Bank Competition and Bargaining over Refinancing

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Abstract

We model mortgage refinancing as a bargaining game involving the borrowing household, the incumbent lender, and an outside bank. In equilibrium, the borrower's ability to refinance depends both on the competitiveness of the local banking market and on the cost of switching banks. We find empirical support for the key predictions of our model using a unique data set containing the population of mortgages in Belgium. In particular, households' refinancing propensities are positively correlated with the number of local branches and negatively correlated with local mortgage market concentration. Moreover, households are more likely to refinance externally if they already have a relation with more than one bank, but the effect is mitigated if their current mortgage lender has a branch locally.

Keywords: mortgage markets; refinancing; bargaining; bank competition; switching costs.

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Why do so many households fail to refinance their mortgage when interest rates decline? Prior research trying to answer this question has largely focused on the drivers of the *demand* for refinancing, attributing household inaction to both behavioral or informational channels (Agarwal et al. 2016; Keys et al. 2016; Johnson et al. 2019). In a recent contribution to this literature, Andersen et al. (2020) empirically model the psychological and information-gathering costs associated with refinancing, and provide evidence that these costs may correlate systematically with borrowers' demographic and socio-economic characteristics.

This paper takes a different perspective. It aims to enrich our understanding of the heterogeneity in refinancing activity by focusing on variation in the *supply* of refinancing options that households face. Our approach is motivated by growing evidence that, first, competitive frictions can affect households' refinancing activity (Scharfstein and Sunderam 2016; Agarwal et al. 2022), and, second, households' access to finance is shaped substantially by local banking and mortgage market conditions (Ergungor 2010; Scharfstein and Sunderam 2016; Célerier and Matray 2019; Buchak and Jørring 2021). If mortgage markets are local in scope, then households' refinancing propensities and payoffs conditional on refinancing may vary geographically and over time as a function of both local competitive conditions and borrowers' interactions with their local banking market.

Our conceptual innovation is to think of households as initiating a bargaining game as soon as they knock on their current lender's door to ask for a refinancing. We build a simple multi-stage bargaining model in which the equilibrium offer that the incumbent lender does in the first stage will be a function of (i) the probability that the borrower gets an offer from a competing bank in a later stage, (ii) the cost for the borrower to switch from its current lender to another bank, and (iii) the relative cost advantage of the competing bank. If the net payoff for the borrower of switching banks is negative, the incumbent bank will refuse to refinance the mortgage. By contrast, if the borrower and the incumbent bank know that a competing offer would yield a positive payoff after accounting for the switching cost, the borrower will be able to refinance. Whether the borrower refinances internally (with the current lender) or externally (with a competing lender) depends on the relative cost advantage of the outside bank and on the switching cost.

We derive three sets of empirical implications from our model. First, both overall refinancing

propensities and the relative share of external refinancing go up with the size and maturity of the mortgage. Moreover, the gross gains from refinancing externally should exceed those from refinancing internally. Second, if local bank competition rises, total refinancing activity—and, in particular, external refinancing activity—is likely to go up. Third, households with lower switching costs are more likely to refinance externally. Moreover, average realized gross gains conditional on refinancing externally will be lower for households with lower switching costs.

To test these predictions, we rely on a unique administrative data set containing all mortgages (and consumer loans) held by households in Belgium since 2006. The data set was provided to us by the National Bank of Belgium. In Belgium, mortgages account for the largest share of household debt, and primarily finance owner-occupied housing. About three quarters of 35-to-65-year-olds own their primary residence. A large majority of mortgages are originated by traditional banks through their branch network. Given the prevalence of fixed interest rate contracts and long maturities, the incentives to refinance tend to be substantial when interest rates fall. Yet, refinancing with a new lender is associated with substantial notary fees.

Our database contains information on more than 7 million mortgage loans (held at some point between 2006 and 2021) for close to 3 million different households. For each mortgage, we observe some basic loan characteristics, the location of the borrower, and the identity of the lender. Each borrower is associated with a unique anonymized identifier that allows us to observe any other loans taken out by the same household. We identify a refinancing as a loan issued in period t that replaces a loan with a similar amount outstanding in period $t-1$. To make sure that we are capturing refinancing activity accurately, we exclude a number of specific cases such as borrower-year combinations associated with a move of the household, or borrowers that have mortgages with multiple banks.

We find that refinancing activity varies strongly over time, with a peak in refinancing in 2015, when more than 8% of mortgages were refinanced. Internal refinancing is much more prevalent than external refinancing, but households that refinance externally realize a higher decrease in mortgage interest rate. Also the variation in the use of external refinancing is in line with the implications of our model as specified above. Namely, the propensity to refinance—in particular externally—increases with the remaining maturity and the outstanding loan balance.

Next, we test whether bank competition affects refinancing activity, as our model predicts.

We construct two historical measures of local banking market competition at the municipality $\times$ year level. Our first variable measures the number of bank branches per square kilometer. The second variable is a HHI-based measure of concentration based on outstanding mortgages. Our regression models include municipality $\times$ bank and bank $\times$ year fixed effects, so that identification is coming from local time-series variation in our competition variables. Our results are in line with expectations: refinancing activity is higher when local mortgage market competition is higher. To mitigate worries that the local presence of banks may correlate over time with borrower characteristics that also drive refinancing, we repeat our models using borrower fixed effects. In these regressions, identification is thus coming from the subset of borrowers that have moved over our time period. The results are qualitatively very similar to those of the baseline models.

We then analyze the effects of switching costs for households. As expected, we find that households that already have a credit relation with another bank are more likely to refinance externally. However, this effect is mitigated if the borrower's current lender has a branch locally, which may be associated with a higher cost of switching away. Moreover, the impact of having another bank on external refinancing is larger in low-income municipalities, suggesting that switching costs matter more there.

Finally, we look at the realized gains conditional on refinancing. In line with the implications of our model, we find that the average gains from refinancing externally are smaller for households with lower switching costs (i.e., for households that already have another bank and for households whose current lender does not have a local branch).

Our paper contributes to different strands of the literature. First, it has been well documented that households often fail to refinance even when it seems optimal to do so (Keys et al. 2016). An extensive literature studies the determinants of household refinancing decisions, mainly focusing on (relatively fixed) borrower characteristics (Agarwal et al. 2016; Bajo and Barbi 2018; Johnson et al. 2019; Andersen et al. 2020). Fewer papers have studied local factors, although recent work by Fisher et al. (2021) shows that the lower refinancing activity in less wealthy areas in the U.K. cross-subsidizes the higher activity in wealthier areas.[1] Our innovation is to study

[1]Other recent papers have studied peer effects in refinancing behavior (Maturana and Nickerson 2019; McCartney and Shah 2021). There is also an emerging literature on the importance of place-based factors in household financial outcomes such as credit usage (Miller and Soo 2021) and consumer financial distress (Keys et al. 2022).

the role of local banking market characteristics (and of borrowers' bank relations).

Second, our paper makes a theoretical contribution by modeling mortgage refinancing as a bargaining game—involving the borrower, the lender, and an outside bank—in the spirit of Rubinstein (1982) and Acharya et al. (2012). In our model, the strategic actions of banks are affected by both the probability that a household will stop searching for refinancing offers and by a household's (financial or non-financial) cost of switching banks. Our model yields empirical predictions on households' refinancing decisions and payoffs overall, while also giving insights into what drives internal refinancing vs. external refinancing. Our work relates to that of Allen et al. (2014), who study the role of competition in search-and-negotiation markets by analyzing the price effects of a merger between two mortgage lenders. Recent survey results by Bhutta et al. (2021) point to an important role for shopping behavior in determining the cost of mortgages, but not much work exists on the topic of the costs and payoffs of switching mortgage lenders for households—unlike in the context of corporate borrowing (Ioannidou and Ongena 2010; Barone et al. 2011).

Third, our empirical analysis contributes to the literature on the importance of local mortgage market concentration. While local lending concentration does not seem to affect interest rates on new mortgages (Fuster et al. 2022), there may be an effect on lending standards and fees (Buchak and Jørring 2021). Other work has focused on how competitive frictions in the refinancing market can hinder the transmission of monetary policy (Scharfstein and Sunderam 2016; Agarwal et al. 2022).[2] Our paper provides additional evidence that local mortgage market concentration affects the extent of refinancing when interest rates go down. As such, it also contributes to a broader discussion about the transmission of monetary policy through the mortgage market (Benetton et al. 2021; Berger et al. 2021) and the effect of monetary policy on the distribution of household debt (Emiris and Koulischer 2021, and references therein).

Finally, our paper adds to a recent body of work that underlines the importance of local bank branches for both households (Ergungor 2010; Célerier and Matray 2019) and firms (Nguyen 2019). Such research is particularly relevant in light of the ongoing changes in the geography of the banking landscape.

[2] Drechsler et al. (2017) study the effect of monetary policy on *deposits*. They find that when rates go up, branches located in more concentrated markets raise their deposit spreads by more. In their model, banks also derive market power from the willingness of depositors to switch banks and depositors' sophistication.

I. Model

To analyze how bank competition can affect the refinancing process, we introduce a model where two banks compete to refinance the mortgage of a borrower.

A. *Setup*

A borrower has a mortgage with a bank A issued at an interest rate r_0. With the initial rate, the value of the contractual mortgage payments is V_0. At the beginning of the refinancing process, interest rates have fallen and the discounted value of the mortgage payments with the lower rates is now $V_1 > V_0$. If the mortgage is not refinanced, bank A thus benefits from a capital gain of $V_1 - V_0$ on the mortgage. To capture some of the gains of lower interest rates, the borrower has two options. First, it can buy back its mortgage at the r_0-discounted value V_0. For that, it would need to secure funding from another bank B. This "external" refinancing is costly as the borrower must pay a cost C for switching banks, which may be a function of both local banking market and borrower characteristics. The second option is to negotiate a new interest rate with the bank A. This is an "internal" refinancing. In that case, the borrower and the bank A must both agree to the new terms of the contract. The borrower and the bank will thus bargain on the new mortgage contract.

We model the bargaining process as a 3-stage game, drawing from the model of bargaining in financial markets of Acharya et al. (2012). In stage 1, the borrower goes to its bank A and receives an offer for a new interest rate. The new rate values the mortgage at V_A which will be between the low value V_0, with the high initial rate, and the high value V_1, in which case the bank transfers all the capital gain to the borrower. The borrower can then either accept or reject the offer of the bank. If she accepts, her payoff is $V_A - V_0$ while the bank keeps $V_1 - V_A$.

If the borrower rejects the offer of bank A, a random shock is realized. With probability $1 - \beta$, the process breaks down and the borrower stops searching. This could reflect for instance the lack of branches of outside banks locally or the impatience of the borrower. With probability β, the process continues and the borrower goes to bank B. The random shock to the bargaining process is a stylized way of capturing the bargaining power of the borrower, as in Acharya et al. (2012).

In stage 2, bank B makes an offer V_B to the borrower to purchase the existing loan contract.[3] Bank B has its own funding cost and so the value of the contract is V_1^B which can differ from the value to bank A. For simplicity, we assume that bank B offers the competitive value $V_B = V_1^B$. This represents the contract that it would offer to any prospective borrower, whether an external refinancer or a new borrower. If the borrower accepts bank B's offer, she pays the cost C and her payoff is $V_B - V_0 - C$. If the borrower rejects the offer, a random shock is again realized which can lead to a breakdown of the search with probability $1 - \beta$, or to a continuation with probability β.[4]

If the search continues, the borrower then goes back to bank A with the competing offer in hand. Bank A then makes a new offer $V_A^{'}$. The borrower can accept or reject the offer. If the offer is rejected, the borrower then takes the offer of bank B with probability β, or the process breaks down with probability $1 - \beta$.

The different bargaining stages are illustrated in Figure 1. The payoffs in parenthesis are respectively those of the borrower, bank A, and bank B.

B. Equilibrium

We solve the game by backward induction, determining the equilibrium in stage 3, then the equilibrium in stage 2 given the equilibrium of stage 3, and the actions of the bank and the borrower in stage 1 knowing the equilibrium in the subsequent stages. In stage 3, the bank A chooses the amount $V_A^{'}$ to offer to the borrower. For the offer to be accepted, the borrower must be offered a payoff at least equal to the expected payoff it would get by rejecting the offer and going to bank B. Since the process would continue with a probability β, the expected payoff of the borrower if she rejects bank A's offer is

$$\beta \left(V_1^B - V_0 - C \right). \tag{1}$$

Bank A thus offers

$$V_A^{'} = \beta \left(V_1^B - V_0 - C \right) + V_0$$

[3] Equivalently, bank B could offer a new mortgage of V_B for the same repayment schedule as the initial mortgage.

[4] We assume that the breakdown probability β is the same at each stage of the process. One way to analyze differences in the relative competitive positions of the incumbent and the outside bank is to consider changes in the cost of switching C relative to β.

in stage 3, which the borrower accepts.

In stage 2, the offer of bank B is the competitive value V_1^B. This offer is accepted by the borrower if the net payoff (taking into account the switching cost) is positive, i.e., if $V_1^B - C > V_0$. In this case, the borrower knows that the payoff of the offer of bank A in stage 3 would be below that of bank B's offer that is on the table: $V_A^{'} - V_0 < V_1^B - V_0 - C$. The borrower thus has an incentive to accept bank B's offer in stage 2 if the net benefit of this offer is positive.

In stage 1, bank A and the borrower know the offer of bank B. If the offer of bank B is insufficient to cover the cost of switching ($V_1^B - C < V_0$), then bank A knows that the borrower is captive. Even though the offer of bank B is better than the current contract of the borrower, the costs of switching are so high that it is not attractive. Bank A thus offers $V_A = V_0$, which the borrower accepts. (Or, equivalently, bank A refuses to renegotiate the loan and the borrower stops searching.) If the offer of bank B is credible and high enough to cover the costs C, then bank A knows that if its offer is rejected, the borrower will go to bank B. To avoid this, it must thus offer the borrower the expected outside payoff as described by equation (1). If the value of the mortgage for bank A is sufficiently large (i.e., if $V_1 - V_0 > \beta\left(V_1^B - V_0 - C\right)$), the bank offers the outside payoff to the borrower, who accepts it. If bank B however has a large competitive advantage, there may be cases where bank A is unable to outbid bank B, despite its natural advantage arising from the penalty for external refinancing C. This occurs in particular if $V_1 - V_0 < \beta\left(V_1^B - V_0 - C\right)$. The next proposition formalizes these results.

Proposition 1 (Equilibrium)**. (i)** *If $V_1^B - V_0 - C < 0$, bank A offers $V_A = V_0$, and the borrower does not refinance.* **(ii)** *If $0 < V_1^B - V_0 - C < \frac{V_1 - V_0}{\beta}$, bank A offers the borrower*

$$V_A = \beta\left(V_1^B - V_0 - C\right) + V_0, \tag{2}$$

in stage 1, and the borrower accepts this offer. **(iii)** *If $V_1^B - V_0 - C > \frac{V_1 - V_0}{\beta}$, bank A offers $V_A = V_1$ in stage 1, which the borrower refuses. In case of no breakdown after stage 1, bank B then offers V_1^B in stage 2, which the borrower accepts.*

To sum up, there are thus three outcomes of the bargaining game that will be determined by the value of the parameters. The first outcome is the case of the "captive borrower". The cost of switching bank C is so high that the net benefit of switching is negative: $V_1^B - V_0 - C < 0$.

Bank A knows that it is not in the interest of the borrower to go to bank B, and it thus refuses to refinance even though it has gained from the increase in mortgage value.

The second case is that of "internal refinancing". Here the borrower could get a positive net gain by switching banks. The incumbent bank A knows this, and offers just the gain that the borrower would get outside. Bank A thus uses the switching cost and the impatience of the borrower to keep a share of the capital gains.

The third case is that of "external refinancing". If the switching cost is relatively low and the no-breakdown probability β is high, bank A may be unable to compete with bank B. This requires bank B to have a competitive advantage over bank A, for instance a lower funding cost, that allows it to offer a better valuation to the borrower. With probability β, the borrower moves on to bank B and accepts the competing offer. Yet, with probability $1 - \beta$, the borrower's search breaks down and no refinancing takes place.

C. Comparative statics

We now analyze the effects of variation in our two key parameters, namely β and C. To guide the interpretation, we assume that there exists a population of borrowers endowed with different existing mortgages, so that we can analyze how population-wide changes in parameter values affect refinancing propensities and average refinancing gains in an economy.

C.1. Variation in breakdown probability

Let us start with the no-breakdown probability β, which we argued before can capture the bargaining power of the borrower with respect to the competing banks. As such, this parameter can be driven both by borrower characteristics (e.g., borrower patience or sophistication) and market characteristics (e.g., the competitiveness of the relevant banking market). Proposition 2 summarizes how variation in β affects equilibrium outcomes in the population of borrowers.

Proposition 2 (Effect of lower breakdown probability)**.** *An increase in borrowers' β is associated with less internal and more external refinancing activity. The net effect on total refinancing activity is ambiguous. Average realized gains conditional on refinancing externally will be lower.*

The bargaining power parameter β does not affect whether a household *can* refinance or

not. However, the threshold for internal vs. external refinancing (i.e., $\frac{V_1 - V_0}{\beta}$) shifts, and so less borrowers will accept bank A's offer in the first stage. We see more external refinancing activity for two reasons. First, more borrowers try to move on to stage 2. Second, the probability of breakdown after stage 1 is lower. However, the effect on total refinancing activity is ambiguous, because it depends on the relative changes both in the fraction of borrowers that now try to refinance externally rather than going for the sure internal refinancing (which has gone up) and in the breakdown probability (which has gone down).

Any borrower's realized gain conditional on refinancing externally is simply $V_1^B - V_0$ before costs (the "gross" gain) and $V_1^B - V_0 - C$ after costs (the "net" gain). Average realized external refinancing gains go down when β increases for everyone, as the threshold borrower that decides to refinance externally (i.e. the borrower for whom $V_1^B - V_0 - C = \frac{V_1 - V_0}{\beta}$) now has a lower $V_1^B - V_0$.[5] Given that C has not changed, both average gross and net gains will go down. The effect on the average realized gain conditional on refinancing internally is ambiguous. On the one hand, bank A now makes better offers to everyone; on the other hand, bank A will no longer refinance internally those borrowers that used to get its best offers.

C.2. Variation in switching costs

We now move to a discussion of the parameter C, which represents the explicit financial costs of external refinancing (e.g., notary fees, administrative costs), but could be interpreted more broadly to include non-pecuniary costs of switching banks, such as the value of the (lost) relationship between the borrower and its long-standing bank. The following proposition summarizes the effect of a decrease in C.

Proposition 3 (Effect of lower switching cost)**.** *A decrease in borrowers' switching cost C is associated with more external refinancing activity. The effect on internal refinancing activity is ambiguous. Average realized gross gains conditional on refinancing externally go down.*

A lower cost of switching will be associated with a higher propensity to refinance externally, for reasons similar to those described before. However, we now also see an expansion in the pool of borrowers that *can* refinance, as the relevant condition is that $V_1^B - V_0 - C > 0$. Whether

[5] Note that there is a strong assumption here that V_1^B is not directly affected by β. This is unlikely in practice: the competitive offer of bank B is likely to go up when markets become more competitive. So we will not focus on this implication of our model empirically.

internal refinancing activity goes up depends on whether the increase in borrowers that now refinance (while they did not refinance before) more than compensates for the borrowers that now try to refinance externally (while they refinanced internally before). If for many borrowers $V_1^B - V_0$ is close to the threshold C, a decrease in switching costs will lead to a high number of borrowers moving from the no-refinancing outcome to internal refinancing. (Before the change, the lack of competition led bank A to refuse to refinance despite the potential positive gain for its borrowers.) If instead for most borrowers $V_1^B - V_0$ is close to the threshold value $\frac{V_1 - V_0}{\beta} + C$, then a decrease in switching costs will mainly lead to borrowers refinancing externally rather than internally. (Before the change, the lack of competition prevented borrowers to switch to a bank that had better funding conditions.) Nonetheless, it is clear that the net effect of a decrease in switching costs on *total* refinancing activity is likely to be positive.

Furthermore, the average realized gross gain conditional on refinancing externally goes down, just like is the case when β goes up. (However, note that any borrower that was already refinancing externally now realizes a higher *net* gain, as the offer of bank B to any borrower has not changed, while C has come down.) The effect on average realized gains conditional on refinancing internally is ambiguous because it depends on composition effects. While bank A makes better offers to everyone, (i) there are people refinancing internally now that were not refinancing at all before, and (ii) bank A will no longer refinance internally those borrowers that used to get its best offers. So compared to the effect of a higher β, there is an additional factor that puts downward pressure on observed realized internal refinancing gains.

D. Empirical implications

We now discuss three different sets of empirical implications of the model. First, we showed that a key determinant of the probability of refinancing—even internally—is the size of the potential (gross and absolute) gain from external refinancing $V_1^B - V_0$ relative to the switching costs C. Keeping the drop in interest rates constant, larger and longer-maturity mortgages will be associated with higher potential gains. For such mortgages, it will be more likely that the gain can cover the costs of switching C. (Remember that if the potential refinancing gain is too small, bank A will refuse to make an interesting offer to the borrower and will keep the capital gain for itself, as it knows that the borrower would not be able to switch banks profitably.)

Keeping constant the relative cost advantage of bank B, we can also expect that for larger and longer-maturity mortgages $V_1^B - V_0$ is more likely to exceed $\frac{V_1 - V_0}{\beta} + C$, meaning that the relative share of external refinancing will go up. Finally, given the higher threshold for refinancing externally than internally, average observed gains from refinancing externally will be higher.

Empirical Implication 1 (Refinancing propensities and realized refinancing gains)**.** *Both overall refinancing propensities and the relative share of external refinancing will go up with the outstanding balance and remaining maturity of mortgages. Gross gains from refinancing externally will generally exceed the gains from refinancing internally.*

Second, let us think about local banking market characteristics. As argued before, both β and C are likely to be affected by both location-specific and household-specific factors. An increase in local banking market competitiveness is likely to be associated both with a higher β and a lower C. For example, if you have more branches locally, it is less likely that your search for refinancing offers breaks down, and it also may become less costly to switch away from your current lender. Given our earlier results, we can formulate the following prediction about what happens if local competition goes up.

Empirical Implication 2 (Effects of local bank competition on refinancing propensitites)**.** *If bank competition rises, total refinancing activity—and, in particular, external refinancing activity— is likely to go up.*

An increase in bank competition can be thought of a joint increase in β and decrease in C. We showed before that external refinancing activity goes up in both cases. The effects on internal refinancing activity are more ambiguous, but in general the effect on *total* refinancing activity is likely to be positive.

Third, a number of implications follow directly from Proposition 3.

Empirical Implication 3 (Effects of household switching costs on refinancing propensities and realized refinancing gains)**.** *Households with lower switching costs are more likely to refinance externally. Observed average realized gross gains conditional on refinancing externally will be lower for households with lower switching costs.*

E. *Discussion*

Our simple bargaining model aims to capture the key parameters that will determine the choice of the borrower. One important assumption that could be relaxed is that the players observe all the parameters of the game. In practice, it is likely that in stage 1 the bank A and the borrower cannot know with certainty the offer of bank B, and instead receive a noisy signal. In that case, bank A in stage 1 will take into account the uncertainty and behave similarly to an auction bidder, shading its offer in order to increase its surplus. A second, related extension of the model would be to include information asymmetry between the banks and the borrower. In that case, an outcome could emerge where bank A may choose to let its worse borrowers go to bank B. This could create a sorting of borrowers of different quality into internal and external refinancing.

II. Empirical setting

A. *Household debt and mortgages in Belgium*

In 2021, mortgage debt in Belgium amounted to 254 billion euros.[6] Mortgages account for the largest share of household debt (94% of total household debt); only 6% is consumer credit and overdrafts. The ratio of mortgage debt to GDP is higher than the average for the euro area (62% in Belgium compared to 46% in the euro area). Over the past decade, the Belgian mortgage market has expanded faster than the euro zone average, with an increase of over 70%. Mortgage markets in other countries that were not too severely affected by the financial crisis (e.g., France, Sweden, Canada, Switzerland) have experienced a similar evolution.

Mortgages primarily finance owner-occupied housing. Specifically, in 2021, owner-occupants and first-time homebuyers accounted for 87 percent of new mortgages, while the remaining 13 percent were buy-to-let investors. According to data from the Household Finance and Consumption Survey (HFCS), thirty-three percent of the adult population has at least one mortgage loan. Seventy-five percent of people aged 35 to 65 own their household's main residence, while one in five households owns other real estate.

[6] The discussion in this subsection is largely based on National Bank of Belgium (2022) and Union Professionnelle du Credit (2021).

A typical mortgage contract has a fixed interest rate. Nine out of ten new mortgages in 2021 had a fixed interest rate or an interest rate with a reset period greater than ten years. The share of fixed-rate mortgages in loan origination has been above 80 percent since 2006, with the exception of a short period during the sovereign debt crisis in 2010. Most loan contracts (95% of the outstanding stock of mortgage loans) are fixed annuity contracts with fixed monthly payments covering both interest and capital repayments over the duration of the contract. Term loans (loans with no principal payments until their final maturity) are not very common, accounting for less than 4% out of the total outstanding.

Two differences with the U.S. mortgage market are worth pointing out. First, legal recourse of creditors is complete. Thus, in a market where home prices are falling, even if the loan is underwater, it is never in the borrower's best interest to default. As a result, observed delinquency and default rates are low. Second, home equity cannot be used to secure consumer loans or lines of credit. Falling house prices will thus affect consumer spending to a lesser extent, as the collateral channel through housing equity withdrawal is not at work.

Most of the mortgage debt is held by the Belgian banking sector. The Belgian mortgage market is fairly concentrated overall, with the top 6 lenders accounting for more than 80% of mortgages outstanding. A small but increasing part is held by the Belgian insurance sector (4% of the outstanding in 2021) and another part is held by providers of social loans (5%). Foreign institutions, either operating cross-border or through branches, only account for a small share of total mortgage loans granted to Belgian residents (less than 5%).

The average maturity of mortgages has increased slightly over the last decade, as illustrated in panel (a) of Figure 2. The figure shows in particular that the share of contracts being issued with a 25 year maturity has increased substantially between 2006 and 2020.

[Insert Figure 2 about here]

Given the prevalence of fixed interest rate and long maturity contracts, refinancing activity can be expected to be substantial when interest rates fall (as was the case for most of our sample period). Indeed, even without identifying refinancing events explicitly, the data suggest economically significant refinancing activity. For example, panel (b) of Figure 2 shows that, for some vintages of mortgage origination, up to 60% of the initial pool of 20-year mortgage loans

has disappeared five years after issuance.

B. Costs of refinancing

Belgian households face a number of costs to refinance their mortgage. First, the bank charges a fee to compensate the loss of interest from the loan. This fee is equal to 3 months worth of interest payments on the outstanding loan. The bank also charges administrative fees that are generally around €250. These fees are capped at a maximum of 50% of the administrative fees of the first issuance. In case of external refinancing, the borrower has to pay additional fees as the intervention of the notary is required. The notary will first remove the collateral rights to the property. The cost of this operation has both a fixed component and a variable component that is proportional to the value of the collateral right and set according to a cost grid dating from the 1970s. The cost is between 0.5% and 1.3% of the refinanced amount. The borrower also has to pay notary fees on the new credit. These fees amount to €230 plus 0.33% of the value of the outstanding balance.

These costs of refinancing are not negligible as illustrated by the following example. Suppose that a household buys a house in 2015 by borrowing €250,000 at a rate of 3.5% for a maturity of 20 years. Five years later, interest rates are at 1.5%. With the new interest rate, the household would pay €23,604 of interest over the full remaining life of the mortgage. The 3.5% mortgage rate instead implies interest payments of €57,119. By refinancing to the lower rate, the household would thus reduce interest payments by €33,515.

The costs of an internal refinancing would include €1,737 of interest compensation fees to the bank. This represents three months of interest payment at the 3.5% annual rate. The borrower would also have to pay an administrative fee of €250, so that the total cost of internal refinancing would be around €1,987. If the borrower chooses an external refinancing, the notary fees will be €1,040 for the removal of the collateral rights and around €1,055 for the new collateral rights. The total cost of external refinancing would thus be of €8,016, or 24% of the (potential) reduction in interest payments. In these computations, we ignored the time value of money. By discounting future cost reductions, the salience of the costs would increase further.

Figure 3 shows how the costs and benefits vary with the initial maturity and loan amount. The cost and benefit simulations build on the example above. In panel (a), the benefits are

calculated on a mortgage of €250,000 with an initial interest rate of 3.5% interest rate that is being refinanced after 5 years. The figure illustrates that the benefits of refinancing increase with maturity for a given fall in interest rates. The differences can be large: for a 1 percentage point fall in the interest rate, the benefit of refinancing a 25 year mortgage can be close to three times as high as the benefits of refinancing a 15 year mortgage. The dotted line on the figure corresponds to the cost of external refinancing. For loans with a short maturity, rates have to fall much more than for long maturity loans for the external refinancing to be attractive. Panel (b) of Figure 3 then shows how the costs and benefits of refinancing vary with the initial loan amount. We consider both the cost of refinancing internally and externally. The maturity of the mortgage at issuance is assumed to be 20 years. The figure considers the case of a fall in interest rate from 3.5% to 2.5% after 5 years. The figure illustrates the fixed costs related to the refinancing of mortgages, so that the relative gains are higher when the mortgages are larger.

[Insert Figure 3 about here]

III. Data

A. Mortgage-level data

A.1. Population of mortgages

Our analysis relies on the official household credit registry of the National Bank of Belgium (NBB). We use an anonymized version of the database that is made available to selected researchers. The credit registry includes the population of all loans and credit lines held by Belgian residents since 2006. We have access to data on loans issued up to December 2021.

The database includes limited information on each borrower, in particular their age and the municipality (zip code) of their primary residence. In terms of loan characteristics, the registry includes type of the loan (e.g., mortgage, consumer loan, credit facility), the identity of the lending institution, the number of co-debtors, the total (initial) amount of the loan, the term length of the loan, the periodic payment, and the date at which the loan was taken out. Every borrower and loan is uniquely identified through a number. Every household is always represented by the same borrower, and so we will use the terms "household" and "borrower"

interchangeably.

In this paper we focus on borrowers that have at least one mortgage loan. The large majority of mortgages are associated with monthly payments; we drop other types of payment schedules. This leaves us with information on 7,342,499 mortgage loans for 2,873,437 different households, as shown in panel (a) of Table I. Panel (b) of the same Table shows descriptive statistics for our sample.

[Insert Table I about here]

Panel (a) of Figure 4 shows the number of active mortgages and the number of borrowers in our sample at the end of each sample period calendar year. It also shows the number of new mortgage loans (which includes loans that refinance existing ones) for each year, and the number of different borrowers associated with the new mortgages. Panel (b) of Figure 4 shows the median and mean euro value of new mortgages for each year, and also the median and mean maturity (in months) associated with new loans. The median maturity is 240 months or 20 years for most of our time frame, except in the years around 2015, when a relatively large fraction of loans refinanced existing ones (cf. infra).

[Insert Figure 4 about here]

Panels (c) and (d) of Figure 4 show geographical heterogeneity in the number of new mortgages and average loan amounts over our sample period. More new loans are issued in the north (Flanders) and the Brussels area than in the south (Wallonia), and major urban areas clearly stand out. Average amounts of new mortgage loans are higher in areas that have higher house prices, such as the Brussels region and large cities (e.g., Antwerp, Ghent, Namur, Liège) with their surrounding municipalities. Municipalities close to the coast and the Ardennes, which are popular vacation destinations, also have higher loan amounts on average.

A.2. Estimating interest rates and loan balances

Our data set does not explicitly include the interest rate and outstanding loan balance associated with each mortgage. We proxy for these loan characteristics as follows.

Based on the monthly payment, the total number of monthly payments, and the amount borrowed, we estimate the monthly interest rate of each loan assuming annuity amortization.

(As mentioned before, the most popular mortgage type in Belgium by far is fixed-rate annuities.) In other words, we numerically solve for r in the standard annuity formula:

$$F = \frac{C}{r}\left(1 - \frac{1}{(1+r)^T}\right),$$

where F is the face value of the loan and C is the monthly payment that we assume the borrower must make for T periods. Figure 5 shows some statistics for the resulting estimated annualized interest rates on new mortgage loans for each sample year.

[Insert Figure 5 about here]

Assuming that borrowers start making payments in the month after taking out the loan, we can then proxy for the outstanding amount of a loan in period t, which we denote by A_t, as:

$$A_t = \frac{C}{r}\left(1 - \frac{1}{(1+r)^{T-t}}\right).$$

We use this method to estimate the outstanding loan balance at the end of each calendar year for each mortgage.

A.3. Proxying for the possible gain from refinancing

At the end of each calendar year, we proxy for households' potential (gross and absolute) gain from refinancing as follows. We compute the duration of each mortgage, following the standard formula for duration of annuities:

$$D = \frac{1+r}{r} - \frac{T}{(1+r)^T - 1},$$

where r is the previously-estimated interest rate on the mortgage and T is the remaining time until maturity implied by the loan characteristics. We also compute for each mortgage the change in the bank-level average interest rate between the loan origination year and the current year, using Monetary and Financial Institutions (MFI) interest rate statistics, which are available starting in 2007. We denote this spread by S. We can then proxy for the percentage gain of refinancing as $-D \times S$ and the euro gain as $-D \times S \times A$, where A is the outstanding loan

amount estimated before.

A.4. Identifying household refinancing

Refinancing decisions are not flagged as such in the data set. When we observe that a borrower takes on new mortgage debt while paying back existing mortgage debt in the same year, then this can indicate different things. A first possibility is that the borrower has refinanced their existing mortgage debt, which is what we want to pick up. A second possibility is that the borrower has sold one or more properties and bought new real estate. A third case is a combination of the other two: the borrower has refinanced while also buying or selling one or more properties.

We leverage the available information on households and their mortgages to isolate refinancing events as well as we can. We apply the following two criteria to identify refinancing (as opposed to non-refinancing) borrowers:

1. **We observe one (or at most two) deleted loan(s) and one (or at most two) new mortgage loan(s) for the same borrower in the same year.** While households can have more than one mortgage associated with one residence—also for fiscal reasons—we want to avoid picking up mortgage activity related to the selling or buying of properties, or cases where it is not clear which old mortgage loans are being refinanced by which new loans.

2. **The total amount of the new loan(s) is between** 90% **and** 140% **of the estimated outstanding amount of the deleted loan(s).** We cannot expect observed deleted and new amounts to be exactly equal for at least two reasons. First, there is measurement error in our computation of the loan balance that was repaid when the old loan was retired. One reason is our assumption that loan payments start immediately after taking out the mortgage. Another reason is that we compute outstanding amounts at the end of each year, and we do not know when exactly the new loan was proposed to the borrower. Second, the costs of refinancing can be included in the new loan. It can also include some extra financing of renovations. However, if the new loan amount is substantially different from (and, in particular, lower than) our estimate of the final balance of the old loan, then it is likely that we are not observing a refinancing event.

However, we exclude from our analysis (i.e., we do not classify borrowers as either refinancing

or non-refinancing):

1. Borrower-year combinations where the borrower's zip code changes, because any change in mortgage debt is then likely to be related to the move (and the purchase of a new home) rather than refinancing.

2. Borrowers that have mortgages with multiple banks simultaneously. Excluding such borrowers simplifies the construction of certain variables of interest, and helps to screen out quasi-professional real estate investors.

3. Borrower-year combinations for which we observe more than 2 deleted loans, more than 2 new loans, or a new-to-deleted ratio outside of the range specified above, as we cannot be sure that *no* refinancing took place.

4. Borrower-year combinations where all of a borrower's mortgage debt is retired, because the decision whether to refinance becomes irrelevant.

We label a refinancing as internal if the bank associated with the new mortgage debt is the same as the one behind the old mortgage, and as external otherwise.

At the loan-year level, all deleted loans by borrowers classified as refinancers are labeled as loans that are being refinanced. All "surviving" (i.e., ongoing) loans by both non-refinancing and refinancing borrowers are labeled as loans that are not refinanced.

A.5. Statistics on refinancing activity

Panel (a) of Figure 6 shows the estimated percentage of mortgages active at the end of each calendar year that are being refinanced internally and externally in the subsequent year (ignoring mortgages that are not classified as either refinanced or non-refinanced). Generally, 1–2% of active mortgages are refinanced every year, with the notable exception of 2014 and 2015 when the share of refinanced loans in the subsequent years reached 8% and 5%, respectively. Refinancing is mostly internal. Panel (b) shows the average interest rate "gain" for internal and external refinancing events for each sample year. In line with Empirical Implication 1, the average differential is generally higher in the case of external refinancing.

[Insert Figure 6 about here]

Figure 7 illustrates the geographical heterogeneity in refinancing activity. Panels (a) and (b) show municipality-level unconditional refinancing propensities during 2015 and 2020 for loans active at the end of 2014 and 2019. Panels (c) and (d) show *external* refinancing percentages.The figures show that there is geographical heterogeneity across municipalities, both across and within regions. Areas with lower refinancing propensities in the south earlier in the sample appear to have higher propensities later on. Areas around Brussels and large cities, as well as areas in the south, have higher external refinancing propensities.

[Insert Figure 7 about here]

B. Other data

B.1. Household bank relations and local mortgage market characteristics

From the same NBB credit registry, we can construct a number of variables at both the borrower and the municipality level. For each borrower, we observe whether they have a credit relation with another bank than their mortgage lender. We also create a number of variables using all of our mortgage data at the level of the municipality. We first compute the local market share (computed using outstanding mortgage amounts in euros) of each mortgage lender. In panels (a) and (b) of Figure 8, we show the market share per municipality of two large banks in 2020. We then measure the local mortgage market concentration using the Herfindahl index, as illustrated in panel (c) for 2020.

[Insert Figure 8 about here]

B.2. Bank branch locations

We construct the history of the population of retail bank branches in Belgium as follows. From the Crossroads Bank for Enterprises, we collect data on all bank-managed agencies (both active and closed down), i.e. branches that are fully-owned and operated by a parent bank group. Next, the Belgian financial sector federation Febelfin has given us access to a list of branches that are operated as independent franchises.[7] For each branch, we have the exact address, the identity of the parent/franchisor bank, and the start and end date of operations. Panel (d) of

[7]This database does not include any branches that stopped operations before 2015.

Figure 8 shows the total number of bank branches for each municipality in 2020. In total, we have data on about 3,500 bank branches for that year. At the start of our time frame, however, there were still more than 5,000 branches in Belgium. Panel (e) of Figure 8 shows the relative change in bank branch count over our sample period for each municipality. Panel (f) of the same figure shows the proportion of borrower-year observations in our data set in which the lender closes their (last) branch in the borrower's municipality. Overall, in about 1% of cases a borrower saw their bank closing the local branch during the year.

IV. Results

A. Mortgage characteristics

When presenting our data, we already showed that realized interest rate "gains" are generally higher for external refinancing than for internal refinancing events, in line with Empirical Implication 1. We also predicted that both overall refinancing propensities and the share of external refinancing will go up with proxies for the market value of the mortgage and the possible gross gain from refinancing. Panels (a) and (b) of Figure 9 show both overall and external refinancing propensities in 2015 (the year with the highest refinancing activity) as a function of number of loan characteristics measured at the end of 2014, namely deciles of time until maturity in panel (a), and deciles of outstanding loan balance in panel (b). Overall, the patterns are in line with expectations.

[Insert Figure 9 about here]

In panel (c), we show refinancing propensities as a function of the previously-estimated possible gain from refinancing (cf. subsection III.A.3). Note that our measure for the potential gain from refinancing will be higher for larger and longer-maturity mortgages. We see that external refinancing becomes substantially more important for the mortgages with the very highest potential refinancing gains.

B. *Local banking market competition*

We continue our empirical analysis by relating refinancing propensities to the structure of the local mortgage market—a test of Empirical Implication 2. The baseline regression model that we estimate can be described as follows:

$$y_{imbt} = X'_{mt}\gamma + Controls'_{imbt}\delta + \lambda_{mb} + \lambda_{bt} + \epsilon_{imbt} \tag{3}$$

where y_{imbt} is a dummy variable that measures whether household i living in municipality m refinances its mortgage with bank b in the year following t, X_{mt} are our time-varying municipality-level independent variables of interest, and λ_{mb} and λ_{bt} are municipality $\times$ bank and bank $\times$ year fixed effects respectively. The first set of fixed effects controls for bank-specific geographical variation in borrower behavior, while the second set of fixed effects controls for bank-specific time-series variation in refinancing propensities. In our baseline models, the vector of controls will include a variable for borrower age and a fourth-degree polynomial of the possible gain from refinancing.

We are interested in the coefficients γ, which are picking up the conditional correlations between local mortgage market characteristics and refinancing activity. The first independent variable that we consider is the number of bank branches per square kilometer, which proxies for the local supply of banking services. The second variable is the local HHI index, which measures the municipality-level concentration of the mortgage market. Because of the inclusion of different sets of fixed effects, identification is coming from local changes over time in these variables. Columns 1 of Table II show the regression results when estimating our baseline model using OLS (i.e., a linear probability model). Standard errors are clustered at the borrower level. In the subsequent models, the dependent variable equals 1 when the household refinances internally (column 2) or externally (column 3).

[Insert Table II about here]

The results show that both internal and external refinancing activity is positively correlated to the local number of bank branches. Given the included fixed effects, one can interpret our results as meaning that a decrease in the number of branches in a borrower's municipality leads

to a decrease in that same borrower's propensity to refinance, both with one's own bank and with a different bank. Similarly, a decrease in the competitiveness of a mortgage market leads to a decrease in refinancing activity.

A worry might still be that time-series variation in the local presence of banks correlates over time with borrower characteristics that also drive refinancing activity. In columns 4–6, we repeat models 1–3 but adding borrower fixed effects. This means that identification is coming from the subset of borrowers that have been exposed to two different local mortgage markets. As estimation relies on households that have had mortgages for some time in two different municipalities, we want to use a sample period that is as long as possible. We therefore replace the estimated expected refinancing gain controls, which we can only compute for mortgages originated since 2007, by simple origination year $\times$ year fixed effects. The results are qualitatively similar to those before, even if the coefficients on the branch presence variable are somewhat lower than before.

C. *Switching costs*

We now turn to heterogeneity in borrowers' bank relations that may affect their decision to refinance internally vs. externally, as predicted by Empirical Implication 3. First, we construct a dummy variable that measures whether the mortgage lender has a branch in the borrower's municipality. Second, we use a dummy variable that equals one if the borrower has credit relations with another bank. The regression models in columns 1–2 of Table III look very similar to those before, with a couple of notable differences. First, we now immediately consider internal and external refinancing separately. Second, we include municipality $\times$ year fixed effects. This means that we are exploiting variation between households *within a municipality* in a given year. Like before, we also still control for bank-specific municipality and year effects.

[Insert Table III about here]

The results in columns 1–2 of Table Table III do not show an effect of whether one's lender has a local branch. However, we find that borrowers that already have a credit relation with another bank are less likely to refinance internally and more likely to refinance externally. In column 3, we limit the analysis to the subsample of refinancers. So we are modeling the choice to refinance

externally rather than internally, conditional on refinancing. Although we observe a negative effect of the presence of a local branch on external refinancing, it is not statistically significant. In columns 4–6, we add an interaction term between our two independent variables of interest. We now see that the negative (positive) effect of having another bank on the propensity to refinance internally (externally) is mitigated if one's lender has a local branch—which may be associated with a higher cost of switching away.

In Table IV, we repeat the models in columns 1–3 of Table III, but now interacting with a dummy that indicates whether the municipality has above-median income (at the start of our sample period) or not, using data come from the Belgian statistical office Statbel. We see that the impact of having another bank on the propensity to refinance externally vs. internally is larger in low-income municipalities. This suggests that switching costs may matter more there.

[Insert Table IV about here]

Finally, we verify whether our proxies for switching costs correlate with gross refinancing gains, as our model predicts. We run regressions similar to those shown before but our dependent variable is now the difference between the old and the new interest rate, scaled by the old interest rate. Our regression specifications moreover control for the old interest rate and for origination year $\times$ year fixed effects. The results are shown in Table V. Our results suggests that lower switching costs—as proxied by not having a lender with a local branch, and by having more than one bank—are associated with lower gross refinancing gains conditional on external refinancing. These results are in line with our Empirical Implication 3.

[Insert Table V about here]

V. Conclusion

We model mortgage refinancing as a bargaining game involving the borrowing household, the incumbent lender, and an outside bank. In equilibrium, the borrower's ability to refinance depends both on the competitiveness of the local banking market and on the cost of switching banks. We find empirical support for the key predictions of our model using a unique data set containing the population of mortgages in Belgium. In particular, households' refinancing

propensities are positively correlated with the number of local branches and negatively correlated with local mortgage market concentration. Moreover, households are more likely to refinance externally if they already have a relation with more than one bank, but the effect is mitigated if their current mortgage lender has a branch locally.

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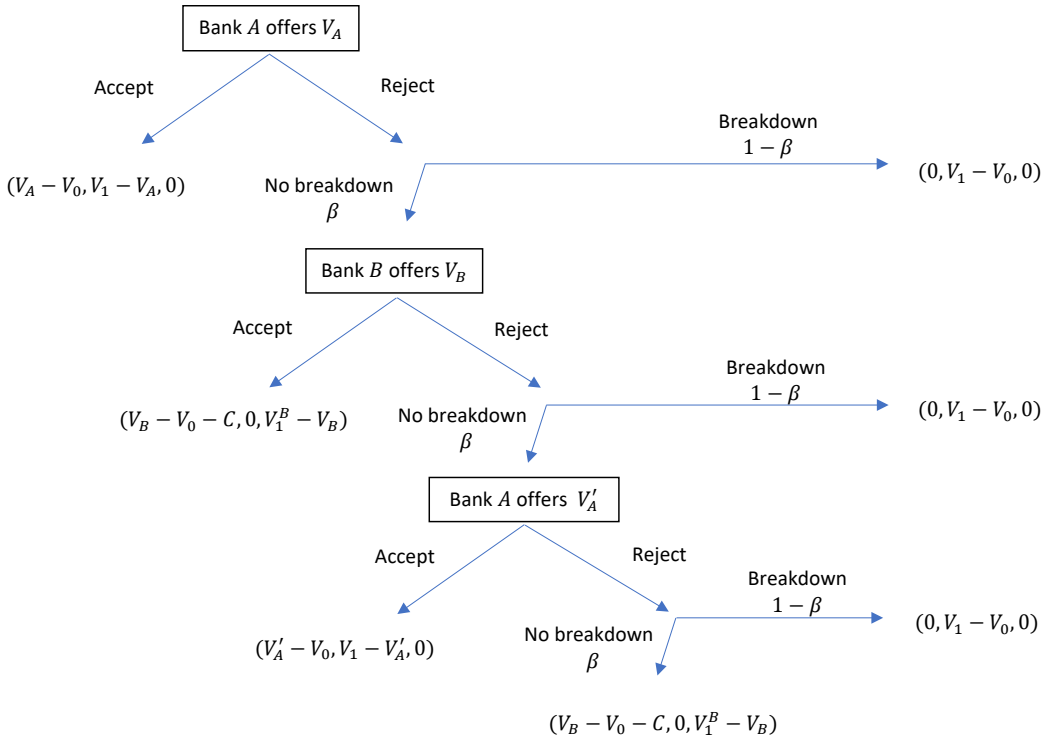
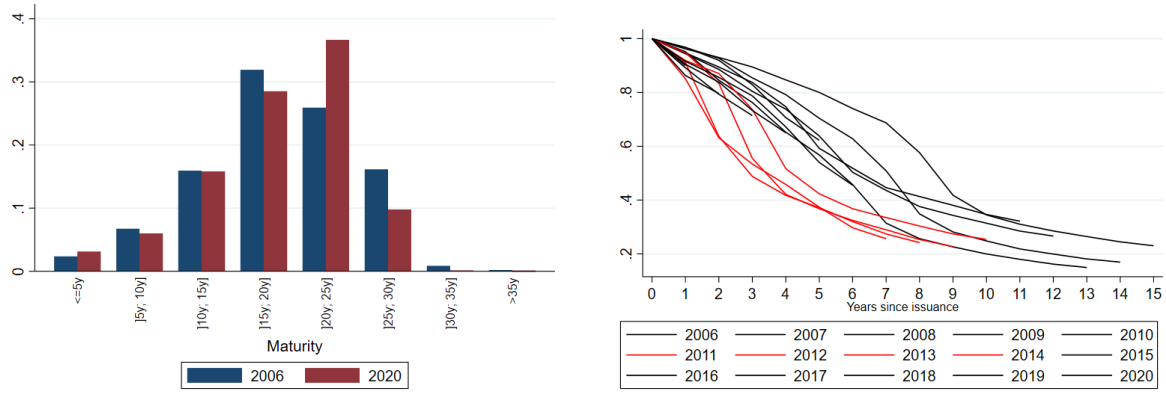


Figure 1. Bargaining stages of refinancing game for the borrower.
This figure shows the different stages of the bargaining game between the borrower, her bank A, and an outside bank B. The payoffs shown in brackets are for the borrower, bank A, and bank B, respectively.

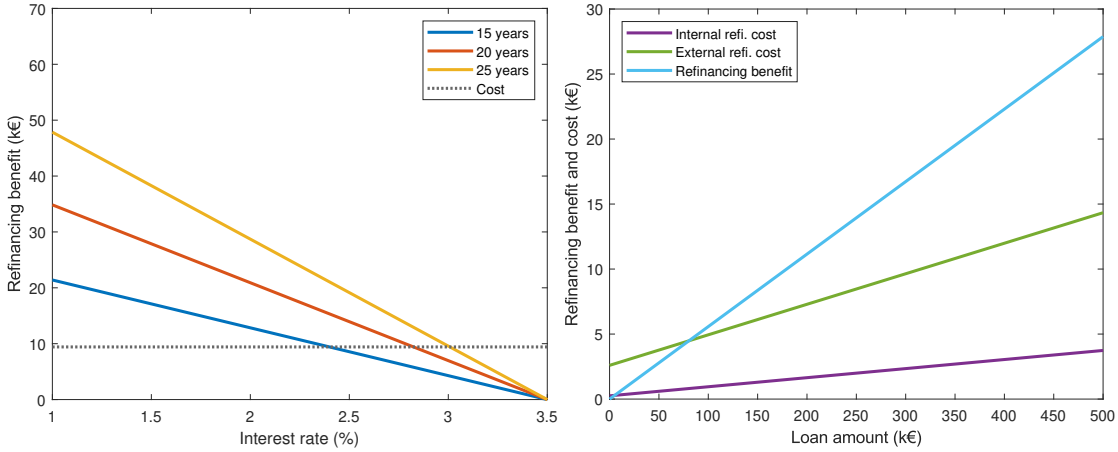


(a) Relative frequency distribution of new mortgage loans by maturity at issuance

(b) Fraction of loans issued in a given year that are still in the pool of outstanding loans by years since issuance.

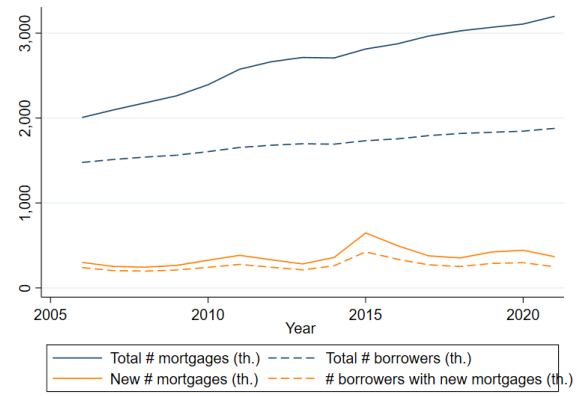
Figure 2. Maturity structure of new loans and survival rate.

Panel (a) of this figure shows the distribution of new mortgage loans by maturity at issuance in 2006 and 2020. Panel (b) shows the fraction of 20-year maturity mortgages that are still outstanding by years since issuance and vintage year.

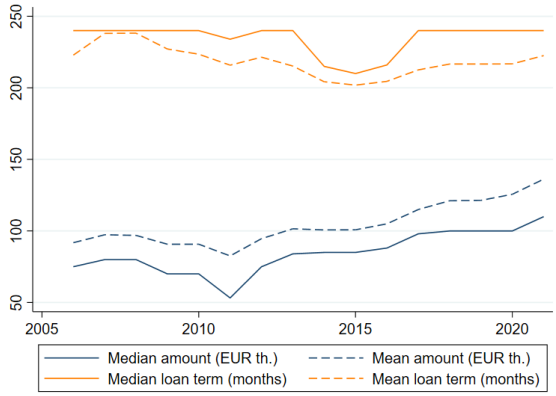


(a) Maturity **(b)** Loan size

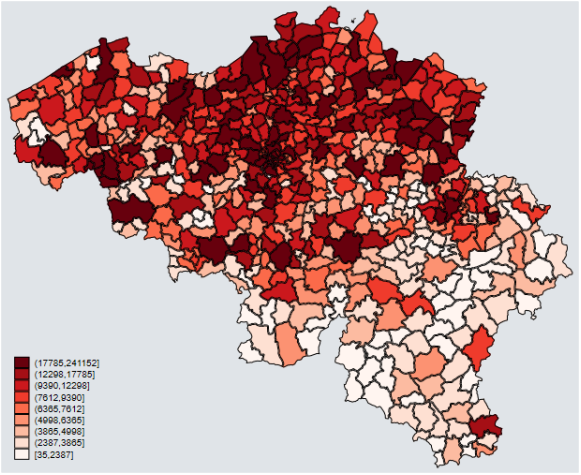
Figure 3. Comparative statics of refinancing costs and benefits.
Panel (a) shows how the gross benefit of refinancing varies with the interest rate for 3 different loan maturities: 15, 20 and 25 years. The benefits are calculated on a mortgage of €250,000 with an initial interest rate of 3.5% that is being refinanced 5 years after origination. The grey dotted line represents the cost of external refinancing. Panel (b) shows how the costs of internal and external refinancing as well as the (gross) benefits of refinancing vary with the initial loan amount. The figure assumes an initial maturity of 20 years with a refinancing 5 years after origination, an initial rate of 3.5%, and a new rate of 2.5%.



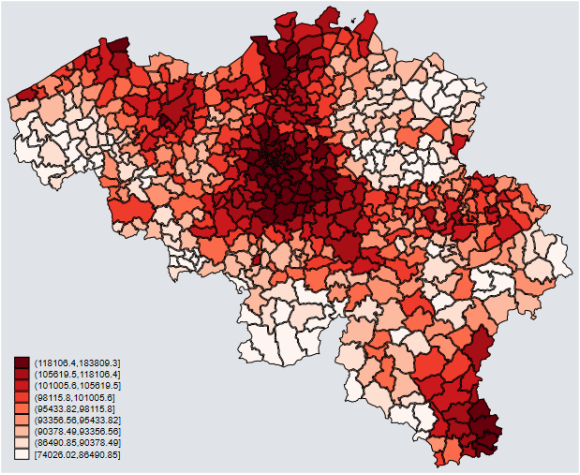
(a) Total and new mortgage loans



(b) Size and maturity of new mortgage loans



(c) Number of new mortgage loans



(d) Average amounts of new mortgage loans

Figure 4. Overview of the mortgage market in Belgium.
Panel (a) of this figure shows the number of borrowers and the number of mortgages outstanding from 2006 to 2021 as well as new borrowers and new mortgages. Panel (b) shows the evolution of the median and mean loan size and maturity (in months). Panels (c) and (d) show the number and the average size of new mortgage loans for the different municipalities in our sample.

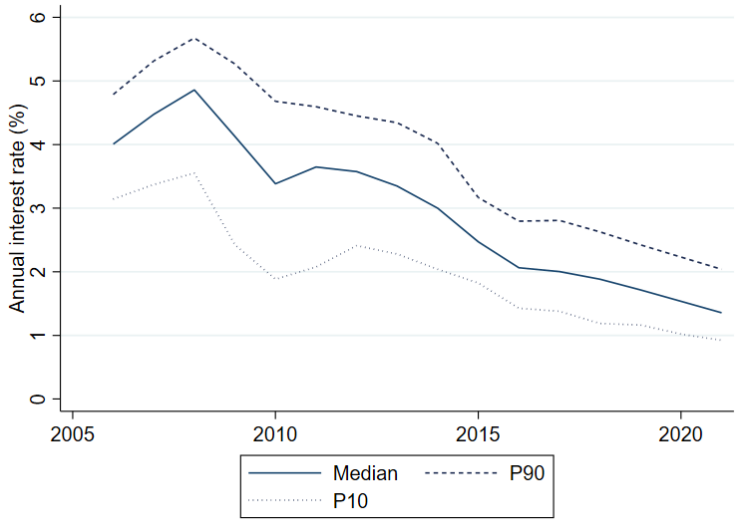
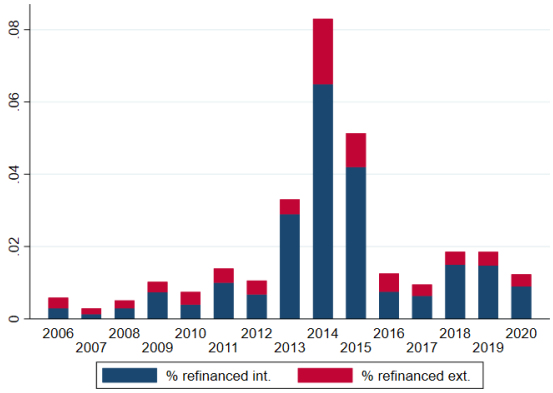
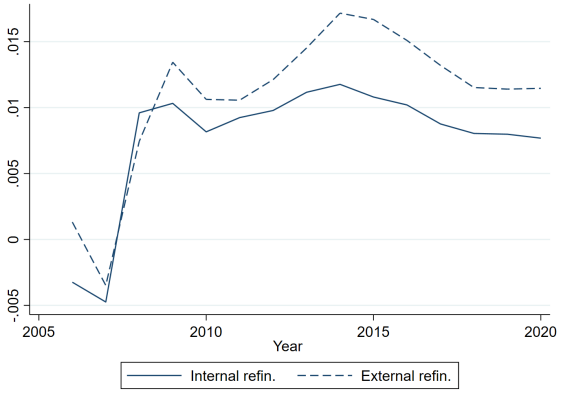


Figure 5. Statistics for estimated interest rates.
This figure shows the yearly median, the 10^{th}, and the 90^{th} percentile of the distribution of estimated annual interest rates on new mortgage loans in our sample.



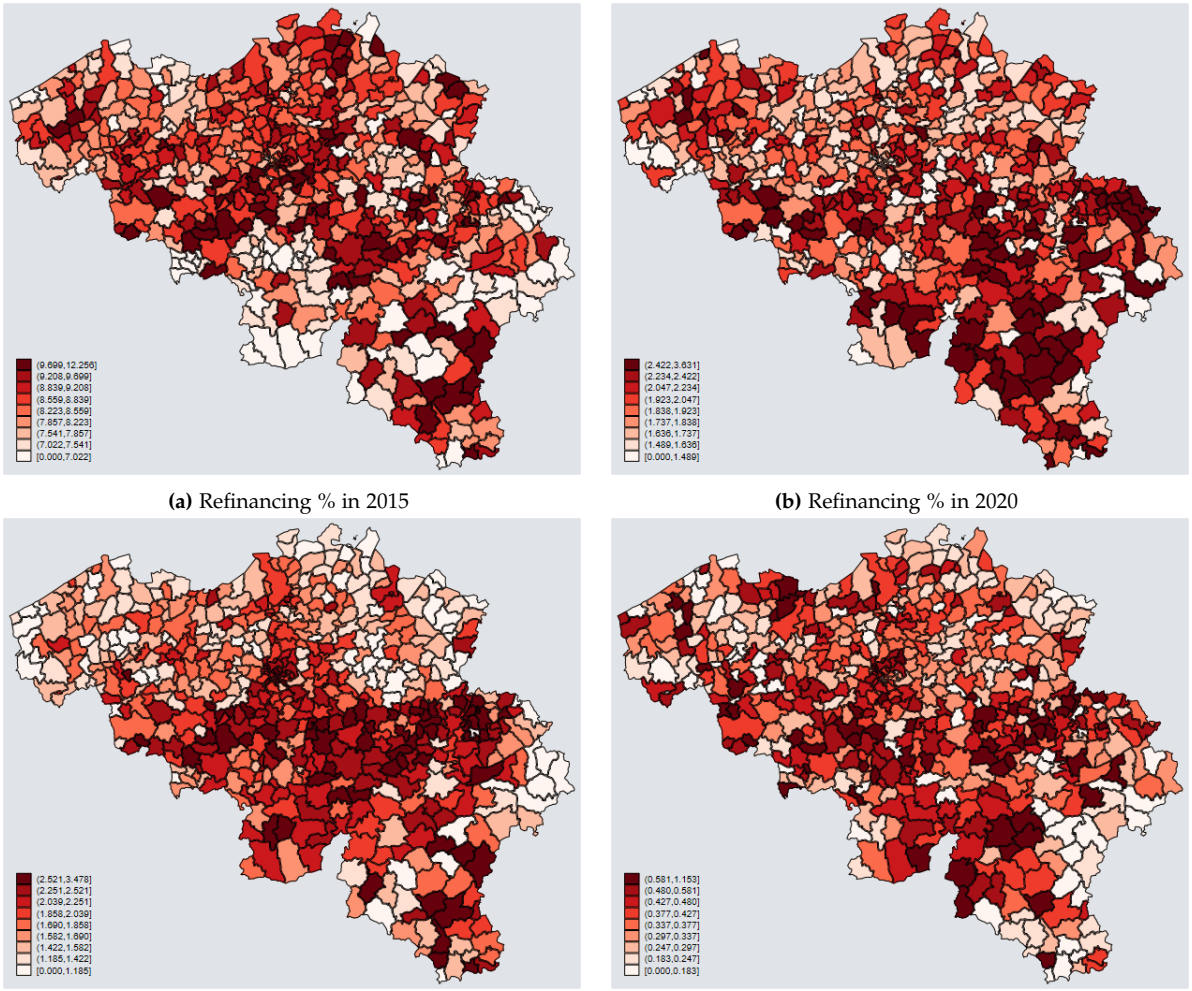
(a) Fraction of active mortgages being refinanced in the next calendar year



(b) Interest rate differential on old vs. new loans

Figure 6. Refinancing activity and realized gains.

Panel (a) of this figure provides an overview of refinancing activity over time, showing the share of mortgages outstanding that is refinanced in any given year, as well as the breakdown between internal and external refinancing. Panel (b) shows the yearly average difference between the interest rate on the initial mortgage and that on the refinanced mortgage.



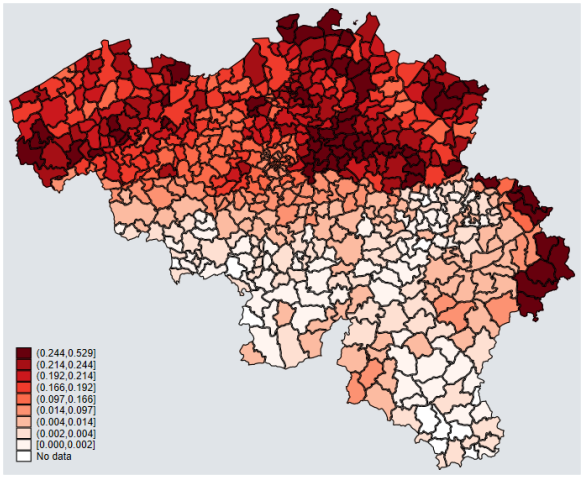
(a) Refinancing % in 2015

(b) Refinancing % in 2020

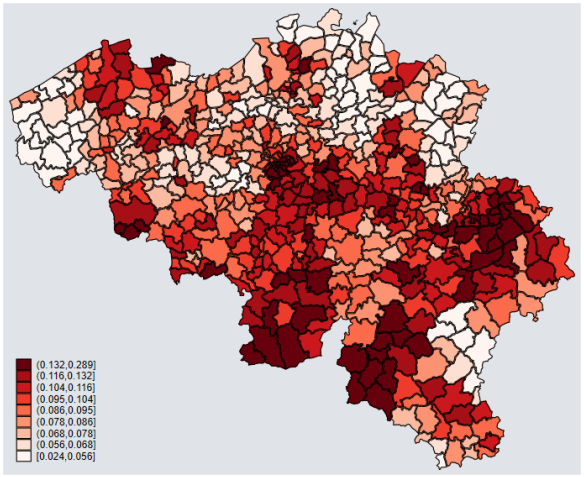
(c) External refinancing % in 2015

(d) External refinancing % in 2020

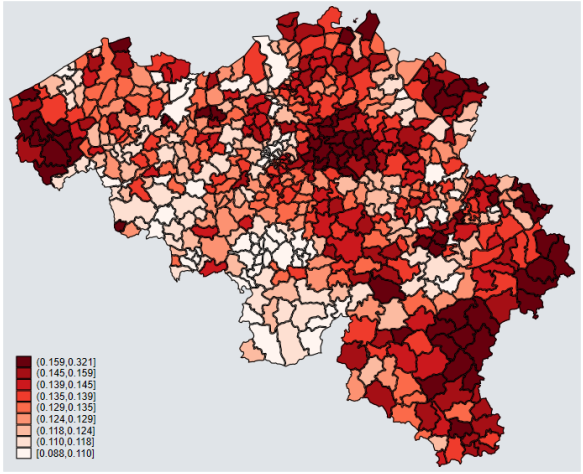
Figure 7. Geographical heterogeneity in refinancing propensities.
These figures show the total and external refinancing activity across municipalities in 2015 and 2020. Refinancing activity is defined as the share of loans that are refinanced in a given year.



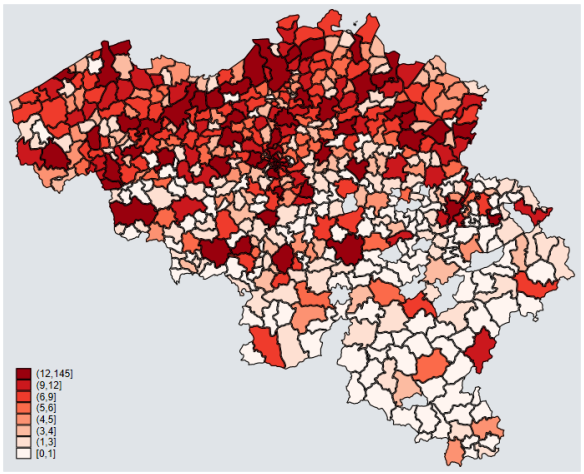
(a) Market share of bank A in 2020



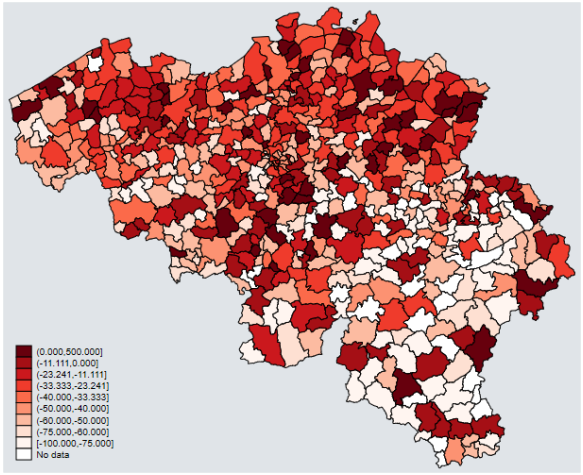
(b) Market share of bank B in 2020



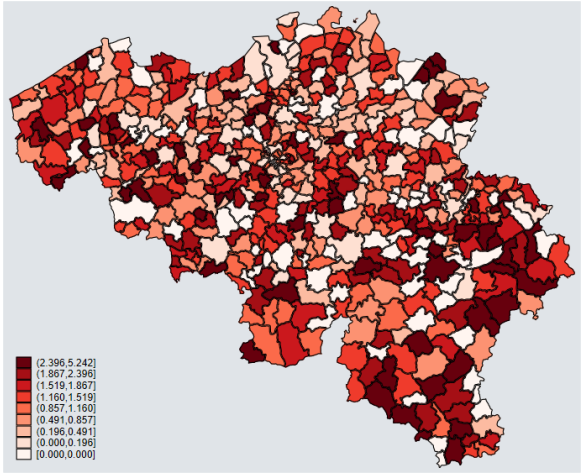
(c) Local HHI index in 2020



(d) Number of bank branches in 2020

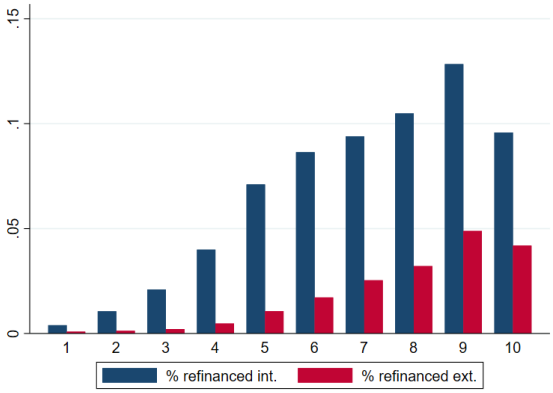


(e) Relative change in number of bank branches 2007–2020

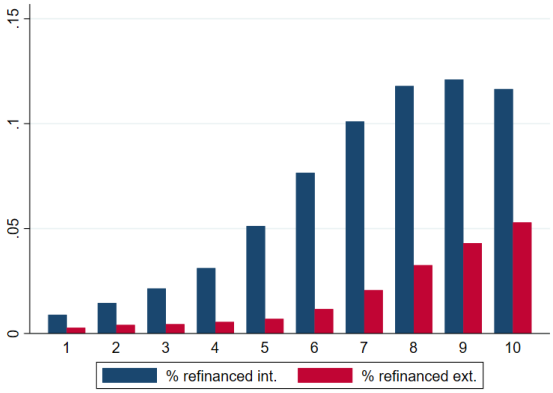


(f) Proportion of borrower-year combinations experiencing local branch closure of lender

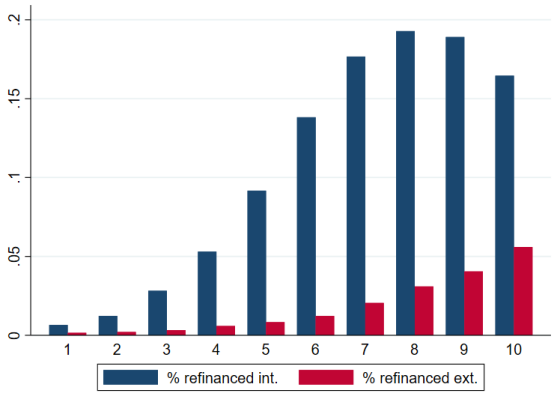
Figure 8. Local mortgage markets.
Panel (a) and (b) of this figure show the local market share of two large banks in 2020. Panel (c) to (f) show geographical heterogeneity in a number of derived measures related to local banking markets.



(a) Deciles of remaining time until maturity



(b) Deciles of estimated loan balance



(c) Deciles of expected gross gain from refinancing

Figure 9. Refinancing propensities in 2015 as a function of loan characteristics at the end of 2014. Panel (a) of this figure shows the fraction of loans that are refinanced (overall or externally) in 2015, by decile of remaining time until maturity measured at the end of 2014. Panels (b) and (c) repeat the exercise by estimate loan balance and gross gain from refinancing.

Table I
Descriptive statistics

Panel (a) of this table shows statistics on the number of borrowers, loans, and municipalities in our data set. Panel (b) shows some statistics related to the size and maturity of the mortgages in our sample.

(a) Frequencies

	N
Number of borrowers	2,873,437
Number of borrowers (new mortgages)	2,183,740
Number of loans	7,342,499
Number of loans (new mortgages)	5,584,637
Number of municipalities	589

(b) Statistics

	N	Mean	S.D.	P10	Median	P90
Loan amount	7,452,814	96,179	107,654	15,793	74,368	200,000
Loan amount (new mortgages)	5,864,375	105,582	117,229	15,000	85,000	219,000
Maturity in months	7,452,814	214	77	120	237	300
Maturity in months (new mortgages)	5,864,375	217	81	120	240	301

Table II
Local banking market competition and refinancing decisions

This table presents coefficients from linear regressions where the dependent variable is a dummy variable that equals one if the household refinances (internally and/or externally). Robust standard errors clustered at the borrower level.

	(1)	(2)	(3)	(4)	(5)	(6)
	All	Internal	External	All	Internal	External
Branches per km2	0.00407***	0.00317***	0.00090***	0.00153***	0.00076***	0.00077***
	(0.00044)	(0.00039)	(0.00021)	(0.00027)	(0.00021)	(0.00017)
Local HHI index	-0.05111***	-0.03436***	-0.01675***	-0.04265***	-0.03348***	-0.00919***
	(0.00773)	(0.00710)	(0.00325)	(0.00462)	(0.00398)	(0.00231)
Refinancing gain polynomial?	Yes	Yes	Yes	No	No	No
Origination year x year F.E.?	No	No	No	Yes	Yes	Yes
Bank x municipality F.E.?	Yes	Yes	Yes	Yes	Yes	Yes
Bank x year F.E.?	Yes	Yes	Yes	Yes	Yes	Yes
Borrower age group F.E.?	Yes	Yes	Yes	Yes	Yes	Yes
Borrower F.E.?	No	No	No	Yes	Yes	Yes
Observations	13,194,575	13,194,589	13,197,369	29,904,070	29,904,093	29,907,884
R squared	0.061	0.055	0.012	0.184	0.176	0.153

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table III
Switching costs and refinancing decisions

This table presents coefficients from linear regressions where the dependent variable is a dummy variable that equals one if the household refinances (internally or externally). In columns 3 and 6, the sample is restricted to refinanced loans only. Robust standard errors clustered at the borrower level.

	(1)	(2)	(3)	(4)	(5)	(6)
	Internal	External	External	Internal	External	External
Lender with local branch	0.00010	-0.00020	-0.00606	-0.00027	-0.00015	-0.00069
	(0.00032)	(0.00015)	(0.00523)	(0.00034)	(0.00016)	(0.00535)
Borrower with other bank	-0.00225***	0.00169***	0.05032***	-0.00299***	0.00179***	0.06206***
	(0.00012)	(0.00005)	(0.00133)	(0.00024)	(0.00011)	(0.00313)
Borrower with other bank				0.00094***	-0.00013	-0.01431***
× Lender with local branch				(0.00027)	(0.00013)	(0.00344)
Refinancing gain polynomial?	Yes	Yes	Yes	Yes	Yes	Yes
Bank x municipality F.E.?	Yes	Yes	Yes	Yes	Yes	Yes
Bank x year F.E.?	Yes	Yes	Yes	Yes	Yes	Yes
Municipality x year F.E.?	Yes	Yes	Yes	Yes	Yes	Yes
Borrower age group F.E.?	Yes	Yes	Yes	Yes	Yes	Yes
Subsample refinancers?	No	No	Yes	No	No	Yes
Observations	13,837,919	13,840,874	448,841	13,837,919	13,840,874	448,841
R squared	0.056	0.013	0.189	0.056	0.013	0.189

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table IV
Geographical heterogeneity in the importance of switching costs

This table presents coefficients from linear regressions where the dependent variable is a dummy variable that equals one if the household refinances (internally or externally). In column 3, the sample is restricted to refinanced loans only. Robust standard errors clustered at the borrower level.

	(1)	(2)	(3)
	Internal	External	External
Lender with local branch	-0.00001	-0.00030	-0.00603
	(0.00046)	(0.00022)	(0.00768)
High-income municipality	0.00020	0.00017	-0.00004
× Lender with local branch	(0.00062)	(0.00030)	(0.01029)
Borrower with other bank	-0.00268***	0.00183***	0.05612***
	(0.00017)	(0.00007)	(0.00198)
High-income municipality	0.00079***	-0.00027***	-0.01042***
× Borrower with other bank	(0.00023)	(0.00010)	(0.00265)
Refinancing gain polynomial?	Yes	Yes	Yes
Bank x municipality F.E.?	Yes	Yes	Yes
Bank x year F.E.?	Yes	Yes	Yes
Municipality x year F.E.?	Yes	Yes	Yes
Borrower age group F.E.?	Yes	Yes	Yes
Subsample refinancers?	No	No	Yes
Observations	13,837,919	13,840,874	448,841
R squared	0.056	0.013	0.189

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table V
Switching costs and realized gains from refinancing

This table presents coefficients from linear regressions where the dependent variable is the difference between the interest rate on the old loan and the interest rate on the new loan scaled by the initial interest rate. In columns 1 and 3 (columns 2 and 4), the sample is restricted to internally (externally) refinanced loans only. Robust standard errors clustered at the borrower level.

	(1)	(2)	(3)	(4)
	Internal	External	Internal	External
Lender with local branch	-0.16339	0.42701**	-0.17145	0.44735**
	(0.10625)	(0.21537)	(0.11044)	(0.21263)
Borrower with other bank	0.01241	-0.09767***	-0.00410	-0.07511**
	(0.01008)	(0.02583)	(0.02481)	(0.03354)
Borrower with other bank			0.02088	-0.04083
× Lender with local branch			(0.02686)	(0.04865)
Initial interest control?	Yes	Yes	Yes	Yes
Origination year x year F.E.?	Yes	Yes	Yes	Yes
Bank x municipality F.E.?	Yes	Yes	Yes	Yes
Bank x year F.E.?	Yes	Yes	Yes	Yes
Municipality x year F.E.?	Yes	Yes	Yes	Yes
Borrower age group F.E.?	Yes	Yes	Yes	Yes
Observations	543,155	168,326	543,155	168,326
R squared	0.128	0.189	0.128	0.189

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$