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Bank Competition and Bargaining over Refinancing

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We model mortgage refinancing as a bargaining game involving the borrowing household, the incumbent lender, and outside banks. We show that bargaining can provide a competitive advantage to the incumbent bank. In equilibrium, the borrower's ability to refinance depends on the incumbent bank's cost (dis)advantage relative to locally present competing banks and on the average creditworthiness of borrowers in the relevant market. It is also driven by borrower impatience and switching costs. We find empirical support for the key predictions of our model in an administrative data set covering the universe of mortgages in Belgium. (*JEL* G11, G21, G51)

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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 and informational channels (Agarwal, Rosen, and Yao 2016; Keys, Pope, and Pope 2016; Johnson, Meier, and Toubia 2019). In a recent contribution to this literature, Andersen et al. (2020) empirically model the psychological and information-gathering costs associated with refinancing,

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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 primarily 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. 2023), 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; Liebersohn 2024). If mortgage markets are local in scope, then households' refinancing propensities 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. The bargaining process is influenced by competition from outside banks, as the borrower has the option to shop for other offers. We integrate the bargaining and competition dynamics in a simple two-stage game. In the first stage (the "bargaining stage"), the borrower tries to negotiate a new interest rate with her current bank. If she accepts the offer of the incumbent bank, this means that the mortgage is refinanced "internally." If the borrower rejects the lender's offer in the first stage, she moves to a second stage (the "competitive round") in which all banks in the borrower's location can make an offer for the mortgage. If one of these outside offers is accepted by the borrower, we speak of an "external" refinancing.

The equilibrium offer that the incumbent lender does in the first stage will be a function of (i) the borrower's current rate, (ii) the relative funding costs of competing banks, (iii) the average quality of borrowers in the market, (iv) the borrower's patience in searching for offers with outside banks, and (v) how costly it is for the borrower to switch from her current lender to another bank. If the net payoff for the borrower of trying to switch 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 costs of searching and switching, the borrower will generally 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 banks and on the search and switching costs. However, we also show that the bargaining phase can provide an additional advantage to the incumbent bank relative to a purely competitive game. By making the first offer, the incumbent bank can in some cases beat the offer of the competing bank despite having a cost disadvantage. The bargaining features of the refinancing process can thus be a source of

inefficiency, providing a new explanation for the low occurrence of external refinancing.

We derive four 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. Second, competing banks only take current market conditions into account when making their offers, while the offer of the incumbent bank depends on the initial conditions of the loan. The reason for this is that the borrower is impatient and, all else equal, prefers to borrow at the incumbent bank instead of searching for outside offers. Knowing this, the incumbent bank reduces its offer in the first stage of bilateral negotiations. Third, refinancing activity will depend on a number of local factors. Ceteris paribus, refinancing probabilities are positively affected by the number of competing banks, the relative cost advantage of competing banks, and the average quality of borrowers in the market. Fourth, borrowers are more likely to refinance if they have lower switching costs, and patient borrowers are more likely to refinance externally.

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 elevated costs.

Our database contains information on more than 7 million mortgage loans (held at some point between 2006 and 2022) 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 mortgage 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 with the deletion of more than two loans.

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. The variation in the propensity to refinance is also in line with the implications of our model: it increases with the remaining maturity and the outstanding loan balance—and more so for external refinancing. We also

show that, conditional on refinancing, the new interest rate is much more sensitive to the old interest rate in the case of a refinancing with the incumbent bank.

Next, we move to the impact of local banking market characteristics. Our first two independent variables measure the number of bank branches per square kilometer and the lowest rate that is "available" (through the presence of a branch) locally. The third independent variable measures the share of delinquent mortgages at the municipality level, as a proxy for the average quality of the pool of borrowers. 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 variables of interest. Our results are consistent with the model: refinancing activity is higher when the local mortgage market is more competitive, with a positive relationship both for internal and external refinancing activity. The regressions also show that a higher presence of risky borrowers in a municipality is associated with lower refinancing propensities, consistent with private information and adverse selection issues hampering the refinancing process.

We also find that if a borrower is with a bank that has a branch locally, she is less likely to switch away, arguably because the cost of doing so is higher. And if she already has a credit relation with another bank, she is more likely to refinance externally. Borrowers with multiple bank relations may face lower switching costs, but it is also likely that they have higher patience in searching (i.e., face a lower search breakdown probability).

One of the unique features of our data is that we observe not only the actual borrowing, but also consultations of the national credit registry by banks. Banks will typically look up a household if they want to gather information on a borrower seeking a new loan. In a strict interpretation of the model, a borrower will only interact with banks other than her own in the "competitive" stage, after she has already rejected her own bank's offer. Yet, more pragmatically, we can consider the first "bargaining" stage as an abstract way of capturing the initial back-and-forth between a borrower and her bank, which may also involve the borrower exploring her options elsewhere. As such, the search activity that can be reverse-engineered from our consultations data will not only reflect the supply-side determinants of refinancing that are the focus of the model, but also the intensity of borrowers' bargaining over refinancing—or even simply the extent to which borrowers gather the necessary information to initiate the bargaining game.

We empirically explore how consultations of households' credit records by outside banks correlate with the same competition and market characteristics as studied before. Given our earlier results that market competitiveness increases refinancing propensities, it is not surprising that we find that a higher presence of bank branches is associated with more shopping activity. However, we also find that a higher riskiness of borrowers in the municipality is associated with higher search activity. This finding, similar to that of

Agarwal et al. (2024), counters a potential alternative explanation for why we see less refinancing in areas with lower-quality borrowers, namely that there is less demand for refinancing in such areas. Rather, it suggests that the supply of refinancing options in these areas is more restricted, in line with the mechanisms at the heart of our model.

Finally, we illustrate how borrower-level demographic characteristics may affect the dynamics that we model. In particular, we show how the positive effect of having multiple bank relations on external refinancing activity disappears with age. We also see a declining pattern for shopping activity, but to a much lesser extent. While the latter finding suggests that older households have higher information-gathering costs, in line with Andersen et al. (2020), the first result indicates that these households also have lower patience in searching for outside offers (or higher switching costs), which allows their bank to retain them.

Our paper contributes to different strands of the literature. First, our paper makes a theoretical contribution by modeling mortgage refinancing as a bargaining game (as in Acharya, Gromb, and Yorulmazer (2012)) with endogenous competition by outside banks (as in Dell'Ariccia and Marquez (2004)). This captures key features of the refinancing process, which is decentralized and where the incumbent bank has substantial negotiation power. While the model of optimal refinancing of Agarwal, Driscoll, and Laibson (2013) focuses on loan and borrower determinants, the equilibrium in our model also depends on competitive characteristics such as the number of lenders active in the local market. Agarwal et al. (2023) consider a general model of refinancing where market power comes in the form of an exogenous mark-up, while the outcome in our model is endogenous to the competitive environment and the bargaining process. In contrast to, for example, Allen, Clark, and Houde (2018) and Agarwal et al. (2024), who focus on search in the context of mortgage origination, we provide a closed-form solution for the refinancing problem. A novel result that emerges from our model including a bargaining phase (and thus not being a pure bidding game with switching costs) is that the incumbent bank may be able to fend off competing banks despite having a cost disadvantage. This provides a novel explanation for the failure to refinance documented in earlier literature, and for the relative scarcity of external refinancing that can be observed in our data.

Second, it has been well documented that households often fail to refinance even when it seems optimal to do so (Keys, Pope, and Pope 2016). An extensive literature studies the determinants of household refinancing decisions, mainly focusing on (relatively fixed) borrower characteristics (Agarwal, Rosen, and Yao 2016; Bajo and Barbi 2018; Johnson, Meier, and Toubia 2019; Andersen et al. 2020; Berger et al. 2023; Gerardi, Willen, and Zhang 2023). Fewer papers have studied geographical heterogeneity, although recent work by Fisher et al. (2024) shows that the lower refinancing activity in less wealthy areas in the United Kingdom cross-subsidizes the higher activity in

wealthier areas.[1] Our innovation is to study the role of local banking market characteristics (and of borrowers' bank relations).[2]

Third, our empirical analysis contributes to the literature on the importance of local banking market concentration. Buchak and Jørring (2021) and Fuster, Lo, and Willen (2024) study the role of the local structure of demand and supply in shaping credit market outcomes. In a recent paper, Liebersohn (2024) shows that a fall in market concentration after forced divestitures increases deposit rates and mortgage originations in the United States. 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. 2023).[3] 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, Gavazza, and Surico 2021; Berger et al. 2021) and the effect of monetary policy on the distribution of household debt (Emiris and Koulischer 2021, and references therein). Our paper also 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.

1. Model

1.1 Simple refinancing rule

We first consider the benchmark case where the borrower has the bargaining power.[4] By contracting on a fixed-rate mortgage, the borrower effectively sells an annuity to the bank. As for any fixed-income security, the sensitivity of the value of the claim to changes in the interest rate will depend for a first approximation on the modified duration. For an interest rate change of Δr, the change in value of the mortgage ΔV is given by:

$$\Delta V = -V_0 \times \text{Duration}^* \times \Delta r,$$

[1] Other recent papers have studied peer effects in refinancing behavior (Maturana and Nickerson 2019; McCartney and Shah 2022). 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, Mahoney, and Yang 2023).

[2] Recent survey and empirical evidence from Bhutta, Fuster, and Hizmo (2021) and Zhang (2022) point to an important role for shopping behavior and transaction costs in determining the cost of mortgages.

[3] Drechsler, Savov, and Schnabl (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.

[4] This benchmark framework is equivalent to the optimal refinancing rule of Agarwal, Driscoll, and Laibson (2013), ignoring the option value of refinancing when interest rates are stochastic.

where V_0 is the outstanding loan amount before the rate change and $\text{Duration}^* = \text{Duration}/(1+r)$ is the modified duration of the loan. If the borrower has the bargaining power, she will choose to refinance as soon as the benefits ΔV are larger than the costs. These costs can include administrative fees but also borrower-specific psychological costs.

How do mortgage characteristics affect the decision to refinance? Clearly, a longer initial maturity will increase the benefits of refinancing for a given fall in interest rates at any point over the mortgage's life cycle. Furthermore, larger loans will be associated with higher benefits of refinancing. If the costs of refinancing have a fixed component, the expected profit of refinancing will grow with the initial mortgage amount. If the costs of refinancing externally (i.e., with a different bank) are higher than those of refinancing internally (i.e., with the current lender), then the borrower never refinances with an outside bank.

1.2 Competition and bargaining

If the borrower has the bargaining power, the decision rule is simple: refinance if the gain in the value of the mortgage outweighs the costs of refinancing. In practice, however, the bank can refuse to refinance—or, technically, offer an unattractive interest rate. In that case, competition and borrower characteristics play a key role in determining the outcome of the refinancing process. To integrate these features, we combine a bargaining process in the spirit of Acharya, Gromb, and Yorulmazer (2012), where two agents bargain in multiple stages and moving to an additional stage is costly, with a competition model in the spirit of Dell'Ariccia and Marquez (2004), where an incumbent bank and outside banks simultaneously make offers to a borrower.

There are three types of agents: a continuum of borrowers $i \in [0,1]$, an incumbent bank A, and N competing banks indexed by $b = 1, \ldots, N$. Each borrower i has a mortgage with a bank A issued at an interest rate r_{0i}, which embeds the bank's competitive risk-free interest rate at origination and a borrower-specific risk premium. The present value of the remaining mortgage payments with the initial interest rate is V_{0i}. At the beginning of the refinancing process, each bank is affected by an interest rate shock.[5] The change in interest rates implies a new valuation of the mortgage that can differ for each bank. We let V_{1i} indicate the value of the future payments when discounted at bank A's new risk-free rate and $K_b V_{1i}$ indicate the value to bank b (again ignoring borrower default risk), where K_b is the funding advantage of bank b relative to bank A.[6]

[5] For instance, a monetary policy shock could affect banks differently (Kashyap and Stein 2000).

[6] We refer to K_b as a "funding advantage," which suggests that $K_b > 1$. While this is the most interesting case to generate external refinancing, our results also hold for $K_b < 1$, where the competing banks still influence the conditions for internal refinancing.

Each borrower i is endowed with an impatience parameter β_i that determines the cost of shopping around for a new mortgage (instead of immediately deciding to stay with the current lender). The impatience parameter β_i discounts the payoffs in the second stage of the bargaining game. It can also be thought of as the likelihood that a borrower stays in the game when moving to the next stage—and as a proxy for borrower bargaining power—as in Acharya, Gromb, and Yorulmazer (2012).[7] It is known to all banks. Each borrower is also endowed with a probability of success θ_i (or, conversely, a probability of default $1-\theta_i$). This probability of success is only known to the borrower; the banks instead know the average probability of success $\theta = E(\theta_i)$, which is common to all borrowers. If default occurs, it happens just after the refinancing has taken place. In this case, the borrower obtains a payoff of zero and the bank loses the amount lent.

To capture the gains of lower interest rates, the borrower has two options. First, she can negotiate a new interest rate with bank A. This is an "internal" refinancing. The second option is for the borrower to buy back her mortgage at its initial value V_{0i} while securing funding from a competing bank b. This "external" refinancing is costly as the borrower must pay a fixed cost C_i for switching banks. The switching cost captures administrative costs such as the notary fees, as well as borrower-specific costs related to switching from the incumbent to a competing bank. This cost is common to all banks but varies across borrowers.

We model the refinancing process as a two-stage game. In the first stage (the "bargaining round"), the borrower goes to her bank A and receives an offer for a new interest rate. The new rate values the mortgage at V_{Ai}. The borrower can then either accept or reject the offer of the bank. If she accepts, her expected payoff is $\theta_i(V_{Ai} - V_{0i})$, which corresponds to the probability of success multiplied by the value that bank A gives to the borrower. The expected payoff of the bank is $\theta V_{1i} - V_{Ai}$, that is, the average probability of success times the value of the remaining mortgage payments at bank A's new risk-free rate, minus the offer made to the borrower.

If the borrower rejects the offer of bank A, she proceeds to the second, "competitive" stage. All banks then bid for the mortgage. The incumbent bank bids V'_{Ai} and the competing banks bid V'_{bi}. Two types of costs now come into play. First, all payoffs are discounted by the impatience parameter β_i. The second cost is the switching cost C_i discussed before, and is relevant if the borrower indeed ends up refinancing her mortgage with a competing bank $b \in \{1, \ldots, N\}$. If the borrower accepts bank b's offer, she pays the cost C_i and her expected payoff is $\beta_i\theta_i(V'_{bi} - V_{0i} - C_i)$. Bank b's payoff is

[7] The idea that patience provides bargaining power goes back to Rubinstein (1982). Note that, while we will speak of β_i as capturing the cost associated with search, it is different from a typical search cost parameter. Namely, in our setting, it is a (multiplicative) discount factor, rather than an (additive) cost that needs to be paid no matter the outcome.

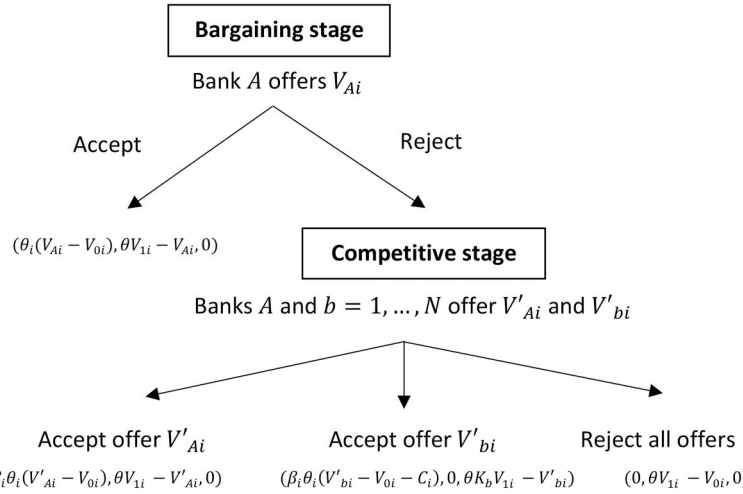


Figure 1
Stages of the refinancing game
This figure shows the two stages of the game between the borrower, her bank A, and the outside banks $b = 1, \ldots, N$. In stage 1, the borrower and the incumbent bank bargain over a potential refinancing. In stage 2, all banks make a refinancing offer. The payoffs shown in brackets are for the borrower, the incumbent bank, and the refinancing outside bank if relevant (0 otherwise).

$\theta K_b V_{1i} - V'_{bi}$, and bank A has a payoff of zero since it loses its borrower. If the borrower rejects all offers, no refinancing takes place.

Figure 1 illustrates the bargaining game and summarizes the payoffs of the different agents. The payoffs in parentheses are those of the borrower, of bank A, and of the outside bank that refinances the mortgage (in case of an external refinancing).

1.3 Equilibrium

We solve the game by backward induction. We first determine the equilibrium of the bidding game in stage 2, and then the equilibrium of bargaining in stage 1 given the equilibrium in stage 2. In the second stage (i.e., the competitive round), a key determinant of the strength of each bank is the maximum net value that it can offer to the borrower. The maximum value that bank A can offer is θV_{1i}. For the competing banks $b = 1, \ldots, N$, this is $\theta K_b V_{1i} - C_i$. In what follows, we rank (without loss of generality) the competing banks, so that bank 1 can provide the lowest net value and bank N can provide the highest net value to the borrower: $\theta K_1 V_{1i} - C_i < \ldots < \theta K_N V_{1i} - C_i$.

To determine the outcome of the bidding game, four different valuations are key: the maximum value that bank A could offer (i.e., θV_{1i}); the highest and second-highest value among the competing banks net of switching cost (i.e., $\theta K_N V_{1i} - C_i$ and $\theta K_{N-1} V_{1i} - C_i$); and the outside option of the borrower,

which is keeping the current mortgage (i.e., V_{0i}). In a bidding game with perfect information and price competition à la Bertrand, the bank with the highest value wins by offering the second-highest value.[8]

There are three potential outcomes in stage 2. First, if $\theta K_N V_{1i} - C_i < V_{0i}$, even the best possible competing offer is insufficient to cover the borrower's switching cost. In this case, bank A offers the reservation value $V'_{Ai} = V_{0i}$ and the borrower does not refinance. A second case is when bank A's valuation of the mortgage is below what competing bank N can offer, $\theta V_{1i} < \theta K_N V_{1i} - C_i$. Bank N then wins by matching the payoff that the borrower can get at bank A or at bank $N-1$, whichever is highest. The borrower switches banks and refinances with bank N at the offer of $V'_{Ni} = \max\{\theta V_{1i} + C_i, \theta K_{N-1} V_{1i}\}$. A third case is when the competing bank N can make a credible offer that would generate a positive payoff to the borrower, $\theta K_N V_{1i} - C_i > V_{0i}$, but bank A can make a better offer. In this case, the borrower refinances internally with bank A at $V'_{Ai} = \theta K_N V_{1i} - C_i$. In other words, bank A offers exactly what the borrower would get from switching to bank N.

In stage 1, the borrower negotiates bilaterally with bank A, which must make an offer. Both the borrower and the incumbent bank know the outcome of stage 2. Moving to stage 2 is costly for the borrower, however, as it involves a discounting of payoffs because of the borrower's impatience and search costs. We can differentiate between different cases, largely mirroring what happens in stage 2. If in stage 2 the equilibrium outcome is that of no refinancing, bank A will also refuse to refinance in stage 1. It offers the borrower the reservation value V_{0i} and no refinancing takes place. The second case is when bank A cannot beat in stage 1 the prospect of bank N's future offer. In particular, if $\beta_i(\theta K_{N-1} V_{1i} - C_i - V_{0i}) + V_{0i} > \theta V_{1i}$, the discounted stage-2 payoff at bank N exceeds the maximum payoff that bank A can offer to the borrower in stage 1. Bank A then offers θV_{1i} in stage 1, which the borrower refuses in order to accept bank N's offer in stage 2. Third, in all other scenarios, bank A is able to match in stage 1 the discounted stage-2 payoff, so that the borrower refinances internally.

The different outcomes of the game can be described by comparing V_{1i} to two thresholds, $\underline{V}_i$ and $\bar{V}_i$:

$$\begin{cases} \underline{V}_i = \dfrac{V_{0i} + C_i}{\theta K_N} \\ \bar{V}_i = \dfrac{\beta_i C_i - (1-\beta_i) V_{0i}}{\beta_i \theta K_{N-1} - \theta}. \end{cases} \tag{1}$$

The next proposition summarizes the outcome of the bargaining game.

[8] This outcome is similar to a second-price sealed-bid auction, where each bidder would bid its value and the winner pays the second-highest bid.

Proposition 1. (Equilibrium) (i) If $V_{1i} < \underline{V}_i$, bank A offers $V_{Ai} = V_{0i}$ in stage 1 and the borrower does not refinance. (ii) If $\underline{V}_i < V_{1i} < \bar{V}_i$, the borrower refinances with bank A in stage 1 and bank A's offer is $V_{Ai} = \beta_i(\max\{\theta V_{1i},\ \theta K_{N-1} V_{1i} - C_i\} - V_{0i}) + V_{0i}$. (iii) If $\bar{V}_i < V_{1i}$, bank A offers $V_{Ai} = \theta V_{1i}$ in stage 1, which the borrower refuses. The borrower then accepts in stage 2 bank N's offer of $V_{Ni} = \theta K_{N-1} V_{1i}$.

Proof. See Appendix. ■

To sum up, there are three outcomes of the bargaining game. Outcome (i) in Proposition 1 is the case of the "captive borrower." The switching cost C_i is so high that the net payoff of changing banks is negative: $V'_{bi} - C_i - V_{0i} < 0 \ \forall b \in \{1, \ldots, N\}$. Bank A knows that it is not in the interest of the borrower to go to a competing bank, and it thus refuses to refinance even though it has gained from the increase in mortgage value. Outcome (ii) is that of "internal refinancing." Here the borrower could get a positive payoff by switching banks in stage 2. The incumbent bank A knows this, and offers just the payoff that the borrower would get outside—taking into account the borrower's impatience β_i and the switching cost C_i. Bank A thus exploits the existence of these frictions to keep a share of the capital gains. Outcome (iii) in Proposition 1 is that of "external refinancing." If the borrower's search and switching costs are relatively low, bank A may be unable to compete. This requires the competing banks to have a competitive advantage over bank A, for instance a lower funding cost, that allows them to offer a better valuation to the borrower.

In most cases, the outcome of the refinancing game is similar to that of a competitive bidding game, where the bank with the highest value (net of switching and impatience costs) wins by offering the second-highest value. One case where the outcome differs from a bidding game, however, is when bank A has the second-highest value. In this case, the incumbent bank can benefit from the bargaining stage of the game to offer the discounted value of the competing offer. As in Ståhl (1972), the different stages of the game allow the incumbent bank to prevail even when it has a disadvantage; the bargaining power of the bank distorts competition. This result could provide a potential rationale for the low frequency of external refinancing that can be observed empirically.

1.4 Comparative statics and empirical predictions

We now discuss the different empirical implications of the model. A first implication of Proposition 1 is that the relative size of V_{1i} compared to V_{0i} is a key determinant of the probability of refinancing—even internally. For the same fall in the interest rate, larger and longer-maturity mortgages will experience higher gains. For such mortgages, it will be more likely that the gain can cover the cost of switching C_i. (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.) All else equal, we can also expect that for larger and longer-maturity mortgages V_{1i} is more likely to exceed the threshold $\bar{V}_i$, meaning that the likelihood of external refinancing should go up.

Proposition 2. (Interest rates and valuation gains). For a given fall in interest rates at banks A and $b = 1, \ldots, N$, the probability of refinancing and the probability of refinancing externally go up with mortgages' outstanding balance and remaining maturity.

Another testable implication of the model is that the offer received by the borrower in case of internal refinancing will depend on the initial conditions of the mortgage V_{0i}. External refinancing offers, however, do not take the initial value V_{0i} into account.

Proposition 3. (Initial conditions and new loan terms). The offer of bank A in the case with internal refinancing depends on the initial loan value V_{0i}, while the offer of the competing bank in the case with external refinancing does not depend on V_{0i}.

This result follows directly from Proposition 1 and is a consequence of the impatience of the borrower. All else equal, the borrower prefers to refinance in the first stage. Bank A knows this, and therefore discounts the stage-2 payoff in its negotiations with the borrower in the first stage. In contrast, outside banks only make their offer in stage 2 and thus only focus on the current value of the mortgage V_{1i}.[9]

Next, let us think about the role of local banking market characteristics. Our model suggests that, all else equal, borrowers will benefit from having more banks compete locally. In addition, if the funding cost advantage of competing banks improves relative to the cost of the incumbent bank, this will also sharpen competition and increase the probability of refinancing. Finally, the average quality of borrowers in the market and the extent of information asymmetries between banks and borrowers will also affect the propensity of borrowers to refinance. In the presence of risky borrowers whose risk is unobserved, the information asymmetry is harmful to borrowers because it lowers the ability of any competing bank to make an attractive offer that surpasses the cost of switching C_i, as the offer of bank b is $\theta K_b V_{1i}$. Thus, even borrowers with a high probability of success θ_i may be unable to

[9] While this theoretical result is clear, testing Proposition 3 empirically is challenging as unobservable loan and borrower characteristics may correlate with the initial starting conditions. In the empirical analysis, we will explore whether the new interest rate obtained by refinancing borrowers depends more on the initial interest rate in the case of refinancing with the incumbent bank.

refinance if they are pooled together with riskier borrowers so that the average θ is low.

Proposition 4. (Local market characteristics). An increase in the number of competing banks N, an increase in the cost advantage of the outside banks K_b, and an increase in the average quality of borrowers in a market θ increases the probability of refinancing and the probability of refinancing externally.

Finally, the model also offers predictions regarding the role of some household-level characteristics. The switching cost C_i and borrower patience β_i play complementary roles. Technically speaking, C_i is an additive term, whereas β_i is a multiplicative one. The switching cost C_i is thus probably more appropriate to think of as the regulatory and administrative costs of switching banks such as notary fees, which directly influence the net payoff of the borrower. The cost C_i plays a key role in determining whether the competing offer is credible and offers a positive net payoff. The impatience term β_i instead can be thought of as capturing potential cognitive costs related to searching for and setting up relations with other banks: the "discounted mental value" of the monetary payoff. In particular, note that the patience β_i does not determine whether the mortgage is refinanced or not. Even if β_i is very low (so the borrower is impatient in her search), the borrower can still refinance with her current bank, albeit at a low net payoff. Instead, the outcome of "no refinancing" depends on the net payoff accounting for C_i: if it is negative because C_i is very high, then there is no refinancing.

Proposition 5. (Borrower characteristics). Households with lower switching costs C_i are more likely to refinance and are more likely to refinance externally. A rise in borrower patience β_i increases the probability of refinancing externally, although it does not affect the overall probability of refinancing.

1.5 Discussion

In combining a model of bargaining with a model of bank competition, we made a number of simplifying assumptions. One of them is that most of the parameters are publicly observed. One possible extension would be to introduce information asymmetry about β_i. Uncertainty about whether borrowers are of the patient vs. impatient type (or low-search-cost vs. high-search-cost type) is probably relevant in reality. Also the assumption that agents observe bank b's cost advantage K_b could be relaxed. In practice, it is likely that in stage 1 bank A and the borrower do not know with certainty the (future) offer of each outside bank, and instead receive a noisy signal. In that case, bank A will in stage 1 take into account this uncertainty and behave like a bidder at an auction, shading its offer in order to increase its payoff.

One information friction that we nonetheless have in the model is that banks are unable to observe the true probability of borrower default $1-\theta_i$. As in Zhang (2022) or Berger et al. (2023), this induces a redistribution across borrowers, in our case benefiting high-risk borrowers at the expense of low-risk borrowers. In addition, however, the presence of high-risk borrowers in the market also affects the ability of outside banks to compete with the incumbent bank, and increases the share of borrowers who cannot refinance at all. One possible extension of the model would be to include information asymmetry between the two banks, by allowing bank A to have more information on θ_i than each bank b. Dell'Ariccia, Friedman, and Marquez (1999) and Dell'Ariccia and Marquez (2004) show that an outcome could then emerge where bank A may choose to let its worst borrowers go. This could create a sorting of borrowers of different quality into internal and external refinancing. In our simplified framework, the switching cost parameter C_i can instead be interpreted as capturing the informational advantage of the incumbent bank.

Borrower search costs are captured in our setting by the discount parameter β_i. Allen, Clark, and Houde (2018), Ambokar and Samaee (2019), and Agarwal et al. (2024) endogenize the search process, with the borrower choosing how many competing banks to visit depending on the expected benefits and costs of searching. The equivalent but more abstract mechanism in our model is that any cost associated with search or shopping that reduces β_i will lower the expected payoff from moving to the competitive stage—and thus from visiting any other bank.

Two final points are also related to the issue of borrower search broadly defined. First, in our model, the borrower only decides to "search" externally if she knows that the highest outside offer will be accepted. The assumption is thus that both the incumbent bank and the borrower know all relevant parameters in the initial bargaining stage. We believe that this first stage should be considered as an abstract way of capturing a borrower's initial back-and-forth with her own bank, which may actually involve exploring options elsewhere. We will revert to this point when considering our data on borrower search.

Second, one thing to note about our bargaining game is that it is conditional on the borrower initiating the refinancing process. We do not explicitly consider factors (e.g., information-gathering costs) that explain why one borrower considers refinancing and another one does not (see, e.g., Andersen et al. 2020). Our focus is on the supply side and interactions with the supply side. Yet, one could again expand the interpretation of our switching cost parameter C_i to capture such borrower-level demand effects. Of course, also the impatience parameter β_i may depend on borrower demographic and socioeconomic characteristics. We will briefly come back to this issue when presenting some borrower-level results at the end of this paper.

2. Empirical Setting

2.1 Household debt and mortgages in Belgium

In 2021, mortgage debt in Belgium amounted to 254 billion euros.[10] Mortgages account for the largest share (94%) of household debt, relative to a 6% share for consumer credit and bank account overdrafts. The ratio of mortgage debt to GDP (62%) is higher than the average for the euro area (46%). From 2006 to 2021, 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% of new mortgages, while the remaining 13% were buy-to-let investors. According to 2021 data from the Household Finance and Consumption Survey, 33% 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 (de Sola Perea and Belle 2022).

Most mortgages have a fixed interest rate, with 9 out of 10 new mortgages in 2021 having a fixed interest rate or an interest rate with a reset period greater than 10 years. The share of fixed-rate mortgages in loan origination has been above 80% 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% of the total outstanding. Mortgages typically have a maturity of 20 or 25 years at issuance. Given the prevalence of fixed interest rate and long maturity contracts, borrowers' interest in refinancing can be expected to be substantial when interest rates fall (as was the case for most of our sample period).

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 relatively 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.

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

Most of the mortgage debt is held by the Belgian banking sector. The Belgian mortgage market is fairly concentrated overall, with the top six 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%).

2.2 Costs of refinancing

Belgian households face a number of explicit costs when refinancing their mortgage. First, the bank charges a fee linked to the interest rate and typically 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 the 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. In addition, the borrower also has to pay notary fees and taxes for the registration of the new credit.

These costs of refinancing are not negligible. 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.[11] 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 €1,765 of interest compensation fees to the bank. The borrower would also have to pay an administrative fee of €250, so that the total cost of internal refinancing would be around €2,015. If the borrower chooses an external refinancing, the notary fees will be €1,249 for the removal of the collateral rights and €6,379 for the drafting of new collateral rights, taxes, and other notary costs. The total cost of external refinancing would thus be €9,643, or 29% of the (potential) reduction in interest payments. In these computations, we ignored the time value of money. By discounting future mortgage payment savings, the salience of the costs would increase further.

The cost structure implies that households with longer maturity loans or larger loans will experience larger gains relative to the costs. One reason for

[11] This example follows the illustration of refinancing costs on the website of the regulator (Financial Services and Markets Authority 2024), with notary fees estimated using a simulator provided by the notaries association (Notaire.be 2024).

this is that the variable costs do not depend directly on the gain in valuation. Also, there are a number of fixed costs that are independent of the size of the loan, which favors relatively larger loans.

3. Data

3.1 Mortgage-level data

3.1.1 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 2022.

The database includes limited information on borrowers, 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, 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 7.7 million mortgage loans for 3 million different households, as shown in Table 1. Close to 6 million mortgages were issued over our time frame.

Panel (a) of Figure 2 shows the median and mean euro value of new mortgages for each year, which both trend upwards slowly over our time frame. The median loan amount is generally lower than the mean, suggesting that loan sizes are skewed to the right.[12] The figure also shows the median and mean maturity (in months) associated with new loans. The median loan term 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).

Panel (b) of Figure 2 illustrates the "survival" of loans in our data set. We see that up to 60% of the initial pool of 20-year mortgage loans has disappeared 5 to 10 years after issuance. Even without identifying refinancing

[12] In additional analysis, we find that 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.

Table 1
Frequencies

	Count
Borrowers	2,990,094
Borrowers (new mortgages)	2,293,693
Loans	7,740,869
Loans (new mortgages)	5,953,532
Municipalities	589

This table shows the number of borrowers, loans, and municipalities in our data set. New mortgages are mortgages originated after the start of our sample period.

events explicitly, the data thus suggest economically significant renegotiation of mortgage contracts.

3.1.2 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.

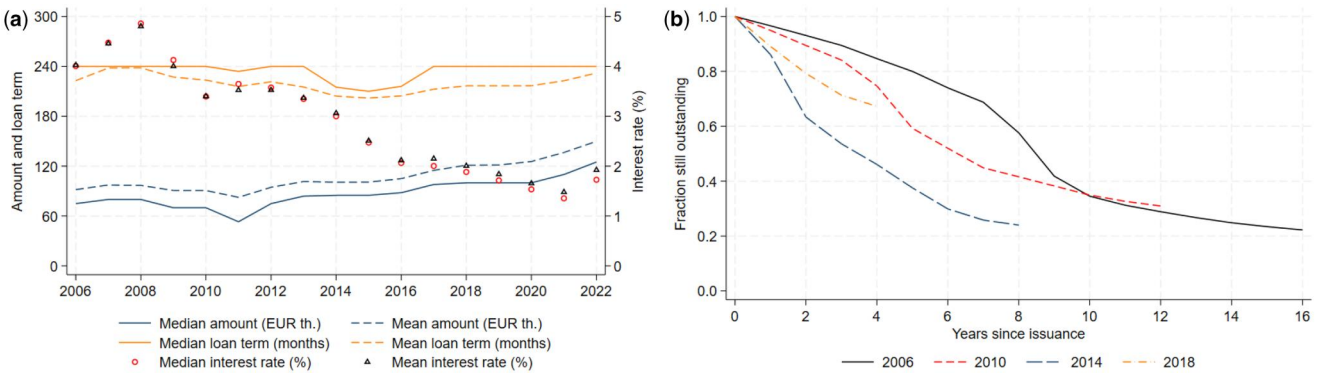
Based on the monthly payment, the total number of monthly payments, and the amount borrowed, we estimate the monthly interest rate of each loan assuming annuity amortization. (As mentioned before, the most popular mortgage type in Belgium by far is fixed-rate annuities.) In other words, we numerically solve for r in the standard annuity formula:

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

where F is the face value of the loan at origination and P is the monthly payment that we assume the borrower must make for T periods. The earlier-introduced panel (a) of Figure 2 shows the mean and the median of the annualized interest rates on new mortgage loans for each sample year. After an initial increase over 2006–2008, we see mortgage rates coming down for most of our time period.

We then use this interest rate to proxy for the outstanding loan balance at the end of each calendar year for each mortgage.

3.1.3 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 her 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.



Characteristics of new mortgage loans

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

Figure 2
Mortgages and refinancing activity
Panel (a) shows the median and mean loan size, maturity, and interest rates from 2006 to 2022. The loan size (in thousand euros) and the maturity (in months) are shown against the left axis. The interest rate (in percentage points) is shown against the right axis. Panel (b) shows the fraction of 20-year-maturity mortgages that are still outstanding by years since issuance and vintage (i.e., issuance) year.

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 nonrefinancing) 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 a 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. (In case of two deleted loans or two new loans, we require both of them to be with the same bank.)
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 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 unlikely that we are observing a refinancing event.

In addition, we exclude from our analysis (i.e., we do not classify borrowers as either refinancing or nonrefinancing):

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. Borrower-year combinations for which we observe more than two deleted loans, more than two new loans, or a new-to-deleted ratio outside of the range specified above, as we cannot be sure that no refinancing took place.
3. Borrower-year combinations where all of a borrower's mortgage debt is retired, because the decision whether to refinance then becomes irrelevant.

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 nonrefinancing and refinancing borrowers are labeled as loans that are not refinanced.) 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.

3.1.4 Time trends in refinancing activity. Panel (a) of Figure 3 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 nonrefinanced). 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) of the same figure shows the average interest rate "gain" for internal and external refinancing events for each sample year. For internal refinancing, we see that, on average, the new rate is about 1 percentage point lower than the old rate. The average differential is somewhat higher in the case with external refinancing.[13]

3.2 Other data

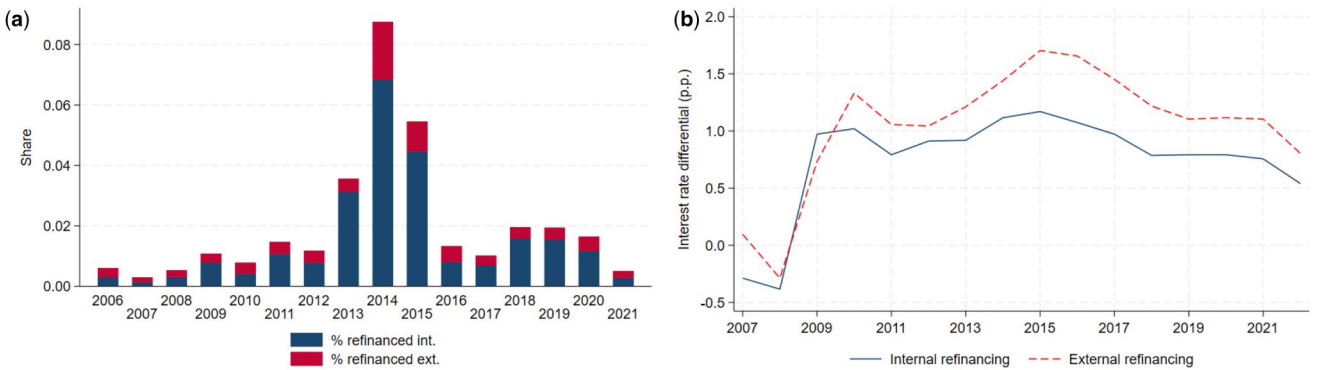
First, from the NBB credit registry, we can construct a number of variables of interest at both the borrower and the municipality level. For each borrower, we observe (i) whether she has a credit relation with a bank other than her mortgage lender, and (ii) whether she ever has been delinquent (more than 90 days past due) on an outstanding loan. Using the same information, we can also aggregate to the municipality-year level the proportion of borrowers that have a loan on which they have ever been delinquent.

Second, a separate data set managed by the NBB logs each time a bank consults the credit outstanding of a household in the credit registry. One of the motivations for the credit registry is to prevent overindebtedness. Banks therefore have the possibility of consulting the registry to obtain information on all loans outstanding at other banks. (There is no credit score system in Belgium.) We construct variables that measure at the borrower-year level (i) whether she was consulted by a bank that is not her own, and (ii) how many other banks consulted the borrower. Given that a bank will typically check a borrower once it has been contacted about some of its credit services, we can use the consultations to proxy for the search activity of borrowers.

Third, 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), that is, 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.[14] For each branch, we have the exact address, the identity of the parent/franchisor bank, and the start

[13] The slightly negative numbers in the first 2 years suggest some measurement error in the identification of refinancing events. Very little actual refinancing took place in 2007–2008 since interest rates were at their highest then since about the turn of the century.

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



Share of mortgages being refinanced in the next calendar year

Interest rate differential on old vs. new loans

Figure 3
Refinancing activity and interest rate gains
Panel (a) shows the share of outstanding mortgages at the end of each year that are refinanced in the next calendar year, distinguishing between internal and external refinancing events. Panel (b) shows the average difference between the rate at issuance and the refinancing rate for all internally and for all externally refinanced mortgages in a given year.

Table 2
Descriptive statistics

	N	Mean	S.D.	P10	P50	P90
All refinancing	37,100,186	0.02	0.14	0.00	0.00	0.00
Internal refinancing	37,100,186	0.02	0.12	0.00	0.00	0.00
External refinancing	37,100,186	0.00	0.07	0.00	0.00	0.00
Old rate (%)	929,703	3.69	1.14	2.27	3.72	4.98
New rate (%)	929,703	2.57	1.02	1.52	2.44	3.78
Consult (dummy)	37,100,186	0.15	0.36	0.00	0.00	1.00
Consult (count)	37,100,186	0.21	0.60	0.00	0.00	1.00
Branches per km2	35,269,703	0.47	0.89	0.05	0.26	0.92
Share of delinquent borrowers	37,100,186	0.06	0.03	0.03	0.05	0.10
Best available rate (%)	31,285,023	2.92	1.19	1.48	2.64	4.77
Borrower has other bank	37,100,186	0.47	0.50	0.00	0.00	1.00
Borrower has been delinquent	37,100,186	0.05	0.22	0.00	0.00	0.00
Lender has local branch	36,878,961	0.65	0.48	0.00	1.00	1.00

This table shows the summary statistics of the main variables used in the regressions. *All refinancing, Internal refinancing*, and *External refinancing* are dummy variables. *Old rate (%)* and *New rate (%)* indicate the rate on the old (refinanced) mortgage and new (refinancing) mortgage, respectively. If there is more than one old or new mortgage, we take the average rate. *Consult (dummy)* is an indicator that equals one if a household is looked up in the national credit registry by another bank. *Consult (count)* measures the number of banks that look up the borrower. *Share of delinquent borrowers* is the fraction of borrowers in a municipality that have ever been past due on one of their outstanding loans. *Best available rate* measures the lowest average (national) interest rate taken over all (large) banks with a branch in a municipality. *Borrower has other bank* is a dummy indicating that the borrower has a loan outstanding with another bank. *Borrower has been delinquent* is a dummy equal to one if the borrower has ever been delinquent on an outstanding loan. *Lender has local branch* is equal to one if the bank of the borrower has a branch in the municipality.

and end date of operations. The total number of branches decreased by about 30% (from more than 5,000 to about 3,500) over our time frame. We use these data to construct variables that measure (i) the number of bank branches per square kilometer for each municipality, and (ii) whether the household's lender has a local branch (i.e., a branch in the borrower's municipality).

Finally, we have yearly data on bank-level average interest rates on loans for larger banks starting in 2007. These data are sourced from the Monetary and Financial Institutions (MFI) Interest Rate Statistics. We use these data to construct a variable at the municipality-year level that measures the "best available rate," taking into account which banks have a branch in that Zip Code.

Table 2 shows descriptive statistics for the variables constructed in the previous paragraphs, as well as for the refinancing dummy variables presented earlier. Our refinancing dummies are non-missing for about 37 million loan-year combinations. The overall refinancing propensity in the pooled sample is about 2%; most refinancing is internal rather than external. The median number of branches per square kilometer is 0.26. The median share of delinquent borrowers in a municipality is 5% with the bottom and upper deciles at 3% and 10%, respectively. In 47% of cases the borrower has a credit relation with another bank, and in 65% of cases the lender has a branch in the borrower's municipality.

4. Results

4.1 Mortgage characteristics, refinancing, and new rates

When presenting our data, we already showed that realized interest rate "gains" are generally higher for external refinancing than for internal refinancing events. This is in line with Proposition 1, as borrowers refinancing externally must obtain a substantial improvement in their interest rate in order to overcome their search and switching costs.

We also predicted in Proposition 2 that refinancing propensities and the share of external refinancing will go up with mortgage value and remaining maturity. Panels (a) and (b) of Figure 4 show both overall and external refinancing propensities in 2015 (the year with the highest refinancing activity) as a function of deciles of time until maturity in panel (a) and deciles of outstanding loan balance in panel (b).

An interesting feature of these figures is that the propensity to refinance internally is hump-shaped with respect to the potential refinancing gains, while the propensity to refinance externally increases monotonically in the refinancing gain. This is in line with the model predictions in Proposition 1: total refinancing and external refinancing activity strictly increase as the gain from refinancing V_{1i} increases. The propensity to refinance internally is, however, ambiguous relative to the refinancing gain. As borrowers shift from the no-refinancing outcome to internal refinancing, internal refinancing increases with the potential gain in Figure 4. However, as the potential gain increases further, Proposition 1 suggests that borrowers will increasingly shift from internal to external refinancing. This is also what we observe in Figure 4. Namely, for the highest potential gains, the share of internal refinancing tends to fall with the gain while external refinancing keeps increasing.

Proposition 3 predicted that, for borrowers that refinance internally (i.e., with their current lender), the new interest rate will be more sensitive to the old interest rate than for borrowers that refinance externally (i.e., with a new bank). We test this prediction in Table 3 by regressing the new, "refinancing" interest rate against the legacy rate decomposed in two elements: (1) the local average rate in the municipality at the time of mortgage origination (a proxy for market conditions), and (2) the difference between the old rate and the local average rate at origination (a proxy for the "premium" paid by the household). We then interact each of these two variables with a dummy for external refinancing. The regressions confirm that the new interest rate for borrowers that refinance externally is less sensitive to both constituents of the rate at origination than for internally refinancing borrowers. In other words, keeping current market conditions equal, borrowers that have experienced a larger drop in interest rates will still be subject to relatively higher rates when refinancing internally, as the incumbent bank benefits from the barriers to switching. This relationship is much smaller however for external refinancing rates, as predicted by Proposition 3.

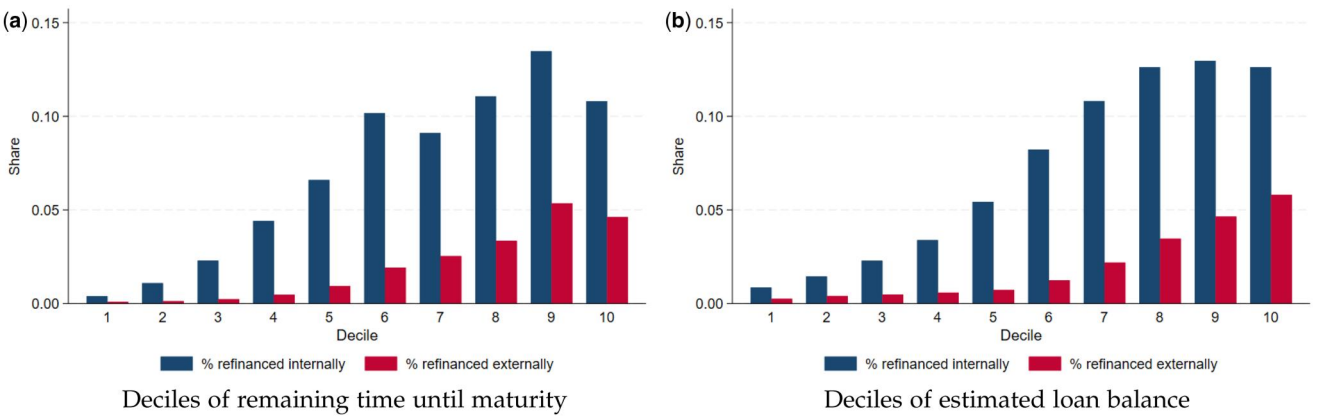


Figure 4
Refinancing propensities as function of loan characteristics
Panel (a) shows the fraction of loans that are refinanced (internally or externally) in 2015, by decile of remaining time until maturity measured at the end of 2014. Panel (b) repeats the exercise grouping loans by their outstanding balance decile.

Table 3
Sensitivity of refinancing rate to rate at origination

	(1) New rate
Local average rate at time of origination	0.20071***
	(0.00499)
External x local average rate	– 0.03070***
	(0.00317)
Diff. of old rate with local average	0.31131***
	(0.00343)
External x difference	– 0.21980***
	(0.00531)
External refinancing	– 0.21653***
	(0.01113)
Origination year x year F.E.?	Yes
Bank x municipality F.E.?	Yes
Bank x year F.E.?	Yes
Municipality x year F.E.?	Yes
Borrower age group F.E.?	Yes
Observations	740,466
R squared	0.625

This table presents coefficients from a regression where the dependent variable is the rate on the new (refinancing) mortgage. The sample is restricted to mortgages that are refinanced (internally or externally). *Local average rate at time of origination* is the average interest rate on new mortgages in the municipality of the borrower at the year of issuance. *Diff. of old rate with local average* is the difference between the rate on the old (refinanced) mortgage and the average interest rate on new mortgages in the municipality of the borrower at the year of issuance. *External* indicates an external refinancing. *External* × *local average rate* and *External* × *difference* interact the external refinancing dummy with the first two independent variables. Standard errors in parentheses are clustered at the borrower and municipality level. $^{*}p < .1$; $^{**}p < .05$; $^{***}p < .01$

4.2 Local banking market characteristics

4.2.1 Drivers of refinancing. We continue our empirical analysis by relating refinancing propensities to a number of characteristics that vary at the municipality × year level, as tests of the predictions in Proposition 4. The baseline regression model that we estimate can be described as follows:

$$y_{lmbt} = X'_{mt}\gamma + Controls'_{lmbt}\delta + \lambda_{mb} + \lambda_{bt} + \varepsilon_{lmbt}, \quad (2)$$

where y_{lmbt} is a dummy variable that measures whether loan l issued to a borrower 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 × bank and bank × 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 all models, we control for whether the borrower has a credit relation with another bank, whether the borrower has ever been delinquent on an outstanding loan, whether the lender has a local branch, the rate on the current mortgage, and borrower age group fixed effects (age < 35, 35–44, etc.).

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 will consider is the number of bank branches per square kilometer, which is the empirical equivalent of N in the model. Second, a key friction in the model is the asymmetric information between the borrower and the banks regarding the quality of the borrower θ_i (or, conversely, the probability of default $1-\theta_i$). We measure (the inverse of) average borrower quality through the share of delinquent borrowers in the municipality. The third variable measures the lowest interest rate available locally, proxying for K_N in the model, as defined before. Because of the inclusion of different sets of fixed effects, identification is coming from local changes over time in these variables.

Columns 1–3 of Table 4 show the regression results when estimating our models when including the first two independent variables described above. The dependent variables in the three regressions are dummies that equal one if the household refinances, refinances internally, and refinances externally. The models are estimated using OLS (i.e., a linear probability model). In this first set of models, we also control for the log of the outstanding loan amount and the residual term of the mortgage to proxy for the potential gain of refinancing. Standard errors are clustered at the borrower and municipality level.

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. (The coefficient in column 1 implies that one additional branch per km2 is correlated with an increase in the overall refinancing propensity of about 0.1 percentage points.) Similarly, a decrease in the average creditworthiness of local borrowers leads to a decrease in refinancing activity.

In columns 4–6 of Table 4, we add our proxy for the best locally available rate. This measure is computed based on a set of larger banks only, as explained before. We now also only include borrowers at those larger banks, and rather than including outstanding loan amount and residual term as controls, we proxy explicitly for households' potential (gross and absolute) euro gain from refinancing taking into account the duration of their mortgage, the change in the bank-level average interest rate between the loan origination year and the current year, and the outstanding loan amount.[15]

We see that a higher (i.e., less favorable) best available rate locally leads to less refinancing overall, in line with the predictions of our model.

[15] At the end of each calendar year, we proxy for households' potential (gross and absolute) gain from refinancing as follows. Denote the duration of a mortgage by D. We then compute for each mortgage the change in the bank-level average interest rate between the loan origination year and the current year, using MFI Interest Rate Statistics, which are available for larger banks 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.

Table 4
Determinants of refinancing activity

	(1) All	(2) Internal	(3) External	(4) All	(5) Internal	(6) External
Branches per km²	0.00114**	0.00060*	0.00054***	0.00314**	0.00223**	0.00091***
	(0.00045)	(0.00034)	(0.00015)	(0.00126)	(0.00097)	(0.00032)
Share of delinquent borrowers	−0.11172***	−0.09692***	−0.01480***	−0.09971***	−0.08335***	−0.01637*
	(0.01092)	(0.00976)	(0.00396)	(0.02433)	(0.01949)	(0.00953)
Best available rate				−0.00315**	−0.00253*	−0.00062
				(0.00145)	(0.00132)	(0.00045)
Borrower has other bank	−0.00126***	−0.00229***	0.00104***	−0.00294***	−0.00469***	0.00175***
	(0.00007)	(0.00007)	(0.00003)	(0.00014)	(0.00013)	(0.00006)
Borrower has been delinquent	−0.01558***	−0.01112***	−0.00446***	−0.02911***	−0.02257***	−0.00654***
	(0.00019)	(0.00021)	(0.00011)	(0.00035)	(0.00031)	(0.00020)
Lender has local branch	−0.00056***	−0.00035*	−0.00021***	−0.00100***	−0.00080**	−0.00020
	(0.00020)	(0.00018)	(0.00008)	(0.00038)	(0.00035)	(0.00016)
Rate on current mortgage?	Yes	Yes	Yes	Yes	Yes	Yes
Additional loan-level controls?	Yes	Yes	Yes	No	No	No
Refinancing gain polynomial?	No	No	No	Yes	Yes	Yes
Borrower age group F.E.?	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
Observations	33,778,124	33,778,124	33,778,124	12,193,890	12,193,890	12,193,890
R squared	0.067	0.062	0.021	0.063	0.057	0.016

This table presents coefficients from linear regressions where the dependent variables are refinancing indicator variables. All variables are defined in Table 2. We control for either loan size and the remaining term of the mortgage (columns 1–3) or an estimate of the potential gain from refinancing (columns 4–6) as described in Section 4 of this paper. Standard errors in parentheses are clustered at the borrower and municipality level. *$p < .1$; **$p < .05$; ***$p < .01$

(The coefficient in column 4 implies that a decrease in the best available rate of 1 percentage point is correlated with an increase in the refinancing propensity of about 0.3 percentage points.) This result is remarkable given the granularity of the fixed effects, which include bank-municipality interaction effects while the best available rate varies at the municipality-year level. The variation used to estimate the coefficient is thus within a municipality and across years, after controlling for the bank-year interaction effects at the aggregate level. The results in columns 4–6 are consistent with those of columns 1–3, despite the additional controls and the smaller sample due to the data requirements for computing the refinancing gain control.

Overall, Table 4 is consistent with the predictions of the model regarding local determinants of refinancing (Proposition 4): a higher presence of local branches is associated with higher refinancing activity, while a higher average credit risk or a smaller interest rate advantage of competing banks are associated with a lower refinancing activity.

Our regression results also show that if a borrower is with a bank that has a branch locally, she is less likely to switch away, arguably because the cost of doing so is higher. And if she already has a credit relation with another bank, she is more likely to refinance externally. Borrowers with multiple bank relations may face lower switching costs, but it is also likely that they have higher patience in searching (i.e., face a lower search breakdown probability).

4.2.2 Insights from consultations data. In Table 5, we repeat the previous model specifications but now using as dependent variables a dummy that indicates whether a household was looked up in the credit registry by a bank that is not their own (columns 1 and 3) and a variable measuring by how many other banks the creditworthiness of the household was consulted (columns 2 and 4). The goal of this exercise is to provide further evidence that the conditional correlations in Table 4 are generated by the mechanisms that we have in mind.

In particular, consider the result in Table 4 that refinancing activity goes down if the average creditworthiness of the local population decreases. While this finding is line with the predictions of our model, an alternative explanation is that households that live in areas with a high share of delinquent borrowers are less likely to seek refinancing (i.e., that the effect is driven by a demand rather than a supply channel). The results in Table 5 show, however, that households living in areas with a lot of delinquent borrowers are actually more likely to be looked up by other banks, suggesting that they are more actively seeking to refinance. This is in line with the findings of Agarwal et al. (2024) that lenders screen out borrowers with low creditworthiness who must then search more, but now at an aggregate level. The result in Table 4 that borrowers from riskier municipalities refinance less is thus consistent with the existence of asymmetric information that hampers the refinancing process.

Table 5
Determinants of consultations by outside banks

	(1) Consult (dummy)	(2) Consult (count)	(3) Consult (dummy)	(4) Consult (count)
Branches per km2	0.00598***	0.00728***	0.01043***	0.01129**
	(0.00153)	(0.00214)	(0.00334)	(0.00463)
Share of delinquent borrowers	1.44226***	2.79344***	1.46940***	2.85252***
	(0.18405)	(0.34467)	(0.20512)	(0.37400)
Best available rate			0.00428	0.01464
			(0.00575)	(0.01037)
Borrower has other bank	0.10574***	0.16458***	0.15373***	0.24071***
	(0.00110)	(0.00239)	(0.00151)	(0.00314)
Borrower has been delinquent	0.07138***	0.21371***	0.09859***	0.29321***
	(0.00252)	(0.00518)	(0.00282)	(0.00617)
Lender has local branch	−0.00168*	−0.00215	−0.00322**	−0.00350*
	(0.00094)	(0.00146)	(0.00126)	(0.00207)
Rate on current mortgage?	Yes	Yes	Yes	Yes
Additional loan-level controls?	Yes	Yes	No	No
Refinancing gain polynomial?	No	No	Yes	Yes
Borrower age group F.E.?	Yes	Yes	Yes	Yes
Bank x municipality F.E.?	Yes	Yes	Yes	Yes
Bank x year F.E.?	Yes	Yes	Yes	Yes
Observations	44,556,141	44,556,141	15,080,043	15,080,043
R squared	0.171	0.158	0.113	0.108

This table presents coefficients from linear regressions where the dependent variables measure consultations of the borrower by outside banks in the national credit registry. All variables are defined in Table 2. We control for either loan size and the remaining term of the mortgage (columns 1–3) or an estimate of the potential gain from refinancing (columns 4–6) as described in Section 4 of this paper. Standard errors in parentheses are clustered at the borrower and municipality level. *$p < .1$; **$p < .05$; ***$p < .01$

Not surprisingly, Table 5 also shows that consultations are higher when the borrower already has a relationship with another bank and they are lower when the incumbent bank has a local branch (which presumably increases the relative costs of switching banks). The results are qualitatively similar whether we use a dummy for consultation (columns 1 and 3) or a count of all the consultations (columns 2 and 4). Similarly, the results are robust to controlling for refinancing gains in columns 3 and 4.

4.3 Borrower characteristics

In this final part, we illustrate how borrower-level demographic characteristics may affect the dynamics that we model. In particular, we analyze how the positive correlation between external refinancing activity and having multiple bank relations varies with age—the only demographic characteristic in our data. We interact the relevant dummy variable with age group fixed effects. We then reestimate our key prior regressions but now including municipality × year fixed effects. This means that we are exploiting variation between households within a municipality in a given year. (We also still control for bank-specific municipality and year effects.) The results are reported in Table 6. (In column 3, we look at the subsample of refinancers only.)

Table 6
Borrower characteristics and refinancing decisions

	(1) Internal	(2) External	(3) External	(4) Consult (dummy)	(5) Consult (count)
Borrower has other bank	−0.00464***	0.00249***	0.04363***	0.14102***	0.23300***
	(0.00018)	(0.00011)	(0.00213)	(0.00147)	(0.00343)
Age 35–44 × Borrower has other bank	0.00123***	−0.00096***	0.00689***	−0.03388***	−0.06303***
	(0.00021)	(0.00012)	(0.00257)	(0.00075)	(0.00136)
Age 45–54 × Borrower has other bank	0.00392***	−0.00207***	0.00486*	−0.04656***	−0.09069***
	(0.00022)	(0.00012)	(0.00280)	(0.00116)	(0.00232)
Age 55–64 × Borrower has other bank	0.00498***	−0.00315***	−0.00690*	−0.05994***	−0.12248***
	(0.00023)	(0.00012)	(0.00416)	(0.00145)	(0.00293)
Age ≥65× Borrower has other bank	0.00462***	−0.00395***	−0.04093***	−0.06494***	−0.13515***
	(0.00029)	(0.00014)	(0.01093)	(0.00206)	(0.00381)
Additional controls?	Yes	Yes	Yes	Yes	Yes
Borrower age group F.E.?	Yes	Yes	Yes	Yes	Yes
Bank x municipality F.E.?	Yes	Yes	Yes	Yes	Yes
Bank x year F.E.?	Yes	Yes	Yes	Yes	Yes
Municipality x year F.E.?	Yes	Yes	Yes	Yes	Yes
Subsample of refinancers?	No	No	Yes	No	No
Observations	35,328,833	35,328,833	747,735	46,575,124	46,575,124
R squared	0.063	0.022	0.397	0.175	0.162

This table presents coefficients from linear regressions where the dependent variables are internal and external refinancing indicator variables (columns 1–3) and measures of consultations of the borrower by outside banks in the national credit registry (columns 4–5). The sample is restricted to cases where the borrower refinances (either internally or externally) in column 3. The additional controls include *Borrower has been delinquent, Lender has local branch*, and the same loan-level controls as in columns 1–3 of Table 4 or columns 1–2 of Table 5. Standard errors in parentheses are clustered at the borrower and municipality level. $^{*}p < .1$; $^{**}p < .05$; $^{***}p < .01$

We see in columns 1–3 of Table 6 that the earlier-documented positive correlation between refinancing activity and having a credit relation with more than one bank disappears for the oldest borrowers. In columns 4–5, we also see that shopping activity declines, but to a much lesser extent than actual refinancing. These results suggest that older households may not only have somewhat higher information-gathering costs, in line with Andersen et al. (2020), but also lower patience in searching for outside offers (or higher switching costs), which allows their bank to retain them.

5. Conclusion

A large literature has documented the existence of frictions in the refinancing process, highlighting both the importance of borrower characteristics (Agarwal, Rosen, and Yao 2016; Keys, Pope, and Pope 2016; Johnson, Meier, and Toubia 2019) and the role of competition between lenders (Agarwal et al. 2024, 2023; Liebersohn 2024). In this paper, we propose a model of refinancing that focuses on the characteristics of the local banking market structure (number of banks, dispersion in funding costs) but also includes borrower-level parameters (default risk, switching costs, patience). We model mortgage refinancing as a bargaining game involving the borrowing household, the incumbent lender, and outside banks. In equilibrium,

the borrower's ability to refinance depends on the incumbent bank's cost (dis)advantage relative to competing banks and the average creditworthiness of borrowers in the local market. It is also driven by switching costs and borrower impatience.

We then use data on the universe of mortgage borrowing in Belgium to test the key predictions of the model. Our data include information on more than 7 million borrowers from 2006 to 2022. We find empirical support for the key predictions of our model, illustrating the role of local banking market competition, information asymmetries with respect to borrower quality, and both borrower-level and loan-level characteristics.

Appendix. Proof of Proposition 1

Proof. We solve the game by backward induction:

Stage 2. We sort banks by their competitive position such that $K_1 < \ldots < K_N$. The maximum value (net of switching cost) that a competing bank b can offer to the borrower is $\theta K_b V_{1i} - C_i \ \forall b \in \{1, \ldots, N\}$. The maximum value that bank A can offer is θV_{1i}.

With perfect information and price competition, the bank with the highest value wins by offering the value of the second highest bank, or the borrower's reservation value V_{0i}. Remember that we assumed that $\theta V_{1i} > V_{0i}$, that is, the new expected value of the loan is higher than the initial value. Three cases must then be considered:

Case 1: Captive borrower: $\theta K_N V_{1i} - C_i < V_{0i}$

The best competing offer is insufficient to cover the switching cost. Bank A offers the reservation value,

$$V'_{Ai} = V_{0i},$$

and the borrower does not refinance.

Case 2: Internal refinancing: $\theta K_N V_{1i} - C_i > V_{0i}$ *and* $\theta K_N V_{1i} - C_i < \theta V_{1i}$

Bank A wins with the offer

$$V'_{Ai} = \theta K_N V_{1i} - C_i.$$

Case 3: External refinancing: $\theta V_{1i} < \theta K_N V_{1i} - C_i$

The borrower switches banks and refinances with bank N at the offer of the value of the second highest bid, that is, the highest competing offer between bank $N-1$ and bank A:

$$V'_{Ni} = \max\{\theta K_{N-1} V_{1i}, \theta V_{1i} + C_i\}.$$

Stage 1. The borrower negotiates with her bank, taking into account the outcome of stage 2. As before, two parameter conditions determine the outcome. The first one is unchanged from stage 2 and determines whether the competing banks can make an offer with positive payoff: $\theta K_N V_{1i} - C_i \gtrless V_{0i}$. The second one compares the discounted payoff of the second highest competing bid in stage 2 with the maximum payoff that bank A could offer in stage 1, $\beta_i(\theta K_{N-1} V_{1i} - C_i - V_{0i}) \lesseqgtr \theta V_{1i} - V_{0i}$.[16] In what follows we first consider the two extreme cases of captive borrower and of external refinancing.

[16] Note that both the highest and second highest competing banks, N and $N-1$, must have higher net value than bank A. If bank A has the second highest value for the borrower in stage 2, that is, $\theta K_{N-1} V_{1i} - C_i < \theta V_{1i} < \theta K_N V_{1i} - C_i$, bank A can beat the competing bank N in stage 1 by discounting its own maximum value (which corresponds to the bid of bank N in stage 2).

Case 1: Captive borrower: $\theta K_N V_{1i} - C_i < V_{0i}$

In this case, bank A knows that the borrower is captive in stage 2. Bank A thus refuses to refinance in stage 1 or, equivalently, offers V_{0i}. The borrower accepts, knowing that she cannot get a better deal in stage 2.

Case 3: External refinancing: $\beta_i(\theta K_{N-1} V_{1i} - C_i - V_{0i}) + V_{0i} > \theta V_{1i}$

In this case, even the discounted second-highest competitive bid beats the highest potential bid of bank A. The competitors N and $N-1$ have an absolute cost advantage. Bank A thus offers $V_{Ai} = \theta V_{1i}$ in stage 1, which the borrower refuses. In stage 2, bank N refinances the loan with the offer $V'_{Ni} = \theta K_{N-1} V_{1i}$.

Case 2: Internal refinancing: $\theta K_N V_{1i} - C_i > V_{0i}$ *and* $\beta(\theta K_{N-1} V_{1i} - C_i - V_{0i}) + V_{0i} < \theta V_{1i}$

In all the other cases, (a) the competitors are credible (i.e. can offer a positive net payoff in stage 2), and (b) bank A can offer a marginally higher payoff in stage 1. If in stage 2 bank N wins by offering bank A's value, then bank A can still win in stage 1 by bidding $\beta_i(\theta V_{1i} - V_{0i}) + V_{0i}$, that is, offering the payoff that the borrower would get in stage 2. If bank $N-1$ is the second highest bidder in stage 2, that is, $\theta K_{N-1} V_{1i} - C_i > \theta V_{1i}$, bank A wins by bidding $\beta_i(\theta K_{N-1} V_{1i} - C_i - V_{0i}) + V_{0i}$. Bank A thus offers

$$V_{Ai} = \max\{\beta_i(\theta V_{1i} - V_{0i}) + V_{0i},\ \beta_i(\theta K_{N-1} V_{1i} - C_i - V_{0i}) + V_{0i}\},$$

which the borrower accepts.

Finally, the two parameter conditions in stage 2 can be expressed using the thresholds defined in (1).

Code Availability

The replication code is available in the Harvard Dataverse at https://doi.org/10.7910/DVN/M9VPCU

References

Acharya, V. V., D. Gromb, and T. Yorulmazer. 2012. Imperfect competition in the interbank market for liquidity as a rationale for central banking. *American Economic Journal: Macroeconomics* 4:184–217.

Agarwal, S., G. Amromin, S. Chomsisengphet, T. Landvoigt, T. Piskorski, A. Seru, and V. Yao. 2023. Mortgage refinancing, consumer spending, and competition: Evidence from the home affordable refinance program. *Review of Economic Studies* 90:499–537.

Agarwal, S., J. C. Driscoll, and D. I. Laibson. 2013. Optimal mortgage refinancing: A closed-form solution. *Journal of Money, Credit and Banking* 45:591–622.

Agarwal, S., J. Grigsby, A. Hortaçsu, G. Matvos, A. Seru, and V. Yao. 2024. Searching for approval. *Econometrica* 92:1195–231.

Agarwal, S., R. J. Rosen, and V. Yao. 2016. Why do borrowers make mortgage refinancing mistakes? *Management Science* 62:3494–509.

Allen, J., R. Clark, and J.-F. Houde. 2018. Search frictions and market power in negotiated-price markets. *Journal of Political Economy* 127:1550–98.

Ambokar, S., and K. Samaee. 2019. Inaction, search costs, and market power in the U.S. mortgage market. Working Paper, University of Pennsylvania.

Andersen, S., J. Y. Campbell, K. M. Nielsen, and T. Ramadorai. 2020. Sources of inaction in household finance: Evidence from the Danish mortgage market. *American Economic Review* 110:3184–230.

Bajo, E., and M. Barbi. 2018. Financial illiteracy and mortgage refinancing decisions. *Journal of Banking & Finance* 94:279–96.

Benetton, M., A. Gavazza, and P. Surico. 2021. Mortgage pricing and monetary policy. Working Paper, CEPR.

Berger, D., K. Milbradt, F. Tourre, and J. Vavra. 2021. Mortgage prepayment and path-dependent effects of monetary policy. *American Economic Review* 111:2829–78.

———. 2023. Refinancing frictions, mortgage pricing and redistribution. Working Paper, NBER.

Bhutta, N., A. Fuster, and A. Hizmo. 2021. Paying too much? Borrower sophistication and overpayment in the U.S. mortgage market. Working Paper, Federal Reserve Bank of Philadelphia.

Buchak, G., and A. Jørring. 2021. Do mortgage lenders compete locally? Implications for credit access. Working Paper, SSRN.

Célerier, C., and A. Matray. 2019. Bank-branch supply, financial inclusion, and wealth accumulation. *Review of Financial Studies* 32:4767–809.

de Sola Perea, M., and L. V. Belle. 2022. Early results of the fourth wave of the Belgian household finance and consumption survey. Working Paper, National Bank of Belgium.

Dell'Ariccia, G., E. Friedman, and R. Marquez. 1999. Adverse selection as a barrier to entry in the banking industry. *RAND Journal of Economics* 30:515–34.

Dell'Ariccia, G., and R. Marquez. 2004. Information and bank credit allocation. *Journal of Financial Economics* 72:185–214.

Drechsler, I., A. Savov, and P. Schnabl. 2017. The deposits channel of monetary policy. *Quarterly Journal of Economics* 132:1819–76.

Emiris, M., and F. Koulischer. 2021. Low interest rates and the distribution of household debt. Working Paper, National Bank of Belgium.

Ergungor, O. E. 2010. Bank branch presence and access to credit in low- to moderate-income neighborhoods. *Journal of Money, Credit and Banking* 42:1321–49.

Financial Services and Markets Authority. 2024. Checklist: Renégocier son crédit hypothécaire. Brussels, Belgium. Available at www.wikifin.be/fr/logement-et-emprunt-hypothecaire/checklist-renegocier-son-credit-hypothecaire.

Fisher, J., A. Gavazza, L. Liu, T. Ramadorai, and J. Tripathy. 2024. Refinancing cross-subsidies in the mortgage market. *Journal of Financial Economics* 158:103876.

Fuster, A., S. H. Lo, and P. S. Willen. 2024. The time-varying price of financial intermediation in the mortgage market. *Journal of Finance* 79:2553–602.

Gerardi, K., P. S. Willen, and D. H. Zhang. 2023. Mortgage prepayment, race, and monetary policy. *Journal of Financial Economics* 147:498–524.

Johnson, E. J., S. Meier, and O. Toubia. 2019. What's the catch? Suspicion of bank motives and sluggish refinancing. *Review of Financial Studies* 32:467–95.

Kashyap, A. K., and J. C. Stein. 2000. What do a million observations on banks say about the transmission of monetary policy? *American Economic Review* 90:407–28.

Keys, B. J., N. Mahoney, and H. Yang. 2023. What determines consumer financial distress? Place- and person-based factors. *Review of Financial Studies* 36:42–69.

Keys, B. J., D. G. Pope, and J. C. Pope. 2016. Failure to refinance. *Journal of Financial Economics* 122:482–99.

Liebersohn, J. 2024. How does competition affect retail banking? Quasi-experimental evidence from bank mergers. *Journal of Financial Economics* 154:103797.

Maturana, G., and J. Nickerson. 2019. Teachers teaching teachers: The role of workplace peer effects in financial decisions. *Review of Financial Studies* 32:3920–57.

McCartney, W. B., and A. M. Shah. 2022. Household mortgage refinancing decisions are neighbor influenced, especially along racial lines. *Journal of Urban Economics* 128:103409–.

Miller, S., and C. K. Soo. 2021. Do neighborhoods affect the credit market decisions of low-income borrowers? Evidence from the moving to opportunity experiment. *Review of Financial Studies* 34:827–63.

National Bank of Belgium. 2022. Financial stability report. Brussels, Belgium. Available at www.nbb.be/en/articles/financial-stability-report-2022.

Nguyen, H.-L. Q. 2019. Are credit markets still local? Evidence from bank branch closings. *American Economic Journal: Applied Economics* 11:1–32.

Notaire.be. 2024. Calcul de frais d'acte de crédit hypothécaire. Brussels, Belgium. Available at www.notaire.be/calcul-de-frais/credit.

Rubinstein, A. 1982. Perfect equilibrium in a bargaining model. *Econometrica* 50:97–109.

Scharfstein, D., and A. Sunderam. 2016. Market power in mortgage lending and the transmission of monetary policy. Working Paper, Harvard University.

Ståhl, I. 1972. Bargaining theory. Stockholm, Sweden: Economic Research Institute, Stockholm School of Economics. Available at https://ex.hhs.se/dissertations/423044-FULLTEXT01.pdf.

Union Professionnelle du Credit. 2021. Annual Report. Available at https://www.upc-bvk.be/files/270/Annual-Reports-FR/3702/2021-FR.pdf.

Zhang, D. 2022. Closing costs, refinancing, and inefficiencies in the mortgage market. Working Paper, Harvard University.

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