The Role of Mortgage Brokers in the Subprime Crisis*

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Abstract

We study the role of mortgage brokers in the subprime crisis using a detailed sample of loans originated by, formerly, one of the largest subprime loan originators, New Century Financial Corporation. Prior to the subprime crisis, mortgage brokerage firms originated about 65% of all subprime mortgages and yet little is known about their behavior and contribution to the subprime crisis. What were the explicit and implicit incentives that lenders like New Century provided to the mortgage brokers? How did the mortgage brokers respond to the incentive scheme? Did the incentive scheme change as loan volume surged? We decompose the broker revenues into a cost and profit component and find evidence consistent with broker market power that is greater for more complex mortgages, mortgages that require less documentation, and for borrowers who may be less informed. We relate the broker profits to the subsequent performance of the loans and show that higher broker profits are associated with worse loan performance suggesting that brokers earned high profits on loans that turned out to be riskier ex post.

1. Introduction

We study the role of independent mortgage brokers in the mortgage origination process using a dataset from one large subprime lender, New Century Financial Corporation, whose rapid rise and fall parallels that of the subprime mortgage market from the mid nineties until the beginning of the financial crisis in 2007. Mortgage brokers act as financial intermediaries who match borrowers with lenders and assist in the selection of loans and the completion of the loan application process. Mortgage brokers are an important channel for origination in the prime market but are a much more important channel in the subprime market where they became the predominant channel for loan origination. For example, in 2005 independent mortgage brokers originated about 65% of all subprime mortgages.[1] Despite the mortgage brokers' central role in the subprime market we know relatively little about their behavior, incentives, or profits. What were the explicit and implicit incentives for mortgage brokers to match borrowers with different types of mortgages? Did these incentives change during the run up to the crisis?

Traditionally a mortgage broker operates as an independent service provider, not as the agent of either the borrower or the lender. The broker charges a direct fee to the borrower and earns an indirect fee—known as the yield spread premium—from the lender. The services provided by the broker include taking the borrower's application, performing a financial and credit evaluation, giving the borrower information about available loan options, and producing underwriting information for the lender.

Obtaining a mortgage is often one of the biggest financial decisions that a household makes, and it is a decision that is made relatively infrequently. The mortgage decision may require the borrower to choose between fixed rate, adjustable rate, or hybrid loans, interest only loans, non-amortizing loans, loans with prepayment penalties, and loans with balloon payments. Depending on the borrower's circumstances different loan types may be optimal, but a cost associated with the potential benefits of a larger set of

[1]Detailed information is available at the National Association of Mortgage Brokers website at www.namb.org.

choices is that it becomes harder for a borrower to evaluate and compare different types of mortgages. A borrower who faces a large number of choices and who may be relatively inexperienced may be able to do better by using a mortgage broker. But by using a broker the borrower also becomes more reliant on the information obtained from the mortgage broker and subject to the conflicts of interest that arise because of the way the broker is compensated.

Part of the mortgage brokers' compensation comes directly from the lender in the form of a yield spread premium. The lender provides the mortgage broker with a set of implicit incentives by selecting different schedules for the yield spread premium. For example, a lender who finds that mortgages with certain attributes are more appealing to the ultimate buyers may change the yield spread premium to reward mortgage brokers for originating such loans. The mortgage broker is likely to trade off the potential benefits of finding the best loan product for the borrower—which may help the broker win future business—against originating a loan product that may generate the highest revenues for the broker from the current loan. We develop a simple framework that allows us to empirically examine these trade offs and apply the technique to a large sample of subprime mortgages. The questions we seek to address are: What were the explicit and implicit incentives that lenders like New Century provided to the mortgage brokers? How did the mortgage brokers respond to the incentive scheme? Did the incentive scheme change as loan volume surged? Is there evidence that mortgage brokers extract rents from the transactions? Is there any relationship between broker rents and the subsequent loan performance?

We study these questions using an extensive sample of mortgages originated by, formerly, one of the largest subprime loan originators, New Century Financial Corporation. The sample contains detailed information on the credit worthiness of the borrower, the purpose of the loan, the appraised property value, the location and type of property, the type and terms of loans originated, loan servicing records, and information on whether or not a mortgage broker was involved in the loan. The sample also reports the fees and

yield spread earned by the brokers that allows us to compute the revenues the brokers earn on each funded mortgage.

Our empirical framework is based on the idea that in order for a mortgage to be funded, it must be acceptable to the borrower, the broker, and the lender given the information each observes. We model the interaction between the borrower and the broker as a bargaining game over the loan terms and type subject to the constraint that the lender will fund the loan. The framework decomposes the total revenues charged by the broker into a cost of facilitating the match and a component that reflects the broker's bargaining power. The lender's surplus is the net present value to the lender from funding the loan gross of the yield spread paid to the mortgage broker. The lender affects the broker's behavior indirectly via the yield spread schedule and directly via the decision to fund a loan. The borrower's surplus depends on the benefit that the borrower receives from the loan which in turn depends on the value that the borrower assigns to owning the property and the valuation of various mortgage attributes.

Some profits must be generated in the chain of loan origination in order for both the lender and the broker to be able to extract profits. Why would competition not eliminate such profits? One possibility is that the range of different mortgage products allow sufficient risk-adjusted price dispersion to exist. Such price dispersion may arise for strategic reasons as argued by Carlin (2009) and may not be eliminated by competition as shown by Gabaix and Laibson (2006). Research on household financial decision provides evidence that individuals and households often make suboptimal decisions, see, for example, Campbell (2006). More choices may also not lead individuals or households to make better decisions, see, for example, Huberman et a. (2004). It therefore seems plausible that neither comparison shopping by borrowers nor more competitive pricing by lenders would necessarily eliminate the price dispersion that enables brokers to profit from the loan originations.

We estimate a stochastic frontier model that decomposes the broker's revenues into a cost component and a profit component. The decomposition rests on the idea that

when the borrower uses the broker, the broker will only propose loans with non-negative broker profit. Empirically the decomposition is identified because of the skewness in the total broker revenues. Our estimates of the broker profits are higher for hybrid mortgages and for mortgages with prepayment penalties; the brokers' bargaining power being greater for such mortgages. Profits are also higher for mortgages with stated or limited documentation and for mortgages obtained to refinance an existing mortgage with cash-out refinancing being the most profitable. These effects are consistent with greater bargaining power when borrowers may be less informed or less sensitive to higher costs.

We find evidence that regulations of the lending practices and the mortgage brokers generate lower broker profits. But we also find some evidence that greater minimum financial requirements for mortgage brokers are associated with higher broker profits consistent with a barriers to entry interpretation.

In order to investigate any relationship between broker rents and the subsequent loan performance we estimate a Cox proportional hazard model for loan delinquency. The estimates imply that the marginal effect of broker profits is positive for future delinquency once we condition on the loan and borrower characteristics, suggesting that brokers earned high profits on loans that turned out to be riskier ex post. In this sense then, New Century provided the brokers with incentives that led to riskier loans.

Demyanyk and Hemert (2009), as well as Mian and Sufi (2009), analyze the quality of securitized subprime mortgage loans. Keys, Mukherjee, Seru, and Vig (2009) and Purnanandam (2009) argue that the lack of screening incentives for originators and excessive risk-taking contributed to the subprime crisis. Despite the prominence of brokers in the subprime mortgage market, little is known about their behavior and contribution to the subprime crisis. El-Anshasy, Elliehausen, and Shimazaki (2006) and LaCour-Little (2006) compare the rates on subprime mortgages originated by lenders through the retail channel and through mortgage brokers. LaCour-Little (2006) shows that loans originated by brokers cost borrowers more than retail loans, while the El-Anshasy, Elliehausen, and

Shimazaki (2006) do not find support for that claim.

Woodward and Hall (2009) examine the total revenues paid by borrowers to mortgage brokers for a sample of FHA loans originated in 2001 and show that a substantial portion can be attributed to broker profits and that the broker profits vary with borrower characteristics, consistent with the brokers' profits stemming from lack of information among borrowers. Our approach to estimating broker rents is similar to the one taken by Woodward and Hall (2009) in that we use stochastic frontier analysis to decompose the broker revenues charged into a cost and a profit component. Garmaise (2009) studies the length and intensity of the broker-lender relationship and finds that the quality of loans originated actually declines in the number of interactions between the broker and the lender.

Theoretical models of the incentive conflicts that arise in situations in which consumers rely on agents for advice and agents potentially are compensated contingent on making sales have been analyzed by, among others, Bergstresser, Chalmers, and Tufano (2009), Gravelle (1994), Inderst and Ottaviani (2009), and Jackson and Burlingame (2007).

The paper proceeds as follows. In Section 2, we provide company background for New Century and describe its loan origination process. We describe the loan origination data, and provide details on broker compensation. Section 3 presents our model framework for the underwriting process. In Section 4, we describe the empirical analysis and discusses the results. Section 5 concludes.

2. New Century Financial Corporation

Our sample contains all loans originated by New Century Financial Corporation (New Century) between 1997 and March 2007.

2.1. Company Background

New Century made its first loan to a borrower in Los Angeles, California in February 1996. Ten years later New Century had more than 7,100 employees and 222 sales offices nationwide, and was one of the largest subprime mortgage originators in the United States.

New Century originated, retained, sold and serviced home mortgage loans designed for subprime borrowers. In 1996, the company originated over $350 million in loans. In 1997, New Century went public and was listed on NASDAQ. In 2001, the company's subprime loan origination volume exceeded $6 billion. Volume continued to grow rapidly, and volume increased tenfold to over $60 billion in 2006. The company grew its product offerings so that by 2006, New Century provided fixed rate mortgages, hybrid mortgages which are adjustable rate mortgages that convert to fixed rate mortgages after a number of months, and balloon mortgages. In 2004, New Century restructured into a real estate investment trust (REIT) and began trading on the NYSE.[2] New Century filed for Chapter 11 bankruptcy protection on April 2, 2007. Below is a summary of New Century's loan origination process.[3]

New Century's Loan Origination Process

1. Independent brokers or New Century brokers identify potential borrowers and complete loan applications. These are submitted either to a New Century account executive or through its web-based loan underwriting process called FastQual.

2. Account executives submit loan applications to New Century account managers, who review the applications to ensure all documentation are in place.

[2]REITs are entities that invest in different kinds of real estate or real estate assets. Mortgage REITs lend money to property owners and developers or invest in financial instruments secured by mortgages. According to the Internal Revenue Code, REITs are required to pay out at least 90% of their income before taxes to shareholders. Source: U.S. Securities and Exchange Commission at http://www.sec.gov/answers/reits.htm, accessed June 2, 2008.

[3]See Palepu, Srinivasan, and Sesia Jr. (2008) for more institutional details.

3. If applications and documentation are in place, account managers sends loans to New Century underwriters. Underwriters review loans for compliance to New Century's underwriting standards and decide whether to approve or deny the loans. Underwriters set the interest rate and the terms of the loan. The company's underwriting guidelines requires a credit report on all applicants from a credit reporting company. The company also reviews all of the applicant's prior mortgage payment histories. During the underwriting process, the home is appraised.

4. If the loan is approved, the underwriter sends the loan to a closing agent for execution.

5. After loan documents are sent, the closing agent sends the documents to a New Century funding officer, who contacts the accounting department and requests the funds to be wired to the funding officers.

2.2. Origination Data

Our sample contains detailed information on the credit worthiness of the borrower, the purpose of the loan (purchase vs. refinance), appraised value, location and type of property, the type and terms of loans originated, originated fees, yield spread premium, and information on whether or not a mortgage broker was involved. These data provide enough detail to allow us to study the matching of borrowers with loan types and the relationship between loan types and revenues paid and received. The sample covers a ten-year period that ends in March 2007 and was obtained from IPRecovery, Inc.[4] The sample contains information on more than 3 million loan records and 1.36 million funded loans across a diverse geographical area. Figure 1 plots the total amount of loans originated by New Century between 1997 and 2006 and the split between loans originated through the broker and retail channels. New Century's loan volume grew approximately

[4]As part of the New Century Financial Corporation bankruptcy proceedings, IP Recovery, Inc. purchased from the New Century Liquidating Trust a collection of datasets on loan origination, loan servicing, loan performance, and broker data for loans originated/serviced by New Century between 1997 and its bankruptcy filing in 2007.

tenfold between 2001 and 2006 and much of that growth stemmed from broker originated loans.

Table 1 reports the descriptive statistics for our origination database, covering the years 1997 to 2006. The first panel shows that the number of loans funded by New Century increased from below 20,000 in 1997 to almost 330,000 in 2006. Interestingly, only 40-50% of the proposed loans were actually funded by New Century, with a roughly equal fraction withdrawn by the borrower and the remaining 10-20% of the proposed loans declined by the lender.

The second panel shows a breakdown of the origination channel for the funded loans and shows how the role of the retail channel steadily decreased as New Century's loan volume increased. The change was accompanied by a steady increase in the number of brokers that New Century did business with. The next panel shows a breakdown of the loan types into fixed-rate mortgages (FRM), hybrid loans, balloon loans, and agency loans. For the whole sample period, hybrid loans were the most common ones followed by fixed-rate loans. The fifth panel reports the purpose of the loan. The purpose of more than half of the mortgages was to refinance an existing loan. In 1997, about 58% percent of the funded broker loans were originated to extract cash by refinancing an existing loan into a larger new mortgage. That percentage stayed fairly flat until 2003, but afterwards decreased somewhat to about 37% in 2006.

New Century had three levels of income documentation: full, limited, and stated. For a full documentation loan, the applicant was required to submit two written forms of income verification showing stable income for at least twelve months. With limited documentation, the prospective borrower was generally required to submit six months of bank statements. For stated docs, verification of the amount of monthly income the applicant stated on the loan application was not required. Palepu, Srinivasan, and Sesia Jr. (2008) note that in all cases, the applicant's employment status was verified by phone (salaried employees). Stated documentation mortgages were often referred to as "liar loans." While there are some fluctuations year-to-year, the general trend for

our sample period is to have fewer full documentation loans and more limited or stated documentation loans later in the sample. The last panel shows mean values for some additional loan and borrower characteristics in our sample.

2.3. Broker Compensation

Brokers are compensated for their services in two ways. First they receive fees paid directly by the borrower. These include the loan origination fee, credit fee, etc. Second, the broker is paid a yield spread premium (YSP) by the lender. Lenders such as New Century usually distribute a wholesale rate sheet to mortgage brokers that sets the minimum mortgage rate based on a number of loan and borrower characteristics. Brokers may then earn a higher fee for originating higher rate loans, all else equal. Yield spread premia therefore are an indirect way for the lender to influence the brokers' origination activity. Brokers need not disclose the YSP to borrowers until closing statements are signed.[5] Exhibit 1 shows an example of a rate sheet distributed by New Century in March of 2007. (Source: "Subprime Debacle Traps Even Very Credit-Worthy," *Wall Street Journal*, Section: A1, December 3rd, 2007, Rick Brooks and Ruth Simon.) The main matrices show at what rates New Century was willing to fund loans as function of the loan program, e.g., full versus stated documentation, and the loan to value ratio (LTV). On the right hand side of the graphic about half way down the page is the YSP box that shows that on this date a 0.5 percent higher rate than the minimum translated into a 1% yield spread premium whereas a 0.875% higher rate translated into a 1.5% yield spread premium. The rate sheet shown here can be viewed as a benchmark. Different brokers may have received a slightly more or less favorable set of quotes depending on their loan volume and history.

Table 2 shows a negative trend in revenues, as a percentage of the loan amount, earned by mortgage brokers over our sample period. One interpretation of this is that it reflects increased competition between brokers doing business with New Century. The various panels show how the revenues break down across different loan products like fixed-rate or

[5]The yield spread premium is reported on lines 80–81 of the HUD-1 statement.

hybrid mortgages with full versus stated documentation. In general, the between product variation is smaller than the variation across time.

Figure 2 reports the unconditional distribution of the broker revenues and its components, all measured in dollars. Panel a reports the direct—or fixed—fee portion of the revenues, Panel b reports the yield spread, and Panel c reports the total broker revenues. All the distributions are quite skewed—there are some extremely large fees and yield spreads paid out to the brokers. The average broker revenues are on the order of $7,000 per loan. The yield spread distribution is more concentrated than the fee distribution, and the fees average about 65% of the total revenues.

Figure 3 provides graphical evidence on how the documentation type effects the distribution of broker revenues. Panel a shows the unconditional distribution of the revenues, Panel b provides the distribution of revenues for the loans with full documentation, Panel c the distribution of loans with limited documentation, and Panel d the distribution of stated documentation loans. The average and median levels of revenues are higher for limited and stated documentation loans relative to full documentation loans, and the right tail of the distribution is heavier for limited and stated documentation loans relative to full documentation loans. Our empirical model uses such variation to identify variation in broker profitability across the different loan categories.

Exhibit 1 shows an example of a rate sheet distributed by New Century. This sheet was distributed in March of 2007. (Source: "Subprime Debacle Traps Even Very Credit-Worthy," *Wall Street Journal*, Section: A1, December 3rd, 2007, Rick Brooks and Ruth Simon.) The main matrices show at what rates New Century was willing to fund loans as function of the loan program, e.g., full versus stated documentation, and the loan to value ratio (LTV). On the right hand side of the graphic about half way down the page is the YSP box that shows that on this date a 0.5 percent higher rate than the minimum translated into a 1% yield spread premium whereas a 0.875% higher rate translated into a 1.5% yield spread premium.

2.4. Loan Performance Data

The data obtained from IPRecovery contains detailed loan servicing records on most of the originated mortgages. For every year from 1999 to 2006, 97% or more of the funded loans are part of the servicing data, except for 2002 (80%) and 2005 (93%). Figure 4 plots the percentage of loans delinquent as a function of the age of the loan by the year of origination. A loan is considered delinquent if payments on the loan are 60 or more days late, or if the loan is reported as in foreclosure, real estate owned, or in default. The left panel of the figure shows actual delinquency rates, which are computed as follows: Let $\hat{p}_s^k$ denote the observed ratio of the number of vintage k loans experiencing a first-time delinquency at s months of age over the number of vintage k loans that either are still active in the servicing data after s months or experience a first-time delinquency at age s. We compute the actual (cumulative) delinquency rate for vintage k at age t, $\hat{P}_t^k$, as

$$\hat{P}_t^k \;=\; 1 - \prod_{s=1}^{t} \left(1 - \hat{p}_s^k\right), \quad \text{for } k = 1999, \ldots, 2005.$$

We find that loans originated in 1999, 2000 and 2001 have the highest unconditional delinquency rates. Table 1 suggests that loans originated during these years have, on average, lower FICO scores and higher initial rates than loans funded later in the sample. We control for such differences in loan-level characteristics by computing adjusted delinquency rates, which are obtained by using estimated coefficients for vintage dummies after controlling for loan, borrower and broker characteristics, and macroeconomic variables.[6] Following Demyanyk and Hemert (2009), we impose the restriction that the average actual and average adjusted delinquency rates are equal for any given age of the loan. The average actual delinquency rate, $\bar{P}_t^k$, is defined as

$$\bar{P}_t \;=\; 1 - \prod_{s=1}^{t} \left(1 - \bar{p}_s\right),$$

where $\bar{p}_s = \frac{1}{7}\sum_{k=1999}^{2005} \hat{p}_s^k$. The right panel of Figure 4 shows the adjusted delinquency

[6] Details are provided in Section 4.

rates. The plot is consistent with the evidence reported in Demyanyk and Hemert (2009) in that, after controlling for year-by-year variation in loan-level characteristics and macroeconomic variables, loans originated in 2004 and 2005 appear riskier ex post than loans originated earlier.

3. Framework

We model the underwriting process as follows. The borrower arrives to the broker requesting a mortgage loan. The broker evaluates the borrower's characteristics including the borrower's credit quality and willingness to pay, and based on that information the broker provides the borrower with financing options. The broker submits funding requests to one or more lenders, and the lenders respond with a decision to fund the loan or not. Funding requests are submitted until the borrower and broker and lender find an acceptable loan. At that point, the mortgage is written. If no acceptable loan is found, then no mortgage is written.

We use P to denote the loan principal, l the loan type—fixed, floating, does the loan have a prepayment penalty, maturity, and so on—and r be the loan's interest rates so that (P, l, r) denotes the loan. We use the subscript i to denote the borrower and the subscript j to denote the mortgage broker. Define the vector of characteristics X_{ij} as

$$X_{ij} \equiv (X_i^B, X_j^{MB}, X^M). \tag{1}$$

Here X_i^B is the vector of characteristics for borrower i such as borrower FICO score, borrower income, borrower age, X_j^{MB} is a vector of mortgage broker characteristics such as the broker's underwriting history and market share, and X^M is a vector of overall market conditions such as the calendar time or recent house price appreciation. All payoffs and decisions are conditional on these characteristics; we drop the conditioning variable X_{ij} from the notation at this point to simplify the notation. Our empirical work conditions on X_{ij}.

Let f denote the total fees that the broker charges the borrower for originating the loan, including the origination fee and the credit fee. Define $\nu(P, l, r)$ as the borrower's dollar valuation for the loan as a function of the loan amount, the terms of the loan, and loan rates. The function $\nu(P, l, r)$ measures the wealth equivalent benefits that the borrower receives from the loan—for expositional purposes we assume that ν is differentiable with respect to its arguments and strictly concave, and we also assume that ν is decreasing in r. Using ν, and assuming that the borrower is risk-neutral, the borrower's total surplus from receiving a funded loan (P, l, r), and paying fees of f is

$$\nu(P, l, r) - f. \tag{2}$$

The lender pays the broker a yield spread of $y(P, l, r)$ for originating the loan. We use C to denote the broker's costs of originating the loan. Here, C includes the broker's time costs of dealing with the borrower, as well as any administrative costs paid by the broker for intermediating the mortgage. Assuming that the broker is risk-neutral, the broker's surplus from originating a funded loan (P, l, r), receiving fees of f and a yield spread of $y(P, l, r)$, and paying costs of C is

$$f + y(P, l, r) - C. \tag{3}$$

We assume that the terms of the mortgage loan can be described by a generalized Nash bargain between the broker and the borrower, subject to the constraint that the lender will fund the loan. Let F denote the set of loans that will be funded by the lender:

$$F(X_{ij}) = \{(P, l, r) | \text{lender will fund loan type } (P, l, r), X_{ij}\}. \tag{4}$$

Here F depends on the vector of characteristics X_{ij} because the lender's decision depends on characteristics of the borrower, broker, and overall market conditions. We drop the conditioning variable to simplify notation.

We use $\rho \in [0,1]$ to denote the bargaining power of the broker relative to the bargaining power of the borrower. If $\rho = 0$ then the borrower has all the bargaining power, and if $\rho = 1$ the mortgage broker has all the bargaining power. The funded loan contract maximizes the generalized Nash product

$$\max_{\{f,l,r\}\in F} \left(f + y(P,l,r) - C\right)^{\rho} \left(\nu(P,l,r) - f\right)^{1-\rho}, \tag{5}$$

subject to the participation constraints:

$$\nu(P,l,r) - f \geq 0, \tag{6}$$

$$f + y(P,l,r) - C \geq 0. \tag{7}$$

Condition (6) requires that the fees do not exceed the borrower's surplus and condition (7) requires that the fees plus the yield spread are greater than or equal to the broker's cost. The participation constraints can only be satisfied if the gains to trade are non-negative:

$$\nu(P,l,r) + y(P,l,r) - C \geq 0, \text{ for some } (P,l,r) \in F. \tag{8}$$

If the gains from trade are negative, the bargaining ends and no mortgage is funded.

When the gains from trade are positive and the terms of the loan are in the interior of F, the first-order-conditions imply

$$\frac{\partial \nu(P,l,r)}{\partial l} + \frac{\partial y(P,l,r)}{\partial l} = 0, \tag{9}$$

$$\frac{\partial \nu(P,l,r)}{\partial r} + \frac{\partial y(P,l,r)}{\partial r} = 0, \tag{10}$$

and

$$(1-\rho)\left(f + y(P,l,r) - C\right) = \rho\left(\nu(P,l,r) - f\right). \tag{11}$$

Conditions (9) and (10) are efficiency conditions: the sum of the marginal benefits to the borrower and the marginal revenues to the broker for the terms of the loan is equal to zero. We have assumed that the borrower and mortgage broker do not bargain over the loan size P. If we relaxed that assumption and allowed the loan size to be part of the bargaining, then efficiency conditions similar to (9) and (10) would also hold. In particular, the loan size would equate the marginal benefits and costs between the borrower and mortgage broker.

Since the lender sets the yield spread, equations (9) and (10) show how that yield spread function effects the loan choice. The lender also affects the loan choice directly through the set of loans that will be funded, F.

Condition (11) is the direct condition for setting the fees: the fees are set so that the total surplus is split according to the relative bargaining power of the broker and the borrower. Using condition (11) to solve for the fees yields

$$f = \rho\nu(P, l, r) + (1 - \rho)(C - y(P, l, r)). \tag{12}$$

If the borrower has all the bargaining power, then $\rho = 0$ and

$$f = C - y(P, l, r)$$

so that all the surplus flows to the borrower. If the broker has all the bargaining power, then $\rho = 1$ and

$$f = \nu(P, l, r)$$

so that all the surplus flows to the broker.

The lender chooses which submitted loans will be funded and the yield spread that is paid to the broker. Let $u(P, l, r)$ denote the lender's expected payoff from financing a mortgage of type (P, l, r). Here, $u(P, l, r)$ represents the net present value to the lender from funding the loan gross of the yield spread paid to the mortgage broker. If the lender

securitizes the loan, $u(P, l, r)$ is the difference between the price paid by the mortgage securitizer for the loan and the amount lent to the borrower. If the lender does not securitize the loan, $u(P, l, r)$ is the difference between the lender's expected present value of the payments received from the borrower and the amount lent to borrower.

Since the lender pays the yield spread $y(P, l, r)$ to the broker, the lender's surplus from funding the mortgage loan is

$$u(P, l, r) - y(P, l, r). \tag{13}$$

The lender will only fund the loan if that payoff is positive, or

$$u(P, l, r) - y(P, l, r) \geq 0. \tag{14}$$

The lender's decisions effect the terms of the loan underwriting process through two channels. First, the lender determines the yield spread function, which determines which loans will be submitted because the yield spread function directly determines the broker's participation constraint in equation (7) and efficiency conditions (9) and (10). Since the broker's surplus directly depends on the yield spread, condition (11) implies that the fees themselves depend on the yield spread. Second, the lender's decision on which loans to fund determines which loans will be offered directly though the effects of the constraints in the set of loans that will be funded, F, on the generalized Nash solution.

To summarize, the loan will be originated if the lender's surplus is positive so that the lender agrees to the funding, if the gains from trade between the borrower and the broker are positive, and the fees will be set so that the surplus is split between the borrower and broker in proportion to their bargaining power.

4. Empirical Analysis

4.1. Decomposing Broker Revenues into Costs and Profits

For the funded loans in our sample, we observe the broker's revenue equal to $f + y(P, l, r)$. Substituting in the equilibrium fees from equation (12), we obtain

$$f + y(P, l, r) = C + \rho \left(\nu(P, l, r) + y(P, l, r) - C \right), \tag{15}$$

which states that the broker's revenue equals the cost of intermediating the loan plus the fraction of the total gains from trade that the broker is able to capture. If the broker has all the bargaining power ($\rho = 1$), the broker receives all the gains from trade, and if the borrower has all the bargaining power ($\rho = 0$), the broker revenues are equal to the costs of intermediating the trade.

We are interested in empirically decomposing the observed revenues into a cost component and the gains from trade captured by the broker. To do so, we parameterize the broker's cost function as

$$C = C(X_{ij}) + \epsilon_{ij}, \tag{16}$$

where $C(X_{ij})$ is the cost function conditional on borrower and mortgage broker characteristics, X_{ij}, and ϵ_{ij} is a zero mean error term that represents unobserved heterogeneity in the brokers' costs. Letting ξ_{ij} be the broker's profit,

$$\begin{aligned} f + y(P, l, r) &= C(X_{ij}) + \epsilon_{ij} + \rho \left(\nu(P, l, r) + y(P, l, r) - C \right) \\ &\equiv C(X_{ij}) + \epsilon_{ij} + \xi_{ij}, \end{aligned} \tag{17}$$

where ξ_{ij} is non-negative. Conversations with a market participant indicated that the broker's cost function is likely to be unaffected by the loan amount, the loan type, or loan rates. Nevertheless, we also report parameter estimates from a specification that allows the cost function to depend, among others, on the loan type, the prepayment penalty,

and whether or not the loan is a refinance. Our main results carry through to such a specification.

The model in equation (17) fits naturally into a specification than can be estimated using stochastic frontier analysis. Kumbhakar and Lovell (2000) and Greene (2002) are textbook references for stochastic frontier models. Frontier models are used to estimate cost or profit functions that are viewed as the most efficient outcomes possible. Individual observations deviate from the efficient outcomes by a symmetric mean zero error and a one-sided error that measures that observation's inefficiency. Such models have been applied in financial economics by Hunt-McCool, Koh, and Francis (1996) and Koop and Li (2001) to study IPO underpricing, by Altunbas, Gardener, Molyneux, and Moore (2001) and Berger and Mester (1997) to study efficiency in the banking industry, by Green, Hollifield, and Schürhoff (2007) to study dealers' profits in intermediating municipal bonds, and by Woodward and Hall (2009) in studying broker profits in the mortgage industry.

In our application, the broker's costs for underwriting the loan take the place of the most efficient broker revenue, and the efficiency term is a measure of the broker's profits. If the borrowers have enough bargaining power, then the broker's revenues would be driven down to their costs, and the one-sided error would be zero. Measures of the relative importance and determinants of the distribution of the one-sided error therefore provide useful information about the brokers' ability to earn profits by underwriting loans. In particular, the distribution of the one-sided error across different loan characteristics provides estimates of the relative profitability of different types of loans.

We note here that both the borrower's and the lender's participation constraints can also be estimated using stochastic frontier analysis. The borrower's participation constraint is that the fees f are less than or equal to the borrower's valuation for the loan $\nu(P, l, r)$, so that fees must equal the borrower's valuation plus a non-negative term equal to the borrower's surplus from the loan. If we parameterize the borrower' valuation and the stochastic distribution of borrower's surplus, then we can econometrically estimate

the borrower's valuation function and the conditional distribution of the borrower's surplus. Similarly, the lender's participation constraint is that the yield spread $y(P, l, r)$ is less than the lender's valuation of the loan $u(P, l, r)$ so that the yield spread is equal to the lender's valuation minus a non-negative term. With parametric assumptions, we can therefore estimate the lender's valuation function and the conditional distribution of the lender's surplus.

To arrive at an econometric specification of the model, we impose parametric structure on the distribution of the symmetric error ϵ_{ij} and on the broker's profits ξ_{ij} We parameterize $\epsilon_{ij} \sim \mathcal{N}(0, \sigma_C^2)$, and we parameterize ξ_{ij} as an exponential with mean parameter $1/\lambda(X_{ij})$. The first two moments of ξ_{ij} are

$$E\left[\xi_{ij} \middle| X_{ij}\right] = 1/\lambda(X_{ij}) \tag{18}$$

$$\text{Std. Dev.}\left[\xi_{ij} \middle| X_{ij}\right] = 1/\lambda(X_{ij}) \tag{19}$$

We estimate specifications in which the exponential term has as parameter $1/\lambda(X_{ij})$ a log-linear function in our explanatory variables X_{ij}. With K conditioning variables,

$$1/\lambda(X_{ij}) = \beta_0 \prod_{k=1}^{K} e^{X_{ij,k}\beta_k}. \tag{20}$$

If the parameter β_0 equals zero, then the broker's profits are zero; the borrowers have all the bargaining power and there is no asymmetric term. If the constant is non-zero, then the brokers have bargaining power and so earn positive profits, on average. Variables that increase $1/\lambda(X_{ij})$ suggest high broker bargaining power or higher yield spread premia and therefore higher profits for the brokers. Because of the log-linear functional form, the coefficients on the conditioning variables measure the percentage change in profits per unit change in the conditioning variable.

We parameterize the broker's cost as a function of dummies for the year and the geographic location. We first consider a tighter specification of the cost function which

does not depend on the loan characteristics as the economic rationale for the costs for different loan types to be different is not clear. We also report the results for a general specification in which the cost function can depend on the characteristics of the loan type. Our main results continue to hold in such a specification.

Let $\{Z_{ij,l}\} \in X_{ij}$ for l=1,...,L denote the dummy variables used for the cost function, we assume

$$C(X_{ij}) = \gamma_0 + \sum_{l=1}^{L} Z_{ij,l}\gamma_l. \tag{21}$$

4.2. Conditioning Variables

The empirical analysis uses a cleaned sample of all funded broker-originated stand-alone first lien loans. The overall NCEN data base contains 3,241,537 records, out of which 1,360,348 are for funded loans. 713,916 of these funded loans are broker-originated stand-alone first lien loans. For loan records to be considered in our empirical analysis, we further require that broker fees, yield spread premia, loan type, purpose, amount and fund date, rate, FICO score, combined loan to value ratio, documentation level, the borrower's age and marital status are available. This leaves us with a final set of 385,984 records. Table 3 reports the summary statistics for the sub-sample used in the estimation.

Our explanatory variables include characteristics of the loans, borrowers, and brokers, variables that capture differences in the regulation, macroeconomic variables, and some demographic variables as well as dummies for the year and the geographical region. Table 4 lists the variables used in our empirical analysis with brief explanations.

The loan characteristics variables include the level of documentation—full, limited or stated documentation; the type of loan—fixed rate or hybrid; the purpose of the loan—purchase or refinance, and if there is cash taken out or not in a refinancing. Different type of loans may generate different levels of profits for the broker as a results of the yield spread premium schedule used by the lender. It may also be the case that the broker's

bargaining power is relatively greater for some loan types.

The borrower characteristics include the borrower's FICO score, the borrower's age, and an indicator for whether the loan is taken by a single person. The borrower's credit history is likely to have some influence on the borrower's access to credit and may therefore influence the borrower's bargaining power. The borrower's age may correlate with the borrower's experience and financial literacy.

Our regulation variables capture state or local laws that deviate from the applicable federal laws. The 1994 Home Owners' Equity Protection Act (HOEPA) set a baseline for federal regulation of the mortgage market. Reports of questionable practices in the subprime mortgage market in the late nineties led to new legislation that targeted predatory lending practices starting with North Carolina in 1999.[7] We apply the approach taken by Ho and Pennington-Cross (2006) and Ho and Pennington-Cross (2005) to our sample period and use an index that measures the coverage of anti-predatory lending laws that assigns higher positive values if the laws cover more types of mortgages than HOEPA. In a similar fashion we construct an index that measures the restrictiveness of the anti-predatory lending laws giving, for example, higher values to laws that put stricter limits on prepayment penalties or balloon payments. Both indexes capture differences between states as well as differences over time as more states implemented anti-predatory lending laws.

In some states, mortgage brokers are subject to different types of occupational licensing laws and regulations.[8] We use the index of mortgage broker regulations constructed by Pahl (2007). In addition, we use the minimum financial requirement for mortgage brokers. For example, states that require a surety bond of $45,000 are assigned a value of 4.5 for that year. Both indices capture differences between states and some changes over time albeit these laws are more stable over time than the anti-predatory lending laws.

[7]The impact and effectiveness of anti-predatory lending laws has been studied by, among others, Ho and Pennington-Cross (2005), Ho and Pennington-Cross (2006) and Li and Ernst (2007).

[8]Pahl (2007) presents a compilation of all state laws and regulations between 1996 and 2006. Kleiner and Todd (2007) study the impact of occupational licensing on employment and earnings of mortgage brokers and the outcomes for borrowers.

To capture more differences between markets we also include some regional and zip-code level variables. We include the percent of the population in a given zip code who is white. Much of the evidence of predatory lending practices that spurred the new legislation came from areas with larger minority populations where subprime lending often was more prevalent.

Goetzmann, Peng, and Yen (2009) report evidence of house price appreciation having an effect on both the demand and supply of mortgages in the subprime market. In our setting, a positive demand effect may increase borrowers' willingness to pay for a mortgage which has the same effect as increasing the broker's bargaining power. We use the FHA house price index to construct a variable that measures the lagged three-year house price appreciation for each of the census divisions. We normalize the appreciation relative to the national index and demean it.

4.3. Estimates for baseline specification

Table 5 reports the point estimates and associated standard errors for the stochastic frontier model applied to our cleaned sample. The coefficients in the frontier model are estimated precisely. We only include first lien loans that do not appear to match with any second lien loans in our sample. We refer to such first lien loans as stand-alone first lien loans. The specification allows the cost to vary across the years and geographic location. The estimate for the constant is approximately \$3,600. The estimates for the geographic location dummies suggests that costs in California, which is our benchmark, are approximately \$1,000 higher than in the other western states, Florida and the Northeast, and approximately \$1,300-\$1,500 higher than the costs in Southern States, Texas, and the Midwest. The estimates for the year dummies show evidence of higher costs in 2001 to 2005 with other years showing smaller deviations from the benchmark level in 1997.

The second column of Table 5 reports the estimates for the broker profit function, and Figure 5 plots the distribution of estimated broker profits. The constant is positive and significantly different from zero providing evidence of broker market power. The

estimates for the geographic location dummies suggest that profits are, other things equal, higher outside California by between 15% and 40%. The estimates for the year dummies suggest that profits declined from 1997, the baseline year, until 2006 consistent with either more competition between mortgage brokers or more competition among subprime lenders leading to smaller yield spread premia or both.

The estimates for the coefficients on loan characteristics show that the broker profit increases in the loan amount and the interest rate on the loan. Other attributes of the loan also matter for the broker profits. A hybrid loan implies a 28% increase in the broker profit. Likewise loans with limited documentation or stated documentation increase the profit estimates by 33% and 18% with the strongest effects for smaller size loans. Loans with prepayment penalties also generate higher estimates for broker profits with a marginal effect of 29%. Similarly, the refinancing generates greater profits, with estimated marginal effects of approximately 16%. The effect on profits is almost doubled when the refinancing takes cash out.

The cumulative loan to value ratio and the FICO score have economically small effects on the estimated broker profits. Likewise other borrower characteristics have relatively small impact. Interestingly, brokers with a longer history of originating loans for New Century earn higher profits. The evidence is consistent with the strength of the broker–lender relationship affecting broker profits and that more experienced brokers have higher bargaining power with the borrowers.

The positive and economically significant marginal effects of many mortgage attributes are consistent with higher yield spreads for such products. An alternative interpretation is that brokers have greater bargaining power for loans that are more complex than the baseline fixed-rate mortgage. The greater profits for limited and stated documentation loans may also be interpreted as evidence that brokers have greater bargaining power when interacting with less informed borrowers, borrowers with more limited outside options.

4.4. Robustness

Table 6 reports the point estimates and associated standard errors for the model with regulatory, demographic, and house price variables added to the broker profit function. The first two regulation variables, coverage and restrictions, have negative point estimates suggesting that more comprehensive anti-predatory lending laws or laws with more restrictions are associated with lower broker profits. There are several interpretations of the negative effect. The laws often impose caps on fees and rates implying that both the direct broker fees and the indirect fees earned from the yield spread premium may be capped. The laws often ban or restrict certain loan types or features. For example, prepayment penalties may only be imposed during the first two years of the loan or balloon payments may not be allowed during the first ten years of the loan. Under a stricter regulatory regime the origination may shift to other loan types of loan features or in some cases fewer loans may be originated.

The next two regulation variables, Pahl's index for broker regulation and the minimum financial requirements, have opposite signs. States and periods with a stricter set of overall mortgage broker regulations produce smaller broker profits. Greater financial requirements, on the other hand, have a positive impact on broker profit consistent with a barriers to entry interpretation.

The estimate for the racial composition of the zip code suggests that brokers extract greater profits in markets with greater minority populations. This may reflect both a relative lack of competition in such markets or the fact that there may be more inexperienced borrowers which would give the brokers stronger bargaining power than with a typical borrower.

The estimate for the house price appreciation variable is positive and significant suggesting that brokers earned higher profits from loans originated in regions or during periods following greater than average house price appreciation. One interpretation is that borrowers are more keen to obtain loans in such situations and therefore may be more willing to "over-pay" to obtain a loan equivalent with weaker bargaining power.

Table 7 reports parameter estimates for a stochastic frontier model in which we allow the cost function to depend on location and time dummies, as well as the type of rates:fixed or hybrid, the documentation type, if the loan has a penalty for early refinancing, and if the loan is a refinance or not. While the coefficients on the additional variables economically large and estimated precisely, the general pattern of the coefficients in the one-sided error is similar to results reports in Table 5, except the refinancing penalty has a lower impact on the profits than in the more restrictive model.

In order to further understand the results, Table 8 reports statistics for the fitted values based on the estimates reported in Table 5. The results are broken down by loan type—fixed-rate versus hybrid loans—and by state—California, Florida, and Texas. By comparing the median values of the profits we observe that hybrid loans produce higher profits in all three states and the effects are economically significant. We also observe that the median fraction of broker revenues from broker fees is fairly stable across loans with high broker profits and loans with low broker profits. The finding suggests that the brokers who are able to extract high profits are usually able to obtain both higher fees from the borrower and also higher yield spread premia from the lender.

Table 9 provides further details on broker revenues and estimated broker profits. For mortgages originated in California, it shows that both median broker revenues and broker profits are higher for loans with low documentation (limited and stated docs) and lower for loans with full documentation. Mortgages to finance the purchase of a home produce lower profits than those obtained to refinance an existing mortgage, with cash-out refinancing being the most profitable. We also show that loans with a prepayment penalty are more profitable than those without.

4.5. Issues of Identification

The stochastic frontier model is estimated from the right tail of the revenue distribution. Appendix A reports the moment conditions used in the model. We will have difficulty in fitting the one-sided error term if the distribution of the revenues is a symmetric distribution. Empirically, the distribution is far for symmetric; see Figure 2 for a

graphical illustration of the fact. The coefficients in the one-sided error distribution are identified by the way in which the right tail of the conditional distribution changes with the conditioning variable. Figure 3 provides graphical evidence that the shape of right tail changes with documentation type. Our empirical estimates of the model indicate that the conditional right tail changes with all our conditioning variables.

4.6. The Effects of Broker Profits on Loan Performance

The effects of broker profits on loan performance are illustrated by Figure 6 which plots, for hybrid loans originated in California, the delinquency rate as a function of months from origination by year of origination for full documentation and stated documentation loans. The subplots on the left show the delinquency rates for low broker profit loans and the subplots on the right show corresponding rates for high broker profits loans. The overall effect is that the delinquency rate tends to be higher for higher broker profit loans, once we condition on loan type.

Our earlier results show that many of the conditioning variables are important for the broker profits. To deal with the effect of the conditioning variables, Table 10 reports parameter estimates for a Cox proportional hazard model that relates 60-day loan delinquency to loan, borrower, and broker characteristics and includes the broker profits estimated in Table 6. The marginal effects are positive for broker profits, suggesting that brokers earned high profits on loans that turned out to be riskier ex post. During the 1999-2006 period, an increase in broker profits by 10% was associated with a 2.4% increase in delinquency rates, all else equal. Loans with stated documentation have positive marginal effects consistent with the findings of Jiang, Nelson, and Vytlacil (2009). Hybrid loans also have positive marginal effects. Refinance cash-out mortgages have a negative marginal effect consistent with the findings and interpretation in Chomsisengphet and Pennington-Cross (2006). The positive marginal effect for the fraction of revenue derived from broker fees is consistent with brokers having greater bargaining power with borrowers who turned out to be of worse quality.

5. Conclusion

We study the role of mortgage brokers in the subprime crisis using an extensive sample of loans originated by, formerly, one of the largest subprime loan originators, New Century Financial Corporation. While mortgage brokerage firms originated about 65% of all subprime loans prior to the crisis, the empirical evidence regarding their incentives and contribution to the subprime crisis remains sparse.

Our work sheds light on the incentive structure for mortgage broker by decomposing broker revenue into a cost and profit component. We find evidence consistent with broker market power that is greater for more complex mortgages and for borrowers who may be less informed. We relate the estimated broker profits to future loan delinquency and find that after controlling for other factors, loans associated with higher broker profits have a greater risk of future delinquency. The establishes a link between broker incentives and delinquency risk in the mortgage market.

Prior to the crisis, mortgage brokers were lightly regulated with some states having no regulation at all.[9] We examine the impact of these laws on the broker profits and find evidence consistent with these laws being effective in the sense that brokers extract lower profits on loan originated in states with more comprehensive or tighter laws. We also find evidence that brokers extract smaller profits in states that have stricter regulations of mortgage broker through various licensing requirements. However, in line with the results of Kleiner and Todd (2007) we find that broker profits are higher in states with greater minimum financial requirements consistent with the idea that an unintended consequence of tighter regulation may be to raise barriers to entry. In future work we plan to investigate whether the actual entry and exit of brokers and differences in competitiveness of the brokerage business is consistent with this interpretation.

[9]One of the recommendations of the President's Working Group on Financial Markets (Progress Update on March Policy Statement on Financial Market Developments, October 2008) was a reform of the mortgage origination process. New legislation sets minimum standards for licensing of mortgage brokers for all states.

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A. Moment Conditions for the Stochastic Frontier Model

The model is:

$$f_{ij} + y_{ij} \equiv w_{ij} = z'_{ij}\gamma + \epsilon_{ij} + \xi_{ij}, \tag{A1}$$

with ϵ_{ij} normally distributed with standard deviation σ and ξ_{ij} exponentially distributed with parameter

$$1/\lambda_{iw_{ij}j} = e^{X'_{ij}\beta}, \tag{A2}$$

with both random variables independent of each other:$\epsilon_{ij} \sim \mathcal{N}(0, \sigma^2)$, and $\xi_{ij} \sim \lambda_{ij}e^{-\lambda_{ij}}$.

Define $q_{ij} = \epsilon_{ij} + \xi_{ij}$, we need the density of q_{ij} to compute the log-likelihood function. Using the formula for the cumulative distribution function for sums of independent random variables,

$$\Pr(q_{ij} \leq q) = \int_0^\infty \Phi\left(\frac{q-s}{\sigma}\right) \lambda_{ij}e^{-\lambda_{ij}s}ds, \tag{A3}$$

with Φ the standard normal cdf. Letting ϕ be the standard normal density, the density function for q_{ij} is:

$$\begin{aligned}
\frac{1}{\sigma}\int_0^\infty \phi\left(\frac{q-s}{\sigma}\right) \lambda_{ij}e^{-\lambda_{ij}s}ds. &= \int_0^\infty \frac{1}{\sqrt{2\pi}\sigma} e^{-\frac{(q-s)^2}{2\sigma^2}} \lambda_{ij}e^{-\lambda_{ij}s}ds \\
&= \int_0^\infty \frac{1}{\sqrt{2\pi}\sigma} \lambda_{ij} e^{-\frac{q^2+s^2-2qs+2\sigma^2\lambda_{ij}}{2\sigma^2}} ds \\
&= \int_0^\infty \frac{1}{\sqrt{2\pi}\sigma} \lambda_{ij} e^{-\frac{(s-(q-\sigma^2\lambda_{ij}))^2}{2\sigma^2} - \lambda_{ij}q + \frac{1}{2}\sigma^2\lambda_{ij}^2} ds \\
&= \left(1 - \Phi\left(-\frac{q}{\sigma} + \sigma\lambda_{ij}\right)\right) \lambda_{ij} e^{-\lambda_{ij}q + \frac{1}{2}\sigma^2\lambda_{ij}^2} \\
&= \Phi\left(\frac{q}{\sigma} - \sigma\lambda_{ij}\right) \lambda_{ij} e^{-\lambda_{ij}q + \frac{1}{2}\sigma^2\lambda_{ij}^2}.
\end{aligned} \tag{A4}$$

The third line follows from completing the square, the fourth line from the definition of the normal cdf, and the final line from the symmetry of the normal cdf.

Using the functional form for λ_{ij}, the contribution to the log-likelihood for one observation therefore is

$$\mathcal{L}_{ij}\left(\gamma,\sigma,\beta;w_{ij},X_{ij},Z_{ij}\right)=\ln\left(\Phi\left(\frac{w_{ij}-Z_{ij}\gamma}{\sigma}-\sigma e^{-X_{ij}\beta}\right)\right)$$
$$+\ln\left(e^{-X_{ij}\beta}\right)-e^{-X_{ij}\beta}(w_{ij}-Z_{ij}\gamma)+\frac{1}{2}\sigma^2\left(e^{-X_{ij}\beta}\right)^2. \quad \text{(A5)}$$

Let $(\hat{\gamma},\hat{\sigma},\hat{\beta})$ be the Maximum Likelihood estimates and let $\hat{q}_{ij}$ be the empirical residuals for the model,

$$\hat{q}_{ij}=w_{ij}-Z_{ij}\hat{\gamma}. \quad \text{(A6)}$$

Differentiating the log-likelihood with respect to the parameters to arrive at the moment conditions for the model:

$$\frac{\partial\mathcal{L}}{\partial\gamma}: \quad \sum_{ij}\left(\frac{\phi\left(\frac{\hat{q}_{ij}}{\hat{\sigma}}-\hat{\sigma}e^{-X_{ij}\hat{\beta}}\right)}{\Phi\left(\frac{\hat{q}_{ij}}{\hat{\sigma}}-\hat{\sigma}e^{-X_{ij}\hat{\beta}}\right)}(-1/\hat{\sigma})+e^{-X_{ij}\hat{\beta}}\right)Z_{ij}=0 \quad \text{(A7)}$$

$$\frac{\partial\mathcal{L}}{\partial\sigma}: \quad \sum_{ij}\left(\frac{\phi\left(\frac{\hat{q}_{ij}}{\hat{\sigma}}-\hat{\sigma}e^{-X_{ij}\hat{\beta}}\right)}{\Phi\left(\frac{\hat{q}_{ij}}{\hat{\sigma}}-\hat{\sigma}e^{-X_{ij}\hat{\beta}}\right)}\left(-\frac{\hat{q}_{ij}}{\hat{\sigma}^2}-e^{-X_{ij}\hat{\beta}}\right)+\hat{\sigma}(e^{-X_{ij}\hat{\beta}})^2\right)=0 \quad \text{(A8)}$$

$$\frac{\partial\mathcal{L}}{\partial\beta}: \quad \sum_{ij}\left(\frac{\phi\left(\frac{\hat{q}_{ij}}{\hat{\sigma}}-\hat{\sigma}e^{-X_{ij}\hat{\beta}}\right)}{\Phi\left(\frac{\hat{q}_{ij}}{\hat{\sigma}}-\hat{\sigma}e^{-X_{ij}\hat{\beta}}\right)}\hat{\sigma}-e^{X_{ij}\hat{\beta}}+\hat{q}_{ij}-\hat{\sigma}^2e^{-X_{ij}\hat{\beta}}\right)e^{-X_{ij}\hat{\beta}}X_{ij}=0. \quad \text{(A9)}$$

From the properties of the exponential distribution for ξ_{ij},

$$E[q_{ij}|X_{ij}]=e^{X_{ij}\beta}, \quad \text{(A10)}$$

and the joint distribution of ϵ_{ij} and ξ_{ij}

$$E[\epsilon_{ij}|q_{ij}] = \frac{\phi\left(\frac{\hat{q}_{ij}}{\hat{\sigma}} - \hat{\sigma}e^{-X_{ij}\hat{\beta}}\right)}{\Phi\left(\frac{\hat{q}_{ij}}{\hat{\sigma}} - \hat{\sigma}e^{-X_{ij}\hat{\beta}}\right)} q_{ij}. \tag{A11}$$

We can interpret

$$\left(\frac{\phi\left(\frac{\hat{q}_{ij}}{\hat{\sigma}} - \hat{\sigma}e^{-X_{ij}\hat{\beta}}\right)}{\Phi\left(\frac{\hat{q}_{ij}}{\hat{\sigma}} - \hat{\sigma}e^{-X_{ij}\hat{\beta}}\right)}(-1/\hat{\sigma}) + e^{-X_{ij}\hat{\beta}}\right)$$

and

$$\left(\frac{\phi\left(\frac{\hat{q}_{ij}}{\hat{\sigma}} - \hat{\sigma}e^{-X_{ij}\hat{\beta}}\right)}{\Phi\left(\frac{\hat{q}_{ij}}{\hat{\sigma}} - \hat{\sigma}e^{-X_{ij}\hat{\beta}}\right)}\hat{\sigma} - e^{X_{ij}\hat{\beta}} + \hat{q}_{ij} - \hat{\sigma}^2 e^{-X_{ij}\hat{\beta}}\right)$$

as generalized residuals for the model, which must be orthogonal to the conditioning information.

Table 1: **Loan Characteristics at Origination by Vintage Year** The table reports descriptive statistics for the New Century loan sample, covering the period from 1997 to 2006.

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
					Number of loans (×1000)					
Funded	19	35	40	38	45	94	164	243	306	327
Declined	10	40	47	43	25	20	81	62	55	65
Withdrawn	21	44	28	14	21	56	105	309	403	278
					Origination channel (Percentage of funded loans)					
Retail	35	32	30	30	24	16	11	12	15	19
Correspondent	12	14	11	9	5	6	9	12	14	13
Broker	53	54	59	61	71	78	79	76	71	68
					Number of brokers with loans originated for NCEN (×1000)					
Number of brokers	1.7	3.2	4.9	5.3	5.9	9.8	15.3	21.3	26.7	29.4
					Loan program (Percentage of funded broker loans)					
FRM	26	39	35	27	20	29	36	42	41	31
Hybrid	74	61	65	73	80	71	64	58	57	62
Balloon	0	0	0	0	0	0	0	0	1	3
FHA/FNMA/FHLMC	0	0	0	0	0	0	0	0	1	4
					Loan purpose (Percentage of funded broker loans)					
Purchase	19	32	24	23	22	21	30	46	53	53
Refinancing (cash out)	58	51	58	60	60	62	59	49	38	37
Refinancing (no cash)	23	17	17	17	18	17	11	5	8	9
					Documentation type (Percentage of funded broker loans)					
Full docs	69	63	65	66	60	61	60	52	55	58
Limited docs	0	0	0	5	8	5	4	4	2	1
Stated docs	31	37	35	29	32	34	36	44	43	41
					Average characteristics for funded broker loans					
Loan amt (×1000)	108	100	108	115	147	156	169	175	184	191
FICO	606	602	596	584	582	592	608	627	633	630
LTV (%)	71	73	72	70	76	77	76	70	66	67
D/I ratio (%)	27	26	27	29	28	28	28	30	31	30
Prepay penalty (%)	63	71	76	83	83	80	79	76	69	64
APR (%)	12.3	11.6	12.0	12.7	10.6	9.2	8.2	8.3	9.3	10.6
Mortgage rate (%)	9.9	10.1	10.3	11.1	9.7	8.5	7.7	7.6	8.0	8.9

Table 2: **Broker Compensation by Vintage Year** The table reports the average yield spread premium, total broker fees, and broker revenues as a percentage of the funded loan amount by origination year. We also report the number of brokers doing business with New Century. The sample includes all broker-originated loans funded by New Century, and covers the time period 1997–2006. The first panel reports results for all broker-originated loans, and the next panels condition on loan type and documentation level.

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
					All funded broker loans					
YSP	2.1	1.8	1.6	1.6	1.4	1.3	1.3	1.3	1.1	1.1
Total fees	2.9	2.9	2.9	2.7	2.4	2.2	1.9	1.7	1.4	1.4
Broker revenue	5.1	4.7	4.5	4.3	3.8	3.5	3.2	3.0	2.5	2.5
# brokers (× 1000)	1.7	3.2	4.9	5.3	5.9	9.8	15.3	21.3	26.7	29.4
					FRMs with full docs					
YSP	1.9	1.8	1.6	1.6	1.4	1.3	1.2	1.1	1.0	1.0
Total fees	3.5	3.4	3.6	3.3	2.9	2.5	2.2	2.0	1.7	1.7
Broker revenue	5.4	5.2	5.2	4.9	4.3	3.8	3.4	3.1	2.7	2.7
# brokers (× 1000)	0.6	1.4	2.0	1.7	1.7	4.2	8.4	11.3	13.8	13.5
					FRMs with stated docs					
YSP	1.8	1.8	1.6	1.6	1.4	1.2	1.2	1.1	0.9	1.0
Total fees	3.5	3.2	3.1	3.0	2.6	2.4	2.2	1.9	1.6	1.7
Broker revenue	5.3	5.0	4.7	4.6	4.0	3.6	3.4	3.0	2.5	2.7
# brokers (× 1000)	0.3	1.0	1.2	0.8	0.9	2.3	5.0	8.9	11.4	10.6
					Hybrid loans with full docs					
YSP	2.2	1.8	1.6	1.6	1.4	1.4	1.4	1.5	1.2	1.1
Total fees	2.7	2.7	2.7	2.7	2.5	2.2	1.9	1.8	1.5	1.4
Broker revenue	5.0	4.5	4.3	4.3	3.8	3.6	3.3	3.2	2.7	2.5
# brokers (× 1000)	1.3	2.0	3.3	3.7	4.1	6.8	10.7	13.2	16.4	19.3
					Hybrid loans with stated docs					
YSP	2.1	1.8	1.5	1.6	1.3	1.3	1.3	1.4	1.1	1.1
Total fees	2.8	2.7	2.5	2.4	2.2	2.0	1.8	1.6	1.3	1.3
Broker revenue	4.9	4.5	4.1	4.0	3.6	3.3	3.1	3.0	2.4	2.4
# brokers (× 1000)	0.8	1.5	2.3	2.5	3.1	5.5	9.4	13.3	15.7	18.0

Table 3: **Loan Characteristics at Origination by Vintage Year for the Cleaned Sample** The table reports descriptive statistics for the cleaned New Century loan sample. The cleaned sample covers the period from 1997 to 2006 and includes all funded broker-originated stand-alone first lien for which data on broker fees, yield spread premia, loan type, purpose, loan amount, initial mortgage rate, FICO score, combined loan to value ratio, documentation level, the borrower's age and marital status are available. This leaves us with a final set of 385,984 records.

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
					Loan program					
FRM	0.16	0.31	0.25	0.15	0.14	0.23	0.26	0.23	0.26	0.24
Hybrid	0.84	0.69	0.75	0.85	0.86	0.77	0.74	0.77	0.74	0.76
					Loan purpose					
Purchase	0.23	0.37	0.29	0.27	0.24	0.22	0.28	0.32	0.3	0.39
Refi (cash out)	0.55	0.46	0.54	0.55	0.59	0.62	0.61	0.62	0.62	0.53
Refi (no cash out)	0.22	0.17	0.17	0.18	0.17	0.16	0.11	0.06	0.08	0.08
					Documentation type					
Full	0.7	0.62	0.65	0.65	0.6	0.6	0.6	0.54	0.61	0.62
Limited	0	0	0	0.05	0.08	0.05	0.04	0.04	0.02	0.01
Stated	0.3	0.38	0.35	0.3	0.32	0.34	0.36	0.42	0.37	0.37
					Fraction of loans seviced by NCEN/OCWEN					
	0.00	0.00	1.00	1.00	0.45	0.30	1.00	1.00	1.00	1.00
					Average loan characteristics					
Loan amt (× 1000)	99	94	107	118	141	154	173	183	183	161
FICO	598	596	590	578	578	586	600	609	603	599
CLTV (%)	74	79	78	77	78	79	82	82	80	83
D/I ratio (%)	26	25	26	28	28	28	28	29	28	28
Prepay penalty	0.55	0.69	0.75	0.86	0.83	0.81	0.81	0.75	0.70	0.64
APR (%)	12.5	11.8	12.2	12.7	10.8	9.3	8.2	8.1	9.1	10.8
Mortgage rate (%)	10.2	10.3	10.6	11.3	10.0	8.7	7.8	7.5	7.9	9.1

Table 4: **List of Variables** The table provides the definition of the conditioning variables used to estimate the stochastic frontier model.

Variable	Description
	Location Indicators
FL	Loans originated in Florida
TX	Loans originated in Texas
West w/o CA	Loans originated in the West outside CA
South w/o FL, TX	Loans originated in South outside FL and TX
MidWest	Loans originated in Midwest
NorthEast	Loans originated in Northeast
Year dummies for loans originated in 1998—2006 with 1997 as the baseline	
	Loan Characteristics
Loan amount	Loan Amount in dollars
Rate	Loan Interest Rate
Hybrid	Indicator for Hybrid Loans
Limited doc	Indicator for Limited Documentation
Stated doc	Indicator for Stated Documentation
Prepay penalty dummy	Indicator for loans with Prepayment Penalty
Refi	Indicator for refinancing
Refi w/ cash out	Indicator for cash-out refinancing
CLTV	Cumulative Loan to Value Ratio
	Borrower Characteristics
FICO	FICO Score
Borrower age	Borrower's Age
One Borrower	Indicator for either separated or unmarried borrower
	Regulation
Regulation (coverage)	Index of coverage of anti-predatory lending laws
Regulation (restrictions)	Index of restrictions of anti-predatory lending laws both based on Ho and Pennington-Cross (2006)
Regulation (brokers, Pahl)	Index of mortgage broker regulation
Regulation (brokers, KT)	Minimum financial requirements for mortgage brokers following Kleiner and Todd (2007) and Pahl (2007)
	Regional/zip-code Characteristics
Racial composition (% white in zip)	% White population in zip-code (Census)
house price appreciation	Lagged abnormal three-year cumulative house price Appreciation, based on FHA house price index for Census divisions
Broker experience	Indicator for Broker with history of 6+ months w/ New Century

Table 5: **Broker profits** The table reports parameter estimates for the stochastic frontier model developed in Section 3 and equations 16 and 17. The dependent variable is broker revenue, computed as the sum of total broker fees plus yield spread premium. The estimates for the cost function are reported in the first two columns. The average cost is $2864.1. The last two columns show the estimated specification of broker profits. The sample includes all stand-alone broker-originated first liens, and covers the from 1997 to 2006. The benchmark set contains all CA fixed-rate mortgage originated in 1997.

	Cost		Profit	
	Estimate	Std. err.	Estimate	Std. err.
Constant	3651.0	(37.93)	136.1150	(7.6905)
FL	-1078.0	(13.18)	0.3195	(0.0096)
TX	-1470.0	(13.08)	0.3410	(0.0119)
West w/o CA	-958.5	(12.44)	0.1685	(0.0088)
South w/o FL, TX	-1398.0	(11.86)	0.3685	(0.0089)
MidWest	-1293.0	(10.45)	0.1770	(0.0082)
NorthEast	-965.4	(12.25)	0.3020	(0.0080)
1998	-199.4	(41.16)	-0.0985	(0.0328)
1999	-86.1	(40.54)	-0.1875	(0.0319)
2000	70.9	(40.81)	-0.3130	(0.0319)
2001	256.3	(39.42)	-0.3415	(0.0308)
2002	417.3	(37.94)	-0.3355	(0.0299)
2003	461.5	(37.56)	-0.3945	(0.0300)
2004	581.9	(37.54)	-0.4190	(0.0300)
2005	416.2	(37.65)	-0.4385	(0.0300)
2006	283.9	(38.01)	-0.5570	(0.0301)
Loan amount			0.8745	(0.0035)
Rate			0.0775	(0.0022)
Hybrid			0.2800	(0.0051)
Limited doc			0.3260	(0.0236)
Stated doc			0.1795	(0.0092)
Loan amt × limited doc			-0.1900	(0.0101)
Loan amt × stated doc			-0.1035	(0.0043)
Prepay penalty dummy			0.2875	(0.0052)
Refi			0.1640	(0.0075)
Refi w/ cash out			0.1520	(0.0066)
CLTV			0.0019	(0.0002)
FICO			-0.0008	(0.0001)
FICO $\geq$ 620			0.0019	(0.0068)
Borr age			0.0050	(0.0002)
Borr separated			-0.0495	(0.0223)
Borr not married			-0.0122	(0.0040)
Brk experience			0.0498	(0.0042)
$\log(\sigma_C^2)$	13.88	(0.0057)		
Observations	385,984			

Table 6: **Broker profits-alternative specification** The table reports parameter estimates for the stochastic frontier model developed in Section 3 and equations 16 and 17. The dependent variable is broker revenue, computed as the sum of total broker fees plus yield spread premium. The estimates for the cost function are reported in the first two columns. The average cost is $2864.1. The last two columns show the estimated specification of broker profits. The sample includes all stand-alone broker-originated first liens, and covers the from 1997 to 2006. The benchmark set contains all CA fixed-rate mortgage originated in 1997.

	Cost		Profit	
	Estimate	Std. err.	Estimate	Std. err.
Constant	3647.0	(38.22)	195.3905	(11.3326)
FL	-1077.0	(13.25)	0.4160	(0.0133)
TX	-1477.0	(13.15)	0.4055	(0.0134)
West w/o CA	-958.8	(12.53)	0.1570	(0.0104)
South w/o FL, TX	-1388.0	(11.89)	0.3620	(0.0106)
MidWest	-1300.0	(10.50)	0.2145	(0.0098)
NorthEast	-947.7	(12.28)	0.3600	(0.0098)
1998	-197.0	(41.47)	-0.0920	(0.0329)
1999	-83.1	(40.83)	-0.1745	(0.0320)
2000	79.0	(41.08)	-0.2900	(0.0321)
2001	264.0	(39.71)	-0.3175	(0.0310)
2002	425.5	(38.23)	-0.2850	(0.0302)
2003	468.4	(37.85)	-0.3170	(0.0303)
2004	594.6	(37.83)	-0.3340	(0.0304)
2005	429.4	(37.95)	-0.3495	(0.0303)
2006	290.8	(38.30)	-0.4500	(0.0305)
Loan amount			0.8890	(0.0036)
Rate			0.0715	(0.0023)
Hybrid			0.2830	(0.0052)
Limited doc			0.3565	(0.0239)
Stated doc			0.1915	(0.0093)
Loan amt × limited doc			-0.1965	(0.0102)
Loan amt × stated doc			-0.1085	(0.0044)
Prepay penalty dummy			0.2640	(0.0055)
Refi			0.1660	(0.0076)
Refi w/ cash out			0.1400	(0.0067)
CLTV			0.0018	(0.0002)
FICO			-0.0008	(0.0001)
FICO $\geq$ 620			-0.0008	(0.0069)
Borrower age			0.0047	(0.0002)
One Borrower			-0.0331	(0.0040)
Regulation (coverage)			-0.0151	(0.0012)
Regulation (restrictions)			-0.0145	(0.0012)
Regulation (brokers, Pahl)			-0.0245	(0.0018)
Regulation (brokers, KT)			0.0076	(0.0013)
Racial composition (% white in zip)			-0.3005	(0.0080)
House price appreciation			0.2165	(0.0510)
Broker experience			0.0515	(0.0043)
$\log(\sigma_c^2)$	13.88	(0.0057)		
Observations	381,333			

Table 7: **Broker profits-alternative specification of the cost function** The table reports parameter estimates for the stochastic frontier model developed in Section 3 and equations 16 and 17. The dependent variable is broker revenue, computed as the sum of total broker fees plus yield spread premium. The estimates for the cost function are reported in the first two columns. The last two columns show the estimated specification of broker profits. The sample includes all stand-alone broker-originated first liens, and covers the from 1997 to 2006. The benchmark set contains all CA fixed-rate mortgage originated in 1997.

	Cost		Profit	
	Estimate	Std. err.	Estimate	Std. err.
Constant	2927.0	(39.39)	281.4627	(16.3248)
FL	-1020.0	(13.16)	0.3795	(0.0132)
TX	-1269.0	(14.06)	0.3015	(0.0137)
West w/o CA	-916.5	(12.5)	0.1380	(0.0104)
South w/o FL, TX	-1261.0	(12.1)	0.3075	(0.0106)
MidWest	-1265.0	(10.64)	0.1955	(0.0098)
NorthEast	-840.9	(12.51)	0.3040	(0.0099)
1998	-132.7	(41.17)	-0.1225	(0.0329)
1999	-98.6	(40.54)	-0.1660	(0.0320)
2000	0.2	(40.83)	-0.2555	(0.0321)
2001	191.0	(39.47)	-0.2845	(0.0310)
2002	373.3	(37.98)	-0.2630	(0.0302)
2003	443.7	(37.6)	-0.3085	(0.0303)
2004	572.3	(37.58)	-0.3255	(0.0304)
2005	422.0	(37.68)	-0.3470	(0.0303)
2006	297.4	(38.05)	-0.4565	(0.0305)
Loan amt			0.8920	(0.0036)
Rate			0.0725	(0.0023)
Hybrid	368.9	(7.51)	0.1025	(0.0063)
Limited doc	-6.3	(19.73)	0.3635	(0.0276)
Stated doc	12.0	(7.10)	0.1905	(0.0108)
Loan amt × limited doc			-0.1985	(0.0106)
Loan amt × stated doc			-0.1105	(0.0046)
Prepay penalty dummy	192.0	(7.836)	0.1720	(0.0067)
Refi	266.4	(11.1)	0.0404	(0.0094)
Refi w/ cash out	143.5	(10.33)	0.0790	(0.0084)
CLTV			0.0019	(0.0002)
FICO			-0.0009	(0.0001)
FICO $\geq$ 620			-0.0017	(0.0069)
Borrower age			0.0047	(0.0002)
One borrower			-0.0354	(0.0040)
Regulation (coverage)			-0.0152	(0.0012)
Regulation (restrictions)			-0.0139	(0.0012)
Regulation (brokers, Pahl)			-0.0234	(0.0018)
Regulation (brokers, KT)			0.0063	(0.0013)
House price appreciation			0.1835	(0.0510)
Racial composition (% white in zip)			-0.2985	(0.0080)
Broker experience			0.0515	(0.0043)
$\log(\sigma_c^2)$	13.87	(0.0057)		
Observations	381,333			

Table 8: **Broker profits** The table reports summary statistics on broker revenues, total fees and yield spread premia (rows one through three), and broker costs and profits all measured in $ as estimated in Table 5 (rows four and five). The last two rows report descriptive statistics for total broker fees, as a fraction of broker revenue, for loans with low broker profits (bottom profit quartile) and high broker profits (top profit quartile). Results are reported for California, Florida, and Texas, and cover the sample period 1997 to 2006.

	FIX							HYBRID						
	mean	std dev	1%	25%	median	75%	99%	mean	std dev	1%	25%	median	75%	99%
							California							
Brk revenue	6385	3003	1594	4300	5850	7889	16150	7481	3471	1955	3714	6860	9256	18695
Fees	4341	2472	411	2716	3965	5520	12656	4658	2657	405	2895	4255	5950	13385
YSP	2044	1471	0	1024	1720	2750	6975	2823	1769	0	1581	2453	3680	8740
Brk costs	4088	152	3451	4067	4112	4233	4233	4073	156	3451	4067	4112	4112	4233
Brk profits	2370	2580	215	584	1342	3300	11910	3386	3199	270	942	2344	4854	14551
				Low profits							Low profits			
Brk fees/rev	0.67	0.2	0.1	0.57	0.71	0.79	1	0.58	0.21	0.07	0.49	0.62	0.73	1
				High profits							High profits			
Brk fees/rev	0.68	0.18	0.12	0.57	0.7	0.79	1	0.63	0.15	0.15	0.54	0.63	0.74	1
							Florida							
Brk revenue	4396	2208	1200	2923	3960	5323	12165	5203	2784	1315	3310	4600	6376	15179
Fees	3111	1757	295	1925	2829	3995	8910	3226	2088	83	1835	2859	4175	10437
YSP	1285	1051	0	650	1050	1620	5320	1977	1414	0	1050	1634	2511	7200
Brk costs	2954	189	2373	2989	2989	3034	3154	2973	157	2373	2989	3034	3155	3155
Brk profits	1466	1786	266	492	802	1642	8851	2221	2456	309	659	1250	2858	12109
				Low profits							Low profits			
Brk fees/rev	0.67	0.2	0.05	0.57	0.7	0.81	1	0.57	0.22	0	0.43	0.6	0.72	1
				High profits							High profits			
Brk fees/rev	0.71	0.17	0.14	0.61	0.73	0.82	1	0.62	0.18	0.07	0.53	0.64	0.74	1
							Texas							
Brk revenue	3471	1722	1051	2412	3113	4100	9745	4338	2587	1051	2760	3724	5081	14940
Fees	2177	1195	119	1463	1955	2670	6252	2476	1670	25	1500	2150	3024	8885
YSP	1294	872	0	770	1120	1600	4606	1862	1323	0	1054	1552	2240	7225
Brk costs	2573	165	1981	2464	2598	2642	2762	2551	185	1981	2464	2597	2642	2762
Brk profits	955	1303	269	405	550	907	6738	1730	2311	317	557	871	1811	12229
				Low profits							Low profits			
Brk fees/rev	0.62	0.19	0	0.54	0.6	0.74	1	0.55	0.2	0	0.45	0.58	0.67	1
				High profits							High profits			
Brk fees/rev	0.62	0.15	0.14	0.55	0.6	0.72	1	0.56	0.15	0.07	0.48	0.58	0.65	0.88

Table 9: **Broker Revenues and Estimated Profits in California for Different Loan Types** This table reports the broker revenues and estimated broker profits as estimated in Table 5 for different types of loans originated in California during the sample period from 1997 to 2006. The revenues and profits are measure in dollars.

	Mean	Std. Dev.	5%	25%	Median	75%	95%
All Mortgages							
Revenue	7228.86	3400.15	2895.80	4832.00	6613.40	8950.00	13702.50
Profits	3152.17	3097.56	355.19	824.07	2070.44	4513.90	9457.39
Fixed Rate							
Revenue	6385.03	3003.22	2520.00	4300.00	5850.00	7888.75	11979.50
Profits	2370.18	2580.25	289.88	584.22	1341.79	3300.43	7642.95
Hybrid Rate							
Revenue	7481.43	3470.60	3055.00	5022.00	6860.00	9256.25	14120.00
Profits	3386.22	3199.42	389.01	941.70	2344.40	4853.85	9881.73
Full Doc							
Revenue	7030.38	3272.90	2860.00	4725.95	6425.00	8677.21	13250.00
Profits	2967.55	2961.58	344.19	776.23	1892.14	4224.10	8994.19
Limited Documentation							
Revenue	7430.10	3511.13	2945.00	4951.00	6819.75	9221.50	14109.00
Profits	3338.83	3215.37	367.19	887.37	2274.59	4799.66	9851.77
Stated Documentation							
Revenue	7750.56	3677.64	3007.50	5089.50	7147.50	9678.00	14907.75
Profits	3641.22	3406.43	401.63	977.80	2627.68	5259.93	10541.82
Purchase							
Revenue	6751.14	3333.49	2550.00	4374.00	6110.00	8410.00	13120.50
Profit	2772.02	2936.56	308.22	651.47	1598.35	3970.74	8837.44
No Cash Out Refinancing							
Revenue	6886.43	3344.71	2773.00	4530.00	6202.13	8500.00	13169.00
Profit	2898.62	3024.85	338.99	709.90	1733.57	4081.55	9006.82
Cash Out Refinancing							
Revenue	7419.52	3409.47	3069.00	5020.00	6817.50	9135.00	13932.96
Profit	3301.71	3143.01	380.57	914.86	2269.20	4701.61	9679.05
No Prepayment Penalty							
Revenue	6806.25	3639.60	2307.50	4222.75	6062.50	8592.21	13711.50
Profit	2958.68	3218.92	301.92	652.80	1675.48	4215.34	9541.55
Prepayment Penalty							
Revenue	7244.70	3389.85	2928.00	4850.00	6630.00	8960.00	13702.50
Profit	3159.42	3092.70	357.54	832.66	2084.20	4525.66	9457.05

Table 10: **Broker Profits and Loan Performance** Parameter estimates for a Cox proportional hazard model for 60-day delinquency which adds the logarithm of the broker profits estimated in Table 6 as an explanatory variable. The sample includes all stand-alone broker-originated first liens, and covers the period from 1999 to 2006. The benchmark set contains all CA fixed-rate mortgages originated in 1999.

Cox Proportional Hazard Model for 60-day delinquency
$h(t|X) = h(t) \times exp(X\beta)$

	I	II	III		I	II	III
FL	-0.195	-0.225	-0.200	PPP	0.023	0.108	0.107
	(0.047)	(0.048)	(0.048)		(0.019)	(0.019)	(0.019)
TX	0.042	-0.0874	-0.046	Refi	-0.029	-0.027	-0.035
	(0.044)	(0.044)	(0.045)		(0.026)	(0.026)	(0.026)
West	0.034	0.023	0.036	Refi cash out	-0.148	-0.080	-0.080
	(0.040)	(0.040)	(0.040)		(0.024)	(0.024)	(0.024)
South	0.169	0.099	0.117	CLTV	0.015	0.014	0.014
	(0.040)	(0.041)	(0.041)		(0.001)	(0.001)	(0.001)
MidWest	0.261	0.189	0.210	FICO	-0.008	-0.006	-0.006
	(0.038)	(0.038)	(0.039)		(0.000)	(0.000)	(0.000)
NorthEast	0.133	0.0741	0.0930	FICO $\geq$ 620	-0.136	-0.143	-0.144
	(0.037)	(0.037)	(0.037)		(0.027)	(0.028)	(0.028)
2000	0.0862	-0.168	-0.179	Borr age	-0.010	-0.011	-0.011
	(0.035)	(0.036)	(0.036)		(0.001)	(0.001)	(0.001)
2001	0.238	0.315	0.307	One borr	0.163	0.175	0.176
	(0.041)	(0.041)	(0.041)		(0.015)	(0.015)	(0.015)
2002	-0.250	0.247	0.260	% White pop	-0.257	-0.221	-0.213
	(0.039)	(0.041)	(0.041)		(0.028)	(0.028)	(0.028)
2003	-0.386	0.291	0.312	Brk exp	-0.015	-0.006	-0.006
	(0.034)	(0.039)	(0.039)		(0.016)	(0.016)	(0.016)
2004	-0.224	0.503	0.529	Reg: covg	-0.050	-0.043	-0.043
	(0.031)	(0.037)	(0.037)		(0.005)	(0.005)	(0.005)
2005	0.0737	0.702	0.713	Reg: restr	0.042	0.041	0.041
	(0.031)	(0.035)	(0.035)		(0.004)	(0.004)	(0.004)
2006	0.413	0.697	0.690	Reg: Pahl	-0.020	-0.016	-0.018
	(0.038)	(0.039)	(0.039)		(0.006)	(0.006)	(0.006)
Log loan amt	-0.364	-0.0598	0.009	Reg: KT	0.011	0.007	0.009
	(0.023)	(0.024)	(0.027)		(0.004)	(0.004)	(0.004)
Hybrid	0.220	0.300	0.320	HP appr	-0.432	-0.133	-0.153
	(0.021)	(0.021)	(0.021)		(0.187)	(0.188)	(0.188)
Limited doc	0.048	-0.014	-0.015	Log brk prft	0.249	0.152	0.123
	(0.046)	(0.046)	(0.046)		(0.013)	(0.013)	(0.014)
Stated doc	0.362	0.148	0.136	Rate		0.317	0.332
	(0.016)	(0.017)	(0.017)			(0.008)	(0.008)
				Fees/revenue			0.270
							(0.045)
Obs	315,947	315,947	315,837				

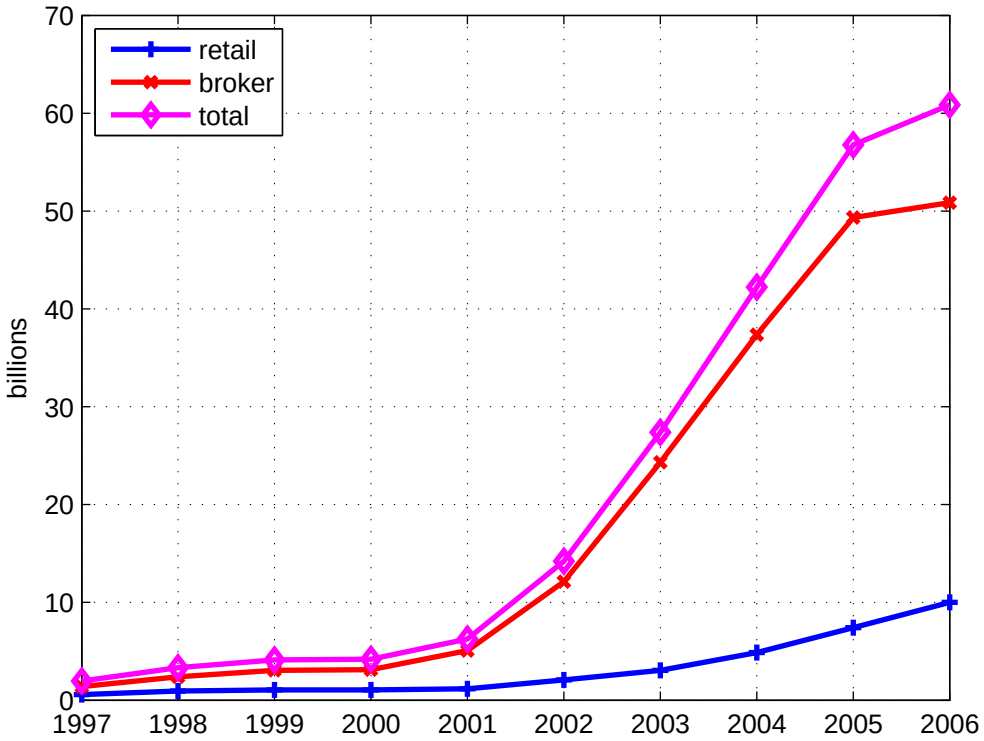
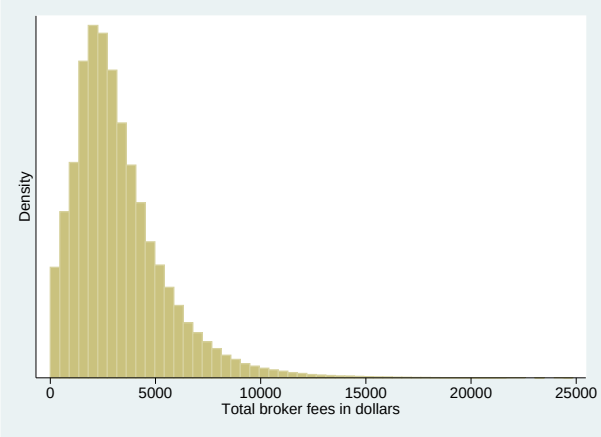
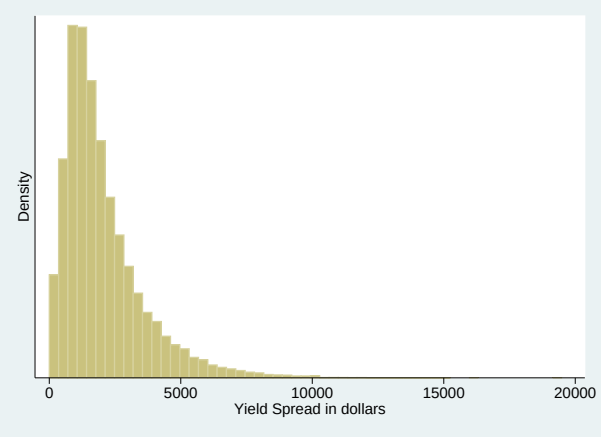


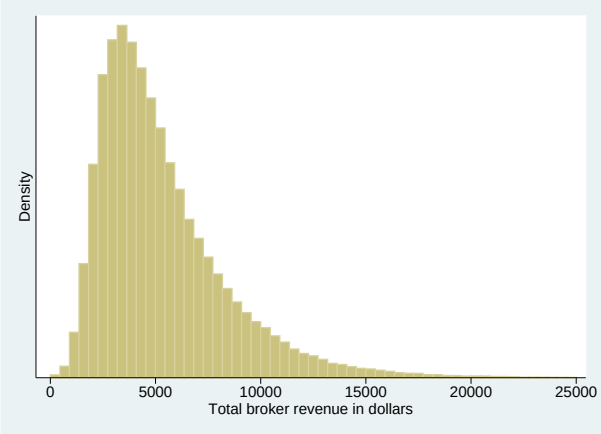
Figure 1: **Origination volume.** Annual loan amount funded by New Century from 1997 to 2006.



Panel a: Fixed fees.

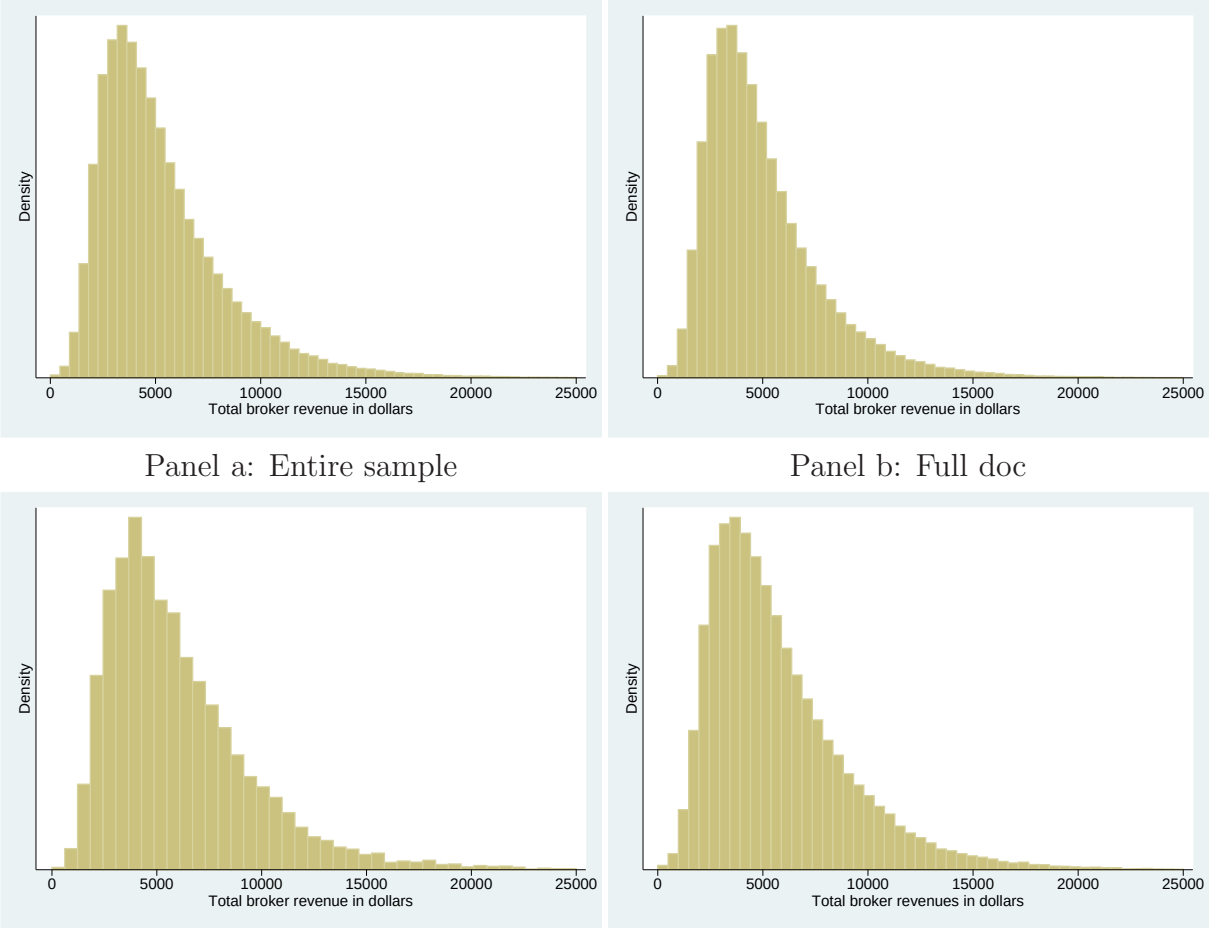


Panel b: Yield spread



Panel c: Brokers total revenues

Figure 2: **Broker revenues:** The figures report the unconditional distribution of broker fees, yields spreads, and the total broker revenues for stand-alone first lien mortgages in our sample.



Panel a: Entire sample

Panel b: Full doc

Panel c: Limited documentation

Panel d: Stated documentation

Figure 3: **Broker revenues across document types** The figures report the unconditional distribution of broker revenues, and the distributions of the broker revenues conditional on the documentation type of the loan.

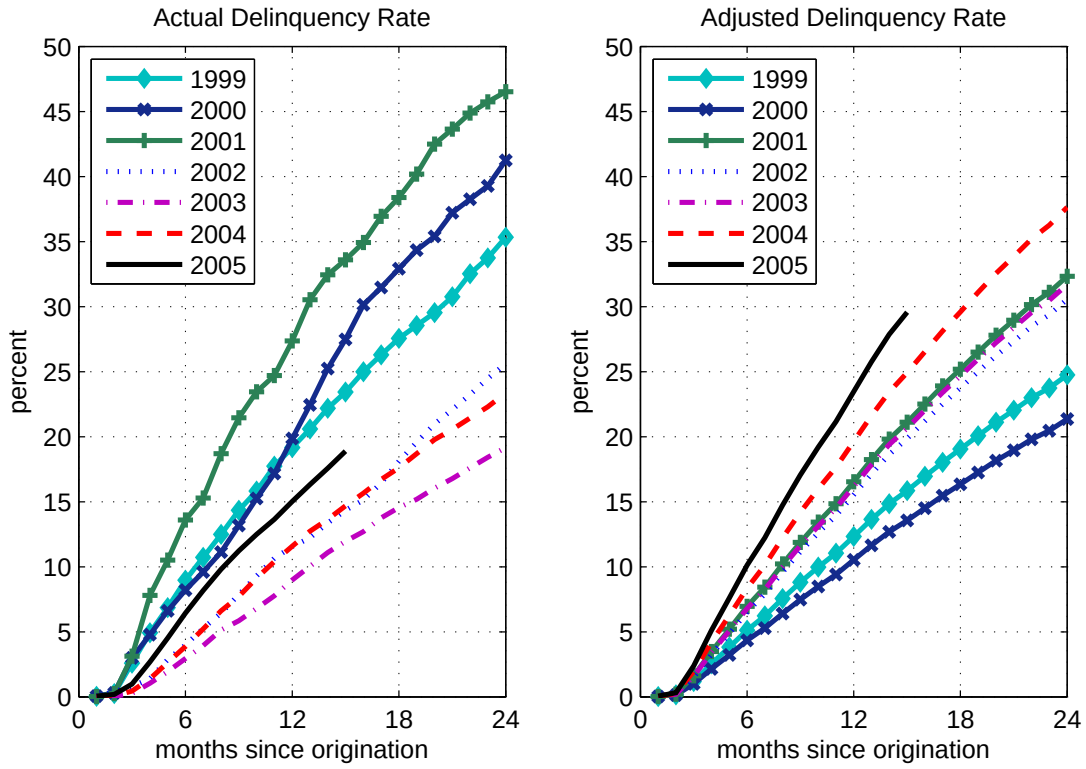


Figure 4: **Delinquency.** Percent of loans delinquent as a function of months from origination by year of origination for stand-alone first lien mortgages in our sample. The actual delinquency rate (left panel) is defined as the cumulative fraction of loans that were past due 60 or more days, in foreclosure, real-estate owned, or defaulted, at or before a given age. The adjusted delinquency rate (right panel) is obtained by adjusting the actual rate for year-by-year variation in loan, borrower and broker characteristics, regulation variables, mortgage rates, and house price appreciation.

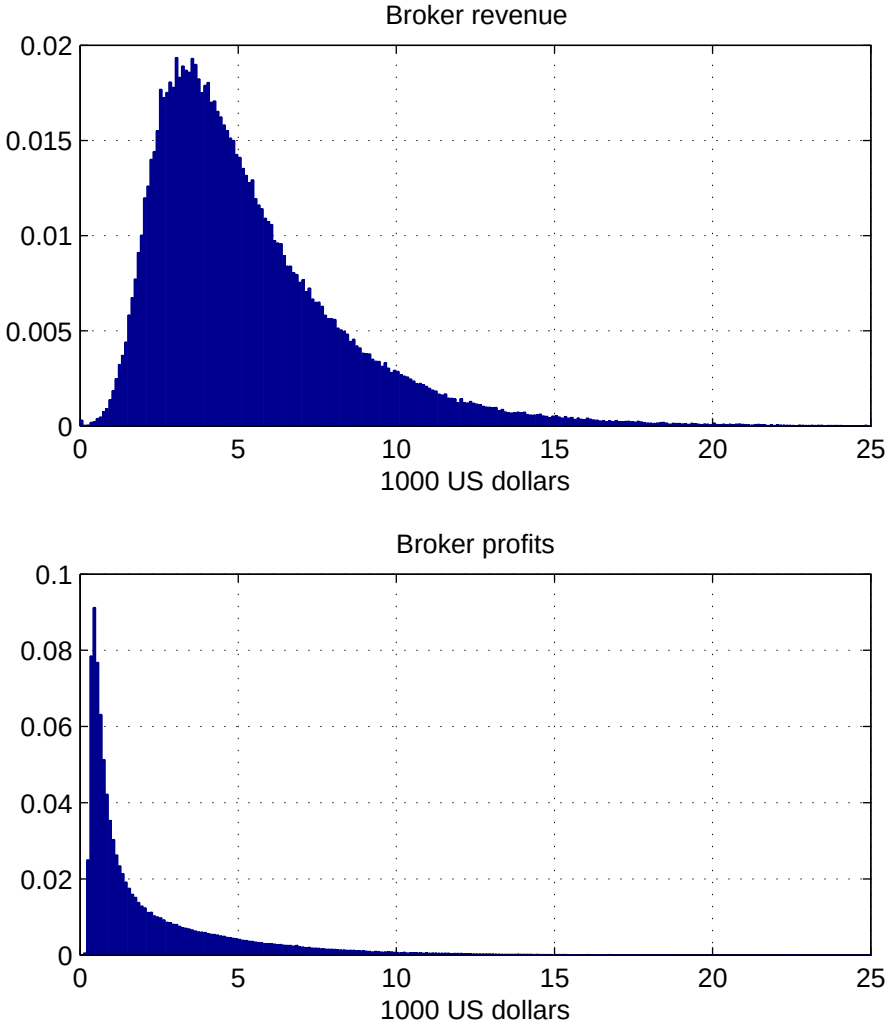


Figure 5: **Broker revenues and profits.** Distribution of broker revenues and estimated broker profits for the specification in Table 5.

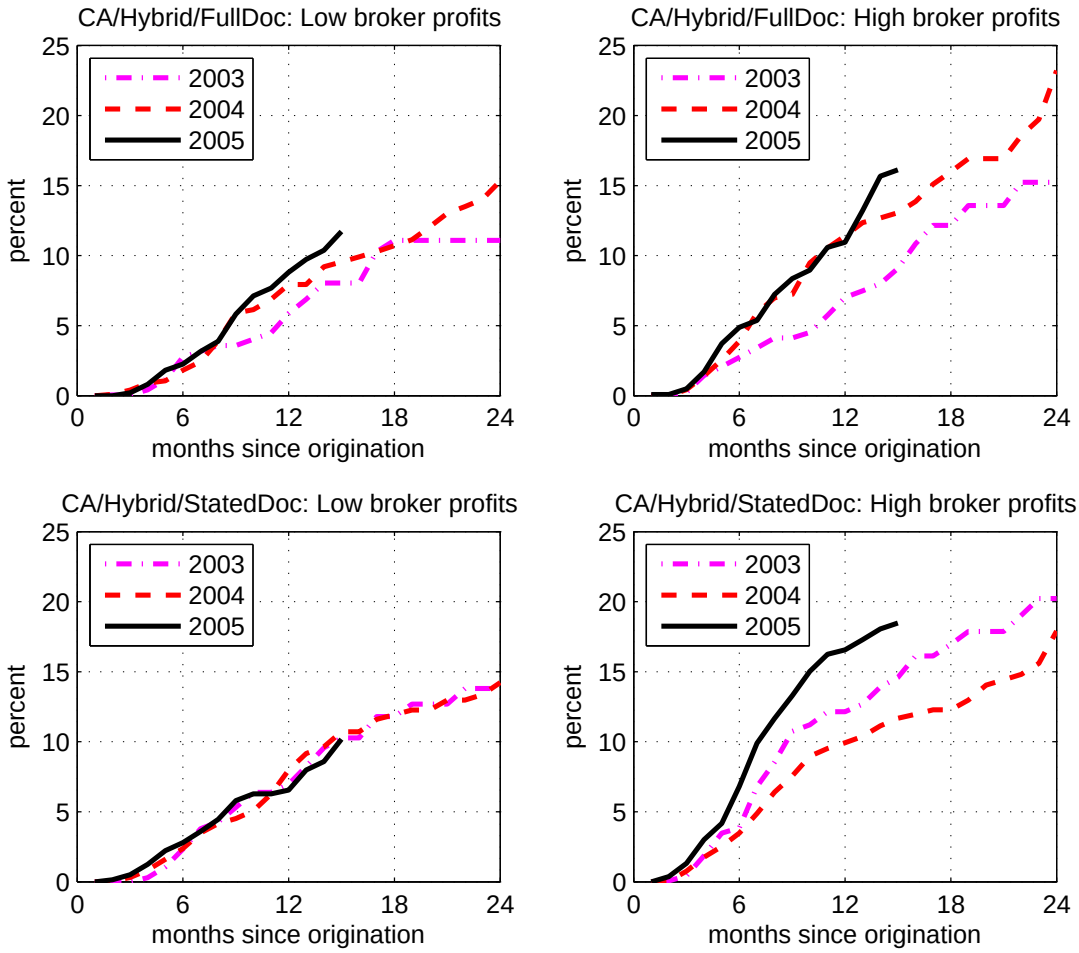


Figure 6: **Delinquency and Broker Profits.** Percent of loans delinquent as a function of months from origination by year of origination for stand-alone first lien hybrid mortgages originated in California. The top left plot shows the 60-day delinquency rates for full-documentation loans with low broker profits, and the top right plot shows the corresponding rates for high-broker-profits loans. Broker profits are computed based on the results reported in Table 6. High-broker-profit (low-broker-profit) loans are those in the upper (lower) tercile of the conditional broker profit distribution. The plots in the lower panel shows similar results for loans with stated documentation.

NEW CENTURY MORTGAGE® CORPORATION

Traditional Rate Sheet

SO. CALIFORNIA

Effective 03/30/2007 | 888-623-LOAN(5626) | www.newcentury.com

2 Year ARM @ PAR

FULL DOC

Mortgage Lates (last 12 months)	Max D/R / LTV / Credit Score*	55% / 65%	55% / 70%	55% / 75%	50% / 80%	50% / 85%	50% / 90%	50% / 95%
AAA	700 +	5.750	5.850	5.950	6.150	6.300	6.550	7.250
0x30	680-699	5.950	6.050	6.150	6.300	6.450	6.700	7.400
BK None Last	660-679	6.000	6.100	6.200	6.400	6.550	6.800	7.550
24 Months	640-659	6.05[illegible]	[illegible]	6.250	6.450	6.650	6.900	7.650
No NOD Last	620-639	6.20[illegible]	[illegible]	6.450	6.650	6.900	7.150	7.850
36 Months	600-619	6.300	6.450	6.550	6.750	7.000	7.250	8.050
Margin: 5.90								
AA	660 +	6.300	6.400	6.500	6.650	6.800	7.050	7.800
0x30	640-659	6.350	6.450	6.550	6.700	6.900	7.150	7.900
BK Rules - see	620-639	6.500	6.650	6.750	6.900	7.150	7.400	8.100
matrix	600-619	6.600	6.750	6.850	7.000	7.250	7.500	8.300
No NOD Last	580-599	6.750	6.850	6.950	7.100	7.400	8.000	9.050
24 months	550-579	7.150	7.250	7.400	7.500	7.900	8.550	
	525-549	7.550	7.650	7.750	7.850	8.250		
Margin: 6.05	500-524	8.050	8.150	8.300	8.400	8.800		
A+	660 +	6.450	6.500	6.650	6.750	7.000	7.200	8.150
1x30	640-659	6.550	6.600	6.700	6.800	7.050	7.250	8.200
BK Rules - see	620-639	6.750	6.800	6.900	7.000	7.250	7.450	8.350
matrix	600-619	6.850	6.900	7.000	7.100	7.400	7.600	8.500
No NOD Last	580-599	7.000	7.050	7.300	7.600	7.800	8.250	
24 months	550-579	7.550	7.650	7.950	8.100	8.250	8.600	
	525-549	7.700	7.800	8.150	8.300	8.500		
Margin: 6.25	500-524	8.100	8.300	8.500	8.600	9.000		
A-	660 +	6.800	6.900	7.000	7.100	7.350	7.600	8.500
3x30	640-659	6.900	6.950	7.050	7.150	7.400	7.650	8.550
BK Rules - see	620-639	7.100	7.150	7.250	7.350	7.600	7.900	8.800
matrix	600-619	7.200	7.250	7.350	7.450	7.800	8.000	
No NOD Last	580-599	7.450	7.500	7.750	8.000	8.150	8.700	
24 months	550-579	7.950	8.100	8.300	8.450	8.650	9.000	
	525-549	8.300	8.450	8.600	8.800	9.100		
Margin: 6.45	500-524	8.700	8.850	9.000	9.200	9.600		
B	660 +	6.950	7.050	7.150	7.300	7.850	8.400	
1x60	640-659	7.050	7.150	7.250	7.400	7.950	8.500	
BK Rules - see	620-639	7.150	7.250	7.350	7.500	8.050	8.600	
matrix	600-619	7.350	7.450	7.550	7.700	8.150		
No NOD Last	580-599	7.750	7.850	7.950	8.100	8.350		
18 months	550-579	8.050	8.150	8.350	8.500	8.650		
	525-549	8.400	8.500	8.650	8.850	9.450		
Margin: 6.70	500-524	8.800	8.900	9.100	9.250			
C	660 +	7.350	7.450	7.550	7.850			
1x90	640-659	7.450	7.550	7.650	7.950			
BK Rules - see	620-639	7.700	7.800	7.850	8.200			
matrix	600-619	7.850	7.950	8.050	8.350			
No NOD Last	580-599	8.100	8.150	8.250	9.300			
12 months	550-579	8.400	8.550	8.700	9.550			
	525-549	8.800	8.900	9.050				
	500-524	9.100	9.350	9.550				

STATED DOC

Mortgage Lates (last 12 months)	Max D/R / LTV / Credit Score*	55% / 65%	55% / 70%	55% / 75%	50% / 80%	50% / 85%	50% / 90%	50% / 95%
AAA	700 +	6.350	6.500	6.700	6.950	7.225	7.700	8.325
0x30	680-699	6.550	6.700	6.90[illegible]	[illegible]	7.375	7.850	8.475
BK None Last	660-679	6.650	6.750	7.00[illegible]	[illegible]	7.625	8.150	8.675
24 Months	640-659	6.750	6.850	7.050	7.350	7.675	8.250	8.775
No NOD Last	620-639	6.950	7.150	7.350	7.650	8.075	8.550	9.125
36 Months	600-619							
Margin: 6.15								
AA	660 +	6.950	7.050	7.300	7.500	7.875	8.400	8.925
0x30	640-659	7.050	7.150	7.350	7.600	7.925	8.500	9.025
BK Rules - see	620-639	7.250	7.450	7.650	7.900	8.325	8.800	9.375
matrix	600-619	7.400	7.600	7.750	8.150	8.525	8.950	
No NOD Last	580-599	7.700	7.750	7.950	8.250	8.725	9.300	
24 months	550-579	8.000	8.150	8.350	8.500	9.075		
	525-549	8.400	8.550	8.700	9.000	9.525		
Margin: 6.30	500-524	8.900	9.000	9.150	9.250			
A+	660 +	7.150	7.200	7.450	7.750	7.925	8.600	
1x30	640-659	7.300	7.400	7.550	7.850	8.075	8.700	
BK Rules - see	620-639	7.600	7.700	7.850	8.050	8.425	8.950	
matrix	600-619	7.900	7.950	8.050	8.200	8.675	9.300	
No NOD Last	580-599	8.000	8.100	8.350	8.750	9.025		
24 months	550-579	8.350	8.500	8.850	9.050	9.325		
	525-549	8.650	8.750	9.100	9.450			
Margin: 6.55	500-524	9.250	9.450	9.650	9.750			
A-	660 +	7.550	7.600	7.850	8.150	8.525		
3x30	640-659	7.700	7.800	7.950	8.200	8.575		
BK Rules - see	620-639	7.950	8.050	8.300	8.450	8.925		
matrix	600-619	8.300	8.350	8.550	8.700	9.075		
No NOD Last	580-599	8.350	8.450	8.750	9.150	9.525		
24 months	550-579	8.750	8.850	9.200	9.450			
	525-549	9.250	9.400	9.550	10.050			
Margin: 6.75	500-524	9.850	10.000	10.250				
B	660 +	7.700	7.850	7.950	8.250			
1x60	640-659	7.800	7.900	8.100	8.400			
BK Rules - see	620-639	8.100	8.250	8.400	8.700			
matrix	600-619	8.350	8.450	8.600	8.900			
No NOD Last	580-599	8.650	8.900	8.950	9.250			
18 months	550-579	8.850	8.950	9.400	9.700			
	525-549	9.400	9.600	9.700				
Margin: 7.05	500-524	10.000	10.100	10.350				
C	660 +	7.800	8.100	8.600				
1x90	640-659	7.900	8.200	8.700				
BK Rules - see	620-639	8.300	8.450	8.950				
matrix	600-619	8.450	8.750	9.250				
No NOD Last	580-599	8.850	9.100	9.600				
12 months	550-579	9.150	9.500	10.000				
	525-549	10.050	10.300					
Margin: 7.35	500-524	10.550	10.800					

Adjustments To Rate

Adjustments To Rate	+/- Rate
SPECIAL	
Purchase if LTV/CLTV <= 90%	-0.125
LTV/CLTV <= 60%	-0.125
3 year ARM special (see flyer)	-0.250
[illegible] (see flyer)	-0.100
[illegible] LTV/CLTV<=80%	-0.250
LOAN SIZE	
> $1,000,000	+0.375
$750,001 - $1,000,000	+0.250
$500,001 - $750,000	-0.125
$300,001 - $500,000	-0.250
$100,001 - $199,999	+0.250
$75,001 - $100,000	+0.500
$50,000 - $75,000	+1.000
[illegible]	+0.350
Limited Docs (6 mos Bank Statements)	+0.375
Full Doc (12 mos Bank Statements)	+0.250
PROPERTY TYPES	
Rural	+0.500
3-4 Units (Full/Limited Doc)	+0.500
3-4 Units (Stated Doc)	+1.000
Condo LTV/CLTV > 80%	+0.250
OCCUPANCY	
N/O/O	+0.750
N/O/O Stated LTV > 80%	+1.250
2nd Home LTV/CLTV > 80%	+0.250
[illegible] only)	
[illegible]	+0.250
1 point YSP	+0.500
1.50 point YSP	+0.875
2 point YSP	+1.250
1 point Buydown (N/A with YSP)	-0.500
PREPAYMENT PENALTY**	
[illegible] w/3 yrs Prepay)	+0.500
[illegible]	+0.750
Waive Pre-pay Penalty	+1.000
PROGRAM	
3 Year ARM	+0.250
5 Year ARM	+0.600
40/30 Year ARM	+0.150
50/30 Year ARM	+0.200
Fixed (30, 20, 15 YR terms)	+0.700
Fixed (40/30 term)	+0.800
[illegible]	+0.900
[illegible]	+0.350
OTHER	
Bankruptcy discharged < 1 year	+0.250
Full Doc C- rates above C grade	+2.250
(C- grade Max 70% LTV - Full/Limited)	
MINIMUM PRODUCT RATES	
ARMs	5.650%
Fixed	6.350%

NOTE: Final calculated rate can't be lower than the minimum product rate.

TERMS AND CONDITIONS

Max YSP = 1 pt. If no pre-pay or Loan Amount > $750,000.