# Origination Channel, Prepayment Penalties, and Default

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**Abstract**

This paper presents evidence that non-bank-originated subprime mortgages have a higher probability of default than bank-originated subprime mortgages, but only for loans with prepayment penalties. Evidence also indicates that non-banks price prepayment penalties less favorably to borrowers than banks do, and non-banks originate disproportionately more loans with prepayment penalties in locales with less financially sophisticated borrowers. State anti-predatory lending law provisions restricting the use of prepayment penalties eliminate the elevated default risk of non-bank originations relative to bank originations. These findings are consistent with incentives generated by non-bank compensation via yield spread premiums on loans with prepayment penalties.

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## 1. Introduction

Of broad concern for our understanding of the recent foreclosure crisis and for housing and financial stability moving forward is the role of compensation incentives across origination channels in mortgage lending. The specific aspect of this concern addressed in this paper is whether and why subprime loans originated by relatively less-supervised non-depository institution mortgage originators ("non-banks") performed worse than subprime loans originated by depository institutions ("banks") primarily supervised by one of the federal financial regulatory agencies: the Federal Reserve, Office of the Comptroller of the Currency (OCC), Federal Deposit Insurance Corporation, Office of Thrift Supervision (OTS), or National Credit Union Association.[1] Results indicate that non-bank originations have a higher probability of default than bank originations, but only for loans that include prepayment penalties. This is the first evidence linking greater default risk across origination channels to a specific loan feature, and is consistent with a greater importance of yield spread premiums (YSPs) in compensation among non-bank originators than bank originators. The paper then presents further evidence that disparities by origination channel in pricing prepayment penalties, borrower financial sophistication, and the role of anti-predatory lending laws are also consistent with differing compensation incentives.

The growth of subprime lending in the United States in the years leading to the recent financial crisis coincided with rapid growth in non-bank origination, with large majorities of subprime mortgages being originated by non-banks.[2] Even before the crisis, some characteristics of non-bank mortgage origination aroused concerns about the quality of loans produced through that channel. Because non-bank originators are not depository institutions, they are not subject to the close supervision of one of the federal financial regulatory agencies listed above, but instead fall only under the less extensive

[1] Many examinations of mortgage lending by origination channel distinguish between originations by direct lenders ("retail") and by brokers ("wholesale"). Here, non-bank originations include both broker originations and originations by direct lenders that are not depository institutions. As is explained in Section 4, the use of this categorization of origination channel is determined by data availability.
[2] Sixty-nine percent of the loans in this paper's sample, which includes subprime originations from 2002-2006, are non-bank-originated.

supervision of the Department of Housing and Urban Development (HUD) and various state authorities, the implication being that with less oversight non-bank originators are more likely than banks to engage in abusive practices to the detriment of borrowers.[3] Non-banks, which include brokers, are also more likely than banks to practice an "originate-to-distribute" business model in which mortgages are sold shortly after origination to another financial institution, usually to be packaged into mortgage-backed securities.[4] This reduces an originator's interest in the long-term performance of the loans, and so increases the incentive to apply less rigorous underwriting standards.

Further, the compensation received by different types of originators is a source of controversy. While much of a broker's compensation is in the form of cash payments directly from the borrower (such as an origination fee based on a percentage of the loan amount and various application or processing fees), a YSP is paid to a broker by the institution to which the broker sells the loan.[5] The size of a YSP is based on the difference between the loan interest rate and a benchmark rate for loans with similar characteristics set by the purchasing institution, giving brokers the incentive to place borrowers in more expensive loans. Consumer advocates consider originator compensation that increases with interest rates to be an inherently abusive practice that leads directly to subprime borrowers being steered into higher interest rate loans and therefore to more defaults. Proponents argue that due to competition in mortgage lending, YSPs from loan buyers are passed through to borrowers via reduced fees, allowing borrowers to exchange a higher interest rate for lower upfront costs.

A mortgage loan officer employed by a direct lending institution generally also has an incentive to place a borrower in a loan with a higher interest rate than a benchmark rate for similar loans set by the loans officer's institution. Compensation based on a higher interest rate of this sort from a direct lender is termed an overage rather than a YSP, but overages and YSPs are economically equivalent – the person

[3] In the years leading up to the foreclosure crisis, many bank holding companies acquired independent non-bank mortgage origination firms. In 2009, the Federal Reserve extended its regulatory reach to encompass non-bank subsidiaries of bank holding companies, bringing many subprime originators under closer federal supervision.
[4] Lenders that plan to hold the loans they originate on their books also frequently securitize their loans in order to hold a more liquid mortgage-backed security rather than a less liquid assortment of individual loans.
[5] Jackson and Burlingame (2007) find that on broker-originated loans for which a YSP is present, it is usually the largest component of a broker's compensation.

responsible for originating the loan gets higher compensation while the borrower receives a higher interest rate than he or she might otherwise get based on the borrower's creditworthiness and other loan terms.

Although direct evidence is lacking, there is reason to believe that YSPs play a larger role in the compensation of brokers than overages do in the compensation of loan officers at direct lenders.[6] Black *et al.* (2003) note great variation in the use of overages at financial institutions, with some encouraging the use of overages in loan officer compensation, others tightly restricting overages, and still others not allowing overages to be collected at all. Woodward (2008) writes that "Traditionally, loan officers are paid a salary, plus some bonus for volume, and in the longer run a bonus for the profitability of their book of loans. Mortgage brokers are freelancers who work on commission only."[7] Higher interest rate loans can enhance the profitability of loans on a loan officer's book, but can also detract from profitability if the higher monthly payments prove less affordable to borrowers, leading to more frequent defaults.[8] This would mitigate the compensation incentive of overages for loan officers. Tzioumis and Gee (2010) examine mortgage loan officer behavior at a bank that strictly limits overages and employs monthly output quotas, and note anecdotal evidence that other banks use similar compensation incentive schemes, although they are not specific as to whether the similarity does or not include the overage restrictions.[9] Restrictions or prohibitions of overages to loan officers and loan officer compensation based on salary

[6] In addition to data on loan officer salary, benefit, and bonus schemes, the ideal evidence would entail comparing wholesale rate sheets providing the schedule of YSPs a lender would pay a broker for loans of different interest rates to retail rate sheets from the same lender providing the same information for the overages available to the lender's own loan officers. Because rate sheets are generally unavailable to the public, I have been unable to acquire such evidence.

[7] Woodward (2008), page 10.

[8] Recent evidence on loan modifications supports a positive relationship between loan interest rates and default rates. Agarwal *et al.* (2011) find that among loans that become 60 days or more past due, a one percentage point reduction in loan interest rates is associated with a four percentage point reduction in redefault. The most recent Mortgage Metrics Report (2010) issued by the OCC and OTS states that loans modified with small or no reductions in monthly payments are over twice as likely to both enter and complete the foreclosure process, compared to loans modified with monthly payment reductions of ten percent or more. The report also shows that interest rate reductions are much more prevalent in loan modifications than other terms that lower monthly payments, like maturity extensions, principal reductions or principal deferrals.

[9] Tzioumis and Gee (2010) find a spike in origination volume near the end of each month. They find no time-varying effects on loan pricing, suggesting that the loan officers do not attempt to increase origination volume near the end of the month by reducing loan interest rates.

and bonuses that are linked to loan volume or long-run performance diminish the incentive effect of overages for loan officers relative to that of YSPs for brokers.

Woodward (2008) also presents evidence that YSPs and overages are not passed through dollar for dollar to customers via reduced fees, and that the amount of pass-through varies by origination channel. In her full sample, borrowers received 22 cents of upfront cost reduction per dollar of YSP from bank direct lenders, 29 cents from large non-bank direct lenders (with size determined by the number of loans originated by a given lender in her sample), 19 cents from small non-bank direct lenders, and only 7 cents from brokers. For the higher interest rate portion of her sample, the differences are more dramatic. Borrowers from bank and large non-bank direct lenders received 24 and 33 cents, respectively, while borrowers from small non-bank direct lenders and brokers actually paid 21 and 16 cents, respectively, in additional upfront costs per dollar of YSP or overage. Lower pass-through of YSPs/overages implies a greater portion of each dollar of YSP/overage available for broker/loan officer compensation, so these results suggest that a dollar of YSP or overage represents a greater compensation incentive for brokers than for direct lender loan officers, with the incentive for small non-bank loan officers being more similar to that of brokers than that of bank loan officers.

Berndt *et al.* (2010) and Ernst *et al.* (2008) provide examples of "rate sheets" that two large subprime lenders supplied to brokers providing the amounts each institution was willing to pay for loans with various characteristics. Both sheets explicitly limit the YSP available on broker originations without prepayment penalties. A prepayment penalty requires a borrower to pay a substantial fee if he or she repays a loan within a specified length of time after origination. This directly raises the cost of repaying a loan through a refinancing or sale while the prepayment penalty is in effect. Critics of prepayment penalties argue that they can trap a borrower in an expensive mortgage, reducing the borrower's wealth (through either high monthly payments or a large prepayment fee). Also, for financially distressed borrowers who can no longer afford their present mortgages and must choose between prepaying and defaulting, increasing the cost of prepayment makes default more likely. Others argue that prepayment penalties can increase borrower wealth and make default less likely if lenders offer lower interest rates for loans featuring prepayment penalties.

If a purchasing institution pays a broker a premium for a loan with a high interest rate, the purchaser may not recoup that premium through higher monthly payments if the borrower quickly refinances into a lower-rate loan. A prepayment penalty ensures that the purchaser will receive either enough higher monthly payments or the penalty fee to recoup the premium paid to the broker. Berndt *et al.* (2010) find that while for many loans it is hard to determine whether broker profits are driven more by YSPs, high borrower valuations of the properties in question, or greater broker bargaining power, in the case of "loans with prepayment penalties, the main driver appears to be the yield spread premium."[10] Ernst *et al.* (2008) note that "in many cases lenders do not allow the broker to get any yield-spread premium if the loan has no prepayment penalty."[11] Direct lenders may make the amount of overage compensation available to loan officers similarly dependent on prepayment penalties, but I have been unable to locate any examples of direct lenders' retail rate sheets or any descriptions of overage compensation being related to prepayment penalties.[12] Absence of evidence is of course not evidence of absence, but it is at least suggestive that consumer advocacy groups explicitly link prepayment penalties to broker compensation via YSPs but are silent on loan officer compensation via overages (see Ernst *et al*, 2008, and Center for Responsible Lending, 2004).

This paper presents evidence that non-bank originations have a higher probability of default than bank originations, but only among loans that have prepayment penalties. Considering the discussion of YSPs, overages, and prepayment penalties above, this finding is consistent with differing compensation incentives being a driving factor in greater default risk for non-bank originations. Specifically (and discussed at greater length in Section 3), the positive relationship between non-bank origination and the probability of default will be stronger for loans with prepayment penalties than for loans without

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[10] Berndt *et al.* (2010), page 29.
[11] Ernst *et al.* (2008), page 37.
[12] Both loan officers and brokers are generally prohibited from making rate sheets available to the public, but unlike wholesale rate sheets that are transmitted to multiple brokers outside of the purchasing institution, retail rate sheets remain within a direct lender's institution.

prepayment penalties if (1) the amount of YSP available to brokers is conditional on loans having prepayment penalties, while the amount of overage for direct lender loan officers is not (or is less often) conditional on prepayment penalties, (2) YSPs are a larger share of brokers' total compensation than overages are of loan officers' compensation, or (3) non-bank originators receive greater compensation per dollar of YSP or overage than bank originators do. The paper then presents a variety of findings regarding differences by origination channel in the pricing of prepayment penalties, the financial sophistication of borrowers, and the effects of provisions in state anti-predatory lending (APL) laws restricting prepayment penalties. In each case, the results are consistent with what one would expect given the different compensation incentives across origination channels.

From a historical perspective, this paper expands our understanding of the workings of the subprime market in the years leading up to the foreclosure crisis by highlighting how variation across origination channels in one particular contract feature was associated with significant differences in loan outcomes. From a current policy perspective, the findings regarding prepayment penalties, defaults, and state APL law provisions are immediately relevant to the prospective success of provisions of the recently enacted Dodd-Frank Wall Street Reform and Consumer Protection Act.[13] The findings are also directly informative regarding how origination incentives grounded in compensation practices influence mortgage performance.

The remainder of this paper is structured as follows. Section 2 discusses the relevant previous literature. Section 3 presents the paper's hypotheses. Section 4 describes the paper's data sources and the econometric methodology employed. Section 5 presents results from the empirical analysis, and Section 6 concludes.

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[13] The full text of the Dodd-Frank Wall Street Reform and Consumer Protection Act is available at http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=111_cong_bills&docid=f:h4173enr.txt.pdf. Title XIV prohibits prepayment penalties entirely on all ARMs and certain high-priced FRMs. On all other mortgages, prepayment penalties are prohibited three years after origination, with the amount of the penalty in the first, second, and third year after origination is limited to 3 percent, 2 percent, and 1 percent, respectively, of the outstanding loan balance. In addition, Title XIV prohibits any compensation to a mortgage originator, like YSPs, for which the amount of compensation varies based on any terms of the loan other than the loan amount.

## 2. Literature Review

The literature focusing on the effects of origination channel in subprime lending is small but growing, spurred in no doubt by the recent foreclosure crisis. Laderman and Reid (2009), Jiang *et al.* (2009), Ding *et al.* (2009), and Ding, Quercia, Reid and White (2010) all associate broker origination with higher probabilities of default, with default variously defined as a loan being sixty days delinquent, ninety days delinquent, or entering foreclosure or "Real Estate Owned" (REO) status. These studies all employ samples that pool subprime loans with other types of mortgages (loans originated under a Community Reinvestment Act special lending program for Ding *et al.* (2009), prime loans for the others), so their findings may not reflect the effects of broker origination specifically on subprime loans. Alexander *et al.* (2002) finds that subprime loans originated by brokers and loan correspondents are more likely to default than retail originations, based on a sample of originations from 1996-1999, well in advance of the recent crisis. Ding, Quercia and White (2010) compare subprime loans originated by brokers with subprime loans originated only by national banks and find that broker-originated loans are likelier to default. That study uses a sample of originations from 2002-2006, but follows loan performance only from December 2006 to December 2008 and so misses a large amount of default and prepayment activity.[14]

Only one previous paper attempts to link the higher probability of default for broker originations to differences in the use of a particular loan feature. Jiang *et al.* (2009) divides their sample mortgages based on origination channel and the level of documentation of borrower information. They find higher delinquency rates for broker-originated loans regardless of the level of documentation.

A small number of papers examine differences in subprime mortgage interest rates based on origination channel, with inconsistent results. LaCour-Little and Holmes (2008) and El-Anshasy *et al.* (2002) find that broker originations have lower loan rates and lower APRs, respectively. Elliehausen *et al.* (2008) find that broker originations generally have higher rates, with larger differences for fixed-rate mortgages (FRMs) than for hybrid adjustable-rate mortgages (ARMs). Ernst *et al.* (2008) also find higher

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[14] The current paper's sample also includes 2002-2006 subprime originations, but follows loan performance from origination through October 2009. The majorities of all defaults and of all prepayments that appear in the data occur within the first two years after origination.

rates for subprime broker originations, but with larger differences for ARMs than for FRMs. Ernst *et al.* (2008) find no difference in mortgage interest rates based on origination channel for prime loans. They attribute the difference between their prime and subprime results to a greater prevalence of YSPs paid to brokers on subprime loans compared to prime loans. Using a sample of prime mortgages, LaCour-Little (2009) finds higher loan rates among broker originations, with lower borrower incomes or credit scores associated with larger discrepancies in rates across origination channels.

YSPs have been the subject of relatively little empirical investigation due to YSP data being generally unavailable. Jackson and Burlingame (2007) and Woodward and Hall (2010) use data on broker originations from 1996-2001 purchased by a single lender to which they had access due to discovery in a legal proceeding. They find that borrowers receive between thirty and forty cents of upfront cost reduction for every dollar that brokers receive in YSPs, indicating that the majority of YSPs paid to brokers are not passed through to borrowers via reduced fees. Woodward (2008) uses HUD-1 settlement statements made available by HUD on a sample of FHA loans from 2001 to analyze total fees paid on broker and bank originations. As noted in Section 1, she finds that borrowers receive greater upfront cost reduction per dollar of YSP or overage on bank originations than broker originations, with results for non-bank direct lenders varying based on institution size.

There is a larger existing literature on the relationship between prepayment penalties and loan performance, and between prepayment penalties and loan interest rates. Prepayment penalties could increase the probability of default if they lower the cost of default relative to the cost of prepayment for financially distressed borrowers, or could decrease the probability of default if loans with prepayment penalties carry lower interest rates. Quercia *et al.* (2007), Danis and Pennington-Cross (2008), Rose (2008), Demyanyk and Van Hemert (2009), and Pennington-Cross and Ho (2010) all find that prepayment penalties are associated with greater probabilities of default, although in Rose (2008) and Pennington-Cross and Ho (2010) this result is somewhat dependent on the specification and type of loan used. All of the above papers except Demyanyk and Van Hemert (2009) use competing risk models that jointly consider the probabilities of prepayment and default, and they all find a negative relationship between prepayment penalties and the probability of prepayment, as one would expect.

DeMong and Burroughs (2005) and Ernst (2005) both use single-equation approaches to examine the effect of prepayment penalties on loan interest rates. DeMong and Burroughs (2005) find prepayment penalties to be associated with lower interest rates for both FRMs and ARMs, while Ernst (2005), whose sample includes only FRMs, finds prepayment penalties to be associated with higher rates for purchase FRMs and to have no significant relationship with refinance FRM rates. Elliehausen *et al.* (2008) and LaCour-Little and Holmes (2008) use multiple-equation approaches controlling for endogeneity among loan interest rates, loan-to-value (LTV) ratios and prepayment penalties. Both find that prepayment penalties are associated with lower interest rates, with the reduction being more pronounced for FRMs than ARMs. LaCour-Little and Holmes (2008) also split their sample by origination channel, and find that the reduction in loan interest rates associated with a prepayment penalty is greater for broker originations. The results of a theoretical model and empirical analysis by Mayer *et al.* (2010) suggest that the least creditworthy borrowers receive the largest reductions in loan rates associated with prepayment penalties.

The existing literature on the effects of state APL laws on subprime lending mostly focuses on the impact of such laws on the volume of subprime lending and on loan interest rates (e.g., see Harvey and Nigro, 2003 and 2004; Quercia *et al.*, 2004; Pennington-Cross and Ho, 2006 and 2008; Li and Ernst, 2007; Bostic *et al.*, 2008). Ding, Quercia, Reid and White (2010) find that having an APL law in effect is associated with a reduction in the probabilities of default and prepayment, and the same holds for certain specific provisions of APL laws (those restricting prepayment penalties, requiring verification of borrowers' ability to repay, and covering a broader portion of loans based on their points and fees). Rose (2011) examines a wider variety of APL provisions, and finds they are generally associated with a lower probability of default and a higher probability of prepayment. He also finds APL provisions can alter the relationship between prepayment penalties and the probability of default. Restrictive APL provisions are frequently associated with prepayment penalties being more positively associated with defaults for FRMs and more negatively related for ARMs.

The present paper makes substantial contributions to the literature on subprime lending and the foreclosure crisis. Foremost, while previous papers have identified a difference in the probability of default by origination channel, this is the first paper to link that difference to a specific contract feature, the use of prepayment penalties. It is also the first to examine how variations in the use of prepayment penalties are consistent with differences in compensation incentives by origination channel. It does so using a sample comprised solely of subprime loans from the mid-2000s, therefore focusing attention on the mortgage market segment most associated with the onset of the recent downturn. With respect to the relationship between prepayment penalties and loan interest rates, it is the only paper to examine that relationship using the fully-indexed rates for ARMs, and so is the first to identify that although an ARM borrower who accepts a prepayment penalty may receive a lower initial rate, the rate he or she pays after adjustment to the fully-indexed rate is likely to be higher regardless of origination channel. Finally, this paper tests how specific state APL law provisions affect subprime loan performance by origination channel, and presents evidence indicating that where the provisions are in effect, non-bank originations do not have a higher probability of default than bank originations.

## 3. Hypotheses

This paper tests several hypotheses concerning origination channel, prepayment penalties, and default risk, based on the compensation incentives associated with YSPs and overages. For convenience, below I use the term YSPs to encompass both YSPs and overages. The hypotheses are described below:

*H1: Non-bank origination is more positively associated with the probability of default for loans with prepayment penalties than for loans without prepayment penalties.* The crux of H1 is that a loan having a prepayment penalty can be taken as an indicator of compensation incentives via YSPs to place the borrower in a higher interest rate loan, and that those incentives are on average stronger for non-bank originators than for bank originators. All else equal, higher interest rate loans should have a higher probability of default.

Suppose that for brokers YSPs (either the amount or whether they are paid at all) are conditional on loans having prepayment penalties, but YSPs are not (or are not as often) conditional on prepayment penalties for direct lender loan officers. Among prepayment penalty loans, YSP compensation would be more prevalent for non-bank originations than for bank originations. If YSPs provide an incentive for originators to place borrowers in higher interest rate loans, and all else equal higher interest rate loans are associated with greater default risk, then non-bank originations would have a higher probability of default than bank originations for prepayment penalty loans. By the same token, among loans without prepayment penalties, YSP compensation would be less prevalent for non-bank originations than for bank originations, and so non-bank originations would have a lower probability of default than bank originations. Suppose instead that YSPs are similarly conditional on prepayment penalties for brokers and loan officers, but that on average YSPs provide greater incentives for non-bank originators than bank-originators to place borrowers in higher rate loans.[15] In this case, non-bank origination would still be positively associated with the probability of default for loans with prepayment penalties because YSP compensation would provide relatively greater incentives to non-bank originators than bank originators. Among loans without prepayment penalties, there would be little compensation via YSPs regardless of originator channel, and so little reason to expect a significant relationship between non-bank origination and the probability of default.

Note that if there are no differences across origination channels in either the link between prepayment penalties and YSPs or the incentive YSPs provide to place borrowers in higher interest rate loans, then H1 is not expected to hold. Note also that H1 does not depend on a prepayment penalty being in effect in a given month. Instead, a loan being originated with a prepayment penalty is taken as a proxy

[15] As discussed in Section 1, this could be because of prohibitions or restrictions on loan officer YSPs by some direct lenders, YSPs forming a smaller part of total compensation for loan officers than for brokers, or differences by origination channel in the percentage of YSPs passed through to borrowers.

for compensation incentives provided by YSPs, which could affect loan terms beyond the expiration of the prepayment penalty.

*H2: Non-banks price prepayment penalties less favorably for borrowers than banks do.* In general, a borrower faced with two otherwise identical loans, one of which features a prepayment penalty while the other does not, will receive a lower interest rate on the loan with the prepayment penalty because the lender faces less prepayment risk. For originators motivated by YSP compensation, this discount for a prepayment penalty is likely to be mitigated by the incentive to increase the interest rate. Due to differing compensation structures, non-bank originators will have a stronger incentive than bank originators to increase the interest rate on prepayment penalty loans.

*H3: Relative to banks, non-banks originate disproportionately more loans with prepayment penalties to borrowers who are less financially sophisticated or more financially constrained.* Less financially sophisticated borrowers are more prone to accept expensive loans despite qualifying for cheaper loans because such borrowers are less likely to (1) be aware that they qualify for cheaper loans, (2) be aware of the importance of comparison shopping among originators for better loan rates, or (3) understand the implications of their loan terms, including prepayment penalties. In addition, a financially constrained borrower may be more likely to accept the terms given by a particular originator rather than shop around if the borrower is unable to pay the high application fees that subprime borrowers often face.[16] Non-bank originators, who face a stronger compensation incentive to place borrowers in expensive loans with prepayment penalties, are likely to originate disproportionately more prepayment penalty loans to those types of borrowers.

*H4: The origination channel effect described in H1 is weaker in the presence of state APL restrictions on the use of prepayment penalties.* H1 relies on YSP compensation being a driving factor behind less affordable loans and greater default risk, and it relies on the availability or amount of YSP compensation being conditional on loans having prepayment penalties. If those are correct, then

[16] McCoy (2007) describes how, unlike prime borrowers, subprime borrowers must often pay substantial application and appraisal fees to originators prior to learning the actual price of a mortgage, potentially making comparison shopping prohibitively expensive.

limitations on the use of prepayment penalties imply limitations on the willingness of purchasing institutions and direct lenders to offer YSPs. This further implies less incentive for originators to place borrowers in higher rate loans. Restrictions on the use of prepayment penalties therefore should weaken the association between non-bank origination and the probability of default among prepayment penalty loans.[17]

## 4. Data and Methodology

This paper uses the LoanPerformance dataset from CoreLogic, Inc., which consists of monthly loan-level data on purchase and refinance mortgages for single family residences originated during 2002-2006 and followed through October 2009.[18] These are loans that have been packaged into subprime-grade private-label mortgage-backed securities. In-depth analysis of state APL provisions in all fifty states is beyond the scope of this paper. Therefore the data covers ten MSAs, listed in Table 1. The selection of these MSAs was based on a report from RealtyTrac, Inc. (2007), providing 2007 foreclosure rates for the hundred largest metropolitan areas in the United States. To ensure that the sample MSAs represent both a substantial number of American households and a diverse range of mortgage market difficulties, I divided the MSAs with populations over one million inhabitants into deciles based on the reported foreclosure rates. From each decile I selected the MSA with the highest population, with the condition that only one MSA from any state be included to ensure geographic diversity.[19] To make the

[17] If originators respond to a reduction in YSP income due to APL law restrictions on prepayment penalties by raising the fees paid upfront by borrowers, then the overall relative costs of bank versus non-bank loans could remain unchanged, and so the association between non-bank origination and default risk might not change due to APL laws. Chari and Jagannathan (1989) argue that upfront points are effectively a form of prepayment penalty.
[18] Mayer and Pence (2009) compare the LoanPerformance data's coverage of subprime origination to the coverage of two other sources, loans originated by lenders appearing on the list of subprime lenders maintained by HUD and higher-priced loans identified since 2004 in data collected under the auspices of the Home Mortgage Disclosure Act. The authors conclude that during the mid-2000s, the LoanPerformance data likely provide the most reliable coverage of subprime originations.
[19] Population figures are from the July 1, 2007 estimates of the U.S. Census Bureau. The highest population MSA from each decile included two California MSAs (Los Angeles and Riverside) and two MSAs covering parts of New Jersey (New York City and Newark). In each case, the lower-population MSA (Riverside and Newark) were replaced by the next most populous MSA in that decile (Miami and San Antonio, respectively).

analyses computationally more tractable, I randomly select 25 percent of loans for specifications (described below) using a loan-month as the unit of observation. For loan-level analyses, I use all loans.

To simplify the construction of ARM-specific variables, the sample ARMs are limited to 30-year loans for which the interest rates adjust every six months, the first scheduled rate adjustments occur in the twenty-fourth or thirty-sixth month, and the interest rates are indexed to the six-month London Interbank Offered Rate (LIBOR). Those loans represent over 96 percent of the total ARM sample. FRMs are limited to loans with terms of fifteen or thirty years, representing over 94 percent of the total FRM sample, to ensure that FRM-specific variables are constructed using market FRM rates of the appropriate maturities. Balloon and interest-only loans are excluded.

The LoanPerformance data contains loan-level information including loan type (FRM or ARM), purpose (purchase or refinance), origination date, dates when a loan is prepaid or a foreclosure process is initiated, the loan interest rate, LTV ratio, and borrower FICO score at origination, whether the borrower withdrew cash out (for refinances), whether the loan was based on low- or no-documentation, and the length of the prepayment penalty period (if any). This data was merged with quarterly MSA-level home price index values from Freddie Mac's conventional mortgage home price index, monthly MSA-level unemployment rates from the Bureau of Labor Statistics, monthly FRM and ARM interest rates from Freddie Mac's Primary Mortgage Market Survey, monthly bank prime interest rates from the Federal Reserve Bank of Saint Louis, ZIP-code level demographic information from the 2000 Census, information on state foreclosure laws from Ghent and Kudlyak (2010), and information on state APL laws assembled by the author.[20] Loans are divided into four categories by loan type and purpose.

[20] An alternative to the Freddie Mac conventional mortgage home price index, the Case-Shiller monthly MSA-level home price index, is available for seven of the ten sample MSAs (it is unavailable for Baltimore, Pittsburgh, and San Antonio). All of the analyses presented in this paper that make use of *CLTV* and *VarHPI* were also run using the Case-Shiller index values to calculate those variables. The pattern of results holds, albeit with reduction in statistical significance in several incidences. That is plausibly related to the sample size reduction caused by excluding three of the MSAs. To examine that, the analyses were run again with the same seven MSAs and using original values of *CLTV* and *VarHPI* based on the Freddie Mac index values. The results for the seven MSAs based on different home price indices are extremely similar. These results are available from the author.

To determine the primary supervisory agency for each originator, originator names in the LoanPerformance data were matched to respondent institution names in the annual HMDA transmittal sheets. In LoanPerformance, originator name is a hand-entered field filled by LoanPerformance's data sources, and so frequently includes abbreviations, truncations, and typos, or is left blank. Two matching approaches were used, an algorithmic one employing a few simple standardizations (e.g., removing punctuation, converting names to all caps) and manual inspection of the lists of LoanPerformance and HMDA names. The algorithmic approach was successful in only a minority of cases, so most matches were accomplished manually. If an algorithmic match differed from a match based on manual inspection, the manual inspection match, which allowed for analytical judgment, was used.

Once an originator was matched to a HMDA respondent, the transmittal sheet data on each lender's primary supervisory agency was used to classify the originator as being either a depository institution ("bank") or not ("non-bank").[21] This is a different categorization than is often used in examinations of origination channel and default, which typically rely on a dataset from Lender Processing Services, Inc. (LPS).[22] The LPS dataset includes a field denoting whether a loan was originated by a retail, wholesale, or correspondent originator, but the dataset does not provide extensive coverage of the subprime market in the years leading up to the recent financial coverage. Additionally, the LPS product to which I have access (the Loss Mitigation Loan Level Data Collection product) does not include information on whether a loan features a prepayment penalty, rendering it of little use in testing this paper's hypotheses. LoanPerformance has the appropriate subprime coverage and the necessary data on prepayment penalties to test the hypotheses, but requires the categorization used here.

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[21] Specifically, banks are defined as originators for which the primary supervisory agency identified by the HMDA transmittal sheet agency code variable is the Federal Reserve, Office of the Comptroller of the Currency, Federal Deposit Insurance Corporation, Office of Thrift Supervision, or National Credit Union Association. Non-banks are defined as originators for which the agency code variable indicates that the Department of Housing and Urban Development is the primary supervisory agency. Following the HMDA agency code designations, mortgage lending subsidiaries of depository institutions and lenders that own depository institutions are classified as banks.
[22] Some papers make use of proprietary data assembled by one or more lending institutions and made available by private arrangement or license. Such datasets can be quite rich, but are generally inaccessible to other researchers, including this one.

The originator could not be identified in approximately 30 percent of sample loans, requiring that those loans be dropped. Dropping so many loans could plausibly introduce bias, so several characteristics of loans with known versus unknown originators are reported in Table 2. For most loan categories, there are few sizable differences, but purchase FRMs are the exception. The originator of noticeably fewer purchase FRMs could be identified (60 percent) than loans in the other categories (69-72 percent). For several variables (percentages of loans with prepayment penalties or for owner-occupied properties, LTV ratio, FICO scores), the discrepancy between values for loans with known versus unknown originators is substantially larger for purchase FRMs than for the other three categories. For the percentage of loans with prepayment penalties, the discrepancy is seven times larger for purchase FRMs than for any other category. This is particularly troublesome given that the hypotheses of this paper all revolve around prepayment penalties. For this reason, purchase FRMs are dropped from the analyses.

Variables used in this paper are defined in Table 3, with means presented in Table 4. Starting with the variables used in the loan outcome analyses, *NonBank*, the key variable of interest, indicates a loan not originated by a depository institution primarily supervised by one of the federal financial regulatory agencies. *PrepayPen* indicates whether a prepayment penalty is in effect for a loan in a given month, and *PrepayPenEnd* indicates loans in the month that a prepayment penalty period ends and the two following months. If prepayment penalties are binding constraints on prepayment, one would expect the probability of prepayment to increase sharply but temporarily immediately after the penalty period ends. *LowNoDoc* indicates loans that were originated based on reduced documentation, which fosters ambiguity in a borrower's ability to repay a loan. This can be used to place a borrower into more expensive loan than the borrower can afford, and so is expected to be positively associated with default. *Cashout* indicates refinancings in which borrowers extract or "cash out" some of their equity. The relationship between it and prepayment is expected to be positive, as borrowers with the demonstrated willingness to extract equity once are plausibly more likely to refinance again.[23]

*FICO* measures the borrower's credit score at origination, which should be negatively related to default. *CLTV* is an estimate of the borrower's equity in the home in the current month. Low or negative equity (implying a high value of *CLTV*) is expected to increase the probability of default as the option to default is more valuable to the borrower, while greater equity (lower *CLTV*) should increase the probability of prepayment as borrowers with significant equity find it easier to refinance their loans and can cash out equity.[24] *RelLoanSize* is included on the premise that loan size may be correlated to borrower income or wealth, and so can indicate protection against financial distress. *RelLoanSize* is expected to be negatively related to default and positively related to prepayment (as qualifying for a refinancing becomes more likely). *ChgUnempl* proxies for the likelihood of an event causing financial distress, and so is expected to be positively related to default and negatively related to prepayment. *VarHPI* captures volatility in house prices, with option theory suggesting that greater volatility makes borrowers likely to delay defaulting in case the option to default becomes more valuable. *Judicial* indicates whether state law requires lenders to go through a judicial foreclosure process rather than a quicker non-judicial process, and so *Judicial* should be associated with a lesser probability of default. All specifications also include origination year and MSA indicator variables.

Three ZIP code level variables from the 2000 Census are used as (admittedly rough) proxies for borrowers' financial sophistication or financial constraints. *College* is the percentage of residents in a borrower's ZIP code that have a Bachelor's degree or higher level of education. *MedianIncome* is the median household income in a borrower's ZIP code. *MedianAge* is the median resident age in a borrower's ZIP code. All three are plausibly related to an understanding of and experience with financial

[23] Table 4 indicates that cashout refinance loans are the great majority of refinance ARMs and FRMs. As a robustness check, all of the analyses on refinance loans reported in this paper were also performed on only cashout refinances. Results were similar throughout, and are available from the author.

[24] It should be noted that in the LoanPerformance data one cannot reliably link first and subordinate liens on the same property, so the variables *CLTV* and *LTV* do not reflect the effect of subordinate liens on borrower equity.

decision-making and to wealth, and all three are highly correlated, so no attempt is made here to relate any of them exclusively to either financial sophistication or financial constraints.[25]

ARM-specific variables are based on those used by Ambrose *et al.* (2005) and Pennington-Cross and Ho (2010). *PaymentAdj* measures the increase in monthly payment at a loan's most recent rate reset, and should be positively associated with defaults and prepayments.[26] *Adj1st* indicates the month of a loan's first scheduled rate reset and the following two months, with the expectation that there should be a spike in defaults and prepayments during that window. *PostAdj1st* indicates all months following the *Adj1st* window to distinguish this period from the months before the first scheduled rate reset. *Spread* uses the spread between the current market FRM and ARM rates to proxy for the potential benefit to a borrower of refinancing into a FRM, and as such should be negatively related to prepayments. *VarLIBOR* captures the volatility of the LIBOR, with option theory suggesting that greater volatility makes borrowers likely to delay prepaying in case the option to refinance becomes more valuable in the future. In FRM specifications, *RefiPremium* has a purpose analogous to *Spread*, using the spread between the loan interest rate and the current market FRM rate, divided by the loan interest rate, as a proxy for the potential benefit to the borrower of refinancing. *VarFixed* is the FRM analogue to *VarLIBOR*.

The specifications that examine the pricing of prepayment penalties utilize some of the above variables and some additional ones. *PrepayLoan* indicates a loan that has a prepayment penalty (of any duration) at origination. *LTV* is the borrower's loan-to-value ratio at origination. *InitialRate* is the initial loan interest rate. For ARMs, the initial rate may be substantially below the rate to which the loan will adjust over time, so I use *Margin* to reflect loan price. *OwnerOcc* indicates a loan associated with an

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[25] Depending on the loan category and the pair of variables used, the bilateral correlations among *College*, *MedianIncome*, and *MedianAge* range from 0.37 to 0.77.

[26] As in Pennington-Cross and Ho (2010), *PaymentAdj* is constrained to be non-negative and equals zero prior to a loan's first scheduled rate reset. When I replace *PaymentAdj* with a similar variable without those constraints, that variable is positively related to the probability of default but negatively related to the probability of prepayment. This might be due to the introduction into the variable of loan modifications, the likeliest source of reductions in monthly payments prior to a loan's first scheduled rate reset. A loan modification may be a temporary step until a distressed borrower can either refinance into a more affordable mortgage or sell his or her house, suggesting a positive relationship between loan modifications and prepayments. Replacing *PaymentAdj* with the altered variable noticeably changes the magnitudes of *Adj1st*, *PostAdj1st* and *Spread* in the prepayment equation results, but other variables are largely unaffected.

owner-occupied property. Multiple indicator variables represent the distributions of resident ages and house values in a borrower's ZIP code. *%Refinance* and *%ShortTenure* are used as proxies for the amount of turnover in a given real estate market, which may be negatively associated with the demand for loans with prepayment penalties. *APL_Duration* and *APL_Amount* indicate state APL law provisions that restrict the use of prepayment penalties beyond the restrictions in effect nationwide under the federal Home Ownership and Equity Protection Act (HOEPA). (The appendix provides additional detail on these variables.) *PrimeRate* is the monthly bank prime loan rate. *3/27ARM* indicates an ARM in which the first rate adjustment occurs three years (rather than two) after origination, while *30YearFRM* indicates a FRM with a 30-year (rather than 15-year) term.

The loan outcome analyses employ multinomial logit (MNL) models with the data structured in event history format, with each observation representing one month in which a loan remains active. In each month, a loan remains active, is prepaid, or defaults, with default defined as a loan first entering foreclosure.[27] A loan drops out of the sample after a first foreclosure start or prepayment. The model directly controls for the competing risks of default and prepayment by requiring that the probabilities of all three outcomes sum to one. Clapp *et al.* (2006) develop a MNL model that incorporates unobserved heterogeneity by modeling individual borrowers as coming from a finite number of discrete groups with unobserved characteristics. That model is econometrically preferable to the standard model, which assumes there is no unobserved heterogeneity across observations, but the model incorporating unobserved heterogeneity is vastly more time intensive and more prone to convergence problems. In unreported regressions using a MNL model with unobserved heterogeneity, only about half converged after several hundred iterations, but the results of those that did are qualitatively similar to the results using the standard MNL model presented below. These specifications employ standard errors clustered

[27] In 115 (0.08 percent) of the sample loans, LoanPerformance data provides a date for the loans entering REO status with no preceding foreclosure start date. In what follows, I treat the REO start dates for those loans as first foreclosure start dates. Excluding those loans from the analyses causes no substantive changes to the results.

by both month and loan.[28] The MNL model also assumes that the odds ratio between any two outcomes is independent of any other possible outcomes. An alternative, the proportional hazard model, estimates the effects of explanatory variables on survival times without requiring assumptions about the underlying hazard function, but does assume that given two observations with different explanatory variable values, the ratio of the observations' hazard functions does not depend on time. As a robustness check, the MNL analyses were also performed using a proportional hazard model, with similar results.[29]

The analysis of the pricing of prepayment penalties is similar to Elliehausen *et al*. (2008) and LaCour-Little and Holmes (2008), who use instrumental variable approaches to address the endogeneity of loan interest rates, LTV ratios, and prepayment penalties. This approach is applied here to all loans, only bank-originated loans, and only non-bank-originated loans to examine how the impact of prepayment penalties on loan prices differs by origination channel. These specifications use loan-level data and employ standard errors clustered by loan.

## 5. Empirical Analysis

### 5.1 Testing Hypothesis 1

Table 5 presents results of MNL regressions of the probabilities of default and prepayment. For each loan category, the first column represents results based on all loans, the second column is based only on loans that have prepayment penalties, and the third column is based only on loans without prepayment

[28] See Petersen (2009) for a discussion of different approaches to clustering standard errors and the availability of code for clustering on two dimensions in various statistical software packages.

[29] Some researchers use a proportional hazard model that controls for unobserved heterogeneity to examine competing mortgage risks (see Deng *et al.*, 2000; Clapp *et al.*, 2006; Pennington-Cross and Ho, 2010). Like its MNL counterpart, the proportional hazard model with unobserved heterogeneity is highly time intensive. Gerardi *et al.* (2009) eschew incorporating unobserved heterogeneity into their proportional hazard model for their full samples specifically due to it being "extremely computationally burdensome," and find no substantial differences in their results when they did so for very small subsets of their data (see their footnote 9). Given this, I do not use such a model here. Clapp *et al.* (2006) use mortgage termination data to compare results using a standard MNL model, a MNL model with unobserved heterogeneity, a standard proportional hazard model, and a proportional hazard model with unobserved heterogeneity. They find similar results across all four models.

penalties.[30] For both purchase ARMs and refinance ARMs, *NonBank* is positively related to the probability of default for prepayment penalty loans, with non-bank origination associated with a 6.5-9.4 percent increase in the probability of default.[31] For loans without prepayment penalties, *NonBank* is not statistically significant, indicating that the higher probability of default associated with non-bank origination is confined to loans with prepayment penalties. The same pattern is visible in the magnitudes of the coefficient estimates of *NonBank* for refinance FRMs, although the estimate for prepayment penalty loans is just short of statistical significance at conventional levels ($p = 0.102$). These results are consistent with H1. With regard to the probability of prepayment, *NonBank* is positively associated with prepayment for refinance ARMs and refinance FRMs regardless of prepayment penalties. Non-bank origination is only related to the probability of prepayment for purchase ARMs without prepayment penalties.

*PrepayPen* is associated with an 8-15 percent reduction in the probability of default, suggesting that on net the reduction in default risk due to lower interest rates on prepayment penalty loans outweighs the increase in default risk due to prepayment penalties raising the cost of prepayment relative to the cost of default. This contrasts with previous studies, which generally find prepayment penalties to be positively associated with default (see Section 2). This apparent discrepancy may be due to sample period differences. Demyanyk and Van Hemert (2009) find that subprime loan quality deteriorated in the years leading up to the mortgage crisis, and my sample includes more loans from those years than the samples of the previous studies. Given the theoretical and empirical result of Mayer *et al.* (2010) that the benefits of prepayment penalties are greatest for the riskiest borrowers, it may not be surprising that prepayment penalties are negatively related to default in my sample.

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[30] In all multinomial logit regressions in these and subsequent tables, for the "Prepays only" subsamples I also estimated the regressions with *PrepayPen* and *PrepayPenEnd* included. In no case were the coefficient estimates for the other variables substantively altered.

[31] For a given coefficient estimate $\beta$, the percentage change in the probability of default or prepayment, relative to the probability of a loan remaining active, associated with a one-unit change in the explanatory variable is calculated as $e^{\beta} - 1$. For example, the 0.0894 shown for *NonBank* in the second column of Table 5 implies a relative change in the probability of a default of $e^{(0.0894)} - 1 = 0.0935$, a 9.4 percent increase.

Most results for the other control variables are in line with expectations, with a few exceptions. *Adj1st* is negatively associated with defaults, indicating that defaults are more likely to be initiated prior to the first rate reset than immediately after. *RelLoanSize* is positively related to defaults, suggesting that instead of proxying for borrower wealth, the variable may capture loans that are large relative to borrowers' incomes. *VarHPI* is positively related to prepayments, which is consistent with most of the variation in house price indices during the sample period being driven by rapidly rising house prices. *ChgUnempl* is negatively related to defaults for ARMs, but not refinance FRMs. If rising unemployment coincides with stable or falling interest rates, then the potential negative income shock of losing a job may be outweighed for many borrowers by smaller payment shocks due to mortgage rate adjustments. *FICO* is positively related to prepayments for purchase ARMs but negatively related for refinances. This may indicate that purchase borrowers are more likely to refinance due to improving circumstances (*e.g.*, ability to qualify for a lower-cost loan) while refinance borrowers are more likely to borrow under difficult circumstances (*e.g.*, inability to afford payments on their current loans).

The results of Table 5 indicate that the relationship between origination channel and the probability of default varies substantially depending on whether a loan does or does not feature a prepayment penalty, and that the variation is similar across loan categories. H1 posits that the variation is due to differences in compensation incentives related to prepayment penalties, but other explanations are possible. For instance, prepayment penalties may be correlated with less borrower financial sophistication, or with a borrower being financially constrained such that the only way the borrower can get a loan interest rate he or she can afford is by accepting a prepayment penalty. Financial constraints and a lack of financial sophistication are quite plausibly correlated with the probability of default.[32] If the relationships between financial sophistication or constraints and default are stronger for borrowers who use non-bank originators than for those who use bank originators, then that would be consistent with the

[32] In unreported regressions otherwise identical to those in Table 5, I included *College*, *MedianIncome*, and *MedianAge*, individually and together. Each of the three variables is negatively and significantly related to the probability of default in most specifications. Inclusion of those variables only trivially changes the coefficient estimates for *NonBank*, *PrepayPen*, and *PrepayPenEnd*. These results are available from the author.

results for *NonBank* in Table 5. Another possible explanation is that prepayment penalties could simply represent an additional risk factor that exacerbates default risk particularly for the less creditworthy borrowers who use non-bank originators.

To test these alternative explanations, Table 6 presents the coefficient estimates of *NonBank* from specifications similar to those in Table 5, but instead of splitting the sample based on prepayment penalties it is split in turn by several other variables indicative of potential risk factors (*LowNoDoc*, *RelLoanSize*, *LTV*, and *FICO*) or borrower financial sophistication or financial constraints (*College*, *MedianIncome*, and *MedianAge*).[33] There are only minor differences in the significance of *NonBank* with respect to the probability of default across the first three sample splits. For the samples split by borrower FICO score, there are differences in significance, but they are not consistent across loan categories.[34] The results for *College*, *MedianIncome*, and *MedianAge* are highly consistent with each other (see footnote 25), but as with *FICO* the differences in significance are not consistent across loan categories. In no case does the pattern of results for *NonBank* resemble the pattern found in Table 5. This strongly suggests that results for *NonBank* in the sample split by prepayment penalties in Table 5 are not capturing an origination channel effect based on an additional loan risk factor or on borrower financial sophistication or constraints. The possibility remains that the Table 5 results reflect greater default risk among borrowers who use non-bank originators based on some margin that is related to prepayment penalties but unrelated to the variables used in Table 6, but precisely what that margin would be is rather unclear.[35] The compensation incentive argument behind H1 appears likelier to be the correct interpretation.

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[33] Results for other variables are similar to those reported in Table 5, and are omitted here for brevity. Complete results are available from the author.

[34] The results based on splitting the sample by FICO score may be clouded by the fact that borrowers with high FICO scores should be less likely to have a subprime loan rather than a prime loan. In unreported regressions available from the author, excluding loans to borrowers with high FICO scores (above 720 or 660) results in point estimates for *NonBank* that are closer across subsamples and with weaker statistical significance than those shown in Table 6.

[35] Information about a borrower's prepayment risk at first would seem to be the likeliest candidate, but when an institution purchases a loan from a broker, the purchasing institution bears the prepayment risk and collects any prepayment penalty, not the broker. For this reason, non-bank originators should be less, not more, likely than bank originators to act on information regarding prepayment risk. For discussion and evidence on third-party mortgage origination and prepayment risk, see LaCour-Little and Chun (1999).

In the later years of the observation period following the onset of the foreclosure crisis, increasing numbers of loan modifications occurred in attempts to prevent borrowers from entering foreclosure. If bank-originated loans were more likely than non-bank-originated loans to be modified (perhaps due to government pressure on federally-supervised lenders), and this greater proclivity to modify were more pronounced for loans with prepayment penalties, that could produce the pattern of results for *NonBank* in the default equations in Table 5. Non-bank originations with prepayment penalties would have a greater probability of default not because borrowers of those loans were more likely to have difficulty making their payments, but because they were less likely to receive loan modifications that could stave off the start of a foreclosure process. To examine this possibility, I performed the analyses from Table 5 with the definition of default altered to include loans that become 90 days delinquent so that the recording of a default is not dependent on the decision of a loan servicer. Results (available from the author) are similar to those in Table 5, but with some noteworthy differences. For purchase ARMs without prepayment penalties, *NonBank* crosses the threshold for significance at the 10 percent level, weakening the support for H1. *NonBank* is negatively significant at the 10 percent level for refinance ARMs without prepayment penalties and is positively significant at the 1 percent level for refinance FRMs with prepayment penalties, both results strengthening the support for H1.

### 5.2 Testing Hypothesis 2

To evaluate the hypothesis that non-banks price prepayment penalties less favorably for borrowers than banks do, Tables 7a-7c present results of regressions examining the role of prepayment penalties in the determination of loan interest rates while controlling for the endogeneity among loan rates, LTV ratios, and prepayment penalties. In deciding on the terms of a loan, borrowers are frequently offered a variety of interest rate and LTV ratio combinations (higher rates associated with higher LTV ratios), with a discrete reduction in interest rate available in exchange for accepting a prepayment penalty. For this reason, single-equation regressions of loan interest rates on determinants including LTV and prepayment penalties may produce biased coefficient estimates. I address this endogeneity by using an equation-by-equation two stage least squares (2SLS) model for estimating loan interest rate and *LTV* and a probit model with instrumental variables (IV) for estimating *PrepayLoan*. An alternative approach to equation-by-equation 2SLS is a simultaneous equation model, which is more efficient if all equations are specified correctly. However, misspecification in one equation of a simultaneous equation system can cause inconsistent coefficient estimates in the entire system, while in an equation-by-equation approach this problem is confined to the equation in which the misspecification exists. Given that the LoanPerformance data has little information regarding borrower characteristics that may be used in determining loan interest rates, concern about misspecification argues for the more robust equation-by-equation model.

In each of Tables 7a-7c (one table for each loan category), the first three columns present results from the loan interest rate regressions using all loans, only bank-originated loans, and only non-bank-originated loans, respectively. For refinance FRMs, the loan interest rate measure is *InitialRate*.[36] The initial interest rate of an ARM is not the most appropriate measure of the ARM's price because the initial rate is often substantially below the fully-indexed rate, so for ARMs the loan interest rate measure is *Margin*.[37] The next three columns show results from the *LTV* regressions, and the final three columns show results of the *PrepayLoan* regressions. To implement the 2SLS model, for each subsample of loans a simple probit regression was run to generate the predicted probability that a loan has a prepayment penalty.[38] Those values and *LTV* appear in the loan interest rate regressions. Either *Margin* or *InitialRate* is included in both the *LTV* and *PrepayLoan* regressions. Given the decision structure described above

[36] Ideally, the loan interest rate would be adjusted to reflect prevailing market subprime mortgage rates at the time of origination, but to my knowledge no index of subprime market rates is available. Instead, I performed the analyses of this section again using *InitialRate* minus the Freddie Mac prime mortgage market survey rate for the loan origination month. I also performed the analyses using *InitialRate* minus the median value of *InitialRate* from all sample loans in the same loan category originated in the same month. In both cases, the results were similar to those reported in this section.

[37] Elliehausen *et al.* (2008) and DeMong and Burroughs (2005) use APR as their loan interest rate measure (adjusted by a market rate at the time of origination, for Elliehausen *et al.*, 2008). Although this captures the interest expected to be paid over the life of an ARM, it does not allow for the possibility of different effects of prepayment penalties on initial rates and fully-indexed rates. Unreported results using *InitialRate* for ARMs are discussed briefly below.

[38] Independent variables for the probit regressions are the same as those in Panel C of Tables 7a-7c, excluding *Margin* and *InitialRate*. Results of these regressions are available from the author.

(selection of an interest rate-LTV combination, then consideration of a prepayment penalty), *LTV* and *PrepayLoan* need not be determined simultaneously, and so do not appear in each other's regressions.

Several loan characteristics are among the explanatory variables in all equations, but each equation also contains instruments associated with the dependent variable. The instrument in the loan interest rate equation is the bank prime rate. This rate is mainly used to price business loans, and may be taken as a measure of the opportunity cost of mortgage lending. The prime rate does not frequently change in response to other market rates, and so should not have a direct bearing on borrowers' choices regarding loan terms. In the *LTV* equations, indicator variables that measure the age distribution of residents in the borrower's ZIP code are used as instruments because older borrowers tend to have more wealth than younger ones, and so may prefer loans with lower LTV ratios. The distribution of house values in the borrower's ZIP code are used on a similar premise, that borrowers with greater wealth are likely to choose higher-value properties. In the *PrepayLoan* equations, the unique variables include *%Refinance*, *%ShortTenure*, and *APL_Duration*. More refinancing activity and more residents who have lived in their homes for a short time may indicate greater turnover in local home ownership, which could affect borrowers' expectations of how long they will be in a particular house and therefore their preferences regarding prepayment penalties. An APL provision restricting the duration of prepayment penalty periods limits the reduction of the lender's prepayment risk that a prepayment penalty offers, and so can make prepayment penalties less attractive to lenders and more attractive to borrowers.[39]

The main variable of interest is *Pr(PrepayLoan)*, the predicted probability that a loan will have a prepayment penalty. The coefficient estimates for *Pr(PrepayLoan)* do not directly indicate the change in loan interest rate associated with a prepayment penalty. Those changes are calculated in Table 8 by multiplying each coefficient estimate for *Pr(PrepayLoan)* by the difference in the average

[39] In unreported regressions, I replaced *APL_Duration* with *APL_Amount*. The two are highly correlated, with correlation coefficients ranging from 0.54 to 0.72, depending on the loan category. Results using *APL_Amount* were similar to those in Tables 7a-7c, the main difference being that the coefficient estimates on *Pr(PrepayLoan)* drop in significance in a few instances. To ensure that potential differences in the durations of prepayment penalty periods offered by non-banks and banks do not distort the reported results, I also ran the regressions using only loans without prepayment penalties and loans with prepayment penalty periods equal to the most common duration for the loan type (24 months for ARMs, 36 months for FRMs). Again, the results were similar.

*Pr(PrepayLoan)* for loans with versus without prepayment penalties. The results in Panel A indicate that for ARMs, accepting a prepayment penalty is associated with an increase in *Margin*, and that the increase is substantially greater for non-bank originations (56-94 basis points) than for bank originations (18-24 basis points). This is consistent with H2. In unreported regressions that are available upon request, I used *InitialRate* instead of *Margin* for ARMs. For refinance ARMs, prepayment penalties are associated with a 14 basis point reduction in initial loan rate for bank originations and a 21 basis point reduction for non-bank originations. For purchase ARMs, prepayment penalties are associated with a 7 basis point increase in initial loan rate for both origination channels. Note that the magnitudes of the increases in *Margin* in Panel A of Table 8 exceed the reductions, if any, in *InitialRate*. For ARM borrowers who retain their loans beyond the first rate reset, savings they may have gained through a discount on their introductory interest rate in exchange for accepting a prepayment penalty may be reduced or lost entirely through subsequently higher rates. This is especially true for non-bank originations, for which the increase in *Margin* is three to four times as large as it is for bank originations.

Panel B of Table 8 indicates that for refinance FRMs, prepayment penalties are association with a 34 basis point reduction in loan interest rate. This magnitude is consistent with Elliehausen *et al.* (2008) and somewhat larger than that found by LaCour-Little and Holmes (2008). Bank originators appear to provide discounts on loan rates for prepayment penalties that are almost 25 basis points greater than the discounts provided by non-bank originators, consistent with H2. A caveat should be noted here. As is the case in many mortgage databases, data on upfront costs, such as points and fees, is unavailable in LoanPerformance. Therefore an investigation of the effect of prepayment penalties on the total cost of a loan across origination channels is not possible here. In addition, this paper is the first examination of how ARM margins are affected by prepayment penalties, and the topic must be explored more deeply for a complete understanding of the full costs and benefits of prepayment penalties. Still, the evidence on loan interest rates is consistent with differential pricing of prepayment penalties as indicated by H2.

### 5.3 Testing Hypothesis 3

LoanPerformance has very little information about borrowers other than FICO scores, so in order to test whether non-banks originate disproportionately more loans with prepayment penalties than banks do to borrowers who are less financially sophisticated or more financially constrained, I use three proxies: *College*, *MedianIncome*, and *MedianAge*. Table 9 provides the percentages of loans that have prepayment penalties in each loan category, with the sample split by origination channel and by one of the proxies. Both banks and non-banks originate a higher percentage of prepayment penalty loans in locales in which residents have lower educational levels, incomes, and ages, as indicated by all of the differences in the italicized rows being positive. In every case, the differences are greater for non-bank-originated loans than for bank-originated loans.[40] Additionally, the disparity between the non-bank differences and bank differences is most pronounced for purchase and refinance ARMs and less pronounced for refinance FRMs, closely matching the pattern of results in Table 5. To the extent that ZIP-code level education, income, and age figures are reasonable proxies for borrower financial sophistication and financial constraints, the evidence in Table 9 is consistent with H3.

### 5.4 Testing Hypothesis 4

State APL laws often have provisions restricting the length of time past origination during which a prepayment penalty can be charged on loans covered by the APL law, or restricting the amount of prepayment penalty that can be charged on covered loans. Table 10 presents the coefficient estimates of *NonBank* from regressions similar to those in Table 5, with the samples split according to whether there was a state APL law in effect at the time of origination that restricted prepayment penalty durations (Panel A) or amounts (Panel B).[41] The left-hand sides of Panels A and B indicate that among loans

[40] These results are consistent with other findings regarding borrower income, age, and education. Woodward (2008) finds that total charges paid at origination are strongly and negatively related to the percent of residents in a borrower's census tract with a college education; Jiang *et al.* (2009) find that borrower income and age are both negatively related to the probability that a loan was originated by a broker; Berndt *et al.* (2010) find that broker profits are negatively related to the percent of residents in a borrower's ZIP code with a Bachelor's degree.
[41] Results for other variables are similar to those reported in Table 5, and are omitted here for brevity. Complete results are available from the author. As noted previously, there is a high degree of correlation between

originated in times and places without the APL law provisions in effect, the pattern for *NonBank* found in Table 5 is strongly apparent. Non-bank-originated loans have a higher probability of default only for loans with prepayment penalties. The right-hand sides indicate that when and where the provisions are in effect, no association between origination channel and default is in evidence. Consistent with H4, the positive relationship between non-bank origination and default risk only for prepayment penalty loans is not only weaker in the presence of state APL restrictions on prepayment penalties, but it disappears altogether. It is important to note that there are endogeneity concerns regarding these findings, as a state's prior mortgage default experience or other housing market conditions could influence both a state's APL laws and subsequent loan outcomes. A thorough analysis of the efficacy of state APL law provisions would need to address such concerns, but is beyond the scope of this paper. That stated, the presented findings are consistent with the prediction based on compensation incentives across origination channels.

Turning to the prepayment equation results, the pattern of results is not as stable, but particularly for ARMs, non-bank origination is positively associated with the probability of prepayment when either APL law provision is in effect. This is true both for loans with and without prepayment penalties. While at first blush it seems unlikely that APL provisions addressing prepayment penalties should affect results concerning loans without prepayment penalties, a plausible explanation involves the high correlations of *APL_Duration* and *APL_Amount* to another type of APL law provision, one limiting the amount of points and fees that may be financed on covered loans.[42] This provision makes refinancing less costly regardless of prepayment penalties, and is plausibly more relevant for ARM borrowers who in many cases took adjustable-rate mortgages with the intention of refinancing prior to the initial rate reset. If brokers, whose compensation relies more heavily on fee income than the compensation of direct lender loan officers, are more constrained by restrictions on points and fees than loan officers, and *APL_Duration* and

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*APL_Duration* and *APL_Amount*. For this reason, I make no conclusion regarding whether the results of Table 11 more reflect the efficacy of restricting durations or restricting amounts.

[42] The correlation coefficients between *APL_Duration* and that APL law provision range from 0.42 to 0.51, depending on the loan category, and those between *APL_Amount* and that provision range from 0.34 to 0.48.

*APL_Amount* capture those restrictions' effects, then that would be consistent with the prepayment equation results from Table 10.

## 6. Conclusion

This paper presents evidence that variation by origination channel in the probability of default, the pricing of prepayment penalties, and the incidence of prepayment penalties by borrower financial sophistication and financial constraints in subprime mortgages are all consistent with differing compensation incentives. In particular, YSPs plausibly both are linked to prepayment penalties and provide greater incentives for non-bank originators than for bank originators to place borrowers in higher rate loans. This is consistent with the finding that non-bank origination is associated with greater default risk for loans with prepayment penalties but not for loans without prepayment penalties, and the finding that non-banks price prepayment penalties less favorably to borrowers than banks do. Compared to banks, non-banks also originate disproportionately more prepayment penalty loans to borrowers who are more likely to accept loans with higher interest rates. Finally, state APL restrictions on the use of prepayment penalties eliminate the greater probability of default on non-bank-originated prepayment penalty loans.

A few caveats are worthwhile here. First, due to a lack of available data, no empirical results directly on YSPs are presented here. This paper's evidence on prepayment penalties is consistent with predictions based on YSPs, but that is a step short of evidence on YSPs. Second, this paper's findings concerning the pricing of prepayment penalties could be profitably revisited by researchers with access to richer datasets that include information on both loan interest rates and upfront costs to get a more complete picture of how prepayment penalties affect total loan costs. Third, this paper's findings do not imply any normative judgment regarding prepayment penalties. Restrictions of prepayment penalties can prevent some defaults by allowing financially distressed borrowers to more easily pay off their loans through refinancings or sales, but can simultaneously harm other borrowers who must accept more expensive loans or be denied mortgage credit altogether because the option to reduce the lender's prepayment risk in exchange for a lower interest rate (initially, at least) is no longer available. Weighing these costs and benefits is beyond the scope of this paper. The findings in this paper instead contribute to the positive conclusion that the relationships among origination channel, prepayment penalties, and default are consistent with the differing compensation incentives faced by bank versus non-bank originators.

These findings highlight how critical originator compensation incentives are to understanding mortgage performance in general and the recent subprime foreclosure crisis in particular. They also suggest that going forward, certain provisions of the recent Dodd-Frank Act (see footnote 13) may be expected to reduce the disparity in default risk across origination channels by lowering the probability of default among non-bank originations.

## Appendix – APL Law Provision Variables

The variables *APL_Duration* and *APL_Amount* indicate state APL provisions in effect at the time of a loan's origination that place greater restrictions on the use of prepayment penalties than the federal HOEPA statute does. Under HOEPA, the duration of a prepayment penalty period on a covered mortgage is restricted to sixty months after origination if the borrower's monthly debts are less than or equal to fifty percent of the borrower's monthly gross income, with prepayment penalties being prohibited if the borrower's debts exceed this level. As detailed in Table A1, *APL_Duration* takes a value of one when and where a state's APL law prohibits prepayment penalties on covered loans prior to sixty months after origination, and zero otherwise. (Provisions regarding prepayment penalties in the sample states' APL laws do not include monthly gross income criteria, and of course state APL laws cannot restrict prepayment penalties more strictly than HOEPA for those loans for which HOEPA prohibits them entirely.) HOEPA does not restrict the amounts of prepayment penalties, so *APL_Amount* takes a value of one when and where a state's APL law places any restriction on prepayment penalty amounts.

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***Table 1: Sample metropolitan statistical areas***

MSA foreclosure rates are from RealtyTrac, Inc. (2008), which defines the foreclosure rate as the percentage of total households entering some stage of foreclosure during the year 2007. The numbers of sample loans reflect both loans for which the originators could be identified and those for which they could not. The numbers of sample observations reflect loans for which the originators could be identified and the random selection of adjustable-rate purchase and refinance loans and fixed-rate refinance loans. Population estimates as of July 1, 2007, are from the US Census Bureau.

| | | Foreclosure rate | Sample loans | | Sample observations | | Population | |
|---|---|---|---|---|---|---|---|---|
| **MSA** | **State(s)** | **Year-end 2007** | **Number** | **Percent** | **Number** | **Percent** | **Number** | **Percent** |
| Miami | FL | 2.724 | 66,399 | 7.7% | 335,125 | 9.1% | 2,382,961 | 4.6% |
| Atlanta | GA | 2.531 | 95,544 | 11.1% | 432,224 | 11.7% | 5,261,296 | 10.2% |
| Phoenix | AZ | 1.915 | 86,659 | 10.1% | 340,363 | 9.2% | 4,165,921 | 8.1% |
| Chicago | IL | 1.641 | 168,711 | 19.6% | 634,006 | 17.2% | 7,929,840 | 15.4% |
| Los Angeles | CA | 1.360 | 194,677 | 22.7% | 753,114 | 20.4% | 9,807,870 | 19.1% |
| San Antonio | TX | 1.067 | 24,676 | 2.9% | 200,591 | 5.4% | 1,984,921 | 3.9% |
| Minneapolis | MN-WI | 0.836 | 66,780 | 7.8% | 228,828 | 6.2% | 3,197,620 | 6.2% |
| Baltimore | MD | 0.734 | 53,678 | 6.2% | 197,370 | 5.3% | 2,663,805 | 5.2% |
| New York | NJ-NY | 0.518 | 69,378 | 8.1% | 342,401 | 9.3% | 11,627,931 | 22.6% |
| Pittsburgh | PA | 0.367 | 32,865 | 3.8% | 232,681 | 6.3% | 2,354,159 | 4.6% |
| Total | | | 859,367 | | 3,696,703 | | 51,376,324 | |

***Table 2: Comparison of loans with identified versus unidentified originators***

This table presents the numbers of loans and mean values of loan-level characteristics of loans for which the originators could be identified and loans for which the originators could not.

| | **Number of loans** | | | **Origination amount** | | | **LTV at orgination** | | |
|---|---|---|---|---|---|---|---|---|---|
| | Identified | Unidentified | *% identified* | Identified | Unidentified | *Difference* | Identified | Unidentified | *Difference* |
| Adjustable-rate refinances | 295,271 | 113,046 | *72.31%* | $200,167 | $195,838 | *$4,329* | 78.28 | 79.01 | *-0.73* |
| Adjustable-rate purchases | 145,605 | 63,126 | *69.76%* | $198,051 | $181,955 | *$16,096* | 84.72 | 86.01 | *-1.29* |
| Fixed-rate refinances | 128,018 | 58,810 | *68.52%* | $189,409 | $195,378 | *-$5,969* | 73.19 | 73.17 | *0.02* |
| Fixed-rate purchases | 19,140 | 12,657 | *60.19%* | $195,040 | $179,085 | *$15,955* | 83.64 | 87.05 | *-3.41* |

| | **Percent with prepayment penalty** | | | **Percent with reduced documentation** | | | **Percent owner-occupied** | | |
|---|---|---|---|---|---|---|---|---|---|
| | Identified | Unidentified | *Difference* | Identified | Unidentified | *Difference* | Identified | Unidentified | *Difference* |
| Adjustable-rate refinances | 0.63 | 0.64 | *-0.01* | 0.36 | 0.33 | *0.03* | 0.95 | 0.95 | *0.00* |
| Adjustable-rate purchases | 0.61 | 0.63 | *-0.02* | 0.49 | 0.44 | *0.05* | 0.89 | 0.90 | *-0.01* |
| Fixed-rate refinances | 0.71 | 0.69 | *0.02* | 0.29 | 0.29 | *0.00* | 0.95 | 0.95 | *0.00* |
| Fixed-rate purchases | 0.69 | 0.55 | *0.14* | 0.39 | 0.44 | *-0.05* | 0.90 | 0.82 | *0.08* |

| | **Borrower FICO at origination** | | | **Months before first rate reset** | | | **Maturity in months** | | |
|---|---|---|---|---|---|---|---|---|---|
| | Identified | Unidentified | *Difference* | Identified | Unidentified | *Difference* | Identified | Unidentified | *Difference* |
| Adjustable-rate refinances | 587.74 | 592.42 | *-4.68* | 25.70 | 27.60 | *-1.90* | ---- | ---- | ---- |
| Adjustable-rate purchases | 637.91 | 634.52 | *3.39* | 25.75 | 27.06 | *-1.31* | ---- | ---- | ---- |
| Fixed-rate refinances | 626.72 | 623.08 | *3.64* | ---- | ---- | ---- | 343.65 | 344.54 | *-0.89* |
| Fixed-rate purchases | 655.86 | 665.85 | *-9.99* | ---- | ---- | ---- | 356.99 | 356.64 | *0.35* |

| | **Initial loan interest rate** | | | **Margin** | | | **Judicial foreclosure state** | | |
|---|---|---|---|---|---|---|---|---|---|
| | Identified | Unidentified | *Difference* | Identified | Unidentified | *Difference* | Identified | Unidentified | *Difference* |
| Adjustable-rate refinances | 7.86 | 7.71 | *0.15* | 5.98 | 6.47 | *-0.49* | 0.48 | 0.43 | *0.05* |
| Adjustable-rate purchases | 7.71 | 7.80 | *-0.09* | 5.89 | 6.55 | *-0.66* | 0.48 | 0.42 | *0.06* |
| Fixed-rate refinances | 7.41 | 7.34 | *0.07* | ---- | ---- | ---- | 0.46 | 0.43 | *0.03* |
| Fixed-rate purchases | 7.74 | 7.72 | *0.02* | ---- | ---- | ---- | 0.48 | 0.45 | *0.03* |

***Table 3: Variable definitions***

Quarterly MSA-level home price index values are from Freddie Mac's conventional mortgage home price indices. Monthly MSA-level unemployment rates are from the Bureau of Labor Statistics. Monthly fixed-rate and adjustable-rate mortgage interest rates are from Freddie Mac's Primary Mortgage Market Survey (PMMS). Bank prime loan rates are from the Federal Reserve Bank of Saint Louis. Resident education, income, age, tenure and house value data are from the 2000 Census. Information on state foreclosure laws is from Ghent and Kudlyak (2010).

| | |
|---|---|
| Static loan characteristic variables: | |
| *NonBank* | Equals 0 if a loan is originated by a depository institution primarily supervised by the Federal Reserve, OCC, FDIC, OTS, or NCUA; 1 otherwise |
| *PrepayLoan* | Equals 1 if the loan features a prepayment penalty; 0 otherwise |
| *LowNoDoc* | Equals 1 if the loan is based on reduced documentation; 0 otherwise |
| *FICO* | Borrower's FICO score at origination |
| *RelLoanSize* | Ratio of loan origination amount to the average origination amount of all sample loans of the same type (FRM or ARM) and purpose (purchase or refinance) originated in the same MSA and year |
| *Cashout* | Equals 1 if the loan is a cashout refinance; 0 otherwise |
| *Judicial* | Equals 1 if the state is a judicial foreclosure state; 0 if a non-judicial foreclosure state |
| *LTV* | Loan-to-value ratio at origination |
| *InitialRate* | Initial loan interest rate at origination |
| *Margin* | Amount added to the index rate of the loan to compute the loan's fully-indexed interest rate |
| *OwnerOcc* | Equals 1 if the loan is for an owner-occupied property; 0 otherwise |
| *3/27ARM* | Equals 1 if the initial interest rate is fixed for three years after origination; 0 if it is fixed for two years after origination |
| *30YearFRM* | Equals 1 if the loan is a 30-year loan; 0 if it is a 15-year loan |
| Time-varying loan characteristic variables: | |
| *PrepayPen* | Equals 1 if a prepayment penalty period is in effect during the entire current month; 0 otherwise |
| *PrepayPenEnd* | Equals 1 in the month that a prepayment penalty ends and in the following two months; 0 otherwise |
| *CLTV* | Current loan balance divided by current home value, where current home value is estimated as (1+ MSA home price appreciation since origination) multiplied by the loan amount at origination divided by the loan-to-value ratio at origination |
| *PaymentAdj* | Percentage change in monthly payment at the time of the most recent interest rate reset, constrained to be non-negative and to equal 0 prior to the loan's first scheduled rate reset |
| *Adj1st* | Equals 1 in the month of the first scheduled rate reset and in the following two months; 0 otherwise |
| *PostAdj1st* | Equals 1 three months or more after the first scheduled rate reset, 0 otherwise |
| *RefiPremium* | Loan interest rate minus current PMMS 30-year or 15-year mortgage fixed rate, divided by the loan interest rate |
| *Age* | Months since origination |
| Macroeconomic, demographic, and anti-predatory lending law variables: | |
| *Spread* | Current PMMS 30-year mortgage fixed rate minus current PMMS 1-year adjustable rate |
| *ChgUnempl* | Current monthly MSA unemployment rate minus the monthly MSA unemployment rate at origination |
| *VarHPI* | Standard deviation of MSA home price index over the previous 8 quarters |
| *VarLIBOR* | Standard deviation of 6-month London Interbank Offer Rate (LIBOR) over the previous 24 months |
| *VarFixed* | Standard deviation of PMMS 30-year or 15-year mortgage fixed rate over the previous 24 months |
| *College* | Percentage of residents 25 years old or older with at least a Bachelor's degree in borrower's ZIP code |
| *MedianIncome* | Median household income (in thousands) in borrower's ZIP code |
| *MedianAge* | Median resident age in borrower's ZIP code |
| *PrimeRate* | Monthly bank prime loan rate |
| *%Refinance* | Percentage of all sample loans in a given loan's ZIP code and origination year that are refinances |
| *%ShortTenure* | Percentage of owner-occupied households in the borrower's ZIP code who have lived in their current households for five years or less |
| *%AgeXX-YY* | Percentage of residents in the borrower's ZIP code between the ages of XX and YY |
| *%Value$X-$Y* | Percentage of specified owner-occupied housing units in the borrower's ZIP code valued between $X00,000 and $Y00,000 |
| *APL_Duration* | Equals 1 if a state's APL law's prohibition against prepayment penalties on covered loans takes effect sooner than five years after loan origination, 0 otherwise |
| *APL_Amount* | Equals 1 if a state's APL law restricts the maximum amount that can be charged as a prepayment penalty on a covered loan, 0 otherwise |

*Table 4: Variable means by origination channel*

| | **Adjustable-rate purchases** | | **Adjustable-rate refinances** | | **Fixed-rate refinances** | |
|---|---|---|---|---|---|---|
| | Bank loans | Non-bank loans | Bank loans | Non-bank loans | Bank loans | Non-bank loans |
| Loans | 14,064 | 22,520 | 20,154 | 53,550 | 8,610 | 23,524 |
| Observations | 333,211 | 502,656 | 432,981 | 1,104,561 | 282,594 | 759,867 |
| Static loan characteristic variables: | | | | | | |
| *PrepayLoan* | 0.62 | 0.62 | 0.68 | 0.61 | 0.70 | 0.73 |
| *LowNoDoc* | 0.38 | 0.52 | 0.33 | 0.36 | 0.30 | 0.28 |
| *FICO* | 634.10 | 635.08 | 593.66 | 586.88 | 635.22 | 630.34 |
| *RelLoanSize* | 0.98 | 0.96 | 1.01 | 0.96 | 1.02 | 0.97 |
| *Cashout* | ---- | ---- | 0.91 | 0.87 | 0.87 | 0.84 |
| *Judicial* | 0.51 | 0.49 | 0.51 | 0.48 | 0.47 | 0.46 |
| *LTV* | 85.22 | 84.39 | 79.30 | 78.62 | 73.23 | 72.66 |
| *InitialRate* | 7.77 | 7.74 | 7.85 | 7.91 | 7.34 | 7.27 |
| *Margin* | 5.93 | 5.86 | 5.92 | 5.99 | ---- | ---- |
| *OwnerOcc* | 0.90 | 0.89 | 0.93 | 0.94 | 0.94 | 0.94 |
| *3/27ARM* | 0.10 | 0.20 | 0.13 | 0.17 | ---- | ---- |
| *30YearFRM* | ---- | ---- | ---- | ---- | 0.89 | 0.90 |
| Time-varying loan characteristic variables: | | | | | | |
| *PrepayPen* | 0.41 | 0.44 | 0.47 | 0.46 | 0.46 | 0.47 |
| *PrepayPenEnd* | 0.04 | 0.04 | 0.04 | 0.03 | 0.03 | 0.03 |
| *CLTV* | 77.61 | 75.46 | 71.87 | 70.15 | 62.41 | 60.83 |
| *Age* | 20.50 | 19.58 | 20.15 | 19.24 | 27.55 | 26.34 |
| *PaymentAdj* | 0.02 | 0.02 | 0.02 | 0.02 | ---- | ---- |
| *Adj1st* | 0.06 | 0.06 | 0.06 | 0.05 | ---- | ---- |
| *PostAdj1st* | 0.26 | 0.22 | 0.24 | 0.22 | ---- | ---- |
| *RefiPremium* | ---- | ---- | ---- | ---- | 0.17 | 0.16 |
| Macroeconomic, demographic, and anti-predatory lending law variables: | | | | | | |
| *ChgUnempl* | 0.13 | -0.05 | 0.07 | -0.10 | 0.08 | -0.11 |
| *VarHPI* | 16.11 | 19.69 | 17.89 | 19.59 | 19.48 | 21.80 |
| *VarLIBOR* | 0.83 | 0.82 | 0.83 | 0.81 | ---- | ---- |
| *Spread* | 1.05 | 1.13 | 1.13 | 1.21 | ---- | ---- |
| *VarFixed* | ---- | ---- | ---- | ---- | 0.32 | 0.32 |
| *College* | 21.30 | 19.94 | 22.46 | 21.20 | 22.27 | 21.02 |
| *MedianIncome* | 46.78 | 45.33 | 48.47 | 46.87 | 47.57 | 45.84 |
| *MedianAge* | 33.60 | 33.12 | 33.71 | 33.40 | 34.09 | 33.72 |
| *PrimeRate* | 5.84 | 5.52 | 5.66 | 5.31 | 5.35 | 5.09 |
| *%Refinance* | 0.63 | 0.65 | 0.69 | 0.69 | 0.70 | 0.70 |
| *%ShortTenure* | 36.14 | 35.64 | 35.55 | 35.03 | 33.63 | 32.92 |
| *%Age18-34* | 24.25 | 24.52 | 24.07 | 24.33 | 23.79 | 24.09 |
| *%Age35-44* | 16.41 | 16.13 | 16.48 | 16.26 | 16.28 | 16.10 |
| *%Age45-59* | 17.29 | 16.95 | 17.42 | 17.15 | 17.57 | 17.30 |
| *%Age60-over* | 13.83 | 13.72 | 13.82 | 13.81 | 14.56 | 14.48 |
| *%Value$1-$2* | 46.02 | 46.24 | 48.03 | 47.54 | 45.54 | 44.88 |
| *%Value$2-$3* | 10.72 | 10.65 | 12.70 | 12.34 | 14.34 | 14.33 |
| *%Value$3-$5* | 4.20 | 4.17 | 5.35 | 4.96 | 6.48 | 6.36 |
| *%Value$5-over* | 1.40 | 1.45 | 1.87 | 1.68 | 2.53 | 2.45 |
| *APL_Amount* | 0.67 | 0.61 | 0.64 | 0.60 | 0.61 | 0.57 |
| *APL_Duration* | 0.79 | 0.75 | 0.74 | 0.71 | 0.76 | 0.79 |

***Table 5: Origination channel and the probabilities of default and prepayment***

This table presents results of multinomial logit regressions based on monthly data for subprime mortgages originated during 2002-2006. Variables are defined as described in Table 3. Each coefficient estimate represents the impact on the probability of a first foreclosure start or a prepayment, relative to the probability of a loan remaining active, of a one-unit change in the corresponding variable. Vintage year indicators, MSA indicators, and a constant term are included in all specifications. Robust standard errors clustered by both loan and month are in brackets. Levels of significance are indicated by *, **, and *** for 10%, 5%, and 1%, respectively.

| | **Adjustable-rate purchases** | | | **Adjustable-rate refinances** | | | **Fixed-rate refinances** | | |
|---|---|---|---|---|---|---|---|---|---|
| | Default equation results | | | Default equation results | | | Default equation results | | |
| | All loans | Prepays only | No prepays | All loans | Prepays only | No prepays | All loans | Prepays only | No prepays |
| *NonBank* | 0.0650** | 0.0894** | 0.0510 | 0.022 | 0.0634** | -0.0288 | 0.0971* | 0.115 | 0.0352 |
| | [0.0296] | [0.0348] | [0.0411] | [0.0266] | [0.0316] | [0.0422] | [0.0572] | [0.0706] | [0.0714] |
| *PrepayPen* | -0.132*** | | | -0.0834** | | | -0.159*** | | |
| | [0.0398] | | | [0.0355] | | | [0.0399] | | |
| *PrepayPenEnd* | -0.0119 | | | -0.0659 | | | -0.0839 | | |
| | [0.0714] | | | [0.0709] | | | [0.0875] | | |
| *LowNoDoc* | 0.315*** | 0.315*** | 0.303*** | 0.429*** | 0.431*** | 0.415*** | 0.413*** | 0.407*** | 0.418*** |
| | [0.0241] | [0.0314] | [0.0363] | [0.0232] | [0.0272] | [0.0316] | [0.0425] | [0.0524] | [0.0652] |
| *Cashout* | | | | -0.0712** | -0.043 | -0.108** | 0.0882 | 0.054 | 0.116 |
| | | | | [0.0346] | [0.0435] | [0.0462] | [0.0542] | [0.0633] | [0.0900] |
| *FICO* | -0.0035*** | -0.0039*** | -0.0029*** | -0.0054*** | -0.0061*** | -0.0042*** | -0.0067*** | -0.0065*** | -0.0071*** |
| | [0.000344] | [0.000415] | [0.000412] | [0.000484] | [0.000496] | [0.000539] | [0.000363] | [0.000475] | [0.000626] |
| *CLTV* | 0.0218*** | 0.0238*** | 0.0124*** | 0.0207*** | 0.0218*** | 0.0153*** | 0.0279*** | 0.0277*** | 0.0241*** |
| | [0.00148] | [0.00166] | [0.00215] | [0.00125] | [0.00150] | [0.00149] | [0.00157] | [0.00196] | [0.00269] |
| *PaymentAdj* | 1.111*** | 1.686*** | -0.024 | 1.255*** | 1.417*** | 0.841*** | | | |
| | [0.295] | [0.334] | [0.372] | [0.214] | [0.258] | [0.275] | | | |
| *Adj1st* | -0.141* | -0.164** | 0.00632 | -0.163** | -0.188*** | -0.102 | | | |
| | [0.0732] | [0.0701] | [0.0886] | [0.0672] | [0.0669] | [0.0794] | | | |
| *PostAdj1st* | 0.0589 | -0.00999 | 0.274*** | 0.0137 | 0.0753 | 0.004 | | | |
| | [0.0665] | [0.0790] | [0.0820] | [0.0571] | [0.0666] | [0.0728] | | | |
| *Spread* | -0.289*** | -0.257*** | -0.343*** | -0.212*** | -0.214*** | -0.215** | | | |
| | [0.0744] | [0.0854] | [0.0965] | [0.0797] | [0.0810] | [0.109] | | | |
| *RefiPremium* | | | | | | | 2.738*** | 2.948*** | 2.472*** |
| | | | | | | | [0.202] | [0.259] | [0.323] |
| *Age* | 0.0689*** | 0.0711*** | 0.0707*** | 0.0934*** | 0.0901*** | 0.0979*** | 0.0714*** | 0.0758*** | 0.0708*** |
| | [0.00562] | [0.00607] | [0.00702] | [0.00534] | [0.00544] | [0.00757] | [0.00648] | [0.00587] | [0.00885] |
| *Age*$^2$ | -0.00080*** | -0.00068*** | -0.0011*** | -0.00107*** | -0.00100*** | -0.0012*** | -0.00072*** | -0.00070*** | -0.00080*** |
| | [9.38e-05] | [9.16e-05] | [0.000123] | [8.24e-05] | [8.10e-05] | [0.000133] | [0.000103] | [8.77e-05] | [0.000151] |
| *RelLoanSize* | 0.189*** | 0.179*** | 0.211*** | 0.0929*** | 0.104*** | 0.0726** | 0.182*** | 0.215*** | 0.142** |
| | [0.0288] | [0.0345] | [0.0416] | [0.0189] | [0.0236] | [0.0334] | [0.0346] | [0.0400] | [0.0596] |
| *ChgUnempl* | -0.0461*** | -0.0510*** | -0.0272 | -0.0470*** | -0.0347** | -0.0603*** | 0.00548 | 0.00642 | -0.0183 |
| | [0.0137] | [0.0161] | [0.0172] | [0.0119] | [0.0149] | [0.0151] | [0.0177] | [0.0224] | [0.0256] |
| *VarHPI* | -0.0146*** | -0.0149*** | -0.0228*** | -0.00623** | -0.00803*** | -0.00794** | 0.000819 | -0.00192 | -0.00245 |
| | [0.00255] | [0.00235] | [0.00431] | [0.00260] | [0.00252] | [0.00389] | [0.00271] | [0.00264] | [0.00644] |
| *VarLIBOR* | -0.164*** | -0.154** | -0.127* | -0.248*** | -0.228*** | -0.229*** | | | |
| | [0.0585] | [0.0768] | [0.0725] | [0.0672] | [0.0716] | [0.0812] | | | |
| *VarFixed* | | | | | | | -1.382*** | -1.178*** | -1.405*** |
| | | | | | | | [0.265] | [0.285] | [0.379] |
| *Judicial* | -0.284 | -0.300 | -0.201 | 0.166 | 0.249 | 0.173 | 0.052 | 0.0567 | 0.0967 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | [0.196] | [0.410] | [0.277] | [0.167] | [0.258] | [0.214] | [0.338] | [0.376] | [0.858] |
| | Prepayment equation results | | | Prepayment equation results | | | Prepayment equation results | | |
| | All loans | Prepays only | No prepays | All loans | Prepays only | No prepays | All loans | Prepays only | No prepays |
| *NonBank* | 0.00501 | 0.00542 | 0.0470* | 0.0422*** | 0.0281* | 0.0455** | 0.0756*** | 0.0909*** | 0.0708** |
| | [0.0164] | [0.0204] | [0.0245] | [0.0127] | [0.0153] | [0.0212] | [0.0204] | [0.0239] | [0.0337] |
| *PrepayPen* | -0.778*** | | | -0.537*** | | | -0.297*** | | |
| | [0.0222] | | | [0.0181] | | | [0.0300] | | |
| *PrepayPenEnd* | 0.352*** | | | 0.309*** | | | 0.263*** | | |
| | [0.0322] | | | [0.0231] | | | [0.0353] | | |
| *LowNoDoc* | 0.00584 | -0.0268 | 0.0516* | -0.0445*** | -0.0370** | -0.0503** | 0.00172 | 0.0239 | -0.0697* |
| | [0.0184] | [0.0196] | [0.0273] | [0.0158] | [0.0157] | [0.0236] | [0.0272] | [0.0353] | [0.0419] |
| *Cashout* | | | | 0.0156 | 0.00715 | 0.0572*** | 0.0201 | -0.0235 | 0.128*** |
| | | | | [0.0141] | [0.0176] | [0.0220] | [0.0269] | [0.0311] | [0.0412] |
| *FICO* | 0.00059*** | 0.00013 | 0.00126*** | -0.00069*** | -0.00096*** | -0.00031* | -0.00144*** | -0.00195*** | -0.00003 |
| | [0.000193] | [0.000227] | [0.000275] | [0.000154] | [0.000188] | [0.000180] | [0.000482] | [0.000617] | [0.000280] |
| *CLTV* | -0.0119*** | -0.0171*** | -0.00164 | -0.00467*** | -0.00353** | -0.0059*** | 0.00100 | 0.00440** | -0.00488*** |
| | [0.00151] | [0.00164] | [0.00187] | [0.00114] | [0.00147] | [0.000943] | [0.00172] | [0.00205] | [0.00136] |
| *PaymentAdj* | 0.475*** | 0.370** | 0.533 | 0.589*** | 0.640*** | 0.653*** | | | |
| | [0.179] | [0.156] | [0.380] | [0.142] | [0.160] | [0.219] | | | |
| *Adj1st* | 0.396*** | 1.293*** | 0.497*** | 0.463*** | 1.071*** | 0.560*** | | | |
| | [0.0680] | [0.0617] | [0.0697] | [0.0527] | [0.0517] | [0.0574] | | | |
| *PostAdj1st* | 0.0808 | 0.657*** | 0.0955 | 0.0862 | 0.396*** | 0.203** | | | |
| | [0.0668] | [0.0627] | [0.100] | [0.0605] | [0.0539] | [0.0791] | | | |
| *Spread* | 0.0743 | 0.109 | -0.047 | 0.0057 | 0.0364 | -0.0562 | | | |
| | [0.0736] | [0.0740] | [0.0973] | [0.0645] | [0.0670] | [0.0718] | | | |
| *RefiPremium* | | | | | | | 1.961*** | 1.682** | 2.523*** |
| | | | | | | | [0.490] | [0.685] | [0.155] |
| *Age* | 0.0818*** | 0.101*** | 0.0711*** | 0.0631*** | 0.0732*** | 0.0543*** | 0.0320*** | 0.0458*** | 0.0152** |
| | [0.00770] | [0.00850] | [0.00902] | [0.00698] | [0.00705] | [0.00673] | [0.00698] | [0.00734] | [0.00625] |
| *Age*$^2$ | -0.00193*** | -0.00218*** | -0.0018*** | -0.00153*** | -0.00154*** | -0.0015*** | -0.00083*** | -0.00092*** | -0.00059*** |
| | [0.000152] | [0.000162] | [0.000216] | [0.000124] | [0.000122] | [0.000143] | [0.000124] | [0.000122] | [0.000111] |
| *RelLoanSize* | 0.0905*** | -0.00798 | 0.243*** | 0.103*** | 0.0436*** | 0.199*** | 0.049 | -0.054 | 0.224*** |
| | [0.0170] | [0.0205] | [0.0285] | [0.0123] | [0.0150] | [0.0184] | [0.0340] | [0.0469] | [0.0317] |
| *ChgUnempl* | -0.130*** | -0.117*** | -0.146*** | -0.165*** | -0.177*** | -0.132*** | -0.145*** | -0.144*** | -0.126*** |
| | [0.0159] | [0.0182] | [0.0205] | [0.0164] | [0.0188] | [0.0176] | [0.0169] | [0.0208] | [0.0167] |
| *VarHPI* | 0.0263*** | 0.0230*** | 0.0253*** | 0.0251*** | 0.0241*** | 0.0322*** | 0.0198*** | 0.0195*** | 0.0215*** |
| | [0.00176] | [0.00190] | [0.00290] | [0.00119] | [0.00117] | [0.00248] | [0.00145] | [0.00146] | [0.00273] |
| *VarLIBOR* | -0.253*** | -0.279*** | -0.118* | -0.349*** | -0.419*** | -0.237*** | | | |
| | [0.0592] | [0.0645] | [0.0682] | [0.0580] | [0.0605] | [0.0604] | | | |
| *VarFixed* | | | | | | | -0.324* | -0.341* | -0.298 |
| | | | | | | | [0.171] | [0.181] | [0.225] |
| *Judicial* | -0.140 | 0.0338 | 0.104 | -0.235*** | -0.00705 | -0.189 | -0.143 | -0.165 | -0.01 |
| | [0.139] | [0.243] | [0.181] | [0.0876] | [0.126] | [0.147] | [0.169] | [0.196] | [0.348] |
| Observations | 690,180 | 436,496 | 253,684 | 1,345,250 | 854,420 | 490,830 | 991,406 | 717,365 | 274,041 |
| Loans | 36,583 | 22,242 | 14,341 | 73,678 | 46,117 | 27,561 | 32,118 | 23,003 | 9,115 |
| Pseudo-$R^2$ | 0.0697 | 0.0867 | 0.0421 | 0.0564 | 0.0659 | 0.0389 | 0.0532 | 0.0551 | 0.0490 |
| Log-likelihood | -155,087 | -95,376 | -59,616 | -301,373 | -190,722 | -110,632 | -114,400 | -82,361 | -31,992 |

***Table 6: Coefficient estimates for NonBank in samples split by other potential risk factors***

This table presents the coefficient estimates for *NonBank* taken from results of multinomial logit regressions based on monthly data for subprime mortgages originated during 2002-2006. Specifications are identical to those for all loans in Table 5, with samples split by *LowNoDoc*, *RelLoanSize*, *LTV*, *FICO*, *College*, *MedianIncome*, and *MedianAge*. Variables are defined as described in Table 3. Each coefficient estimate represents the impact on the probability of a first foreclosure start or a prepayment, relative to the probability of a loan remaining active, of a loan being non-bank-originated rather than bank-originated. Vintage year indicators, MSA indicators, and a constant term are included in all specifications. Robust standard errors clustered by both loan and month are in brackets. Levels of significance are indicated by *, **, and *** for 10%, 5%, and 1%, respectively. Complete results are available upon request.

| | **Documentation level** | | **Relative loan size** | | **LTV at origination** | | **FICO at origination** | |
|---|---|---|---|---|---|---|---|---|
| | Reduced Doc | Full Doc | Below median | At or above median | Below median | At or above median | Below median | At or above median |
| Default equation | | | | | | | | |
| Adjustable-rate purchases | 0.0737** | 0.0611* | 0.0889** | 0.0603* | 0.240** | 0.0605** | 0.0364 | 0.116*** |
| | [0.0334] | [0.0348] | [0.0408] | [0.0333] | [0.107] | [0.0304] | [0.0336] | [0.0418] |
| Adjustable-rate refinances | 0.0533 | -0.00038 | 0.0125 | 0.0339 | 0.0256 | 0.0248 | 0.00187 | 0.0648* |
| | [0.0338] | [0.0316] | [0.0339] | [0.0321] | [0.0483] | [0.0287] | [0.0349] | [0.0352] |
| Fixed-rate refinances | 0.115 | 0.0932* | 0.0888 | 0.106 | 0.108 | 0.0995 | 0.121** | 0.0873 |
| | [0.0913] | [0.0552] | [0.0637] | [0.0698] | [0.0743] | [0.0663] | [0.0616] | [0.0828] |
| Prepayment equation | | | | | | | | |
| Adjustable-rate purchases | 0.0225 | -0.00652 | -0.00161 | 0.0103 | -0.0848 | 0.0119 | 0.00492 | 0.0137 |
| | [0.0217] | [0.0213] | [0.0234] | [0.0201] | [0.0581] | [0.0174] | [0.0234] | [0.0211] |
| Adjustable-rate refinances | 0.0169 | 0.0548*** | 0.0430*** | 0.0373** | 0.0373** | 0.0382** | 0.0333*** | 0.0508*** |
| | [0.0211] | [0.0148] | [0.0155] | [0.0173] | [0.0175] | [0.0167] | [0.0129] | [0.0196] |
| Fixed-rate refinances | 0.0125 | 0.104*** | 0.0875*** | 0.0642** | 0.106*** | 0.0329 | 0.0714*** | 0.0858*** |
| | [0.0363] | [0.0219] | [0.0229] | [0.0302] | [0.0287] | [0.0265] | [0.0249] | [0.0302] |

| | **College-educated by ZIP** | | **Median income by ZIP** | | **Median age by ZIP** | |
|---|---|---|---|---|---|---|
| | Below median | At or above median | Below median | At or above median | Below median | At or above median |
| Default equation | | | | | | |
| Adjustable-rate purchases | 0.108*** | 0.0114 | 0.117*** | 0.0104 | 0.0861** | 0.0290 |
| | [0.0355] | [0.0359] | [0.0406] | [0.0349] | [0.0370] | [0.0374] |
| Adjustable-rate refinances | 0.0138 | 0.0213 | 0.0209 | 0.0178 | 0.0437 | -0.00259 |
| | [0.0313] | [0.0321] | [0.0345] | [0.0353] | [0.0350] | [0.0351] |
| Fixed-rate refinances | 0.00109 | 0.194*** | 0.00713 | 0.188*** | 0.00947 | 0.185*** |
| | [0.0686] | [0.0675] | [0.0733] | [0.0611] | [0.0693] | [0.0606] |
| Prepayment equation | | | | | | |
| Adjustable-rate purchases | 0.0175 | -0.00685 | 0.0389* | -0.0303 | 0.0417* | -0.0269 |
| | [0.0225] | [0.0226] | [0.0222] | [0.0233] | [0.0232] | [0.0225] |
| Adjustable-rate refinances | 0.0536*** | 0.0290* | 0.0553*** | 0.0276* | 0.0592*** | 0.0259* |
| | [0.0167] | [0.0170] | [0.0176] | [0.0147] | [0.0187] | [0.0139] |
| Fixed-rate refinances | 0.0609** | 0.0779*** | 0.0912*** | 0.0542** | 0.0835*** | 0.0604** |
| | [0.0284] | [0.0255] | [0.0249] | [0.0258] | [0.0295] | [0.0249] |

***Table 7a: Prepayment penalties and interest rate margins – adjustable-rate purchase mortgages***

This table presents results of 2SLS and IV probit regressions based on loan-level data for subprime adjustable-rate purchase mortgages originated during 2002-2006. Variables are defined as described in Table 3. Panel A employs predicted probabilities of a loan having a prepayment penalty derived from the results of a probit specification similar to the IV probit specification shown but excluding *Margin*. Vintage year indicators, MSA indicators, and a constant term are included in all specifications. Robust standard errors clustered by month are in brackets. Levels of significance are indicated by *, **, and *** for 10%, 5%, and 1%, respectively.

| | Panel A: 2SLS Dependent variable: *Margin* | | | Panel B: 2SLS Dependent variable: *LTV* | | | Panel C: IV probit Dependent variable: *PrepayLoan* | | |
|---|---|---|---|---|---|---|---|---|---|
| | All loans | Bank loans | Non-bank loans | All loans | Bank loans | Non-bank loans | All loans | Bank loans | Non-bank loans |
| *Pr(PrepayLoan)* | 1.587*** | 0.628*** | 1.706*** | | | | | | |
| | [0.0430] | [0.0841] | [0.0472] | | | | | | |
| *Margin* | | | | -0.120 | 5.370*** | -1.263*** | 4.599*** | 1.857*** | 0.335 |
| | | | | [0.226] | [0.663] | [0.249] | [1.604] | [0.207] | [0.327] |
| *LTV* | 0.0172*** | 0.0190*** | 0.0149*** | | | | | | |
| | [0.00190] | [0.00325] | [0.00219] | | | | | | |
| *NonBank* | -0.0193*** | | | -0.487*** | | | 0.275 | | |
| | [0.00556] | | | [0.0484] | | | [0.172] | | |
| *FICO* | -0.0036*** | -0.0049*** | -0.0029*** | 0.0175*** | 0.0558*** | 0.00503*** | 0.0152*** | 0.00776*** | 0.000849 |
| | [5.71e-05] | [0.000134] | [5.60e-05] | [0.000851] | [0.00296] | [0.000854] | [0.00535] | [0.000915] | [0.000929] |
| *LowNoDoc* | 0.260*** | 0.358*** | 0.179*** | -2.437*** | -4.857*** | -1.755*** | -0.895*** | -0.709*** | -0.147*** |
| | [0.00711] | [0.0156] | [0.00728] | [0.0565] | [0.185] | [0.0608] | [0.255] | [0.0561] | [0.0400] |
| *RelLoanSize* | -0.0882*** | -0.129*** | -0.0458*** | 3.332*** | 3.179*** | 3.777*** | 0.341** | 0.229*** | -0.0782*** |
| | [0.00587] | [0.00900] | [0.00743] | [0.0526] | [0.103] | [0.0682] | [0.140] | [0.0313] | [0.0199] |
| *OwnerOcc* | -0.188*** | -0.267*** | -0.162*** | -2.260*** | 1.211*** | -3.502*** | 0.979*** | 0.462*** | 0.262*** |
| | [0.00921] | [0.0145] | [0.0120] | [0.0794] | [0.235] | [0.0882] | [0.311] | [0.0687] | [0.0469] |
| *3/27ARM* | 0.0925*** | 0.0284 | 0.0697*** | 0.129** | 0.409*** | 0.165** | -0.177*** | -0.446*** | -0.144*** |
| | [0.00787] | [0.0199] | [0.00765] | [0.0587] | [0.138] | [0.0665] | [0.0539] | [0.0369] | [0.0167] |
| *PrimeRate* | -0.00483 | -0.0986*** | 0.0528*** | | | | | | |
| | [0.00604] | [0.0109] | [0.00688] | | | | | | |
| *%Age18-34* | | | | 0.0120* | 0.0105 | 0.0186** | | | |
| | | | | [0.00715] | [0.0132] | [0.00899] | | | |
| *%Age35-44* | | | | 0.0199 | 0.0794*** | -0.0345* | | | |
| | | | | [0.0148] | [0.0276] | [0.0185] | | | |
| *%Age45-59* | | | | 0.0375*** | 0.00957 | 0.0570*** | | | |
| | | | | [0.0120] | [0.0214] | [0.0153] | | | |
| *%Age60+* | | | | 0.00329 | 0.0345*** | -0.0141* | | | |
| | | | | [0.00594] | [0.0111] | [0.00739] | | | |
| *%Value$1-$2* | | | | -0.0364*** | -0.0372*** | -0.0373*** | | | |
| | | | | [0.00118] | [0.00222] | [0.00147] | | | |
| *%Value$2-$3* | | | | -0.0608*** | -0.0706*** | -0.0583*** | | | |
| | | | | [0.00268] | [0.00506] | [0.00330] | | | |
| *%Value$3-$5* | | | | -0.0816*** | -0.0757*** | -0.0808*** | | | |
| | | | | [0.00450] | [0.00867] | [0.00549] | | | |
| *%Value$5+* | | | | -0.153*** | -0.124*** | -0.155*** | | | |
| | | | | [0.00532] | [0.0108] | [0.00645] | | | |
| *%Refinance* | | | | | | | -0.438*** | 0.152 | -0.326*** |
| | | | | | | | [0.169] | [0.116] | [0.0769] |
| *%ShortTenure* | | | | | | | -0.209* | -0.230** | -0.202*** |
| | | | | | | | [0.118] | [0.105] | [0.0603] |
| *APL_Duration* | | | | | | | 1.023** | -0.137*** | -0.502*** |
| | | | | | | | [0.517] | [0.0455] | [0.149] |
| Observations | 146,710 | 56,094 | 90,616 | 146,710 | 56,094 | 90,616 | 145,413 | 55,569 | 89,844 |
| $R^2$ | 0.121 | 0.151 | 0.147 | 0.103 | -0.0279 | 0.0558 | | | |
| F-statistic | 775 | 367 | 696 | 627 | 282 | 361 | | | |
| $\chi^2$ | | | | | | | 8,594 | 9,413 | 39,386 |

***Table 7b: Prepayment penalties and interest rate margins – adjustable-rate refinance mortgages***

This table presents results of 2SLS and IV probit regressions based on loan-level data for subprime adjustable-rate refinance mortgages originated during 2002-2006. Variables are defined as described in Table 3. Panel A employs predicted probabilities of a loan having a prepayment penalty derived from the results of a probit specification similar to the IV probit specification shown but excluding *Margin*. Vintage year indicators, MSA indicators, and a constant term are included in all specifications. Robust standard errors clustered by month are in brackets. Levels of significance are indicated by *, **, and *** for 10%, 5%, and 1%, respectively.

| | Panel A: 2SLS Dependent variable: *Margin* | | | Panel B: 2SLS Dependent variable: *LTV* | | | Panel C: IV probit Dependent variable: *PrepayLoan* | | |
|---|---|---|---|---|---|---|---|---|---|
| | All loans | Bank loans | Non-bank loans | All loans | Bank loans | Non-bank loans | All loans | Bank loans | Non-bank loans |
| *Pr(PrepayLoan)* | 0.861*** | 0.521*** | 0.901*** | | | | | | |
| | [0.0222] | [0.0802] | [0.0213] | | | | | | |
| *Margin* | | | | -8.246*** | 4.665*** | -9.644*** | 0.252 | 1.711*** | 7.890** |
| | | | | [0.401] | [0.884] | [0.393] | [0.284] | [0.177] | [3.266] |
| *LTV* | 0.00612*** | 0.0126*** | 0.00377*** | | | | | | |
| | [0.000453] | [0.00109] | [0.000474] | | | | | | |
| *NonBank* | 0.0691*** | | | -0.0778 | | | -0.490*** | | |
| | [0.00445] | | | [0.0577] | | | [0.00967] | | |
| *FICO* | -0.0050*** | -0.0060*** | -0.0046*** | 0.0131*** | 0.0819*** | 0.00651*** | 0.00109 | 0.00896*** | 0.0349** |
| | [4.08e-05] | [9.38e-05] | [4.35e-05] | [0.00195] | [0.00477] | [0.00185] | [0.00133] | [0.000953] | [0.0145] |
| *LowNoDoc* | 0.130*** | 0.384*** | 0.0388*** | -1.368*** | -4.415*** | -1.887*** | -0.0415 | -0.629*** | -0.243** |
| | [0.00381] | [0.00874] | [0.00410] | [0.0719] | [0.315] | [0.0654] | [0.0329] | [0.0624] | [0.0999] |
| *RelLoanSize* | -0.105*** | -0.115*** | -0.0968*** | 9.733*** | 8.002*** | 10.84*** | -0.0377 | 0.0578*** | 0.642** |
| | [0.00417] | [0.00788] | [0.00485] | [0.0681] | [0.0978] | [0.0831] | [0.0261] | [0.0208] | [0.283] |
| *OwnerOcc* | -0.0963*** | -0.207*** | -0.0581*** | 0.847*** | 4.066*** | 0.274* | -0.157*** | 0.220*** | 0.571 |
| | [0.00766] | [0.0157] | [0.00857] | [0.124] | [0.236] | [0.144] | [0.0377] | [0.0447] | [0.356] |
| *3/27ARM* | 0.0191*** | -0.0294* | 0.00254 | -0.12 | 0.203 | 0.117 | -0.246*** | -0.352*** | 0.0344 |
| | [0.00513] | [0.0161] | [0.00532] | [0.0750] | [0.158] | [0.0861] | [0.0127] | [0.0292] | [0.0762] |
| *Cashout* | -0.000207 | 0.119*** | -0.0417*** | -1.517*** | -1.040*** | -2.200*** | -0.115*** | -0.265*** | 0.422* |
| | [0.00543] | [0.0127] | [0.00579] | [0.0813] | [0.165] | [0.0967] | [0.0130] | [0.0328] | [0.240] |
| *PrimeRate* | -0.0186*** | -0.0953*** | 0.0161*** | | | | | | |
| | [0.00423] | [0.00925] | [0.00459] | | | | | | |
| *%Age18-34* | | | | -0.0879*** | -0.0676*** | -0.0905*** | | | |
| | | | | [0.00867] | [0.0138] | [0.0103] | | | |
| *%Age35-44* | | | | 0.320*** | 0.289*** | 0.332*** | | | |
| | | | | [0.0184] | [0.0292] | [0.0218] | | | |
| *%Age45-59* | | | | -0.0386*** | 0.00887 | -0.0535*** | | | |
| | | | | [0.0148] | [0.0230] | [0.0178] | | | |
| *%Age60+* | | | | -0.0459*** | -0.0123 | -0.0402*** | | | |
| | | | | [0.00741] | [0.0121] | [0.00879] | | | |
| *%Value$1-$2* | | | | -0.0869*** | -0.0668*** | -0.0933*** | | | |
| | | | | [0.00152] | [0.00241] | [0.00179] | | | |
| *%Value$2-$3* | | | | -0.192*** | -0.156*** | -0.199*** | | | |
| | | | | [0.00320] | [0.00528] | [0.00377] | | | |
| *%Value$3-$5* | | | | -0.243*** | -0.205*** | -0.259*** | | | |
| | | | | [0.00511] | [0.00808] | [0.00607] | | | |
| *%Value$5+* | | | | -0.444*** | -0.345*** | -0.450*** | | | |
| | | | | [0.00634] | [0.0112] | [0.00745] | | | |
| *%Refinance* | | | | | | | -0.0686* | 0.779*** | -1.609*** |
| | | | | | | | [0.0391] | [0.112] | [0.601] |
| *%ShortTenure* | | | | | | | -0.0619* | -0.0202 | -0.563** |
| | | | | | | | [0.0334] | [0.0826] | [0.261] |
| *APL_Duration* | | | | | | | -0.483*** | 0.107*** | 1.695 |
| | | | | | | | [0.0709] | [0.0309] | [1.072] |
| Observations | 297,406 | 82,172 | 215,234 | 297,406 | 82,172 | 215,234 | 294,436 | 80,846 | 213,590 |
| $R^2$ | 0.154 | 0.165 | 0.178 | -0.163 | 0.188 | -0.185 | | | |
| F-statistic | 2,315 | 671 | 2,125 | 2,210 | 881 | 1,685 | | | |
| $\chi^2$ | | | | | | | 123,032 | 12,680 | 8,136 |

***Table 7c: Prepayment penalties and initial loan rates – fixed-rate refinance mortgages***

This table presents results of 2SLS and IV probit regressions based on loan-level data for subprime fixed-rate refinance mortgages originated during 2002-2006. Variables are defined as described in Table 3. Panel A employs predicted probabilities of a loan having a prepayment penalty derived from the results of a probit specification similar to the IV probit specification shown but excluding *InitialRate*. Vintage year indicators, MSA indicators, and a constant term are included in all specifications. Robust standard errors clustered by month are in brackets. Levels of significance are indicated by *, **, and *** for 10%, 5%, and 1%, respectively.

| | Panel A: 2SLS Dependent variable: *InitialRate* | | | Panel B: 2SLS Dependent variable: *LTV* | | | Panel C: IV probit Dependent variable: *PrepayLoan* | | |
|---|---|---|---|---|---|---|---|---|---|
| | All loans | Bank loans | Non-bank loans | All loans | Bank loans | Non-bank loans | All loans | Bank loans | Non-bank loans |
| *Pr(PrepayLoan)* | -0.708*** | -2.033*** | -0.573*** | | | | | | |
| | [0.0561] | [0.175] | [0.0504] | | | | | | |
| *InitialRate* | | | | -4.174*** | -0.415 | -5.381*** | -0.0649 | -0.304** | 0.18 |
| | | | | [0.384] | [0.515] | [0.505] | [0.106] | [0.148] | [0.117] |
| *LTV* | 0.00912*** | 0.00950*** | 0.00858*** | | | | | | |
| | [0.000449] | [0.00101] | [0.000491] | | | | | | |
| *NonBank* | 0.0549*** | | | 0.225** | | | -0.0269 | | |
| | [0.00576] | | | [0.0922] | | | [0.0294] | | |
| *FICO* | -0.0090*** | -0.0093*** | -0.0089*** | -0.0216*** | 0.0105** | -0.0319*** | -0.000826 | -0.00319** | 0.00158 |
| | [4.31e-05] | [9.56e-05] | [4.77e-05] | [0.00347] | [0.00477] | [0.00453] | [0.000946] | [0.00134] | [0.00102] |
| *LowNoDoc* | 0.369*** | 0.209*** | 0.391*** | 0.0953 | -1.217*** | 0.527** | -0.0754* | -0.171*** | -0.0443 |
| | [0.00575] | [0.0179] | [0.00636] | [0.168] | [0.242] | [0.219] | [0.0423] | [0.0628] | [0.0459] |
| *RelLoanSize* | -0.340*** | -0.274*** | -0.363*** | 14.12*** | 12.03*** | 15.25*** | 0.0901*** | -0.0248 | 0.181*** |
| | [0.00645] | [0.0124] | [0.00749] | [0.120] | [0.176] | [0.159] | [0.0335] | [0.0434] | [0.0339] |
| *OwnerOcc* | -0.530*** | -0.438*** | -0.563*** | -1.835*** | 1.489*** | -3.282*** | -0.318*** | -0.138* | -0.401*** |
| | [0.0118] | [0.0229] | [0.0137] | [0.252] | [0.371] | [0.331] | [0.0640] | [0.0800] | [0.0841] |
| *30YearFRM* | 0.187*** | 0.325*** | 0.168*** | 8.881*** | 9.077*** | 8.587*** | 0.172*** | 0.340*** | 0.00385 |
| | [0.00995] | [0.0255] | [0.0109] | [0.168] | [0.287] | [0.204] | [0.0364] | [0.0478] | [0.0390] |
| *Cashout* | 0.0749*** | 0.143*** | 0.0564*** | -0.834*** | 0.0766 | -1.244*** | -0.0846*** | 0.0412 | -0.159*** |
| | [0.00749] | [0.0169] | [0.00820] | [0.120] | [0.244] | [0.136] | [0.0246] | [0.0422] | [0.0313] |
| *PrimeRate* | 0.293*** | 0.403*** | 0.255*** | | | | | | |
| | [0.00717] | [0.0162] | [0.00783] | | | | | | |
| *%Age18-34* | | | | -0.173*** | -0.220*** | -0.150*** | | | |
| | | | | [0.0139] | [0.0255] | [0.0165] | | | |
| *%Age35-44* | | | | 0.300*** | 0.385*** | 0.251*** | | | |
| | | | | [0.0286] | [0.0523] | [0.0339] | | | |
| *%Age45-59* | | | | -0.180*** | -0.219*** | -0.148*** | | | |
| | | | | [0.0244] | [0.0442] | [0.0290] | | | |
| *%Age60+* | | | | -0.0656*** | -0.0874*** | -0.0586*** | | | |
| | | | | [0.0116] | [0.0214] | [0.0138] | | | |
| *%Value$1-$2* | | | | -0.151*** | -0.117*** | -0.164*** | | | |
| | | | | [0.00279] | [0.00487] | [0.00338] | | | |
| *%Value$2-$3* | | | | -0.268*** | -0.221*** | -0.289*** | | | |
| | | | | [0.00510] | [0.00897] | [0.00618] | | | |
| *%Value$3-$5* | | | | -0.367*** | -0.339*** | -0.378*** | | | |
| | | | | [0.00727] | [0.0132] | [0.00864] | | | |
| *%Value$5+* | | | | -0.572*** | -0.515*** | -0.595*** | | | |
| | | | | [0.00805] | [0.0140] | [0.00976] | | | |
| *%Refinance* | | | | | | | 0.550*** | 0.497*** | 0.597*** |
| | | | | | | | [0.0944] | [0.150] | [0.103] |
| *%ShortTenure* | | | | | | | 0.0889 | 0.0547 | 0.151* |
| | | | | | | | [0.0791] | [0.113] | [0.0884] |
| *APL_Duration* | | | | | | | 0.672*** | 0.183* | 1.005*** |
| | | | | | | | [0.132] | [0.0958] | [0.174] |
| Observations | 129,682 | 35,395 | 94,287 | 129,682 | 35,395 | 94,287 | 127,946 | 34,411 | 93,535 |
| $R^2$ | 0.513 | 0.463 | 0.540 | 0.206 | 0.299 | 0.177 | | | |
| F-statistic | 5,853 | 1,349 | 4,968 | 1,765 | 553 | 1,317 | | | |
| $\chi^2$ | | | | | | | 19,839 | 4,967 | 22,948 |

***Table 8: Estimated loan interest rate changes associated with prepayment penalties***

This table presents estimates of the change in *Margin* and *InitialRate* associated with a loan having a prepayment penalty. Estimates are calculated as the coefficient estimate for *Pr(PrepayLoan)* from Panel A of Tables 7a-7c multiplied by the difference between the average value of *Pr(PrepayLoan)* for loans that do have a prepayment penalty and the average value of *Pr(PrepayLoan)* for loans that do not have a prepayment penalty.

| **Panel A** | Estimate for *Pr(PrepayLoan)* | Average *Pr(PrepayLoan)* *PrepayLoan* = 1 | *PrepayLoan* = 0 | Change in *Margin* |
|---|---|---|---|---|
| Adjustable-rate purchases | | | | |
| All loans | 1.587*** | 0.789 | 0.329 | 0.731 |
| Bank loans | 0.628*** | 0.759 | 0.373 | 0.243 |
| Non-bank loans | 1.706*** | 0.827 | 0.273 | 0.944 |
| Adjustable-rate refinances | | | | |
| All loans | 0.861*** | 0.822 | 0.291 | 0.457 |
| Bank loans | 0.521*** | 0.782 | 0.441 | 0.178 |
| Non-bank loans | 0.901*** | 0.853 | 0.226 | 0.564 |

| **Panel B** | Estimate for *Pr(PrepayLoan)* | Average *Pr(PrepayLoan)* *PrepayLoan* = 1 | *PrepayLoan* = 0 | Change in *InitialRate* |
|---|---|---|---|---|
| Fixed-rate refinances | | | | |
| All loans | -0.708*** | 0.853 | 0.367 | -0.344 |
| Bank loans | -2.033*** | 0.774 | 0.487 | -0.585 |
| Non-bank loans | -0.573*** | 0.893 | 0.283 | -0.350 |

***Table 9: Percentages of loans with prepayment penalties by origination channel and financial sophistication proxies***
This table presents the percentage of loans with prepayment penalties in samples split by whether loans are originated by non-banks or banks and by whether loans are for properties in ZIP codes with below or above median values of *College*, *MedianIncome*, and *MedianAge*. T-tests indicate that all differences are statistically significant at the 0.01% level.

| | **Adjustable-rate purchases** | | **Adjustable-rate refinances** | | **Fixed-rate refinances** | |
|---|---|---|---|---|---|---|
| | Non-bank loans | Bank loans | Non-bank loans | Bank loans | Non-bank loans | Bank loans |
| Percent college-educated | | | | | | |
| Below median | 66.0% | 63.8% | 67.1% | 70.8% | 74.8% | 70.6% |
| At or above median | 56.0% | 58.6% | 54.4% | 63.9% | 69.4% | 65.8% |
| *Difference* | *10.0%* | *5.2%* | *12.7%* | *6.9%* | *5.4%* | *4.8%* |
| Median household income | | | | | | |
| Below median | 68.3% | 65.4% | 69.0% | 71.6% | 74.9% | 70.5% |
| At or above median | 53.5% | 57.3% | 52.6% | 63.3% | 69.4% | 66.0% |
| *Difference* | *14.8%* | *8.1%* | *16.5%* | *8.4%* | *5.6%* | *4.4%* |
| Median age | | | | | | |
| Below median | 68.4% | 63.2% | 71.0% | 72.6% | 76.9% | 70.4% |
| At or above median | 52.9% | 59.0% | 50.7% | 62.4% | 67.1% | 65.9% |
| *Difference* | *15.5%* | *4.2%* | *20.3%* | *10.2%* | *9.8%* | *4.5%* |

***Table 10: Coefficient estimates for NonBank in samples split by prepayment penalty APL law provisions***

This table presents the coefficient estimates for *NonBank* taken from results of multinomial logit regressions based on monthly data for subprime mortgages originated during 2002-2006. Specifications are identical to those in Table 5, with samples split by *APL_Duration* and *APL_Amount*. Variables are defined as described in Table 3. Each coefficient estimate represents the impact on the probability of a first foreclosure start or a prepayment, relative to the probability of a loan remaining active, of a loan being non-bank-originated rather than bank-originated. Vintage year indicators, MSA indicators, and a constant term are included in all specifications. Robust standard errors clustered by both loan and month are in brackets. Levels of significance are indicated by *, **, and *** for 10%, 5%, and 1%, respectively. Complete results are available upon request.

| **Panel A** | **Prepayment penalties allowed beyond five years after origination (*APL_Duration* = 0)** | | **Prepayment penalties prohibited beyond five years after origination (*APL_Duration* = 1)** | |
|---|---|---|---|---|
| | Prepays only | No prepays | Prepays only | No prepays |
| Default equation | | | | |
| Adjustable-rate purchases | 0.241*** | 0.130 | 0.0119 | 0.0431 |
| | [0.0603] | [0.109] | [0.0402] | [0.0429] |
| Adjustable-rate refinances | 0.113** | -0.00211 | 0.0148 | -0.0302 |
| | [0.0509] | [0.0986] | [0.0368] | [0.0456] |
| Fixed-rate refinances | 0.194** | 0.0459 | 0.0934 | 0.0365 |
| | [0.0955] | [0.170] | [0.0797] | [0.0744] |
| Prepayment equation | | | | |
| Adjustable-rate purchases | -0.0603** | -0.00785 | 0.0416* | 0.0626** |
| | [0.0303] | [0.0624] | [0.0225] | [0.0250] |
| Adjustable-rate refinances | -0.0119 | 0.0633 | 0.0597*** | 0.0514** |
| | [0.0281] | [0.0442] | [0.0176] | [0.0231] |
| Fixed-rate refinances | 0.160*** | 0.0527 | 0.0694** | 0.0640 |
| | [0.0482] | [0.0588] | [0.0274] | [0.0413] |

| **Panel B** | **No restriction on amount of prepayment penalty (*APL_Amount* = 0)** | | **Amount of prepayment penalty is restricted (*APL_Amount* = 1)** | |
|---|---|---|---|---|
| | Prepays only | No prepays | Prepays only | No prepays |
| Default equation | | | | |
| Adjustable-rate purchases | 0.129*** | 0.0362 | 0.0443 | 0.0555 |
| | [0.0489] | [0.0693] | [0.0505] | [0.0472] |
| Adjustable-rate refinances | 0.101** | -0.0735 | 0.00317 | -0.00883 |
| | [0.0463] | [0.0794] | [0.0423] | [0.0455] |
| Fixed-rate refinances | 0.147* | 0.212 | 0.0883 | 0.00964 |
| | [0.0772] | [0.158] | [0.0953] | [0.0720] |
| Prepayment equation | | | | |
| Adjustable-rate purchases | -0.0262 | 0.0452 | 0.0347 | 0.0518** |
| | [0.0261] | [0.0472] | [0.0277] | [0.0264] |
| Adjustable-rate refinances | -0.00357 | 0.0578 | 0.0620*** | 0.0486** |
| | [0.0253] | [0.0403] | [0.0176] | [0.0244] |
| Fixed-rate refinances | 0.169*** | 0.106* | 0.0387 | 0.0539 |
| | [0.0371] | [0.0588] | [0.0300] | [0.0400] |

***Table A1: APL_Duration and APL_Amount values***

This table presents the values for *APL_Duration* and *APL_Amount* used in this paper's analyses, based on the author's examination of each sample state's APL laws. Sample loans were originated between Jan. 2002 and Dec. 2006.

| | ***APL_Duration*** | | ***APL_Amount*** | |
|---|---|---|---|---|
| **State** | **Dates** | **Value** | **Dates** | **Value** |
| Arizona | Jan. 2002-Dec. 2006 | 0 | Jan. 2002-Dec. 2006 | 0 |
| California | Jan. 2002-Dec. 2006 | 1 | Jan. 2002-Dec. 2006 | 1 |
| Florida | Jan. 2002-Sept. 2002<br>Oct. 2002-Dec. 2006 | 0<br>1 | Jan. 2002-Dec. 2006 | 0 |
| Georgia | Jan. 2002-Sept. 2002<br>Oct. 2002-Dec. 2006 | 0<br>1 | Jan. 2002-Sept. 2002<br>Oct. 2002-Dec. 2006 | 0<br>1 |
| Illinois | Jan. 2002-Dec. 2003<br>Jan. 2004-Dec. 2006 | 0<br>1 | Jan. 2002-Dec. 2003<br>Jan. 2004-Dec. 2006 | 0<br>1 |
| Maryland | Jan. 2002-Sept. 2002<br>Oct. 2002-Dec. 2006 | 0<br>1 | Jan. 2002-Sept. 2002<br>Oct. 2002-Dec. 2006 | 0<br>1 |
| Minnesota | Jan. 2002-Dec. 2006 | 1 | Jan. 2002-Dec. 2006 | 1 |
| New Jersey | Jan. 2002-Dec. 2006 | 0 | Jan. 2002-Dec. 2006 | 0 |
| New York | Jan. 2002-Dec. 2006 | 1 | Jan. 2002-Dec. 2006 | 0 |
| Pennsylvania | Jan. 2002-Dec. 2006 | 0 | Jan. 2002-Dec. 2006 | 0 |
| Texas | Jan. 2002-Dec. 2006 | 1 | Jan. 2002-Dec. 2006 | 1 |
| Wisconsin | Jan. 2002-Jan. 2005<br>Feb. 2005-Dec. 2006 | 0<br>1 | Jan. 2002-Jan. 2005<br>Feb. 2005-Dec. 2006 | 0<br>1 |