencies) during 2004–2012. Source: National Bank of Romania.

Figure A5: Histogram of Estimated Coefficients from "leave-one-policy-out" Estimations



Notes: The figure shows a frequency distribution for estimates of the coefficient on macroprudential policy (MPP) index in the specification in column 1 of Table 2 when the MPP index is recalculated by leaving one policy change (or set of policy changes in a given quarter) out at a time. Clustering of coefficient estimates around the value -0.05 (seen in column 1 of Table 2) suggests that our main results are not driven by any policy or set of tools. Source: National Bank of Romania.

Dato	Mammidantial valian maanua	011	I on don	Uman
Date	MPP	Overall	Lender index MPP ^{BANK}	nousenoid index MPP ^{HH}
		+1 if tigh	tening and –	1 if loosening
2004Q1	consumer credit: installments shall not exceed 30% of net incomes of the borrower and his family; mgg credit: installments shall not exceed 35% of net incomes of the borrower and his family	1	0	1
2004Q1	consumer credit: downpayment of at least 25% or cosigner commitment for purchases of goods; collateral and/or cosigner commitment for other types of consumer credit; mortgage	1	0	1
2004Q3	credit: credit value shall not exceed 10% of property value reserve requirement ratio on foreign currency deposits raised from 25% to 30% , reserve ratio on domestic currency deposits stays at 18%	-1	-1	0
2005Q1	reserve requirements broadened to include all foreign currency liabilities carrying maturities of over 2 years	1	1	0
2005Q3	regulation on provisioning and loan classification refined to take into account the foreign	1	1	0
2005Q3	eligibility criteria for DSTI was further tightened; overall installments associated with the sum of all credit contracts shall not exceed 40% of net incomes		0	1
2005Q3	foreign currency credit exposure of a credit institution arising from loans granted to un- hedged individuals and legal entities shall not exceed 300% of own funds	1	1	0
2005Q3	provisioning rules tighten: credit institutions may include borrowers who do not earn steady income in the currency in which their loan is denominated at most in the "B" financial	1	1	0
2005Q3	reserve requirements on domestic currency liabilities reduced from 18% to 16%			0
2005Q3	reserve requirements base broadenend to include all foreign currency liabilities carrying maturities of over 2 years regardless of when they were raised	1	1	0
2006Q1	reserve requirements on foreign currency liabilities raised from 30% to 35% and later to 40%	2	2	0
2006Q2 $2006Q4$	reserve requirements increased from 16% to 20% (for the first time in 6.5 years) eligibility constraints (LTV, DSTI) on household loans apply to regulated non-bank credit		$1 \\ 0$	0 1
2007Q1	institutions as well eligibility criteria for DSTI defined by banks' internal models	-1	0	-1
2007Q1	foreign currency credit exposure limits removed		·	0
2007Q1 2007Q1	loan-to-value (LTV) limit removed following entry into the European Union, minimum capital requirement lowered from 12%		-1	-1 0
2007Q1	10 0/0 full enforcement of Basel II regulatory framework. Lower risk-weights (standardized ap- moach) and tichtening of onerational risk management.	-1	-	0
$\begin{array}{c} 2008 Q1 \\ 2008 Q1 \end{array}$	higher provisioning rate for loans to unhedged foreign currency borrowers the October 2005 restriction regarding the possibility to classify an unhedged borrower in	1-1	1-1	0
2008Q1	the "b" mnancial performance category at most is removed a new requirement introduced, regarding distinct provisioning coefficients for loans in foreign currency or linked to another currency and granted to unhedged borrowers, as compared to hedged borrowers	Ţ	1	0

Table A1: Macroprudential Policy Measures, 2004–2012

Date	Macroprudential policy measure	Overall	Lender	Household
	ALL'A ALL'ALL'ALL'ALL'ALL'ALL'ALL'ALL'AL	Index	Index MPP ^{BANK}	maex MPP ^{HH}
		+1 if tigh	tening and –	1 if loosening
2008Q3	current year profits excluded from regulatory capital			0
2008Q3	banks must consider the interest and exchange rate risk in setting the indebtedness ceiling	1	0	1
	(set on a case by case basis using internal risk models)			
2008Q4	reserve requirementes on domestic currency liabilities reduced from 20% to 18%	Ļ.	-1	0
2009Q1	requirement to take into calculation interest rate risk and currency risk when setting the	-1	0	-1
	indebtedness ratio for clients taking loans backed by mortgage on the home or the land within city limits removed			
2009Q1	the minimum capital adequacy ratio set at 10% as long as multilateral financing arrangement	1	1	0
900009	whith the EQ, the LMF and Other IF IS in place reversal of Anonst 2008 measure recarding canital (current year profits included in reculatory	,	, 	C
	capital)	H	4	0
2009Q2	a fraction of the collateral value (less than 25%) can be deducted from the value of "loss"	-	-1	0
	(i.e. 90+ days overdue) exposures to compute provisions (under the old regulation, no such			
	deduction allowed)			
2009Q2	launch of the "first home" mortgage subsidy government program		-1	-1
2009Q2	reserve requirements on foreign currency liabilities with residual maturity greater than 2 wars reduced from 40% to 0%	-1	-1	0
200903	reserve requirements on domestic currency lighilities reduced from 18% to 15%	,	, I	0
200903	reserve requirements on foreign currency liabilities with maturity less than 2 years were	۰ ۱		
))) 	reduced from 40% to 25%)
2009Q4	regulation 20/2009 allows inclusion of interim profits in capital		-1	0
2009Q4	reserve requirements on foreign currency liabilities with maturity less than 2 years were	-1	-1	0
	reduced from 30% to 25%	Ţ	Ţ	c
201102	reserve requirements on foreign currency habilities with maturity less than 2 years reduced from 25% to 20%			0
2011Q4	introduce a loan-to-value ceiling by type of loan currency denomination, and specific foreign	3	0	3
	limit is 85% for local currency loans, 80% for foreign currency loans to hedged borrowers,			
	75% to EURO denominated loans to unhedged borowers; and 60% for other currency loans			
	to unneaged bortowers. Lt V minuts do not apply to mortgages under the mist nome moment. For concurron modif in foreign currents, the value of minubaced goods chall not			
	program. For consumer create in toterar currency, the value of purchased goods shall not exceed 133%. Maturity of consumer credit set at maximum 5 years.			
2012Q4	extension of regulatory measures to nonfinancial companies that are unhedged to currency	1	1	0
	risk by requiring lenders to apply tighter conditions on loreign currency-denominated loans			

Table A1: Macroprudential Policy Measures, 2004–2012 (continued)

Table A2: Variable Definitions and Sources

Variable	Description	Source
CREDIT REGISTERS		
Loan amount (in local currency:	Loan amount granted to an individual or a nonfinancial company,	NBR
Borrower age (years)	Borrower age expressed in years at the time of loan granting.	NBR
Debt-sevice-to-income ratio (DSTI)	Debt-service-to-income ratio at loan origination computed as the	NBR and Ministry of Public
	borrower's debt payments divided by gross income.	Finances
First-home mortgage	Dummy variable that takes value 1 if the mortgage was granted	NBR
	under the first-time home ownership government program, 0 oth-	
Finne loop tome	erwise.	NDD
Firm loan type	(business lines of credit) 3 (other loans, including those for inven-	NDR
	tories, equipment financing, and trade).	
MACBO VABIABLES		
Macroprudential policy index	Macroprudential policy index computed coded based on the ex-	Authors' calculations
(MPP)	haustive list of macroprudential instruments and tools employed	
	by the NBR during 2004-2012 (Table A1). A tightening is coded as	
	+1, a loosening by -1 , a neutral measure by 0. The index is com-	
	puted as the cumulative sum of macroprudential measures starting in 2004.01 such that higher values indicate a tightening of macro	
	prudential conditions (Cerutti, Claessens and Laeven, 2017).	
Lender-targeted MPP index	Same as above, but focused on bank-based macroprudential in-	Authors' calculations
(MPP^{BANK})	struments. See Table A1 for how we coded each macroprudential	
	instrument.	
Household-targeted MPP index (MDDHH)	Same as above, but focused on borrower-based macroprudential	Authors' calculations
(MFF)	instrument.	
GDP growth	Real (year on year) growth rate of seasonally-adjusted GDP	IMF's International Finan-
		cial Statistics
U.S. VIX	The implied volatility of 3-month options on the S & P500 Index	Federal Reserve Bank of St.
	(CBOE S&P 500 3-Month Volatility Index).	Louis
BANK VARIABLES		
Size	Logarithm of the total assets.	NBR
Capital	Liquid assets divided by required liquid assets.	NBR
Return on assets (ROA)	Net income divided by total assets.	NBR
Non-performing loans (NPL)	Non performing loans in percent of gross loans.	NBR
Risk profile	Risk weighted assets in percent of total assets.	NBR
Foreign funding	Foreign funding (non-resident deposits, mostly in EUR and long-	NBR
	term) scaled by total assets. Defined as all deposits with matu-	
	rity less than 1 year before 2005, deposits of all maturities during 2005O1-2009O1 and deposits with maturity less than 2 years dur-	
	ing 2009Q2-2012.	
Foreign bank	Dummy variable for banks with majority foreign ownership.	NBR
FIRM VARIABLES		
Firm industry	1 (agriculture), 2 (extractive industry), 3 (manufacturing), 4 (util-	Ministry of Public Finances
	ities), 5 (construction), 6 (trade), 7 (services) and 8 (real estate).	
Real estate firm	Dummy variable that takes value 1 if the company in from the real	Ministry of Public Finances
Einmig total agents (in DON)	estate and construction sectors (codes 5 and 8), and 0 otherwise.	Ministry of Dublic Finances
Firm's tangibility ratio (fixed assets	The ratio of fixed to total assets (book values)	Ministry of Public Finances
to total assets)	The rate of inverse could about (book variable).	
Firm's cash ratio	The ratio of cash to total assets (book values).	Ministry of Public Finances
Firm's ROA	Earnings before interest and taxes (EBIT) divided by the book	Ministry of Public Finances
	value of total assets.	
ECONOMIC ACTIVITY		
Building permit growth	County-level residential building permits (square meters approved	National Institute of Statis-
House price growth	Growth rate of county-level house prices on quarterly frequency.	URL: imobiliare ro
Nightlights	County-level nightlights on quarterly frequency.	NOAA National Geophysical
		Data Center (NGDC)

	(1)	(2)	(3)	(4)	(5)	(6)		
Dependent variable:	Macroprudential policy (MPP index)							
Monetary policy rate	-0.0212					-0.1364		
	(0.103)					(0.208)		
Real GDP growth		0.3308^{***}				0.4241^{***}		
		(0.117)				(0.135)		
CPI Inflation			0.0135			-0.1258		
			(0.183)			(0.345)		
U.S. VIX				-0.0329		-0.0085		
				(0.078)		(0.082)		
$\Delta NER (RON/EUR)$					0.0992	0.2178		
					(0.141)	(0.238)		
Observations	36	36	36	36	36	36		
R^2	0.001	0.233	0.000	0.008	0.010	0.325		

Table A3: Macro Determinants of Macroprudential Policies

Notes: This table explores the determinants of the MPP index and finds that the most robust covariate is real GDP growth, providing a rationale for controlling for GDP growth and interactions with other variables in all our specifications. Higher values of the MPP index indicate a tightening of macroprudential conditions (see Section 2). Estimates come an OLS time-series regression on quarterly data over 2004–2012. The dependent variable is the MPP index. All variables enter contemporaneously. Robust standard errors are reported in parentheses. *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level. Source: See Table A2 for variable definitions and data sources.

Table A4: Macroprudential Policies and Household Credit—Full Set of CovariateCoefficients in Baseline Specifications

	(1)	(2)	(3)	(4)
Dependent variable:	Н	ousehold loa	n amount (lo	g)
MPP	-0.0531***		-0.0397**	-0.1478**
MPP×FX	(0.019)	-0.0705***	(0.016)	(0.055)
MPP×RON		(0.017) -0.0388		
$\mathrm{MPP}\!\times\!\mathrm{DSTI}\!\times\!\mathrm{FX}$		(0.024)	-0.0396***	
MPP×DSTI×RON			(0.009) 0.0111^{**}	
DSTI			(0.005) 0.7285^{***}	
$MPP \times Foreign funding \times FX$			(0.068)	-0.0021**
$MPP \times Foreign funding \times RON$				(0.001) -0.0001
$MPP \times Foreign \ bank \times FX$				(0.001) 0.1437^{**}
$MPP \times Foreign \ bank \times RON$				(0.059) 0.1540**
FX loan	1.6617***	1.9455***	1.5441***	(0.065) 1.8757^{***}
GDP growth	(0.110) -0.0136	(0.205)	-0.0006	(0.262) -0.0154
GDP growth \times FX	(0.010)	-0.0233	(0.009)	(0.020)
GDP growth \times RON		(0.021) -0.0117 (0.012)		
GDP growth $\times \rm DSTI \times FX$		(0.012)	-0.0173^{*}	
GDP growth $\times \rm DSTI \times \rm RON$			-0.0248***	
GDP growth $\!\times\!$ Foreign funding $\!\times\!$ FX			(0.008)	0.0016^{**}
GDP growth $\!\times\!$ Foreign funding $\!\times\!$ RON				-0.0005
GDP growth $\times {\rm Foreign}~{\rm bank} \times {\rm FX}$				(0.001) -0.0126 (0.033)
GDP growth $\times {\rm Foreign \ bank} \times {\rm RON}$				(0.033) 0.0108 (0.018)
Monetary policy rate	-0.1079^{***}	-0.1064^{***}	-0.0815^{***}	-0.1379^{***}
Inflation	(0.021) 0.0741^{***} (0.017)	(0.025) 0.0710^{***} (0.017)	(0.020) 0.0733^{***} (0.014)	(0.023) 0.0732^{***} (0.017)
VIX	(0.0017) 0.0044 (0.007)	(0.011) (0.0040) (0.007)	(0.014) (0.0032)	(0.0017) (0.0034)
Bank size	-0.5412^{**} (0.247)	-0.5190** (0.248)	-0.3303 (0.213)	-0.5747^{**} (0.242)
Bank capital	-0.0334** (0.016)	-0.0309* (0.016)	-0.0155	-0.0347* (0.018)
Bank liquidity	-0.0601** (0.027)	-0.0621** (0.027)	-0.0473***	-0.0504^{*} (0.026)
Bank ROA	-0.1002 (0.080)	-0.1020 (0.081)	-0.1470 (0.091)	-0.1250 (0.081)
Bank NPL	-0.1939^{**} (0.077)	-0.1912^{**} (0.078)	-0.0859^{*} (0.050)	-0.1959^{**} (0.078)
Bank risk profile	-0.0162^{**} (0.006)	-0.0166^{**} (0.006)	-0.0123^{**} (0.006)	-0.0157^{**} (0.006)
Bank foreign funding	0.0007 (0.002)	0.0007 (0.002)	0.0003 (0.002)	0.0004 (0.002)
Foreign bank	-0.1909** (0.083)	-0.2016** (0.081)	-0.1651*** (0.059)	-1.5208^{***} (0.527)
Borrower age	-0.0080**** (0.003)	-0.0081**** (0.003)	-0.0019 (0.002)	-0.0081**** (0.003)
First-home mortgage	-0.0228 (0.145)	-0.0839 (0.142)	-0.0192 (0.096)	-0.0485 (0.147)
Observations	2,753.494	2.753.494	1,999.534	2.753.494
R^2	0.219	0.219	0.254	0.220
GDP growth interactions Bank×Year FE	Yes	Yes Yes	Yes Yes	Yes Yes
County×Year FE Loan-type×Year FE	Yes Yes	Yes Yes	Yes Yes	Yes Yes

Notes: The table shows all covariates in the regressions from baseline Table 2. MPP represents the macroprudential policy index (defined in Section 2), where higher values indicate a tightening of macroprudential conditions. GDP growth interactions refer to GDP growth×FX and GDP growth×RON in column 2; GDP growth×FX×DSTI and GDP growth×RON×DSTI in column 3; and GDP growth×FX×Foreign funding and GDP growth×RON×Foreign funding in column 4. Standard errors are clustered at the bank and county-quarter level. *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level. Source: See Table A2 for variable definitions and data sources.

	(1)	(2)	(3)	(4)				
Dependent variable:	Household loan amount (log)							
MPP×EU	-0.0568^{***}	-0.0564^{***}						
MPP×non-EU	-0.0733^{***} (0.018)	(0.010)						
$MPP \times pre-EU$. ,	-0.0919^{***} (0.026)						
$MPP \times post-EU$		-0.0648*** (0.021)						
$\mathrm{MPP}{\times}\mathrm{FX}{\times}\mathrm{EU}$			-0.0704^{***} (0.017)	-0.0793^{***} (0.018)				
MPP×RON×EU			-0.0407 (0.024)	-0.0414^{*} (0.024)				
$MPP \times FX \times non-EU$			-0.0539** (0.020)					
$MPP \times RON \times non-EU$			-0.0764^{***} (0.022)					
$MPP \times FX \times pre-EU$				-0.1548^{***} (0.041)				
$MPP \times FX \times post-EU$				-0.0496^{*} (0.025)				
$MPP \times RON \times pre-EU$				-0.0725^{**} (0.033)				
$MPP \times RON \times post-EU$				-0.0739^{***} (0.022)				
$\frac{\text{Observations}}{R^2}$	$2,753,494 \\ 0.219$	$2,753,494 \\ 0.219$	$2,753,494 \\ 0.220$	$2,753,494 \\ 0.220$				
Other controls	Yes	Yes	Yes	Yes				
GDP growth interactions Bank×Year FE	Yes	Yes	Yes Yes	Yes Yes				
County×Year FE	Yes	Yes	Yes	Yes				
Loan-type×Year FE	Yes	Yes	Yes	Yes				

 Table A5:
 Macroprudential Policies and Household Credit—Robustness within

 Narrow Window around EU Entry

Notes: This table shows that the baseline results are robust to focusing on a narrow window of nine months around EU entry. EU is a dummy variable that takes the value of one for nine months around the date of EU entry (January 1, 2007) and zero otherwise. MPP represents the macroprudential policy index (defined in Section 2), where higher values indicate a tightening of macroprudential conditions. The data are at the bank-borrower-loan-quarter level. Pre-EU takes the value of one before the EU entry period and zero otherwise; post-EU takes the value of one after the EU entry period and zero otherwise. The dependent variable is log(amount) of each loan extended by a bank to an individual borrower in a given county and quarter. All control variables (with coefficients not reported) are as in Table 2. Standard errors are reported in parentheses and are clustered at the bank and county-quarter level. *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level. Source: See Table A2 for variable definitions and data sources.

	(1)	(2)	(3)	(4)	(5)			
Dependent variable:	Household loan amount (log)							
MPP	-0.2216^{***}	-0.2300^{***}						
VIX	(0.000) $-0.0401^{\#}$ (0.025)	(0.008) $-0.0413^{\#}$ (0.025)	-0.0010	-0.0014	-0.0009			
MPP×VIX	0.0069***	(0.025)	(0.013)	(0.013)	(0.013)			
MPP×VIX×FX	(0.002)	0.0081^{***}						
MPP×VIX×RON		(0.003) 0.0066^{**} (0.002)						
$\mathrm{MPP}{\times}\mathrm{Low}~\mathrm{VIX}{\times}\mathrm{FX}$		(0.002)	-0.1096^{***}					
MPP×Low VIX×RON			(0.023) -0.0639 (0.041)	-0.0544	-0.0651			
$\mathrm{MPP}{\times}\mathrm{High}\ \mathrm{VIX}{\times}\mathrm{FX}$			-0.0138	-0.0302	(0.040) -0.0127 (0.023)			
$\mathrm{MPP}{\times}\mathrm{High}\ \mathrm{VIX}{\times}\mathrm{RON}$			(0.024) -0.0394 (0.036)	-0.0302 (0.029)	-0.0406 (0.036)			
$\mathbf{MPP}{\times}\mathbf{Low}\ \mathbf{VIX}{\times}\mathbf{FX}{\times}\mathbf{High}\ \mathbf{DSTI}$			(0.000)	-0.1115^{***} (0.026)	(0.000)			
MPP×Low VIX×FX×Low DSTI				-0.0955*** (0.026)				
MPP×Low VIX×FX×High Foreign Funding				(0.020)	-0.1136^{***} (0.028)			
MPP×Low VIX×FX×Low Foreign Funding					-0.0903^{***} (0.025)			
p-value t-test Ha: $ 1 > 2 $		0.021						
p-value t-test Ha: $ 3 > 4 $ p-value t-test Ha: $ 3 > 5 $			$0.019 \\ 0.001$					
p-value t-test Ha: $ 3 > 6 $			0.001	0.018				
p-value t-test fla. $ 7 > 6 $ p-value t-test Ha: $ 9 > 10 $				0.018	0.030			
Observations R^2	2,753,494 0.220	2,753,494 0.220	2,753,494 0.220	1,999,534 0.253	2,753,494 0.220			
Other controls	Yes	Yes	Yes	Yes	Yes			
GDP growth interactions	Yes	Yes	Yes	Yes	Yes			
County×Vear FE	res Ves	res Ves	res Ves	res Ves	res Ves			
Loan-type×Year FE	Yes	Yes	Yes	Yes	Yes			

Table A6: VIX, Macroprudential Policies, and Household Credit—Robustness to Triple Clustering

Notes: This table shows that the coefficient estimates in the baseline Table 3 have standard errors that are robust to tripleclustering on bank, county, and quarter. MPP represents the macroprudential policy index (defined in Section 2), where higher values indicate a tightening of macroprudential conditions. The data definitions and all control variables (with coefficients not reported) are the same as in Table 3. *** indicates significance at the 1% level, ** at the 5% level, * at the 10% level, and #at the 15% level. Source: See Table A2 for variable definitions and data sources.

Table A7: VIX, Macroprudential Policies, and Household Credit—Robustness to Continuous VIX

	(1)	(2)	(3)	(4)				
Dependent variable:	Household loan amount (log)							
MPP	-0.2216***	-0.2300***	-0.1629***	-0.2263***				
VIX	(0.060)	(0.062)	(0.035) -0.0252*	(0.061)				
V 12X	(0.020)	(0.020)	(0.014)	(0.020)				
MPP×VIX	0.0069***			× /				
	(0.002)							
MPP×VIX×FX		(0.0081^{***})						
MPP×VIX×RON		0.0066^{***}	0.0044***	0.0065***				
		(0.002)	(0.001)	(0.002)				
$\mathbf{MPP}{\times}\mathbf{VIX}{\times}\mathbf{FX}{\times}\mathbf{High}\ \mathbf{DSTI}$			0.0060***					
MPP VIX VEX VLow DSTI			(0.001) 0.0038***					
			(0.001)					
${\rm MPP}{\times}{\rm VIX}{\times}{\rm FX}{\times}{\rm High}$ Foreign Funding			()	0.0076^{***}				
				(0.002)				
MPP×VIX×FX×Low Foreign Funding				0.0084^{***}				
				(0.005)				
Observations	2,753,494	2,753,494	1,999,534	2,753,494				
R^2	0.220	0.220	0.231	0.220				
Other controls	Yes	Yes	Yes	Ves				
GDP growth interactions	Yes	Yes	Yes	Yes				
$\operatorname{Bank} \times \operatorname{Year} \operatorname{FE}$	Yes	Yes	Yes	Yes				
$County \times Year FE$	Yes	Yes	Yes	Yes				
$Loan-type \times Year FE$	Yes	Yes	Yes	Yes				

Notes: This table shows that the coefficient estimates in the baseline Table 3 are robust to using the continuous VIX variable. MPP represents the macroprudential policy index (defined in Section 2), where higher values indicate a tightening of macroprudential conditions. The data definitions and all control variables (with coefficients not reported) are the same as in Table 3. *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level. Source: See Table A2 for variable definitions and data sources.

	(1)	(2)	(3)	(4)	(5)	(6)			
Dependent variable:	Household loan amount (log)								
	VIX contemporaneous VIX minimum lag								
MPP×VIX×FX	0.0019^{***} (0.001)			0.0018^{***} (0.001)					
$\text{MPP}{\times}\text{VIX}{\times}\text{FX}{\times}\text{High DSTI}$		0.0020^{***} (0.000)			0.0019^{***} (0.000)				
$\mathbf{MPP}{\times}\mathbf{VIX}{\times}\mathbf{FX}{\times}\mathbf{Low}\ \mathbf{DSTI}$		0.0000 (0.000)			-0.0003 (0.000)				
$\mbox{MPP}{\times}\mbox{VIX}{\times}\mbox{FX}{\times}\mbox{High Foreign Funding}$			0.0014^{**} (0.001)			0.0012^{*} (0.001)			
$\mbox{MPP}{\times}\mbox{VIX}{\times}\mbox{FX}{\times}\mbox{Low Foreign Funding}$			0.0026^{***} (0.001)			0.0025^{**} (0.001)			
Observations R^2	$2,753,494 \\ 0.240$	$1,999,525 \\ 0.252$	$2,753,494 \\ 0.240$	$2,753,494 \\ 0.240$	$1,999,525 \\ 0.252$	$2,753,494 \\ 0.240$			
Other controls	Yes	Yes	Yes	Yes	Yes	Yes			
GDP growth interactions	Yes	Yes	Yes	Yes	Yes	Yes			
$Bank \times Quarter FE$	Yes	Yes	Yes	Yes	Yes	Yes			
County×Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes			
Loan-type×Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes			

Table A8: VIX, Macroprudential Policies, and Household Credit—Robustness to Different Lags between Continuous VIX and MPP

Notes: This table shows that the coefficient estimates in the baseline Table 3 are robust to using the continuous VIX variable with different lags. In columns 1–3, the VIX is not lagged (z = 0), and in columns 4–6 it is lagged (z = 0.5 quarters). MPP represents the macroprudential policy index (defined in Section 2) and lagged between one and two quarters, where higher values indicate a tightening of macroprudential conditions. The data definitions and all control variables (with coefficients not reported) are the same as in Table 3. *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level. Source: See Table A2 for variable definitions and data sources.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dependent variable:	Corporate credit volume (log)						
Dependent variable: MPP ^{HH} ×Low VIX MPP ^{HH} ×High VIX MPP ^{HH} ×Real estate×Low VIX MPP ^{HH} ×Real estate×High VIX MPP ^{HH} ×Other firm MPP ^{BANK} ×Real estate	0.1308** (0.060) -0.0023 (0.079)	0.0980* (0.050) -0.0206 (0.074)	0.1264*** (0.045) 0.0841* (0.050) 0.0745 (0.051)	$\begin{array}{c} 0.1067^{***}\\ (0.037)\\ 0.0746\\ (0.056)\\ 0.0636^{*}\\ (0.031) \end{array}$	0.1078*** (0.032) 0.0766 (0.066) 0.0677* (0.033) 0.0011 (0.057)		
$MPP^{BANK} \times Other firm$ $MPP^{HH} \times Real \ estate \times FX$					(0.027) -0.0022 (0.027)	-0.0089	0.0380
MPP ^{HH} ×Real estate×RON×Low VIX						$(0.059) \\ 0.1164^{***} \\ (0.041) \\ 0.0822$	$(0.034) \\ 0.1244^{***} \\ (0.038) \\ 0.00023$
$MPP^{HH} \times Real estate \times RON \times High VIX$ $MPP^{HH} \times Other firm \times FX$						(0.0823) (0.059) 0.0060 (0.041)	$\begin{array}{c} 0.0923 \\ (0.072) \\ 0.0509 \\ (0.032) \end{array}$
$MPP^{HH} \times Other firm \times RON$ $MPP^{BANK} \times Real estate \times FX$						0.0705^{**} (0.031)	0.0776^{**} (0.031) -0.0357 (0.040)
$MPP^{BANK} \times Real estate \times RON$							(0.040) 0.0021 (0.029)
MPP ^{BANK} ×Other firm×FX							-0.0407 (0.032)
Observations	383.603	353.634	353.634	353.632	353.632	353.632	0.0014 (0.026) 353.632

Table A9: VIX, Macroprudential Policies, and Business Credit—Robustness to Triple Clustering

$\frac{\text{Observations}}{R^2}$	$383,603 \\ 0.372$	$353,634 \\ 0.590$	$353,\!634 \\ 0.590$	$353,632 \\ 0.608$	$353,\!632 \\ 0.608$	$353,632 \\ 0.609$	$353,632 \\ 0.609$
Other controls CDP growth interactions	Yes	Yes	Yes Ves	Yes Ves	Yes Ves	Yes Ves	Yes Ves
Bank FE	Yes	Yes	Yes	165	165	165	165
County FE	Yes	Yes	Yes				
Industry FE	Yes	Yes	Yes				
Year FE	Yes	Yes	Yes				
Loan-type FE	Yes	Yes	Yes				
Bank×Year FE				Yes	Yes	Yes	Yes
County×Year FE				Yes	Yes	Yes	Yes
Loan-type×Year FE				Yes	Yes	Yes	Yes
Firm FE		Yes	Yes	Yes	Yes	Yes	Yes

Notes: This table shows that the coefficient estimates in the baseline Table 5 have standard errors that are robust to tripleclustering on bank, county, and quarter. MPP^{HH} refers to household-targeted macroprudential policies, while MPP^{BANK} refers to lender-targeted macroprudential measures (see Table A1), where higher values indicate tighter macroprudential policy conditions. The data definitions and all control variables (with coefficients not reported) are the same as in Table 5. *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level. Source: See Table A2 for variable definitions and data sources.