The impact of sectoral macroprudential capital requirements on mortgage lending: evidence from the Belgian risk weight add-on

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THE IMPACT OF SECTORAL MACROPRUDENTIAL CAPITAL REQUIREMENTS ON MORTGAGE LENDING: EVIDENCE FROM THE BELGIAN RISK WEIGHT ADD-ON*

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Abstract: In December 2013 the National Bank of Belgium introduced a sectoral capital requirement aimed at strengthening the resilience of Belgian banks against adverse developments in the real estate market. This paper assesses the impact of this macroprudential measure on mortgage lending. Our results indicate that the sectoral capital requirement on average did not affect IRB banks' mortgage rates and mortgage loan growth. However, the findings do indicate that IRB banks may have reacted heterogeneously to the introduction of the measure: capital-constrained banks with more exposures to the segment targeted by the additional requirement tend to respond stronger in terms of mortgage lending.

Keywords: Systemic risk, macroprudential policy, bank capital requirements, real estate.

JEL codes: E44, E58, G21, G28

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1 INTRODUCTION

In the Basel framework, capital requirements are a key tool to increase the resilience of the banking sector. Whereas the focus of minimum capital requirements is on the solvency position of individual banks, macroprudential requirements on top of the microprudential ones aim at preserving stability of the banking sector and financial stability as a whole. More specifically, the accumulation of capital buffers makes banks more resilient to negative shocks, thereby limiting the impact of downturns on the financial system and on the broader economy.

Macroprudential capital requirements, while sharing the ultimate objective of safeguarding the stability of the financial system, differ in, *inter alia,* their scope of application. On the one hand, capital requirements can have a broad focus, applying to banks' total risk weighted assets (RWA), as in the case of the countercyclical capital buffer and capital surcharges for globally or domestically systemically important institutions. On the other hand, capital requirements can be designed to shield the financial sector from risks emerging from specific sectoral exposures. In such cases, the additional requirement does not apply to banks' total RWA but instead on specific portfolios in their balance sheets.

Due to the detriment that systemic risks stemming from excessive developments in real estate markets can exert on financial stability[1], sectoral capital requirements have been increasingly considered as macroprudential instruments to address vulnerabilities related to real estate exposures. In recent years, several European countries activated capital-based macroprudential instruments targeting real estate assets[2], either directly, by setting higher capital ratio requirements for the concerned segments (e.g. the activation of a countercyclical capital buffer in Switzerland, with its scope of application to assets secured by real estate property), or indirectly, by adjusting parameters, such as risk weights (RW)[3], which affect capital requirements for real estate exposures (e.g. a 25 percent RW floor on mortgage loans in Sweden, tighter criteria for the application of preferential RW to residential property in Croatia, Ireland and the UK, increased RW for exposures secured by commercial real estate properties in Ireland, Norway, Romania and Sweden).

In December 2013, the National Bank of Belgium introduced a macroprudential measure aimed at strengthening the resilience of Belgian banks against adverse developments in the real estate

[1] See for example Crowe et al. (2013) and Hartmann (2015). Claessens et al. (2009) show that financial and economic busts preceded by a real estate boom are particularly harmful from a financial stability perspective since they are longer and costlier than the average downturn. On the interplay between mortgage loan financing, leverage, real estate prices and the macro-economy, see for example Kiyotaki and Moore (1997), Aoki et al. (2004), Davis and Heathcote (2005), Iacoviello (2005), Iacoviello and Neri (2010), Forlati and Lambertini, 2011), Kannan and Rabanal (2012).

[2] See ESRB (2016), "A Review of Macroprudential Policy in the EU in 2015" provides for a comprehensive overview of macroprudential policy in Europe.

[3] See Anderson et al. (2012) and Bank of England (2011) on the use of risk weights as macroprudential instruments.

market. The measure imposed a 5 percentage point add-on to the RW on Belgian residential real estate exposures for banks calculating regulatory capital requirements through an internal ratings-based (IRB) approach. While the effects of capital-based measures in terms of increased capital available to absorb potential losses are readily measurable (for example, the Belgian measure entailed an increase in the average RW for IRB banks from 10 percent at the end of 2012 to 15 percent at the end of 2013[4]), their consequences on the supply and pricing of credit, being either intended or unintended, are more difficult to assess. This is due to the challenges of isolating the impact of policy changes from that of other developments that might have affected banks' lending behaviour during the same period.

This paper aims at quantifying the impact of the introduction of the macroprudential add-on to RW for domestic residential real estate exposures in Belgium on the pricing and growth of mortgage loans granted by Belgian IRB banks. Using bank-level data on mortgage loan portfolios, mortgage loan rates, regulatory capital requirements and additional bank balance sheet characteristics, we find that the sectoral capital requirement on average did not affect IRB banks' mortgage rates and mortgage loan growth: the point estimate of the impact on mortgage rates is about 5 basis points, whereas the impact on mortgage loan growth is very close to zero, and neither one of these estimates is statistically significant.

However, the findings do indicate that IRB banks may have reacted heterogeneously to the introduction of the RW add-on: IRB banks having a larger share of affected mortgage loans in their balance sheet and facing a relatively larger additional capital requirement due to the RW add-on reduce mortgage lending growth relatively more. In contrast, IRB banks with a larger voluntary management capital buffer exhibit stronger mortgage loan growth after the introduction of the measure. These effects are temporary, however, and no longer significant in the second year after the introduction. For mortgage rates, we find that IRB banks with a larger share of mortgage loans to Belgian households in their balance sheet increased mortgage rates relatively more in the first year after the introduction of the measure and charge relatively lower rates in the second year. IRB banks with a lower reliance on affected mortgage loans, in contrast, initially charged relatively lower mortgage rates and increased their price of mortgage loans relatively more only in the second year after the introduction. Simulations show that the initial impact on the mortgage rate of IRB banks with large reliance on mortgage loans to Belgian households is stronger than the subsequent impact on the mortgage rate of IRB banks with a lower share of mortgage loans in their balance sheet total. Yet, the overall effect on the mortgage rates and mortgage loan growth of individual banks in our sample remains limited in terms of both statistical and economic significance.

[4] See the National Bank of Belgium's "Financial Stability Report", 2014.

By analysing the impact of a sectoral macroprudential measure on mortgage lending, this paper contributes to the literature on the impact of capital requirements on bank lending. The vast majority of this literature has focused on the changes to overall capital requirements, either following the introduction of the new Basel regulation, or due to changes in individual banks' capital requirements. The analysis of the effects of sectoral capital requirements in general, and of those targeting real estate exposures in particular, is much less explored. This is not surprising, given the relatively recent experience with the introduction of such instruments, which leads to a scarcity of observations for a proper ex post policy assessment. To our knowledge, this paper is among the first to provide empirical evidence on the impact of introducing a sectoral macroprudential capital requirement on lending rates and growth. Documenting the impact of such macroprudential requirements is crucial for gaining experience with these instruments and for improving the effectiveness of macroprudential policies in general.

The rest of the paper is organised as follows. Section 2 provides a brief overview of the recent literature on the effects of capital requirements on bank lending. In Section 3 we explain in more detail the Belgian macroprudential measure that is the focus of this paper. Sections 4 and 5 present the empirical specification and the data underlying our analysis, of which the results are discussed in Section 6. Section 7 concludes.

2 LITERATURE ON THE EFFECTS OF (SECTORAL) CAPITAL REQUIREMENTS ON BANK LENDING

Due to the increased emphasis on macroprudential policy in the aftermath of the financial crisis, a new body of studies in the already vast literature examining the costs and the benefits of capital requirements has flourished. However, a broad consensus has not yet been reached, neither regarding the positive effects of capital requirements on reducing the probability and the cost of crises, nor concerning the transmission of capital-based policy measures on the price and volume of credit (e.g. Galati and Moessner (2014), Tressel and Yuanyan (2016)).

On the benefits side, capital requirements are expected to foster financial stability by reducing the probability of banks' financial distress and by minimizing their losses given default. However, the evidence on both the effect of capital requirements on banks' ex ante risk taking behaviour and on the ex post effectiveness in improving financial system resilience is mixed. While some studies confirm the positive effect of capital requirements in reducing banks' risk taking (e.g. De Haan and Klomp (2012)), banks' financial fragility (e.g. De Jonghe (2010), Miles et al. (2012), Diamond and Rajan (2001)), Baker and Wurgler (2015)) and the cost of banking crises (e.g. Dewatripont and Tirole (1994), Gambacorta and Mistrulli (2004), Albertazzi and Marchetti (2010), Beltratti et al. (2012),

Kapan and Minoiu (2013)), others find either non-significant or even opposite results (e.g. Demirgüç-Kunt and Detragiache (2011)).

The costs entailed by higher capital requirements can be quantified in terms of forgone lending and, possibly, reduced economic activity. Banks' behaviour following the policy change is a key determinant of its transmission to lending volumes and lending rates. For an increase in capital requirements to exert an effect on banks' lending decisions, banks need to consider equity more expensive than debt or that their voluntary management buffer held above minimum regulatory requirements falls below an internal or external target level.

The empirical assessment of the effect of capital requirements on lending volumes and interest rates is challenging not only due to the shortage and/or strict confidentiality of data on past changes in bank capital requirements, let alone macroprudential capital requirements, but also because, for the observed changes, it is difficult to disentangle the effect of the regulation from other, broader, developments (e.g. Noss and Toffano (2016)). However, the increased availability of policy changes involving capital requirements, led an increasing number of authors to explore their effects on banks' behaviour in terms of supply and pricing of credit. More specifically, this growing strand of literature based on a diversity of countries suggests that capital-based macroprudential regulation does affect bank lending and loan pricing (e.g. Martynova (2015) and Basel Committee of Banking Supervision (2016), and the references therein).

Most of these empirical studies focus on assessing the impact of overall minimum regulatory capital requirements: given the rather recent experience with macroprudential capital requirements, and specifically sectoral capital requirements targeting mortgage lending, evidence on the impact of sectoral macroprudential capital requirements is scarce. Martins and Schechtman (2014) analyze the effectiveness of a within-sector bank regulation that was implemented in Brazil in December 2010 in response to increasing risk in the auto loan market in the context of rapid household credit growth. Regulatory RW were raised for targeted auto loans (high LTVs and long maturities) from 75% to 150%, whereas other auto loans were not affected by the measure. They find that lending spreads charged on targeted loans increased by at least 2.19 percentage points more than on untargeted loans. This amounts to 15% of lending spreads, leading the authors to conclude that the effect was material. Martins and Schechtman (2014) also observe a (temporary) decline in lending volumes of targeted loans relative to a moderate increase pattern in untargeted loans, which is confirmed by Afanasieff et al. (2015). Gómez et al. (2017) identify the effect of macroprudential regulations in Colombia over the period 2006-2009. The tools applied include reserve requirements and dynamic provisioning on commercial loans. The latter has similarities to a sectoral capital buffer and is shown to have had a negative impact on credit growth and contributed to stabilise the credit cycle in

Colombia before the financial crisis in 2008-2009. Specifically on sectoral requirements targeting real estate exposures, Crowe et al. (2013), state that the empirical evidence on the impact of increased capital requirements and/or risk weights on particular groups of real estate loans is mixed: while some attempts (such as the cases of Bulgaria, Croatia, Estonia, and Ukraine) failed to stop the boom, others (such as the case of Poland) were at least a partial success. Closest to our paper, Basten and Koch (2017) examine the impact of the activation in February 2013 of a sectoral countercyclical capital buffer in Switzerland. This capital buffer of 1% targeting the residential mortgage market in Switzerland was introduced to protect the banking sector from the consequences of excessive credit growth by increasing its resilience. Furthermore, as a secondary objective the instrument should lean against the build-up of excesses. They find that while the sectoral countercyclical capital buffer did not affect banks' rejection rates, both capital-constrained and mortgage-specialised banks exhibited higher offered mortgage rates after the introduction of the measure. Furthermore, mortgage-specialised banks reduced year on year mortgage loan growth by 0.19 percentage points after the activation. Basten and Koch (2017) conclude that the overall size of the identified effects is relatively small.

By providing evidence on the impact of a sectoral macroprudential measure on mortgage rates and mortgage loan growth, we contribute to this scant literature on the impact of sectoral capital requirements on bank lending. Before turning to the empirical analysis, we explain in more detail the Belgian macroprudential measure that is the focus of this paper.

3 THE BELGIAN MACROPRUDENTIAL MEASURE

Macroprudential instruments targeting real estate exposures can be classified as either borrower-based or capital-based. Borrower-based instruments act on the terms and conditions of credit, for example by imposing limits to the loan-to-value (the ratio between the size of the loan and the value of the financed property) or to the borrower's debt service costs.[5] Capital-based instruments affect banks' balance sheets through changes in capital requirements, imposed either directly by setting higher regulatory capital ratio requirements for real estate exposures, or indirectly by acting on parameters, such as RW, which affect capital requirements.

The Basel Accord foresees two possible methods for calculating capital requirements for retail mortgage loan exposures. The standardised (STA) approach applies a fixed RW (35 percent) to all exposures secured by mortgages on residential property, which is then used as a basis for computing the amount of capital required under Pillar I for this exposure class. The IRB approach allows banks to use internal models for estimating the key parameters (notably the probability of default and the

[5] See for example the ESRB "Handbook on Operationalising macroprudential policy in the banking sector (2010)".

loss given default) used as input in the Basel RW function for the calculation of the RW to be applied to the bank's mortgage loan exposure.

In Belgium, the STA approach is mainly used by small credit institutions, covering a small share of total mortgage loans held by the Belgian banking sector. A fact-finding exercise conducted by the National Bank of Belgium in 2012 revealed that RW on mortgage loans of Belgian banks using the IRB approach were not only substantially lower than those resulting from banks applying the STA approach but also on average quite low compared to those of other European countries.[6] While the low level of IRB RW (on average 10 percent) can be justified by the absence of major downturn events in the historical credit loss data of the Belgian real estate market on which the model parameters are calibrated, the presence of pockets of vulnerabilities represented by segments of the outstanding mortgage loan portfolio (characterised by high loan-to-value ratios, high debt service ratios and long maturities) raised concerns over the resilience of Belgian banks against higher than expected losses that could result from abrupt developments in the Belgian real estate market.

Against this background, the National Bank of Belgium introduced in December 2013 a macroprudential measure consisting in a 5 percentage point add-on to the RW on Belgian residential real estate exposures for banks calculating regulatory capital requirements through an IRB approach.[7] The macroprudential measure was primarily aimed at increasing banks' resilience against potential losses stemming from less buoyant conditions on the residential real estate market. The immediate effect of the measure in terms of increased capital to absorb potential losses is readily measurable: as a consequence of the policy, the average RW on mortgage loan exposures used as input for calculating the capital requirements of Belgian IRB banks increased from 10 percent to 15 percent. At the sectoral level, the add-on resulted in a total additional capital requirement for all IRB banks in the sample of EUR 820 million (as of January 2014), representing in aggregate about 1.8 percent of these banks' outstanding Tier 1 capital.

The objective of the add-on was not to curb the supply of credit per se. Yet, to the extent that banks perceive higher capital requirements as increasing their cost of funding (and/or as decreasing their voluntary management buffer above minimum requirements below an internal or external target), they may decide to pass on this perceived increase in funding cost to their customers. In the following sections we aim at quantifying to what extent Belgian IRB banks that were affected by the macroprudential measure indeed responded to its introduction by adjusting their mortgage loan pricing upward and/or by curbing mortgage loan growth.

[6] See European Banking Authority, 2013, "Third interim report on the consistency of risk-weighted assets, SME and residential mortgages".

[7] The choice to operate through RW rather than setting a higher regulatory capital requirement stems from restrictions in European legal framework (the Capital Requirements Regulation and Directive, CRR/CRD IV) laying out the prudential rules for the EU banking system.

4 EMPIRICAL SPECIFICATION

To assess the impact of the macroprudential RW add-on on mortgage lending, we estimate the following equation:

$$Y_{b,t} = \alpha + \beta_{b,t}\, I(add\text{-}on_t) \times I(irb_t) + \gamma_{b,t} I(add\text{-}on_t) + \delta_{b,t} I(irb_t) + \theta X_{b,t-1} + FE_b + FE_t + \varepsilon_{b,t} \quad (1)$$

where $Y_{b,t}$ denotes either the mortgage loan rate charged by bank b in month t or the growth rate of bank b's mortgage loan stock over the next 12 months relative to the level in month t. $I(add\text{-}on_t)$ is an indicator variable that equals one during the months in which the RW add-on is in place (from December 2013 onwards) and zero otherwise, $I(irb_t)$ is an indicator variable that equals one for banks that use the IRB approach for determining the risk weights on mortgages and zero otherwise, $X_{b,t-1}$ is a vector of bank-specific control variables, FE_b and FE_t denote bank and time fixed effects, respectively, and $\varepsilon_{b,t}$ is a normally distributed error term.

The impact of the RW add-on on the mortgage loan spread is captured by the difference-in-differences estimator $\beta_{b,t}$, which is defined as

$$\beta_{b,t} = \beta_0 + \beta_1 Sens_{b,t-1} \quad (2)$$

where $Sens_{b,t-1}$ is a subset of the vector of bank specific control variables $X_{b,t-1}$that we interact with $I(add\text{-}on_t) \times I(irb_t)$ to measure differences in sensitivity of IRB banks to the RW add-on. To control for a potential change in the relationship between $Y_{b,t}$ and $Sens_{b,t-1}$ *for both IRB and STA banks* after the introduction of the macroprudential measure and for IRB banks having a sensitivity of $Y_{b,t}$ to $Sens_{b,t-1}$different from that for STA banks *at all times*, $\gamma_{b,t}$ and $\delta_{b,t}$ follow a similar specification. It should be noted that the constant terms γ_0 and δ_0 are not identified as a consequence of the inclusion of time and bank fixed effects, respectively.

Equation (1) can be rewritten as

$$Y_{b,t} = \alpha + \beta_0\, I(add\text{-}on_t) \times I(irb_t) + \beta_1\, I(add\text{-}on_t) \times I(irb_t) \times Sens_{b,t-1} + \gamma_1 I(add\text{-}on_t) \times Sens_{b,t-1} + \delta_1 I(irb_t) \times Sens_{b,t-1} + \theta X_{b,t-1} + FE_b + FE_t + \varepsilon_{b,t} \quad (3)$$

The parameter $\beta_{b,t} = \beta_0$ is obtained when the add-on indicator is not interacted with any sensitivity variables $Sens_{b,t-1}$ and therefore captures the average impact of the add-on on the IRB banks in the sample. When the variables in $Sens_{b,t-1}$ are included, $\beta_{b,t}$ equals the expression in equation (2), which allows us to quantify any heterogeneous reactions of mortgage loan spreads across IRB banks.

5 DATA

Our analysis relies on a sample of 14 Belgian banks, of which 8 use the IRB approach for the calculation of regulatory capital requirement (and are therefore directly affected by the macroprudential measure) and 6 using the STA approach. The data used are available at monthly frequency and span the period from January 2012 to December 2015, i.e. about two years before and after the introduction of the macroprudential measure in December 2013.

The first dependent variable of interest is the interest rate applied to new mortgage loans to households in Belgium. The data on mortgage rates are obtained from the National Bank of Belgium's MFI Interest Rate (MIR) statistics and cover four repricing segments: loans with repricing period up to 1 year, loans with repricing period between 1 and 5 years, loans with repricing period between 5 and 10 years, and loans with repricing period longer than 10 years. The MIR data contain monthly observations of individual banks' average mortgage rates in each of the four repricing segments. Our dependent variable, the average mortgage loan rate, is expressed in basis points and amounts to the volume-weighted average rate charged on new loans by a bank in a given month across the four repricing segments. Summary statistics of mortgage rates are shown in Table 1. The table shows that the mortgage rates on average are almost 20 basis points lower for IRB banks than for STA banks, but the dispersion around the mean is large for both groups of banks.

Our second dependent variable is the growth rate of a bank's mortgage loan stock over the next 12 months. The data to compute the mortgage growth rate is obtained from the National Bank of Belgium's supervisory statistics.[8] Table 1 indicates that IRB banks' mortgage loan portfolios have grown stronger on average than those of STA banks during the sample period. However, like for mortgage rates, the dispersion around the means is large.

Figure 1 illustrates the dynamics of the weighted average mortgage rate and mortgage loan growth between January 2012 and December 2015 for IRB and STA banks respectively, whereby the weights are given by the banks' share in the total outstanding amount of mortgage loans to Belgian households. This period during which the macroprudential measure was in place is marked by the shaded area in Figure 1.

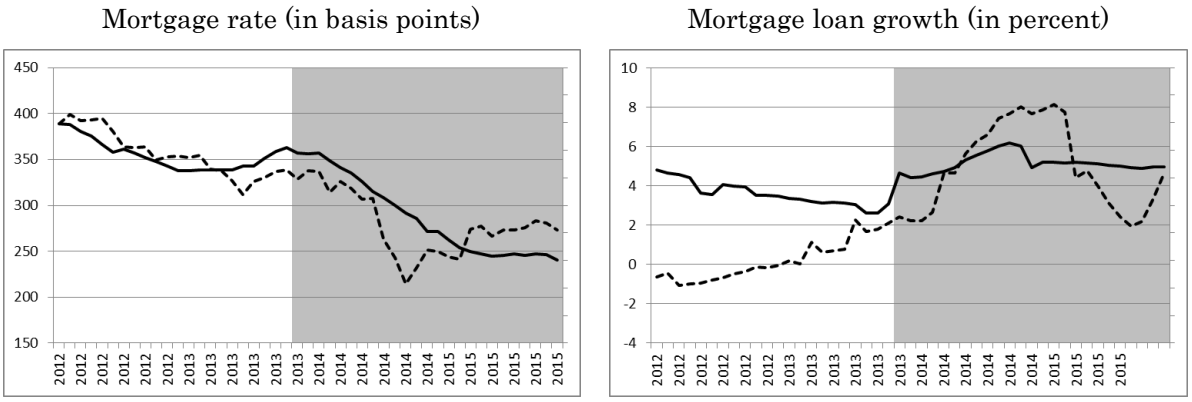
The left-hand part of Figure 1 shows that, in line with the policy interest rate, mortgage rates follow a declining trend over the sample period. Furthermore, lending rates of IRB banks and STA banks exhibit on average a very large co-movement (the correlation between the two series amounts to 85

[8] The mortgage growth rate is calculated as $100 \times \frac{\sum_{i=1}^{12}(S_{b,t+i}-S_{b,t+i-1}-(reclassifications_{b,t+i}+write-offs_{b,t+i}))}{S_{b,t}}$, where $S_{b,t}$ is the outstanding amount of loans to Belgian households for house purchase corrected for securitisations in month t. In contrast to the simple annual percentage change of the mortgage loan stock, this approach allows accounting for reclassifications and write-offs.

percent), suggesting the presence of common factors and/or endogenous behaviour (e.g. due to competition) that lead to very similar dynamics across the entire sector.

Average mortgage loan growth rates in the right-hand part of Figure 1 indicate that the difference in dynamics between IRB banks and STA banks is somewhat larger for mortgage loan growth rates. In particular, the two series exhibit an opposing trend between January 2012 and July 2013. After that, the co-movement between the average mortgage loan growth rates of the two groups of banks is larger (correlation of 72 percent).

Figure 1 - Evolution of weighted average mortgage rates and mortgage loan growth



Sources: NBB MIR statistics, NBB supervisory statistics (Schema A).

Notes: The bold line denotes the weighted average for IRB banks, the dashed line denotes the weighted average for STA banks. The weights used for computing weighted averages are given by the banks' share in the total outstanding amount of mortgage loans to Belgian households. The shaded area denotes the period during which the macroprudential measure was in place.

To account for differences in mortgage rates and mortgage loan growth across banks and over time, we control for bank and time fixed effects in the sample. In addition, we consider a broad set of control variables obtained from Datastream and supervisory reporting[9] as shown in Table 1. The swap rate, which proxies for the banks' funding cost corresponding to the repricing profile their new mortgage production[10], as on average very similar between IRB and STA banks. This also holds for the average share of new mortgage loan production in the four repricing segments: both IRB and STA banks on average tend to issue more loans with repricing periods longer than 10 years

[9] The data on Belgian mortgage loans, total assets, total loans and deposits are at solo level and obtained from Schema A reports, whereas capital related variables are sourced from COREP. The Tier 1 capital ratio requirement results from the National Bank of Belgium's Supervisory Review and Evaluation Process (SREP) decisions regarding banks' capital requirements. Capital ratio and requirement variables are at consolidated level.

[10] The 1 year swap rate is assigned to mortgage loans with repricing period up to 1 year, the 5 year swap rate to mortgage loans with repricing period between 1 and 5 years, the 10 year swap rate to mortgage loans with repricing period between 5 and 10 years, and the 20 year swap rate to mortgage loans with repricing period longer than 10 years. Like the average mortgage loan rate, the swap rate is expressed in basis points and amounts to the volume-weighted average swap rate across the four repricing segments in a bank's new mortgage loan production.

(Repricing segment 4). However, the dispersion around the means indicates a large variation over banks and/or time of the share of the repricing segments in new mortgage loans. The table further shows that IRB banks on average are significantly larger than STA banks (EUR 100 billion vs EUR 3.58 billion). The average differences between IRB and STA banks seem relatively limited for the importance of Belgian mortgage loans in the balance sheet total and the loan to deposit ratio, but the dispersion around the mean is large for both groups of banks.

Table 1 - Summary statistics

	IRB banks					STA banks				
Variable	Obs.	Mean	Std. Dev.	Min.	Max.	Obs.	Mean	Std. Dev.	Min.	Max.
Mortgage rate	343	317.02	64.21	186.07	463.11	207	334.19	144.58	168.65	995.00
Mortgage loan growth	336	5.20	3.92	-4.10	17.17	195	3.04	11.54	-14.95	28.51
Swap rate	343	153.81	48.18	48.52	268.62	207	150.05	58.05	13.7	265.99
Repricing segment 1	343	6.79	7.47	0.00	36.59	207	11.66	17.49	0.00	100
Repricing segment 2	343	20.74	18.38	0.21	82.08	207	21.92	25.79	0.00	100
Repricing segment 3	343	17.71	16.88	0.17	65.29	207	10.96	13.14	0.00	100
Repricing segment 4	343	54.76	30.38	0.00	97.76	207	55.47	31.04	0.00	100
Total assets (EUR bill)	343	99.76	77.00	17.42	292.47	207	3.58	2.70	0.47	9.99
Loan to deposit ratio	343	84.42	12.21	64.78	107.57	207	85.45	26.50	18.86	178.63
Mortgage loans to total assets	343	28.35	15.46	12.03	57.64	207	30.55	17.73	7.86	63.05
Additional capital to RWA	198	0.67	0.53	0.16	2.04	0				
Capital buffer to RWA	198	3.39	2.27	-2.43	11.33	0				

Source: NBB MIR statistics, NBB supervisory statistics (Schema A, COREP), NBB SREP, Datastream.
Notes: We only show summary statistics for Additional capital to RWA for IRB banks after the introduction of the measure, as the additional capital requirement implied by the RW add-on is strictly positive only for IRB banks from December 2013 onwards and zero otherwise. The number of observations for Capital buffer to RWA is lower due to data availability.

The share of Belgian mortgage loans in total assets and the last two control variables in Table 1 are (also) used to assess to what extent IRB banks' response to the macroprudential measure in terms of mortgage loan supply and pricing differs according to specific characteristics of IRB banks. In particular, the share of Belgian mortgage loan exposures in the banks' total balance sheet and the additional capital required by the measure as a share of RWA capture the relative degree to which IRB banks are affected in terms of additional capital requirements following the increase in the risk weight.[11] The capital buffer relative to RWA variable captures the degree to which the affected banks have room to absorb this additional capital requirement by reducing the voluntary management buffer they hold above minimum regulatory requirements. It should be noted that we only show summary statistics for Additional capital to RWA for IRB banks after the introduction of the measure, as the additional capital requirement implied by the RW add-on is strictly positive only for IRB banks from December 2013 onwards and zero otherwise. The number of observations for Capital buffer to RWA is lower due to data availability. Table 1 shows that the RW add-on results in additional required capital amounting to on average 0.67 percent of RWA, but this effect increases up to 2.04 percent for the bank that is most affected by the measure. The data indicate that IRB

[11] The additional capital required by the measures is obtained by multiplying the amount of Belgian mortgage loans on the balance sheet with the bank's Tier 1 capital requirement and the change in the mortgage loan RW introduced by the add-on (0.05).

banks on average have available a voluntary management buffer of 3.39 percent above the minimum requirement to absorb this additional capital requirement. In our analysis below, we transform these last two variables into an indicator variable that equals one if the observation belongs to the upper quartile of the variable's distribution (for the sample of IRB banks after the introduction of the measure) and zero otherwise.

Simple correlation analysis (not shown) indicates that IRB banks that are relatively more mortgage-concentrated tend to have a lower Tier 1 capital ratio requirement. Consequently, for some banks these two factors may be balancing each other in determining the additional capital required by the RW add-on. Yet, correlations of these two variables with the variable measuring additional capital required by the RW add-on relative to RWA are positive (both slightly above 55 percent). There seems to be no relationship between the size of the capital buffer to RWA and the size of the voluntary management buffer above the minimum requirement (correlation coefficients of -9 percent). The correlation analysis also shows that IRB banks that are expected to be affected more by the RW add-on tend to be the smaller IRB banks. Therefore, any finding that these IRB banks respond more aggressively in terms of mortgage loan pricing or curbing mortgage loan growth is unlikely to be driven by market power.

6 RESULTS

This section reports the results of the econometric analysis of the impact of the Belgian macroprudential RW add-on on IRB banks' mortgage rates and mortgage loan growth. We consider several model specifications[12] and provide robustness checks with respect to the sample period used.

6.1 Baseline results

Table 2 reports the results obtained from a baseline model without sensitivity variables. The left-hand panel shows that in this baseline specification without bank-specific control variables, the RW add-on is estimated to have increased IRB banks' mortgage rates on average by 12 basis points. When bank-specific control variables are added the point estimate on the RW add-on's effect on IRB banks' mortgage rates drops to on average 5 basis points. In both cases, the estimate is not statistically significant, however. This result is confirmed when we reduce the estimation sample to 2013-2014, i.e. one year before and after the introduction of the measure.

Table 2 – Impact of the RW add-on on mortgage lending: baseline results

	Mortgage rate		Mortgage loan growth	
	2012-2015	2013-2014	2012-2015	2013-2014

[12] In addition, to assess the effects of potential outliers we have performed median regressions with bank and time fixed effects. The results were both quantitatively and qualitatively very similar to our standard panel regressions.

$I(add\text{-}on) \times I(irb)$	12.705	5.296	11.167	6.007	-1.502	0.668	-1.475	-0.749
	(7.792)	(6.970)	(8.278)	(9.436)	(2.833)	(2.478)	(2.727)	(2.870)
Mortgage loans to total assets		1.240*		-0.061		-0.444**		0.184
		(0.656)		(1.721)		(0.199)		(0.606)
Log total assets		29.483**		32.833		-13.837**		0.170
		(10.810)		(46.514)		(6.260)		(21.165)
Loan to deposit ratio		0.311**		0.655		-0.103**		-0.097
		(0.138)		(0.480)		(0.046)		(0.074)
Swap rate	0.917***	0.897***	1.245*	1.046**	0.034	0.052	0.053	0.066
	(0.187)	(0.199)	(0.609)	(0.474)	(0.047)	(0.037)	(0.105)	(0.121)
Repricing segment 1	0.945**	0.867**	1.315	0.892	0.081	0.123**	0.131	0.157
	(0.334)	(0.361)	(1.282)	(0.976)	(0.070)	(0.053)	(0.208)	(0.237)
Repricing segment 2	1.037**	0.971**	1.584	1.387	0.003	0.028	0.054	0.063
	(0.405)	(0.402)	(0.985)	(0.839)	(0.057)	(0.043)	(0.136)	(0.154)
Repricing segment 3	0.398	0.426*	0.434	0.428	-0.013	-0.025	-0.010	-0.014
	(0.238)	(0.221)	(0.478)	(0.464)	(0.037)	(0.031)	(0.052)	(0.051)
Constant	99.571**	-655.136**	82.650	-718.960	1.547	347.448**	-0.821	-4.330
	(35.392)	(285.585)	(96.235)	(1206.141)	(6.268)	(155.139)	(15.612)	(514.062)
Adjusted R^2	0.870	0.882	0.714	0.727	0.060	0.296	0.107	0.147
Obs.	550	550	270	270	531	531	267	267

Notes: Standard errors are in parentheses. $I(add\text{-}on_t)$ is an indicator variable that equals one during the months in which the RW add-on is in place (from December 2013 onwards) and zero otherwise, $I(irb_t)$ is an indicator variable that equals one for banks that use the IRB approach for determining the risk weights on mortgages and zero otherwise. All bank-specific control variables are lagged by one period. All specifications include bank and time dummies. Significance: *** 1 percent, ** 5 percent, * 10 percent.

The left-hand results further show that some additional bank characteristics explain differences in mortgage loan pricing in this baseline specification. First, banks that are more reliant on mortgage business tend to charge higher mortgage rates. Second, larger banks charge higher rates on their mortgage loans on average, probably due to their market power. Third, a higher loan to deposit ratio is associated with higher mortgage loan spreads. A possible explanation for this finding is that banks that fund a larger share of loans by sources other than customer deposits tend to price in the additional liquidity risk they bear. It should be noted that these effects are no longer statistically significant in the regressions on the sample period 2013-2014. Finally, mortgage rates are explained by the swap rate and by the repricing segment: during our sample period, mortgage loans with repricing periods up to 5 years tend to be priced at statistically significantly larger rates than mortgage loans with repricing periods longer than 10 years. The latter no longer holds for the reduced sample period, however.

The right-hand panel of Table 2 presents the equivalent results for mortgage loan growth. The findings suggest that there has been no statistically significant impact of the macroprudential measure on mortgage loan growth. In the regressions on the full data sample, mortgage loan growth

is smaller for banks that have a larger focus on Belgian mortgage loans. This finding is consistent with banks targeting a stable balance sheet composition: when the share of Belgian mortgage loans rises (falls), the growth rate of the portfolio over the next year is reduced (raised). Also increasing balance sheet size tends to reduce mortgage loan growth. As the mortgage loan stock is highly correlated with total assets, this finding may in part be a mechanical effect: for a given amount of new loans, growth rates decrease when the mortgage loan stock increases. Finally, banks with a higher loan to deposit ratio exhibit lower mortgage loan growth, suggesting that banks that take more liquidity risk are more cautious in terms of expanding the mortgage portfolio. Alternatively, it could be that funding sources other than customer deposits are primarily used to finance investments other than traditional mortgage loans. Again, these results are no longer statistically significant for the shorter sample. Overall, the explanatory power of the regressions is much lower for loan growth than for mortgage rates.

6.2 Sensitivity variables

The baseline results on average did not show any significant impact of the macroprudential measure on mortgage lending: the point estimate of the impact on mortgage rates is about 5 basis points, whereas the impact on mortgage loan growth is very close to zero, and neither one of these estimates is statistically significant. The subsequent specifications extend the baseline model by adding sensitivity variables in the treatment effect. While IRB banks did not react to the RW add-on on average, it may be that banks' reaction depends on balance sheet characteristics. In particular, we test whether banks that are affected relatively more by the macroprudential measures react more strongly in terms of mortgage loan pricing and/or curbing mortgage loan growth.

Table 3 presents the results of these specifications for the mortgage rate: the variable name in the header specifies the *Sens*-variable that is interacted with the various indicator variables. For instance, the second and the fifth column of Table 3 show, for the full and reduced sample, respectively, that IRB banks' reaction to the introduction of the RW add-on does not depend on the importance of Belgian mortgages in the balance sheet total. This is also the case for the voluntary management capital buffer over the minimum requirement. The sixth column of Table 3 provides some, albeit statistically not very strong, evidence that IRB banks for which the additional capital requirement implied by the RW add-on is more important raise their mortgage rates relatively more. For the remainder, the results are similar to the ones reported in the left-hand part of Table 2.

Table 3 - Impact of the RW add-on on mortgage rates: sensitivity variables

	Mortgage rate					
	2012-2015			2013-2014		
	Mortgage loans to total	Capital amount to	Capital buffer to	Mortgage to total	Capital amount to	Capital buffer to

	assets	RWA	RWA	assets	RWA	RWA
$I(add\text{-}on) \times I(irb)$	0.580	5.438	5.298	-20.742	1.931	6.616
	(8.856)	(7.263)	(6.777)	(15.422)	(9.065)	(9.269)
$I(add\text{-}on) \times I(irb) \times Sens$	0.060	-0.490	-0.009	0.573	12.706*	-2.356
	(0.191)	(3.146)	(4.026)	(0.364)	(5.871)	(5.568)
$I(add\text{-}on) \times Sens$	-0.490***			-0.754***		
	(0.117)			(0.234)		
$I(irb) \times Sens$	1.106			7.400***		
	(0.661)			(1.842)		
Mortgage loans to total assets	1.174**	1.254*	1.240*	-1.941	-1.098	-0.126
	(0.507)	(0.696)	(0.658)	(1.336)	(1.649)	(1.716)
Log total assets	35.381***	29.705**	29.481**	20.944	11.338	30.213
	(8.429)	(11.270)	(11.149)	(31.867)	(44.189)	(49.050)
Loan to deposit ratio	0.421***	0.309**	0.311**	1.158**	0.745	0.651
	(0.095)	(0.140)	(0.140)	(0.456)	(0.479)	(0.487)
Swap rate	0.820***	0.897***	0.897***	0.757	1.154**	1.062**
	(0.193)	(0.199)	(0.199)	(0.479)	(0.491)	(0.473)
Repricing segment 1	0.756**	0.868**	0.867**	0.402	1.107	0.923
	(0.350)	(0.361)	(0.361)	(1.016)	(1.020)	(0.970)
Repricing segment 2	0.852*	0.972**	0.971**	1.061	1.527	1.407
	(0.406)	(0.403)	(0.404)	(0.846)	(0.859)	(0.836)
Repricing segment 3	0.429*	0.427*	0.426*	0.340	0.435	0.438
	(0.214)	(0.222)	(0.219)	(0.460)	(0.467)	(0.460)
Constant	-795.754***	-660.657**	-655.085**	-496.873	-200.324	-656.854
	(223.586)	(297.193)	(293.557)	(818.206)	(1142.548)	(1265.815)
Adjusted R^2	0.886	0.882	0.882	0.748	0.732	0.726
Obs.	550	550	550	270	270	270

Notes: Standard errors are in parentheses. $I(add\text{-}on_t)$ is an indicator variable that equals one during the months in which the RW add-on is in place (from December 2013 onwards) and zero otherwise, $I(irb_t)$ is an indicator variable that equals one for banks that use the IRB approach for determining the risk weights on mortgages and zero otherwise. The variable name in the header specifies the *Sens*-variable that is interacted with the various indicator variables. All bank-specific control variables are lagged by one period. All specifications include bank and time dummies. Significance: *** 1 percent, ** 5 percent, * 10 percent.

The results on the specifications with sensitivity variables for the impact of the RW add-on on mortgage loan growth are reported in Table 4. While the results on the full sample in the left-hand part do not show any evidence of heterogeneous effects of the macroprudential measure, the results on the 2013-2014 sample in the right-hand part indicate that IRB banks' reaction to the RW add-on in terms of curbing mortgage loan growth depends on the degree to which they are affected by the measure. In particular, IRB banks for which the mortgage exposures that are affected by the macroprudential measure account for a larger share of the balance sheet curb mortgage loan growth relatively more. This finding is confirmed when using the additional capital requirement variable: IRB banks for which the amount of additional capital required by the RW add-on is relatively larger,

exhibit lower mortgage loan growth. Finally, mortgage loan portfolios of IRB banks that have a larger capital buffer above minimum regulatory requirements tend to grow relatively faster after the introduction of the macroprudential measure. Like for the mortgage rate, the inclusion of the sensitivity variables does not affect the results on the remaining variables in the regression.

Table 3- Impact of the RW add-on on mortgage loan growth: sensitivity variables

	Mortgage loan growth					
	2012-2015			2013-2014		
	Mortgage loans to total assets	Capital amount to RWA	Capital buffer to RWA	Mortgage to total assets	Capital amount to RWA	Capital buffer to RWA
$I(add\text{-}on) \times I(irb)$	6.232	1.303	0.332	9.276**	0.588	-1.606
	(4.611)	(2.404)	(2.506)	(3.781)	(2.596)	(2.681)
$I(add\text{-}on) \times I(irb) \times Sens$	-0.190	-2.087	1.356	-0.279***	-4.168**	3.315*
	(0.108)	(1.287)	(1.430)	(0.087)	(1.667)	(1.727)
$I(add\text{-}on) \times Sens$	0.189*			0.144		
	(0.099)			(0.080)		
$I(irb) \times Sens$	-0.080			-1.371		
	(0.344)			(0.894)		
Mortgage loans to total assets	-0.406***	-0.387*	-0.445**	0.770	0.524	0.275
	(0.083)	(0.201)	(0.201)	(0.441)	(0.557)	(0.588)
Log total assets	-14.087**	-13.020**	-13.375**	8.983	7.223	3.857
	(5.725)	(5.793)	(6.096)	(19.588)	(19.059)	(19.756)
Loan to deposit ratio	-0.133*	-0.111**	-0.100**	-0.199*	-0.126*	-0.091
	(0.069)	(0.049)	(0.046)	(0.095)	(0.068)	(0.072)
Swap rate	0.070	0.050	0.049	0.071	0.030	0.043
	(0.046)	(0.036)	(0.036)	(0.125)	(0.114)	(0.109)
Repricing segment 1	0.151**	0.127**	0.122**	0.151	0.087	0.113
	(0.067)	(0.053)	(0.053)	(0.242)	(0.224)	(0.214)
Repricing segment 2	0.050	0.030	0.030	0.055	0.017	0.034
	(0.053)	(0.043)	(0.046)	(0.161)	(0.147)	(0.139)
Repricing segment 3	-0.027	-0.021	-0.027	-0.013	-0.016	-0.028
	(0.035)	(0.032)	(0.034)	(0.052)	(0.048)	(0.047)
Constant	348.223**	327.013**	336.470**	-201.186	-174.429	-91.711
	(143.803)	(144.210)	(151.612)	(480.383)	(463.752)	(481.548)
Adjusted R^2	0.346	0.310	0.304	0.280	0.233	0.208
Obs.	531	531	531	267	267	267

Notes: Standard errors are in parentheses. $I(add\text{-}on_t)$ is an indicator variable that equals one during the months in which the RW add-on is in place (from December 2013 onwards) and zero otherwise, $I(irb_t)$ is an indicator variable that equals one for banks that use the IRB approach for determining the risk weights on mortgages and zero otherwise. The variable name in the header specifies the *Sens*-variable that is interacted with the various indicator variables. All bank-specific control variables are lagged by one period. All specifications include bank and time dummies. Significance: *** 1 percent, ** 5 percent, * 10 percent.

6.3 Timing effects

The previous subsections showed that while the average impact of the macroprudential measure was not significant, there is some evidence of heterogeneous effects across IRB banks' mortgage loan growth. We next investigate whether the impact of the RW add-on, while on average not significant over the entire evaluation period after its introduction, is particularly more pronounced in one of the two years after the introduction. It could for instance be that IRB banks' reaction was initially strong but soon faded, or that IRB banks only reacted to the introduction of the measure with a lag.

The left-hand part of Table 5 shows the results of this assessment for the mortgage rate. The second column of the table confirms the earlier finding that the RW add-on on average did not have a significant impact on mortgage rates: the impact is close to 5 basis points both in the first and the second year after the introduction of the measure. The fourth and the fifth column also confirm that IRB banks did not react heterogeneously depending on the relative amount of additional required capital due to the RW add-on or the capital buffer above the minimum requirement. The third column, however, shows that IRB banks with a larger share of mortgage loans to Belgian households in their balance sheet increased mortgage rates relatively more in the first year after the introduction of the measure and charge relatively lower rates in the second year. IRB banks with a lower reliance on affected mortgage loans, in contrast, initially charged relatively lower mortgage rates and increased their price of mortgage loans relatively more only in the second year after the introduction. A simulation of this model for the individual IRB banks in our sample shows that the initial impact on the mortgage rate of IRB banks with large reliance on mortgage loans to Belgian households is stronger than the subsequent impact on the mortgage rate of IRB banks with a lower share of mortgage loans in their balance sheet total. More specifically, the impact of the RW add-on on the mortgage rate ranges from -7 basis points to +21 basis points across individual IRB banks in the first year after the introduction, with the lower bound of the range not being statistically significantly different from zero. The range of impacts across individual IRB banks narrows in the second year, with values going from -12 basis points to +12 basis points. Neither the lower nor the upper bound of this range is significantly different from zero.

Like for mortgage rates, the first column of the right-hand part of Table 5 confirms that the RW add-on on average did not affect mortgage loan growth. The remaining three columns of the right-hand panel show that the heterogeneous reactions across IRB banks in terms of curbing mortgage loan growth are only present in the first year after the introduction of the measure: IRB banks having a larger share of affected mortgage loans in their balance sheet and facing a relatively larger additional capital requirement due to the RW add-on reduce mortgage lending growth relatively more, and IRB banks with a larger voluntary management capital buffer exhibit stronger mortgage loan growth after the introduction of the measure. A simulation of the impact across individual IRB banks shows that the impact of the RW add-on on mortgage loan growth ranges from -5.96

percentage points to +4.13 percentage points in the first year after the introduction. While the latter value is not statistically significant, the above findings suggest that there may have been a shift from IRB banks with a large focus on mortgage loans to more diversified IRB banks. These effects are temporary, however, and no longer significant in the second year after the introduction.

Table 5 - Impact of the RW add-on on mortgage lending: timing effects

	Mortgage rate				**Mortgage loan growth**			
		Mortgage loans to total assets	Capital amount to RWA	Capital buffer to RWA		Mortgage to total assets	Capital amount to RWA	Capital buffer to RWA
$I(add\text{-}on) \times I(irb) \times I(2014)$	4.094	-15.286	3.698	4.913	0.470	7.345	1.455	-0.355
	(9.983)	(10.605)	(10.495)	(9.798)	(3.139)	(4.386)	(2.891)	(3.032)
$I(add\text{-}on) \times I(irb) \times I(2015)$	6.619	19.737*	7.201	6.024	0.889	4.921	1.196	0.890
	(6.050)	(9.267)	(6.109)	(5.441)	(2.550)	(6.933)	(2.670)	(2.655)
$I(add\text{-}on) \times I(irb) \times I(2014) \times Sens$		0.651**	1.143	-3.083		-0.240**	-3.135*	3.330*
		(0.241)	(4.184)	(3.241)		(0.086)	(1.502)	(1.712)
$I(add\text{-}on) \times I(irb) \times I(2015) \times Sens$		-0.566**	-2.471	2.522		-0.135	-0.754	-0.454
		(0.252)	(3.504)	(6.173)		(0.164)	(1.523)	(1.382)
$I(add\text{-}on)) \times I(2014) \times Sens$		-0.994***				0.203**		
		(0.119)				(0.072)		
$I(add\text{-}on)) \times I(2015) \times Sens$		0.064				0.169		
		(0.187)				(0.149)		
$I(irb) \times Sens$		0.913				-0.079		
		(0.796)				(0.428)		
Mortgage loans to total assets	1.269*	1.310*	1.294*	1.243*	-0.439**	-0.404**	-0.389*	-0.422*
	(0.608)	(0.682)	(0.649)	(0.604)	(0.200)	(0.138)	(0.203)	(0.197)
Log total assets	29.506**	33.071***	29.312**	28.440**	-13.837**	-13.437**	-12.718**	-12.609*
	(10.413)	(8.307)	(10.728)	(10.341)	(6.214)	(5.975)	(5.621)	(5.853)
Loan to deposit ratio	0.300**	0.318**	0.292**	0.296**	-0.105*	-0.127	-0.108*	-0.099*
	(0.120)	(0.129)	(0.120)	(0.123)	(0.055)	(0.096)	(0.056)	(0.054)
Swap rate	0.902***	0.888***	0.914***	0.910***	0.052	0.062	0.042	0.044
	(0.207)	(0.188)	(0.213)	(0.210)	(0.035)	(0.045)	(0.032)	(0.031)
Repricing segment 1	0.874**	0.859**	0.896**	0.892**	0.125**	0.135**	0.113**	0.110**
	(0.369)	(0.361)	(0.377)	(0.376)	(0.049)	(0.062)	(0.049)	(0.042)
Repricing segment 2	0.973**	0.940**	0.983**	0.989**	0.029	0.040	0.024	0.019
	(0.403)	(0.396)	(0.404)	(0.406)	(0.042)	(0.055)	(0.043)	(0.038)
Repricing segment 3	0.426*	0.407*	0.427*	0.429*	-0.025	-0.027	-0.021	-0.029
	(0.216)	(0.208)	(0.218)	(0.216)	(0.032)	(0.034)	(0.032)	(0.032)
Constant	-657.172**	-758.884***	-654.335**	-632.294**	347.220**	333.699**	320.631**	318.435**
	(276.058)	(223.981)	(283.567)	(273.643)	(153.202)	(147.963)	(139.556)	(144.798)
Adjusted R^2	0.882	0.889	0.881	0.882	0.295	0.354	0.316	0.319
Obs.	550	550	550	550	531	531	531	531

Notes: Standard errors are in parentheses. $I(add\text{-}on_t)$ is an indicator variable that equals one during the months in which the RW add-on is in place (from December 2013 onwards) and zero otherwise, $I(irb_t)$ is an indicator variable that equals one for banks that use the IRB approach for determining the risk weights on mortgages and zero otherwise. The variable name in the header specifies the *Sens*-variable that is interacted with the various indicator variables. All bank-specific control variables are lagged by one period. All specifications include bank and time dummies. Significance: *** 1 percent, ** 5 percent, * 10 percent.

7 CONCLUSION

By analysing the impact of a sectoral macroprudential measure on mortgage loan lending, this paper contributes to the understanding of the potential impact of sectoral macroprudential capital requirements. Such evidence is crucial for improving the effectiveness of macroprudential policies, especially as analysis of the effects of sectoral capital requirements in general, and of those targeting real estate exposures in particular, is scant.

Our results suggest that, in line with previous findings in the literature (e.g. Carlson, et al. (2013), Aiyar et al. (2014) and Basten and Koch (2017)), banks may react in a heterogeneous way to sectoral macroprudential capital requirements. In particular, banks that are relatively more affected by the additional requirement and that are more capital-constrained tend to respond stronger in terms of mortgage lending.

However, the paper also shows that on average the impact of the macroprudential measure on mortgage lending was relatively limited both in terms of statistical and economic significance. As such, this is not surprising, as the objective of the measure was not to curb credit supply per se. On the one hand, this could be interpreted as a positive finding: the evidence shows that banks' resilience to sectoral risk could be raised at low overall cost of foregone credit. On the other hand, this finding confirms the conclusion of Basten and Koch (2017) for the Swiss countercyclical capital buffer. As one of the explanatory factors for their overall small effects on mortgage lending, they argue that the Swiss countercyclical buffer amounted to only 1 percent of risk-weighted domestic residential mortgages. However, assuming a 10 percent minimum capital requirement, a back of the envelope calculation shows that the Belgian RW add-on of 5 percentage points, which raises the average risk weight from 10 percent to 15 percent, would on average be equivalent to a sectoral capital buffer requirement that is five times bigger than the Swiss measure.

This raises the question on what should be the calibration of sectoral capital requirements if they were intended to have material impact on credit supply. Unfortunately, due to potential non-linearities in banks' reactions to regulatory requirements, our estimates do not allow drawing conclusions on whether a stronger calibration of the measure would have had more sizable effects on mortgage lending. Therefore, future work is needed on further assessing whether sectoral capital

requirements could be effective in curbing credit supply, or whether instead, alternative measures, such as borrower-based instruments (e.g. LTV caps) would be needed to achieve this objective.

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