Competition in Online Markets: When Banks Compete, Do Consumers Really Win?

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Abstract

The emergence of the Internet and price comparison sites have made information readily accessible to consumers. The reduction of search costs is presumed to increase competition and reduce the price consumers pay for products. I propose an alternative hypothesis; Internet comparison search sites create an anticompetitive environment by allowing price comparison sites to act as information gatekeepers. Using a unique data set, I examine a mortgage firm's pricing strategies on Lendingtree.com, a price comparison site, and in traditional retail markets. I find evidence of market power in online markets that does not exist in retail markets. I use a switching regression to control for market selection. I find that online and retail consumers pay the same price on average for a mortgage. The presumed benefits from the reduction in search cost are offset by the anticompetitive environment on Lendingtree.com. For a subset of loans, the anticompetitive effect dominates the search cost effect and leads to higher prices in online markets

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1 Introduction

From the developement of the Internet and online markets we have seen the emergence of price comparison sites. The objective of these sites is to aggregate price information from multiple suppliers. Through one click, consumers are able to observe a list of prices from participating firms. A quick search on the Internet will reveal that price comparison sites exist for most products. Consumers can search for air travel (Kayak.com), insurance(Progressive), hotels (Hotels.com), or mortgages (Lendingtree.com) and receive a list of prices. Price comparison sites have reduced the marginal cost of search and thus, are presumed to create more competitive markets (Stigler 1961). The availability of information allows consumers to choose the lowest priced producer. In an environment of Bertrand competition, prices will converge towards the law of one price (Salop and Stiglitz 1977, Bakos 1997).

Price comparison sites also serve as information gatekeepers, controlling the amount of information supplied and consumed. Gatekeepers may charge participating firms, consumers, or both a fee to access information (Baye and Morgan, 2001). A participation fee may reduce the amount of information provided and can introduce an anticompetitive effect. Furthermore, information gatekeepers have the ability to restrict the amount of quotes provided to the consumer, the order that prices are reported, and create an environment of repeat interaction between suppliers that could support tacit collusion. Consumers searching on a price comparison site assume these sites provide information on all available prices. For example, the Lendingtree.com slogan “When banks compete, you win”, suggest a benefit to consumers whom use the site to ”shop” prices.

The aim of this paper is to empirically examine and test for market competitiveness in the presence of a gatekeeper. To test for market outcomes using variation in mortgage prices on Lendingtree.com relative to the prices traditional retail consumers pay, I use micro-level data from a mortgage firm that originated loans through traditional retail markets and on Lendingtree.com. A major advantage of my research is, by examining a single firm’s pricing strategy, I am able to control for firm and cost heterogeneity as the source for differences in online and retail prices.

Thus, any variations in pricing strategy will be attributed to product characteristics and market structure. The availability of data on firm profits makes it possible to test for pricing differences while controlling for operation and production costs across market types. Another advantage of this dataset is that it provides actual transaction prices and not quoted prices, which is a limitation present in most research testing for online market competitiveness (Ghose and Yao, 2011).

After controlling for observables, I find that consumers searching through Lendingtree.com pay the same price for a mortgage as other consumers who come to the lender through traditional ways.The lower marginal cost of search through the gatekeeper does not lead to more competitive outcomes as Lendingtree.com's slogan implies. The gains from lower search costs are offset by the anticompetitive environment in the gatekeeper model. I provide evidence of the firm's ability to price discriminate based on loan and consumer characteristics in the Lendingtree.com market, but not in traditional markets. The ability to price discriminate suggests that the firm has market power in online markets that are not present in the traditional market

These finding are important for the research that has aimed to test the competitiveness of online markets relative to traditional markets. The inconsistency of the findings in the literature may be attributed to the differences in the conduct and market structure of the information provider in online markets.[1] The existence of a gatekeeper and its conduct may affect the comptitivness of online markets.

2 Mortgage Markets and Consumer Search

Consumers in search for a mortgage price may search on the Internet, or through traditional retail markets. Consumers' search on the Internet can be conducted by visiting each individual firm's website, or by visiting a gatekeeper which aggregates prices from multiple firms. There are several search price comparison sites in the mortgage market, namely Lowermybills.com, Nextag.com, E-loan.com,

[1]See Bakos (2000) and Smith, Bailey and Brynjolfsson (2000) for a survey of the literature on internet markets. See Baye, Morgan and Scholten (2004) and Pan, Ratchford and Shankar (2004) for a summary of empirical results.

Bankrate.com and Lendingtree.com. Each of these firms operates differently and provides a different level of service. E-loan.com and Bankrate.com specialize in providing information on aggregate market information, trends, and average rates. Bankrate.com provides the consumer with a list of firms that operate in their market and their respective advertised price. A consumer wanting to receive a quote for a mortgage on E-loan.com is directed to Lendingtree.com. Lendingtree.com, Servicemagic.com and Lowermybills.com require that the consumer complete an application to receive a quote. The level of information required for the application varies. Lowermybills.com has a simple four-step application process, while the Lendingtree.com application may take 20-30 minutes to complete. Additionally, the number of firms that the consumer receives a quote from will vary by gatekeeper.

Traditional retail search requires that the consumer contact each firm directly. This method of search can also be conducted online, as consumers apply for a mortgage through the each firm's website individually. For the purpose of this research any search that is not conducted through a price comparison site is considered traditional retail. This classification also includes consumers physically visiting the firm, or those applying by phone.

Whether searching through a gatekeeper or in traditional retail markets the consumer is eventually matched to a loan originator who will finalize the mortgage transaction. In the online market, Lendingtree.com provides a higher level of service and a more complete price juxtaposition by providing information on the total cost of a mortgage (interest rate and fees). Since the loan originator is usually a commission-based employee, Lendingtree.com discloses the loan originator's fee (or estimate) to the consumer. Loan orginator fees are non-trivial and can be as high as seven percent of the loan amount. Their commision is generated in one, or both of two ways: 1) the loan originator can charge the customer a fee for the service provided, 2) and/or offer the customer an interest rate higher than the wholesale price and receive a yield spread premium (YSP). More commonly, loan originators receive income through both sources. By providing this information upfront through the quote, Lendingtree.com has become the dominant price comparison site in the mortgage market. Due to its dominance as a gatekeeper in the mortgage market, the following section will detail the consumer's search process on Lendingtree.com and traditional retail markets.

2.1 Lendingtree.com

The application process on Lendingtree.com requires customers to provide personal information including social security number, the requested loan amount, and prefferred loan program. The consumer's social security number allows Lendingtree to obtain a credit score for each applicant. This is different than other gatekeepers which rely on consumers to self report their credit score.

After the customer completes the required information, each application is submitted to five firms on the network which are licensed to operate in the state where the property is located.[2] Although Lendingtree's advertising suggest that all possible firms will compete for their business, Lendingtree.com restricts the number of quotes the customer receives. Lendingtree suggests that by using a complex predictive modeling system they are able to match lenders and customers to ensure the highest probability of success.

This matching process takes into account customer credit score, the loan program requested, the lender's customer service performance, and the lender's past success with the requested loan program and credit score. A competing firm is allowed to provide up to three distinct quotes to each customer. The three quotes can be differentiated by loan type (fixed, adjustable rate mortgage, or home equity line of credit), duration, and/or closing costs. If the applicant meets the credit score requirements for all 5 network firms, the applicant will receive a maximum of 15 offers. However, the firms choosing to offer a quote cannot observe how many other firms are competing for the client or, in theory which firms they are competing against. Using state licensing information and the Lendingtree.com list of participants, however it is possible for a lender to predict which firms it is likely to face in each market. If the applicant's credit score or the loan requested does

[2]loan applications were sent to four firms before February 1,2004. As of 10/23/07 there were 303 firms part of the network. On 9/16/09, there were 216 firms. Some firms operate nationally, while others operate in selected states.

not meet the guidelines for available products, firms can choose not to provide a quote. It is possible that the applicant receives no offers when applying; but this is rare and more likely firms will provide the customer with a quote on alternative loan products.

Firms pay a flat fee to Lendingtree.com for the opportunity to compete for a customer's business. The firm that provides the"winning" bid on a loan and completes the transaction is required to pay a computer loan origination fee (CLO) to Lendingtree.com from the proceeds of the loan. The CLO fee is a function of loan type, loan amount, and customer credit score; at times this fee can exceed $1000. Lendingtree.com is able to extract profits from the network of firms, which would only be possible if firms experience above-normal profits by joining the network.The existence of above-normal profits contradicts the outcome proposed by search models, which predict lower profits in online markets due to the increase in availability of information to the consumer. The hypothesis that Lendingtree.com may be creating an anti-competitive effect is supported by the firms' willingness to pay a fee to maintain a presence on the network.

2.2 Traditional Retail Market

The traditional retail market is where consumers apply directly to the firm. This process includes any business obtained through local advertising, word of mouth referral, applications directly submitted to the firm's website and any physical visit, call or email by the customer. Consumers searching through the traditional retail market will follow a sequential search process, where each consumer observes one price quote per unit of search. Alternatively, search through a gatekeeper is non-sequential in nature. A consumer will observe multiple quotes per unit of search. In the case of Lendingtree.com each unit of search yields at least five price observations.

In the traditional search process, the only information available to the firm is consumer characteristics and the loan program requested. The firm is uncertain about the search behavior of the consumer, their search cost or search strategy. Moreover, the firm is unaware of which firms it is in direct competition with. The firm's objective is to quote a price that is marginally lower than the consumer's reservation price. Since the reservation price is a function of consumer information about the price distribution in the economy, the firm is therefore uncertain about the consumer's reservation price. The uncertainty of consumer search strategy, competitors, and consumer reservation price may force the firm to operate in a Bertrand setting.

3 Data

I obtained proprietary data from a mortgage company after it ceased operations in August 2007. This mortgage firm made available its customer database purged of any information that identifies individual customers. The database includes all loan applications submitted to the firm through Lendingtree.com and retail locations. The data spans five years from 2002 to 2007, where the firm received a total of 41,054 loan applications.

Since my purpose is to examine the difference in price paid by Lendingtree.com customers and retail customers, I limit the sample to completed transactions (ie. closed loans). I restrict the sample period to include data from 2002 to 2006. The data from 2007 are interesting in their own right; however management's decision to cease operations were made public in early 2007. To eliminate any bias introduced by this information, the 2007 observations are excluded. During the time period selected, the firm processed 7,977 loans.[3]. Furthermore, due to the complex and varied mortgage products in the market during the period of study, I limit the scope of study to loans classified as "agency" loans by Fannie Mae and Freddie Mac.[4] Agency loans have identical default and prepayment risk, and do not impose any interest rate adjustment to the note rate as long as the customer is approved.

There are 3,368 completed transactions in the reduced sample. Summary statistics for both samples are included in Table 2. Summary statistics for the large sam-

[3]I refer to this sample as the large sample in my discussion.
[4]I refer to this sample as the reduced sample.

ple are presented in column 3, and column 6 details the small sample statistics. In columns 1 and 2, the statistics for the Lendingtree.com customers are compared to the retail customers in the large sample. Column 4 and 5 are for comparison of Lendingtree.com customers and traditional customers in the reduced sample.

Provided in the data are individual loan data characteristics. The data identifies loans closed through Lendingtree.com or retail markets and includes the consumer's credit score. The average credit score for all completed transactions is 665 (column 3), while the average for the reduced sample is 10 points higher.

Loan-level variables include information on the type of loan, whether the loans are fixed rate or adjustable rate mortgages (ARM). The ratio of loan to home value (LTV) represents the amount of equity the consumer has in the property. The higher the LTV, the lower the equity, and the higher the presumed risk of default. The average observation in the reduced sample has a loan amount of $139,870 and a LTV of 74%.

Loans that are cash-out loans, purchase loans, or second lien loans are represented by dummy variables. Loans that are not cash-out, purchase, or second-lien are considered rate/term refinances. Cash-out loans represent 54% of the loans originated during the sample period. Second-lien loans are loans that place the mortgage in second position to receive any funds in the event of a foreclosure or sale of the home. Rate/term refinancing occurs when customers refinance to take advantage of more favorable terms, such as adjusting the duration of the loan (term), or more likely to take advantage of lower interest rates in the market (rate). Although all loans in the reduced sample have an identical overall default risk, as defined by their agency classification, consumer credit score, loan types, and loan durations do vary.

Using the loan program variable, I construct a dummy variable that takes on the value of 1 for fixed loans and 0 for adjustable rates (ARMs and Home Equity lines of credit). Fixed-rate mortgages account for 92%; this is a drastic difference from the large sample where fixed loans account for 62% of all loans. Adjustable rate mortgages are more likely to be associated with subprime loans, while agency loans are considered prime loans. Adjustable rate mortgages should be underrepresented in the reduced sample by construct. The market-choice variable is equal to 1 if the customer applied through Lendingtree.com and 0 otherwise. In the sample period, Lendingtree.com loans accounted for 70% of the firm's business.

Without any controls, the search theory prediction that more information would reduce the dispersion of prices seems to be supported (Stigler 1961). The variance of prices on Lendingtree.com is 1.41 but is not statistically different from 1.52 for retail customers. Figure 1 shows the price kernel densities for both markets.[5] The mean and dispersion of price is smaller for lendingtree.com loans relative to retail markets. Table 3 provides summary statistics for Lendingtree loans by year and shows that online customers paid less on average compared to retail customers (Table 4). Bailey's (1998) hypothesis that the dispersion of prices would decrease with time as more consumers used the Internet is not supported by the data. The variance of prices in both markets over time. Nonetheless, the variance of online prices is consistently lower than the variance of retail prices. Although the reduced sample eliminates any heterogeneity due to subprime loans such as No Income Verification, Stated-Income, or No-Income-No-Asset Loans, the reduced sample is representative of the large sample in most categories. Most importantly for this study, the proportion of online and retail transactions is 70% in both the large sample and reduced sample.

4 Empirical Model and Specification

The consumer's decision between online and retail firms is a function of their search costs and can not be assumed to be random. Since market-choice is endogenous, an OLS estimation of the model would not yield consistent estimates of the coefficients. To correct for the endogenity I employ a switching model. This enables me to control for the endogenity between the price paid by each customer and their market choice.

Consumers maximize their expected surplus (ES) given their search cost (C)

[5]A subsample of the data that only includes first-lien, fixed-rate, and 30 year loans. Figure 2 includes all loans in the reduced sample.

and the underlying distribution of total mortgage prices (denoted by P)

$$ES(C) = \int_b^c CS(P)\mathrm{d}F(P) \tag{1}$$

where b and c represent the lower and upper bound of the price distribution in the market. Expected surplus is maximized by integrating consumer surplus (CS) with respect to the price distribution. Consequently, consumers will search online if the expected gains from online shopping exceed their reservation price ρ_i.

$$P_{ir} - P_{io} > \rho_i \tag{2}$$

where P_{io} denotes the rate for individual i in online markets and P_{ir} denotes the rate for the individual in retail markets. Thus, the consumer uses an online gatekeeper like Lendingtree if the gains of online commerce are greater than their reservation price ρ_i. This implies that online consumers have higher search costs and are attempting to reduce their search costs by using an online gatekeeper and avoiding the more costly search process associated with retail markets.

Consumer reservation price ρ_i is a function of the individual characteristics X_i, and search costs C_i.

$$\rho_i = \alpha X_i + \beta C_i + \epsilon_{1i} \tag{3}$$

Individual characteristics are observable loan variables, while search cost is unobservable. However search costs C_i can be estimated by

$$C_i = \gamma_1 + \gamma_2 X_i + \gamma_3 Z_i + \epsilon_{2i} \tag{4}$$

X_i represents the vector of observable loan characteristics and Z_i are instruments used for the exclusion restriction. I include distance of the property from the firm's office as an instrument.[6] Consumers farther from the home office incur a

[6]Figure 3 shows variation between online and retail transactions by state.The firm had three physical locations. The main office was located in Lousiville, KY and two satellite offices in

higher search cost of visiting the firm and would be more likely to shop through Lendingtree.com. While a larger distance will increase search cost, it should not affect the price the consumer pays for a mortgage. Additionally, Census data on education is used as exclusion restrictions. More-educated consumers may be more likely to be familiar with the benefits of the Internet and thus shop online.

Following Lee (1978), a consumer will shop online if

$$Price_{ir} - Price_{io} > \alpha X_i + \beta(\gamma_1 + \gamma_2 X_i + \gamma_3 Z_i + \epsilon_{2i}) + \epsilon_{1i} \tag{5}$$

The estimation can be written as a probit model where the consumer will shop online if $\tau_i^* > 0$

$$\tau_i^* = \gamma_0 + \gamma_1(P_{ir} - P_{io}) + \gamma_2 X_i + \gamma_3 Z_i + \epsilon_i \tag{6}$$

Thus, conditional on online search the price equation is

$$E[P_{io}|o] = \theta_{o1} + \theta_{o2} X_i + \sigma_{1\epsilon}(\frac{f(-\varphi_i)}{1 - F(-\varphi)}) + \epsilon_o \tag{7}$$

Where F is the cumulative distribution and f is its density function. The retail price equation is consequently written as

$$E[P_{ir}|r] = \theta_{r1} + \theta_{r2} X_i - \sigma_{2\epsilon}(\frac{f(-\varphi_i)}{F(-\varphi)}) + \epsilon_r \tag{8}$$

The errors are assumed to be trivariate normal with Covariance matrix

$$\Omega = \begin{bmatrix} \sigma_\epsilon^2 & \sigma_{\epsilon o} & \sigma_{\epsilon r} \\ \sigma_{\epsilon o} & \sigma_o^2 & . \\ \sigma_{\epsilon r} & . & \sigma_r^2 \end{bmatrix}$$

If the error terms in the price equations are uncorrelated with the error term in the propensity equation, the estimation is then reduced to a pooled OLS.

The switching model will allow an estimation of the joint determination of the propensity to conduct online search (equation 6) and the price of a mortgage for

Duluth, MN and Lexington,KY. The shortest distance from the three offices to the applicant's address is used as measure of distance.

each market (equation 7 and equation 8). This construct will control for selection into market type based on unobservable characteristics. Estimation of the price equation using a switching model is efficient and provides consistent standard errors by employing a full-information maximum likelihood method (FIML) to simultaneously estimate the propensity to shop online and the price equation for each market type (Green 2003).[7]

The estimation of the dependent variable, price, must control for the two-part pricing of mortgages. The true cost of a mortgage must consider the interest rate of the mortgage and any fees paid to the broker.[8] A borrower can gain a lower interest rate if they are willing to pay a higher fee to the broker. Therefore the endogeneity between interest rate and fees must be controlled to eliminate any bias. Baye and Morgan (2001) have provided evidence of dispersion in interest rate but due to lack of data, broker fees have not been examined.

I construct an Annual Percentage Rate (APR) that takes into account the total price, interest rate and fees paid.[9] The APR variable represents the revenue (in percent of loan amount) the firm receives from each loan. The APR each customer receives is a function of interest rates at time t, their default and prepayment risk, and any upfront fees paid.

$$APR_{it} = f(I_i(R_t, f_{jt}, D(X_i), P(X_i)), U_i(X_i)) \tag{9}$$

The mortgage interest rate I_i is a function of the prevailing market interest rates R at time t and firm j's cost of capital at time t, f_{jt}. $D(X_i)$ and $P(X_i)$ represent individual i's default and prepayment risk respectively. By restricting the sample of loans to only FNMA and FHLMC agency loans, I am examining the pricing on a set of loans that have been determined to have equal default and prepayment risk. Additionally, in a single firm analysis the cost of capital can be assumed to

[7] Although efficient, FIML are computationally burdensome and may not converge. Limited-information maximum likelihood (LIML), like the Heckman two-stage least squares (2SLS) are preferred for their simplicity and robustness to non-normality. While robust, the LIML is not as efficient as FIML.

[8] Black, Boehm and DeGennaro (2003).

[9] See Appendix for the method of calculating APR.

be constant across all loans (Stengel and Glennon 1999). Finally, I can replace R_t with the 10 year Treasury rate at time t.[10] I subtract the 10 year treasury rate from the APR measure to construct the price measure.

$$Price_i = APR_{it} - R_t \tag{10}$$

$$Price_i = \beta_0 + \beta_1 X_i + \epsilon_i \tag{11}$$

Since the data is restricted only to loans that have the same credit risk and the macroeconomic environment is controlled for by treasury rates, then the price equation is actually measuring the markup (discount) each consumer pays above (below) the average rate. In equation 11, β_1 should be equal to zero. A negative (positive) coefficient is interpreted as an increase (decrease) in the consumer's bargaining power.

By comparing the variation in the firm's markup strategies, I can observe if mortgage prices vary depending on the clientele in each market. This allows me to examine whether the firm is able to price discriminate according to the search costs incurred by the consumer. If online markets reduce the search costs, and cause a reduction in asymmetric information, customers will receive a lower average rate and a reduction in the markup. However, if Lendingtree.com reduces competition, then consumers shopping through that market will pay more for a mortgage.

5 Results

The results from the switching model are reported in Table 5. The estimation of equations six, seven and eight indicate that consumers' shopping methods are random and selection based on unobservables is unsubstantiated. The coefficients

[10] Measurement error can be introduced in the selection of 10 year treasury rates. Sirmens and Benjamin (1990) suggest that the actual "lock" data of a mortgage rate can be anytime between application and the closing of a loan. Crawford and Rosenblatt (1999), find that variation in lock dates can be explained by variation in expectation of interest rate movements. The data provides application date and closing date but not lock date. I use the closing date as time t.

ρ_1 and ρ_2 are statistically insignificant and thus the errors between the error term in the market choice probit model and the errors from the price equations are uncorrelated. The insignificance of the correlation coefficients implies that the propensity to shop online and the price equation are in fact exogenous. [11]

Since endogeneity does not play a role in pricing, consumer search in online markets does not affect the price they pay for a mortgage. Without selection into market type as a concern, the estimation method can be estimated using grouped OLS. The results are provided in Table 7. The result from estimating equation 11 will measure the adjustment to the average rate consumers pay for Agency loans given their characteristics. Since Agency loans all have an identical price of risk, the coefficients associated with the variable will indicate the markup or discount that consumers pay due to the variable of interest.

I find that Lendingtree.com consumers on average pay twelve-hundredths of a percent less than a traditional retail consumer. However, the constants are not statistically different from each other. Therefore, consumers shopping on Lendingtree.com pay the same price for a mortgage relative to the retail consumer. The reduction in search cost by shopping on Lendingtree.com does not lead to lower prices relative to traditional retail markets.

When examining the variation in markups across market types, I find that five of the variable coefficients are not equal in both equations. Consequently, even for subsets of the mortgage market Lendingtree.com consumers and retail consumers are treated equally. There is a statistically significant difference in the coefficients for loan duration, purchase loans and for loans originated in 2006.[12] What becomes evident is that the firm is able to price discriminate when pricing Lendingtree.com loans. In the online price equation, loan-duration dummy variables are significant and increasing; whereas loan-duration is statistically insignificant in the retail price equation. Relative to the reference category, the online consumer pays a premium for each additional five years up to 25 years. There is a decrease in the premium

[11] As a robustness check, I estimate the model using Heckman two stage least square. However, the results remain unchanged. Results are provided in Table 6.

[12] The slowdown in the mortgage market reduced mortgage demand, and this is reflected in the pricing of mortgages in 2006.

by roughly 1 percent for 30-year mortgage relative to 25-year mortgages. This is probably due to the amount of information, advertising and their popularity of 30-year mortgages in general. The consumer would have more information about the distribution of 30-year mortgage prices in the market. Further evidence of price discrimination in online markets is thatconsumers searching for a mortgage to purchase a home will pay 45 basis points more if they obtain the mortgage through Lendingtree.com compared to retail markets.

Although all loans have the same risk of default and prepayment, with Lendingtree loans consumer characteristics enable the mortgage firm to adjust its markup. In the retail market, I find that the coefficients are statistically insignificant, which implies that the firm does not price discriminate based on observable consumer and loan characteristics. The Lendingtree.com model provides the firm with market power, as indicated by its ability to price discriminate, which does not exist in the retail market. The reduction in consumer search cost in online markets does not lead to a reduction in the price paid. The evidence of price discrimination indicates that Lendingtree.com creates a less than fully competitive environment.

The existence of variation in prices indicates that the firm is more likely to charge different prices for equally risky loans in online markets. However, this variation in pricing might be due to the fee lenders are required to pay to Lendingtree.com (CLO fee). The CLO fee imposes higher cost to the firm and must be accounted for, thus, I create a new measure of price that excludes the CLO fee.[13] If Lendingtree.com is equally as competitive as traditional retail markets, then the coefficients should be equal across market price equations and statistically insignificant. That would imply that the variation in prices was solely due to the CLO fee. If the coefficients of variables in online markets are lower than retail markets, this would support the hypothesis that Lendingtree.com is a more competitive market.

The results of the grouped OLS estimation are reported in Table 8. After controlling for variation of marginal costs, I find that the average price in online

[13] See the Appendix for the method of calculating APR.

markets is lower. Fixed loans pay a premium in both markets, but the premium in online markets is lower. This would suggest that online consumers searching for fixed mortgages benefit from shopping on Lendingtree.com. This result supports online search as more competitive relative to retail search. However, further analysis provides contradictory evidence. Coefficients that are statistically different across markets are mostly higher in the Lendingtree.com market; the only exceptions are fixed loans, and loans originated in 2004. Any loan duration receives a higher premium in online markets compared to retail markets. Purchase loans pay on average 23 basis points more in online markets after controlling for the CLO fee.

I find that the CLO fee does not explain away the variation in prices across markets and across variables within the Lendingtree.com market. After controlling for the additional cost of operating on Lendingtree.com, the evidence of price discrimination and market power is still prevalent.

6 Conclusion

Much effort has been devoted to measuring the competitiveness of online markets relative to traditional retail markets. Economic theory predicts that online markets help lower search cost and will increase information available to the consumer. As consumers become aware of the price distribution in the market, they are able to choose the lowest-priced firm. The introduction of online markets is expected to cause a reduction in prices.

In this research I find that online markets do not necessarily reduce market prices. I provide evidence from a single mortgage firm that operates in both the retail market and online through Lendingtree.com. I test for differences in the pricing strategies by the firm in each market. Even after controlling for cost differences, I find that consumers pay the same price in both markets. By operating on Lendingtree.com, the firm is able to price discriminate and consumers may pay a higher price by searching online. Consumers searching for a mortgage to purchase a home, or consumers searching for a mortgage with a duration other than 30 years will pay more if shopping through Lendingtree.com.

The presumption that consumers will "win" by allowing banks to compete when shopping on Lendingtree.com is not supported. Lendingtree.com reduces competitivion by restricting the number of quotes the consumer receives and by creating an environment with repeated interaction between firms. Therefore, when examining the market competitiveness of online markets, further research must consider the role of "gatekeepers" and their conduct.

Firms like Lendingtree.com advertise a competitive market due to the lower search cost, and more accessible information. In fact, firms operating on Lendingtree.com gain market power because of the restricted number of quotes. Firms are able to tacitly collude and erode the gains from lower search costs. Furthermore, the uncertainty associated with the retail consumers information set, forces the firm to price more aggressively since the firm does not know what prices the retail consumer has already observed.

The threat of competition in retail markets is more severe than the actual competition on Lendingtree.com. Empirical literature examining the effects of the Internet on pricing has been inconclusive. Future research should carefully consider the structure of the online market. The conduct of the gatekeeper can create an anticompetitive effect that offsets the effects of the reduction in search costs.

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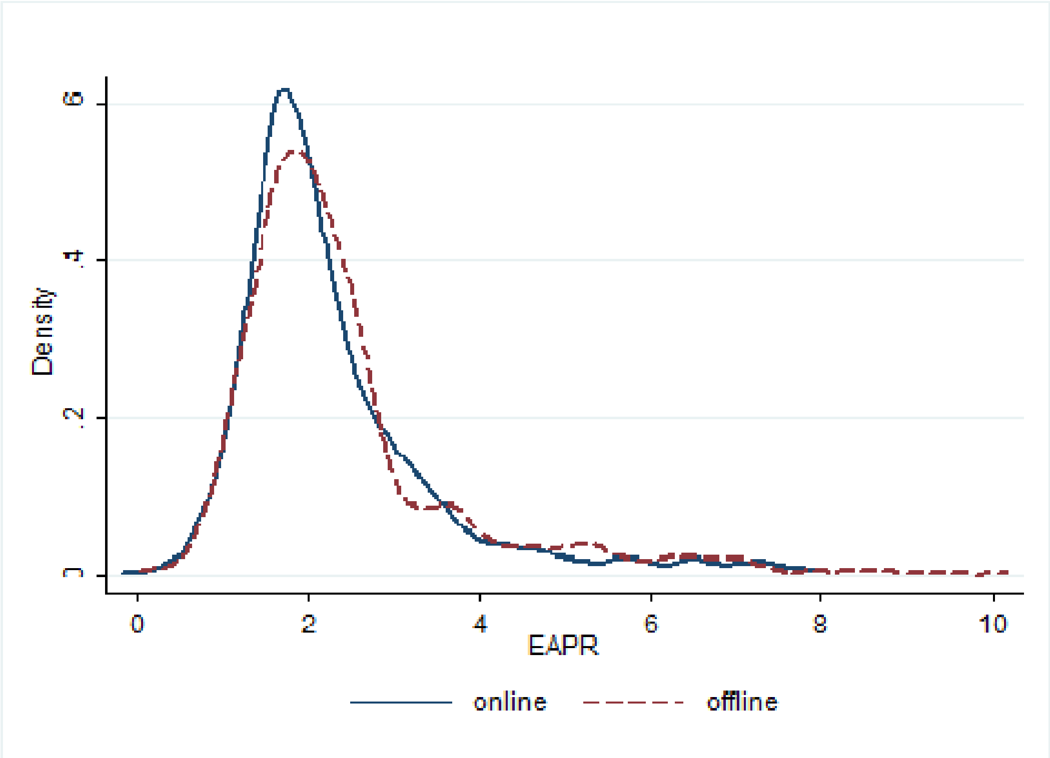

Figure 1

Price Dispersion for 30 Year Fixed Mortgages

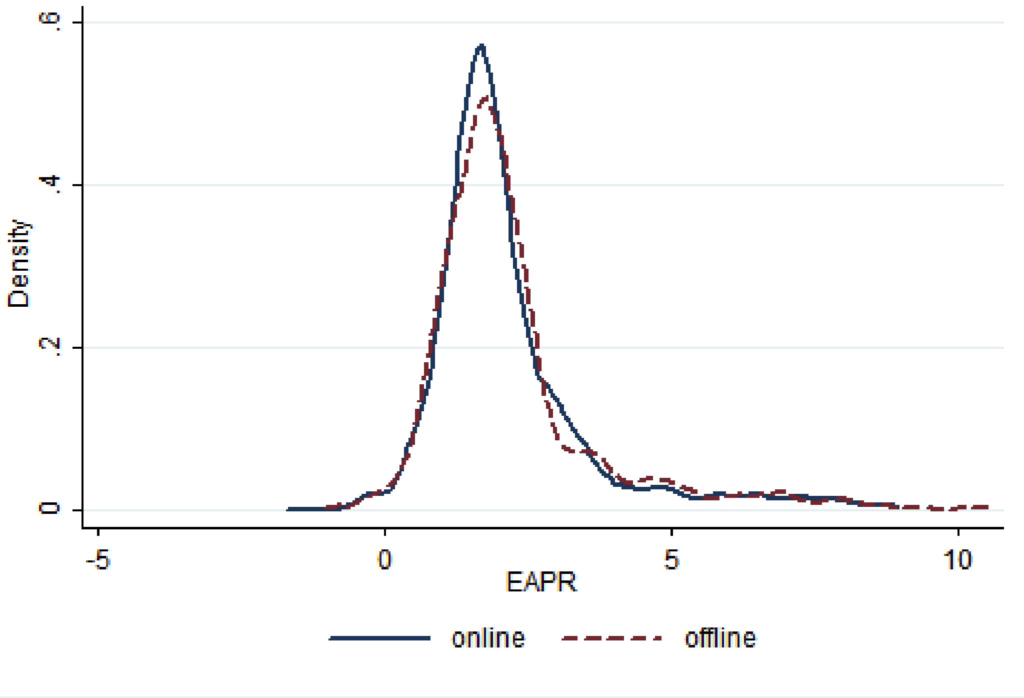

Figure 2

Price Dispersion for All Loans

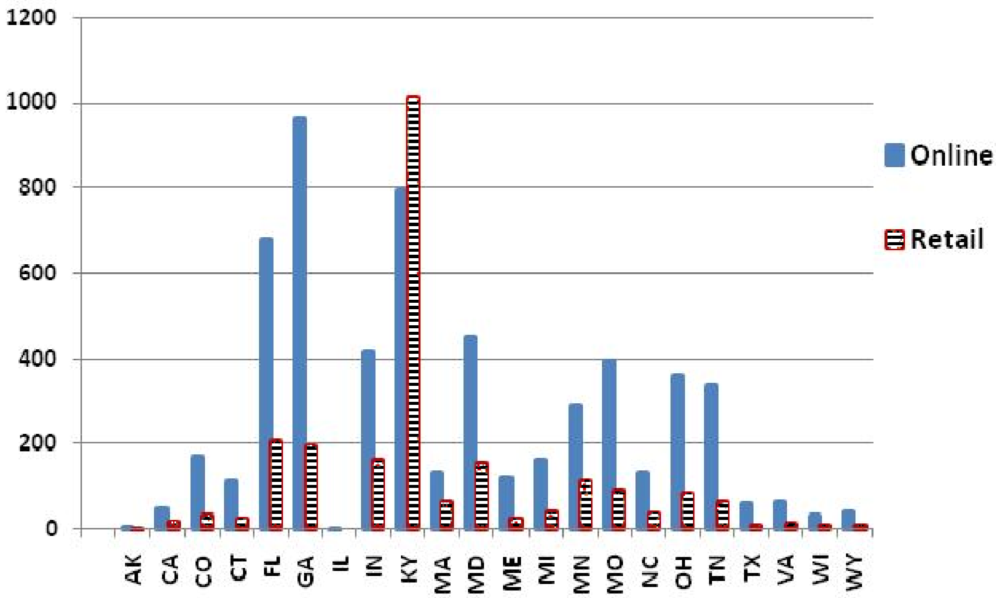

Figure 3
Loan Origination Volume by State

Table 1 Default and Prepayment Variables	
Variable	Explanation
Expense to income	The ratio of housing payment to Gross Income
Debt to income	The ratio of total monthly debt payment to Gross Income
Net worth	Savings & The value of Stock Accounts, Retirement Accounts, Home Equity (Second/Investment Properties)
Employment history	A measure of income and employment stability
Loan to value Ratio	A measure of the amount of homeowner equity invested in the property
Fixed loan	A mortgage with a fixed interest rate for the duration of the loan
Adjustable rate mortgage (ARM)	A mortgage with a rate that adjust during the life of the loan
Term of loan	The length or duration of the loan. Most popular mortgage durations are 10 , 15 , 20 , 25 , 30
Loan amount	The outstanding amount to be paid
Credit score	A measure of consumer's credit worthiness.
Lien position	In the case of foreclosure or sale of the house, the lien position determines who receives funds first. It is important in the case where sale/foreclosure proceeds are less than total mortgage debt outstanding.
Refinance type	Refinance loans are either Rate and Term or Cash-out. Rate and term is when a consumer refinance to adjust the term or rate of a mortgage. Cash-out refinances is when a consumer liquidates some of the equity of the home.
Purchase	Loans made to consumers to purchase a home.
Liquid assets	Savings accounts and stock account are considered liquid assets. Where as retirment accounts like 401Ks are not liquid
Bankruptcy	A recent bankruptcy would affect credit scores. Consumers with Bankruptcies in the past 2 years are considered high risk
Foreclosure	If the consumer defaulted on a previous loan and foreclosure preceedings are reported on credit reports
Prepayment penalty	Most states allow the lender to impose a prepayment penalty on mortgages for a specific time frame. Usually it ranges from 3-5 years and the penalty can vary from 1-9%. Prepayment Penalties are usually associated with Subprime loans. Agency loans do not have a prepayment penalty.

Table 2
Summary Statistics

	Large Sample			Reduced Sample		
	(1) Online	(2) Retail	(3) Average	(4) Online	(5) Retail	(6) Average
Interest Rate	6.98	6.84	6.94	6.33	6.31	6.32
Commission	1375.79	1091.03	1293.03	1330.89	951.77	1216.28
APR	7.17	7.01	7.13	6.51	6.46	6.49
APR-10yr Treasury	2.77	2.7	2.75	2.14	2.21	2.16
Lendingtree.com Fee	600.47	0	426.47	601.27	0	420.32
Credit Score	663.16	672.79	665.97	672.62	681.53	675.34
Loan To Value	76.16	72.38	75.06	74.88	71.89	73.96
Loan amount	135.78	130.28	134.2	142.1	134.59	139.87
Fixed	0.63	0.62	0.62	0.94	0.92	0.93
Agency Loans	0.42	0.44	0.42	1	1	1
Cash Out	0.58	0.39	0.53	0.61	0.39	0.54
Purchase	0.14	0.35	0.2	0.11	0.32	0.17
Second	0.16	0.22	0.18	0.13	0.17	0.14
term10	0.03	0.04	0.03	0.02	0.03	0.02
term15	0.09	0.08	0.09	0.15	0.14	0.15
term20	0.05	0.05	0.05	0.08	0.08	0.08
term25	0.02	0.02	0.02	0.01	0.01	0.01
term30	0.81	0.8	0.81	0.74	0.74	0.74
YR2002	0	0.08	0.02	0	0.11	0.03
YR2003	0.09	0.2	0.12	0.11	0.25	0.15
YR2004	0.27	0.16	0.24	0.3	0.16	0.26
YR2005	0.4	0.34	0.38	0.4	0.33	0.38
YR2006	0.24	0.22	0.23	0.19	0.15	0.18
education	10.1	10.22	10.13	10.09	10.24	10.13
distance	422.39	294.78	385.36	420.98	265.75	374.14
Obs	5664	2311	7977	2353	1013	3368

Table 3
Online Summary Statistics by Year for Conforming Loans

Variable	2003	2004	2005	2006	Total Online
Credit score	668.46	670.58	676.49	670.33	672.67
Interest Rate	6.195	6.352	6.343	6.40	6.329
APR	6.36	6.54	6.52	6.54	6.51
APR-10 yr Treasury	2.20	2.26	2.23	1.73	2.14
Loan To Value	73.34	71.23	75.29	80.62	74.84
Loan Amount ($1,000)	141.14	137.37	145.92	142.33	142.14
Upfront Fee	1407.65	1318.87	1303.76	1359.19	1330.05
Fixed	0.957	0.929	0.936	0.925	0.934
Cash out	0.65	0.63	0.59	0.5918	0.61
Purchase	0.046	0.112	0.12	0.09	0.11
Second	0.039	0.107	0.152	0.193	0.134
Lendingtree Fee	560.63	615.94	611.67	578.88	601.26
term10	0.03	0.023	0.021	0.023	0.023
term15	0.190	0.155	0.133	0.141	0.147
term20	0.082	0.096	0.083	0.070	0.084
term25	0.0078	0.0042	0.0127	0.0045	0.0081
term30	0.69	0.72	0.75	0.76	0.74
Education	10.02	10.04	10.17	10.04	10.09
Distance	408.12	425.85	426.22	408.24	420.76
Observations	257	712	945	441	2355

Table 4

Retail Summary Statistics by Year for Conforming Loans

Variable	2002	2003	2004	2005	2006	Total Retail
Credit score	694.32	687.96	683.50	676.57	671.38	681.64
Interest Rate	6.05	6.13	6.39	6.48	6.28	6.30
APR	6.18	6.27	6.55	6.63	6.47	6.46
APR-10 year Treasury	2.12	2.32	2.28	2.37	1.67	2.21
Loan To Value	70.16	70.03	68.78	71.29	80.27	71.82
Loan Amount ($1,000)	135.48	131.04	135.82	134.64	139.06	134.70
Upfront Fee	671.47	806.52	876.14	1040.21	1268.44	950.58
Fixed	0.91	0.94	0.89	0.91	0.92	0.91
Cash out	0.35	0.37	0.39	0.39	0.41	0.39
Purchase	0.06	0.13	0.43	0.43	0.45	0.32
Second	0.05	0.06	0.19	0.23	0.29	0.17
term10	0.03	0.04	0.02	0.02	0.02	0.03
term15	0.11	0.15	0.15	0.13	0.18	0.14
term20	0.13	0.12	0.09	0.06	0.05	0.08
term25	0.04	0.004	0	0.01	0	0.01
term30	0.7	0.69	0.74	0.78	0.76	0.74
education	10.42	10.27	10.40	10.14	10.15	10.24
Distance	140.69	173.16	284.74	338.70	325.46	265.58
Obs	694.32	251	164	336	154	1015

Table 5
Switching Regression

Variable	(1) Price Online	(2) Z	(3) Price Retail	(4) Z	(5) Probit online	(6) Z
Credit Score	-0.0055*	12.57	-.0055*	7.98	-0.001	1.93
Loan Amount	-0.0051*	15.66	-.0061*	10.38	0.0038	1.09
Fixed	1.1661*	11.18	1.286*	8.13	0.134349	1.38
30 yr term	.8038*	4.68	.628*	2.55	-0.0457	0.28
25 yr term	1.774*	5.42	0.0498	0.1	0.1297	0.42
20 yr term	.7848*	4.15	0.4961	1.69	0.046	0.25
15 yr term	0.2566	1.42	-0.011	0.04	-0.00778	0.04
Loan To Value	-0.0000916	0.08	0.0025	1.26	.00295*	2.6
Cash out	0.0739	1.27	0.0192	0.17	.1589*	2.68
Purchase	.5294*	5.22	-0.0054	0.03	-0.897*	12.04
Second	0.1117	1.28	0.19	1.39	-0.126	1.57
Coverage Law	-0.0079	0.49	-0.0339	1.03	-0.0617*	3.62
Enforcement Law	-0.0139	0.8	-0.011	0.29	-0.1131*	6.39
2006	-.5548*	5.19	-.6757*	3.53	.9193*	11.04
2005	-0.0413	0.42	0.0657	0.38	.9441*	13.56
2004	-0.638	0.62	0.0801	0.37	1.199*	15.54
Distance					0.0045*	5.04
Education					-0.016	1.36
Constant	4.922*	12.65	5.093*	7.62	0.5066	1.32
/lns1 and /lns2	0.2005*	13.12	0.2818592*	11.89		
/r1 and /r2	-0.139	-1.89	0.079	0.49		
Sigma	1.22*	0.0187	1.33*	0.0314		
Rho1 and Rho2	-0.138	0.0725	0.0787	.15911		

LR test of Indep Eqns $\chi^2(1)$=7.35 Prob>χ^2=0.0067
*significant at the 5% level

Table 6

Heckman Two Stage Least Square

	(1) Online-Price	(2) Online Probit	(3) Retail Price	(4) Retail Probit.
Credit Score	-0.005	-0.001	-0.006	-.001
	(9.32)**	(1.92)	(7.59)**	(1.88)
Loan amount	-0.005	0	-0.006	0
	(13.86)**	(1.24)	(9.81)**	(1.28)
Fixed	1.085	0.135	1.305	-0.125
	(8.88)**	(1.39)	(7.98)**	(1.29)
term30	0.807	-0.049	0.674	0.048
	(4.07)**	(0.30)	(2.54)*	(0.29)
term25	1.658	0.139	0.069	-0.139
	(4.37)**	(0.44)	(0.13)	(0.45)
term20	0.749	0.038	0.501	-0.038
	(3.42)**	(0.21)	(1.69)	(0.21)
term15	0.242	-0.011	-0.006	0.01
	(1.16)	(0.06)	(0.02)	(0.06)
LTV	-0.002	0.003	0.003	-0.003
	(1.24)	(2.62)**	(1.34)	(2.54)*
Cash out	-0.021	.158	0.044	-0.156
	(0.29)	(2.67)**	(0.36)	(2.64)**
Purchase	1.136	-0.896	-0.113	0.895
	(5.61)**	(12.04)**	(0.41)	(12.04)**
Second	0.195	-0.125	0.171	0.129
	(1.91)	(1.55)	(1.20)	(1.61)
Coverage law	0.026	-0.061	-0.043	0.062
	(1.22)	(3.60)**	(1.14)	(3.63)**

Absolute value of z statistics in parentheses

* significant at 5%

Table 6

Heckman Two Stage Least Square

	(1) Online-Price	(2) Online Probit	(3) Retail Price	(4) Retail Probit.
Enforcement law	0.062	-0.113	-0.031	0.113
	(2.09)*	(6.43)**	(0.56)	(6.45)**
YR2006	-1.181	0.92	-0.562	-0.917
	(5.55)**	(11.05)**	(1.88)	(11.02)**
YR2005	-0.677	0.944	0.184	-0.941
	(3.24)**	(13.56)**	(0.62)	(13.53)**
YR2004	-0.824	1.195	0.229	-1.193
	(3.39)**	(15.51)**	(0.62)	(15.50)**
Distance		0.01		-0.01
		(4.91)**		(4.87)**
Education		-0.016		0.016
		(1.41)		(1.36)
Constant	5.625	0.508	5.35	-0.512
	(11.56)**	(1.33)	(6.30)**	(1.33)
Observations	3359	3359	3361	3361

Absolute value of z statistics in parentheses

* significant at 5%

Table 7
OLS Price Estimation

	Online Price Equation	t	Retail Price Equation	t
Credit score	-0.01	(12.78)**	-0.01	(8.01)**
Loan amount	-0.01	(15.55)**	-0.01	(10.37)**
Fixed	1.18	(11.27)**	1.27	(8.10)**
term30	0.8	(4.67)**	0.67	(2.53)*
term25***	1.79	(5.47)**	0.04	(0.08)
term20***	0.79	(4.17)**	0.49	(1.66)
term15***	0.26	(1.42)	-0.01	(0.05)
LTV	0.02	(0.11)	0.02	(1.19)
Cash out	0.09	(1.48)	0.01	(0.04)
Purchase ***	0.45	(4.86)**	0.05	(0.45)
Second	0.1	(1.16)	0.2	(1.47)
Coverage law	-0.01	(0.76)	-0.03	(0.92)
Enforcement law	-0.02	(1.42)	0.01	(0.02)
YR2006***	-0.47	(4.82)**	-0.74	(5.10)**
YR2005	0.04	(0.47)	0.001	(0.38)
YR2004	0.03	(0.38)	0.01	(0.02)
Constant	4.83	(12.51)**	4.95	(8.16)**
R-squared	0.25		0.24	

Absolute value of t statistics in parentheses
* significant at 5%
** significant at 1%
*** Reject the null at 5% for differences in coefficient across equations.

Table 8

OLS Profit Estimation

	Online Profit Equation	t	Retail Profit Equation	t
Credit score	-0.004	(9.61)**	-0.01	(8.01)**
Loan amount	-0.01	(13.97)**	-0.01	(10.37)**
Fixed***	.911	(8.27)**	1.27	(8.10)**
term30***	0.98	(5.42)**	0.67	(2.53)*
term25***	2.27	(6.53)**	0.04	(0.08)
term20***	1.895	(9.43)**	0.49	(1.66)
term15***	2.24	(11.72)**	-0.01	(0.05)
LTV	0.02	(0.61)	0.01	(1.19)
Cash out	0.12	(2.00)*	0.01	(0.04)
Purchase***	.237	(2.42)**	0.05	(0.45)
Second	0.032	(0.36)	0.2	(1.47)
Coverage law	-0.029	(1.70)	-0.03	(0.92)
Enforcement law	-0.052	(2.98)**	0.002	(0.02)
YR2006***	0.075	(0.79)**	-0.74	(5.10)**
YR2005	0.062	(0.67)	0.01	0.2
YR2004***	-0.425	(4.08)**	-0.003	(0.02)
Constant	4.80	(11.74)**	4.95	(8.16)**
R-squared	0.29		0.24	

Absolute value of t statistics in parentheses

* significant at 5%

** significant at 1%

*** Reject the null at 5% for differences in coefficient across equations.

APPENDIX

Calculating APR

Calculating APR for the consumer or the Price Variable

$$L - U = P_1/(1 + APR) + P_2/(1 + APR)^2 + 0(P_n + B_n)/(1 + APR)^n \tag{12}$$

where

$L = loan\,amount$

$U = commission$

$P = payment\,given\,the\,interest\,rate$

$B = ending\,balance$

Solving for APR provides the true cost of the loan to the consumer after controlling for the commission.

Calculating APR for the firm or the Profit Variable

$$L - (U - CLO) = P_1/(1 + APR) + P_2/(1 + APR)^2 + 0(P_n + B_n)/(1 + APR)^n \tag{13}$$

where

CLO= the fees paid to the Price Comparison Site.