

Discounting in Mortgage Markets*

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Abstract

This paper studies discounting in mortgage markets. Using transaction-level data on Canadian mortgages, we document that over time there has been an increase in both the average discount and the amount of dispersion. The standard explanation for dispersion in credit markets is that lenders engage in risk-based pricing. Our setting is unique since contracts are guaranteed by government-backed insurance, meaning risk cannot be the main driver of dispersion. We find that dispersion arises for the same reasons as in traditional retail markets. Mortgage rates depend on individual, contractual, and shopping market characteristics. We investigate whether the observed consumer-specific pricing is evidence of price discrimination.

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1 Introduction

In many markets prices are determined through a negotiation process between buyers and sellers. Sellers post a price, but consumers may be able to negotiate a discount. The extent to which sellers are willing to discount may depend on consumer, contractual, and market-structure characteristics. This type of pricing behavior can be found, for example, in the markets for automobiles, houses, consumer loans, health insurance, and personal finance.

In this paper we study discounting in the market for mortgages. For most households a mortgage represents its largest debt. In the mortgage market the discounting process can result in a substantial amount of dispersion in the rates received by different borrowers. In our sample of Canadian mortgage contracts the coefficient of variation for discounts in 2004 was 82 per cent and this dispersion led to economically important differences in the costs of financing the purchase of a home. Given an average loan of \$143,070 in 2004, the extra term interest cost of paying the rate associated with the 75th percentile discount rather than the 25th percentile discount is \$12,468.¹ Our data set contains information on mortgage, household, financial institution, and market structure characteristics which allows us to quantify the extent of dispersion over time, across markets, and across financial institutions and to determine the extent to which this dispersion can be explained by price discrimination.

Extensive price dispersion has also been documented in other credit markets, with most of the observed dispersion attributed to the ability of lenders to sort borrowers according to their level of risk (see for instance Edelberg (2006) and Livshits, MacGee, and Tertilt (2009)).² For our analysis we make use of detailed transaction-level data on mortgages administered by the two government-guaranteed mortgage insurance providers in Canada. As a result, the loans we study are all fully insured, meaning that risk-based pricing cannot explain the observed dispersion in rates.

Once the influence of risk-screening has been suppressed, dispersion in the mortgage market

¹The full amortization interest cost (over 25 years) on this mortgage is \$46,629.

²The development of ‘risk-based pricing’ has been facilitated by technological advances that make credit scoring much less costly than it was twenty years ago and has been encouraged by the fact that it can be significantly more profitable than uniform pricing. Einav, Jenkins, and Levin (2009) study pricing and contract design in the subprime auto-sales market and find that using credit scoring to determine down-payment sizes can increase profits by 22 per cent relative to uniform pricing. For a theoretical analysis of the benefits of information technology of bank profits see Hauswald and Marquez (2003).

arises from the same sources as in traditional retail markets where a number of studies have documented important dispersion in prices (see for example Borenstein and Rose (1994), Goldberg (1996), Lach (2002), and Delgado and Waterson (2003)). Like traditional retail markets, the retail banking industry is characterized by important switching costs, differentiated firms, and local variation in the degree of market power.

The objective of this paper is twofold. First, we document the reduced-form relationship between consumer and market characteristics and discounting. Second, we test whether some of this dispersion is due to price discrimination. Our results show that borrowers face higher rates in more concentrated markets and when their chosen financial institution is dominant in their local market. We find that borrowers whose financial institutions have larger branch networks pay higher rates. We also find evidence that rates vary with consumer characteristics. Switchers receive better rates than do borrowers staying with their main financial institution. Borrowers transiting out of renting or living with their parents pay lower rates than do previous home owners. Financially constrained borrowers pay higher rates. We also estimate a set of quantile regressions to analyze the effect of transaction characteristics on rates at different percentiles of the conditional discount distribution. We find that for most covariates, the marginal effects are significantly different across the quantiles of the distribution. Since we control for a rich set of characteristics that affect the profitability of the transaction, what is left reflects heterogeneity in consumers' outside options or willingness to pay, suggesting that financial institutions are discriminating across borrowers.

A focus of the literature on retail-market price dispersion has been on explaining the source of consumer-based pricing. In less competitive environments, dispersion may be the result of rent extraction on the part of firms, with consumers paying different prices depending on their willingness to pay. If, on the other hand, the market is more competitive, dispersion may simply be due to heterogeneous costs (or profitability) of serving customers. A large literature has developed to try to disentangle these effects and identify price discrimination in other markets (c.f. Borenstein (1991), Busse and Rysman (2005), Dafny (2010)). The standard approach has been to find controls for costs or competition and then to test for dispersion or nonlinearities in prices.

In this paper we compare pricing patterns across broker and non-broker transactions. The idea

is similar to Scott Morton, Zettelmeyer, and Silva-Risso (2003) who compare car prices negotiated over the internet to those negotiated at the dealer. In our case, since consumers transacting through brokers get more quotes, they may face a more competitive environment and extract a larger share of the transaction surplus. To study this we compare the marginal effect of consumer and contractual characteristics in the broker and non-broker segments. We test whether the relationship between covariates and rates is the same in both segments. If it is, it suggests that the transaction surplus is split the same way whether transacting through a broker or not, and so gathering quotes on one's own is as effective as hiring a broker in terms of generating competition. If, on the other hand, the relationship between rates and covariates is different in the two samples, then the surplus will be split differently, and we will be able to learn something about which covariates influence profits/costs and which influence consumer surplus, and therefore whether the observed dispersion is due discrimination or cost/profit-based pricing. Our results suggest that lenders discriminate over consumers based on characteristics such as experience, income, and credit-score, but that observed dispersion associated with variables such as loan-to-value ratio, total debt, and loyalty are due to differences in cost/profitability of consumers.

The paper is organized as follows. Section 2 presents a description of the household-level data, including trends in the Canadian mortgage market. Section 3 discusses pricing and negotiation in the Canadian mortgage market. Section 4 describe the determinants of discounts. Section 5 tests for price discrimination. Finally, Section 6 concludes. Tables and figures are collected in the Appendix.

2 Data

This section describes the data as well as some key institutional features of the industry. Section 2.1 details mortgage contracts, as well as the features of the Canadian mortgage market that are relevant for understanding the main results. Section 2.2 describes the structure of the industry. Section 2.3 summarize the main trends in this market.

2.1 Mortgage contracts

Mortgage products offered by Canadian lenders fall into two broad categories: conventional mortgages (low loan-to-value), that are typically uninsured but can be privately insured, and high loan-to-value mortgages, that require insurance. Our empirical analysis concerns only insured contracts, which represent by far the largest category among newly issued mortgages. About 73 per cent of residential mortgages and over 80 per cent of new home-owners purchase contracts require insurance coverage.³ This is because mortgage insurance is required for households borrowing more than 75 per cent of the cost of the home from a regulated financial institution.⁴ Mortgages are insured by either the government insurer, Canada Mortgage and Housing Corporation (CMHC), or a private insurer, Genworth Financial Canada.⁵

The government of Canada explicitly backstops the two mortgage insurers, who are insuring the lenders against the risk of borrower default. Because of this, the government sets minimum standards for insured mortgages, and the final decision on whether a mortgage application is accepted rests with the insurer. In addition to the 75 per cent LTV rule mentioned above, the government requires that households have a debt service to gross income ratio of less than 32 and a total debt service ratio of less than 40.⁶ These lending standards remained constant during our sample period and were relaxed only slightly post-2006. Moreover, the insurance premiums are common to both companies, and are typically rolled into the mortgage and financed over the full amortization. These premiums range from 1.75 to 3.25 per cent for the most common mortgages contracts, and depend only on the loan-to-value ratio.

Our main data-set is a sample of insured mortgage contracts obtained directly from CMHC and Genworth. From the former, we obtained a 10 per cent random sample of new mortgage contracts issued between 1992 to 2004, sampled by Census Metropolitan Area (CMA).⁷ Genworth provided us

³The percentage of government guaranteed mortgages is calculated as total insurance in force over total residential mortgage credit. As of 2009 CMHC had 473 billion CAD, Genworth 224 billion CAD and Canada Guaranty about 5 billion CAD of insurance in force in a market of 965 billion CAD.

⁴This threshold was raised to 80% in 2007.

⁵Genworth Financial entered the Canadian market in late 1995 and has grown to about one-third of the market.

⁶Gross debt service is defined as principal and interest payments on the home, property taxes, heating costs, annual site lease in case of leasehold, and 50 per cent of condominium fees. Total debt service (TDS) is defined as all payments for housing and other debt.

⁷Breslaw, Irvine, and Rahman (1996) have previously used this data to study mortgage term and amortization

with their full set of loans issued between 1996 and 2004. Since these contracts are over-represented relative to CMHC's, we randomly selected Genworth contracts to match their aggregate market shares for each year.

Both CMHC and Genworth only began collecting key household-level information in 1998, and therefore much of our empirical analysis focuses on the 1999-2004 period. In total we have access to 20 household/mortgage characteristics, including all of the financial characteristics of the contract (i.e. rate, loan size, house price, debt-ratio, risk-type), the lender identity (for the 12 largest lenders), and some demographic characteristics (e.g. income, prior relationship with the bank, residential status, dwelling type).⁸ In addition, we observe the location of the purchased house up to the forward sortation area, which is a finer measure than the CMA. While the average forward sortation area (FSA) has a radius of 7.6 kilometers, the median is much lower at 2.6 kilometers.⁹

Since we are interested in explaining patterns of interest rate dispersion across households, we restrict our sample to contracts with homogenous terms. In particular, our analysis focuses on contracts with a 25 years amortization period, and 5 year fixed-rate term. This represents the largest category of contracts issued during our sample period. Between 1999 and 2004, over 92 per cent of contracts were fixed rates, among which over 80 per cent had a 5 year term (the second most common term was 36 months, with 13 per cent of the sample). A 5 year fixed-rate mortgage contract must be renegotiated every five years, which in effect acts like an adjustable rate mortgage with a fixed time-frame to renegotiate. Our analysis focuses only on newly issued mortgages so we exclude home-owners that are either refinancing or renewing their mortgage contract.

Table 2 presents summary statistics of the discrete variables for our restricted sample of 5 year fixed rate mortgages amortized over 25 years. Over 25 per cent of the borrowers in our sample owned a home at the time of the contract. These *previous owners* are obtaining a mortgage for a new property, but still do not have enough equity in the previous house to avoid paying insurance on their new one. The remaining *new home owners* are exiting from renting or living with their parents. We also find that the majority of Canadians buy detached homes, and that by the late choice between 1980-1988.

⁸Table 1 in the Appendix lists all of the variables included in data-set.

⁹The FSA is the first half of a postal code. There are over 1,300 FSA's in Canada, and over 850,000 postal codes.

1990's the market share of brokers was over 30 per cent.¹⁰

Table 4 displays the market share of brokers and branches by type of financial institution. The vast majority of mortgage contracts that are with the Big 6 banks are negotiated at branches, with only around 27 percent of contracts using brokers. In contrast, over half of contracts with trusts use brokers (57 per cent), as do almost 80 percent of contracts with other financial institutions.

Summary descriptions of continuous variables are presented in Table 3. We present the mean, median, and standard deviation for (i) the full sample, (ii) a sub-sample of previous home-owners, and (iii) a sub-sample of new home-owners. The purpose of splitting the sample in this way is to explore the possibility that more experienced home-buyers have a different mortgage shopping experience than first-time home-buyers.

For the full sample the mean borrower has been with his/her financial institution 48 months before the contract is signed, about 6 months more than the mean for new home-owners and 20 months less than the mean for previous home-owners. Previous home-owners are therefore less likely to switch financial institution. This is more stark when looking at the median relationships, 1 month for new buyers and 40 months for previous owners.

The average household income is very different across residence groups: new home-owners are about \$11,000 poorer than existing home owners (i.e. \$65,300 versus \$76,600). This difference is reflected also in the house price, and in the loan size. The mean loan is about \$143,000 to purchase a \$158,000 home (all in 2002 dollars). The LTV for new home-buyers is slightly higher than than of previous home buyers.

The majority of households in our sample invest the minimum down-payment of 5 per cent. Figure 5 plots LTV ratios. LTV ratios are highly localized around 90 and 95, and to a lesser extent 75, 80, and 85. The clustering comes about because the pricing schedule is discrete and there are only a small number of price-quantity pairs.

An average total debt service ratio (TDS) of 31.9 is relative low compared to the guideline maximum of 40. Figure 5 presents a histogram of borrowers' total debt service ratios. The graph

¹⁰As far as we are aware, during our sample period all lenders except the largest in the country, RBC, process broker-business.¹¹ Rather than use mortgage brokers RBC relies more heavily on in-house mortgage specialists (most financial institutions have mortgage specialists in addition to using brokers). These are broker-like individuals that only work for one lender.

is right-censored at 50, with all ratios greater than 50 accumulated at 50. There do not appear to be differences in the distribution of TDS ratios across samples. The 40 per cent TDS guideline is largely followed, with very few households borrowing with a TDS greater than the guideline maximum. Given the heavy right-skewness of the distribution, however, the constraint does appear to be binding for a large number of households. Previous home-owners and first-time home-owners have similar TDS ratios.

Discounting is prevalent in the Canadian mortgage market. Table 3 presents the sample means and standard deviations for both the transaction price less the adjusted bond rate and the posted price less the adjusted bond rate.¹² The difference between the two is the mean discount. Over the full sample, the mean discount is 86 basis points and the median is 97 basis points. These represent discounts of 14 and 15 per cent, respectively.

We also have information on the posted mortgage rates for most of the banks. These data were collected every Wednesday from the Globe & Mail newspaper archives. Unfortunately these archives do not list information on posted rates for some of the smaller institutions. For this reason, despite the fact that we are interested in studying discounts, most of our analysis will actually focus on margins. More specifically we focus on the transaction rate minus a swap-adjusted bond rate. We can construct this measure regardless of which financial institution holds the mortgage contract.

2.2 Market Structure

The Canadian mortgage market is dominated by the “Big 6” Canadian banks (Bank of Montreal, Bank of Nova Scotia, Banque Nationale, Canadian Imperial Bank of Commerce, Royal Bank Financial Group, and TD Bank Financial Group), a regional cooperative network – Desjardins – and a provincially owned deposit-taking institution – Alberta’s ATB Financial. Collectively, they control 90 per cent of assets in the banking industry and are called the “Big 8.” Their dominance stems from the period of consolidation that occurred in the early 1990s when the large banks acquired nearly all of the trust companies who until that point had played an important role in the mortgage

¹²Banks use swaps to hedge the fact that they hold short-term liabilities (deposits) and long-term assets (mortgages). As the swap market developed, bond rates (including mortgage rates), became more closely linked to banks’ funding costs at long maturities (Allen and McVanel (2009)).

market. Poor loans in the 1980s left the trust companies or their holding companies in financial distress. As a response to these troubles, and to the fact that trust companies had an unfair legislative advantage when it came to making loans (having to do with reserve requirements), legislative changes took place in 1992 to allow banks to enter the trust business.

From Micromedia we have information on the locations of branches for each financial institution in each market for 1998-2004. We use this information to construct two key measures of concentration by local market. First, we construct a branch Herfindahl-Hirschman Index at the FSA level with a 5 KM radius around the centroid of the FSA. Summary statistics are presented in Table 3. The mean HHI is 0.203 and the standard deviation is 0.115. The second market structure variable is a borrower-specific which we denote *Relative network*. It is calculated as the fraction of branches in a neighborhood owned by the borrower's lender over the average branch network of other lenders. The mean relative network is 1.22 and the standard deviation is 0.99. For more details on the evolution of branch networks in Canada see Allen, Clark, and Houde (2008).

It is important to note here, that the evolution of the banking system following the 1992 Bank Act has led Canadian households to treat their primary bank as a “one-stop shop” (universal bank) where they purchase the majority of their financial services.¹³ From Table 5 we see that 67 per cent of Canadian households have their mortgage at the same financial institution as their main checking account. In addition, 55 per cent of household loans, 78 per cent of credit cards, 73 per cent of term deposits, 45 per cent of bonds/guaranteed investments and 39 per cent of mutual funds are held at the same financial institution as the households main checking account.

2.3 Market trends: The rise of discounting

Discounting has not always been the norm in Canada. Until the mid 1990s very few Canadians received any discount on their mortgage.¹⁴ Figure 1 characterizes the evolution of discounting for the most popular Canadian mortgage product – the 5-year fixed rate mortgage. The figure illustrates how discounting has increased by about 100 basis points over the 12 years from 1992 to

¹³The strong attachment Canadians have for their banks has implications for bank-customer relationships and the importance of the local branch to communities.

¹⁴This was also true in the US. See for instance Duca and Rosthenal (1994) and Edelberg (2006).

2004. However, the mark-up in the posted price has also increased over time by about the same amount and so, as can be seen in the figure, the average margin – the difference between the average transaction rate and the bond rate (which proxies the cost of funding) – remained fairly constant over the period.

In other words, the average borrower is as well off in 2004 as in the early 1990's. However, these trends hide the fact that not all borrower-types experience gains. This can be seen in Figure 2 which presents two histograms: one of discounts from 1992-1995 and the other of discounts from 2000- July 2002.¹⁵ In the earlier period there is little dispersion and the vast majority of households received either no discount or a small discount.¹⁶ Towards the latter part of our sample only a small fraction of borrowers do not receiving any discount, many receive large discounts, and there is considerable variance in the discounts received.

Figure 3 confirms the increase in dispersion over time. It presents a whisker plot illustrating the dispersion in transaction rates for 5 year fixed rate mortgages. Since there is a substantial amount of price dispersion coming from week-to-week changes in posted rates, we subtract from the transaction rate the within-week median rate. The figure reveals that rate dispersion is increasing over time.

These trends coincide with a number of important changes to the market structure of the Canadian banking industry. Following the regulatory changes of the early 1990's, the Canadian banking industry underwent a major merger and acquisition wave, with the major banks acquiring almost all of the trust companies over the following decade. The result was a concentrated mortgage market in which a small number of large national financial institutions dominated the market.

Historically, the trusts offered lower rates and captured a large fraction of those borrowers that

¹⁵TD-Canada Trust adopted a no-haggle policy in November 2002 which has a large effect on discounts, therefore we cut off the sample a few months before that.

¹⁶In Figure 2 some of the discounts are negative, which should never be the case. Lenders can offer borrowers a discount on the posted price, but are not allowed to offer a loan to a high-risk borrower for a premium. In the U.S., for example these premiums are called “overage” and there is evidence that they are more likely to be charged to minorities, e.g. Courchane and Nicerkson (1997) The negative discounts that we observe in the data come about because of how the data are administered and how rates are negotiated. Typically, a borrower will negotiate a rate several weeks prior to the purchase of the home, and this rate can be adjusted (downwards) until the purchase date. We observe posted rates weekly, and match the transaction rate with the posted rate for the week closest to the day the home is purchased, and not the posted rate on the day that the transaction rate is negotiated. Therefore if the posted rate falls and the borrower does not renegotiate, the discount could be counted as negative.

shopped for the best rate. Having swallowed up the trust companies, the large financial institutions began competing heavily amongst themselves for these borrowers. At the same time the Canadian market opened its doors to virtual and brick-and-mortar foreign competition in the mid 1990's. As part of their entry strategy some foreign competitors used different pricing schemes than the primary lenders. Unlike the primary Canadian lenders, ING Canada, for example, entered with low no-haggle rates. The result was that the large financial institutions moved to a strategy in which they established higher posted rates and then negotiated individual-specific discounts rather than lowering posted prices for everyone. Therefore, while the average borrower is as well off under this new strategy, some types of borrowers experience gains, while others are worse off. Using this strategy the large financial institutions were able to maintain (or even grow) their market share.¹⁷

Also in the mid 1990's, the role of mortgage brokers as financial intermediaries began to grow in Canada. Figure 4 presents the evolution of the share of transactions that were broker-assisted in our sample. The share increased from less than 15 per cent to over 35 per cent in 7 years.¹⁸ A large number of consumers, therefore, choose to elicit the help of a broker when shopping for a mortgage. Of course, the direction of causality is not at all clear. The use of brokers may have increased due to the fact that banks began offering discounts, but they may have also contributed to this increase in discounting. In Section 4 we show that, on average, borrowers that use a broker pay less on their mortgage than borrowers who do not.

Finally, there were important technological changes occurring during this time in the Canadian mortgage market.¹⁹ The 1990's saw the advent of LAN and the internet making it easier for staff at financial institutions to handle larger volumes of applications. More importantly the underwriting processes of financial institutions became automated during this time period making it much easier to work through the loan approval process. Since we are dealing only with insured mortgages, it should also be noted that in 1996 the CMHC introduced an automated approval system which

¹⁷There exists an extensive literature, starting with Riley and Zeckhauser (1983), that compares the profitability of posted-price and haggling pricing strategies. In a laboratory setting Cason, Friedman, and Milam (2003) find that markups (and profits) are significantly higher in haggle environments than posted price environments.

¹⁸This is still substantially less than in the United States where pre-crisis brokers originate 68 per cent of mortgages. In 2009 the share of mortgages originated by brokers in the U.S. was less than 15 per cent.

¹⁹Similar changes occurred around the same time in the US. Underwriting systems were developed and data storage costs decreased, and so risk-based pricing grew in importance. See for instance Edelberg (2006) and Dick and Lehnert (2010).

dramatically increased the speed of its mortgage approval process. Prior to this the banks faxed the information to the CMHC for approval. The new automated system standardized the national credit approval system and reduced the number of errors in client profiles at the CMHC. All of these changes may have made it easier for lenders to offer different rates to different borrowers as a function of their measurable characteristics.

3 Pricing and Negotiation

Most Canadian banks operate nationally and post prices that are common across the country. Lenders typically post the mortgage rate for their different products on a weekly basis in both national and local newspapers, as well as online. This is different than in the United States, where even national lenders such as Bank of America post different mortgage rates on their web-site depending on a consumer's zip code.²⁰

There is little dispersion in posted prices, especially among the Big six financial institutions. In fact, the coefficient of variation on posted rates for the Big six during the early part of our sample period is always around zero. Allen and McVanel (2009) provide a detailed analysis of movements in Canadian banks' posted rates. Most of the time (between 63 and 66 per cent depending on the term), posted prices do not change from week to week. When prices do change, only 6 per cent of the time do we observe only one bank adjusting its rates.

Therefore, in shopping for a mortgage contract one option for consumers is to pay the posted price of their home bank or of some rival bank. However, in Canada this is not their only option. Local branch managers have the authority to offer borrowers discounts below the posted price under general guidelines from headquarters. Rather than settle for the posted price consumers can instead try to obtain mortgage contracts with lower rates. There are two ways for them to do this.

One approach is to hire a broker to search for the best rates on their behalf. Unlike in the United States, brokers in Canada have fiduciary duties. Brokers are compensated by lenders, but "hired" by borrowers to gather the best quotes from multiple lenders. Typically, brokers are compensated between 1-1.3 per cent of the volume of mortgages that they bring to a lender. Borrowers could

²⁰Canadian banks operating in the U.S. also use this strategy for their U.S. locations.

potentially hire several brokers, something we cannot observe.²¹

Rather than hire a broker, a borrower can instead search independently to obtain a list of quotes. Our data do not provide information on the number of quotes gathered by borrowers, but survey evidence from CAAMP reveals that on average borrowers make between two and four contacts and negotiate with between one and two financial institutions when searching for a rate. There are two main forces influencing the rate quote(s) received by borrowers: (1) their preferences – namely search costs, bargaining ability, and valuation of bank services, and (2) their current and future profitability. The burden of gathering multiple quotes lies on consumers and there is heterogeneity in the cost of search across consumers. Consumers also differ in their bargaining ability and their valuation of various services related to the financial institutions themselves. For instance, there may be heterogeneity in their valuation of the branch/ATM network (since some may value being able to easily access a branch while others may do all of their banking online), their valuation of the other loan services provided by lenders or wealth management services. Finally, some consumers may have a higher willingness to pay to have a mortgage contract with their current financial institution.

Branch managers try to screen consumers based on their search costs, their valuation for their services, and their observable characteristics, and then evaluate the profitability of signing particular borrowers to mortgage contracts. Branch managers have an incentive to offer larger discounts to consumers who have gathered, or have the potential to gather, multiple rate quotes, and to those that are, or will be more profitable to the bank. On the other hand, negotiating larger discounts is costly for the bank and can reduce the commissions earned by branch employees (see KPMG (2008)).

The profitability of a mortgage contract signed between a particular borrower and a particular lender can be broken down into three components: (i) profits stemming directly from the contract, (ii) profits stemming from the purchase of complementary services, and (iii) profits stemming from future mortgage contracts signed between the two parties. Profits stemming directly from the

²¹In contrast, in the U.S. brokers receive both a cash-fee from the borrower and a yield-spread premium from the lender. The yield-spread premium is an increasing function of both the loan size and the interest rate, therefore brokers in the U.S. do not have an incentive to find borrowers the lowest rate (e.g. Hall and Woodward (2010)).

contract depend on the revenues and costs it generates. Since the vast majority of mortgages in Canada are five-year fixed rate terms, in most cases direct revenue depends only on the size of the loan and the interest rate charged. Lenders must also consider the risk of default on the contract. However, since the contracts in our sample are all fully insured, default is less of a concern for lenders.²² There is though some risk of prepayment by the borrower which would reduce the revenue earned directly from the mortgage contract. More specifically, in some cases borrowers will contribute over and above their monthly payment to pay down the mortgage more quickly than the lender expected.²³ This risk is greater when borrowers face higher interest rates and for those that are (for given levels of debt) less leveraged and/or wealthier. The direct costs are related to the maturity-matched bond rate and the risk associated with default. Since we are looking only at insured mortgages the cost to banks in the case of default are mostly just transaction costs. Nonetheless, this risk is clearly greater for borrowers that are more leveraged and with poorer credit history, and so we would expect lenders to view these borrower-types as being less profitable.

Contract profitability also depends on the potential for borrowers to make complementary purchases at the same financial institution where they hold their mortgage, such as saving/deposit accounts, other loans, credit cards, and investment products. The size of a borrower's down-payments, for example, may influence how likely (s)he is to want, or be able to, borrow from the same institution in the near term for other durables. This is particularly important in our context

²²According to a recent report by the Royal Bank of Canada (Hardy and Mun (2009)), the historical average cost of mortgage default in Canada is 2 basis points per year. Historical delinquency rates in Canada are less than 0.4%, about ten times smaller than in the U.S.

²³It is standard for borrowers to be granted a 15 per cent (and sometimes as high as 20 per cent) prepayment option per year. This means that a lump sum of 15 per cent of the original principal value can be paid down in any year of the contracted-term. Any unused prepayment room expires at the end of each year. Note that this prepayment risk is different than the risk most often discussed in the U.S. banking industry. In the U.S. the concern is that when interest rates decrease, consumers will attempt to pay down their entire mortgage and refinance. This is of little concern in Canada. The penalty for prepayment in excess of the stipulated limit can be fairly severe. According to Lascelles (2010) the prepayment penalty amounts to the greater of three months of interest or the interest rate differential (IRD) between the locked-in rate and the market rate times the number of remaining years. This effectively neutralizes any financial incentive to renegotiate in quest of a lower borrowing rate as the cost precisely offsets the advantage. However, up until 1999 CMHC policy stipulated that for the remaining two years of a five-year term, the penalty should be just the three months of interest. This rule has since been eliminated, but some lenders may still abide by it. It remains the case that for any mortgage term of greater than five years, the penalty for prepayment after the first five years cannot exceed three months of interest. Consistent with this, it appears that Canadians take advantage of their prepayment option much less than in the U.S. For instance, whereas Canadian borrowers can prepay up to 15-20 per cent of their mortgage each year without penalty, the average prepayment is less than 1 per cent (Lascelles 2010).

since, as mentioned above, most Canadians hold their mortgage at their main financial institution.

Finally, profitability is affected by the potential for borrowers to renew their mortgage with the same financial institution at the end of the contract term. Financial institutions may have an incentive to lock-in borrowers since few negotiate the renewal of their mortgage.²⁴ This tendency provides lenders with an incentive to attract consumers with larger loans who have large outstanding balances at the time of renewal. Similarly, younger consumers and first-time home buyers are likely to be more profitable in the long-term for lenders.

3.1 Negotiation on elements other than discounts

We assume throughout that borrowers can negotiate only on rates. It is possible that in some cases borrowers and lenders negotiate on elements of the mortgage contract other than rates. In Canada there are a number of closing fees, some of which might be negotiable, and others which are clearly not negotiable (at least with the lender). For example, a lender may require a property assessment before lending funds to buy the home. Typically the assessor is recommended by the real estate agent, and the cost ranges from 250 to 350 dollars. The appraisal could be waived by the lender, and is typically done so unless the purchasing price of the home is substantially greater than the market value. Anecdotal evidence suggests this fee is only rarely negotiable. CMHC and Genworth also used to charge an underwriting fee for mortgage insurance, and this could potentially be waved by the lender. The fee was between 75 and 165 dollars (these fees were dropped in 2006). Fees that are typically not negotiated between the lender and borrower include the home inspection fee (which the lender does not require), land registration fees (which are paid to the municipality) property taxes and insurance, and legal fees (paid to a notary or lawyer). Note that for property insurance the lender could offer a preferable rate (which we do not see in the data) rather than a discount on the mortgage price. This is rather unlikely as Canadian banks are not permitted to sell insurance inside their branch.

There is also some evidence that lenders will in rare instances negotiate on the fraction of the contract that can be prepaid without penalty.

²⁴CAAMP conducts annual surveys on the Canadian mortgage market and systematically finds that borrowers overwhelmingly (over 85 per cent) renew their mortgage with their existing financial institution.

4 Empirical analysis

In Section 2 we provided evidence showing that rates in the Canadian mortgage market are highly dispersed. This is despite the fact that the loans we study are all fully insured and so the role of risk is much less important than in standard credit markets. The purpose of this section is to determine what factors explain the remaining variation. We first present a variance decomposition that reveals substantial within group dispersion. Second, we decompose discounts into loan, bank, and consumer effects. Our objective is to explain what characteristics are associated with better or worse discounts. This part of the analysis is purely descriptive. We simply provide a set of stylized facts that highlight the factors other than risk that explain rate dispersion. In section 5 we go beyond the descriptive and attempt to identify whether the observed dispersion is due to rent extraction or to heterogeneity in cost/profitability. Specifically, our objective is to test for each of the loan, bank, and consumer characteristics whether they are related to (i) the profitability of each contract to the lender (in terms of prepayment and complementary services, and future renegotiation value) or to (ii) heterogeneity in consumer preferences – in search costs, in bargaining ability, and in willingness to pay for bank characteristics.

The focus of our analysis in this section and the next is on margins (transaction rates minus adjusted bond rate) rather than discounts because we do not have the posted rate for some of the smaller financial institutions. We restrict attention to 5 year fixed-rate mortgages amortized over 25 years, and to the 1999-2004 period. As we saw from Figure 3 there is a substantial amount of dispersion in rates even after accounting for weekly rate movements.

4.1 Explaining discounts

In Table 6 we present some descriptive statistics on rate dispersion. First, the fraction of borrowers paying the posted rate is only 7.6 per cent in our sample period.²⁵ The fact that so few borrowers pay the posted rate suggests that banks are practicing consumer-based pricing. Second, the variance

²⁵The average between 1992-1998 was 20 percent, although even that masks the fact that prior to 1997 over 50 per cent of borrowers paid the posted price.

decompositions that we present suggest that there is substantial within group dispersion.²⁶ The exercise we undertook was to group borrowers into discrete homogeneous categories and compare the between- and within-group variance. Whether groups are defined as financial institutions (*lender*), local shopping markets (*FSA*), loan characteristics (*X*), or market structures (*HHI*, *N*), rates vary substantially. The exception is when the group is defined as quarters (*Q*). At least in the earlier sample a somewhat large sample of borrowers is paying relatively close to the posted rate. The fact that the between-variation across quarters is decreasing is consistent with a decrease over time in the proportion of borrowers paying the posted rate. Overall, as fewer borrowers pay the posted rate consumer-specific pricing increases.

In what follows we decompose margins in our sample into loan, bank, and consumer effects. The first set of estimation results are presented in Table 7. All specifications include bank and week fixed effects. Columns (2)-(4) also include FSA (neighborhood) fixed effects. In Column (5) we replace the FSA fixed effects with about 25 FSA-level 2001 census variables such as rental and housing costs, income, age, etc. Focusing first on household income we see from columns (1) and (2) that richer households appear to pay lower mortgage rates. However, looking at column (2) we can see that some of this is due to unobserved neighborhood effects correlated with income. Furthermore, when conditioning on loan size the story is different; richer households in fact pay higher rates than poorer households (column (3)). The more expensive the home, however, the larger is the discount.

Table 7 also shows that the most financially constrained households (those with an LTV of 95, i.e. 1(Min. down)) pay higher rates than other borrowers – about 11 basis points more than the base-ratio of LTVs less than 0.85. 1(Min. down)) isolates the effect of down payment on rates since we control for house prices. Our results suggest that lenders charge a premium for such a high leverage ratio. For the typical mortgage in our sample 11 basis points is economically significant, translating into an increase of \$9.46 per month in mortgage payments for 5 years for the borrower, or an increase of \$761.74 in total interest payments. The more borrowers put down (relative to the baseline), the smaller the premium they are charged. Borrowers in the 0.9-0.95 range pay a

²⁶We present $1 - V(Y|x)/V(Y)$, which is the average within group x variance of Y , divided by the variance of Y , therefore a high number means that x can explain variation in Y .

premium of about 4 basis points, while borrowers in the 0.85-0.9 range pay a premium of about 1.6 basis points.

Finally, comparing columns (4) and (5) we see that the FSA fixed effects explain more of the variance in the rates than the FSA-level control variables, but not by a large amount. We use specification (5) throughout the rest of the paper to be consistent with the quantile specifications we present in below.²⁷

In Table 8 we display estimates for market and household characteristics, as well as the loan characteristics from Table 7. All specifications include week and bank fixed effects, along with the FSA-level census variables. Column (1) uses all of the contracts from 1999 to 2004 and from both insurers, while column (2) uses only the CMHC sample. The reason is that the Genworth sample is missing information on certain demographic characteristics. Comparing columns (1) and (2) we can see that results are essentially unchanged, and so for the rest of the analysis we restrict attention to the CMHC sample. Columns (3)-(6) further restrict the data to various subsamples. In column (3) we drop the period from November 2002 to August 2004. TD-Canada Trust was experimenting with a no haggle policy during this period, which could have an effect on our estimates. In column (4) we restrict attention to contracts signed with the Big 8 financial institutions, while in columns (5) and (6) we compare new owners to previous owners.

We consider first the effect of market structure on margins. We find that more branch-concentrated neighborhoods (HHI) on average experience higher rates. In the full sample a one-standard deviation increase in market concentration leads to a 3% increase in the margin. *Relative network* is a borrower-specific variable and is calculated as the fraction of branches in a neighborhood owned by the borrower's lender over the average branch network of other lenders. We conclude that consumers who choose to transact with larger network banks pay more. The effect of branch network size is, however, relatively small. A one standard deviation increase in relative size leads to a 1.9% increase in the banks' margin.

Turning to household characteristics we study the effect of borrower credit scores on rates. The literature on 'risk-based pricing' suggests that interest rate dispersion in many credit markets can

²⁷It is substantially easier to estimate quantiles for a specification with 20 FSA controls than one with over 1300 FSAs fixed effects.

largely be explained by heterogeneity in borrower risk levels and the ability of financial institutions to discriminate between borrowers according to these differences. We also find that borrower risk influences rates. In our data, *CREDIT* is a categorical variable with four risk categories. The highest risk category represents the most creditworthy borrowers (credit scoring in Canada is done by the same two companies as in the United States: Equifax and TransUnion). The omitted category, *CREDIT1* represents borrowers that are the least credit worthy. Our results suggest that borrowers with better credit scores receive larger discounts.

Renters, *Parents*, and *Switchers* all receive lower rates. The base category for *Renters* and *Parents* is *Previous home – owners*. Borrowers in the base category are likely older than in the other two categories. Our results suggest, therefore, that first-time buyers receive discounts relative to previous owners. This is consistent with Goldberg (1996) who, in the context of the car market, finds that households under the age of 30 who have not previously purchased a car receive discounts relative to experienced buyers. We can compare the dollar savings of our proxy for first-time buyers with Goldberg’s proxy for first-time buyers. For the typical mortgage first-time buyers save \$381 over 5 years. In the car market Goldberg (1996) finds that first-time buyers receive a discount of approximately \$440. The average car loan is approximately 70 months (*bankrate.com*), therefore the savings per year are \$75, which is approximately the same amount we find in the mortgage market.

The *Switcher* variable is an indicator variable equal to 1 if the borrower signs a mortgage with a financial institution that is not their main financial institution at the time of the mortgage origination. The lender is therefore attracting a new client. Our estimates suggest that new clients receive larger discounts than existing clients, on the order of 13 basis points over the full sample. This is consistent with the extensive literature on consumer switching costs giving firms market power over loyal consumers (e.g. see Klemperer (1995)).

Over the full sample the average impact of a mortgage broker is to reduce rates by 18.8 basis points (13 with only the CMHC sample). Using a broker, therefore, is associated with a reduction in monthly mortgage payments of between \$11 and \$16, depending on the sample. In total using a broker can save a borrower between \$900 and \$1315 in interest costs over 5 years. Brokers are a

significant factor, therefore, in driving discounts. This result is in sharp contrast to the mutual fund industry, for example, where Bergstresser, Chalmers, and Tufano (2009) find that on a risk-adjusted basis brokers actually delivered lower returns to consumers than direct channels between 1996-2004 in the U.S. It also appears to be in sharp contrast to the U.S. mortgage-broker experience where due to the lack of fiduciary duties mortgage brokers led borrowers to sign unfavorable contracts (Hall and Woodward (2010) or Berndt, Hollifield, and Sandås (2010)). It should be pointed out that in our estimation there might be unobserved borrower characteristics that affect both the decision to shop with a broker and outcomes. For instance, financially literate borrowers are likely to get better rate quotes regardless of whether they use a broker or not. If these borrowers are also more prone to shop with a broker, this may inflate the coefficient on the broker variable. On the other hand, the coefficient on the broker variable would be downward biased if poorer or more financially constrained households recognized that they would be at a disadvantage when bargaining and therefore more likely to hire a broker (similar to Scott Morton, Zettelmeyer, and Silva-Risso (2003) in the car market).

Columns (3)-(6) provide more disaggregated information. The results in column (3) are almost identical to those in (2) suggesting that the no-haggle policy of TD Canada Trust had little overall impact on the factors influencing discounting. Column (4) focuses on borrowers who sign mortgages at one of the 8 largest mortgage providers (Big 8) in Canada. The key differences between columns (4) and (2) are with the *Switcher* and *LTV* variables. Borrowers who are new clients at one of the Big 8 banks receive less of a discount than borrowers who are new clients elsewhere. These results are consistent with the earlier result that banks with larger local branch networks offer smaller discounts. This second result, however, suggests that in addition to competitive price factors (*Relative network*), lenders with larger branch networks also have a competitive quality factor. That is, consumers appear willing to sign a mortgage contract with a large Big 8 bank at a worse rate than they could receive elsewhere. One reason could be that borrowers value the other services provided by the lender and the lender takes this into account when pricing the mortgage.²⁸ As

²⁸In a different market Verboven (2002) finds that the same firm selling the same car but with two engine options – diesel or gasoline – charges a 70-90 per cent mark-up on the diesel engine above the cost difference because of consumer’s willingness to pay for quality. In a case study of S&P index funds Hortaçsu and Syverson (2004) show that some firms can charge more for what appear to be nearly identical goods because, in addition to search costs,

mentioned above, the majority of Canadians do their banking at one financial institution, therefore it seems likely that consumers take into account the quality of the lender as a whole, not only as a mortgage-provider.

Columns (4) and (5) separate out contracts for new and previous home-owners. In some cases there are only small differences between the two groups of home-buyers, but in others it is substantial. For example, only the most financially constrained previous home-owners pay a premium, and it is one-third the size of the premium of the most financially constrained new home-owners. Another interesting difference shows up with *Switcher*. We find that previous home-owners that switch financial institutions receive a larger discount than new home-buyers. This should not be surprising. Previous home owners are also more experienced in mortgage contracting. *Switcher* is a proxy for consumers who reject the initial offer from their home bank. Conditional on searching, more experienced negotiators receive better rates.

4.2 Quantile Regressions

We next examine results from quantile regressions of margins on loan, market, and household characteristics, controlling for week, bank, and province fixed effects as well as census variables. The sample period is 1999-2004. We are interested in determining the effects of the covariates on margins for different quantiles of the conditional margin distribution. Our objective is to test whether the marginal effect of the different covariates are constant across the conditional margin distribution. Estimates for some of the quantiles are presented graphically in Figure 6.

In each picture, the X-axis indicates the quantile of the distribution of margins conditional on the particular covariate. The quantiles of the margin distribution capture the distribution of the outcome of the negotiation. Low quantiles represent borrowers who received a relatively big discount given their value of the covariate, while high quantiles are borrowers paying high rates relative to their value (that is, they are receiving almost no discount).

We are conditioning on a very rich set of financial characteristics that affect the profitability of the transaction. Therefore, what is left reflects mostly borrower heterogeneity, and so it makes

investor's perceive quality differences based on such things as whether the fund is exchange-traded and the number of funds under management, for example.

sense to think of this distribution as stemming from consumers' unobserved search/negotiation ability: low quantiles are consumers with low search costs who are able to gather quotes from multiple lenders or with good negotiation skills, while higher quantiles are consumers with larger search costs.

For the majority of covariates the marginal effects are heterogeneous across the distribution of rates. The exceptions are some of the *LTV* variables. For the household characteristics that we examine (*CREDIT* score, renter, parent, and switcher), a consistent U-shaped pattern emerges. The marginal effect of the household characteristics on margins is decreasing until we reach the highest quantiles, at which point it begins to increase. In other words the marginal effect of having a better *CREDIT* score or of being a new consumer (*Switcher*) on discounts is increasing in transaction rate up until about the 80th percentile, at which point the marginal effect on discounts begins to decrease. At both the lowest and the highest rates, therefore, the marginal effect of having a good *CREDIT* score or being a new client does not lead to a noticeable discount.

At the highest point in the distribution, the dispersion in rates should be zero, or close to it, since there is a ceiling imposed on branch managers by the posted rate. Because the posted price is independent of consumer characteristics, the marginal effects should be zero conditional on paying the posted price. (If the distribution were not truncated, there would be no increase at this end of the distribution.) Similarly, at the lowest point in the distribution, there is a floor imposed by the financial institution's cost of funding. Financial institutions are limited in the extent to which they can subsidize the rates offered to consumers with attractive characteristics. For borrowers in between, those who do not search too much or have intermediate negotiation skills, the transaction rate is highly correlated with the particular characteristic. In other words, the marginal effect of the covariate on this part of the distribution is much more important.

What conclusions can we draw from the quantile analysis? The fact that the marginal effects of the different covariates are not constant across quantiles is further evidence of consumer-based pricing. Interpreting the the distribution as stemming from search costs or bargaining ability leads us to suspect that this is evidence of price discrimination on the part of lenders. In the next section we attempt to more formally test for this, and to determine which variables are associated with

this type of rent-seeking behavior on the part of lenders.

5 Testing for Price Discrimination

Having established that mortgage rates vary with a number of consumer and contractual characteristics, we would like to determine for each of these characteristics whether the dispersion they generate represents discrimination or simply cost/profit heterogeneity. A lender's ability to extract consumer-specific rents is dependent on the degree of competition. Only in less competitive markets will banks be able to extract a larger share of the surplus. In more competitive environments, dispersion is due simply to heterogeneity in the cost or profitability of serving customers. A large literature has developed to try to disentangle these effects and identify price discrimination in other markets (c.f. Borenstein (1991), Borenstein and Shepard (1996), Busse and Rysman (2005), Dafny (2010)). The usual method has been to find controls for costs and competition and then to test for dispersion or nonlinearities in prices.

Our approach in this paper is to compare pricing patterns across broker and non-broker transactions. In markets where transaction prices differ from posted prices, competition is consumer specific, with the degree of competition faced by a consumer determined by the quality of his/her outside option (usually given by the number of quotes). Since consumers transacting through brokers get more quotes, it is possible that they face a more competitive environment and so their share of the surplus from the transaction may be different.

To study this we compare the marginal effect of consumer and contractual characteristics in the broker and non-broker segments. This is similar to what Scott Morton, Zettelmeyer, and Silva-Risso (2003) are doing when they compare car prices negotiated over the internet to those negotiated at the dealer. We test whether the relationship between covariates and rates is the same in both segments. If it is, it suggests that the transaction surplus is split the same way whether transacting through a broker or not, and so gathering quotes on one's own is as effective as hiring a broker in terms of generating competition. If, on the other hand, the relationship between rates and covariates is different in the two samples, then the surplus will be split differently, and we will be able to learn something about which covariates influence profits/costs and which influence consumer

surplus, and therefore whether the observed dispersion is due discrimination or cost/profit-based pricing.

To formalize this we present a simple bargaining model between borrower and lender. Consider a setup in which each borrower i contracts with a single lender j . Both parties have full information and the transaction price is determined through Nash Bargaining. Denote the borrower's value of contracting with a lender as u and the price paid at institution j by p_{ij} , and at the next-best option by $p_{i,-j}$. We let $p_{i,-j} = c(Z) + \mu(N(X, B))$, where c is the cost of serving customer i and μ is the markup over cost on the next-best option. Z and X are profit/cost and consumer surplus shifters respectively, with the consumers surplus shifters measuring consumer search or negotiation ability. The markup depends on the number of financial institutions searched over, N , which in turn depends on covariates, X , and whether or not the borrower used a broker, $B = \{0, 1\}$. We assume that the markup is convex and decreasing in N such that the additional benefit from searching over lenders is increasing at a decreasing rate (so that the markup is shrinking at a decreasing rate). Furthermore, we make two assumptions on N . First, we assume that brokers affect the ease with which consumers search over financial institutions such that for a given X the number of financial institutions sampled by a borrower is greater when the borrower uses a broker than when they do not: $N(X, B = 1) > N(X, B = 0)$. Second, we assume that N can be increasing or decreasing in X , but that $|N'(X, B = 1)| \leq |N'(X, B = 0)|$ such that the marginal effect of any covariate X is smaller when using a broker.

The negotiated price then is the solution to the following maximization problem:

$$\max_{p_{ij}} [u - p_{ij} - (u - p_{i,-j})]^{1-\alpha} [p_{ij} - c(z)]^{\alpha},$$

where α describes the lender's bargaining strength relative to that of the borrower. The price is therefore:

$$p_{ij} = c(Z) + \alpha\mu(N(X, B)).$$

We are interested in understanding how broker use influences the effect of different covariates on prices. Specifically, we would like to know whether broker use differentially influences the effect

of profit/cost and consumer surplus shifters. We compare $\frac{\partial p_{ij}}{\partial X}|_{B=1}$ to $\frac{\partial p_{ij}}{\partial X}|_{B=0}$, and $\frac{\partial p_{ij}}{\partial Z}|_{B=1}$ to $\frac{\partial p_{ij}}{\partial Z}|_{B=0}$. Looking first at X we have that:

$$\frac{\partial p_{ij}}{\partial X}|_{B=1} - \frac{\partial p_{ij}}{\partial X}|_{B=0} = \alpha(\mu'(N(X, B = 1))N'(X, B = 1) - \mu'(N(X, B = 0))N'(X, B = 0)).$$

The sign of this expression depends on whether $N'(X, B)$ is positive or negative (whether the marginal effect of X on the borrower's propensity to search is positive or negative). From our assumptions above on μ and our first assumption on N we have that $|\mu'(N(X, B = 1))| < |\mu'(N(X, B = 0))|$. Since μ' is strictly negative, we have that if $N'(X, B)$ is positive, then the difference is also positive, and negative otherwise.

In contrast since brokers have no influence on the cost of serving customers, we have that:

$$\frac{\partial p_{ij}}{\partial Z}|_{B=1} - \frac{\partial p_{ib}}{\partial Z}|_{B=0} = 0.$$

To summarize, we have the following predictions: (i) broker use has no influence on the effect of covariates that shift profits/costs on prices, (ii) broker use has a positive influence on the effect of covariates that shift consumer surplus on prices if the marginal effect of the covariate on the propensity to search is positive, and (iii) broker use has a negative influence on the effect of covariates that shift consumer surplus on prices if the marginal effect of the covariate on the propensity to search is negative.

In Table 9 we present results showing the relative importance of contractual and demographic characteristics for broker transactions versus branch transactions. We interact each of the explanatory variables with the broker indicator and compare these coefficients to those obtained when interacting with a branch indicator. We restrict attention to contracts signed with the Big 8 lenders in order to focus on the effect of brokers on search intensity since an additional role that brokers can play is to sample a different set of lenders than do borrowers searching on their own.

The first thing to note is that for some of the covariates, the coefficients in the broker sample are significantly different than for the branch transactions suggesting that broker use leads to significantly different divisions of the transaction surplus. Next we investigate which covariates are

associated with cost/profit shifting and which with consumer surplus/willingness to pay. For the *renters* and *parents* variables the difference is positive and significant. This is consistent with the idea that, relative to previous home owners, borrowers transiting out of renting and living with their parents search more banks, and so these must be variables that shift consumer surplus. In other words, the better rates being offered to these borrowers are due to the fact that they are more price elastic, and not because lenders anticipate receiving from them a stream of complementary profits in the future.

For the *income* and *credit* variables the difference is negative and significant. This is consistent with the fact that higher income borrowers or those with high FICO scores are less likely to take the time to engage in time-consuming search, and so these too are variables that shift consumer surplus. So, the better rates associated higher FICO scores are not the result of lenders taking good credit scores as a signal that a borrower will be profitable in terms of future complementary profits. Rather, higher FICO score customers have a different willingness to search than lower FICO score customers.

In contrast, for the *LTV* and *other debts* variables the difference is not statistically different from zero. From our predictions above, we know that if there is no difference in the marginal effects between broker transactions and branch transaction, then the covariate in question is a cost/profit shifter. Financial institutions are concerned about the risk of default and future profitability of the consumers and these variables provide signals of borrower profitability.

Similarly, the difference for the *switcher* variable is not statistically different from zero suggesting that it too is a cost/profit shifter. The better rates accorded to borrowers who switch financial institutions arise because lenders may be more aggressive in trying to attract new customers since the increase in future complementary profits from getting a new client may exceed the associated decrease in profits for the home bank losing the borrower.

Note that for the market structure variables the difference is also not statistically different from 0. A priori we would have thought that these would have been variables that shifted consumer surplus through their effect on the outside option, rather than cost/profit shifters. Closer examination reveals that, at least in the case of *HHI*, this may be correct. Our measures of market

structure are somewhat imprecise and as a result the estimated standard errors are quite large. Therefore, despite the fact that for *HHI* the difference is positive and economically important, it is insignificant. On the other hand, it could be simply that market structure is a cost/profit shifter, with the profitability of consumers depending on the degree of competition in the market.

6 Conclusion

This paper studies prices in the Canadian mortgage market, in particular the prevalence of discounting by the majority of lenders. We find that discounting has increased over time and that there is considerable dispersion in discounts. Since the contracts we study are all insured, we look for factors other than risk to explain this dispersion. We find that as in other retail markets the contributing factors are related to switching costs, differentiation, and market structure. Moreover, as the number of borrowers paying the the posted rate has decreased, the contribution of consumer-specific variables has increased.

We test for price discrimination by comparing contracts that were negotiated through brokers to those that were not, since the former were negotiated in a more competitive environment. The evidence suggests that some of the dispersion is simply the result of cost/profit based heterogeneity, but that some of it is due to rent-extraction on the part of firms.

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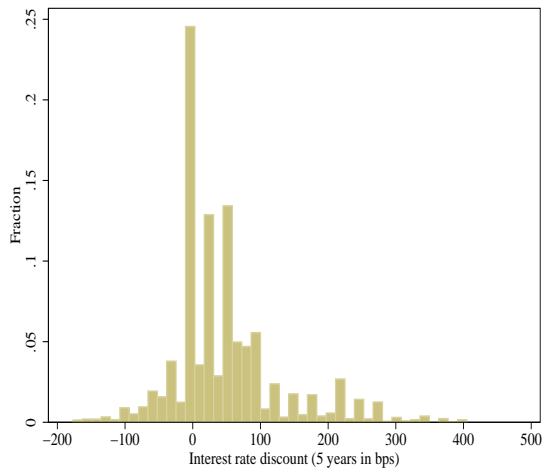
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Figures

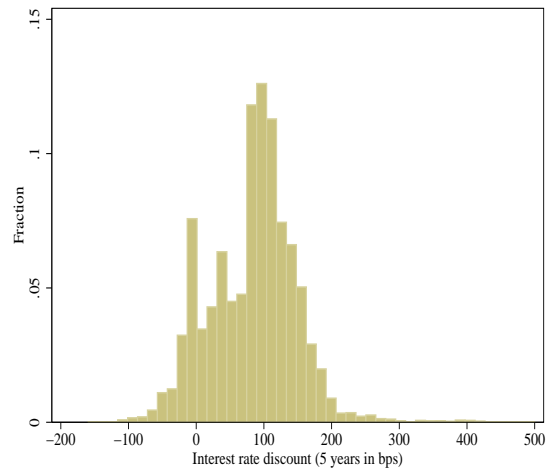


Figure 1: Mortgage Discounting



(a) 1992-1995

$\Pr(\text{Discount} \leq 0) = 35\%$



(b) 2000- July 2002

$\Pr(\text{Discount} \leq 0) = 13\%$

Figure 2: Mortgage Price Dispersion

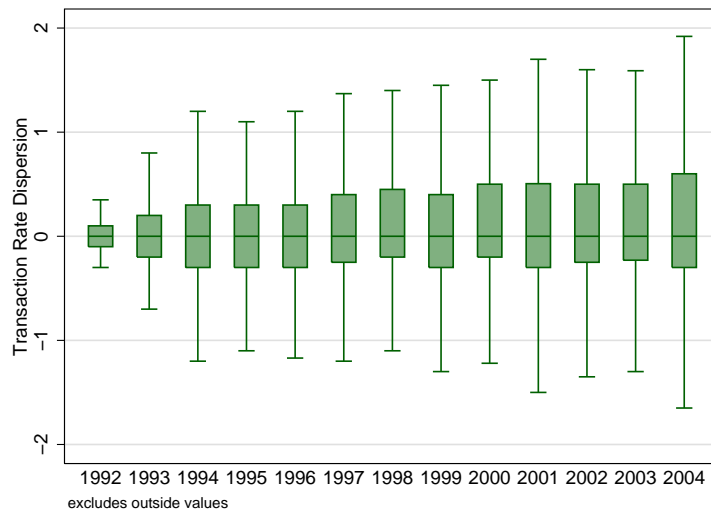


Figure 3: Transaction Rates for 5 year Fixed Rate Mortgage minus the within week Median Rate (1992-2004)

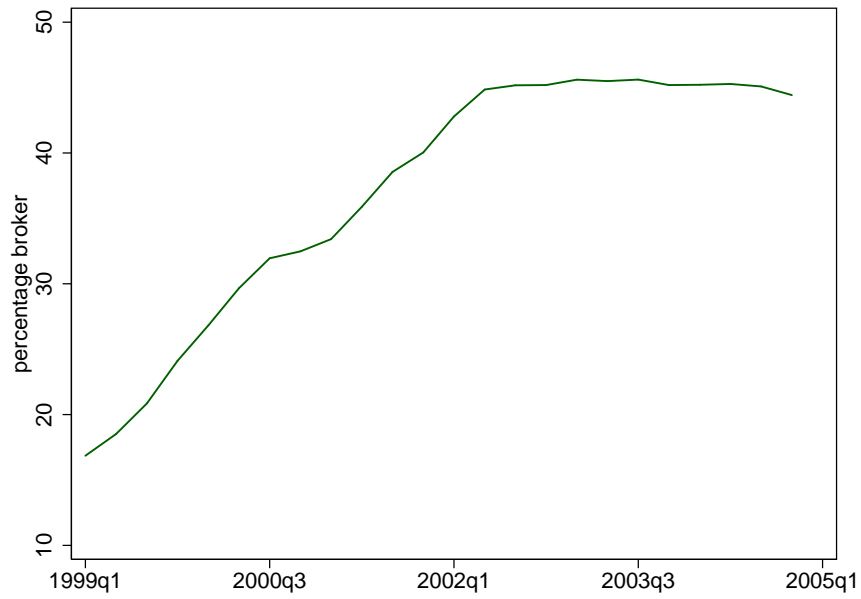


Figure 4: Mortgage Brokers

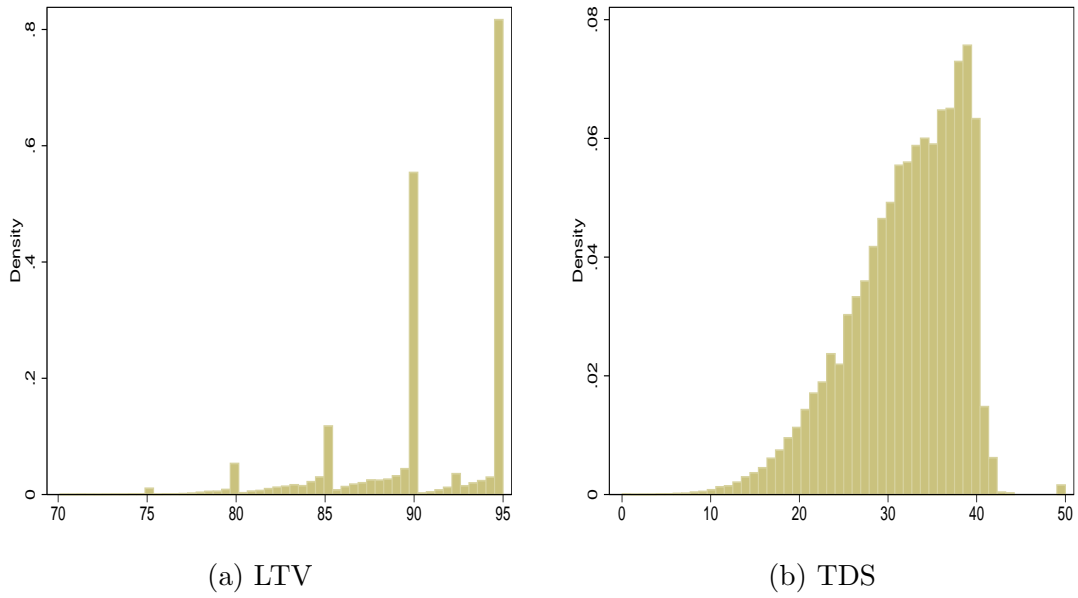
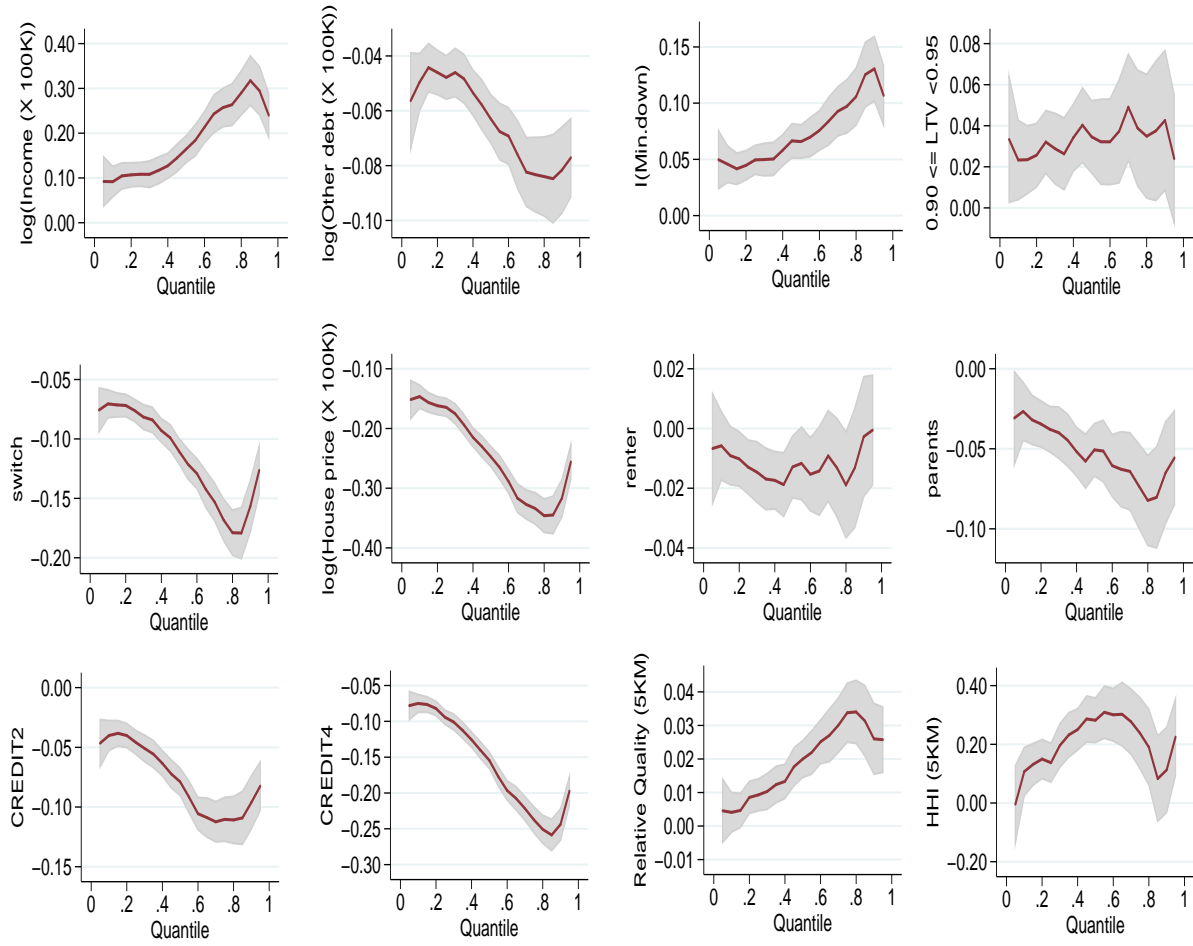


Figure 5: Loan to Value and Total Debt Service Ratios: 1999-2004

Figure 6: Quantiles Estimates (1999-2004)

Dependent Variable: Transaction Rate minus adjusted bond rate (margin)

The estimates are from a quantile regression of the transaction rate on loan, market, and households characteristics. We also include week, bank, and province fixed effects as well as census division characteristics.



Tables

Table 1: Definition of Household / Mortgage Characteristics

Name	Description
FI	Type of lender
Source	Identifies how lender generated the loan (branch, online, broker, etc)
Income	Total amount of the borrower(s) salary, wages, and income from other sources
TSD	Ratio of total debt service to income
Duration	Length of the relationship between the borrower and FI
R-status	Borrowers residential status upon insurance application
FSA	Forward sortation area of the mortgaged property
Market value	Selling price or estimated market price if refinancing
Applicant type	Quartile of the borrowers risk of default
Dwelling type	10 options that define the physical structure
Close	Closing date of purchase or date of refinance
Loan amount	Dollar amount of the loan excluding the loan insurance premium
Premium	Loan insurance premium
Purpose	Purpose of the loan (purchase, port, refinance, etc.)
LTV	Loan amount divided by lending value
Price	Interest rate of the mortgage
Term	Represents the term over which the interest rate applies to the loan
Amortization	Represents the period the loan will be paid off
Interest type	Fixed or adjustable rate
<i>CREDIT</i>	Summarized application credit score (minimum borrower credit score).

Some variables were only included by one of the mortgage insurers.

Table 2: Summary Description of Discrete Variables: 1999-2004

Variable	Choice	Percentage of Contracts
Source [†]	branch	65.8%
	broker	34.2%
Dwelling type	detached	65.2%
	semi-detached	11.6%
	row or mobile	10.6%
	apartment/condo	12.5%
Residential status [‡]	own	21.7%
	rent	69.4%
	parents	8.8%

Table 3: Summary Description of Continuous Variables: 1999-2004

Variable	Mean	Median	Std. Dev.
Borrower/lender relationship [†]			
full sample	47.9 mth	2 mths	71.4 mths
home-owners	68.0 mths	40 mths	81.0 mths
non-home-owners	42.3 mths	1 mth	67.4 mths
Loan amount			
full sample	\$143,070	\$133,227	\$61,673
previous owners	\$152,988	\$142,823	\$65,561
new owners	\$140,322	\$130,591	\$60,265
Buying price of house			
full sample	\$157,846	\$146,291	\$69,813
previous owners	\$171,586	\$158,998	\$75,652
new owners	\$154,039	\$142,785	\$67,615
LTV			
full sample	91.1	92.2	4.46
previous owners	89.8	90.0	4.90
new owners	91.5	93.3	4.26
Household income			
full sample	\$67,793	\$63,650	\$26,853
previous owners	\$76,658	\$72,150	\$29,809
new owners	\$65,337	\$61,684	\$25,434
TDS			
full sample	32.5	33.5	5.78
previous owners	32.9	34.1	5.78
new owners	32.4	33.3	5.78
Transaction price minus adjusted bond rate			
full sample	1.18%	1.15%	0.70%

Continued on next page...

... table 3 continued

Variable	Mean	Median	Std. Dev.
previous owners	1.20%	1.17%	0.71%
new owners	1.18%	1.15%	0.69%
Posted price minus adjusted bond rate	2.07%	2.12%	0.38%
HHI (5KM)	0.2029	0.1804	0.1153
Relative network (5KM)	1.224	1.071	0.994

Notes: Nominal values are deflated using the consumer price index, base=2002. The home-owner and non-home-owner categories are based on CMHC data, since CMHC is the only insurer to collect this information. The full sample is CMHC and Genworth combined. Cost of funding is based on the five year bond rate. ‡: the length of the borrower/lender relationship at the time of the mortgage origination is only available from 1998 onward.

Table 4: Broker usage by Financial Institution Type: 1999-2004

	Broker	Bank Branch
Big 6	27.2	72.8
Credit Unions	43.1	56.8
Trust companies	56.8	43.2
Other Financial institutions	79.8	20.2

Table 5: Banking Habits of Canadians: 1999-2006

We report summary statistics on bank account(s) usage using data from an annual survey conducted by Ipsos-Reid called the Canadian Financial Monitor. The survey consists of approximately 12,000 households per year. Allen, Clark, and Houde (2008) use this survey to analyze the diffusion of electronic banking in Canada between 1998-2006. We define a household's main financial institution as the institution corresponding to the most active checking account.

Account	Main FI	Second FI	All other FI
Mortgage (all)	67.4%	10.9%	21.7% ^a
Mortgage (no broker)	70.3%	10.8%	18.9%
Mortgage (broker)	37.3%	30.6%	32.1%
Loan	55.8%	9.6%	34.6%
Credit card ^b	77.9%	20.7%	1.4%
GIC or term deposit	72.8%	15.8%	11.4%
Bonds, t-bills, other guaranteed invest's	45.3%	7.8%	46.9%
Mutual funds ^c	38.8%	7.2%	54.0%

^a: The majority of the time the reason a mortgage is classified as "other" is that the household has written down the lender as category "any bank" or "any credit union", which does not match with the more specific name the respondent provided when responding to the question about their main financial institution. The credit card category excludes retail cards. ^b: The average household has 2.5 cards although half of these are retail cards, which can only be used at the retail outlet that issued the card. GIC is an acronym for Government Investment Certificate. These are fixed term deposits, typically 1-3 years. ^c: Investor Group Inc. has the largest market share of the mutual fund industry in Canada and they are not a deposit-taking institution which explains the relatively low share of mutual funds held at households main financial institution.

Table 6: Variance Decomposition

Each statistic is calculated for each period. The variable $1(R = \bar{R})$ is the fraction of transaction rates that are within 1/10 of the posted rate. The log margin is denoted by m , and the residual log margin is denoted by e . The standard-deviation $sd(e)$ is calculated using the residual of a linear regression of log markup on contractual and household characteristics, census variables, and month fixed effects. The ratio $V(Y|x)/V(Y)$ is the average within group x variance of Y , divided the total variance of Y . Each grouping variables are discrete. Q is the quarter of each year, FSA denote the postal code area of each contract, L is the lender name, X is a discrete variable measuring financial characteristics (i.e. income group X house price group X maximum LTV = 10 groups), HHI is the discretized HHI measure of branches within a 5KM neighborhood (i.e. increment of 0.02), and N is the number of lenders within 5KM. The data-set is a random sample of 5 year fixed-rate contracts between 1992 and 2004.

	1992-1998	1999-2004
$1(R = \bar{R})$	0.1972	0.0761
$sd(m)$	0.4249	0.2632
$sd(e)$	0.2502	0.2178
<i>Diff.</i>	<i>0.1747</i>	<i>0.0454</i>
$1 - V(m Q)/V(m)$	0.4697	0.1864
$1 - V(m L)/V(m)$	0.0064	0.0199
$1 - V(m FSA)/V(m)$	0.0112	0.0490
$1 - V(m X)/V(m)$	0.0077	0.0351
$1 - V(m HHI)/V(m)$	0.0012	0.0114
$1 - V(m N)/V(m)$	0.0013	0.0184

Table 7: Regression Results with Contractual Variables (1999-2004)

Dependent Variable: Transaction Rate minus adjusted bond rate (margin)

Income is monthly income. *Other debt* is the households monthly debt obligations other than the mortgage. This includes payments on personal loans such as auto loans but also property taxes and credit card limits. Also included in the regression are categorial variables for the loan-to-value ratio (LTV), where the base-ratio is less than 0.85. The categories are based on Figure 5. $1(\text{Min.down})$ is a dummy variable for borrowers with an LTV of 0.95, i.e. those making the smallest down payment possible by law. *House price* is the transaction price of the house and *Loan* is self explanatory. All regressions include week and bank fixed effects.

VARIABLES	(1) Full	(2) Full	(3) Full	(4) Full	(5) Full
log(Income (X 100K))	-0.128 [†] (0.00494)	9.80e-05 (0.00523)	0.130 [†] (0.00646)	0.224 [†] (0.00863)	0.227 [†] (0.00863)
log(Other debt (X 100K))				-0.0665 [†] (0.00388)	-0.0633 [†] (0.00386)
$0.85 \leq LTV < 90$				0.0194 [†] (0.00630)	0.0192 [†] (0.00630)
$0.90 \leq LTV < 0.95$				0.0489 [†] (0.00771)	0.0499 [†] (0.00770)
I(Min.down)				0.113 [†] (0.00657)	0.112 [†] (0.00655)
log(House price (X 100K))			-0.873 [†] (0.0383)	-0.272 [†] (0.00798)	-0.292 [†] (0.00764)
log(Loan (X 100K))			0.619 [†] (0.0393)		
Constant	1.214 [†] (0.0318)	1.318 [†] (0.0320)	1.507 [†] (0.0324)	1.422 [†] (0.0330)	1.559 [†] (0.0986)
Observations	98,160	98,160	98,160	98,160	97,914
R-squared	0.338	0.388	0.399	0.403	0.385

Robust standard errors in parentheses

[†] $p < 0.01$, ^b $p < 0.05$

Table 8: Regression Results Including Observable Borrower/Lender Characteristics (1999-2004)

Dependent Variable: Transaction Rate minus adjusted bond rate (margin)

HHI is the Herfindahl-Hirschman Index of branches in a borrowers 5KM neighborhood. *Relative network* is the fraction of branches owned by the lender in the borrowers 5KM neighborhood. *Renter* is a dummy variable equal to 1 if the borrower was a renter prior to applying for a mortgage. *Parents* is a dummy variable equal to 1 if the borrower was living with his/her parents prior to applying for a mortgage. Renters and Parents are relative to previous owners. *Switcher* is a dummy variable indicating a borrower has signed a mortgage with a financial institution that is not their main financial institution. *broker* is a dummy variable equal to 1 if the borrower used a broker to facilitate the mortgage transaction. There are 4 credit categories, the base is *CREDIT1*. The highest credit category represents the most creditworthy borrowers. Column (1) has both Genworth and CMHC households while Columns (2)-(6) use only CMHC households. Column (3) excludes the Nov 2002-December 2004 period because TD Bank experimented with a no haggle pricing policy. Column (4) includes borrowers only at the largest 8 financial institutions. Column (5) are new home-owners and column (6) are previous home-owners. Controls include FSA census variables in 2001.

VARIABLES	(1) Full	(2) CMHC	(3) Haggle	(4) Big 8	(5) FTB	(6) Previous
log(Income (X 100K))	0.218 [†] (0.00929)	0.225 [†] (0.0103)	0.217 [†] (0.0121)	0.214 [†] (0.0118)	0.223 [†] (0.0116)	0.227 [†] (0.0228)
log(Other debt (X 100K))	-0.0700 [†] (0.00415)	-0.0782 [†] (0.00466)	-0.0819 [†] (0.00552)	-0.0809 [†] (0.00537)	-0.0793 [†] (0.00517)	-0.0710 [†] (0.0110)
0.85 ≤ <i>LTV</i> < 90	0.0148 ^b (0.00671)	0.0105 (0.00738)	0.0238 [†] (0.00885)	0.0386 [†] (0.00818)	0.0165 (0.00888)	0.00551 (0.0134)
0.90 ≤ <i>LTV</i> < 0.95	0.0405 [†] (0.00821)	0.0369 [†] (0.00904)	0.0514 [†] (0.0108)	0.0856 [†] (0.0101)	0.0471 [†] (0.0104)	0.0251 (0.0200)
I(Min.down)	0.106 [†] (0.00705)	0.0795 [†] (0.00774)	0.0894 [†] (0.00924)	0.122 [†] (0.00864)	0.0928 [†] (0.00913)	0.0463 [†] (0.0154)
log(House price (X 100K))	-0.275 [†] (0.00822)	-0.272 [†] (0.00888)	-0.283 [†] (0.0103)	-0.272 [†] (0.0102)	-0.268 [†] (0.0103)	-0.277 [†] (0.0182)
CREDIT2	-0.0697 [†] (0.00564)	-0.0810 [†] (0.00615)	-0.0874 [†] (0.00704)	-0.0695 [†] (0.00711)	-0.0883 [†] (0.00691)	-0.0556 [†] (0.0137)
CREDIT3	-0.120 [†] (0.00554)	-0.132 [†] (0.00601)	-0.132 [†] (0.00692)	-0.117 [†] (0.00692)	-0.141 [†] (0.00672)	-0.0978 [†] (0.0136)
CREDIT4	-0.169 [†] (0.00549)	-0.176 [†] (0.00594)	-0.180 [†] (0.00697)	-0.154 [†] (0.00678)	-0.185 [†] (0.00665)	-0.139 [†] (0.0135)
renter		-0.00954 (0.00551)	-0.0101 (0.00649)	-0.0153 ^b (0.00618)		
parents		-0.0534 [†] (0.00843)	-0.0586 [†] (0.0101)	-0.0578 [†] (0.00942)		
switch		-0.129 [†] (0.00591)	-0.133 [†] (0.00703)	-0.0899 [†] (0.00679)	-0.120 [†] (0.00659)	-0.158 [†] (0.0139)
broker	-0.188 [†] (0.00481)	-0.130 [†] (0.00575)	-0.132 [†] (0.00677)	-0.138 [†] (0.00653)	-0.122 [†] (0.00637)	-0.161 [†] (0.0137)
HHI (5KM)	0.324 [†] (0.0371)	0.350 [†] (0.0412)	0.280 [†] (0.0482)	0.378 [†] (0.0465)	0.422 [†] (0.0468)	0.140 (0.0874)
Relative network (5KM)	0.0194 [†] (0.00286)	0.0152 [†] (0.00301)	0.0162 [†] (0.00340)	0.0110 [†] (0.00315)	0.0139 [†] (0.00338)	0.0221 [†] (0.00676)
Constant	1.492 [†] (0.116)	1.442 [†] (0.117)	1.451 [†] (0.128)	1.121 [†] (0.121)	1.410 [†] (0.132)	1.718 [†] (0.245)
Observations	83,539	66,041	48,003	50,398	52,120	13,921
R-squared	0.400	0.416	0.414	0.418	0.416	0.430

Robust standard errors in parentheses

[†] p<0.01, ^b p<0.05

Table 9: Regression Results Including Observable Borrower/Lender Characteristics (1999-2004)

Dependent Variable: Transaction Rate minus adjusted bond rate (margin)

The regressors are the same as in Table 8. Column (1) is the interaction of the explanatory variables with broker while column (2) us their interaction with bank branch managers. We also include the effect of broker on the intercept.

VARIABLES	(1) Broker	(2) No Broker	(3) Broker difference
log(Income (X 100K))	0.176*** (0.0224)	0.230*** (0.0148)	-0.0542** (0.0262)
log(Other debt (X 100K))	-0.0731*** (0.0108)	-0.0846*** (0.00665)	0.0115 (0.0129)
$0.85 \leq LTV < 90$	0.0498*** (0.0173)	0.0313*** (0.00946)	0.0185 (0.0198)
$0.90 \leq LTV < 0.95$	0.103*** (0.0209)	0.0748*** (0.0120)	0.0286 (0.0242)
I(Min.down)	0.140*** (0.0184)	0.114*** (0.0103)	0.0255 (0.0207)
log(House price (X 100K))	-0.210*** (0.0179)	-0.297*** (0.0122)	0.0869*** (0.0199)
CREDIT2	-0.0966*** (0.0141)	-0.0585*** (0.00868)	-0.0382** (0.0163)
CREDIT3	-0.143*** (0.0140)	-0.108*** (0.00860)	-0.0350** (0.0164)
CREDIT4	-0.174*** (0.0134)	-0.148*** (0.00843)	-0.0255 (0.0156)
renter	0.0340*** (0.0130)	-0.0293*** (0.00719)	0.0633*** (0.0149)
parents	-0.00410 (0.0208)	-0.0712*** (0.0110)	0.0671*** (0.0228)
switch	-0.0820*** (0.0115)	-0.0943*** (0.00982)	0.0123 (0.0146)
Relative network (5KM)	0.00682 (0.00744)	0.0122** (0.00530)	-0.00535 (0.00689)
HHI (5KM)	0.506*** (0.119)	0.311*** (0.0628)	0.195 (0.122)
Constant	1.339*** (0.126)	1.339*** (0.126)	1.339*** (0.126)
Observations	48,749	48,749	48,749
R-squared	0.418	0.418	0.418

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1