Global Financial Cycle, Household Credit, and Macroprudential Policies

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We show that macroprudential policies dampen the impact of global financial conditions on local bank credit cycles. For identification, we exploit variation in the U.S. VIX and household and business credit registers in an emerging market economy where banks depend on foreign funding and macroprudential measures vary over the full cycle. Our results suggest that when the VIX is low, tighter macroprudential policies reduce household lending, notably for riskier (FX and high DSTI) loans and by banks dependent on foreign funding. Moreover, they increase (less regulated) local currency lending to real estate firms, while leaving business lending to other firms unchanged. Such periods are associated with less subsequent total lending to households and firms and with a lower share of FX loans at the local level. Consistently, when the VIX is low, tighter macroprudential policies dampen house prices and economic activity.

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

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Financial crises and economic recessions tend to be preceded by credit booms (Dell'Ariccia *et al.*, 2012; Gourinchas and Obstfeld, 2012; Schularick and Taylor, 2012), especially household credit booms (Mian *et al.*, 2017). These booms are often financed by foreign liquidity, including foreign currency (FX) credit (Bruno and Shin, 2020), highlighting the link between global financial conditions and the local economic cycle (Rey, 2015; Jordà *et al.*, 2011). The experience of the 2008–09 global financial crisis (GFC) has generated broad agreement that macroprudential policies should be part of the policy toolkit for reducing procyclicality in credit and hence crisis risk (e.g., Hanson *et al.* (2011); Freixas *et al.* (2015); IMF-FSB-BIS (2016); Farhi and Werning (2016); Duffie (2018); Jeanne and Korinek (2019); Forbes (2021). Nevertheless, while the domestic effects of macroprudential policies have been studied extensively, much less is known about these policies' ability to insulate the local credit and economic cycle from changes in global financial conditions.

In this paper, we study the role of macroprudential policies in dampening the effects of global financial conditions on local credit and the real economy over a full boom-bust cycle. For identification, we use data from Romania, an emerging market in the European Union (EU) that is exposed to global financial conditions through a banking system reliant on foreign funding and that extends risky FX loans to the household sector. We also exploit a wide range of macroprudential policies around the GFC to compare the effects of 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 exante macroprudential policies.

Our empirical analysis examines the responses of total and FX lending to households and firms to global financial conditions in interaction with exante macroprudential policies. We capture fluctuations in global financial conditions using changes in the U.S. VIX. We measure the macroprudential policy stance using information on numerous macroprudential instruments implemented by the National Bank of Romania's (NBR) during 2004–2012, which we

aggregate into one index so as to analyze the effects of the global VIX on local bank credit depending on predetermined local macroprudential policies. These policies include limits on banks' FX credit exposures, minimum reserve requirements on FX deposits (a key source of foreign bank funding), ceilings on debt-service-to-income (DSTI) ratios, and changes in bank capital requirements. The high frequency and number of macroprudential measures during this period makes it difficult to isolate the effect of any given policy. Instead, we capture macroprudential policy changes following Cerutti *et al.* (2017) and define a macroprudential policy index (MPP) as the cumulative sum of all tightenings (+1) and easings (−1) starting in 2004, such that each policy is reflected in the index while in place.

The U.S. VIX is not only driven by factors external to Romania, but is also crucial for the global financial cycle (Rey, 2015) and for banks. This is because fluctuations in global liquidity, captured by the VIX, affect bank lending via banks' access to foreign liquidity. As argued in Adrian and Shin (2010), global banks tend to adjust their balance sheets in response to changes in economic conditions that affect bank value, for instance, through value-at-risk constraints (Adrian and Shin, 2014). During asset price booms, bank net worth increases, inducing expansions in bank leverage and supporting more lending for a given level of capital. The VIX as a barometer of global financial conditions is therefore associated with bank leverage and shows up as a global factor that explains both capital flows and bank lending (Bruno and Shin, 2015a,b). Our suggestive evidence for this mechanism shows that in the cross-section of banks, the banks with higher exante share of foreign funding become even more dependent on foreign funding and increase their total nondeposit liabilities when the VIX declines. In addition, for these banks the expansion of liabilities and total balance sheet size is accompanied by growth in lending. Our specifications in the credit register data build on this mechanism to examine how household lending responds to changes in the VIX depending on exante macroprudential policies.

Our lending 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 levels. 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 36 commercial banks and their characteristics (loan amount, loan 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 to nearly 83,000 firms. The datasets are matched with quarterly supervisory information on bank balance sheets and with annual data on firm financials. We also use quarterly data on economic activity across counties, including house prices, building permits, and nightlights.

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

Second, we analyze whether banks reallocate some of the lending capacity released by tighter regulatory constraints on household leverage to the (less regulated) business sector, especially when the VIX is low. We find that a tightening in household-targeted 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 or in periods of high VIX. Despite this rebalancing effect, we also find that when the VIX is low, tighter exante macroprudential policies are associated with less subsequent total lending and also 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 macroprudential

policies are stronger. Economic areas more exposed to macroprudential policies through a higher exante share of FX loans on local banks' books have lower house price growth and economic activity (measured by approvals of building permits and nightlights) than other areas, 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 asymmetries in the effectiveness of macroprudential regulation. This asymmetric effect speaks to John Maynard Keynes' "pushing on a string" metaphor in the context of monetary policy, according to which policies tend to be more powerful in affecting lending during good times than in crisis times. This finding is policy relevant because central bank liquidity provision during crises is typically limited in emerging market economies, which makes it even more crucial for macroprudential policy to work during booms (Jeanne and Korinek, 2019).

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 17.8%. 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. In addition, a tightening of macroprudential policy by half an SD is associated with total credit volume (household plus corporate) that is lower by 11.8% and FX credit volume lower by 15.7%. Turning to real effects, when the VIX is low and macroprudential policies tighten by half an SD, areas with high exante share of FX loans experience lower growth rate of local house prices and economic activity by between 0.9 and 1.9 ppts compared to 0.3 and 0.7 ppts for low exposure areas. These effects are smaller or statistically insignificant when the VIX is high. A back-of-the-envelope calculation suggests that, abstracting from general equilibrium effects, household FX lending would have grown 2.8 times faster during the pre-GFC boom in the absence of macroprudential policies.

Our estimates are robust to endogeneity concerns. To strengthen the causal interpretation of our findings, we show our baseline results are robust to excluding large economic areas

(the capital Bucharest and its metropolitan area) where macroprudential policies and bank foreign presence may be endogenous with respect to credit growth and economic conditions. Our results also hold up in a differential exposure design similar to a Bartik-style approach (where FX shares in a local area depend on exante shares of each bank in that local area and the FX share of lending in the whole country rather than in the local area) and a system GMM estimator that instruments for the VIX and MPP with lagged levels and differences of these variables. As macroprudential policies generally tighten in response to higher credit growth, the reverse causality bias on the estimated MPP effect should be positive, which works against us finding the negative effect that we obtain. Hence, our results can be interpreted as a lower bound. Relatedly, we control for potential confounders of macroprudential policies by including interaction terms between real GDP growth—the only robust macro determinant of macroprudential policy—and all the relevant covariates to ensure that the estimates coefficients on the MPP index do not pick up changes in the local busines scycle. Further, we capture unobserved changes in bank balance sheets, the macroeconomic environment, and specific loan markets (e.g., mortgages or consumer loans) with bank×time, borrower's county×time and loan-type×time fixed effects. As the U.S. VIX may capture not only global financial conditions, but also the state of the real economy, we show that our results only reflect financial linkages by controlling for real linkages with external demand in key specifications, which leaves the results unchanged.

Contributions to the Literature Our paper contributes to three strands of literature. 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 liquidity on bank lending and risk-taking (Bruno and Shin, 2015a,b; Coimbra and Rey, 2018; Giannetti and Laeven, 2012; Schnabl, 2012) through the activities of international banks (Cetorelli and Goldberg, 2012, 2011). Bräuning and Ivashina (2019) and Morais *et al.* (2019) show there is a robust relation between

U.S. monetary policy and credit cycles in emerging markets through an international bank lending and risk-taking channel of global monetary policy. Baskaya *et al.* (2017) 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, as well as insights on the substitutability between household and business loans.

Second, the paper adds to the literature on the effectiveness of macroprudential policies in reducing the procyclicality of the banking sector. Some studies take a cross-country perspective and find that macroprudential policies are associated with lower growth in domestic credit and economic aggregates (Cerutti *et al.*, 2017; Claessens *et al.*, 2013; Ostry *et al.*, 2012). Bruno *et al.* (2017) show that macroprudential policies targeting bank inflows dampen the effect of the VIX on cross-border flows during periods of high volatility. Focusing on the case of South Korea, Bruno and Shin (2014) show that macroprudential policies are associated with a reduction in the volatility of cross-border lending with respect to the VIX. Our paper shares the same mechanism with these studies by which the VIX is a global factor that explains capital flows and bank lending (Bruno and Shin, 2015a,b), with the difference that foreign flows to the banking sector in our context are nonresident FX deposits from parent banks as opposed to cross-border direct flows (as in Cetorelli and Goldberg (2012) and Morais *et al.* (2019)). We also contribute by showing with household and business loan-level data how macroprudential policy affects the credit cycle, including bank risk-taking and real effects, depending on the fluctuations in the VIX.

Our paper also complements recent studies of individual macroprudential policies, but differs in that we focus on many simultaneous macroprudential policies implemented during a full boom-bust cycle, with the advantage that regulatory arbitrage is less likely (IMF, 2014). For instance, Acharya *et al.* (2020) show that tighter loan-to-value and loan-to-income ratios on mortgages in Ireland leads banks to reallocate liquidity toward riskier securities and corporate lending. Our results echo these findings by showing that tighter household-

targeted macroprudential policies are associated with more lending to riskier (real estate) firms, though banks at the same time compensate risk by granting these loans in local currency. Jiménez *et al.* (2017) find a positive effect of dynamic loan loss provisioning in Spain on corporate credit during a crisis. By contrast, we focus on household lending and find stronger effects of macroprudential policy during the credit boom, when the VIX is low.

Third, we contribute to the literature on household debt as a driver of credit boom-bust cycles (Mian *et al.*, 2017; Keys *et al.*, 2014). While credit booms support growth and financial development, they often end up in costly balance sheet dislocations and financial crises, in part because delinquencies and writedowns impair credit recovery during the bust (Di Maggio and Kermani, 2017). While the cross-country evidence suggests that macroeconomic policies have rarely prevented credit booms or stopped them from turning into bad ones (Dell'Ariccia *et al.*, 2012), recent studies show that certain regulations targeting household leverage can be effective at dampening the growth of the mortgage market and reducing borrower indebtedness (DeFusco *et al.*, 2020; Benetton, 2021). Our paper contributes by bringing an international channel, in particular evidence on the effectiveness of macroprudential policies in emerging market economies reliant on global liquidity, to inform the academic and policy debate that macroprudential policy can contain booms in household credit.

The paper proceeds as follows. Section 1 describes the macroeconomic background of the analysis, the Romanian banking sector, and introduces the measurement of the macroprudential policy index (MPP). Section 2 describes our data. Section 3 discusses the economic mechanism and the empirical specifications. Section 4 presents the results for bank lending and real economy effects. Section 5 concludes.

1 Setting and Macroprudential Policies

In this section we describe the boom-bust cycle experienced by Romania during the period of analysis, the banking sector, and our approach to measuring the macroprudential policy

environment. Romania is a bank-dependent emerging market economy where a large portion of the banking sector is foreign-owned and banks rely heavily on cross-border funding, especially in the form of nonresident deposits from parent banks. Furthermore, a significant share of household credit is extended in FX (especially EUR).

Boom-Bust Cycle around GFC Between 2004 and 2012, Romania experienced a full boom-bust cycle. In the years leading to EU accession in 2007, the economic landscape was one of strong economic growth, bank credit fueled by large capital inflows, and the entry of foreign-owned banks. Bank credit (including in FX) grew at an average real rate of 23% (Figure 1), leading to a staggering rise in household debt, which grew at an annual rate of 77% during 2005–2008. The GFC triggered a deep economic downturn followed by a modest recovery. After the crisis, the banking system retrenched and the large share of FX loans coupled with currency depreciation led to a significant rise in nonperforming loans (NPLs), which slowed down bank balance sheet recovery and credit growth.

Banking Sector Characteristics Over the sample period, the banking system comprises 42 licensed banks (of which we have consistently reported loan-level data for 36 banks). There was significant foreign bank entry during the boom period, especially from West European banking groups.[1] We follow Claessens and Van Horen (2014) and classify a bank as foreign-owned when 50% or more of its shares are held by foreign owners each year (we do not distinguish between private and state-owned banks). Between the start and end of the sample period, the number of foreign banks increases from 22 to 29 banks out of 36 banks. In 2012, foreign banks extended 80% of the household loans and accounted for more than

[1]Between 2004 and 2012, there were 12 bank mergers & acquisitions and one merger, 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 is 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 supervisory regulations, with the exception of capital requirements during 2007–2011, which only applied to subsidiaries. Credit is granted locally by the subsidiaries of foreign banks.

three-quarters of total banking sector assets.

All banks in the sample, including domestic banks, rely to some degree on foreign funding, which consists mostly of nonresident foreign currency deposits from parent banks ($> 90\%$) and to a small degree of loans from international development banks ($< 5\%$). The average share of foreign funding in total assets across banks is 20%, with significant cross-sectional variation: on average it is below 2% for three banks, above 75% for two banks, and between 6% and 45% for all other banks in the sample. Foreign banks rely more on foreign funding than domestic banks (23% compared to 14% on average). Almost half of nonresident deposits are short term (with maturity below 2 years) and most deposits are denominated in EUR.

Household credit represents half of total private credit and more than half of outstanding bank loan claims are in FX. Mortgages tend to be denominated in FX (81% of loans in EUR, 7% of loans in CHF, and the rest in USD, GBP, and YEN). About one-fifth of consumer loans are also extended in FX (mainly EUR), while local wages are largely denominated in local currency (IMF, 2010). Figure A1 shows household credit by type and currency based on loan originations in the household credit register. At domestic banks, FX lending represents 45% of total household lending while at foreign bank this figure is 71%. Furthermore, domestic banks account for one-tenth of total FX lending volume over the sample period.

Measuring Macroprudential Policies A key ingredient to our analysis is a measure of macroprudential policy conditions. During 2004–2012, the NBR adopted a wide range of macroprudential measures to manage the financial risks associated with the credit cycle while supporting financial intermediation (NBR, 2003, 2004). During the credit boom, it targeted the level and composition of bank lending by raising reserve requirements on FX deposits and reducing those on local currency deposits, setting limits on FX credit exposures to unhedged borrowers, and imposing ceilings on LTV ratios for mortgages and DSTI ratios for all household loans. In 2007 Romania joined the EU and began harmonizing its banking regulations with the Basel II framework, which involved a softening of some macroprudential

policies. For instance, banks were allowed to set LTV and DSTI ceilings based on their own risk management models, FX credit exposure limits were removed, and capital requirements were reduced. During the credit bust, the NBR reversed some of its earlier tightening, for instance by lowering reserve requirements for all bank deposits across currencies and setting higher LTV and DSTI ceilings by currency.

The frequent implementation and changes in macroprudential policies observed in Romania is common across countries but makes it difficult to estimate the effect of individual policies. Instead, we follow Cerutti *et al.* (2017) and define a macroprudential policy index (MPP) to capture overall macroprudential policy conditions. The index is computed as the cumulative sum of the measures after classifying them as tightenings or easings and coding them as $+1$ for a tightening and -1 for an easing in the quarter when the instrument is in place (see Table A1 for the assignment of all policies). Each policy enters the index starting the quarter when it is introduced until the quarter when it is removed. 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.[2] Figure 1 shows the evolution of the index during the sample period together with that of household credit growth and Figure A2 shows a breakdown of the index into broad categories of policies. The index ranges between 0 and 12, with a mean of 5 and a standard deviation of 3.586. For some analyses we construct two additional MPP indices that capture measures which specifically target household leverage versus bank leverage.

2 Data

The main datasets combine two credit registers on the lending activities of banks to households and firms with bank- and borrower-level financial information from the NBR and the

[2]Before 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.

Ministry of Public Finances. The lending microdata has near-universal coverage of bank credit. All data sources, described in detail below, cover the 2004:Q1-2012:Q4 period. Table 1 reports descriptive statistics and Table A2 lists variable sources and definitions.

Household Credit Register Data on individual loans to households come from the "Central Credit Register" of the NBR and are filed by depository financial institutions. The minimum reporting threshold is RON 20,000 (approximately USD 4,500). For each loan we observe the issuing bank, loan amount, currency, and maturity. (Loan rates are only available after the end of our sample period.) For borrowers we see the county of residence (for 42 counties), DSTI ratios at origination, and age. The clean dataset contains 2,753,494 individual loans extended by 36 banks to about 1.4 million borrowers. 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 supervisory bank balance sheet data.

Corporate Credit Register This data set, also maintained by the BNR as part of the "Central Credit Register," contains detailed information on bank loan originations to non-financial firms (with reporting threshold of USD 4,500), for which we observe headquarters location (county) and industry. The corporate credit register is matched by unique tax ID to confidential information on firms' annual financial information. 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 firms). The average business loan is USD 142,000 (and USD 171,000 for real estate firms). About 17% of business loans are granted in FX.

Local Economic Activity We gather data on three measures of economic activity at the county-quarter level—house prices from the property website www.imobiliare.ro, number of residential building permits from the National Institute of Statistics (a strong predictor of local economic activity), and nighttime luminosity (nightlights) from the National Oceanic

and Atmospheric Administration (NOAA) of the U.S. Department of Commerce. Nightlights are a common proxy for economic activity at the subnational level, see Pinkovskiy and Sala-i Martin (2016) and Henderson *et al.* (2012).

Macroeconomic Variables Following the literature, we measure global financial conditions with the U.S. VIX, shown in Figure A3, where lower values of the VIX reflect lower volatility and investor risk aversion (Miranda-Agrippino and Rey, 2020; Rey, 2015). Given the high correlation between the U.S. VIX and the European VSTOXX, our results are virtually the same if we use the European measure. We measure domestic monetary policy with the 7-day repo rate at which the NBR conducts open market operations. Other macroeconomic variables include real GDP growth, CPI inflation, and the nominal exchange rate from the IMF's International Financial Statistics.

3 Economic Channel and Empirical Specifications

3.1 Economic Channel

VIX, Foreign Funding, and Household Lending Our empirical analysis relates changes in global financial conditions to household credit via bank access to foreign funding. The mechanism is based on the notion that bank leverage is procyclical, for instance because of changes in bank net worth via value-at-risk constraints (Adrian and Shin, 2014), which makes credit availability procyclical (Adrian and Shin, 2010). An increase in bank leverage during booms supports more lending given existing capital and the reverse occurs during busts. This mechanism implies that the VIX, a barometer of global financial conditions, is associated with bank leverage, capital flows, and bank lending (Bruno and Shin, 2015a,b). We provide suggestive evidence for this mechanism in the cross-section of banks in Table 2, which shows that when the VIX declines and global liquidity is more ample, banks with higher exante foreign funding shares are able to expand even further their reliance on foreign

funding and their total nondeposit liabilities, as well as loan-to-asset ratios and balance sheet size. Our specifications in the credit register loan-level data build on the link between the VIX and bank foreign funding to test how household lending responds to shifts in the VIX depending on exante macroprudential policies.

Level and Asymmetric Effects of Macroprudential Policies We expect macroprudential policies to affect the level and composition of bank credit by changing the relative cost of alternative bank funding sources or the cost of holding certain bank assets. Higher reserve requirements on FX deposits and higher provisioning rates for FX loans make FX activities more expensive from a balance sheet capacity and regulatory point of view. Similarly, limits on DSTI and LTV ratios discourage lending to indebted borrowers. A policy tightening should incentivize banks to reduce costly lending to households and to rebalance towards other asset classes (such as, in our setting, less regulated business loans). Furthermore, given that borrowers in emerging markets generally lack access to diversified sources of external financing (in Romania, less than 10% of household financing comes from nonbank lenders), macroprudential policies should affect the real economy.

Turning to the state dependence of macroprudential policies' effectiveness over the credit cycle, we take cues from the literature on monetary policy. Conventional wisdom is that boosting credit and economic activity with interest rate policy in a recession is like "pushing on a string." Studies of the U.S. and European economies document asymmetric monetary policy effects over the cycle, with weaker effects in recessions (Tenreyro and Thwaites, 2016). Similar to monetary policy, macroprudential policies may have asymmetric effects depending on bank constraints and incentives. During booms, banks expand and balance sheet constraints may bind, strengthening the effect of macroprudential policies and the incentives to circumvent regulation. By contrast, a softening of macroprudential policies during a bust can be less effective if banks are reluctant to release capital buffers for lending, which may happen if banks expect loan losses, increased regulatory oversight, or an uncertain outlook.

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 exante macroprudential policies. We use the following specification:

$$\begin{aligned} VOLUME_{ijklt} = & \beta_1 MPP_{t-z} \times RISK \times LOW\ VIX \\ & + \beta_2 MPP_{t-z} \times RISK \times HIGH\ VIX \\ & + CONTROLS + \alpha_{it} + \eta_{kt} + \xi_{lt} + \epsilon_{ijklt}, \end{aligned} \tag{1}$$

where $VOLUME_{ijkt}$ is the log(amount) of loan l extended by bank i to individual borrower j in county k in quarter t. VIX enters the specifications as continuous variable or as dummy variables for LOW (below-mean) vs. HIGH (above-mean) VIX. Splitting the period into low/high VIX roughly corresponds to the global boom and bust around the GFC, as seen in Figure A3. In the main analysis, the MPP index enters with lag z (relative to the VIX) given by the average over the past two quarters. We measure the riskiness of lending (RISK) with an indicator for FX loans, one for high-leverage borrowers measured by above-median DSTI at origination,[3] and one for high (above-median) bank reliance on foreign funding. Across specifications we test that $\beta_1 = \beta_2$ against the alternative hypothesis that the effects are stronger when the VIX is low.

Controls include macroeconomic variables (domestic monetary policy rate, GDP growth, and CPI inflation), bank characteristics (size (log-assets), capital and liquidity ratios, return on assets (ROA), NPL ratio, risk profile (risk weighted assets divided by total assets), the share of foreign funding in total assets, and an indicator 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 mortgage program). As shown in Table A3, the only statistically significant determinant of MPP is the GDP growth rate therefore all regressions

[3]This measure of risk is preferable to ex post measures such as loan delinquencies because it only reflects the bank's assessment of risk and is not contaminated by events affecting loan performance after the granting of the loan (see, Dell'Ariccia *et al.* (2017) and Jiménez *et al.* (2014)).

additionally include GDP growth interactions with the risk variables interacted with MPP. The 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.

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:

$$\begin{aligned} VOLUME_{ijklt} = {} & \beta_1 {MPP^{HH}}_{t-z} \times RISK \times LOW\ VIX \\ & + \beta_2 {MPP^{HH}}_{t-z} \times RISK \times HIGH\ VIX \\ & + CONTROLS + \alpha_{it} + \eta_{kt} + \xi_{lt} + \gamma_j + \epsilon_{ijkt}, \end{aligned} \tag{2}$$

where $VOLUME_{ijkt}$ 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. The key explanatory variable is the interaction of the household-targeted MPP index (MPP^{HH}) with the VIX and the riskiness of business lending (RISK) measured as an indicator for firms in the real estate and construction sector. Macroeconomic and bank controls are the same as in Equation (1). We further add firm characteristics (log-assets, tangibility ratio, cash ratio, return on assets, all lagged one year, firm industry fixed effects), and loan FX dummy and loan maturity. In some 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). Positive coefficients on β_1 and β_2 would indicate that a tightening of MPP^{HH} is associated with spillovers from policies targeting household leverage to corporate lending.

Real Effects We test for aggregate lending and real effects of the VIX depending on exante macroprudential policies in data at the county-quarter level. For lending outcomes, we estimate:

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

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 bust. We control for year fixed effects τ_t and county fixed effects η_k, the same macroeconomic variables as in Equations (1)-(2), and the average characteristics of banks in each county (weighted by the market shares of banks in each county).

The second specification is for measures of real economic activity. We construct a county-level measure of exposure to MPP defined as the lagged share of FX loans and interact it with MPP and with high/low VIX. The intuition is that counties with a higher exante 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 affects in the boom and bust phases of the cycle). The specification is given by:

$$\begin{aligned} REAL\ OUTCOME_{kt} = \beta_1 FX\ SHARE_{kt-z} \times MPP_{t-z} \times LOW\ VIX \\ + \beta_2 FX\ SHARE_{dt-z} \times MPP_{t-z} \times HIGH\ VIX \\ + \gamma FX\ SHARE_{kt-z} + CONTROLS + \eta_k + \tau_t + \epsilon_{dt}, \end{aligned} \tag{4}$$

where $REAL\ OUTCOME_{kt}$ is growth rate of building permits, house prices, or night-lights. We allow macroprudential policies to have a more delayed impact on the real economy and show regressions with a lag z of two quarters. Specifications include lagged bank characteristics in the county (as in Equation (3)), GDP interactions (with the same lag structure

as the MPP term), quarterly fixed effects τ_t and county fixed effects η_k. The coefficients of interest β_1 and β_2 are expected to be negative.

We estimate baseline 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 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 Results: Bank Lending and Real Effects

4.1 Effects on Household Lending

Baseline Results Table 3 presents a first set of regressions exploring the link between macroprudential policies and household credit, without VIX interactions, focusing on the three risk indicators: FX loans, high-DSTI borrowers, and banks reliant on foreign funding. The estimates in column 1 indicate that tighter macroprudential policies are associated with a reduction in the volume of FX lending (significant at the 1% level) and no change in local currency lending.[4] In column 2, 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. Finally, in column 3 we obtain that tighter macroprudential policies are negatively related to FX lending by banks more

[4]In Table A4 we report regression results that show coefficient estimates for all covariates included in these main regressions. We also report an additional specification in column 4 which estimates the level effect of the MPP which reveals a negative and statistically significant, suggesting that a tightening of macroprudential policy is associated with lower household loan growth. The rationale for examining this specification is that it allows us a to perform a critical check if the results are driven by particular macroprudential policy events. For this purpose, we recalculate the MPP index by leaving out the policies implemented in any given quarter, then re-estimate the specification and collect the coefficient estimates on MPP. We plot the distribution of these estimates in Figure A4, which shows that the procedure delivers estimates centered on -0.05, the value corresponding to the full MPP index. Therefore, the results are not driven by any particular policy or set of policy tools.

reliant on foreign funding.[5] Overall, the regression results in Table 3 suggest that tighter macroprudential policies are associated with lower household loan growth, especially for riskier loans.[6]

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 4, 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 exante 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 ease, proxied by a declining VIX, tighter exante macroprudential policy is associated with a shift in the currency composition of household credit away from FX toward local currency loans.

In column 3 of Table 4 we investigate this effect across currencies and for low/high values of the VIX (Equation (1)). We find that macroprudential policies are associated with lower loan volumes in FX when the VIX is low compared to when it is high or compared to loan growth in local currency. P-values for t-tests indicate that the coefficients on the triple interaction MPP×Low VIX×FX are larger in absolute value (more negative) than those on the interaction MPP×Low VIX×RON (p-value=0.009) and the interaction with

[5]This result is not driven by foreign bank ownership, which is included as a control variable in interaction with MPP and loan currency. Bank size does not drive this result either, as additional interactions of MPP with bank size and loan currency are insignificant and do not affect the results for foreign funding (results not reported).

[6]We also show our results hold up in a narrow window around the EU entry. This test is meant to alleviate potential concerns that the significant easing of macroprudential policies around Romania's entry into the EU in 2007, when the macroprudential policy index and credit become strongly negatively correlated (see Figure 1), is driving our full-sample results. As shown in Table A5, we estimate the main regressions allowing 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 banking regulations with the Basel II Accord. Across specifications, the estimates suggest that no particular period is driving the main results.

high-VIX (p-values are 0.000 for both tests). These findings suggest greater effectiveness of macroprudential policies in dampening the effects of global liquidity on risky FX household credit during the boom phase of the cycle.

In columns 4–5 of Table 4 we turn to borrower DSTI and bank reliance on foreign funding as dimensions of risk. As the estimate on the triple interaction term MPP×Low VIX×FX in column 3 is statistically significant, we unpack this term by high/low DSTI and by 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 larger dampening effects of the global financial cycle on high-risk household credit (with p-values of 0.005 and 0.026, respectively).

Economic Interpretation The coefficient estimates are 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 17.8% and RON loan volumes lower by 10.8%.[7] The dampening effect on FX lending is larger by 2.4 ppts for a high-DSTI borrower compared to a low-DSTI borrower. Similarly, this effect it is lager by 3.5 ppts for banks with high versus low exposure to foreign funding.

Robustness Tests We subject the baseline results in Tables 3-4 to several sensitivity tests. First, we check if our main results are stronger for foreign banks given that they are relatively more dependent on foreign funding. The estimates in Table A6 indicate that the effects of MPP on FX lending are stronger for foreign banks in some specifications, but the coefficients are still negative, even if less precisely estimated for domestic banks (columns 1-2). Crucially, in column 3 we see that foreign funding is an important channel for both domestic and foreign banks: the estimates show that FX lending declines when macroprudential policies tighten roughly by the same extent across bank types with above-median levels of foreign funding

[7] We obtain these estimates by taking the coefficients in column 3, multiplying them by 1.793 (half an SD of MPP), then taking the exponential. For instance, for the effect on FX loan volumes we have $(-0.1096) \times 1.793 = -0.1965$. We calculate the FX loan volume decrease as $1 - exp(-0.1965) = 17.8\%$.

(we fail to reject the null hypothesis that the coefficients on foreign vs. domestic bank are equal at the 1% level of significance, with p-value=0.442).

Second, we focus on particular periods to check if the weaker effects documented for the high-VIX period are related to the increased post-crisis regulation of financial intermediaries. As shown in Table A7 for alternative cutoff dates (2006Q4 and 2009Q2), the dampening effects of MPP on FX lending to households are statistically significant both before and after 2006Q4 and for banks more reliant on foreign funding (columns 1-2). Consistent with our previous results, the estimates in columns 3-4 indicate stronger effects for the pre-2009Q2 low-VIX period. As an additional check, Table A8 shows that if we only use the data until 2009Q2, the results are very similar to the main regressions: MPP is more effective at reducing FX volumes from banks with higher foreign funding shares, both on average (columns 1-2) and when the VIX is low (columns 3-4) compared to when it is high. These tests suggest that our findings are unlikely driven by post-crisis regulation but by the crisis period itself, when the VIX was high.

Addressing Endogeneity For a causal interpretation of our findings, we present four additional tests. First, we show the baseline results are robust to dropping from the sample all the loans to borrowers located in the capital Bucharest and metropolitan area. This test addresses endogeneity because Bucharest and its metro area are the most economically important regions of the country (accounting for 25% of GDP) and may have a major influence on macroprudential policies, foreign bank presence, and banks' lending activities. The results are reported in Tables A9 and A10 and show that our baseline findings are robust, both in terms of statistical significance and economic importance, even when we exclude the most important and developed economic areas in the country.

Second, we check that our results reflect a global financial channel and not a global real channel that may also be correlated with the VIX. We capture real linkages with external demand, defined as the export-weighted average GDP growth rate of major trading partners.

In Table A11 we repeat the main regressions and control for external demand both in level and interactions with MPP and loan currency. The results remain virtually unchanged.

Third, we check the robustness of our results in two alternative estimation approaches: a differential exposure design similar to a Bartik-style approach and a GMM estimator. For this purpose, we aggregate the household lending microdata in a panel dataset at the bank-county-quarter level over 2004–2012. To test if our results hold up in a Bartik-style approach, we define a county-level FX exposure measure that captures an area's exante sensitivity to changes in MPP and the VIX due to a bank's initial total lending in that area and that bank's share of FX lending in the whole country (not the potentially endogenous part in that area). The measure is constructed using 2004 values of these shares so it is predetermined relative to future local economic conditions that may influence banks' lending decisions. Then we interact this FX exposure variable with the MPP index and the VIX to estimate the effects of macroprudential policies on household lending depending on the VIX and on exante FX exposure. The results are reported in Table 5. The coefficient estimates are statistically significant at conventional levels and indicate that higher exante county FX exposure is associated with lower total and FX household lending volumes when MPP tightens (columns 1-2). Moreover, the effects on FX lending are significantly larger when the VIX is lower (column 3), in areas with high-DSTI borrowers (column 4), and for banks reliant on foreign funding (column 5).

Finally, we use the system GMM estimator (Blundell and Bond, 1998) and instrument the MPP and VIX with past levels and differences of these variables. We further mitigate endogeneity concerns by using exante bank-level foreign funding (in 2004). The results are reported in Table 6. Across specifications, the coefficient estimates have the expected sign and are significant at conventional levels. They indicate that a tightening of macroprudential policies is associated with lower total and FX household lending (columns 1-2) and the effect on FX lending is significantly larger when the VIX is lower (column 3), for high-DSTI borrowers (column 4), and for banks dependent on foreign funding (column 5). Taken to-

gether, these additional tests highlight the robustness of our baseline findings to endogeneity concerns.

4.2 Effects on Business Lending

Do banks respond to tighter regulatory constraints on household leverage by taking more risk in less-regulated activities, and does this behavior vary over the boom-bust cycle? 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 regress loan amounts on household-targeted MPP index (MPP^{HH}) without VIX interactions. Table 7 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, which shows a statistically significant coefficient for firms in the real estate and construction sectors but not for other firms, pointing towards a spillover effect only for the real estate and construction sector.

The remaining specifications examine the robustness of this result. Columns 4–5 in Table 7 show that the estimate on $\text{MPP}^{\text{HH}}\times$Real estate firm is robust to controlling for macroprudential policies that restrict lenders' balance sheets (MPP^{BANK}). In columns 6–7 we explore heterogeneity in this effect by currency and find that the coefficient on $\text{MPP}^{\text{HH}}\times$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 5.6% overall and 6.1% in RON.

Using the specification in Equation (2), next we analyze the role of the global financial

cycle by estimating specifications with high/low VIX interactions. The estimates reported in Table 8 show that the spillover effect discussed above is driven by the low-VIX period (see columns 1–2, with estimates that are statistically significant only for $\text{MPP}^{\text{HH}}\times$Low VIX). Next we zoom in on heterogeneous effects for real estate firms. Across specifications in columns 3–7, the coefficient estimates on low-VIX interactions are statistically significant at conventional levels. By contrast, the effects are either weaker or statistically insignificant for firms outside the real estate sector and for high-VIX periods.

Overall, the analysis of corporate loans suggest that banks respond to tighter constraints on household leverage by reallocating lending capacity to the less regulated corporate sector, especially during the global boom when the VIX is low.

4.3 Effects on the Real Economy

Regression results from specifications that link macroprudential policies to local credit and its composition (Equation (3)), together with VIX interactions, are shown in Table 9. 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 effects of tighter MPP^{HH} on business credit (documented in the previous subsection) 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 9 break down this effect over the global boom-bust cycle and show that the key coefficient estimates on MPP$\times$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%. (The corresponding figures for total credit, using the estimates in columns 4–5 of Panel B, are 11.7% and 15.6%.) Crucially, the estimates from county-level regressions are close in magnitude to those from loan-level regressions, namely 15.7% in county-level data (Table 9, column 4) compared to 17.8% in loan-level data (Table 4, column 3).

Subsequent specifications focus on the relation between changes in global financial conditions and MPP with the real economy. We employ three real sector outcomes: building permits, house prices, and nightlights. Further, we exploit cross-sectional variation in exante 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 more exposed counties experience a greater decline in economic activity compared to other counties (see Equation (4)).

The estimates are reported in Table 10. The specifications in columns 1–3 show that the interaction of macroprudential policy and exante 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. This result suggests that tighter macroprudential 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 ± 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 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 credit cycle to changes in global financial conditions and point to a previously undocumented asymmetry in the effectiveness of macroprudential regulations. The estimates obtained in our reduced-form estimations can help us gauge the magnitude of the household credit boom. Abstracting from general equilibrium effects and focusing on household lending, a back-of-the envelope calculation indicates that before the GFC, when global financial conditions were favorable, FX lending would have grown 2.8 times faster than it did in the absence of any macroprudential policies. Furthermore, the growth rate of FX lending before the GFC could have been halved if macroprudential policies were tighter by an additional 3.8 units (or a little more than one SD).

5 Conclusions

Macroprudential perspectives on regulation and supervision have gained significant ground since the GFC. Yet, there is no systematic evidence on the interaction of domestic macroprudential policies with the effects of the global financial cycle on the local economy. Our contribution is to bring the international dimension to questions of macroprudential policy effectiveness in a context where banks rely on foreign liquidity. We exploit external variation in global financial conditions facing an emerging market economy and extensive microdata from confidential household and corporate credit registers.

Our results suggest that, when the VIX is low, tighter exante 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 real estate firms. When the VIX is low, tighter exante macroprudential policies also reduce total (household and business) lending and the share of FX lending at the local level, suggesting

a compositional shift toward relatively safer local currency loans. Finally, when the VIX is low, the real effects of tighter exante macroprudential policies—notably, lower construction activity, house price growth, and nightlights growth in areas with higher exante share of FX lending—are relatively stronger. Taken together, the results suggest that macroprudential policy is consistently more effective at "taming" risky credit booms during the boom phase of the cycle, when global financial conditions are favorable and investor 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 in dampening the build-up of financial stability risks during the boom phase of the global financial cycle. Our results also have important implications for policymakers in open emerging market economies where national monetary policies are constrained by global financial conditions even when they pursue flexible exchange rate policies. Finally, our estimates should be interpreted keeping in mind that our paper is based on a reduced-form empirical approach and hence abstracts from normative statements about the appropriate level and choice of macroprudential policies, an area that is left for future research.

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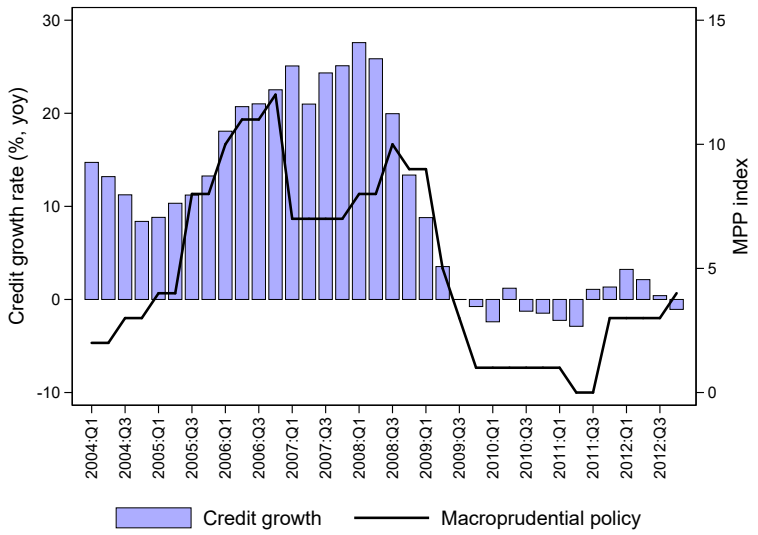
FIGURES AND TABLES

Figure 1: **Household Credit Growth and Macroprudential Policy Index**



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 *et al.* (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.

Table 1: **Descriptive Statistics**

	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
B. 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
C. MACRO VARIABLES				
U.S. VIX	36	20.814	9.682	18.405
Overall MPP	36	5.000	3.586	4.000
Household-targeted MPP (MPP^{HH})	36	2.250	1.052	2.000
Bank-targeted MPP (MPP^{BANK})	36	2.333	3.594	1.500
D. BANK VARIABLES				
Size (log-assets)	919	21.814	1.587	21.837
Tier 1 capital ratio (%)	919	10.294	6.374	8.472
Liquidity (securities/assets) (%)	919	2.541	2.207	1.897
Return on assets (ROA)	919	-0.183	2.688	0.330
Non-performing loans (NPL) (%)	919	4.109	5.824	0.934
Risk profile (RWA/assets)	919	61.618	12.959	63.189
Bank foreign funding (%)	919	20.359	42.235	10.399
Foreign bank dummy	919	0.803	0.398	1.000
Wholesale funding ratio (%)	919	38.519	19.141	38.764
Loan-to-asset ratio (%)	919	54.198	11.560	56.142
E. FIRM VARIABLES				
Size (log-assets)	174,726	13.917	1.674	13.743
Tangibility (fixed assets/total assets)	174,726	0.380	0.254	0.358
Cash ratio (cash/total assets)	174,726	0.089	0.148	0.032
Return on assets (ROA)	174,726	0.157	0.861	0.092
Real estate firm dummy	174,726	0.118	0.323	0.000
F. AGGREGATE VARIABLES FOR 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, MPP^{HH}, and and MPP^{BANK} are the overall macroprudential policy index, the household-targeted and the bank-targeted one (defined in Section 1), where higher values indicate a tightening of macroprudential conditions. 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%. In the two credit registers (panels A-B), variables are winsorized at the 1% level. Bank variables are reported based on the bank-quarter panel (panel D) and firm variables are reported based on firm-year panel (Panel E). Panel F refers to data at the county-quarter level. 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.

Table 2: **Suggestive Evidence on the Channels: Effects of VIX on Bank Foreign Funding and Balance Sheet Growth**

	(1)	(2)	(3)	(4)
Dependent variable	**Foreign funding ratio**	**Wholesale funding ratio**	**Loan-to-asset ratio**	**Total asset growth**
Foreign funding$_{2004}$×VIX	-0.0694**	-0.0143**	-0.0124**	-0.0072**
	(0.029)	(0.006)	(0.005)	(0.003)
Foreign funding$_{2004}$	1.4684**	0.5537***	0.5022***	0.3340
	(0.585)	(0.149)	(0.123)	(0.230)
Observations	1,012	1,012	1,012	1,012
R^2	0.357	0.770	0.658	0.256
Bank FE	Y	Y	Y	Y
Quarter FE	Y	Y	Y	Y
Bank controls	Y	Y	Y	Y
Bank controls×VIX	Y	Y	Y	Y
Macro controls×Foreign funding	Y	Y	Y	Y

Notes: This table shows the effects of the U.S. VIX on bank liability and asset growth. The data are at the bank-quarter level over 2004–2012. The dependent variables are foreign funding ratio (% assets), wholesale funding ratio (nondeposit liabilities in % assets), loan-to-asset ratio, and total asset growth. The explanatory variable "Foreign funding" ratio is measured at the start of the sample in 2004. All regressions include bank controls lagged one quarter (ROA, NPL, and foreign bank dummy) in levels and interactions with the VIX, and macroeconomic variables lagged one quarter (macroprudential policy index, domestic monetary policy, GDP growth, and inflation) in interactions with the foreign funding ratio. Standard errors are reported in parentheses and are clustered at the bank level. *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table 3: **Macroprudential Policies and Household Lending**

	(1)	(2)	(3)
Dependent variable:	**Household loan amount (log)**		
MPP		-0.0397**	-0.1478**
		(0.016)	(0.055)
MPP×FX	-0.0705***		
	(0.017)		
MPP×RON	-0.0388		
	(0.024)		
MPP×DSTI×FX		-0.0396***	
		(0.009)	
MPP×DSTI×RON		0.0111**	
		(0.005)	
DSTI		0.7285***	
		(0.068)	
MPP×Foreign funding×FX			-0.0021**
			(0.001)
MPP×Foreign funding×RON			-0.0001
			(0.001)
Observations	2,753,494	1,999,534	2,753,494
R^2	0.219	0.254	0.220
Other controls	Y	Y	Y
GDP growth interactions	Y	Y	Y
Bank×Year FE	Y	Y	Y
County×Year FE	Y	Y	Y
Loan-type×Year FE	Y	Y	Y

Notes: This table shows baseline effects of macroprudential policies on household credit. 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 1), 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 1, GDP growth×FX×DSTI and GDP growth×RON×DSTI in column 2, GDP growth×FX×Foreign funding, GDP growth×RON×Foreign funding, GDP growth×FX×Foreign-bank and GDP growth×RON×Foreign-bank in column 3. 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. 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.

Table 4: **VIX, Macroprudential Policies, and Household Lending**

	(1)	(2)	(3)	(4)	(5)
Dependent variable:	**Household loan amount (log)**				
MPP	-0.2216***	-0.2300***			
	(0.060)	(0.062)			
VIX	-0.0401*	-0.0413**	-0.0010	-0.0014	-0.0009
	(0.020)	(0.020)	(0.009)	(0.010)	(0.009)
MPP×VIX	0.0069***				
	(0.002)				
MPP×VIX×FX [1]		0.0081***			
		(0.002)			
MPP×VIX×RON [2]		0.0066***			
		(0.002)			
MPP×Low VIX×FX [3]			-0.1096***		
			(0.025)		
MPP×Low VIX×RON [4]			-0.0639*	-0.0544*	-0.0651*
			(0.034)	(0.030)	(0.034)
MPP×High VIX×FX [5]			-0.0138	-0.0302**	-0.0127
			(0.017)	(0.013)	(0.015)
MPP×High VIX×RON [6]			-0.0394	-0.0302	-0.0406
			(0.028)	(0.021)	(0.028)
MPP×Low VIX×FX×High DSTI [7]				-0.1115***	
				(0.023)	
MPP×Low VIX×FX×Low DSTI [8]				-0.0955***	
				(0.024)	
MPP×Low VIX×FX×High Foreign Funding [9]					-0.1136***
					(0.024)
MPP×Low VIX×FX×Low Foreign Funding [10]					-0.0903***
					(0.022)
p-value t-test Ha: |1| > |2|		0.011			
p-value t-test Ha: |3| > |4|			0.009		
p-value t-test Ha: |3| > |5|			0.000		
p-value t-test Ha: |3| > |6|			0.000		
p-value t-test Ha: |7| > |8|				0.005	
p-value t-test Ha: |9| > |10|					0.026
Observations	2,753,494	2,753,494	2,753,494	1,999,534	2,753,494
R^2	0.220	0.220	0.220	0.253	0.220
Other controls	Y	Y	Y	Y	Y
GDP growth interactions	Y	Y	Y	Y	Y
Bank×Year FE	Y	Y	Y	Y	Y
County×Year FE	Y	Y	Y	Y	Y
Loan-type×Year FE	Y	Y	Y	Y	Y

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 1), 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 A8 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.

Table 5: **Addressing Endogeneity: Bartik-style Approach**

Dependent variables:	(1)	(2)	(3)	(4)	(5)
	Household loan amount (log)				
	Total	**FX**	**FX**	**FX**	**FX**
	A. Exposure including the focal county				
County FX Exposure×MPP	-0.0516**	-0.0526**			
	(0.024)	(0.026)			
County FX Exposure×MPP×Low VIX			-0.0748**		
			(0.039)		
County FX Exposure×MPP×High VIX			-0.0173	-0.0173	-0.0173
			(0.037)	(0.037)	(0.037)
County FX Exposure×MPP×Low VIX×High DSTI				-0.1633***	
				(0.051)	
County FX Exposure×MPP×Low VIX×Low DSTI				0.0785	
				(0.048)	
County FX Exposure×MPP×Low VIX×High Foreign Funding					-0.3193***
					(0.062)
County FX Exposure×MPP×Low VIX×Low Foreign Funding					-0.0517*
					(0.030)
Observations	25,187	25,187	25,187	23,721	25,187
R^2	0.805	0.764	0.764	0.770	0.764
	B. Exposure excluding the focal county				
County FX Exposure×MPP	-0.0590**	-0.0601**			
	(0.027)	(0.029)			
County FX Exposure×MPP×Low VIX			-0.0845**		
			(0.042)		
County FX Exposure×MPP×High VIX			-0.0207	-0.0207	-0.0207
			(0.041)	(0.041)	(0.041)
County FX Exposure×MPP×Low VIX×High DSTI				-0.1840***	
				(0.056)	
County FX Exposure×MPP×Low VIX×Low DSTI				0.0887	
				(0.052)	
County FX Exposure×MPP×Low VIX×High Foreign Funding					-0.3486***
					(0.068)
County FX Exposure×MPP×Low VIX×Low Foreign Funding					-0.0603*
					(0.034)
Observations	25,187	25,187	25,187	23,721	25,187
R^2	0.805	0.764	0.764	0.770	0.764
Bank×Year:Quarter FE	Y	Y	Y	Y	Y
County FE	Y	Y	Y	Y	Y

Notes: This table shows estimates for the effects of macroprudential policies on household credit using a Bartik-style approach. The data in the regression sample are at the bank-county-quarter level over 2004–2012. The dependent variable is total household lending or FX lending (log) extended by a given bank to borrowers in a given county and quarter. County FX exposure, measured at the start of the sample period, is defined as product of the exante FX shares of each bank in the county and the bank's FX share of lending in the whole country (including the focal county in panel A and excluding it in panel B). Formally, in panel B, $County\ FX\ Exposure_{c,t_0} = \sum_{b=1}^{N}(Total\ Loan\ Share_{b,c,t_0} \times National\ FX\ Loan\ Share_{b,-c,t_0})$, where c indexes counties, b indexes banks, and t_0 refers to the first year of the sample period. MPP represents the macroprudential policy index (defined in Section 1), where higher values indicate a tightening of macroprudential conditions. High/low DSTI and high/low foreign funding are both defined as above/below sample median. All macro variables are taken as averages over the last two quarters. Macro controls refer to macro variables (local monetary policy, GDP growth, inflation). Bank controls refer to bank variables in levels (size, capital, liquidity, ROA, NPL, risk profile, share of foreign funding, and foreign bank dummy) and interacted with GDP growth, and county controls refer to average borrower age, share of mortgages, and share of first-home mortgages. 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.

Table 6: **Addressing Endogeneity: System GMM Estimator**

Dependent variables:	(1)	(2)	(3)	(4)	(5)
	Household loan amount (log)				
	Total	**FX**	**FX**	**FX**	**FX**
MPP	-0.1015***	-0.3290***		-0.4623***	-0.3069***
	(0.015)	(0.066)		(0.115)	(0.112)
MPP×Low VIX [1]			-0.2911***		
			(0.045)		
MPP×High VIX [2]			-0.1954***		
			(0.045)		
MPP×VIX×High DSTI				-0.0141***	
				(0.004)	
MPP×VIX×Low DSTI				0.0025	
				(0.004)	
MPP×VIX×High Foreign funding					-0.0074**
					(0.003)
MPP×VIX×Low Foreign funding					-0.0050
					(0.004)
p-value t-test Ha: $\|1\| > \|2\|$			0.000		
Observations	23,162	23,162	23,162	21,676	23,162
County FE	Y	Y	Y	Y	Y
Macro controls	Y	Y	Y	Y	Y
Bank controls	Y	Y	Y	Y	Y
County controls	Y	Y	Y	Y	Y
Bank FE	Y	Y	Y	Y	Y

Notes: This table shows GMM estimates for the effects of macroprudential policies on household credit. The data in the regression sample are at the bank-county-quarter level over 2004–2012. The dependent variable is total household lending or FX lending (log) extended by a given bank to borrowers in a given county and quarter. The system GMM estimator uses collapsed instruments for endogenous variables MPP, VIX, and GDP growth, that are constructed using the first four lags. Bank and county fixed effects are treated as exogenous instruments. The share of foreign funding is measured at the beginning of the sample (in 2004). MPP represents the macroprudential policy index (defined in Section 1), where higher values indicate a tightening of macroprudential conditions. High/low DSTI and high/low foreign funding are both defined as above/below sample median. All macro variables are taken as averages over the last two quarters. Macro controls refer to macro variables (local monetary policy, GDP growth, inflation). Bank controls refer to bank variables in levels (size, capital, liquidity, ROA, NPL, risk profile, share of foreign funding, and foreign bank dummy) and interacted with GDP growth, and county controls refer to average borrower age, share of mortgages, and share of first-home mortgages. Standard errors are reported in parentheses and are clustered at the bank-county 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.

Table 7: **Macroprudential Policies and Business Lending—Spillover Effects**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dependent variable:	**Corporate credit volume (log)**						
MPP^{HH}	0.1105**	0.0791					
	(0.049)	(0.049)					
MPP^{HH}×Real estate firm			0.1218***	0.1034***	0.1030**		
			(0.042)	(0.033)	(0.039)		
MPP^{HH}×Other firm			0.0737	0.0631	0.0662		
			(0.050)	(0.039)	(0.048)		
MPP^{BANK}×Real estate firm					0.0023		
					(0.021)		
MPP^{BANK}×Other firm					-0.0017		
					(0.018)		
MPP^{HH}×Real estate firm×FX						-0.0061	0.0398
						(0.039)	(0.037)
MPP^{HH}×Real estate firm×RON						0.1128***	0.1197***
						(0.037)	(0.038)
MPP^{HH}×Other firm×FX						0.0054	0.0496
						(0.036)	(0.045)
MPP^{HH}×Other firm×RON						0.0701	0.0763
						(0.042)	(0.047)
MPP^{BANK}×Real estate firm×FX							-0.0354
							(0.028)
MPP^{BANK}×Real estate firm×RON							0.0031
							(0.024)
MPP^{BANK}×Other firm×FX							-0.0403*
							(0.023)
MPP^{BANK}×Other firm×RON							0.0018
							(0.018)
Observations	383,603	353,634	353,634	353,632	353,632	353,632	353,632
R^2	0.372	0.590	0.590	0.608	0.608	0.609	0.609
Other controls	Y	Y	Y	Y	Y	Y	Y
GDP growth interactions			Y	Y	Y	Y	Y
Bank FE	Y	Y	Y				
County FE	Y	Y	Y				
Industry FE	Y	Y	Y				
Year FE	Y	Y	Y				
Loan-type FE	Y	Y	Y				
Bank×Year FE				Y	Y	Y	Y
County×Year FE				Y	Y	Y	Y
Loan-type×Year FE				Y	Y	Y	Y
Firm FE		Y	Y	Y	Y	Y	Y

Notes: This table shows spillover effects of household-targeted macroprudential policies on business credit. 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. 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.

Table 8: **VIX, Macroprudential Policies, and Business Lending—Spillover Effects**

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

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 7. Lower-level interactions and level variables are also included. Low/high VIX refer to periods of below/above mean values of the VIX index. Standard errors are reported in parentheses and are clustered at the bank and county-quarter level. These results are robust to conservative triple clustering on bank, county, and quarter (see Table A13). *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level. Source: See Table A2 for variable definitions and sources.

Table 9: **VIX, Macroprudential Policies, and Local Lending**

Dependent variables:	(1) **Total Volume**	(2) **FX Volume**	(3) **FX Share**	(4) **Total Volume**	(5) **FX Volume**	(6) **FX Share**
			A. Household Lending			
MPP	-0.0451*	-0.0831***	-0.0133**			
	(0.026)	(0.030)	(0.005)			
MPP × Low VIX [1]				-0.0766***	-0.1041***	-0.0170***
				(0.021)	(0.028)	(0.006)
MPP × High VIX [2]				-0.0011	-0.0537	-0.0106*
				(0.027)	(0.039)	(0.005)
p-value t-test Ha: $\|1\| > \|2\|$				0.003	0.072	0.066
Observations	1,428	1,428	1,428	1,428	1,428	1,428
R^2	0.942	0.926	0.923	0.947	0.928	0.924
			B. Total (Household and Corporate) Lending			
MPP	-0.0458*	-0.0758***	-0.0077			
	(0.023)	(0.026)	(0.005)			
MPP × Low VIX [1]				-0.0702***	-0.0953***	-0.0077#
				(0.019)	(0.024)	(0.005)
MPP × High VIX [2]				-0.0117	-0.0485	-0.0077
				(0.025)	(0.034)	(0.006)
p-value t-test Ha: $\|1\| > \|2\|$				0.013	0.074	0.494
Observations	1,428	1,428	1,428	1,428	1,428	1,428
R^2	0.907	0.917	0.818	0.911	0.919	0.818
Macro controls	Y	Y	Y	Y	Y	Y
County controls	Y	Y	Y	Y	Y	Y
GDP growth interactions				Y	Y	Y
County FE	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y

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 1), 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). 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.

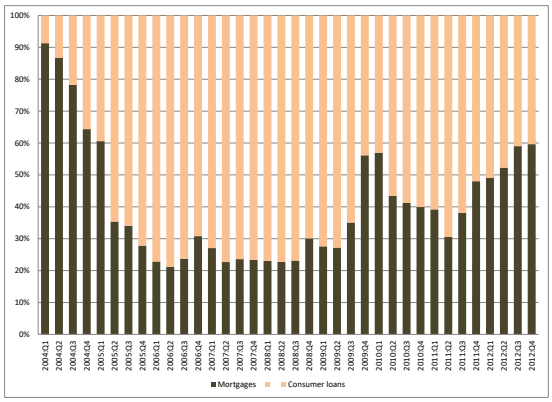
Table 10: **VIX, Macroprudential Policies, and Economic Activity**

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable:	**Building Permits**	**House Prices**	**Night-lights**	**Building Permits**	**House Prices**	**Night-lights**
MPP × FX loan share	-0.2378#	-0.2658***	-0.6647*			
	(0.170)	(0.065)	(0.294)			
MPP × FX share × Low VIX [1]				-0.4660*	-0.3298***	-0.7071**
				(0.233)	(0.100)	(0.282)
MPP × FX share × 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	Y	Y	Y	Y	Y	Y
GDP growth interactions	Y	Y	Y	Y	Y	Y
County FE	Y	Y	Y	Y	Y	Y
Quarter FE	Y	Y	Y	Y	Y	Y

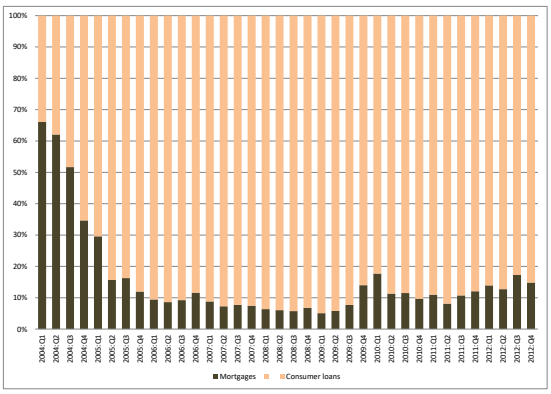
Notes: This table shows the real effects of macroprudential policies after two quarters and their interactions with VIX. Data are at the county-quarter level for 42 counties and sample period depends on availability of the outcome variable (See Section 2). The dependent variables are residential building permit, house price, and nightlights growth. MPP represents the macroprudential policy index (defined in Section 1), 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. 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.

INTERNET APPENDIX

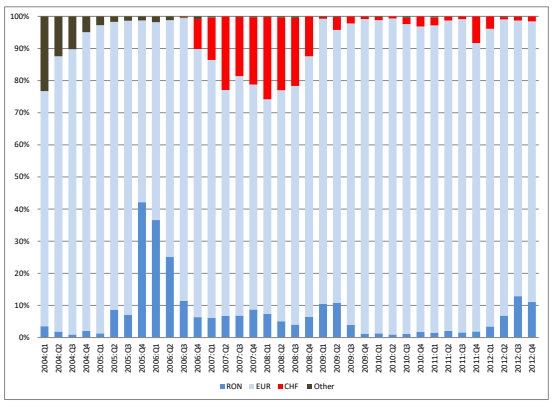
Figure A1: **Household Credit by Type and Currency**



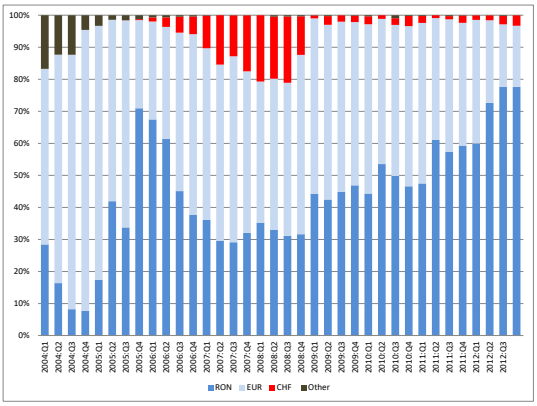
(a) Loan volume by type



(b) Loan number by type



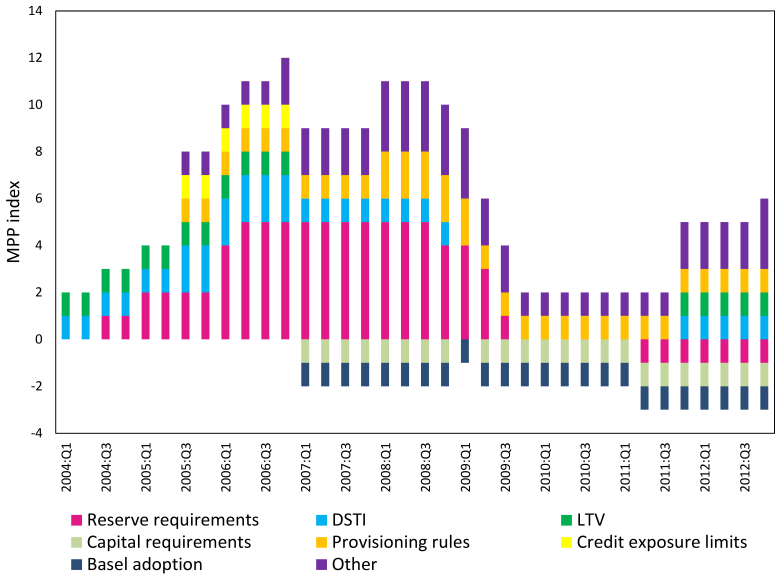
(c) Mortgages by currency



(d) Consumer loans by currency

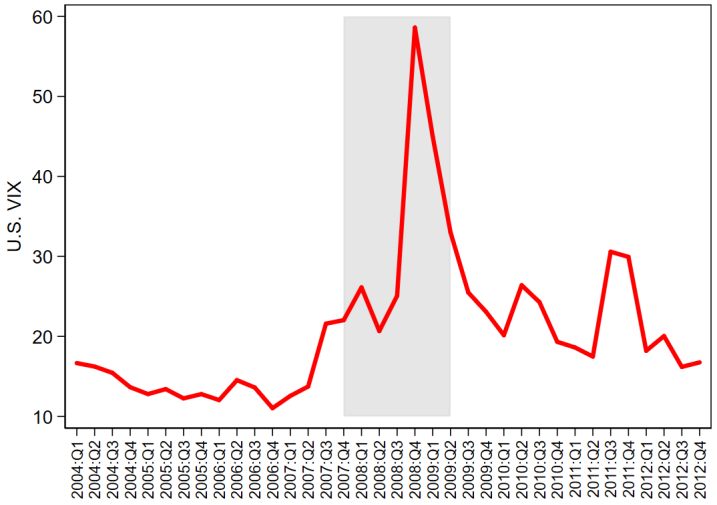
Notes: The figure plots total bank credit by type (mortgages versus consumer loans) and currency (RON, EUR, CHF, and other currencies) during 2004–2012. Source: National Bank of Romania.

Figure A2: **Components of the Macroprudential Policy Index**



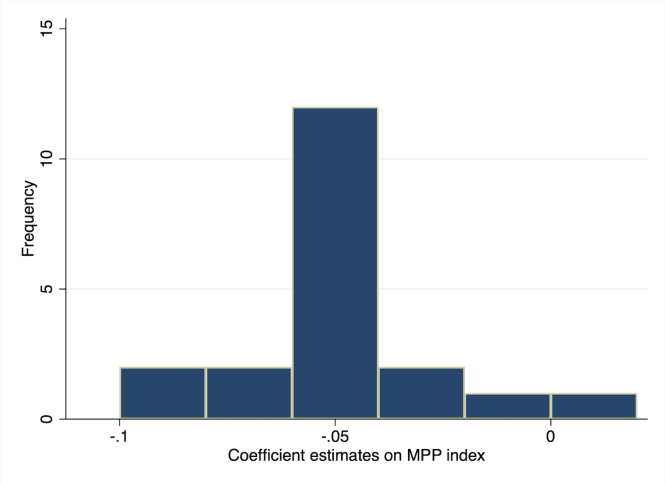
Notes: The figure depicts the composition of the macroprudential policy (MPP) index, constructed following the approach in Cerutti *et al.* (2017) by coding introductions and changes in macroprudential instruments employed by the NBR as tightenings (+1) or loosenings (−1). The index is defined as the 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.

Figure A3: **U.S. VIX**



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 A4: **Histogram of Estimated MPP Effects on Household Lending 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 4 of Table A4 when the MPP index is recalculated by leaving policy changes in a given quarter out. Clustering of coefficient estimates around the value -0.05 (seen in column 4 of Table A4) suggests that our main results are not driven by any policy or set of policy tools. Source: National Bank of Romania.

Table A1: **Macroprudential Policy Measures, 2004–2012**

Date	Macroprudential policy measure MPP	Overall index	Lender index MPP^{BANK}	Household index MPP^{HH}
		+1 if tightening 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 credit: credit value shall not exceed 75% of property value	1	0	1
2004Q3	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 currency risk of the borrower	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	1	0	1
2005Q3	foreign currency credit exposure of a credit institution arising from loans granted to unhedged 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 performance category	1	1	0
2005Q3	reserve requirements on domestic currency liabilities reduced from 18% to 16%	-1	-1	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	reserve requirements increased from 16% to 20% (for the first time in 6.5 years)	1	1	0
2006Q4	eligibility constraints (LTV, DSTI) on household loans apply to regulated non-bank credit institutions as well	1	0	1
2007Q1	eligibility criteria for DSTI defined by banks' internal models	-1	0	-1
2007Q1	foreign currency credit exposure limits removed	-1	-1	0
2007Q1	loan-to-value (LTV) limit removed	-1	0	-1
2007Q1	following entry into the European Union, minimum capital requirement lowered from 12% to 8%	-1	-1	0
2007Q1	full enforcement of Basel II regulatory framework. Lower risk-weights (standardized approach) and tightening of operational risk management	-1	-1	0
2008Q1	higher provisioning rate for loans to unhedged foreign currency borrowers	1	1	0
2008Q1	the October 2005 restriction regarding the possibility to classify an unhedged borrower in the"B" financial performance category at most is removed	-1	-1	0
2008Q1	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	1	1	0

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

Date	Macroprudential policy measure MPP	Overall index	Lender index MPP^{BANK}	Household index MPP^{HH}
		+1 if tightening and −1 if loosening		
2008Q3	current year profits excluded from regulatory capital	1	1	0
2008Q3	banks must consider the interest and exchange rate risk in setting the indebtedness ceiling (set on a case by case basis using internal risk models)	1	0	1
2008Q4	reserve requirementes on domestic currency liabilities reduced from 20% to 18%	-1	-1	0
2009Q1	requirement to take into calculation interest rate risk and currency risk when setting the indebtedness ratio for clients taking loans backed by mortgage on the home or the land within city limits removed	-1	0	-1
2009Q1	the minimum capital adequacy ratio set at 10% as long as multilateral financing arrangement with the EU, the IMF and other IFIs in place	1	1	0
2009Q2	reversal of August 2008 measure regarding capital (current year profits included in regulatory capital)	-1	-1	0
2009Q2	a fraction of the collateral value (less than 25%) can be deducted from the value of "loss" (i.e. 90+ days overdue) exposures to compute provisions (under the old regulation, no such deduction allowed)	-1	-1	0
2009Q2	launch of the "first home" mortgage subsidy government program	-1	-1	-1
2009Q2	reserve requirements on foreign currency liabilities with residual maturity greater than 2 years reduced from 40% to 0%.	-1	-1	0
2009Q3	reserve requirements on domestic currency liabilities reduced from 18% to 15%	-1	-1	0
2009Q3	reserve requirements on foreign currency liabilities with maturity less than 2 years were reduced from 40% to 25%	-1	-1	0
2009Q4	regulation 20/2009 allows inclusion of interim profits in capital	-1	-1	0
2009Q4	reserve requirements on foreign currency liabilities with maturity less than 2 years were reduced from 30% to 25%	-1	-1	0
2011Q2	reserve requirements on foreign currency liabilities with maturity less than 2 years reduced from 25% to 20%	-1	-1	0
2011Q4	introduce a loan-to-value ceiling by type of loan currency denomination, and specific foreign currency shocks to determine the maximum indebtedness level (for mortgage loans, LTV 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 unhedged borrowers. LTV limits do not apply to mortgages under the "first home" program. For consumer credit in foreign currency, the value of purchased goods shall not exceed 133%. Maturity of consumer credit set at maximum 5 years.	3	0	3
2012Q4	extension of regulatory measures to nonfinancial companies that are unhedged to currency risk by requiring lenders to apply tighter conditions on foreign currency-denominated loans	1	1	0

Table A2: **Variable Definitions and Sources**

Variable	Description	Source
CREDIT REGISTERS		
Loan amount (in local currency: RON)	Loan amount granted to an individual or a nonfinancial company, expressed in local currency (Romanian New Leu, RON).	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 borrower's debt payments divided by gross income.	NBR and Ministry of Public Finances
First-home mortgage	Dummy variable that takes value 1 if the mortgage was granted under the first-time home ownership government program, 0 otherwise.	NBR
Firm loan type	The variable takes the values: 1 (commercial real estate loans), 2 (business lines of credit), 3 (other loans, including those for inventories, equipment financing, and trade).	NBR
MACRO VARIABLES		
Macroprudential policy index (MPP)	Macroprudential policy index computed coded based on the exhaustive 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 computed as the cumulative sum of macroprudential measures starting in 2004:Q1, such that higher values indicate a tightening of macroprudential conditions (Cerutti *et al.*, 2017).	Authors' calculations
Lender-targeted MPP index (MPP^{BANK})	Same as above, but focused on bank-based macroprudential instruments. See Table A1 for how we coded each macroprudential instrument.	Authors' calculations
Household-targeted MPP index (MPP^{HH})	Same as above, but focused on borrower-based macroprudential instruments. See Table A1 for how we coded each macroprudential instrument.	Authors' calculations
GDP growth	Real (year on year) growth rate of seasonally-adjusted GDP.	IMF's International Financial Statistics
U.S. VIX	The implied volatility of 3-month options on the S & P500 Index (CBOE S&P 500 3-Month Volatility Index).	Federal Reserve Bank of St. Louis
External demand	Export-weighted real GDP growth of major trading partners, in deviation from Romania's GDP growth.	IMF's World Economic Outlook
BANK VARIABLES		
Size	Logarithm of the total assets.	NBR
Capital	Tier 1 capital in percent of total assets.	NBR
Liquidity	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-term) scaled by total assets. Defined as all deposits with maturity less than 1 year before 2005, deposits of all maturities during 2005Q1-2009Q1, and deposits with maturity less than 2 years during 2009Q2-2012.	NBR
Foreign bank	Dummy variable for banks with majority foreign ownership as in Claessens and Van Horen (2014).	NBR
Wholesale funding ratio	Nondeposit liabilities divided by total assets.	NBR
Loan-to-Asset ratio	Total loans divided by total assets.	NBR
FIRM VARIABLES		
Firm industry	1 (agriculture), 2 (extractive industry), 3 (manufacturing), 4 (utilities), 5 (construction), 6 (trade), 7 (services) and 8 (real estate).	Ministry of Public Finances
Real estate firm	Dummy variable that takes value 1 if the company in from the real estate and construction sectors (codes 5 and 8), and 0 otherwise.	Ministry of Public Finances
Firm's total assets (in RON)	Logarithm of the book value of total assets.	Ministry of Public Finances
Firm's tangibility ratio (fixed assets to total assets)	The ratio of fixed to total assets (book values).	
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 value of total assets.	Ministry of Public Finances
ECONOMIC ACTIVITY		
Building permits	Growth rate of county-level residential building permits (square meters approved building area) issued on quarterly frequency.	National Institute of Statistics
House prices	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)

Table A3: **Macro Determinants of Macroprudential Policies**

	(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)
ΔNER (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

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 1). Estimates come from an 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 Lending—Full Set of Covariate Coefficients in Baseline Specifications**

	(1)	(2)	(3)	(4)
Dependent variable:	**Household loan amount (log)**			
MPP		-0.0397**	-0.1478**	-0.0531***
		(0.016)	(0.055)	(0.019)
MPP×FX	-0.0705***			
	(0.017)			
MPP×RON	-0.0388			
	(0.024)			
MPP×DSTI×FX		-0.0396***		
		(0.009)		
MPP×DSTI×RON		0.0111**		
		(0.005)		
DSTI		0.7285***		
		(0.068)		
MPP×Foreign funding×FX			-0.0021**	
			(0.001)	
MPP×Foreign funding×RON			-0.0001	
			(0.001)	
MPP×Foreign bank×FX			0.1437**	
			(0.059)	
MPP×Foreign bank×RON			0.1540**	
			(0.065)	
FX loan	1.9455***	1.5441***	1.8757***	1.6617***
	(0.205)	(0.092)	(0.262)	(0.110)
GDP growth		-0.0006	-0.0154	-0.0136
		(0.009)	(0.020)	(0.010)
GDP growth×FX	-0.0233			
	(0.021)			
GDP growth×RON	-0.0117			
	(0.012)			
GDP growth×DSTI×FX		-0.0173*		
		(0.009)		
GDP growth×DSTI×RON		-0.0248***		
		(0.006)		
GDP growth×Foreign funding×FX			0.0016**	
			(0.001)	
GDP growth×Foreign funding×RON			-0.0005	
			(0.001)	
GDP growth×Foreign bank×FX			-0.0126	
			(0.033)	
GDP growth×Foreign bank×RON			0.0108	
			(0.018)	
Monetary policy rate	-0.1064***	-0.0815***	-0.1379***	-0.1079***
	(0.029)	(0.026)	(0.025)	(0.027)
Inflation	0.0710***	0.0733***	0.0732***	0.0741***
	(0.017)	(0.014)	(0.017)	(0.017)
VIX	0.0040	0.0032	0.0034	0.0044
	(0.007)	(0.009)	(0.007)	(0.007)
Bank size	-0.5190**	-0.3303	-0.5747**	-0.5412**
	(0.248)	(0.213)	(0.242)	(0.247)
Bank capital	-0.0309*	-0.0155	-0.0347*	-0.0334**
	(0.016)	(0.014)	(0.018)	(0.016)
Bank liquidity	-0.0621**	-0.0473***	-0.0504*	-0.0601**
	(0.027)	(0.016)	(0.026)	(0.027)
Bank ROA	-0.1020	-0.1470	-0.1250	-0.1002
	(0.081)	(0.091)	(0.081)	(0.080)
Bank NPL	-0.1912**	-0.0859*	-0.1959**	-0.1939**
	(0.078)	(0.050)	(0.078)	(0.077)
Bank risk profile	-0.0166**	-0.0123**	-0.0157**	-0.0162**
	(0.006)	(0.006)	(0.006)	(0.006)
Bank foreign funding	0.0007	0.0003	0.0004	0.0007
	(0.002)	(0.002)	(0.002)	(0.002)
Foreign bank	-0.2016**	-0.1651***	-1.5208***	-0.1909**
	(0.081)	(0.059)	(0.527)	(0.083)
Borrower age	-0.0081***	-0.0019	-0.0081***	-0.0080***
	(0.003)	(0.002)	(0.003)	(0.003)
First-home mortgage	-0.0839	-0.0192	-0.0485	-0.0228
	(0.142)	(0.096)	(0.147)	(0.145)
Observations	2,753,494	1,999,534	2,753,494	2,753,494
R^2	0.219	0.254	0.220	0.219
Bank×Year FE	Yes	Yes	Yes	Yes
County×Year FE	Yes	Yes	Yes	Yes
Loan-type×Year FE	Yes	Yes	Yes	Yes

Notes: The table shows all covariates in the regressions from baseline Table 3 (columns 1-3). In column 4 we report an additional specification that identifies the level effect of MPP. MPP represents the macroprudential policy index (defined in Section 1), where higher values indicate a tightening of macroprudential conditions. 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.

Table A5: **Macroprudential Policies and Household Lending—Robustness within Narrow Window around EU Entry**

	(1)	(2)
Dependent variable:	**Household loan amount (log)**	
MPP×FX×EU	-0.0704***	-0.0793***
	(0.017)	(0.018)
MPP×RON×EU	-0.0407	-0.0414*
	(0.024)	(0.024)
MPP×FX×non-EU	-0.0539**	
	(0.020)	
MPP×RON×non-EU	-0.0764***	
	(0.022)	
MPP×FX×pre-EU		-0.1548***
		(0.041)
MPP×FX×post-EU		-0.0496*
		(0.025)
MPP×RON×pre-EU		-0.0725**
		(0.033)
MPP×RON×post-EU		-0.0739***
		(0.022)
Observations	2,753,494	2,753,494
R^2	0.220	0.220
Other controls	Y	Y
GDP growth interactions	Y	Y
Bank×Year FE	Y	Y
County×Year FE	Y	Y
Loan-type×Year FE	Y	Y

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 1), 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 3. 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.

Table A6: **Macroprudential Policies and Household Lending: Effects By Bank Ownership**

	(1)	(2)	(3)
Dependent variable:	**Household loan amount (log)**		
MPP		-0.0397**	-0.1425**
		(0.016)	(0.057)
MPP×FX×Foreign bank	-0.0711***		
	(0.019)		
MPP×FX×Domestic bank	-0.0607		
	(0.060)		
MPP×RON	-0.0388		
	(0.024)		
MPP×DSTI×FX×Foreign bank		-0.0394***	
		(0.010)	
MPP×DSTI×FX×Domestic bank		-0.0458	
		(0.044)	
MPP×DSTI×RON		0.0109**	
		(0.005)	
DSTI		0.7298***	
		(0.062)	
MPP×Foreign-funding×FX×Foreign bank			-0.0020**
			(0.001)
MPP×Foreign-funding×FX×Domestic bank			-0.0029*
			(0.002)
MPP×Foreign-funding×RON			-0.0001
			(0.001)
Observations	2,753,494	1,999,534	2,753,494
R^2	0.219	0.254	0.220
Other controls	Y	Y	Y
GDP growth interactions	Y	Y	Y
Bank×Year FE	Y	Y	Y
County×Year FE	Y	Y	Y
Loan-type×Year FE	Y	Y	Y

Notes: This table shows effects of macroprudential policies on household credit for foreign and domestic banks. 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 1), where higher values indicate a tightening of macroprudential conditions. Foreign (domestic) bank is an indicator taking the value of 1 (0) when half (50%) or more of its shares are held by foreign owners, and 0 (1) otherwise. 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 sources.

Table A7: **Macroprudential Policies and Household Lending: Effects By Time Period**

	(1)	(3)	(3)	(4)
Dependent variable:	**Household loan amount (log)**			
	A. Effects pre vs. post 2006Q4		**B. Effects pre vs. post 2009Q2**	
MPP		-0.1374**		-0.1494**
		(0.058)		(0.055)
MPP×FX×Pre	-0.1113***		-0.0787***	
	(0.018)		(0.017)	
MPP×FX×Post	-0.0461**		0.0198	
	(0.019)		(0.039)	
MPP×RON	-0.0457*		-0.0384	
	(0.024)		(0.024)	
MPP×Foreign-funding×FX×Pre		-0.0034***		-0.0023**
		(0.001)		(0.001)
MPP×Foreign-funding×FX×Post		-0.0017*		0.0033
		(0.001)		(0.005)
MPP×Foreign-funding×RON		-0.0005		-0.0001
		(0.001)		(0.001)
Observations	2,753,494	2,753,494	2,753,494	2,753,494
R^2	0.220	0.220	0.219	0.220
Other controls	Y	Y	Y	Y
GDP growth interactions	Y	Y	Y	Y
Bank×Year FE	Y	Y	Y	Y
County×Year FE	Y	Y	Y	Y
Loan-type×Year FE	Y	Y	Y	Y

Notes: This table shows effects of macroprudential policies on household credit for periods before and after 2006Q4 (columns 1-2) and 2009Q2 (columns 3-4). 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 1), 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 sources.

Table A8: **Macroprudential Policies and Household Lending: Effects Until 2009Q2**

	(1)	(2)	(3)	(4)
Dependent variable:	**Household loan amount (log)**			
MPP		-0.1819**		
		(0.078)		
MPP×FX	-0.1140***			
	(0.018)			
MPP×RON	-0.0872***			
	(0.026)			
MPP×Foreign-funding×FX		-0.0015**		
		(0.001)		
MPP×Foreign-funding×RON		0.0006		
		(0.001)		
MPP×Low VIX×FX			-0.1746***	
			(0.031)	
MPP×Low VIX×RON			-0.1484***	-0.1521***
			(0.039)	(0.040)
MPP×High VIX×FX			-0.0880***	-0.0866***
			(0.024)	(0.024)
MPP×High VIX×RON			-0.1110**	-0.1148**
			(0.044)	(0.045)
MPP×Low VIX×FX×High Foreign Funding				-0.1783***
				(0.031)
MPP×Low VIX×FX×Low Foreign Funding				-0.1526***
				(0.032)
VIX			-0.0170	-0.0175
			(0.014)	(0.014)
Observations	1,856,501	1,856,501	1,856,501	1,856,501
R^2	0.196	0.197	0.199	0.199
Other controls	Y	Y	Y	Y
GDP growth interactions	Y	Y	Y	Y
Bank×Year FE	Y	Y	Y	Y
County×Year FE	Y	Y	Y	Y
Loan-type×Year FE	Y	Y	Y	Y

Notes: This table shows effects of macroprudential policies on household credit for the periods until 2009Q2. 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 1), 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 Tables 3 (columns 1-2) and 4 (columns 3-4). *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level. Source: See Table A2 for variable definitions and sources.

Table A9: **VIX, Macroprudential Policies, and Household Lending—Robustness to Triple Clustering of Standard Errors**

	(1)	(2)	(3)	(4)	(5)
Dependent variable:	**Household loan amount (log)**				
MPP	-0.2216***	-0.2300***			
	(0.066)	(0.068)			
VIX	-0.0401#	-0.0413#	-0.0010	-0.0014	-0.0009
	(0.025)	(0.025)	(0.013)	(0.013)	(0.013)
MPP×VIX	0.0069***				
	(0.002)				
MPP×VIX×FX		0.0081***			
		(0.003)			
MPP×VIX×RON		0.0066**			
		(0.002)			
MPP×Low VIX×FX			-0.1096***		
			(0.029)		
MPP×Low VIX×RON			-0.0639	-0.0544	-0.0651
			(0.041)	(0.036)	(0.040)
MPP×High VIX×FX			-0.0138	-0.0302	-0.0127
			(0.024)	(0.020)	(0.023)
MPP×High VIX×RON			-0.0394	-0.0302	-0.0406
			(0.036)	(0.029)	(0.036)
MPP×Low VIX×FX×High DSTI				-0.1115***	
				(0.026)	
MPP×Low VIX×FX×Low DSTI				-0.0955***	
				(0.026)	
MPP×Low VIX×FX×High Foreign Funding					-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: $\|3\| > \|4\|$			0.019		
p-value t-test Ha: $\|3\| > \|5\|$			0.001		
p-value t-test Ha: $\|3\| > \|6\|$			0.001		
p-value t-test Ha: $\|7\| > \|8\|$				0.018	
p-value t-test Ha: $\|9\| > \|10\|$					0.030
Observations	2,753,494	2,753,494	2,753,494	1,999,534	2,753,494
R^2	0.220	0.220	0.220	0.253	0.220
Other controls	Y	Y	Y	Y	Y
GDP growth interactions	Y	Y	Y	Y	Y
Bank×Year FE	Y	Y	Y	Y	Y
County×Year FE	Y	Y	Y	Y	Y
Loan-type×Year FE	Y	Y	Y	Y	Y

Notes: This table shows that the coefficient estimates in the baseline Table 4 have standard errors that are robust to triple-clustering on bank, county, and quarter. MPP represents the macroprudential policy index (defined in Section 1), 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 4. *** 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 A10: **Addressing Endogeneity: Table 3 Estimations Excluding Bucharest and Metropolitan Area**

Dependent variable:	(1)	(2)	(3)
	Household loan amount (log)		
MPP		-0.0391**	-0.1474**
		(0.016)	(0.056)
MPP×FX	-0.0723***		
	(0.018)		
MPP×RON	-0.0385		
	(0.025)		
MPP×DSTI×FX		-0.0406***	
		(0.008)	
MPP×DSTI×RON		0.0100**	
		(0.004)	
DSTI		0.7460***	
		(0.069)	
MPP×Foreign-funding×FX			-0.0023*
			(0.001)
MPP×Foreign-funding×RON			-0.0002
			(0.001)
Observations	2,156,722	1,589,529	2,156,722
R^2	0.218	0.251	0.219
Other controls	Y	Y	Y
GDP growth interactions	Y	Y	Y
Bank×Year FE	Y	Y	Y
County×Year FE	Y	Y	Y
Loan-type×Year FE	Y	Y	Y

Notes: This table shows effects of macroprudential policies on household credit excluding Bucharest and the metropolitan area. 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 1), 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 sources.

Table A11: **Addressing Endogeneity: Table 4 Estimations Excluding Bucharest and Metropolitan Area**

Dependent variable:	(1)	(2)	(3)	(4)	(5)
	Household loan amount (log)				
MPP	-0.2249***	-0.2328***			
	(0.062)	(0.064)			
VIX	-0.0409*	-0.0421*	-0.0008	-0.0014	-0.0007
	(0.021)	(0.022)	(0.010)	(0.011)	(0.010)
MPP×VIX	0.0070***				
	(0.002)				
MPP×VIX×FX [1]		0.0082***			
		(0.003)			
MPP×VIX×RON [2]		0.0068***			
		(0.002)			
MPP×Low VIX×FX [3]			-0.1103***		
			(0.028)		
MPP×Low VIX×RON [4]			-0.0604	-0.0520	-0.0617*
			(0.036)	(0.031)	(0.035)
MPP×High VIX×FX [5]			-0.0180	-0.0330**	-0.0171
			(0.018)	(0.013)	(0.017)
MPP×High VIX×RON [6]			-0.0409	-0.0315	-0.0421
			(0.027)	(0.021)	(0.026)
MPP×Low VIX×FX×High DSTI [7]				-0.1131***	
				(0.024)	
MPP×Low VIX×FX×Low DSTI [8]				-0.0968***	
				(0.025)	
MPP×Low VIX×FX×High Foreign Funding [9]					-0.1139***
					(0.027)
MPP×Low VIX×FX×Low Foreign Funding [10]					-0.0932***
					(0.024)
p-value t-test Ha: $\|1\| > \|2\|$		0.011			
p-value t-test Ha: $\|3\| > \|4\|$			0.005		
p-value t-test Ha: $\|3\| > \|5\|$			0.000		
p-value t-test Ha: $\|3\| > \|6\|$			0.000		
p-value t-test Ha: $\|7\| > \|8\|$				0.009	
p-value t-test Ha: $\|9\| > \|10\|$					0.023
Observations	2,156,722	2,156,722	2,156,722	1,589,529	2,156,722
R^2	0.219	0.219	0.219	0.250	0.219
Other controls	Y	Y	Y	Y	Y
GDP growth interactions	Y	Y	Y	Y	Y
Bank×Year FE	Y	Y	Y	Y	Y
County×Year FE	Y	Y	Y	Y	Y
Loan-type×Year FE	Y	Y	Y	Y	Y

Notes: This table shows effects of macroprudential policies on household credit excluding Bucharest and the metropolitan area. 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 1), 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 4. *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level. Source: See Table A2 for variable definitions and sources.

Table A12: **VIX, Macroprudential Policies, and Household Lending—Robustness to Controlling for External Demand**

	(1)	(2)	(3)	(4)
Dependent variable:	**Household loan amount (log)**			
MPP	-0.2260***	-0.2327***	-0.1578***	-0.2291***
	(0.066)	(0.068)	(0.040)	(0.067)
VIX	-0.0573***	-0.0572***	-0.0336***	-0.0571***
	(0.019)	(0.020)	(0.009)	(0.020)
MPP×VIX	0.0076***			
	(0.002)			
MPP×VIX×FX		0.0082***		
		(0.002)		
MPP×VIX×RON		0.0073***	0.0046***	0.0072***
		(0.002)	(0.001)	(0.002)
MPP×VIX×FX×High DSTI			0.0058***	
			(0.001)	
MPP×VIX×FX×Low DSTI			0.0037***	
			(0.001)	
MPP×VIX×FX×High Foreign Funding				0.0078***
				(0.002)
MPP×VIX×FX×Low Foreign Funding				0.0084***
				(0.003)
External demand	0.1825*	0.1711*	0.1245	0.1723*
	(0.094)	(0.096)	(0.098)	(0.095)
MPP×External demand×FX	-0.0156	-0.0093	-0.0014	-0.0092
	(0.014)	(0.014)	(0.011)	(0.014)
MPP×External demand×RON	-0.0252*	-0.0246*	-0.0104	-0.0243*
	(0.013)	(0.013)	(0.011)	(0.013)
Observations	2,753,494	2,753,494	1,999,534	2,753,494
R^2	0.221	0.221	0.232	0.221
Other controls	Y	Y	Y	Y
GDP growth interactions	Y	Y	Y	Y
Bank×Year FE	Y	Y	Y	Y
County×Year FE	Y	Y	Y	Y
Loan-type×Year FE	Y	Y	Y	Y

Notes: This table shows that the coefficient estimates in the baseline Table 4 are robust to controlling for external demand, a measure of the real global channel that might be correlated with the U.S. VIX. External demand is defined as the export-weighted average GDP growth rate of major trading partners. The VIX enters as a continuous variable as in Table A6. MPP represents the macroprudential policy index (defined in Section 1), 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 4. *** 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 A13: **VIX, Macroprudential Policies, and Business Lending—Robustness to Triple Clustering of Standard Errors**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dependent variable:	**Corporate credit volume (log)**						
MPP^{HH}×Low VIX	0.1308**	0.0980*					
	(0.060)	(0.050)					
MPP^{HH}×High VIX	-0.0023	-0.0206					
	(0.079)	(0.074)					
MPP^{HH}×Real estate×Low VIX			0.1264***	0.1067***	0.1078***		
			(0.045)	(0.037)	(0.032)		
MPP^{HH}×Real estate×High VIX			0.0841*	0.0746	0.0766		
			(0.050)	(0.056)	(0.066)		
MPP^{HH}×Other firm			0.0745	0.0636*	0.0677*		
			(0.051)	(0.031)	(0.033)		
MPP^{BANK}×Real estate					0.0011		
					(0.027)		
MPP^{BANK}×Other firm					-0.0022		
					(0.027)		
MPP^{HH}×Real estate×FX						-0.0089	0.0380
						(0.059)	(0.034)
MPP^{HH}×Real estate×RON×Low VIX						0.1164***	0.1244***
						(0.041)	(0.038)
MPP^{HH}×Real estate×RON×High VIX						0.0823	0.0923
						(0.059)	(0.072)
MPP^{HH}×Other firm×FX						0.0060	0.0509
						(0.041)	(0.032)
MPP^{HH}×Other firm×RON						0.0705**	0.0776**
						(0.031)	(0.031)
MPP^{BANK}×Real estate×FX							-0.0357
							(0.040)
MPP^{BANK}×Real estate×RON							0.0021
							(0.029)
MPP^{BANK}×Other firm×FX							-0.0407
							(0.032)
MPP^{BANK}×Other firm×RON							0.0014
							(0.026)
Observations	383,603	353,634	353,634	353,632	353,632	353,632	353,632
R^2	0.372	0.590	0.590	0.608	0.608	0.609	0.609
Other controls	Y	Y	Y	Y	Y	Y	Y
GDP growth interactions			Y	Y	Y	Y	Y
Bank FE	Y	Y	Y				
County FE	Y	Y	Y				
Industry FE	Y	Y	Y				
Year FE	Y	Y	Y				
Loan-type FE	Y	Y	Y				
Bank×Year FE				Y	Y	Y	Y
County×Year FE				Y	Y	Y	Y
Loan-type×Year FE				Y	Y	Y	Y
Firm FE		Y	Y	Y	Y	Y	Y

Notes: This table shows that the coefficient estimates in the baseline Table 8 have standard errors that are robust to triple-clustering 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 8. *** 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.