Higher Bank Capital Requirements and Mortgage Pricing: Evidence from the Countercyclical Capital Buffer

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We examine mortgage pricing before and after Switzerland was the first country to activate the Countercyclical Capital Buffer of Basel III. Observing multiple mortgage offers per request, we obtain four core findings. First, capital-constrained banks raise their rates relatively more. Second, so do banks specialized in mortgage lending. Third, risk-weighting schemes supposed to discriminate against more risky borrowers do not amplify the effect of higher capital requirements. Fourth, CCB-subjected banks and CCB-exempt insurers raise mortgage rates, but insurers raise rates by on average 8.8 bp more. To conclude, lenders welcome the opportunity to increase mortgage rates, but the CCB capital requirements do not discourage banks from risky mortgage lending.

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1. Introduction

In February 2013 Switzerland became the first country to activate the *Countercyclical Capital Buffer (CCB)* as the macro-prudential tool of Basel III. Its first Swiss activation required banks to hold extra equity capital worth 1% of their risk-weighted assets secured by domestic residential property.

This paper investigates the impact of the CCB's increased capital requirements on mortgage pricing. We shed light on different bank balance sheet characteristics including capitalization, business model, portfolio and funding structure that might render banks more sensitive to the effects of the CCB. As risk-weighting schemes tied to loan-to-value (LTV) ratios link the riskiness of individual borrowers to the regulatory capital requirements of banks, we also examine whether these threshold LTV ratios amplify the CCB effects. We exploit a comprehensive dataset of a Swiss online mortgage broker, which allows us to separate mortgage demand from mortgage supply. Customers provide detailed information on their financial situation and the real estate property they intend to buy. Then, each mortgage request receives several binding but independent offers by banks and insurance companies. As we observe responses from both banks and insurers, we can also analyze the effect on insurers which do not need to comply with the CCB's capital requirements.

Our study yields four core findings. First, capital-constrained banks raise their offered mortgage rates relatively more in response to the CCB. This is in line with capital buffer theory of bank lending, in which changes in regulatory capital standards require more and faster adjustment of banks with lower capital buffers. Second, while banks specialized in mortgage lending do in general offer lower rates, they raise their rates relatively more in response to the CCB. We interpret this as a roll-over to new customers also of those additional capital costs arising from mortgages already on the balance sheet.

Third, banks in general do charge more on very risk mortgages with LTV ratios above respectively 66% and 80%. But although loans with high LTV ratios receive higher risk weights and hence higher capital requirements, they turn out not to amplify the CCB effects. In this light, we might interpret LTV thresholds as signals for very risky mortgages inducing all lenders to charge a risk premium. Apparently, the existing risk-weighting schemes create only a relatively weak link between LTV ratios and capital requirements. Our fourth finding suggests that banks and insurers increase their average mortgage rates after the CCB's activation, but insurers raise rates by on average 8.8 bps more than banks. Hence, we find no evidence of "policy leakage" in the sense of CCB-exempt insurers seeking to underbid CCB-subjected banks. We interpret this as the insurers' choice to improve their markups instead of expanding their market share and mortgage volume. Generally speaking, the CCB activation raises mortgage rates but neither banks nor insurers become more reluctant to offer mortgages at sufficiently high prices.

To conclude, both types of lenders prefer to raise prices and most likely markups. Banks probably do so in order to increase their retained earnings and ultimately strengthen their capital base. Insurers do so as they prefer higher profits over gaining market share from CCB-subjected banks. Yet, common risk-weighting schemes associated with the Basel capital standards do not amplify the CCB effect and thus do not prevent banks from offering very risky mortgages.

Our unique setup and dataset allow us to advance the understanding of the CCB effects as the macro-prudential policy tool of Basel III, as well as those of regulatory capital standards more generally. First, Switzerland was the first country worldwide to activate the CCB. This allows us to assess how higher bank capital requirements affect the willingness of banks to make a mortgage and the explicit pricing of mortgages. Second, our dataset allows us to disentangle

mortgage supply and mortgage demand as several banks submit independent offers for each anonymized mortgage request. We can thus attribute differences in the pricing of banks to their idiosyncratic balance sheet characteristics that might strengthen a bank's sensitivity to higher capital requirements. This allows us to extrapolate our results to other countries, periods and distinct bank characteristics: For instance our results suggest that the CCB can be expected to affect loan pricing more (less) strongly the lower (higher) are banks' capital buffers.

Third, as bank decisions are made solely on the basis of the hard information we observe, we are able to rule out any distortions from soft information or relationship lending, as documented in Brown and Hoffmann (2013) or Puri et al. (2012). As banks cannot observe their competitors' offers and participation, we put forward that individual offers are not distorted by superior knowledge, private information or aspects of competition. Fourth, we study the effectiveness of risk-weighting schemes on the pricing of a specific asset class. In general, risk-weighting schemes specify how risk characteristics of a certain asset class translate into bank-specific regulatory capital requirements. We examine how a positive shock to capital requirements on an asset class that is possibly amplified by risk-weighting schemes shapes a bank's pricing of that assets class. Our results hence also inform the debate on the appropriate design of risk-weighting schemes to shape lending incentives. Fifth, our comparison of banks with insurers allows us to track possible leakage effects of a regulatory measure that targets some market participants but may also have an indirect effect on other market participants.

The remainder of the paper is structured as follows. The next section sketches the institutional background. This includes the Swiss implementation of the Basel III regulation in general and the issuance and activation of the CCB tool in particular, as well as other changes in relevant mortgage market regulation. It also outlines the relevant literature. Section 3 presents our dataset and Section 4 our empirical approach with regression specifications and results. Section 5

concludes and discusses potential policy implications as well as possible avenues for future research.

2. The CCB and its Higher Capital Requirements

2.1 Switzerland as the first country to activate the CCB

The Countercyclical Capital Buffer (CCB) is the macro-prudential component of the Basel III banking regulation proposed by the Basel Committee on Banking Supervision (BCBS 2010a). In Switzerland, the Basel III regulation was implemented through a revision of the Capital Adequacy Ordinance (CAO) adopted by the Federal Council on June 1, 2012, one year after the issuance by the BCBS. It included the option for the government to activate a CCB from July 2012 onward, while the remaining requirements went officially into force on January 1, 2013.[1] On July 1, 2012, there was an additional change in Swiss mortgage market regulation. This included an amortization requirement to reduce Loan-to-Value (LTV) ratios to two-thirds within 20 years, and the requirements for home buyers to supply at least 10% of the house value as "hard equity", i.e. equity not taken from households' pension funds. By contrast, Swiss mortgage market regulation does to this day not have any references to other common mortgage risk indicator neither to the Loan-to-Income (LTI) nor the related Debt-Service-to-Income (DSTI) nor Payment-to-Income (PTI) ratio. In this paper, we focus on LTV ratios explicitly and implicitly control for all other measures. Both of the above-mentioned regulatory changes were implemented by the Swiss Financial Market Supervisory Authority FINMA which recognizes the

[1] We would expect any effects of this general Basel III adoption through the Federal Council to take effect at the latest from June 1, 2012 rather than only from January 1, 2013, when it became effective, because not adjusting as soon as they have the information would tend to be costly to banks. Note however that this assumption is not required for our identification as any general Basel III effects occurring on January 1, 2013, would be absorbed by the complete set of year-month fixed effects.

self-regulation proposed by the Swiss Bankers Association in SBA (2011) and SBA (2011) as minimum standard. The *activation* of the CCB occurred half a year after these changes, on February 13, 2013. Figure 1 illustrates the different periods of our sample.

In our analysis we focus on the effects of the CCB *activation* as opposed to the CCB becoming available as a policy tool. However, the coincident effects of the CCB's availability and other mortgage market reforms between July 2012 and January 2013 are hard to disentangle. So any reader interested in the joint effect of CCB availability and actual CCB activation may wish to interpret our estimates only as lower bounds. Our focus lies on the interactions between CCB and bank and borrower characteristics rather than on average effects. Furthermore, in our view the effects of the activation alone are far more policy-relevant than the joint effect would be: Firstly, after the Basel III issuance through the BCBS in 2011 individual jurisdictions and national regulators have little leeway not to make the CCB tool available, but they do have discretion about whether, when and how to actually activate it. Secondly, the event of the CCB becoming available as a policy tool happens only once for each jurisdiction, whereas its actual activation can be adjusted whenever national regulators deem this useful.

The purpose of the CCB is to address the *pro-cyclicality* of bank capital requirements implied by earlier sets of the Basel regulation. In that previous regulation, risk weights were tied to the estimated probability of default which however tended to fall in periods of high credit growth.[2] Thus lending was made less expensive in periods in which growth was already high and vice-versa, thus *reinforcing* the credit cycle. In response, the Basel Committee developed the CCB (BCBS 2010b).

[2] See for instance Gordy and Howells (2006), Jokipii and Milne (2008) or Aikman et al (2014), as well as the relevant papers cited therein.

The CCB comes on top of the *minimum capital requirement* (MCR) already in place under Basel II and the *capital conservation buffer* (also known as Pillar II requirements) also introduced by Basel III. The minimum requirement amounts to 8% of risk-weighted assets (RWA) and its violation will automatically trigger regulatory action. The *capital conservation buffer* acts as a cushion when equity capital temporarily falls in times of financial market turmoil. Its size depends on regulators' assessment of a bank's systemic importance. Basel III stipulates only that it must amount to at least 2.5% of RWA, but in Switzerland it ranges from 2.5% to 6.4% of RWA, depending on which out of 5 risk categories a bank has been assigned to. While there is a phase-in period for those capital requirements, we would expect their effect on loan pricing to take effect at the latest by the time by which the new requirements have been definitely decided on. FINMA (2011) and Jans & Passardi (2013) provide more details on the implementation of the minimum capital requirement and the capital conservation buffer in Switzerland.

As distinct from permanent requirements, national authorities can impose the CCB as an additional temporary capital requirement whenever they deem credit growth excessive. In our case, Article 44 of the Capital Adequacy Ordinance (CAO) regulating the Swiss implementation of Basel III states two equally important objectives for the new policy tool, which are also both mentioned by the Basel Committee (BCBS 2010b). First, by requiring the build-up of additional equity capital in periods of high credit growth, the aim was to *strengthen lenders' resilience* to potential loan losses when the risk of such losses increases.[3] Second, to the extent to which internal finance is more expensive than external finance (which often enjoys tax privileges), higher capital requirements should also make lending more expensive and thus slow down credit growth when the buffer is activated.

[3] There has also been a lively discussion of which indicators would be suitable to time activation and release of the CCB. See Drehmann et al. (2010), Drehmann et al. (2011), Repullo & Saurina (2011), Edge & Meisenzahl (2011), Hahm & Shin (2013), BOE (2014).

According to the general Basel III framework, the CCB applies to all risk-weighted assets. In deviation from this, the Swiss setup allows the authorities to activate the CCB only for part of banks' portfolios. In this light, Swiss authorities decided to restrict the first activation of the CCB to risk-weighted assets secured by domestic residential property in order to address a potential housing bubble without risking to cause a credit crunch in other bank lending activities. Upon recommendation by the Swiss National Bank (SNB) and after consultation of the supervisor FINMA, the Swiss government activated the CCB on 13 February 2013. It required banks to raise additional CET 1 capital worth 1% of their risk-weighted domestic residential mortgages by September 2013.[4] [5]

Finally, note that both the CCB and the self-regulation apply to all banks contained in our sample, including subsidiaries of foreign banks[6], but neither applies to insurers. As outlined in FINMA (2014), insurers account for about 4% of Swiss residential mortgage lending. We elaborate on the role of insurers in Subsection 4.4.

2.2 Specificities of the Swiss mortgage and real estate markets

Since in our setup the CCB applies specifically to Swiss mortgages, we a briefly introduce the Swiss real estate and mortgage markets. The first thing that stands out is that Switzerland has always had a comparatively low owner-occupancy rate relative to other developed countries. At the national average, that rate was below one-third until the early 1990s. It has since risen to slightly above 40% given the possibility to use pension funds for home purchases, to benefit from tax incentives and low interest rates, especially during the more recent years[7]. The tax treatment is meant to be ownership neutral: Imputed rents are fully taxed also for owner-occupiers, while

[4] About a year later, in January 2014, that requirement was furthermore raised to 2%, to be fulfilled by July 2014, but that increase is not investigated here for lack of data on the subsequent period.

[5] For further details on the adoption of the Basel III regulation and the first activation of the CCB, see also FINMA (2012a), FINMA (2012b), SNB (2013a) and SNB (2013b).

[6] By contrast, foreign branches would not yet be covered, as full reciprocity has not yet been implemented. However, foreign branches play not significant role in the Swiss mortgage market and correspondingly there are none contained in our sample.

[7] Source: Bundesamt für Wohnungswesen, Wohneigentumsquoten 1990, 2000 und 2012 nach Kantonen, http://www.bwo.admin.ch/dokumentation/

on the other hand interest payments can be deducted from taxable income.[8] This system is in principle neutral to ownership, however it does provide incentives for slow mortgage amortization given home ownership. Hence Swiss households tend to amortize on a far longer schedule than the contractual maturity and typically make the balloon payment of outstanding principal at the end by refinancing, i.e. taking out a new loan. As a consequence, Swiss mortgage debt increased significantly during the recent boom. It is now one of the highest in the world as a percentage of GDP (see FINMA [2014]), although most home owners accumulate savings in other accounts while keeping their mortgage debt outstanding. In contrast, , to the US, for example, early repayments in Switzerland usually occur only when households have to move, e.g. because of divorce or job changes. However, borrowers do not repay earlier for strategic reasons, as Swiss banks usually charge a compensating fine for the lost investment opportunity and all incurred costs. In Switzerland, both banks and insurance companies offer mortgages, although the insurers hold only about 4% market share (see FINMA [2014]). Swiss mortgage suppliers rarelz offer contractual maturities in Switzerland above 10 years, although amongst maturities below 10 years those with longer fixing of interest rates have become significantly more popular in the low interest rate environment of the past few years[9]. More than half of all submitted mortgage applications in our comparis.ch dataset request mortgages with interest rates fixed for 10 years. Finally, looking at the Swiss house price cycle, Swiss house prices saw their last peak around 1992, then declined until about 1999, and have since been continuously growing for the recent 15 years. As Basten & Koch (2014) show in more detail, part of this boom has likely been due to the low interest environment and the appealing business model of mortgage lending for both banks and households, but another significant part is due to increased immigration and demand for housing facing a relatively inelastic housing supply.[10]

2.3 By how much might the CCB increase mortgage rates?

This section develops a back of the envelope estimate for the anticipated increase in mortgage rates that banks charge after the CCB's activation. Initially we gauge the additional cost that a

[8] According to IMF (2011) Switzerland is the only country apart from the Netherlands to have this fully ownership neutral tax regime.

[9] According to SNB (2014) the share of outstanding mortgage debt with a remaining maturity above 5 years increased from about 15% in 2009 to above 25% in 2014..

[10] For another up-to-date portrait of the Swiss mortgage market, see Brown and Guin (2013)

bank incurs when funding 1% of a risk-weighted mortgage with equity rather than debt. Figure 2 computes the cost differential for a bank that intends to make a mortgage worth CHF 1mn. As published in the most recent report by the Swiss National Bank (see SNB [2012]), we draw on the Swiss market-wide average risk-weight of 40%, which corresponds to a loan-to-value (LTV) ratio of about 77%. This implies *risk-weighted assets* worth CHF 400'000. Hence, the 1% CCB implies an additional equity capital requirement worth 1%*CHF 400'000 = CHF 4'000. As the bank has to replace debt by equity capital funding, we have to multiply those CHF 4'000 with the cost differential between equity and debt finance. Based on the public annual reports of the banks in our sample, we compute an average cost differential of 3.84%[11]. To proxy this cost differential we take the difference between the average reported return on equity and the average ratio of interest expenses to external funding by deposits and bonds.[12] Ultimately we arrive at an extra cost worth CHF 154, or 1.54 bp when set in relation to the mortgage amount.

So we would expect an average mortgage rate increase worth 1.54bp *if* banks pass on to a consumer only the marginal cost of that specific mortgage, and *if* the CCB effect works exclusively through raising the current marginal refinancing cost. However, a bank has two more options to comply with the CCB when offering a mortgage. On the one hand, a bank might pass on less than those 1.54bp if they wish to underbid competitors and might incur part of the additional cost itself in an attempt toincrease its market share. On the other hand, a bank might pass on more for several reasons. First, the CCB imposes higher costs for all mortgages issued in the past that enter a bank's balance sheets. Specialized banks with a higher share of mortgages

[11] This is not too different from the 4.66% estimate obtained by Junge and Kugler (2013) using the annual return of the Swiss SPI stock market index and the 12-month CHF libor rate for 1990-2010, with the difference possibly due to the fact that our sample does not contain both big banks, see below.

[12] This does not account for potential changes in the cost differential that might result from a reduction in leverage making the bank safer. This simplification seems fine to us for the present back-of-the-envelope illustration given that the impact of the CCB on the bank's overall leverage is quite small.

relative to other assets hence suffer from an additional cost burden. They cannot pass on this burden to its already borrowing customers, as it is reputationally very difficult to raise the mortgage rates in retrospect on contracts concluded in the past. This is discussed also in Button et al. (2010) who term the higher costs on existing loans "back-book effect" and write: "An increase in the mark-up is consistent with a desire by lenders to improve the net interest margin given the low return on the stock of existing loans (the 'back-book effect')". Put differently, if the market situation allows so, then banks might try to instead pass those costs on to new customers. Banks may not be sure whether potential new customers are willing to bear those extra costs, i.e. whether raising prices by that amount would mean loosing customers or whether competitors will uniformly exploit this opportunity to increase mortgage rates. Our dataset on the online mortgage marketprovides us with a clean setup to analyze which of the three options bank choose. On the one handbanks cannot see their competitor's offer and on the other hand they get immediate feedback on how potential customers respond.Second, beyond this potential passing-on of costs associated with mortgages made in the past, lenders might increase prices beyond those 1.54bp also because they may see the CCB activation as a signal by the authorities that they perceive greater risks in that market than those currently priced in by lenders. . In this sense, the CCB may be working not only through the channel of raising banks' financing costs but also through the second channel of signalling higher risk associated with domestic residential mortgage lending. Our analyses below will answer by how much lenders do actually raise prices in response to the CCB. As we observe offers from multiple lenders for exactly the same requests, we can link these differences to banks' idiosyncratic balance sheet characteristics.

2.4 Existing Literature

While there has been some work on the need for more countercyclical instruments as well as on possible conditioning variables, work on the effects of a CCB once implemented is very limited. As Switzerland was the first country to activate a CCB in February 2013, empirical evaluations of the CCB do to the best of our knowledge not yet exist. Yet several strands of the literature relate to our paper.

First, there is a literature on how actual bank capitalization affects bank lending. On the theory side, Boot et al. (1993), Sharpe (1990), and Diamond and Rajan (2000) develop models that examine how equity capital should affect bank lending. Gersbach and Rochet (2012) build a simple model of bank lending and show that the volatility of lending can be reduced by requiring higher capital ratios in boom times. With respect to the regulatory framework, Repullo and Suarez (2004) investigate how the transition from Basel I to Basel II translates into changes in a theoretical loan pricing equation. On the empirical side, Hubbard et al. (2002) find that banks with low capital demand higher rates from borrowers with high switching costs. Steffen and Wahrenburg (2008) obtain similar findings in their analysis of UK loans. Santos and Winton (2010) point out that less well capitalized banks are more sensitive to their customers' characteristics than better capitalized ones. Kashyap and Stein (2000) find that banks with less liquid balance sheets exhibit a stronger lending effect in response to a monetary policy shock. Kishan and Opiela (2000) stress that the degree of capitalization matters in that small and less well capitalized banks respond most strongly to monetary policy. Jokipii and Milne (2011), using US balance sheet data, find evidence for the "capital buffer theory". This theory suggests that banks hold buffers of capital above the regulatory requirements to avoid inadvertent breach of those requirements. It predicts that in the short run banks with low buffers will exhibit a negative relationship between equity capital and risk-weighted assets (RWA), i.e. new regulatory

requirements like the CCB will force them to simultaneously increase their capital and reduce (or abstain from increasing) their RWA. By contrast, banks with high buffers do not need to make that significant and fast adjustments in their capital ratios and hence have less need to adjust lending or its pricing in response to higher capital requirements. The impact of capital buffers or "excess capitalization" is also investigated by Gambacorta and Mistrulli (2004 and 2014) measure capitalization not simply as the absolute capital to assets ratio, but as the percentage deviation of that ratio from its regulatory minimum. We also draw on this measure of capitalization to proxy the sensitivity of banks towards a regulatory capital shock. More specifically on the effects of regulatory capital requirements, several papers conduct mostly accounting-based quantitative impact studies (QIS) on the effect of capital requirements on loan pricing. These include Cournède and Slovik (2000), Elliot (2009), King (2010), Cosimano and Hakura (2011) and Hanson et al. (2011).

While assuming that the costs of equity and debt remain unchanged, Cournède and Slovik (2000) draw on a balance sheet identity and apply it to aggregate data of different industrialized countries. This approach implicitly corresponds to our back of the envelope concept as we draw on the same set of assumptions and let the analogous ratios enter our compution. To put our back of the envelope estimate of 1.54 bp into perspective, it is important to recognize that *estimates crucially hinge on* the assumed average risk-weight applied to the mortgage as well as *on the difference between the cost of debt and equity funding*. The cost differential used in the studies cited above ranges from 7.7% for Japan to 12.7% for the US as opposed to 3.84% in our sample of Swiss banks. Their average risk-weight applied to all assets ranges from 53.9% for the Euro area and 76.4% for the US as opposed to the average risk weight of 40% based on the Swiss mortgages market. This might explain why their estimated impact of a 1% increase in equity capital applying to all risk-weighted assets ranges from 8.4 bp for Japan, 14.3 bp for the Euro

area and 20.5 bp for the US, respectively and thus considerably exceeds our back of the envelope estimate applied to risk-weighted mortgages only and a much lower cost differential. Junge and Kugler (2013) quantify the impact of the higher capital requirements introduced with Basel III on the Swiss economy as a whole, taking into account both costs and benefits. On the one hand they estimate how changes in capital requirements and hence in leverage affect the riskiness and hence the required returns to shareholders of banks, and how this in turn may translate into changes in lending spreads and thereby in GDP. On the other hand, they estimate how capitalization affects the probability and severity of financial crises associated with losses in GDP.

More specifically on the CCB, Drehmann and Gambacorta (2012) run a simulation of the CCB effects on bank lending and find that the buffer can indeed slow down credit growth during booms and moderate a credit contraction once it is released.

The closest to an empirical evaluation of the Basel III CCB by use of micro-level data is the work by respectively Aiyar et al (2012) and Jiménez et al. (2012). Aiyar et al (2012) evaluate the effects of bank-specific capital requirements in the UK that, while not being part of an explicit "macro-prudential policy", used to vary counter-cyclically already since Basel I. On the theory side, *they point out that for countercyclical capital requirements to affect mortgage lending, banks must not be too over-capitalized relative to regulatory requirements from the outset.* Our analysis pays special attention to the issue of excess capitalization against the background of Swiss banks during the phase-in period of Basel III. Aiyar et al (2012) also emphasize that the purpose of countercyclical capital requirements may be defeated when there exists a set of

lenders to whom the requirements do not apply.[13] This motivates our analysis of the lending response of insurers in Switzerland.

Jiménez et al. (2012) by contrast evaluate the effects of "dynamic provisioning" introduced by Spain already in 2000. The policy required provisioning conditional also on system-wide indicators rather than only bank-specific losses. As Crowe et al. (2011) point out, counter-cyclical provisioning differs from countercyclical capital requirements along the important dimension that the requirements are binding also when banks are already better capitalized than required by regulators. Jiménez et al. (2012) use bank, loan and firm level data to analyze the impact of these provisions on bank lending to firms. They find that the countercyclical provisioning rules did indeed help to smooth the Spanish credit cycle.

2.5 Defining the scope of our paper

Our paper differs in several respects from the above-cited work. First, in contrast to the two existing empirical evaluations of counter-cyclical tools, we empirically analyze the specific CCB as the macro-prudential tool of Basel III[14]. Second, we focus on mortgages and hence bank lending to private households (which is by far the largest asset category of most domestically focused banks) rather than bank lending to firms as mostly analyzed in the literature (see e.g. Cornett et al. [2011], Jiménez et al.[2012], Gambacorta and Mistrulli [2014]). Third, we can disentangle mortgage demand and supply. To examine mortgage supply, thanks do our special setting we can analyze how the distinct mortgage offers vary with bank balance sheet characteristics *for the same mortgage request* before and after the activation of the CCBThis would not be possible in a setting with only one supplier per request, because there one could

[13] This potential weakness is also mentioned in European Systemic Risk Board (2014)

[14] To be precise the CCB as applied in Switzerland is the closest existing approximation of the Basel III CCB. It differs slightly from the "pure" Basel version only insofar as that it was restricted to domestic residential mortgages, whereas the CCB outlined in BCBS (2010) does in principle apply to all assets.

control for inter-bank differences in borrower characteristics only on the basis of observables. Furthermore, we are able to observe both the willingness to make a loan (like for instance Jiménez et al., 2012) *and* the pricing. This is helpful because a contraction of the supply curve in the volume price space may result in either. To examine how mortgage request characteristics shape the CCB effect, we can take lender fixed effects to analyze how borrower risk translates into mortgage pricing before and after the CCB. This allows us to go beyond merely assessing the aggregate rise in lending spreadsFourth, we can examine possible leakage effects within mortgage supply as we compare the mortgage pricing of insurers to that of banks.

As indicated above, the Swiss law making the CCB available as a policy tool lists with equal weight two goals of the counterccyclical capital buffer. First, banks are to hold more equity capital to bear potential losses and thus become more resilient to potential credit losses. Our paper abstains from analyzing whether banks have indeed strengthened their capital base after the CCB's activation. But it assesses whether better capitalized banks, banks with more corporate or reserve capital and banks which have just increased their equity capital respond differently to the CCB. Second, the CCB is to slow down lending growth during booms. This paper examines whether banks become indeed more or less reluctant to make new mortgages, how the effect of the CCB on pricing depends on bank characteristics, and whether banks charge extra for very risky mortgages before and after the CCB's activation. This contribution is of value for assessing the effects of the CCB, but also more widely for assessing the effects of other changes in regulatory capital requirements.

3. Data

The online platform Comparis intermediates many financial services for private households and it provides us with the data of their mortgage platform. Customers pay CHF 148 (about USD 160 as of 2014) and submit comprehensive information on the real estate property to be bought, their household finances and the requested mortgage amount and maturity model. Comparis sends the anonymized customer request to different mortgage lenders. As common in Switzerland, banks and big insurance companies constitute the supply side on the Swiss mortgage market. Having screened the customers, mortgage lenders then decide whether to make a binding offer and at which mortgage rate and conditions. Bank offers can however not deviate from the requested mortgage amount.

This dataset forms the backbone of our paper and it has several remarkable features that suit our empirical analysis. First, it allows us to distinguish between mortgage demand and supply. In particular, we observe several distinct offers by lenders on the aggregate supply curve for each mortgage demand request instead of a market outcome. Second, all lenders receive exactly the same set of anonymized information on the customer and the underlying real estate property. For our analysis, we can draw on exactly the same set of borrower information as banks do, plus all details on offers and conditions subsequently received by applicants. This allows us to analyze the role of hard information on this specific mortgage request from potential confounding factors arising through soft information and pricing based on other relationships between the bank and the borrower.[15] Third, lenders do neither know which competitors participate nor do they observe the details of their competitors' offers either before or after making their submission. These features assure that lenders submit binding offers that truly reflect their eagerness to bid for the

[15] See Brown and Hoffmann (2013) for the role of other bank relationships in the Swiss retail market, and Puri et al. (2012) for the role of relationship lending in neighboring Germany.

mortgage without distorting aspects of competition or superior knowledge. Fourth, since the request is costly and since offers are binding conditional on verifiable information, customers have an incentive to submit correct information. Fifth, our dataset contains different types of lenders active in the Swiss mortgage market from different banking groups (cantonal banks, regional banks, cooperative banks, foreign banks) and even insurers companies. The only group not represented here are Switzerland's two globally systemically important banks (GSIBs). For the two GSIBs domestic mortgage lending is not a core business activity and furthermore their risk weights and hence capital requirements are computed using the Internal Ratings Based (IRB) approach rather than the Basel Standardized Approach (SA) described in this paper and used by all other banks.

To avoid any distortions, we restrict our view to 10 year fixed rate mortgages which account for more than half of requested mortgage models (see our companion paper Basten and Koch [2014]).[16] While some offers carry only a single rate for the entire mortgage, others carry different rates for different tranches. In that case we compute the tranche-weighted average mortgage rate for each offer.

Figure 1 shows the exact timing of events: On June 1, 2012, the Swiss Federal Council adopted the revised Capital Adequacy Ordinance, laws regulating the implementation of the Basel III banking regulation in Switzerland. In general the new Basel III provisions entered into force on January 1, 2013, whereas the Countercyclical Buffer (CCB) could in principle have been activated as early as July 1, 2012. At the same time, new mortgage market regulation was adopted on June 1, 2012, and entered into force on July 1, 2012. [17] For us, this means that the

[16] We repeat our analyses with the 2nd most frequent category of 5 year fixed rate mortgages yields the same conclusions as detailed below.

[17] For details, see FINMA (2012a), FINMA (2012b) and SNB (2013b).

point at which the CCB became available as a policy tool coincided with other relevant changes, whereas the point at which it was activated did not. We hence focus on analyzing the effects of its activation, which we consider the more policy-relevant event, for two reasons. First, national regulators have little discretion with regard to the adoption of the respective laws, given the Basel III requirements. Yet, they do have full discretion about whether, when and how to activate a CCB. Second, the adoption of the relevant laws occurs only once per jurisdiction, whereas the activation can be adjusted whenever national regulators deem this useful. This said, the reader should be aware that in addition to the activation effects analyzed in this paper, there may have been effects of the mere availability of the CCB, and any reader interested in the joint effect may wish to view our results as a lower bound on those. At the same time, given the advantages of our dataset, we focus on investigating the heterogeneity of the effect across lender (supply) and borrower (demand) characteristics rather than estimate some average effect of the CCB. Given these considerations, we define the CCB=1 or treatment period as starting with the activation on February 13, 2013. As CCB=0 or control period we use data from July 1, 2012, so as to ensure complete homogeneity of the sample with respect to the other mortgage market regulation as well as the adoption of the Basel III laws.[18] The end of our sample in October 2013 is dictated by data availability, since after that date Comparis adopted a new business model for their mortgage platform.

Table 1 presents our database in terms of demand and supply participation. Column (1) refers to the period CCB=0. Column (2) ranges from the activation of the CCB on February 13, 2012 until

[18] Hence we consider the general Basel III provisions to have taken effect at the latest from June 1, 2012, when the laws were definitely adopted, and not only from January 1, 2013, when they entered into force. This makes sense because we would expect to adjust their behavior at the latest once the new requirements are known to be definite, for later adjustment would be expected to be more costly. By the same token, we consider the CCB activation to be effective from its announcement on February 13, 2013, and not only from the end of the transition period in September 2014. This makes all the more sense since our outcome of interest is the pricing of lending and hence adjustments on the asset side, rather than adjustments on the liability side which banks might not always be able to make in small steps.

the end of our sample on October 24, 2013 (CCB=1). Our data on mortgage demand show that the number of requests declines slightly over time. We attribute this to the fact that initially Comparis was the only major online mortgage platform in Switzerland, whereas later other platforms went online, too. However, the average LTV remains at about 65%, such that the composition of applicants appears to be stable over time[19]. Furthermore, in our empirical analysis below month fixed effects are to absorb any aggregate changes that might affect all lenders.

Turning to mortgage supply, Table 1 exhibits a declining total number of answers for both lenders in total as well as individually. Customers receive on average 5.9 (=3873/661) answers in the period before the CCB shock and 4.8 (=2461/516) answers after it. Most importantly, the shares of offers and rejections relative to the total number of answers are fairly stable over time. On average, 85.54% of received answers are offers before the activation of the CCB and 87.2% after it. Table 1 also displays a rise in offered interest rates over time. Both banks and insurance companies charge higher rates in later periods. Cross-sectionally, insurance companies generally seem to offer cheaper rates, as do mortgage-specialized banks.

Indeed, our sample's rising interest rates (not conditioning on request characteristics or the CCB activation) in later periods reflect a general trend starting at the beginning of 2013. Figure 3 shows the average offered mortgage interest rate in the sample and contrasts it with the evolution of the Swiss 10 year swap rates and the Swiss 10 year government bond yield. In our analysis we account for this upward trend in interest rates by including the Swiss 10 year swap rate as a refinancing control variable and further add monthly time dummies to absorb any other general economic developments.

[19] We also run a difference in means test to check whether the LTV ratios of customers that banks and insurers send offers to change over time. We do not find a significant difference between both periods.

To investigate how representative our sample of mortgage suppliers is of the Swiss mortgage market overall, we compare our bank-level data as published in annual reports. to the data from the most recent report by the Swiss National Bank (see SNB [2012]), which contains information on the distribution of mortgage lending across cantons and across LTV buckets. Table 2 shows the comparison. Following the SNB statistics, we compute the share of all extended mortgages in Switzerland by locational canton of the real estate property in Column (1a) and sort the cantons by rank order of the entire Swiss market. Column (2a) gives the share of requested mortgage volumes by locational canton and Column (2b) gives the share's rank according to our sample. The last two columns replicate the share and its rank in our sample but draw on the un-weighted average of requests instead of weighting by requested mortgage amounts as in previous columns. The figures show that our sample is quite representative, covering not only the most densely populated cantons like Zurich but also the more rural ones. More formally, we can compute the $\chi 2$ statistic to test the null hypothesis that both represent the same underlying distribution. Doing so yields test statistics between 5 and 6, depending on whether we look at the volume or number of requests. These values are far below the relevant critical values to reject the null (starting from about 34 for 25 degrees of freedom), so we can confidently conclude that our sample has no geographical bias relative to the entire Swiss mortgage market,-

To assess whether our sample is also representative in terms of customer risk characteristics, we construct three categories of loan to value (LTV) buckets given in the SNB statistics. In the entire Swiss mortgage market, about 92.4% of all issued mortgages fall into the lowest LTV bucket below 67%. This compares well with our sample, in which 91% of all requested mortgages fall into this bucket. As to more risky mortgages in the medium category of LTV ratios above 67% but below 80%, data on the entire Swiss market say that 5.7% populate this bucket. In our sample, 8.2% of all mortgages populate that medium bucket. The top bucket

ranges from LTVs above 80% to 100% and is filled by 1.9% of the entire Swiss market, whereas only 0.8% of our sample fill this bucket. These small differences between both samples in the most risky buckets likely derive from the fact that data on the entire Swiss market unfortunately are only available for the stock of all mortgages held by banks. By contrast,, our sample focuses on mortgage requests submitted after July 2012 when stricter rules on LTV ratios above 80% and tighter rules on household equity became effective.

Next, we can also compare the household financial variables in our sample to summary statistics from the Swiss Household Budget Survey (HBS). Our summary statistics in the top panel of Table 6 show a mean (median) gross annual household income of CHF 178'600 (157'500) and mean (median) household wealth of CHF 527'230 (320'000). To readers not familiar with the Swiss context, this will likely sound extremely high. Yet, one must keep in mind that the price level is equally high so that for instance average loan-to-value and debt-to-income ratios are similar to those in other countries. We can compare these numbers to the average household income (wealth is not available there) in the HBS, which for home owners amounts to CHF 151'000 on average and rises to between CHF 157'000 and CHF 167'000 for households with respectively 1 and 3 children. This partly corroborates the generally higher price and income levels in Switzerland, although we note that if anything the households in our sample have incomes (and hence target homes) slightly above the average of the entire Swiss market.

Overall however we infer from these figures, that our sample's composition in terms of charged interest rates, borrower characteristics and geographical distribution proves relatively stable and representative.

4 Empirical Analysis

This section presents both our empirical approach and our results, structured by three questions of interest. After presenting a decomposition of mortgage interest rates as a conceptual basis in Subsection 4.1, we first analyze whether specific balance-sheet characteristics render a bank more sensitive to the CCB's regulatory design in Subsection 4.2. Second, we assess the effectiveness of risk-weighting schemes that might amplify the CCB's effects in Subsection 4.3. Third, Subsection 4.4 compares the responses of respectively banks and insurers. Subsection 4.5 summarizes our robustness checks.

4.1 Decomposing the Mortgage Interest Rate

To structure our ideas about how the additional capital requirements imposed by the CCB affect mortgage lending rates, we resort to the interest rate decomposition used in Button et al. (2010) tailored to our mortgage setup in Equation (1).

$$rate_{ijt} = funding\ cost_{jt} + credit\ risk_{ijt} + residual_{jt} \quad (1)$$

The rate offered by bank *j* to customer *i* comprises the *funding cost* of bank *j* at point in time *t*, the *credit risk* that bank *j* associates with the riskiness of the borrower *i* and a *residual*. We follow Button et al. (2010) and ascribe funding cost to external funding which should remain unaffected by the CCB. The *credit risk* features two cost components: first, the *cost of the expected loss (EL)* linked to the new loan and second the *cost of holding equity capital* that absorbs the *unexpected* losses linked to the new loan. To compute the *cost of the expected* loss, Button et al. (2010)

define the *loss given default (LGD)* as an increasing function of the LTV ratio. To compute the *cost of holding equity capital*, Button et al. (2010) refer to regulatory capital requirements. At this point, the CCB's higher capital requirements come into play such that extra equity capital worth 1% of risk-weighted mortgages translates into higher *cost of equity capital* in Equation (1). As the average risk weight increases with higher LTV ratios, risk-weighting schemes might amplify the CCB effect. Subsection 4.3 elaborates on this mechanism of LTV threshold effects. The residual in Equation (1) captures bank *j*'s operating costs as well as a targeted mark-up over marginal costs. The CCB requires banks to hold extra equity capital worth 1% of all previously issued, risk-weighted mortgages on its balance sheet. However, these mortgage contracts have been concluded in the past. Hence, the CCB ceteris paribus squeezes mark-ups, especially for banks with a mortgage-concentrated asset portfolio. In parallel with Button et al. (2010), we call this a "back-book" effect as the CCB lowers the return on existing assets. In an attempt to restore its mark-up, a bank can raise its mortgage interest rate. Section 4.2 features a bank's degree of business specialization in mortgage lending as one sensitivity measure that interacts with the CCB's effect and thus drives the mortgage rate. Further, banks might also increase their mortgage rates to rebuild their profit margins to compensate for the current environment of scarce profitable investment opportunities. Finally, a bank might also perceive the CCB activation as a signal and hence feel inclined to raise prices more than can be explained by higher capital costs alone.

4.2 Sensitivity Measures linked to a Bank's Balance Sheet Characteristics

In this subsection, we restrict our focus to banks and zoom in on how balance sheet characteristics drive their individual pricing of mortgages. We can thereby analyze whether

certain balance sheet characteristics render a bank particularly sensitive to the CCB's regulatory design. To tackle potential endogeneity concerns, we exploit bank-level data from public annual reports lagged by one year, i.e. of the years 2011 and 2012.

Our sensitivity indicator assigns banks to two groups depending on whether a bank's sensitivity level as indicated by the past year's balance sheet lies below or above the median of all participating banks in that current year. The sensitivity indicator itself enters our estimations and we further interact it with a CCB activation indicator to investigate to what extent the sensitivity measures reinforce the CCB effect.

4.2.1 Definition of Sensitivity Measures

Excess Capitalization as a Measure of Being Capital Constrained

Here we distinguish between ***constrained*** and unconstrained banks, where the former are defined as banks whose excess capitalization was below the median excess capitalization of all participating banks. Banks must ensure not only that they remain solvent, but also that they do not violate regulatory capital requirements, because violations will trigger regulatory action and having to raise additional equity at short notice can be very expensive. On these grounds the capital buffer hypothesis stipulates that banks that have reached their internally defined buffers above regulatory requirements will seek to maintain these buffers by adjusting capital and risk-weighted assets in line with each other, whereas banks currently below their target buffers will seek to improve their capitalization by a combination of increasing their absolute level of capital and decreasing their risk-weighted assets. While banks' target buffers are not observable to us, we can approximate a bank's difference to its target capitalization with its current buffer level. This implies that when requirements are increased through the CCB, banks with already low buffers will come under even more pressure to adjust and will have to adjust their lending relatively more than banks with comfortable buffers. To test this, we follow Gambacorta and

Mistrulli (2004 and 2014) in focusing on "excess capitalization" defined as actual capitalization minus regulatory requirements relative to the regulatory requirements. As explained in Jans and Passardi (2013), the supervisor FINMA has assigned Swiss banks to five target and intervention threshold groups depending inter alia on their balance sheet size. Hence, two banks with the same equity ratio may have different levels of excess capitalization if FINMA has put them into different groups with different regulatory equity capital requirements. We proxy excess capitalization as the percentage deviation of the equity ratio from this regulatory intervention threshold.[20] In their quantitative impact study, Cournède and Slovik (2011) state that for banks maintaining a discretionary capital buffer, the impact of higher capital requirements on lending spreads might be lower. Based on empirical evidence, Gambacorta and Mistrulli (2014) find that banks with higher excess capitalization shield their customers during financial crises. This is because banks with comfortable excess capitalization have more degrees of freedom. They can still freely conduct their mortgage business and do not need to worry about violating the regulatory intervention threshold. Yet, banks which are close to the intervention threshold calibrate the mortgage rate to the tradeoff between approaching the threshold and reaping additional profits. We therefore anticipate that banks with little excess capitalization deemed ***constrained*** in our framework on average charge higher rates. When the CCB was activated, these banks became even more constrained charging even higher rates as a compensation for granting a mortgage.

Specialization and Business Focus

[20] We focus on total capital, as this is available in public balance sheets. Since the CCB is to be provided entirely in the form of Tier 1 capital, another possibly relevant measure would be being constrained in terms of Tier 1 capital. While a bank's Tier 1 capital buffers may differ somewhat from its total capital buffer, results based on Tier 1 buffers can be expected to be similar, because we use the robust measure of whether or not a bank's buffer is below the sample median. Hence a bank that is e.g. at the 20th percentile in terms of its Tier 1 buffer but at the 40th percentile in terms of its total capital buffer would nonetheless end up in the same below-median group and only banks with one buffer below and the other above the median would lead to different results when using alternative definitions of equity capital.t

Mortgage-focused banks, defined as banks whose ratio of mortgages to equity capital lies above the median of all banks, might be more sensitive to the CCB's particular design in Switzerland due to the "back-book effect" discussed above. In general, we put forward that banks with a higher share of mortgages on their balance sheets benefit from specialization in the mortgage business. These banks can pass their gains from economies of scale on to their customers by charging lower mortgage rates. Furthermore, against the background on relationship lending, Gambacorta and Mistrulli (2014) find that banks with a business focus on retail lending protect their corporate customers during financial crises. However, the CCB as designed in the Swiss context applies exclusively to residential mortgage lending while sparing other bank businesses. As it applies to all residential mortgages on balance sheets, the CCB bites even more into the equity of banks reporting a high share of mortgages in their asset portfolio. Yet, the rates on mortgage contracts concluded in the past cannot easily be adjusted to the CCB's increased capital requirements. For this reason, we expect that banks with a very mortgage intensive portfolio per unit of equity and a business focus on mortgage lending respond more strongly to the CCB's activation.

Capitalization

Capitalization considers whether a bank is better capitalized than the median of all banks in terms of its equity capital to total assets (*Equity Capital/TA*) ratio. We further decompose the capitalization measure into indicators of whether the corporate capital ratio (*Corporate Capital/TA*) and the capital reserves ratio (*Capital Reserves/TA*) exceed the median of all banks. This measure complements the previously presented *Constrained* indicator, and our argument runs in parallel. Banks with low capital ratios should be willing to expand their mortgage lending only in return for higher mortgage rates.

The expenses or figurative price of raising different kinds of equity capital motivates our distinction between corporate capital and capital reserves. Banks might find it easier to increase their equity capital by retaining more of their earnings instead of annoying shareholders by diluting the value of their shares upon issuing new corporate capital. For this reason we hypothesize that banks which have relatively more corporate capital as opposed to retained earnings might feel pressured to generate higher profits to cater to their shareholders and thus charge higher rates. As the CCB imposes even higher capital requirements, we assume that the CCB reinforces this mechanism.

Equity Capital and Mortgage Growth Rates

To analyze how banks that have preemptively strengthened their capital base or cut mortgage growth respond to the CCB, we use indicators of whether the ***growth rates*** of equity capital (Δ*Equity Capital*) and mortgages (Δ*Mortgages*) lie above the median among all offering banks in our sample. We assume that banks which have recently increased their CET1 capital feel relatively freer to follow a profit maximizing strategy. Expected effects depend on how profitable banks deem the mortgage business. After the CCB shock, banks which have recently increased their equity ratio should be able to cushion the extra equity levy on mortgages. By contrast, banks which have recently experienced substantial mortgage growth might follow a strategy to expand their market share. For this reason we expect these banks to offer cheaper mortgage rates to their customers before the CCB's activation. As the CCB's regulatory design exercises a stronger effect on banks with a lot of mortgages on their balance sheets, one might expect that these banks might revise their strategy and increase mortgage rates relative to the pre CCB period.

Retail Banks

In an attempt to proxy the ***business model of retail banking***, we resort to the ratio of customer funds to mortgages (*Customer Funds/Mortgages*) and construct an above median indicator on

whether the bank's funding of mortgages is higher than the median among all banks. We hypothesize that banks in the retail business have more local expertise and can thus charge lower rates in general. As taking deposits usually goes hand in hand with mortgage lending, these banks are usually highly exposed to the mortgage market and thus carry a lot of mortgages on their balance sheets. We thus assume that these banks raise their mortgage rates after the CCB's activation to pass on the additional costs to their customers,

Return on Equity

Finally, we study the ***return on equity (ROE)*** which has a twofold interpretation. On the one hand, it should proxy for a bank's profitability, on the other hand it might proxy for the cost of equity capital. We hypothesize that ***profitable banks*** also have more degrees of freedom to act and exhibit lower sensitivity to the CCB effects. Jiménez et al. (2012) find a positive effect of bank profitability on interest rates which might stem from the fact that more profitable banks charge higher rates as they can select among borrowers and are not forced into less profitable deals. Yet, ROE also serves as cost of equity proxy. If the Modigliani-Miller Theorem (1958) holds and the marginal cost of capital equals the marginal cost of debt finance, then a change in the equity-debt finance structure imposed by regulation should not affect banks' total refinancing cost and should hence not affect their mortgage pricing. If by contrast equity finance is more expensive than debt finance, as contended by many bankers, then an imposed increase in the equity finance share should increase banks' funding costs and, to the extent to which this is passed on, lead to higher mortgage rates.[21] Banks with high costs of equity funding should be more reluctant to make mortgages. In particular, banks whose cost of equity finance exceeds the median of all banks should be more restrictive as mortgage lending requires banks to hold

[21] Junge and Kugler (2013) find for a sample of five publicly listed Swiss banks that the elasticity between a bank's leverage and its CAPM-β is about 55% of what it would be if the Modigliani-Miller theorem did fully hold.

relatively more equity relative to other asset categories. As the CCB affects the equity capital requirements, we assume that banks with higher or relatively higher equity funding costs demand extra compensation by charging relatively higher mortgage rates.

4.2.1 Estimation Approach

Equation (2) describes our estimation procedure with the tranche-weighted mortgage rate $rate_{ijt}$ offered by bank *j* to requesting customer *i* at point in time *t* as left-hand side variable.

$$rate_{ijt} = \alpha_1 + \beta_{11} sens_{j,201x} + \beta_{12} ccb_t * sens_{j,201x} + FE\_request_i + FE\_lender_j + \varepsilon_{ijt} \quad (2)$$

To study the general impact and particular effects that unfold after the CCB shock materializes, we let the bank-level sensitivity indicator $sens_{j,201x}$ and its interaction with the CCB shock dummy ccb_t enter our estimation. These time-varying sensitivity measures originate from the respective bank's annual public report of the previous year, i.e. of 2011 or 2012. To absorb customer characteristics including its financial situation, mortgage risk, location related effects and the real estate property type, we add request fixed effects $(FE\_request_i)$ to our specification. This allows us to zoom in on the within request variation and to compare the pricing of different sets of banks. Note that controlling for request fixed effects (with each request having taken place either before or after the CCB activation) means that we cannot at the same time estimate an average effect of the CCB in this section. Our procedure follows Puri et al. (2011), in that the equation contains no ccb_t term on its own. Instead we focus on how the CCB effect interact with bank characteristics. To absorb *time-invariant* heterogeneity among lenders, we also add lender fixed effects[22]. We compute heteroskedasticity robust standard errors, but do

[22] We run two robustness checks for the sensitivity analysis which are exhibited in the Online Appendix. First, we drop the lender fixed effects in Table A, but our core results remain virtually unaffected. Second, we define the median indicator for the set of banks offering for each specific request instead of all participating banks in our sample. Again, as shown in Appendix Table B, our results remain intact.

not cluster them by bank as the number of clusters would be too low and as cluster size differs considerably across lenders.

4.2.2 Descriptive Statistics

Table 3 shows our descriptive statistics on the sample of bank offers only. In the upper panel, it gives customer characteristics of the requests to which banks respond with an offer. The mean offered mortgage rate amounts to 208 bp and the mean indicated LTV ratio by the customer lies at 65%. One caveat applies to the first panel: the indicated request characteristics are by construction of our sample artificially inflated as this sample draws on multiple offers per individual request. The second panel gives the bank sensitivity dummies, while the third panel refers to the underlying levels. To highlight some sensitivity measures, Table 3 indicates that banks report an excess capitalization of 40.58% above the regulatory capital coverage ratio. Banks further invest 974.40 CHF into mortgage lending per 1 CHF of equity. The equity capital ratio (un-weighted CET1 ratio) lies at 7.3% with the capital reserve ratio exceeding the corporate capital ratio. Equity has grown annually by on average 6.64% between 2010 and 2012, whereas mortgage volumes have grown by on average 8.6%. The average ROE lies at 4.69% which ensues from our sample of rather small banks, retail banks and cantonal banks.

4.2.3 Results

Table 4 displays our estimation results from a regression of the offered mortgage rate on the different sensitivity measures and their interactions with the CCB dummy (*CCB*) indicating that its tighter capital requirements enter into force.

Different columns relate to the inclusion of a sensitivity dummy indicating whether the respective sensitivity measure lies above (or below in case of being *Constrained*) the median among all participating banks and the interaction of this sensitivity dummy with the CCB

activation indicator. As evidenced by Table 4, most of our results broadly align with our expectations on sensitivity concepts, but some results related to capitalization establish a contrast.

Excess Capitalization as a Measure of Being Capital Constrained

Results in Column (1) point out that *capital-constrained* banks *raise* their rates by on average 6.3 bp more after the CCB's regulatory shock to capital requirements than do their unconstrained peers. This positive estimate on the interaction term reflects that banks which are close to the intervention threshold become even more constrained once the CCB is activated. Indeed, the CCB raises the intervention threshold while squeezing excess capitalization. Banks now charge an even higher mortgage rate that reflects their tradeoff between approaching the now even closer threshold and forgoing additional profits. The simple *Constrained* indicator is insignificant. Apparently before the CCB's activation, banks that are closer to the intervention threshold still enjoy sufficiently many degrees of freedom to make mortgages whose pricing does not reflect their low excess capitalization. We highlight these results on constrained banks as the first core finding of our paper which matches the predictions of the "capital buffer theory" described above.

Specialization and Business Focus

Results on the ratio of *Mortgages/Equity Capital* in Column (2) reveal that banks that specialize in the mortgage business submit offers which are on average 7.7 bp cheaper than those of their competitors. After the CCB activation, however, these banks increase their mortgage rates by on average 6.5 bp. The higher capital requirements force banks to hold more equity capital for each mortgage unit already on their balance sheets. Some of that additional cost on their existing portfolio is hence passed on to new customers

We highlight these results on mortgage specialized banks as the second core finding of our paper which is in line with the "back-book effect described in Button et al. (2010).

Capitalization

Results in Columns (3) through (5) show that well capitalized banks charge on average lower rates after the CCB activation but the equity capital's split into corporate capital and capital reserves reveals that capital reserves drive this finding. Banks with *Equity Capital/TA* above the median charge on average 8.9 bp less than their competitors after higher capital requirements come into force. Interestingly, our estimate on the CCB's interaction with corporate capital points into the opposite direction. Banks with above median *Corporate Capital/TA*, charge almost 5 bp less before the CCB's activation, but 8.3 bp more after it. Our estimate on the CCB's interaction with capital reserves matches the result on the equity capital composite. Banks with above median *Capital Reserves/TA* charge 8.7 bp less after the CCB became effective. One might interpret this in light of the efforts or the figurative price associated with holding or raising both types of equity capital. Banks might face less opposition from existing shareholders when strengthening their capital base by retained earnings than by diluting the value of their shares by issuing new corporate capital. Further, a higher share of corporate capital means that shareholders demand relatively more compensation, whereas capital reserves do not. For this reason banks that report higher levels of corporate capital might feel under pressure to generate higher profits after the CCB's activation by charging higher mortgage rates to pay higher dividends. One of our robustness checks incorporates the equity capital ratio and its components instead of the median indicators, but arrives at the same conclusions.

Equity Capital and Mortgage Growth Rates

Columns (6) and (7) examine the growth rates of equity and mortgages. The negative coefficient on Δ*Equity Capital* shows that banks which have strengthened their equity capital

more than below median competitors generally charge 4.8 bp less. One might think of these banks as disposing of more "free capital" to seize investment opportunities. The CCB's activation now utilizes some of these degrees of freedom which might explain the positive and significant interaction terms. In other words, banks that have recently strengthened their equity capital become more reluctant to make mortgages after the CCB by charging on average 2.6 bp more. Public annual reports show that most of the banks in our sample have increased their equity capital by retained earnings while only some banks have issued more corporate capital.

The negative but significant coefficient on Δ*Mortgages* in Column (7) reveals that banks exhibiting above median growth rates of mortgages entering their balance sheet are cheaper. Yet, the interaction with the CCB is insignificant. For this reason we infer that banks seeking to expand their market shares do so by submitting cheaper offers and continue to do so after the CCB imposes stricter capital requirements. Apparently, the banks with high *recent* mortgage growth rates are not necessarily the same as those with already very mortgage intensive balance sheets.

Retail Banks

Column (8) relates to how banks finance their mortgage issuance. Our results on *Customer Funds/ Mortgages* point out that banks which finance a higher share of their mortgages through customer funds charge on average 22.3bp less than their competitors with below median refinancing ratios. We attribute this finding to retail banks feeling more confident in the mortgage business with a lot of expertise on the local market. The interaction with the CCB turns out to be insignificant. Apparently these specialized banks continue making good offers also after the CCB activation. This finding complements our previous result on Δ*Mortgages* and *Mortgages/Equity Capital*. We infer that banks with a standard retail business model based on deposits and mortgages submit in general cheaper offers. After the CCB, however, banks pass on higher costs

ensuing from their balance sheet burden of mortgages to customers. Whether or not these banks have recently expanded their mortgage portfolio and the refinancing of these mortgages does not shape their response to tighter capital requirements.

Return on Equity

The estimate on the interaction of *ROE* and the CCB in column (9) carries a negative coefficient while the ROE coefficient itself is insignificant. In light of this result, we prefer to interpret ROE as a profitability measure rather than as a measure of equity cost. Thus, more profitable banks charge less after the CCB imposes stricter capital requirements. This finding fits with our results on *Capital Reserves/TA* as higher retained profits feed into capital reserves. Jointly considered, we conclude that very profitable banks that build up equity capital through retained earnings do not curb their lending after the CCB but offer cheaper rates instead. A robustness check using the return on assets (ROA) instead of ROE draws the same inferences.

To sum up, we find that capital-constrained banks and banks which carry a lot of mortgages on their balance sheet pass the costs of higher capital requirements on to their customers. By contrast, very profitable banks or banks with substantial shares of retained earnings as equity capital lower their rates and continue mortgage issuance independently from their recent mortgage growth and their refinancing model.

4.3 Do LTV Threshold Effects amplify the CCB effect?

This subsection unfolds the request-level dimension to study whether LTV thresholds that are associated with risk-weighting schemes of a bank's assets amplify the effect of tighter capital requirements imposed by the CCB.

The CCB shock increases a bank's equity requirements per unit of risk-weighted mortgage lending. This design applies to all mortgages issued in the past that form part of a bank's balance sheet and it applies to all new mortgages that a bank intends to make. Facing new mortgage demand, banks that are close to or below the regulatory equity requirement, can either raise their equity or restrict mortgage lending. In the latter case, a contraction of the supply curve can either show up in our data on the quantity side as a reduced propensity to make an offer, or on the price side as higher mortgage rates offered. As the bank-specific CCB effect ensues from its composite of risk-weighted residential mortgages, the distinct LTV ratios of individual mortgages on bank balance sheets matter.

Figure 4 illustrates how risk-weighting schemes translate the individual customer's loan-to-value (LTV) ratios into capital requirements for the offering bank and thereby link the riskiness of the mortgage to the capitalization of a bank. The tranche of a mortgage above a customer's LTV ratio of two-thirds (66%) receives a risk weight of 75%, while the mortgage tranche with LTV ratios below two thirds receive a risk weight of just 35% (see FINMA [2013a]). The top tranche above the LTV ratio of 80% receives a risk weight of 100%. Therefore, one may expect banks to pay special attention to the LTV ratios of new customers. This comes on top of the relevance of the LTV as an indicator of the credit risk associated with a loan, alongside the Loan-to-Income (LTI) ratio. In this paper, we focus on LTV ratios explicitly and implicitly we capture other measures by adding control variables to the regression specification

4.3.1 Estimation Approach

Equation (3) describes our regression specification that we run on our sample of banks.

$$\begin{aligned} & rate_{ijt} \\ & = \alpha_1 + \beta_{21} ltv_{it} + \beta_{22} ltv67_{it} + \beta_{23} ltv80_{it} + \beta_{24} ccb_t * ltv67_{it} + \beta_{25} ccb_t ltv80_{it} \\ & + \gamma_{20} refin_t + \gamma_{21}' CUSTOM_{it} + FE + \varepsilon_{ijt} \end{aligned} \tag{3}$$

We regress the tranche-weighted mortgage rate $rate_{ijt}$ offered by bank *j* to requesting customer *i* at point in time *t* on the customer-specific LTV ratio, two dummies *ltv67* and *ltv80* indicating whether this LTV ratio equals or exceeds respectively 67% or 80%, as well as the interactions of these dummies with CCB activation indicator. To control for aggregate supply effects such as refinancing conditions, we include the Swiss 10-year swap rate ($refin$). To control for the individual traits of non-repeated requests, we add individual customer characteristics such as income, wealth, an indicator of other debt and age. We further again include lender fixed effects. And, to control for aggregate demand effects across individual requests, we add month[23], property type and domiciled canton fixed effects. Standard errors are robust for the same reasons as previously specified.

Due to the higher risk as well as higher risk weights, we anticipate that generally banks put an extra levy on LTV ratios above 66% ($\beta_{22} > 0, \beta_{23} > 0$). After the activation of the CCB, very high LTV mortgages bite even more into the equity capital. We hence assume that banks charge higher mortgage rates after the CCB shock, as they require extra compensation for the additional equity capital that they have to hold ($\beta_{24} > 0, \beta_{25} > 0$) for the bank sample. If however these threshold LTV ratios merely reflect a risk premium instead of the risk-weighting schemes, the amplification effect of β_{24} and β_{25} is probably muted.[24]

4.3.2 Results

Table 5 presents our results on banks. It points out that LTV per se is insignificant, but banks charge on average more than 2 bp extra on the entire mortgage for LTV ratios exceeding 67% and on top of that another 1.5 to 1.8 bp on LTV ratios exceeding 80%. However both interactions

[23] We use monthly time fixed effects while splitting the event month February 2013 into two parts.

[24] The payment to income (PTI) ratio, the other common measure of mortgage riskiness next to the LTV ratio, is not in focus here, Implicitly capture it by adding control variables to the regression specification

of the CCB with the high LTV dummies turn out to be insignificant. Thus the risk-weighting scheme does not amplify the CCB effect. We stress this as the second core finding of our paper. One likely reason for this result is the fact that escalating risk weights apply only to the mortgage tranche in excess of the 66% or 80% LTV threshold and not to the entire mortgage. Our alternative hypothesis suggests that LTV threshold indictors just signal very risky mortgages inducing lenders to charge a risk premium. In that case, risk-weighting schemes might indeed prove to be ineffective when capital requirements on behalf of the bank become stricter but lending standards with respect to the customer characteristics remain.

We briefly discuss our results on control variables to assess whether our regression specification yields reasonable results. The estimated coefficient on the swap rate states that a 100 bp increase in the swap rate translates into an increase of the average mortgage rate of about 74 bp. A hint at the fact that many of our participating banks substantially draw on retail instead of wholesale funding can rationalize this number. We further find that a 100 bp increase in the specified income or wealth (entering our regression in logs) of the customers reduces her mortgage rate by on average 3 or 0.8 bp, respectively. Coefficients on the indicator of other private debt or the customer's age do not yield significant estimates. This leads us to use the regression specification of column (3) as our preferred set of control variables which incorporates income and wealth but ignores insignificant customer characteristics.

We conclude from this experiment that LTV thresholds most likely signal very risky mortgages which induce banks to charge a risk premium. Indeed, LTV thresholds do not amplify the CCB effects for banks which hints at the weak nexus between risk-weighting schemes and capital requirements as commonly applied in the framework of Basel III.

4.4 Banks and Insurers as Competitors on the Mortgage Market

Two different types of mortgage lenders provide their services on the Comparis mortgage platform: banks and insurers. As insurers are exempt from the regulatory framework of Basel III, the CCB applies exclusively to banks, but not insurers. However, the CCB might affect insurers indirectly, as the CCB changes the costs of their competitors. If insurers expect this to lead to higher prices on the bank side, they may see this as an opportunity either to underbid banks and hence increase their market shares ("policy leakage") or to also raise prices and thereby to increase their profits per unit of mortgage lending. Furthermore, insurers may also respond to the signaling channel mentioned above for banks, namely understand the CCB as a signal from the central bank about increased risks in mortgage lending. After three simple comparison of mean tests in Table 7 a to c, we run regressions including both types of lenders to compare the lending behavior of banks and insurers before and after the CCB's stricter capital requirements became effective in Table 7 d.

Acceptance Rates

Table 7 a compares the acceptance rates of banks and insurers before and after the CCB's activation. Its last column shows that banks are more likely to respond with an offer in both periods and this difference in acceptance rates does not significantly change over time. Its last row states that, if anything, banks and insurers become slightly more likely to submit offers after the CCB was activated. We infer from this comparison of means that any CCB on the willingness to make loans operates through pricing rather than through the propensity to offer.

That said, we can analyze the pricing of offers without having to worry that offers may be selective. This focus on loan pricing as opposed to the decision whether or not to make an offer also aligns with the arguments of Hanson et al. (2011) and the literature based on quantitative

impact studies (see for instance Elliott [2009], Cosimano and Hakura [2011] or Cournède and Slovik [2011]).

For this reason, we resort to standard regressions below, using the mortgage rate as independent variable instead of further investigating the approval rates of lenders.

Changes in the composition of demand?

One might object however that the CCB implicitly alters mortgage demand and its composition. In this sense, households might anticipate that banks become more reluctant to lend and shy making very risky mortgages. To address this concern, we refer again to Table 1. It shows that despite the lower number of requests during the CCB=1 period, the average applicant's LTV has not changed much. This runs counter to households fearing to be declined for requesting high LTV ratios. To further check whether changes in the composition of mortgage demand do not distort our results, we run a difference in means test on the LTV ratios requested by the customers. Results in Table 7 c show that these LTV ratios do not change over time and there is no significant difference between banks and insurers as to which LTV ratios they reject. We first conclude that banks and insurers do not exhibit different preferences for LTV ratios in terms of their willingness to lend. Later, however, we will show that they price the very risky mortgages differently.

Mortgage Rates

Table 7 b compares the offered mortgage interest rates of banks and insurers before and after the CCB activation. The last column points out that banks charge higher mortgage rates in both periods with no significant change in this difference over time. The last row of Table 7 b states that banks and insurers have significantly raised their mortgage rates by on average 30 bp after the CCB came into force. Two caveats are in order. First, this plain comparison of means does neither control for individual customer characteristics and the associated riskiness of a mortgage,

nor does it control for changes in the aggregate interest rate level or any concomitant macroeconomic development. It simply motivates our baseline specification including individual mortgage characteristics and customer controls on the individual level as well as including a refinancing control variable and a host of fixed effects to absorb potentially common driving factors.

4.4.1 Estimation Approach

In order to test for the differences in mortgage pricing of banks and insurers after the CCB's activation we run the following regression.

$$rate_{ijt} = \alpha_1 + \beta_{31} ccb_t bank_j + \beta_{32} ccb_t nonb_j + \gamma_{31} refin_t + \gamma_{32}' MORTG_{it} + \gamma_{31}' CUSTOM_{it} + FE + \varepsilon_{ijt} \quad (4)$$

Equation (4) now specifies our estimation equation while referring to the full sample of banks and insurers. This time, we regress the tranche-weighted offered mortgage rate $rate_{ijt}$ on an indicator whether the offering lender *j* is a bank $(bank_j)$ or an insurer $(nonb_j)$ interacted with the CCB indicator. We further control for aggregate refinancing conditions, mortgage and customer characteristics as well as a host of monthly time, lender, property type and locational canton fixed effects. The interactions here capture the price increase after the CCB was activated, whereas the general price increase was entirely absorbed by time fixed effects in the previous estimation equations.

It is important to recall that insurers are exempt from the CCB and any Basel III regulation. Instead they must follow their own regulation as specified in FINMA (2013b). This regulation states that -- as long as the portion above an LTV ratio of two-thirds is being amortized, the same requirement that became obligatory for banks in July 2012 – any mortgage lending until an LTV of 80% can be fully counted for tied computing tied assets. Hence for insurers we would not expect the same discontinuity in costs at the two-thirds LTV as for banks, but we would expect a

discontinuity at the 80% LTV. However, as these rules do not change during our sample, it is important to control for these LTV effects, we can draw a comparison between banks and insurers with respect to the CCB.

4.4.2 Descriptive Statistics

Table 6 repeats mortgage demand statistics. The first panel refers to the full sample, the second panel isolates banks and the third panel isolates insurers. As the observational unit is the offer and Table 6 features statistics based on multiple offers per individual requests, descriptive statistics are inflated by the number of offers per request. For this reason, we abstain from presenting further details as Table 2 gives un-weighted and more informative details differentiated by banks and insurers.

4.4.3 Results

Table 7 d shows our results on the joint sample of banks and insurers. We sequentially add mortgage characteristics and request controls while the main focus lays on the interaction of the CCB dummy with an indicator of whether the offering lender is a bank (BANK) or an insurer (NONB). This procedure has two advantages. First, we can individually test whether banks and/or insurers have raised or cut their mortgage rates after the CCB's stricter capital requirement for banks came into force. Second, we can run a Wald test as displayed in the last two lines to find out whether the difference between banks and insurers after the CCB activation is significant. We borrow this procedure from Puri et al. (2011) in order to simultaneously include lender and monthly time fixed effects. To control for aggregate demand effects, we include a full set of fixed effects referring to the underlying real estate type and its domiciled canton, using robust standard errors for the previously cited reasons.

Table 7 d accommodates our previous findings that banks and insurers charge higher mortgage rates after the CCB's activation. Banks charge on average 17-18 bp more while insurers charge on

average 26-28 bp more. The last two lines exhibit our result that insurers have raised rates by on average 8.8 bp more than banks. We highlight this finding as the third core result of our paper. One might as well have expected no impact on the insurers (given no direct CCB applicability) or even an attempt to underbid banks (given the existing literature on leakage). Indeed, after the activation many banks and newspapers complained publicly that the CCB would disadvantage them vis-à-vis insurers. [25]

This finding that banks add less to the CCB`s surcharge relative to insurers survives the inclusion of mortgage characteristics with threshold LTV effects as well as control variables on the individual request level. Column (4) displays our preferred specification to contrast the responses of banks and insurers, controlling for an extensive set of request and mortgage characteristics. As opposed to that, Column (7) distinguishes between different banking groups but abstains from running multiple Wald tests. We find that cantonal banks (KANTONALBANK; plus 14 bp), most of which are endowed with an explicit government guarantee, raise mortgage rates less than subsidiaries[26] of foreign banks (FOREIGNBANK; plus 19.5 bp) while other retail banks (OTHERBANK capturing for instance the banks owned by supermarket chains as well as very small savings banks or cooperatives, plus 20.7 bp) lead the price increase. These numbers align well with the estimated range of an 4.8 to 28 bp increase in lending rates as suggested by the literature on quantitative impact studies (see e.g. Elliott [2009], Cournède and Slovik [2011], Cosimano [2011]).These quantitative impact studies however deal with simulations and balance sheet identities to gauge the impact of capital requirements more generally and not specifically with the CCB or the Swiss context.

[25] E.g. bank analysts predicted: „Now [insurers] have the potential to … increase their market share". See Wacker (2013).

[26] In Switzerland, the subsidiaries included in our sample are also subject to the CCB's increased capital requirements.

Our results on banks and insurers however hint at an indirect effect. Insurers apparently expect banks as their competitors to pass on higher costs to their customer. A priori that leaves insurers two possible responses: Either to bid more aggressively for customers than banks and hence to increase their market share, or to bid less aggressively than banks in order to reap more profits. Our results provide tentative evidence that insurers opt for higher profits. The low interest rate environment and scarce profitable, but moderately risky investment prospects on financial markets might explain this finding. Insurers hence anticipate banks to raise offered mortgage rates after the CCB's activation, but apparently insurers increase rates even stronger. In general our findings on insurers bear analogy to the results in Aiyar et al (2012). They show that in the UK higher capital requirements for UK banks have led to a response in the lending also by foreign banks who were not directly affected by the rate increase. The setting differs from ours in that the UK lenders who were not directly affected responded with a more aggressive market stance, i.e. they seized the opportunity to increase their market share. Such a response would have defeated a large part of the purpose of the CCB: It would still have improved the loss absorption capacity of banks, but would have increased the exposure of insurers without improving their loss absorption capacity, and might then have had no effect at all on equilibrium interest rates and mortgage volume growth.

To summarize, our comparison of banks and insurers shows that both charge more after the CCB's shock to capital requirements which actually only affect banks but not insurers. Indeed, banks contribute less to the surcharge after the CCB.

4.5 Robustness Checks

To check the robustness of our results, we repeat the previous estimations with different subsamples and specifications.

First, we restrict the estimation sample to a window covering only three months before and three months after the CCB activation. Our findings on sensitivity measures remain mainly unaffected except for two results. First, we find that banks that have recently increased their equity capital now cut their rates after the CCB. We interpret this as an effect of relief in the most recent period after the activation, which waters out once banks realize that the capital increase might not have been sufficient. Second, we find that banks with higher return on equity also raise their rates immediately after it. We interpret this as banks trying to maintain higher levels of profitability immediately after the shock. Either difference may reflect that over a number of months banks' response to the CCB is likely to depend also on how their competitors turn out to respond and on how stable mortgage demand will develop turns out to be.

Our findings on the ineffectiveness of risk-weighting schemes and LTV thresholds remain intact. When rerunning the comparison between banks and insurers on the shorter window and hence with significantly fewer observations, we cannot estimate all fixed effects included in our baseline regressions, so we focus on the simple comparison of means here. That suggests that both lenders raise mortgage rates after the CCB, and insurers seem to charge even more than banks.

As an alternative control for the refinancing rate, we use the Swiss 10-year government bond rate instead of the Swiss 10-year swap rate. All findings remain almost entirely unaffected.

Finally, using different sets of fixed effects and clustering does not harm our findings, either.

5 Conclusions

This paper examines how Swiss lenders price mortgages before and after the activated *Countercyclical Capital Buffer (CCB)* imposes higher capital requirements on banks. Since Switzerland was the first country to activate a Basel III style CCB, this is, to the best of our knowledge, its first empirical evaluation.

Our dataset on multiple independent offers per individual mortgage request allows us to separate mortgage demand and mortgage supply. To shed light on how a bank's capitalization, business model, portfolio and funding structure shape its pricing before and after the shock to capital requirements, we add bank-level data from public annual reports. We further analyze critical loan-to-value (LTV) ratios, as risk-weighting schemes link the riskiness of individual borrowers to regulatory bank capital requirements. Indeed, these risk-weighting schemes may be expected to amplify the CCB effects. To put our results into perspective, we contrast banks that are subject to higher capital requirements with insurers that are exempt from it but compete with banks as suppliers in the Swiss mortgage market. This enables us to compare the responses of banks experiencing the capital requirement shock to the behavior of insurers beyond the realm of Basel III.

Four core findings emerge. First, capital-constrained banks with little *excess capitalization* relative to the regulatory intervention threshold, i.e. with a low *capital buffer*, raise their rates relatively more after the CCB activation. This reflects a bank's tradeoff between approaching the now even closer intervention threshold and reaping additional profits, as pointed out in the *capital buffer theory*. Second, banks which are very *specialized* in mortgage lending do also increase their offered mortgage rates relatively more. Thus, as higher capital requirements apply both to new mortgages and to the stock of issued mortgages on balance sheets, banks seem to roll

over the extra costs of previously issued mortgages to their new customers. This is in line with the findings on the *back-book effect* in Button et al. (2010).

Our third finding relates to the pricing of very risky mortgages. Risk-weighting schemes put an extra equity levy in terms of equity capital requirements on very risky mortgages with LTV ratios above 66% and 80%. We find that banks generally charge more on very risky mortgages, but these risk-weighting schemes do not amplify the CCB effects. This suggests that the nexus between the customer's leverage and regulatory risk weights may still be weaker than would be optimal. We provide two possible explanations for this finding. On the one hand, higher risk weights apply only to the tranche of lending above the respective LTV threshold rather than to the entire mortgage amount. This weakens the average risk-weight effect for the whole mortgage. On the other hand, we might interpret LTV thresholds as the signals for very risky mortgages inducing lenders to charge a risk premium. In this light, LTV thresholds linked to regulatory risk-weighting schemes prove ineffective when interacted with the CCB's shock to capital requirements.

Fourth, both banks and insurers as their competitors *increase* their average mortgage rates after the CCB has been activated. Yet insurers raise rates by on average 8.8 bp more than banks despite being exempt from the CCB and any Basel III capital standards. Hence, policy leakage, in the sense of underbidding by insurers exempt from the CCB, does not seem to be an issue in the Swiss mortgage market. While a priori it was not clear whether banks' higher costs and consequently higher mortgage rates would induce insurers to either expand their market shares or to expand of their profits per unit of mortgage lending, we provide evidence that in the market environment under investigation insurers prefer lower, but more profitable lending volumes over larger, but less profitable lending volumes. This is in line with the mortgage market developments sketched in FINMA (2014). It is also in line with the evidence of not too fierce

mortgage market competition, as evidenced by relatively unchanged asset margins (see SNB [2014a]).The low interest rate environment and scarce profitable, but moderately risky investment prospects might further rationalize our finding. Against this background, we interpret the increase of insurers' rates as an implicit side effect.

This adds a very interesting twist to the discussion and literature on possible leakage of economic policy in general and macro-prudential policy in particular. It provides an example where actors not subjected to the policy themselves are indeed affected indirectly through market forces, but in a direction different from what may have been expected. Such indirect effects can be a very important issue, so we expect our findings to constitute a starting point for further work to better understand such side effects. We conclude that lenders welcome the opportunity of this regulatory capital shock to increase mortgage prices, but higher capital standards do not discourage banks from offering very risky mortgages.

To conclude, both types of lenders raise mortgage rates. Banks probably to so to increase their markups and hence retained earnings to strengthen their capital base. Insurers prefer higher markups over a further expansion of the lending volumes.

Our paper informs the debate on macro- and micro-prudential regulation. We find that the CCB does not impinge on the willingness of banks to issue loans, only the pricing of mortgages shows significant effects. In terms of balance sheet characteristics, the CCB seems to exercise the incentive effects envisioned by the regulator. Yet, our study reveals that the CCB does not make lending to very risky customers more expensive. Regulators might have anticipated an increase of the extra levy on the most leveraged households, but our analysis demonstrates that risk-weighting schemes seem to be ineffective in light of the higher capital requirements imposed by the CCB. Finally, our analysis has shown some side effects on insurers. These findings might

invite regulators to pay special attention to the competitors of banks that are beyond the realm of capital standards as suggested by Basel III.

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DEFINITIONS OF VARIABLES

Dependent Variable	
Offered Mortgage Rate	Tranche-weighted offered mortgage interest rate measured in basis points and winsorized at the 1st and 99th percentile.
Refinancing Control	
Swap Rate 10y	10 year Swiss interbank swap rate.
Mortgage Characteristics	
LTV	Loan to value ratio as specified by the customer.
LTV67	Indicator of whether the LTV equals or exceeds the value of 67%.
LTV80	Indicator of whether the LTV equals or exceeds the value of 80%.
Bank Sensitivity Measures	
Excess Capitalization	Excess capitalization is measured as the distance between the bank's capital coverage ratio and the target ratio relative to the target ratio.
Constrained (0/1)	Indicator equal to one if Excess Capitalization is *below* the median.
Capital Coverage Ratio	Actual Capitalization as defined in FINMA (2011).
Mortgages/Equity Capital	Ratio of mortgages to Equity Capital. Equity Capital is defined as CET1 capital and can be decomposed into corporate capital and capital reserves.
Mortgages/Equity Capital (0/1)	Indicator equal to one if Mortgages/Equity Capital is above the median.
ΔEquity Capital	Annual growth rate of Equity Capital.
ΔEquity Capital (0/1)	Indicator equal to one if ΔEquity Capital is above the median.
ΔMortgages	Annual growth rate of mortgage volume on a bank's balance sheet.
ΔMortgages (0/1)	Indicator equal to one if ΔMortgages is above the median.
Customer Funds	The due to customers such as deposits as well as cash bonds.
Customer Funds (0/1)	Indicator equal to one if Customer Funds is above the median.
ROE	Return on equity.
ROE (0/1)	Indicator equal to one if ROE is above the median.
Customer Controls	
Income	Annual household income as specified by the customer expressed in ln.
Wealth	Wealth including retirement savings as specified by the customer expressed in ln.
Debt	Indicator of whether the customer reports any kind of debt.
Age	Age of the customer.

APPENDIX

Figure 1: Sample and Shock Periods

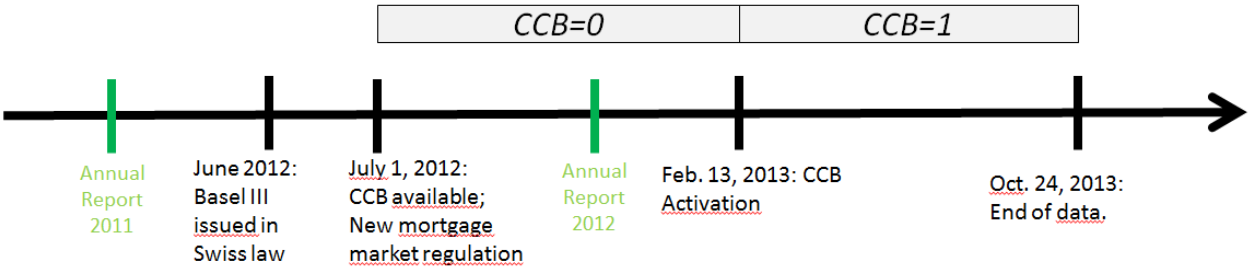
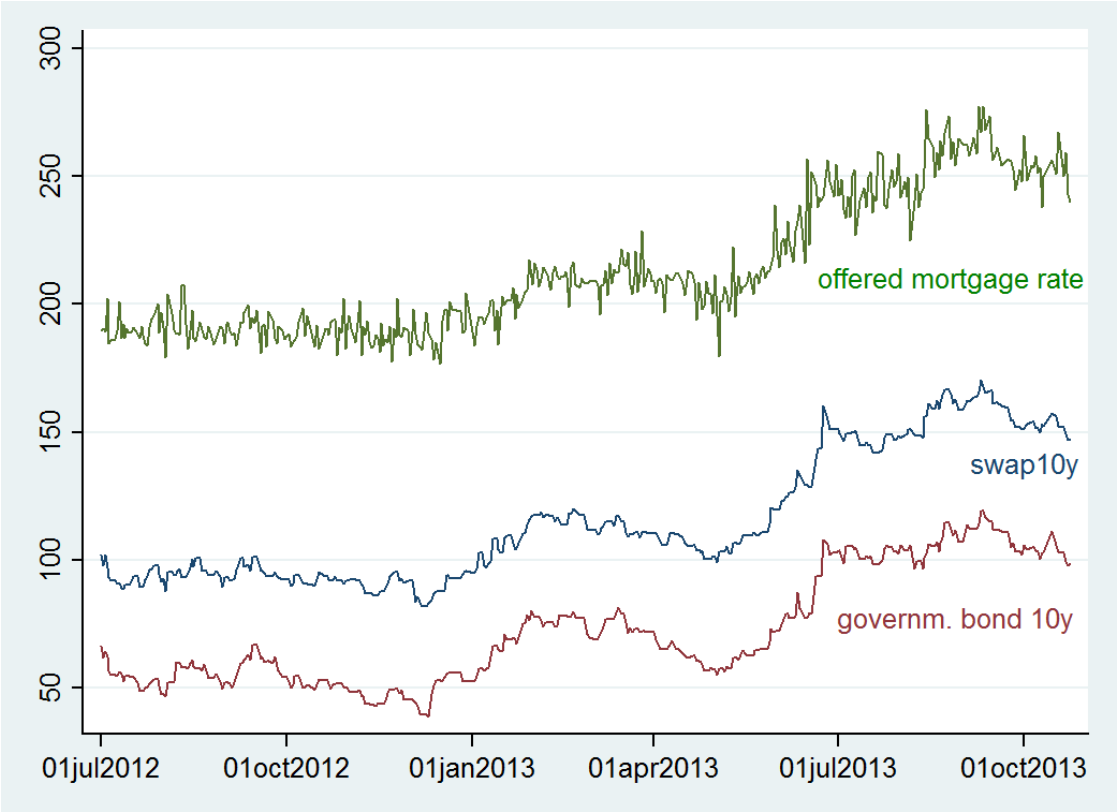


Figure 2: Back of the Envelope Computation of a bank's expected additional cost

By how much does the CCB raise an average bank's costs per mortgage?

Mortgage Amount	CHF	1'000'000
Risk-Weighted Mortgage (RWM) using average risk weight of 40%	CHF	400'000
Additional Equity Capital Requirement of the CCB set to 1% of RWM	CHF	4'000
Cost Differential Substitute Equity Capital for Debt Assuming Cost of Equity – Cost of Debt= 3.84%	CHF	154
Extra costs relative to the mortgage amount	bp	1.54

Figure 3: Sample Averages of all 10 Year Offered Mortgage Rates, 10 Year Swiss Swap Rates and Government Bonds



Sources: Bloomberg, Comparis and authors' calculations

Figure 4: Mortgage Tranche and Mortgage Total Average Risk Weights as Functions of the Loan to Value (LTV) Ratio

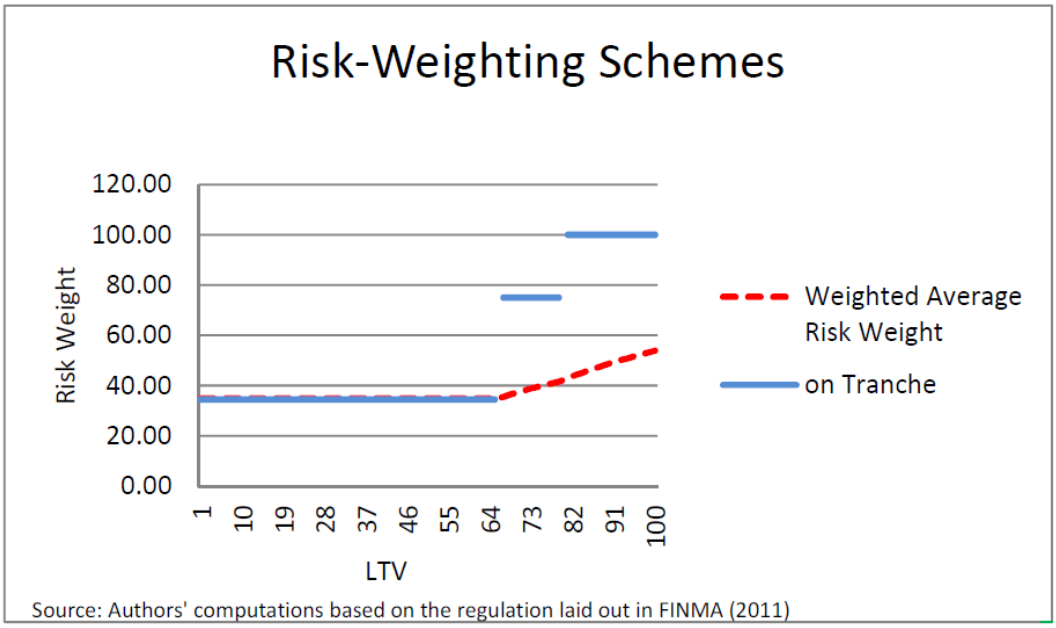


Table 1: Mortgage Demand and Supply Participation

		CCB=0	CCB=1
Mortgage Demand			
Number of Requests		661	516
Applicant's LTV		65.66	65.42
Mortgage Supply			
Number of Answers	all	3'873	2'461
	by banks	2'744	1'865
	by insurers	1'129	596
Number of Offers	all	3'313	2'146
	by banks	2'390	1'655
	by insurers	923	491
Number of Rejections	all	560	315
	by banks	354	210
	by insurers	206	105
Offered Mortgage Rate	all	192.26	223.59
	by banks	195.39	226.36
	by insurers	184.18	214.24

Notes: This table presents our database in terms of mortgage demand and supply participation. It focuses on requested 10-year fixed rate mortgages only. The underlying average offered mortgage interest rates result from the tranche-weighted offered mortgage interest rates.

Table 2: Our Sample and the Swiss Mortgage Market

Locational Canton of the real estate property	Switzerland 2012: Share of Issued Mortgages		Estimation Sample: Share of Requested Mortgage Volumes		Estimation Sample: Share of Requests	
	in % (1a)	Rank (1b)	in % (2a)	Rank (2b)	in % (3a)	Rank (3b)
Zurich	19.19	1	25.59	1	22.51	1
Berne	10.77	2	11.69	3	13.25	2
Aargau	8.73	3	10.26	4	11.47	3
Vaud	8.07	4	11.73	2	10.96	4
St.Gallen	5.73	5	4.61	5	5.52	5
Geneva	5.06	6	2.70	12	1.78	15
Ticino	4.73	7	2.52	13	2.21	13
Lucerne	4.64	8	4.42	6	4.33	6
Basel Land	3.86	9	2.94	9	2.80	10
Valais	3.59	10	1.77	15	2.29	12
Thurgau	3.48	11	3.81	7	3.91	7
Solothurn	3.37	12	2.93	10	3.31	9
Graubünden	3.33	13	1.56	17	1.87	14
Fribourg	3.23	14	3.13	8	3.82	8
Schwyz	2.37	15	2.74	11	2.46	11
Zug	2.04	16	1.82	14	1.27	17
Basel Stadt	1.92	17	1.64	16	1.53	16
Neuchatel	1.53	18	1.03	18	1.19	18
Schaffhausen	0.94	19	0.41	23	0.68	19
Jura	0.75	20	0.41	22	0.59	20
Appenzell AR	0.62	21	0.36	24	0.59	21
Nidwalden	0.54	22	0.61	20	0.42	23
Obwalden	0.47	23	0.75	19	0.59	22
Glarus	0.44	24	0.43	21	0.42	24
Uri	0.40	25	0.16	25	0.17	25
Appenzell IR	0.18	26	0.00	26	0.00	26

Notes: This table compares the entire Swiss mortgage market in Columns (1a) and (1b) with our sample in Columns (2a) to (3b). We compute the share of all mortgages by locational canton of the associated real estate property for the stock of all issued mortgages in Switzerland in Column (1a). By analogy, Column (2a) gives the share of requested mortgage volumes by locational canton and Column (3a) indicates the share of requests per locational canton while giving equal weight to each request instead of weighting by mortgage volume. Source: SNB (2012) and Comparis.

Table 3: Descriptive Statistics of Offered Mortgage Rate Regressions including Sensitivity Measures with Banks only

	mean	p50	sd	min	max	N
1120 requests; 22 bank						
offered mortgage rate (in bp)	208.08	201.20	24.68	159	277.5	4'045
Swap Rate 10y (in %)	1.09	1.03	0.21	0.82	1.70	4'045
CCB (0/1)	0.41	0.00	0.49	0	1	4'045
LTV (in%)	65.17	70.00	15.73	7	100	4'045
LTV67 (0/1)	0.56	1.00	0.50	0	1	4'045
LTV80 (0/1)	0.20	0.00	0.40	0	1	4'045
Income (in CHF tsd)	176.71	155.00	92.65	15.00	1400.00	4'045
Wealth (in CHF tsd)	521.40	313.00	967.57	5.00	20000.00	4'045
Income (ln)	11.98	11.95	0.44	9.62	14.15	4'045
Wealth (ln)	12.64	12.65	1.01	8.52	16.81	4'045
Debt (0/1)	0.16	0.00	0.37	0	1	4'045
Age	44.60	44.00	9.36	20	79	4'045
Bank Sensitivity (above/below median)						
Constrained (0/1)	0.61	1	0.49	0	1	4'045
Mortgages/Equity Capital (0/1)	0.47	0	0.50	0	1	4'045
Equity Capital/TA (0/1)	0.34	0	0.47	0	1	4'045
Corporate Capital/TA (0/1)	0.56	1	0.50	0	1	4'045
Capital Reserves/TA (0/1)	0.37	0	0.48	0	1	4'045
ΔEquity Capital (0/1)	0.60	1	0.49	0	1	4'045
ΔMortgages (0/1)	0.57	1	0.50	0	1	4'045
Customer Funds/Mortgages (0/1)	0.78	1	0.41	0	1	4'045
ROE (0/1)	0.61	1	0.49	0	1	4'045
Bank Sensitivity (levels)						
Excess Capitalization (in %)	40.58	44.79	21.82	8.29	119.61	3'129
Mortgages/Equity Capital (in %)	974.40	902.60	220.30	379.73	1785.48	4'045
Equity Capital/TA (in %)	7.30	7.36	1.19	4.91	13.96	4'045
Corporate Capital/TA (in %)	1.59	1.28	1.13	0.00	3.72	4'045
Capital Reserves/TA (in %)	5.40	5.07	1.84	2.57	12.91	4'045
ΔEquity Capital (in %)	6.64	4.39	11.75	0.17	146.48	4'045
ΔMortgages (in %)	8.59	8.35	7.33	1.57	94.42	4'045
Customer Funds/Mortgages (in %)	115.87	110.68	32.90	37.14	202.95	4'045
ROE (in %)	4.69	6.10	2.56	0.17	9.54	4'045

Notes: This table exhibits descriptive statistics of our regressions with banks only. We express the dependent variable offered mortgage interest rate in basis points and winsorize it at the 1st and 99th percentile. LTV67 [LTV80] stands for an indicator of whether this LTV exceeds the value of 67 [80]. All Bank Sensitivity measures (above/below median) in the second panel feature (0/1) indicators of whether the bank is above the median among all participating banks in a given year (except for Constrained which refers to Excess Capitalization being *below* the median). All Bank Sensitivity measures in the third panel feature levels. Constrained draws on excess capitalization measured as the distance between the bank's capital coverage ratio and the target ratio relative to the target ratio. Mortgages/Equity Capital refers to the ratio of mortgages to equity capital. Equity capital is defined as CET1 capital and can be decomposed into corporate capital and capital reserves. ΔEquity Capital and ΔMortgages represents the growth rates of Equity Capital and the stock of mortgages on balance sheets, respectively. Customer Funds capture the due to customers such as deposits as well as cash bonds while ROE stands for the Return on Equity. Please refer to the Descriptions of Main Variables for more details.

Table 4: Mortgage Rate Regression with Sensitivity Measures for Banks only

Offered Mortgage Rate

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Sensitivity Measures									
Constrained	6.8883								
	(5.9641)								
CCB*Constrained	6.2789***								
	(0.9325)								
Mortgages/Equity Capital		-7.6884***							
		(0.8925)							
CCB*Mortgages/Equity Capital		6.5307***							
		(0.9604)							
Equity Capital/TA			1.0708						
			(3.4065)						
CCB*Equity Capital/TA			-8.8509***						
			(0.9922)						
Corporate Capital/TA				-4.9685**					
				(2.3202)					
CCB*Corporate Capital/TA				8.3259***					
				(0.8766)					
Capital Reserves/TA					-11.5118				
					(12.4785)				
CCB*Capital Reserves/TA					-8.7294***				
					(0.9274)				
ΔEquity Capital						-4.7533***			
						(0.7278)			
CCB*ΔEquity Capital						2.5683**			
						(1.2662)			
ΔMortgages							-2.2854***		
							(0.7056)		
CCB*ΔMortgages							0.8470		
							(1.1763)		
Customer Funds/Mortgages								-22.3350**	
								(11.3287)	
CCB*Customer Funds/Mortgages								-0.1036	
								(1.1002)	
ROE									-1.1818
									(2.0306)
CCB*ROE									-1.8902**
									(0.8741)
Constant	242.7159***	246.7853***	199.6107***	242.9582***	249.4647***	200.9042***	219.6279***	252.3132***	243.3556***
	(7.3538)	(6.1920)	(6.5295)	(5.3274)	(3.5127)	(6.2541)	(5.4697)	(4.0835)	(5.8023)
Observations	4,045	4,045	4,045	4,045	4,045	4,045	4,045	4,045	4,045
R-squared	0.8281	0.8297	0.8306	0.8305	0.8309	0.8277	0.8255	0.8248	0.8252

Notes: This table shows the results of an OLS regression with the offered mortgage rate. The offered mortgage rate is measured in basis points and winsorized at the 1st and 99th percentile. All bank sensitivity measures feature a (0/1) indicator of whether the bank is above the median among all participating banks in a given year (except for Constrained which refers to excess capitalization being *below* the median). Please refer to Table 3 and the Descriptions of Main Variables for more details. All regressions include fixed effects for each request and for each offering bank. Heteroskedasticity consistent standard errors in parentheses with ***, ** and * denoting significance at the 1%, 5% and 10% level.

Table 5: Mortgage Rate Regression with Threshold LTVs for Banks only

Offered Mortgage Rate					
	(1)	(2)	(3)	(4)	(5)
Mortgage Characteristics					
LTV	0.0282	0.0261	0.0264	0.0267	0.0251
	(0.0206)	(0.0205)	(0.0204)	(0.0205)	(0.0207)
LTV67 (0/1)	2.1329***	2.5814***	2.3856***	2.3825***	2.3527***
	(0.6950)	(0.6923)	(0.6954)	(0.6960)	(0.6966)
LTV80 (0/1)	1.8084**	1.8488**	1.5700**	1.5591**	1.5391**
	(0.7500)	(0.7441)	(0.7462)	(0.7476)	(0.7476)
CCB*LTV67 (0/1)	-1.4976	-1.4916	-1.4856	-1.4931	-1.5161*
	(0.9193)	(0.9122)	(0.9111)	(0.9108)	(0.9115)
CCB*LTV80 (0/1)	0.8679	1.3353	1.4530	1.4593	1.4828
	(1.1688)	(1.1508)	(1.1509)	(1.1516)	(1.1516)
Refinancing Control					
Swap Rate 10y	73.6928***	75.1129***	74.4085***	74.3725***	74.2675***
	(4.6923)	(4.6574)	(4.6616)	(4.6695)	(4.6725)
Request Controls					
Income		-3.9127***	-3.1353***	-3.1514***	-3.2027***
		(0.4673)	(0.5086)	(0.5114)	(0.5191)
Wealth			-0.8430***	-0.8406***	-0.8085***
			(0.2241)	(0.2240)	(0.2278)
Debt (0/1)				0.1442	0.1768
				(0.5425)	(0.5434)
Age					-0.0158
					(0.0227)
Constant	120.4573***	166.4232***	168.8237***	185.1407***	186.3524***
	(8.7060)	(9.8368)	(9.8425)	(9.9337)	(10.0654)
Observations	4,045	4,045	4,045	4,045	4,045
R-squared	0.7593	0.7635	0.7643	0.7644	0.7644

Notes: This table shows the results of an OLS regression with the offered mortgage rate as left-hand side variable. The offered mortgage rate is measured in basis points and winsorized at the 1st and 99th percentile. LTV67 [LTV80] stands for an indicator of whether this LTV exceeds the value of 67 [80]. CCB*LTV67 [CCB*LTV80] refers to the interaction of the CCB with the LTV67 [LTV80] variable. To control for the general level of refinancing costs, we add the 10-year interest swap rate. Please refer to Table 3 and the Descriptions of Main Variables for more details. All regressions include fixed effects for the offering bank, the month of submission (while February 2013 is split into a pre and post February 2013 dummy), the request's property type and domiciled canton. Heteroskedasticity consistent standard errors in parentheses with ***, ** and * denoting significance at the 1%, 5% and 10% level.

Table 6: Descriptive Statistics for the Full Sample as well as Banks and Insurers, separately

	mean	p50	sd	min	max	N
1129 requests; 22 banks and 3 insurers						
offered mortgage rate (in bp)	204.62	200	25.09	159	277.5	5'459
CCB (0/1)	0.39	0	0.49	0	1	5'459
LTV (in%)	65.30	70	15.40	7	100	5'459
LTV67 (0/1)	0.56	1	0.50	0	1	5'459
LTV80 (0/1)	0.20	0	0.40	0	1	5'459
Income (in CHF tsd)	178.60	157.5	94.24	15	1'400	5'459
Wealth (in CHF tsd)	527.23	320	946.54	5	20'000	5'459
Income (ln)	11.99	11.97	0.44	9.62	14.15	5'459
Wealth (ln)	12.66	12.68	1.01	8.52	16.81	5'459
Debt (0/1)	0.17	0	0.37	0	1	5'459
Age	44.58	44	9.33	20	79	5'459
1126 requests; 22 banks						
offered mortgage rate (in bp)	208.08	201.2	24.68	159	277.5	4'045
CCB (0/1)	0.41	0	0.49	0	1	4'045
LTV (in%)	65.17	70	15.73	7	100	4'045
LTV67 (0/1)	0.56	1	0.50	0	1	4'045
LTV80 (0/1)	0.20	0	0.40	0	1	4'045
Income (in CHF tsd)	176.70	155	92.66	15	1'400	4'045
Wealth (in CHF tsd)	521.40	313	967.57	5	20'000	4'045
Income (ln)	11.98	11.95	0.44	9.62	14.15	4'045
Wealth (ln)	12.64	12.65	1.01	8.52	16.81	4'045
Debt (0/1)	0.16	0	0.37	0	1	4'045
Age	44.60	44	9.36	20	79	4'045
851 requests; 3 insurers						
offered mortgage rate (in bp)	194.71	191.17	23.59	159	277.5	1'414
CCB (0/1)	0.35	0	0.48	0	1	1'414
LTV (in%)	65.66	69	14.40	7	81	1'414
LTV67 (0/1)	0.55	1	0.50	0	1	1'414
LTV80 (0/1)	0.19	0	0.39	0	1	1'414
Income (in CHF tsd)	184.00	160	98.46	35	1400	1'414
Wealth (in CHF tsd)	543.89	335	883.74	5	20'000	1'414
Income (ln)	12.02	11.98	0.44	10.46	14.15	1'414
Wealth (ln)	12.71	12.72	1.01	8.52	16.81	1'414
Debt (0/1)	0.17	0	0.37	0	1	1'414
Age	44.51	43	9.24	24	79	1'414

Notes: This table exhibits descriptive statistics of our regressions with banks and insurers. We express the dependent variable offered mortgage rate in basis points and winsorize it at the 1st and 99th percentile. LTV67 [LTV80] stands for an indicator of whether this LTV exceeds the value of 67 [80]. Please refer to the Descriptions of Main Variables for more details.

Table 7 a: Comparison of Means: Acceptance Rates

OFFER(0/1)

	Banks (1)	Insurers (2)	Difference (1)-(2)
CCB=0	0.871***	0.818***	0.053***
	(0.006)	(0.011)	(0.013)
CCB=1	0.887***	0.824***	0.064***
	(0.007)	(0.016)	(0.017)
Difference	0.016*	0.006	0.010
	(0.010)	(0.019)	(0.022)

Notes: This table shows comparison of means estimates of loan acceptance rates. Heteroskedasticity consistent standard errors in parentheses with ***, **, and * denoting significance at the 1%, 5%, and 10% level.

Table 7 b: Comparison of Means: Offered Mortgage Rates

Offered Mortgage Rate

	Banks (1)	Insurers (2)	Difference (1)-(2)
CCB=0	195.647***	184.324***	11.323***
	(0.294)	(0.538)	(0.613)
CCB=1	226.033***	214.274***	11.786***
	(0.624)	(1.024)	(1.200)
Difference	30.386***	29.924***	0.463
	(0.690)	(1.157)	(1.347)

Notes: This table showscomparison of means estimates of the CCB's effect on the offered mortgage interest rate for respectively banks and insurers. The offered mortgage rate is measured in basis points and winsorized at the 1st and 99th percentile. Robust standard errors in parentheses with ***, **, and * denoting significance at the 1%, 5%, and 10% level.

Table 7 c: Comparison of Means: Requested LTV Ratios

Requested LTV

	Banks (1)	Insurers (2)	Difference (1)-(2)
CCB=0	64.983***	65.791***	-0.8080
	(0.329)	(0.473)	(0.576)
CCB=1	65.451***	65.418***	0.0330
	(0.374)	(0.653)	(0.752)
Difference	0.4670	-0.3730	0.8410
	(0.498)	(0.806)	(0.947)

Notes: This table shows mean Difference-in-Difference (DID) estimates of the loan-to-value (LTV) ratio as indicated in the customer's request. Heteroskedasticity consistent standard errors in parentheses with ***, **, and * denoting significance at the 1%, 5%, and 10% level.

Table 7 d: Offered Mortgage Rate Regression Comparing Banks, Banking Groups and Insurers

Offered Mortgage Rate

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(a) CCB*BANK	18.1311***	18.7369***	18.0803***	17.7655***	17.8320***	17.9357***	
	(2.9282)	(2.9042)	(2.8706)	(2.8755)	(2.8842)	(2.8860)	
(a) CCB*KANTONALBANK							14.0554***
							(2.9824)
(a) CCB*FOREIGNBANK							19.5148***
							(2.9216)
(a) CCB*OTHERBANK							20.6944***
							(2.8853)
(b) CCB*NONB	26.9625***	27.5509***	26.8791***	26.5553***	26.6166***	26.7209***	26.8837***
	(3.0176)	(2.9943)	(2.9620)	(2.9652)	(2.9725)	(2.9763)	(2.9617)
Refinancing Control							
Swap Rate 10y	72.5580***	71.9349***	72.9096***	71.9478***	71.8929***	71.8162***	72.1620***
	(4.1694)	(4.1393)	(4.1210)	(4.1210)	(4.1282)	(4.1309)	(4.0720)
Mortgage Characteristics							
LTV	0.1600***	0.0476***	0.0458**	0.0459**	0.0463**	0.0449**	0.0449**
	(0.0113)	(0.0183)	(0.0181)	(0.0181)	(0.0181)	(0.0182)	(0.0179)
		3.1308***	3.5347***	3.2709***	3.2630***	3.2274***	3.3118***
		(0.5445)	(0.5424)	(0.5448)	(0.5450)	(0.5480)	(0.5425)
LTV80 (0/1)		2.6726***	2.9084***	2.6146***	2.6032***	2.5909***	2.6349***
		(0.5138)	(0.5082)	(0.5103)	(0.5108)	(0.5111)	(0.5081)
Request Controls							
Income			-3.4705***	-2.4471***	-2.4696***	-2.5118***	-2.4437***
			(0.4118)	(0.4494)	(0.4530)	(0.4586)	(0.4494)
Wealth				-1.0885***	-1.0860***	-1.0598***	-1.0799***
				(0.1969)	(0.1969)	(0.2000)	(0.1954)
Debt (0/1)					0.2066	0.2359	
					(0.4682)	(0.4686)	
Age						-0.0136	
						(0.0199)	
Constant	118.6651***	122.6677***	162.3979***	165.5466***	165.6442***	166.5243***	166.5272***
	(12.3072)	(12.5125)	(13.5326)	(13.5074)	(13.4919)	(13.5910)	(14.0626)
Observations	5,459	5,459	5,459	5,459	5,459	5,459	5,459
R-squared	0.7602	0.7632	0.7664	0.7678	0.7678	0.7678	0.7702
DID estimate (a)-(b)	-8.831	-8.814	-8.799	-8.790	-8.785	-8.785	
Wald test (a)-(b) p-value	0	0	0	0	0	0	

Notes: This table shows the results of an OLS regression with the offered mortgage rate as left-hand side variable. This offered rate is measured in basis points and winsorized at the 1st and 99th percentile. CCB*BANK [CCB*NONB] refers to the interaction of the CCB with an indicator BANK [NONB] of whether the offering institution is a bank [insurer]. KANTONALBANK, FOREIGNBANK and OTHERBANK are dummy variables indicating the banking group in which a bank can be classified according to the standars of the Swiss National Bank. To control for the general level of refinancing costs, we add the 10-year interest swap rate. LTV67 [LTV80] stands for indicator of whether this LTV exceeds the value of 67 [80]. The diagnostic section reports the DID estimate and its p-value from the Wald test under the H0 that the difference between banks and insurers equals zero. All regressions include fixed effects for the offering bank, the month of submission (while February 2013 is split into a pre and post February 2013 dummy), the request's property type and domiciled canton. Heteroskedasticity consistent standard errors in parentheses with ***, ** and * denoting significance at the 1%, 5% and 10% level.

ONLINE APPENDIX

Table A: Mortgage Rate Regression with Sensitivity Measures for Banks only (dropping lender fixed effects)

Offered Mortgage Rate

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Sensitivity Measures									
Constrained	-1.3034**								
	(0.5715)								
CCB*Constrained	6.5410***								
	(1.0078)								
Mortgages/Equity Capital		-3.7413***							
		(0.5432)							
CCB*Mortgages/Equity Capital		6.8657***							
		(0.9672)							
Equity Capital/TA			1.8843***						
			(0.6325)						
CCB*Equity Capital/TA			-10.4998***						
			(1.0641)						
Corporate Capital/TA				-2.5858***					
				(0.5566)					
CCB*Corporate Capital/TA				8.3608***					
				(0.9354)					
Capital Reserves/TA					2.9878***				
					(0.6078)				
CCB*Capital Reserves/TA					-9.8486***				
					(1.0050)				
ΔEquity Capital						-4.2074***			
						(0.5551)			
CCB*ΔEquity Capital						-1.1350			
						(1.2034)			
ΔMortgages							1.0233*		
							(0.5447)		
CCB*ΔMortgages							-5.9851***		
							(1.1462)		
Customer Funds/Mortgages								-2.6399***	
								(0.6578)	
CCB*Customer Funds/Mortgages								-1.8787	
								(1.1721)	
ROE									-2.4163***
									(0.5184)
CCB*ROE									-2.6871***
									(0.9181)
Constant	188.8034***	199.0756***	223.1157***	271.7250***	222.0122***	229.2074***	223.9767***	234.5185***	227.4163***
	(0.5715)	(0.8003)	(0.6325)	(0.7518)	(0.6078)	(0.5551)	(0.5447)	(0.9701)	(0.5184)
Observations	4,045	4,045	4,045	4,045	4,045	4,045	4,045	4,045	4,045
R-squared	0.7990	0.7989	0.8050	0.8009	0.8031	0.8009	0.7975	0.7976	0.7995

Notes: This table shows the results of an OLS regression with the offered mortgage rate. The offered mortgage rate is measured in basis points and winsorized at the 1st and 99th percentile. All bank sensitivity measures feature a (0/1) indicator of whether the bank is above the median among all participating banks in a given year (except for Constrained which refers to excess capitalization being below the median). Please refer to Table 3 and the Descriptions of Main Variables for more details. All regressions include fixed effects for each request. Heteroskedasticity consistent standard errors in parentheses with ***, ** and * denoting significance at the 1%, 5% and 10% level.

Table B: Mortgage Rate Regression with Sensitivity Measures for Banks only (median defined by request)

Offered Mortgage Rate

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Sensitivity Measures									
Constrained	-4.4477***								
	(0.7415)								
CCB*Constrained	4.9998***								
	(0.9769)								
Mortgages/Equity Capital		-0.9983							
		(0.8613)							
CCB*Mortgages/Equity Capital		5.2898***							
		(0.8490)							
Equity Capital/TA			6.0687***						
			(0.8036)						
CCB*Equity Capital/TA			-5.3629***						
			(0.8125)						
Corporate Capital/TA				-1.8063*					
				(0.9895)					
CCB*Corporate Capital/TA				4.9641***					
				(0.8452)					
Capital Reserves/TA					6.5858***				
					(0.8422)				
CCB*Capital Reserves/TA					-5.5689***				
					(0.8070)				
ΔEquity Capital						-3.4667***			
						(0.5955)			
CCB*ΔEquity Capital						4.3064***			
						(0.9476)			
ΔMortgages							-4.5582***		
							(0.5924)		
CCB*ΔMortgages							1.9115**		
							(0.8787)		
Customer Funds/Mortgages								3.1210***	
								(0.6048)	
CCB*Customer Funds/Mortgages								-2.8956***	
								(0.8868)	
ROE									0.3603
									(0.9652)
CCB*ROE									-0.9884
									(0.8199)
Constant	191.8106***	191.9504***	188.1387***	194.8207***	187.6749***	194.8675***	193.9656***	192.3980***	192.6553***
	(6.5472)	(6.3357)	(5.7286)	(5.5800)	(5.7184)	(6.9342)	(6.3859)	(6.1538)	(6.1903)
Observations	3,955	3,955	3,955	3,955	3,955	3,955	3,955	3,955	3,955
R-squared	0.8202	0.8203	0.8219	0.8198	0.8222	0.8197	0.8214	0.8190	0.8176

Notes: This table shows the results of an OLS regression with the offered mortgage rate. The offered mortgage rate is measured in basis points and winsorized at the 1st and 99th percentile. All bank sensitivity measures feature a (0/1) indicator of whether the bank is above the median among all participating banks for a given request (except for Constrained which refers to excess capitalization being below the median). Please refer to Table 3 and the Descriptions of Main Variables for more details. All regressions include fixed effects for each request and for each offering bank. Heteroskedasticity consistent standard errors in parentheses with ***, ** and * denoting significance at the 1%, 5% and 10% level.