Prepayment Penalties: Efficiency and Predation

October 2011

Morgan J. Rose

University of Maryland, Baltimore County
Department of Economics
1000 Hilltop Circle
Baltimore, MD 21250
mrose@umbc.edu

Office of the Comptroller of the Currency
Visiting Scholar
250 E Street, SW
Washington, DC 20219
Morgan.Rose@occ.treas.gov

Abstract

This paper presents evidence that reductions in mortgage interest rates associated with prepayment penalties are greater for riskier borrowers, as measured by mortgage type, credit scores, and local incomes and education levels. This is consistent with an efficiency view that, by reducing the reclassification risk faced by lenders, prepayment penalties can be welfare-improving. Additional findings indicate that prepayment penalties are also used as a predatory lending tool, but that the efficiency view dominates the predatory view in most circumstances. State anti-predatory lending laws restricting the duration and amount of prepayment penalties appear to curb the predatory use of prepayment penalties.

JEL Classifications: G21, G28, G01, D18, L85

Key words: prepayment penalties; predatory lending; financial regulation; mortgage crisis; reclassification risk

1. Introduction

A prepayment penalty requires a borrower to pay a substantial fee if he or she repays a mortgage loan within a specified time period following the origination of the loan. Although prepayment penalties are rare among prime mortgages, they are prevalent in the subprime market. They are also quite controversial. Critics consider prepayment penalties to be predatory loan features that trap borrowers in high-cost loans, stripping borrowers of wealth and making mortgage defaults more likely, especially among more vulnerable groups of borrowers. Supporters argue that prepayment penalties are a means of protecting lenders from risks associated with borrowers repaying mortgages early, and so allow lenders to offer more affordable loans with lower interest rates, particularly for the riskiest borrowers.

These two views, which I term the "predatory view" and the "efficiency view" and discuss more fully below, imply several empirically testable hypotheses regarding the relationship between prepayment penalties and loan interest rates across different types of loans. This paper uses a sample of nearly 200,000 subprime loans originated over 2003-2006 to test the hypotheses across subsets of loans in the years leading up to the subprime mortgage crisis. In general, the findings are more consistent with the efficiency view than the predatory view, with riskier or more vulnerable borrowers receiving greater reductions in loan interest rates in exchange for accepting loans with prepayment penalties. However, findings associated with certain types of loans and the effects of state anti-predatory lending (APL) law provisions that limit the use of prepayment penalties support the predatory view. Taken together, the results lend credence to both views, but suggest that in most circumstances the efficiency view dominates the predatory view in terms of overall effects on the pricing of prepayment penalties.

Advocates of the predatory view argue that prepayment penalties are abusive loan features that strip wealth from borrowers by trapping them in expensive loans, requiring borrowers to either continue making high monthly payments, pay a substantial prepayment fee, or default. Borrowers whose credit improves such that they could qualify for lower interest rate loans may be unable to afford a refinancing if it requires a large prepayment penalty. For financially distressed borrowers who cannot afford their current monthly mortgage payments, prepayment penalties that make refinancing or selling the house prohibitively expensive will drive them toward default. Quercia *et al.* (2007), Danis and Pennington-Cross (2008), Rose (2008), Pennington-Cross and Ho (2010), and Demyanyk and Van Hemert (2011) 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.

Prepayment penalties are also related to yield spread premiums, a form of mortgage originator compensation that increases with the difference between the loan interest rate and a benchmark rate for loans with similar characteristics set by the lending institution. When a lending institution offers a third-party originator higher compensation for originating a loan with a higher interest rate, a requirement that that the loan carry a prepayment penalty deters the borrower from quickly refinancing into a less expensive loan. With a prepayment penalty in effect, the purchasing institution can recoup the higher originator compensation through the collection of either the higher monthly payments or the prepayment fee. This type of originator compensation provides originators with an incentive to steer borrowers into more expensive loans.[1] Berndt *et al.* (2010) and Ernst *et al.* (2008) provide examples of "rate sheets" that

[1] For analyses of originator compensation via yield spread premiums, see Jackson and Burlingame (2007), Woodward (2008), and Woodward and Hall (2010).

explicitly link the yield spread premium a lending institution is willing to pay originators to the presence of a prepayment penalty. To the extent that yield spread premiums are conditional on loans having prepayment penalties, prepayment penalties may be associated with increases in loan interest rates.

Under the predatory view, borrowers receive no substantial benefits from prepayment penalties. Lenders are therefore expected to originate more loans with prepayment penalties to groups of borrowers that are more vulnerable to predatory lending practices, and the relationship between prepayment penalties and loan interest rates is expected to be less favorable for those groups as well. Such groups include less financially sophisticated borrowers who may be unaware of either the range of loans for which they could qualify or the implications of their loan terms, and financially constrained borrowers who may be more likely to accept the terms given by a particular originator rather than shop around.[2] Rose (2011) finds that prepayment penalties are more prevalent among subprime loans originated in locales with lower education levels, household incomes, and resident ages. Woodward (2008) presents evidence that the total charges paid at origination are negatively related to the education levels in a borrower's census tract.

The efficiency view is most explicitly laid out in a theoretical model by Mayer *et al.* (2010). The model posits two reasons why lenders charge higher rates to riskier borrowers: (1) riskier borrowers are more likely to default, and (2) riskier borrowers exhibit greater "reclassification risk," a term used here to denote the probability that borrowers who receive a

[2] According to McCoy (2007), subprime borrowers are often required to pay originators hefty application and appraisal fees prior to learning the interest rates and terms of a mortgage, which can make comparison shopping prohibitively expensive for financially constrained borrowers. The same is not true in the prime mortgage market.

positive credit shock will prepay by refinancing into lower interest rate loans.[3,4] Lenders anticipate that over time, riskier mortgage pools will see more borrowers refinance out of them as positive credit shocks occur, causing lenders to charge ex ante higher loan rates to riskier borrowers. Prepayment penalties impede refinancing and therefore reduce the reclassification risk faced by lenders, allowing lenders to offer lower interest rates. Reclassification risk is greater for riskier borrowers, and so the riskiest borrowers should see the largest reductions in loan interest rates associated with prepayment penalties. The lower interest rates available due to these "prepayment penalty discounts" make mortgages more affordable, which should both expand credit availability and reduce the likelihood of default, with the greatest benefits accruing to the riskiest borrowers.

Most studies of the pricing of prepayment penalties, including DeMong and Burroughs (2005), Ernst (2005), Elliehausen *et al.* (2008), LaCour-Little and Holmes (2008), Mayer *et al.* (2010), and Rose (2011), have found that loan interest rates are significantly lower for loans with prepayment penalties, although there have been exceptions for certain types of loans. Ernst (2005) finds that prepayment penalties are associated with higher loan rates for purchase subprime fixed-rate mortgages (FRMs), but are not related to refinance FRM loan rates. Rose (2011) finds that while the initial interest rates on subprime adjustable-rate mortgages (ARMs) are lower for loan with prepayment penalties, the interest rates on those loans are subsequently adjusted to greater margins above the prevailing market rates to which ARMs are indexed.

[3] Avery *et al.* (2005) state that "Borrowers in the higher-priced segment of the home-loan market have higher prepayment rates than others because many of them improve their credit profiles over time as they make regular payments, and this improvement in turn allows them to qualify for a lower rate loan…. For a higher-priced loan, a small improvement in the borrower's credit history score may translate into a substantial reduction in interest rates and may encourage prepayment," (page 369).

[4] The term "reclassification risk" is usually used in the context of life and health insurance markets, in which the revelation of negative information about a person's health can result in increased premiums. Hendel and Lizzeri (2003) find that commitments to long-term life insurance contracts reduce this reclassification risk and improve welfare relative to short-term contracts.

Mayer *et al.* (2010) find that while prepayment penalties are associated with lower loan rates for most subprime FRM borrowers, they are associated with higher rates for subprime FRM borrowers with high FICO scores. This is consistent with their model's prediction that loan rate reductions associated with prepayment penalties should be greater for riskier borrowers, but their model provides no explanation for why prepayment penalties would be associated with higher loan rates for some borrowers.

As discussed in the next section, the efficiency view and predation view imply several contradictory predictions concerning the changes in loan interest rates associated with prepayment penalties for different groups of borrowers. This is because the borrowers who are likely to receive the greatest benefits from prepayment penalties under the efficiency view are often the borrowers most likely to be harmed by prepayment penalties under the predatory view. Borrowers with binding financial constraints or poor credit histories are the most likely to qualify for better loans in the event of a positive credit shock, and so present lenders with the most reclassification risk. The same borrowers are also the most likely to have fewer competing sources of mortgage credit available, have less financial ability to shop around for favorable mortgage terms, and, if credit history and financial constraints are linked to financial sophistication, be less able to fully understand their loan terms.

The research design of this paper is to examine variations in prepayment penalty discounts based on measures that capture borrower reclassification risk, credit histories, and financial constraints or sophistication, in order to determine which view's predictions are most consistent with the empirical evidence. Mayer *et al.* (2010) and DeMong and Burroughs (2005) both examine how prepayment penalty discounts vary based on borrower credit scores, but do so using a single-equation approach that does not address the potential endogeneity between loan

interest rates, loan-to-value (LTV) ratios, and prepayment penalties. This paper uses a multiple-equation instrumental variables approach to account for that endogeneity, and examines the variation of prepayment penalty discounts along a greater number of margins relevant to the efficiency and predatory views. The findings are more consistent with the efficiency view, in that riskier borrowers, as defined by several measures, receive larger prepayment penalty discounts than safer borrowers. However, selected findings are supportive of the predatory view. These results suggest that while the effects of prepayment penalties described by the efficiency view are predominant in most circumstances, some predatory use of prepayment penalties does occur.

This paper makes several contributions to the growing literature on the pricing of prepayment penalties. First, by explicitly drawing out multiple empirical implications of the predatory and efficiency views for different loan and borrower characteristics, this paper presents more detailed and direct empirical testing of the two views than the previous literature. Second, the sample includes subprime mortgages originated during 2003-2006, while previous papers (with the exception of Rose (2011)) use originations from 2004 or earlier. Demyanyk and Van Hemert (2011) document the deterioration of subprime mortgage credit quality in the years leading to the recent mortgage crisis. This weakening of underwriting standards suggests increases in both reclassification risk and the potential scope for predatory lending, which I am the first to exploit by tracking the evolution of prepayment penalty discounts over the sample period. The findings indicate that as the years progressed, prepayment penalty discounts became larger, with the increase concentrated among loans with the most reclassification risk. Third, this is the first paper to empirically examine the role of prepayment penalty duration in the pricing of prepayment penalties, finding that controlling for the duration of prepayment penalties

dramatically changes the estimates of prepayment penalty discounts. Finally, because my sample captures variation across states and over time in state APL law provisions regarding prepayment penalties, I provide the first evidence that prepayment penalty discounts are larger in the presence of such restrictions. As is discussed below, this finding suggests that some predatory use of prepayment penalties does occur, and that consumers may benefit from APL laws that restrict, but do not prohibit, prepayment penalties. This is particularly relevant given that the 2010 Dodd-Frank Wall Street Reform and Consumer Protection Act prohibits prepayment penalties from some types of mortgages while restricting their duration and amount in others.[5]

The remainder of this paper is structured as follows. Section 2 presents hypotheses, and Section 3 describes the data and econometric methodology used. Section 4 provides the results of the empirical analyses. Section 5 discusses conclusions to be drawn from the results.

2. Hypotheses

This paper tests several hypotheses derived from the efficiency and predatory views. In some cases the two views yield identical predictions, while in others the predictions conflict. Note that the two views are not mutually exclusive, so where the predictions conflict one should interpret the empirical evidence as indicating whether one view is or is not dominant, not whether one view is or is not correct.

H1: The discount associated with a prepayment penalty is greater for refinance loans than for purchase loans. This hypothesis holds under the efficiency view and the predatory view.

[5] Title XIV, Section 1414 of the Dodd-Frank Act prohibits prepayment penalties entirely on all ARMs and certain high-priced FRMs. For other FRMs, prepayment penalties cannot be imposed beyond three years after origination. The amount of a prepayment penalty is limited to 3 percent, 2 percent, and 1 percent of the outstanding loan balance in the first, second, and third years, respectively, after origination.

For the efficiency view, the salient fact concerning loan purpose is that borrowers of refinance loans have already demonstrated a willingness to prepay a mortgage, and so reclassification risk is likely to be higher for refinance loans than for purchase loans. This implies larger prepayment penalty discounts on refinance loans. For the predatory view, the salient fact is that on average, purchase loan borrowers are less experienced mortgage market participants than refinance loan borrowers – by definition, a refinance is not a borrower's first mortgage. Less experienced borrowers are less likely to fully understand the terms of their loans and are more easily taken advantage of, resulting in smaller prepayment penalty discounts on purchase loans.

H2: If the efficiency view is dominant, then the discount associated with a prepayment penalty is greater for loans to less creditworthy, more financially constrained borrowers. If the predatory view is dominant, then the discount associated with a prepayment penalty is lower for loans to less creditworthy, more financially constrained borrowers.[6] According to the efficiency view, the least creditworthy, most financially constrained borrowers are the borrowers who are most likely to prepay their loans upon receiving a positive credit shock, and so those borrowers should receive the largest prepayment penalty discounts. According to the predatory view, the least creditworthy, most financially constrained borrowers are the most vulnerable to predatory lending practices, due to either a lack of access to alternative mortgage credit sources or a link between those characteristics and financial sophistication. As such, those borrowers should receive the smallest prepayment penalty discounts.

H3: If the efficiency view is dominant, then in the years leading up to subprime mortgage crisis the discount associated with a prepayment penalty increased, especially for refinance loans and loans to less creditworthy, more financially constrained borrowers. If the predatory

[6] The term "creditworthy" is used in this paper to refer only to borrowers' credit histories, and not to any inherent characteristics of borrowers.

view is dominant, then in the years leading up to subprime mortgage crisis the discount associated with a prepayment penalty decreased, especially for purchase loans and loans to less creditworthy, more financially constrained borrowers. As noted above, Demyanyk and Van Hemert (2011) document a decline in subprime mortgage underwriting standards over the years included in this paper's sample. Under the efficiency view, the extension of subprime mortgage credit deeper into the pools of more marginal potential borrowers should be associated with increasing reclassification risk and therefore larger prepayment penalty discounts, and the effect should be most pronounced among those groups of loans already associated with greater reclassification risk. Under the predatory view, prepayment penalty discounts should fall as credit is extended to less experienced, less financially sophisticated, or otherwise more vulnerable borrowers.

H4: If the efficiency view is dominant, then conditional on loans having prepayment penalties, prepayment penalty period durations are longer for refinance loans than for purchase loans. If the predatory view is dominant, then conditional on loans having prepayment penalties, prepayment penalty period durations are shorter for refinance loans than for purchase loans. Under the efficiency view, borrowers with the greatest ex ante reclassification risk receive the greatest benefit from having a prepayment penalty versus not having one. The same rationale indicates that the marginal benefit of a longer prepayment penalty period versus a shorter one is greatest for borrowers with the greatest ex ante reclassification risk. The predatory view suggests that less experienced borrowers should receive more abusive loan terms, which includes longer prepayment penalty period durations.

H5: Conditional on loans having prepayment penalties, prepayment penalty period durations are longer for loans to less creditworthy, more financially constrained borrowers.

This hypothesis holds under the efficiency view and the predatory view. The efficiency view predicts this because less creditworthy, more financially constrained borrowers are associated with greater reclassification risk, while the predatory view predicts this because such borrowers are more vulnerable to predatory lending practices.

H6: If an APL provision restricting the duration of prepayment penalty periods or the amounts of prepayment penalties is effective at curbing predatory lending, then the discount associated with a prepayment penalty is greater for loans originated with the APL provision in effect. If such an APL provision does not substantially curb predatory lending, then the discount associated with a prepayment penalty is lower for loans originated with the APL provision in effect. Restrictions on the durations or amounts of prepayment penalties limit the protection against reclassification risk that prepayment penalties can offer, which the efficiency view suggests should reduce prepayment penalty discounts. Restrictions on the use of prepayment penalties also reduce the incentives for the predatory use of prepayment penalties, which should increase prepayment penalty discounts. To the extent that APL restrictions of prepayment penalties discourage the most abusive uses of prepayment penalties while still allowing prepayment penalties to provide lenders with substantial protection against reclassification risk, then the net effect of the restrictions should be to increase prepayment penalty discounts. If APL restrictions do not substantially reduce the predatory use of prepayment penalties, either because the restrictions are ineffective or because such predatory use does not occur, then the net effect of the restrictions should be to reduce prepayment penalty discounts.

3. Data and Methodology

The dataset for this paper consists of fixed-rate subprime mortgages for single family residences originated during 2003-2006 in ten metropolitan statistical areas (MSAs) from the LoanPerformance database from CoreLogic, Inc.[7] These are loans that were packaged into subprime-grade private-label mortgage-backed securities. ARMs are excluded from the analysis. The pricing of prepayment penalties for ARMs is complicated by the frequent use of low initial "teaser" rates that remain fixed for some time after origination, after which loan rates become indexed to a specified margin above a market interest rate.[8] Some borrowers take ARMs with the intention of prepaying the loan before the first interest rate adjustment, further complicating the pricing of prepayment penalties for ARMs.

Loans are taken from ten MSAs rather than a nationwide sample because the analysis includes data on specific provisions of state APL laws, and an in-depth survey of the APL provisions of all fifty states is beyond the scope of this paper. The selection of MSAs was based on a report from RealtyTrac, Inc. (2008), 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.

[7] 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.

[8] Rose (2011) finds that prepayment penalties are associated with lower initial loan rates (14-21 basis points) for refinance ARMs and higher initial loan rates (7 bp) for purchase ARMs. Prepayment penalties are associated with 46 and 73 bp increases in margins for refinance and purchase ARMs, respectively. This is consistent with findings presented in the next section, in which the pricing of prepayment penalties is more favorable for FRM refinance borrowers than to purchase FRM borrowers.

The ten MSAs are listed in Table 1.[9] To better control for loan terms and amortization schedules that could affect the loan characteristics of interest, sample loans are limited to those with those with maturities of fifteen or thirty years, and balloon and interest-only loans are excluded.

The LoanPerformance data contains loan-level information on whether a loan has a prepayment penalty at origination (*PP*), the duration of the prepayment penalty period (if any), the loan interest rate (*InitialRate*), LTV ratio (*LTV*), and borrower FICO score (*FICO*) at origination, whether the loan was based on low- or-no documentation (*LowNoDoc*), whether the loan is for an owner-occupied property (*OwnerOcc*), the loan purpose (refinance or purchase), whether the borrower extracted cash out (*RefiCash*) or not (*RefiNoCash*) in a refinance loan, and whether the loan term is thirty years (*30Year*) rather than fifteen years. *RelLoanSize* is calculated as the loan origination amount divided by the average origination amount for all sample loans with the same purpose and originated in the same MSA and year. The loan-level data was merged with ZIP code level demographic information from the 2000 Census, monthly bank prime interest rates from the Federal Reserve Bank of Saint Louis, and information on state APL law provisions assembled by the author. Variables are defined in Table 2, with summary statistics presented in Table 3.

To estimate the change in loan interest rate associated with a loan having a prepayment penalty, I use an instrumental variables approach that addresses the endogeneity of loan interest rates, LTV ratios, and prepayment penalties. This is the approach used in Rose (2011), and is similar to those used by Elliehausen *et al.* (2008) and LaCour-Little and Holmes (2008). When taking out a mortgage, borrowers frequently choose from a variety of combinations of interest

[9] 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) was replaced by the next most populous MSA in that decile (Miami and San Antonio, respectively).

rates and LTV ratios (with lower rates associated with lower LTV ratios), with a discrete reduction in interest rates available for accepting a prepayment penalty. To address this endogeneity in the choice of loan terms, I first use a probit model to estimate *PP*, and then use the predicted values from that model in an equation-by-equation two stage least squares (2SLS) model for estimating *InitialRate* and *LTV*.[10] A simultaneous equation 2SLS approach is more efficient than an equation-by-equation one if all of the 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. The LoanPerformance database contains little information on potentially relevant borrower characteristics, raising a concern about misspecification and arguing for the more robust equation-by-equation approach.

LTV and the predicted values of *PP* appear in the *InitialRate* equation, and *InitialRate* appears in the *LTV* equation. Given the decision structure described above (selecting an interest rate and LTV combination, then choosing whether or not to accept a prepayment penalty), *LTV* and *PP* need not be determined simultaneously, and so *PP* does not appear in the *LTV* equation. The other loan-level variables appear in all three equations. Each equation also includes instruments specific to the dependent variable. The *PP* equation includes two variables, *%Refinance* and *%ShortTenure*, designed to capture turnover in local home ownership, which could affect expectations of how long a borrower will live in a particular house. High turnover

[10] Elliehausen *et al.* (2008) and DeMong and Burroughs (2005) use APR, which captures the cost of initial points and fees as their measure of loan prices. Information about points and fees is unavailable in LoanPerformance. Those two studies generally find larger prepayment penalty discounts than have previous studies that use initial interest rates as the measure of loan prices, including Rose (2011), Mayer et al. (2010), LaCour-Little and Holmes (2008), and Ernst (2005). Another variable for which it would be useful to control in examinations of the pricing of prepayment penalties is the amount of the required prepayment fee. To my knowledge no previous study has incorporated data on prepayment fee amounts, and I also lack access to such data.

would lower borrowers' preferences for prepayment penalties while raising the preferences of lenders, leaving the expected net effect unclear. *%Refinance* indicates the percentage of LoanPerformance subprime loans (FRMs and ARMs) originated in each ZIP code and year that are refinances. *%ShortTenure* reflects the percentage of households in each ZIP code in which the residents have lived in their houses for five years or less. *APL_Dur* indicates that an APL provision restricting the duration of prepayment penalty periods is in effect at loan origination. Such a provision can limit the protection against prepayment risk and reclassification risk that a prepayment penalty offers a lender, and so make prepayment penalties less attractive to lenders and more attractive to borrowers.[11] The instrument in the *InitialRate* equation is the bank prime rate, which is mainly used to price business loans and proxies for the opportunity cost of mortgage lending. Higher prime rates should be associated with higher loan interest rates. The prime rate should not directly influence borrower's choices regarding loan terms as it does not generally change in response to changes in other market rates. The instruments in the *LTV* equation are two sets of indicator variables describing the distribution of resident ages and house values across ZIP codes. The premise is that older borrowers and borrowers buying higher-value properties are on average wealthier, and that wealthier borrowers may prefer loans with lower LTV ratios. All specifications include indicator variables for MSA and origination year. Standard errors are clustered by the month of origination.

[11] As a robustness check, I repeated the analyses reported in Tables 4 and 5 below after replacing *APL_Dur* with *APL_Amt*, which indicates that an APL provision restricting the maximum amount that can be charged as a prepayment penalty is in effect at loan origination. The changes in loan interest rates associated with a prepayment penalty are generally larger in the results using *APL_Amt* than those reported below, but in most cases (those involving *College* being the exception) show the same pattern of results with respect to the paper's hypotheses. Log-likelihood and pseudo-R^2 values are uniformly higher for the *APL_Dur* specifications than for the *APL_Amt* ones. The two provisions are highly correlated, with correlation coefficient of 0.60, and including both *APL_Dur* and *APL_Amt* in the same specification resulted in quite large but oppositely signed coefficient estimates for both. All of these unreported results are available from the author.

4. Empirical Analyses

Panel A of Table 4 presents results from the probit and 2SLS specifications using the full sample to estimate the loan interest rate discount associated with a prepayment penalty. The key variable of interest is *Pr(PP)*, the predicted values of *PP* derived from the probit model. The change in loan interest rates associated with a loan having a prepayment penalty is calculated in Panel B as the coefficient estimate for *Pr(PP)* in the 2SLS *InitialRate* equation multiplied by the difference between the mean value of *Pr(PP)* for loans with prepayment penalties and the mean value of *Pr(PP)* for loans without prepayment penalties. The results indicate that across the full sample, a prepayment penalty is associated with a discount of 10.6 basis points (bp). This is toward the middle of the range of previous papers' findings for the change in loan rate associated with a prepayment penalty, which runs from a decrease of 60 bp to an increase of 40-50 bp. The following analyses split the sample along multiple lines to test the hypotheses presented above.

4.1 Testing Hypotheses 1 and 2

Table 5 presents results similar to those in Panel B of Table 4, showing the changes in loan interest rates associated with prepayment penalties across sample splits designed to test Hypotheses 1 and 2. (Complete results of the probit and 2SLS models on which Table 5's figures are based are in the Appendix of this paper.) According to Hypothesis 1, the prepayment penalty discount should be greater for refinance loans that for purchase loans. The first two rows of Table 5 support that hypothesis. Prepayment penalties are associated with a 16 bp decrease in loan rates for refinances, but are associated with a 7 bp increase for purchase loans. Both the efficiency and predatory views predict that the discount should be greater for refinances, but the efficiency view does not offer an explanation for the increase in loan rates found for purchase

loans. The analyses below will provide evidence that in almost all subsets of loans, prepayment penalties are associated with lower interest rates. Table 5's results for purchase loans empirically support the contention that while the effects described in the efficiency view may dominate those described in the predatory view in most cases, the predatory view holds merit and some amount of predatory lending utilizing prepayment penalties does occur, at least for purchase loans.

The remaining rows of Table 5 split the sample based on *FICO*, *College*, and *Income*, three variables intended to capture borrower creditworthiness and financial constraints as called for in Hypothesis 2.[12] The results indicate that prepayment penalty discounts are higher for borrowers with lower FICO scores and who reside in locales with lower levels of education and household income. Assuming that these variables are reasonable proxies for borrower creditworthiness and financial constraints, these results are consistent with the efficiency view and contradict the predatory view.

4.2 Testing Hypothesis 3

Table 6 provides results based on analyses similar to those from Tables 4 and 5, but performed separately for loans originated in each year of the sample period.[13] The top set of results, based on the full sample, show that prepayment penalty discounts increased as credit quality declined leading up to the subprime mortgage crisis, more than doubling from 8 bp for 2003 originations to 20 bp for 2006 originations. The results for the split samples indicate that the changes in prepayment penalty discounts occurred primarily among refinance loans, loans to

[12] It should be noted that *College* and *Income* are based on ZIP code level data and so are only proxies for borrower education and income.

[13] Results from the probit and 2SLS models on which Table 6's figures are based are not presented for the sake of brevity, but are available from the author.

borrowers with lower credit scores, and loans to borrowers residing in locales with lower education levels and incomes. For purchase loans, the changes in loan rates associated with prepayment penalties are positive and stable but the coefficient estimates for *Pr(PP)* are not statistically significant. Prepayment penalty discounts hardly changed at all during the sample period for borrowers with higher FICO scores, and only changed at the tail end of the sample period for borrowers in better-educated, higher income ZIP codes. Prepayment penalty discounts increased earlier and increased more for refinance loans and loans to less creditworthy, more financially constrained borrowers. This is consistent with the efficiency view and contradicts the predatory view.

4.3 Testing Hypotheses 4 and 5

Panel A of Table 7 shows the average duration of prepayment penalty periods, conditional on a loan having a prepayment penalty. For the full sample, the average duration is just under 35 months. The modal duration (not shown in the table) is 36 months, representing seventy percent of all loans with a prepayment penalty. Eighteen percent of prepayment penalty loans have shorter durations (mostly 12 months), and twelve percent have longer ones (almost all 60 months). Turning to the split samples, average durations are longer for refinances than for purchases, which according the Hypothesis 4 is consistent with the efficiency view and contradicts the predatory view. Durations are also longer for less creditworthy, more financially constrained borrowers, which according to Hypothesis 5 is consistent with both views.

Panel B of Table 7 presents results from repeating the analyses of Tables 4 and 5 while constraining the sample to include only loans that do not have prepayment penalties and loans that have prepayment penalties of 36 months, thereby controlling for durations in estimating the

pricing of prepayment penalties.[14] The changes in *InitialRate* associated with prepayment penalties are more extreme here than in Tables 4 and 5, with several exceeding 100 bp, but the pattern of results is largely the same. Discounts are greater for refinance loans and for loans with lower values of *FICO*, *College*, and *Income*. Prepayment penalties continue to be associated with increases in loan rates for purchase loans, but now the same holds for loans to borrowers with high FICO scores.[15] Clearly the artificial constraint of possible durations of prepayment penalties imposed here raises selection bias concerns, and so the estimates in Panel B need to be viewed with caution. Nonetheless, two points may perhaps be taken from them. First, the fact that the pattern of results with regard to Hypotheses 1-3 matches those in the previous tables provides some assurance that differences in durations do not drive the results in the previous tables. Second, the dramatic changes in prepayment penalty discounts between previous tables and Table 7 suggest that the results of the previous tables and of previous studies on the pricing of prepayment penalties may mask substantial heterogeneity of prepayment penalty discounts based on durations. Investigating that heterogeneity while appropriately addressing selection issues is beyond the scope of this paper.

4.4 Testing Hypothesis 6

Table 8 provides estimates of the change in loan interest rates associated with prepayment penalties with the sample split by *APL_Dur* and *APL_Amt*. These variables indicate state APL provisions in effect at the time of a loan's origination that place greater restrictions on the duration and amount, respectively, of prepayment penalties than the federal Home Ownership

[14] Results from the probit and 2SLS models on which the figures in Panel B of Table 7 are based are not presented for the sake of brevity, but are available from the author.
[15] This is consistent with Mayer *et al.* (2010), who find that prepayment penalties are negatively associated with loan interest rates for loans to borrowers with FICO scores under 680, but positively associated with loan interest rates for loans to borrowers with FICO scores over 680.

and Equity Protection Act (HOEPA). Because HOEPA applies nationwide, only state APL provisions that are more restrictive than the corresponding provisions in HOEPA should affect mortgage lending practices. HOEPA restricts the duration of a prepayment penalty period on a covered mortgage to sixty months after origination, so *APL_Dur* 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. HOEPA does not restrict the amounts of prepayment penalties, so *APL_Amt* takes a value of one when and where a state's APL law places any restriction on prepayment penalty amounts.

The results indicate that prepayment penalty discounts are several times greater for loans originated with APL provisions restricting the use of prepayment penalties in effect. Based on Hypothesis 6, this is consistent with the APL provisions reducing the use of prepayment penalties as a predatory loan feature while preserving the usefulness of prepayment penalties as a way for lenders to protect themselves against reclassification risk. Stated differently, in general the effects described in the efficiency view appear to dominate the effects described in the predatory view, but where APL provisions restrict (without prohibiting) the use of prepayment penalties, the reduction in predatory lending via prepayment penalties makes the efficiency view even more dominant.[16]

5. Conclusions

The findings in the preceding section provide evidence that prepayment penalty discounts are greater for refinance (versus purchase) loans, loans to borrowers with lower credit scores, and

[16] It should be noted that there are endogeneity concerns regarding these findings, as a state's previous mortgage or housing market conditions could affect both a state's APL laws and subsequent loan pricing characteristics. A complete examination of the efficacy of state APL laws would need to address the determinants of those laws and their specific provisions, but such an analysis is beyond the scope of this paper.

loans originated to residents of locales with lower incomes and education levels. These results are consistent with the efficiency view, in which the riskiest borrowers receive the greatest benefit from prepayment penalties. Although the efficiency view appears to dominate the predatory view, particular results that cannot be explained by the efficiency view lend credence to the predatory view. Prepayment penalties are associated with higher loan interest rates for purchase loans, which could indicate predatory lenders taking advantage of borrowers with less mortgage market experience (relative to refinance borrowers). APL provisions restricting the use of prepayment penalties are associated with larger prepayment penalty discounts, suggesting that such provisions reduce predatory lending via prepayment penalties. This implies both that the predatory view has real merit, and that APL provisions that restrict, without prohibiting, prepayment penalties can protect some borrowers from the harmful effects that the predatory view predicts.

The APL provision results also suggest that the prepayment penalty restrictions on non-high-priced FRMs under the Dodd-Frank Act may benefit consumers by curbing some predatory lending practices and encouraging larger prepayment penalty discounts. However, the prohibition of prepayment penalties on high-priced FRMs may reduce the welfare of those least creditworthy, most financially constrained borrowers who could benefit the most from the availability of prepayment penalties. The results also suggest that the prohibition of prepayment penalties on ARMs may be detrimental to consumer welfare, but this conclusion must be regarded as speculative as the analyses here include only FRMs.

Overall, these findings inform, but do not definitively answer, the question of whether prepayment penalties are on the whole beneficial or harmful to consumers. A definitive answer would require examinations of, among other things, probabilities of default and prepayment, the

benefits of access to credit, and the costs of default. While acknowledging that the net benefit of prepayment penalties may be positive or negative, the results presented in this paper do strongly suggest that the net benefit is greater for riskier borrowers. For those concerned with the impacts of loan features particularly on more vulnerable groups of consumers, this conclusion remains highly relevant.

Appendix

Tables A1-A4 provide the complete regression results on which Table 5 is based. Tables A5-A6 do the same for Table 8. The regression results underlying Table 6 and Panel B of Table 7 are not included here for the sake of brevity, but are available from the author.

References

Avery, R.B., G.B. Canner, and R.E. Cook. 2005. New Information Reported under HMDA and Its Application in Fair Lending Enforcement. *Federal Reserve Bulletin* 91 (Summer):344-394.

Berndt, A., B. Hollifield, and P. Sandas. 2010. The Role of Mortgage Brokers in the Subprime Crisis. NBER Working Paper 16175.

Danis, M.A., and A. Pennington-Cross. 2008. The Delinquency of Subprime Mortgages. *Journal of Economics and Business* 60 (1-2):67-90.

DeMong, R.F. and J.E. Burroughs. 2005. Prepayment Fees Lead to Lower Interest Rates. *Equity Magazine* November/December 2005:19-21.

Demyanyk, Y., and O. Van Hemert. 2011. Understanding the Subprime Mortgage Crisis. *The Review of Financial Studies* 24 (6):1848-1880.

Elliehausen, G., M.E. Staten, and J. Steinbuks. 2008. The Effect of Prepayment Penalties on the Pricing of Subprime Mortgages. *Journal of Economics and Business* 60 (1-2):33-46.

Ernst, K.S. 2005. Borrowers Gain No Interest Rate Benefits from Prepayment Penalties on Subprime Mortgages. Center for Responsible Lending research report.

Ernst, K.S., D. Bocian, and W. Li. 2008. Steered Wrong: Brokers, Borrowers, and Subprime Loans. Center for Responsible Lending research report.

Hendel, I.E., and A. Lizzeri. 2003. The Role of Commitment in Dynamic Contracts: Evidence from Life Insurance. *Quarterly Journal of Economics* 118 (1):299-327.

Jackson, H.E., and L. Burlingame. 2007. Kickbacks or Compensation: The Case of Yield Spread Premiums. *Stanford Journal of Law, Business, and Finance* 12 (2):289-361.

LaCour-Little, M., and C. Holmes. 2008. Prepayment Penalties in Residential Mortgage Contracts: A Cost-Benefit Analysis. *Housing Policy Debate* 19 (4):1-43.

Mayer, C.J., and K. Pence. 2009. Subprime Mortgages: What, Where, and To Whom? E. Glaeser and J. Quigley, editors. *Housing Markets and the Economy: Risk, Regulations, and Policy: Essays in Honor of Karl E. Case* Lincoln Land Institute: Cambridge, MA.

Mayer, C.J., T. Piskorski, and A. Tchistyi. 2010. The Inefficiency of Refinancing: Why Prepayment Penalties Are Good for Risky Borrowers. NBER Working Paper 16586.

McCoy, P.A. 2007. Rethinking Disclosure in a World of Risk-based Pricing. *Harvard Journal on Legislation* 44:123-166.

Pennington-Cross, A., and G. Ho. 2010. The Termination of Subprime Hybrid and Fixed Rate Mortgages. *Real Estate Economics* 38 (3):399-426.

Quercia, R.G., M.A. Stegman, and W.R. Davis. 2007. The Impact of Predatory Loan Terms on Subprime Foreclosures: The Special Case of Prepayment Penalties and Balloon Payments. *Housing Policy Debate* 18 (2):311-346.

RealtyTrac Inc. 2008. Detroit, Stockton, Las Vegas Post Highest 2007 Metro Foreclosure Rates. Press release, February 13, 2008.

Rose, M.J. 2011. Origination Channel, Prepayment Penalties, and Default. *Real Estate Economics*, forthcoming.

Rose, M.J. 2008. Predatory Lending Practices and Subprime Foreclosures: Distinguishing Impacts by Loan Category. *Journal of Economics and Business* 60 (1-2):13-32.

Woodward, S.E. 2008. A Study of Closing Costs for FHA Mortgages. U.S. Department of Housing and Urban Development, Office of Policy Development and Research.

Woodward, S.E., and R.E. Hall. 2010. Consumer Confusion in the Mortgage Market: Evidence of Less than a Perfectly Transparent and Competitive Market. *American Economic Review* 100 (2):511-515.

Table 1: Sample metropolitan statistical areas

MSA foreclosure rates at year-end 2007 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. Population estimates as of July 1, 2007, are from the US Census Bureau.

		Foreclosure	Sample loans		Population	
MSA	**State(s)**	**rate**	**Number**	**Percent**	**Number**	**Percent**
Miami	FL	2.7	20,030	10.1%	2,382,961	4.6%
Atlanta	GA	2.5	17,848	9.0%	5,261,296	10.2%
Phoenix	AZ	1.9	15,190	7.6%	4,165,921	8.1%
Chicago	IL	1.6	23,483	11.8%	7,929,840	15.4%
Los Angeles	CA	1.4	55,686	28.0%	9,807,870	19.1%
San Antonio	TX	1.1	10,530	5.3%	1,984,921	3.9%
Minneapolis	MN-WI	0.8	9,315	4.7%	3,197,620	6.2%
Baltimore	MD	0.7	13,602	6.8%	2,663,805	5.2%
New York	NJ-NY	0.5	22,680	11.4%	11,627,931	22.6%
Pittsburgh	PA	0.4	10,494	5.3%	2,354,159	4.6%
Total			198,858		51,376,324	

Table 2: Variable definitions

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 anti-predatory lending laws is from the author's analysis of the relevant state legislation and regulations. All other variables are from the LoanPerformance dataset from CoreLogic.

PP	Equals 1 if the loan features a prepayment penalty; 0 otherwise
InitialRate	Initial loan interest rate at origination
LTV	Loan-to-value ratio at origination
FICO	Borrower's FICO score at origination
LowNoDoc	Equals 1 if the loan is based on reduced documentation; 0 otherwise
RelLoanSize	Ratio of loan origination amount to the average origination amount of all sample loans of the same purpose (purchase or refinance) originated in the same MSA and year
OwnerOcc	Equals 1 if the loan is for an owner-occupied property; 0 otherwise
RefiCash	Equals 1 if the loan is a cashout refinance; 0 otherwise
RefiNoCash	Equals 1 if the loan is a non-cashout refinance; 0 otherwise
30Year	Equals 1 if the loan is a 30-year loan; 0 if it is a 15-year loan
%Refinance	% of LoanPerformance subprime loans by ZIP code and origination year that are refinances
%ShortTenure	% of owner-occupied households in the borrower's ZIP code in which the residents have lived in their current houses for five years or less
APL_Dur	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_Amt	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
PrimeRate	Monthly bank prime loan rate at origination
%Age18-34	% of residents in the borrower's ZIP code between the ages of 18 and 34
%Age35-44	% of residents in the borrower's ZIP code between the ages of 35 and 44
%Age45-59	% of residents in the borrower's ZIP code between the ages of 45 and 59
%Age60+	% of residents in the borrower's ZIP code 60 years old or older
%Value$1-$2	% of specified owner-occupied housing units in the borrower's ZIP code valued between $100,000 and $200,000
%Value$2-$3	% of specified owner-occupied housing units in the borrower's ZIP code valued between $200,000 and $300,000
%Value$3-$5	% of specified owner-occupied housing units in the borrower's ZIP code valued between $300,000 and $500,000
%Value$5+	% of specified owner-occupied housing units in the borrower's ZIP code valued above $500,000
College	Percentage of residents 25 years old or older with at least a Bachelor's degree in borrower's ZIP code
Income	Median household income (in thousands) in borrower's ZIP code

Table 3: Summary statistics

Variable	Mean	Median	St. Dev.
PP	0.69	1.00	0.46
InitialRate	7.33	7.10	1.23
LTV	74.64	79.89	16.01
FICO	630.33	628.00	62.56
LowNoDoc	0.31	0.00	0.46
RelLoanSize	0.99	0.88	0.51
OwnerOcc	0.94	1.00	0.24
RefiCash	0.75	1.00	0.43
RefiNoCash	0.11	0.00	0.31
30Year	0.92	1.00	0.26
%Refinance	0.70	0.71	0.11
%ShortTenure	0.34	0.32	0.11
APL_Dur	0.82	1.00	0.38
APL_Amt	0.62	1.00	0.48
PrimeRate	5.34	4.43	1.53
%Age18-34	24.10	23.88	4.79
%Age35-44	16.18	15.93	2.16
%Age45-59	17.24	17.27	3.10
%Age60+	14.21	13.71	5.58
%Value$1-$2	47.09	48.14	24.50
%Value$2-$3	14.01	7.94	14.48
%Value$3-$5	5.96	1.52	10.05
%Value$5+	2.18	0.39	6.79
College	20.85	18.40	12.75
Income	46.13	43.75	15.62

Table 4: Prepayment penalties and loan rates – full sample

Panel A presents the results of probit and 2SLS regressions using loan-level data for subprime fixed-rate mortgages originated during 2003-2006. *Pr(PP)* is defined as the predicted values from the probit model. Other variables are defined in Table 2. In Panel B, the change in loan interest rate associated with a loan having a prepayment penalty is calculated as the coefficient estimate for *Pr(PP)* multiplied by the difference between the mean value of *Pr(PP)* for loans with prepayment penalties and the mean value of *Pr(PP)* for loans without prepayment penalties. Vintage year indicators, MSA indicators, and a constant term are included in all specifications. Standard errors are clustered by month of origination. Levels of significance are indicated by *, **, and *** for 10%, 5%, and 1%, respectively.

Panel A: Determinants of *PP*, *InitialRate*, and *LTV*

Model:	Probit	2SLS	2SLS
Dependent variable:	*PP*	*InitialRate*	*LTV*
Pr(PP)		-0.242***	
		[0.0291]	
LTV		0.0122***	
		[0.000372]	
InitialRate			-7.034***
			[0.399]
FICO	-7.13E-05	-0.00851***	-0.0411***
	[0.000148]	[3.39e-05]	[0.00338]
LowNoDoc	-0.111***	0.379***	1.065***
	[0.0138]	[0.00442]	[0.167]
RelLoanSize	0.0642***	-0.378***	12.10***
	[0.0172]	[0.00477]	[0.111]
OwnerOcc	-0.0803***	-0.504***	-3.799***
	[0.0260]	[0.00832]	[0.240]
RefiCash	0.0147	-0.244***	-11.71***
	[0.0252]	[0.00695]	[0.177]
RefiNoCash	0.0248	-0.342***	-11.44***
	[0.0168]	[0.00870]	[0.227]
30Year	0.241***	0.154***	9.976***
	[0.0152]	[0.00846]	[0.165]
%Refinance	0.234***		
	[0.0668]		
%ShortTenure	0.115*		
	[0.0615]		
APL_Dur	1.169***		
	[0.123]		
PrimeRate		0.250***	
		[0.00531]	
%Age18-34			-0.153***
			[0.0121]
%Age35-44			0.245***
			[0.0247]
%Age45-59			-0.153***

			[0.0211]
%Age60+			-0.0295***
			[0.0102]
%Value$1-$2			-0.155***
			[0.00266]
%Value$2-$3			-0.276***
			[0.00466]
%Value$3-$5			-0.363***
			[0.00668]
%Value$5+			-0.564***
			[0.00728]
Observations	194,194	198,858	198,858
R^2	0.377	0.500	0.097

Panel B: Change in *InitialRate* associated with a prepayment penalty

	Means of Pr(PP)		
Estimate for *Pr(PP)*	*PP* = 1	*PP* = 0	Change in *InitialRate*
-0.242***	0.829	0.390	-0.106

Table 5: Prepayment penalties and loan rates – sample splits

This table presents results based on probit and 2SLS regressions using loan-level data for subprime fixed-rate mortgages originated during 2003-2006 with the sample split based on loan purpose and the sample medians of *FICO*, *College*, and *Income*. Complete regression results appear in Tables A1-A4 of the appendix to this paper. Levels of significance for coefficient estimates of *Pr(PP)* in the 2SLS regressions are indicated by *, **, and *** for 10%, 5%, and 1%, respectively.

		Means of Pr(PP)		
	Estimate for *Pr(PP)*	*PP* = 1	*PP* = 0	Change in *InitialRate*
Refinances	-0.338***	0.833	0.376	-0.155
Purchases	0.205**	0.789	0.429	0.074
FICO < median	-0.487***	0.860	0.417	-0.216
FICO >= median	-0.134***	0.840	0.448	-0.053
College < median	-0.339***	0.840	0.402	-0.148
College >= median	-0.219***	0.824	0.398	-0.094
Income < median	-0.570***	0.835	0.391	-0.253
Income >= median	-0.188***	0.830	0.407	-0.080

Table 6: Prepayment penalties and loan rates by origination year

This table presents results from analyses similar to those in Tables 4 and 5 run separately for loans in each origination year. Complete regression results are available from the author. Levels of significance for coefficient estimates of *Pr(PP)* in the 2SLS regressions are indicated by *, **, and *** for 10%, 5%, and 1%, respectively.

	Full sample			
	Estimate for *Pr(PP)*	Means of Pr(PP) *PP* = 1	*PP* = 0	Change in *InitialRate*
2003	-0.188***	0.838	0.391	-0.084
2004	-0.192***	0.852	0.400	-0.087
2005	-0.246***	0.841	0.363	-0.118
2006	-0.396***	0.802	0.300	-0.199

	Refinances				**Purchases**			
	Estimate for *Pr(PP)*	Means of Pr(PP) *PP* = 1	*PP* = 0	Change in *InitialRate*	Estimate for *Pr(PP)*	Means of Pr(PP) *PP* = 1	*PP* = 0	Change in *InitialRate*
2003	-0.253***	0.845	0.379	-0.118	0.025	0.765	0.399	0.009
2004	-0.243***	0.857	0.393	-0.112	0.022	0.830	0.436	0.009
2005	-0.286***	0.841	0.348	-0.141	0.093	0.810	0.398	0.038
2006	-0.425***	0.803	0.289	-0.218	0.018	0.774	0.330	0.008

	***FICO* below median**				***FICO* at or above median**			
	Estimate for *Pr(PP)*	Means of Pr(PP) *PP* = 1	*PP* = 0	Change in *InitialRate*	Estimate for *Pr(PP)*	Means of Pr(PP) *PP* = 1	*PP* = 0	Change in *InitialRate*
2003	-0.295***	0.880	0.424	-0.135	-0.194***	0.842	0.433	-0.079
2004	-0.335***	0.874	0.427	-0.150	-0.089**	0.863	0.452	-0.036
2005	-0.310***	0.857	0.389	-0.145	-0.154***	0.853	0.406	-0.069
2006	-0.500***	0.832	0.314	-0.259	-0.130*	0.816	0.376	-0.057

	***College* below median**				***College* at or above median**			
	Estimate for *Pr(PP)*	Means of Pr(PP) *PP* = 1	*PP* = 0	Change in *InitialRate*	Estimate for *Pr(PP)*	Means of Pr(PP) *PP* = 1	*PP* = 0	Change in *InitialRate*
2003	-0.149*	0.856	0.407	-0.067	-0.205***	0.827	0.392	-0.089
2004	-0.268***	0.858	0.401	-0.122	-0.156***	0.849	0.411	-0.068
2005	-0.350***	0.844	0.356	-0.171	-0.195***	0.844	0.382	-0.090
2006	-0.475***	0.807	0.302	-0.240	-0.365***	0.800	0.304	-0.181

	***Income* below median**				***Income* at or above median**			
	Estimate for *Pr(PP)*	Means of Pr(PP) *PP* = 1	*PP* = 0	Change in *InitialRate*	Estimate for *Pr(PP)*	Means of Pr(PP) *PP* = 1	*PP* = 0	Change in *InitialRate*
2003	-0.198***	0.850	0.398	-0.090	-0.197***	0.835	0.401	-0.086
2004	-0.392***	0.854	0.395	-0.180	-0.139***	0.855	0.418	-0.061
2005	-0.418***	0.841	0.346	-0.207	-0.180***	0.846	0.387	-0.083
2006	-0.454***	0.800	0.289	-0.232	-0.380***	0.814	0.321	-0.187

Table 7: Prepayment penalty durations

Panel A presents the average number of months after origination that a prepayment penalty is in effect for those loans that have prepayment penalties. T-statistics from difference in means tests all indicate significance at the 1% level. Panel B presents results from analyses similar to those in Tables 4 and 5 including only loans with prepayment penalty durations of 36 months and loans without prepayment penalties. Complete regression results are available from the author. Levels of significance for coefficient estimates of *Pr(PP)* in the 2SLS regressions are indicated by *, **, and *** for 10%, 5%, and 1%, respectively.

	Panel A		**Panel B**			
	Mean			Means of Pr(PP)		
	duration	T-statistic	Estimate for *Pr(PP)*	*PP* = 1	*PP* = 0	Change in *InitialRate*
All loans	34.98		-1.761***	0.821	0.280	-0.952
Refinances	35.15	12.79	-2.076***	0.826	0.269	-1.158
Purchases	33.88		1.555***	0.776	0.322	0.707
FICO < median	35.56	17.38	-2.042***	0.857	0.309	-1.119
FICO >= median	34.41		0.744***	0.830	0.331	0.370
College < median	36.21	36.95	-1.277***	0.830	0.283	-0.700
College >= median	33.76		-0.957***	0.813	0.288	-0.503
Income < median	36.48	44.88	-1.867***	0.825	0.272	-1.032
Income >= median	33.50		-0.259	0.823	0.298	-0.136

Table 8: Prepayment penalties and loan rates – samples split by APL provisions
This table presents results based on probit and 2SLS regressions using loan-level data for subprime fixed-rate mortgages originated during 2003-2006 with the sample split based on *APL_Dur* and *APL_Amt*. Complete regression results appear in Tables A5 and A6 of the appendix to this paper. Levels of significance for coefficient estimates of *Pr(PP)* in the 2SLS regressions are indicated by *, **, and *** for 10%, 5%, and 1%, respectively..

		Means of Pr(PP)		
	Estimate for *Pr(PP)*	*PP* = 1	*PP* = 0	Change in *InitialRate*
APL_Dur = 1	-2.016***	0.848	0.421	-0.861
APL_Dur = 0	-0.886***	0.720	0.576	-0.127
APL_Amt = 1	-2.512***	0.857	0.427	-1.080
APL_Amt = 0	-0.621***	0.824	0.638	-0.115

Table A1: Prepayment penalties and loan rates – sample split by loan purpose

This table presents the results of probit and 2SLS regressions using loan-level data for subprime fixed-rate mortgages originated during 2003-2006 with the sample split between refinance and purchase loans. Specifications are identical to those in Table 4 except *RefiCash* is omitted for refinances and both *RefiCash* and *RefiNoCash* are omitted for purchases. Levels of significance are indicated by *, **, and *** for 10%, 5%, and 1%, respectively.

Model:	Probit		2SLS		2SLS	
Dependent variable:	*PP*		*InitialRate*		*LTV*	
	Refinances	Purchases	Refinances	Purchases	Refinances	Purchases
Pr(PP)			-0.338***	0.205**		
			[0.0296]	[0.104]		
LTV			0.0103***	0.0371***		
			[0.000366]	[0.00200]		
InitialRate					-7.619***	-2.923***
					[0.443]	[0.683]
FICO	1.44E-05	-0.000768***	-0.00866***	-0.00786***	-0.0491***	0.000325
	[0.000169]	[0.000208]	[3.58e-05]	[0.000106]	[0.00384]	[0.00504]
LowNoDoc	-0.112***	-0.151***	0.370***	0.457***	1.271***	-0.580*
	[0.0136]	[0.0283]	[0.00472]	[0.0128]	[0.183]	[0.308]
RelLoanSize	0.0745***	0.0814***	-0.356***	-0.435***	13.55***	3.804***
	[0.0182]	[0.0279]	[0.00518]	[0.0115]	[0.120]	[0.231]
OwnerOcc	-0.243***	0.152***	-0.510***	-0.471***	-3.422***	-3.340***
	[0.0324]	[0.0420]	[0.00970]	[0.0187]	[0.270]	[0.407]
RefiCash	-0.0353		0.0980***		-0.0719	
	[0.0238]		[0.00635]		[0.122]	
30Year	0.201***	0.331***	0.165***	0.0953*	9.831***	10.81***
	[0.0177]	[0.0593]	[0.00838]	[0.0494]	[0.174]	[0.651]
%Refinance	0.304***	0.264**				
	[0.0752]	[0.121]				
%ShortTenure	0.142**	-0.0595				
	[0.0654]	[0.106]				
APL_Dur	1.237***	0.869***				
	[0.126]	[0.113]				
PrimeRate			0.240***	0.327***		
			[0.00558]	[0.0162]		
%Age18-34					-0.171***	-0.0288
					[0.0133]	[0.0249]
%Age35-44					0.328***	-0.247***
					[0.0272]	[0.0541]
%Age45-59					-0.168***	-0.0129
					[0.0232]	[0.0435]
%Age60+					-0.0315***	-0.0334
					[0.0112]	[0.0211]
%Value$1-$2					-0.166***	-0.0701***
					[0.00287]	[0.00542]
%Value$2-$3					-0.297***	-0.139***
					[0.00507]	[0.0102]
%Value$3-$5					-0.388***	-0.185***
					[0.00720]	[0.0152]
%Value$5+					-0.598***	-0.323***
					[0.00790]	[0.0162]
Observations	166,928	27,266	171,177	27,681	171,177	27,681
R^2	0.416	0.289	0.505	0.471	0.063	-0.012

Table A2: Prepayment penalties and loan rates – sample split by borrower FICO score

This table presents the results of probit and 2SLS regressions using loan-level data for subprime fixed-rate mortgages originated during 2003-2006 with the sample split by *FICO*. Specifications are identical to those in Table 4. Levels of significance are indicated by *, **, and *** for 10%, 5%, and 1%, respectively.

Model:	Probit		2SLS		2SLS	
Dependent variable:	*PP*		*InitialRate*		*LTV*	
	FICO below median	*FICO* at or above median	*FICO* below median	*FICO* at or above median	*FICO* below median	*FICO* at or above median
Pr(PP)			-0.487***	-0.134***		
			[0.0443]	[0.0329]		
LTV			0.0135***	0.0155***		
			[0.000590]	[0.000454]		
InitialRate					-5.597***	-6.692***
					[0.473]	[0.573]
FICO	0.00263***	-0.00147***	-0.0127***	-0.00507***	-0.0180***	-0.0602***
	[0.000187]	[0.000173]	[9.95e-05]	[6.22e-05]	[0.00597]	[0.00335]
LowNoDoc	-0.0917***	-0.141***	0.449***	0.383***	0.266	0.871***
	[0.0121]	[0.0192]	[0.00732]	[0.00514]	[0.230]	[0.234]
RelLoanSize	0.174***	-0.0128	-0.498***	-0.295***	14.24***	10.91***
	[0.0165]	[0.0190]	[0.00881]	[0.00508]	[0.179]	[0.118]
OwnerOcc	-0.276***	0.0187	-0.559***	-0.523***	-2.023***	-4.417***
	[0.0388]	[0.0281]	[0.0161]	[0.00877]	[0.339]	[0.343]
RefiCash	-0.207***	0.112***	-0.269***	-0.195***	-10.48***	-12.01***
	[0.0361]	[0.0205]	[0.0124]	[0.00794]	[0.239]	[0.238]
RefiNoCash	-0.0808**	0.0453**	-0.363***	-0.295***	-9.007***	-12.61***
	[0.0316]	[0.0205]	[0.0148]	[0.0101]	[0.299]	[0.313]
30Year	0.112***	0.338***	0.126***	0.158***	8.587***	10.75***
	[0.0210]	[0.0184]	[0.0126]	[0.0106]	[0.205]	[0.250]
%Refinance	-0.0638	0.445***				
	[0.0699]	[0.0877]				
%ShortTenure	0.148*	-0.0591				
	[0.0796]	[0.0682]				
APL_Dur	1.189***	1.204***				
	[0.137]	[0.113]				
PrimeRate			0.263***	0.257***		
			[0.00792]	[0.00667]		
%Age18-34					-0.187***	-0.118***
					[0.0170]	[0.0163]
%Age35-44					0.247***	0.238***
					[0.0341]	[0.0336]
%Age45-59					-0.194***	-0.0799***
					[0.0290]	[0.0288]
%Age60+					-0.0471***	-0.0218
					[0.0139]	[0.0138]
%Value$1-$2					-0.159***	-0.144***
					[0.00327]	[0.00369]
%Value$2-$3					-0.281***	-0.266***
					[0.00638]	[0.00652]
%Value$3-$5					-0.377***	-0.348***
					[0.0101]	[0.00880]
%Value$5+					-0.505***	-0.570***
					[0.0121]	[0.00941]
Observations	96,153	98,041	98,575	100,283	98,575	100,283
R^2	0.429	0.342	0.457	0.441	0.170	0.127

Table A3: Prepayment penalties and loan rates – sample split by education

This table presents the results of probit and 2SLS regressions using loan-level data for subprime fixed-rate mortgages originated during 2003-2006 with the sample split by *College*. Specifications are identical to those in Table 4. Levels of significance are indicated by *, **, and *** for 10%, 5%, and 1%, respectively.

Model:	Probit		2SLS		2SLS	
Dependent variable:	*PP*		*InitialRate*		*LTV*	
	College below median	*College* at or above median	*College* below median	*College* at or above median	*College* below median	*College* at or above median
Pr(PP)			-0.339***	-0.219***		
			[0.0837]	[0.0285]		
LTV			0.0157***	0.0102***		
			[0.000657]	[0.000533]		
InitialRate					-8.104***	-4.445***
					[0.553]	[0.513]
FICO	1.42E-05	-0.000175	-0.00861***	-0.00838***	-0.0476***	-0.0233***
	[0.000168]	[0.000161]	[5.01e-05]	[4.62e-05]	[0.00469]	[0.00433]
LowNoDoc	-0.0968***	-0.142***	0.394***	0.375***	1.502***	0.0725
	[0.0183]	[0.0156]	[0.00638]	[0.00626]	[0.234]	[0.216]
RelLoanSize	0.345***	0.0189	-0.655***	-0.278***	20.47***	10.11***
	[0.0240]	[0.0151]	[0.0158]	[0.00595]	[0.230]	[0.117]
OwnerOcc	-0.0576**	-0.143***	-0.457***	-0.515***	-4.215***	-3.166***
	[0.0270]	[0.0380]	[0.0110]	[0.0128]	[0.313]	[0.332]
RefiCash	0.025	-0.00467	-0.272***	-0.201***	-13.18***	-10.14***
	[0.0269]	[0.0289]	[0.0108]	[0.00960]	[0.279]	[0.204]
RefiNoCash	0.0815***	-0.0214	-0.372***	-0.298***	-12.59***	-9.939***
	[0.0273]	[0.0202]	[0.0132]	[0.0118]	[0.348]	[0.269]
30Year	0.163***	0.288***	0.169***	0.162***	8.850***	10.01***
	[0.0180]	[0.0208]	[0.0120]	[0.0124]	[0.232]	[0.223]
%Refinance	0.260***	0.155*				
	[0.0763]	[0.0909]				
%ShortTenure	-0.384***	0.127*				
	[0.0817]	[0.0657]				
APL_Dur	0.623***	1.430***				
	[0.104]	[0.124]				
PrimeRate			0.261***	0.254***		
			[0.00754]	[0.00753]		
%Age18-34					-0.420***	-0.234***
					[0.0258]	[0.0159]
%Age35-44					-0.0111	-0.0538
					[0.0405]	[0.0369]
%Age45-59					-0.736***	-0.198***
					[0.0424]	[0.0267]
%Age60+					-0.0476***	-0.183***
					[0.0179]	[0.0150]
%Value$1-$2					-0.187***	-0.135***
					[0.00350]	[0.00483]
%Value$2-$3					-0.305***	-0.286***
					[0.0102]	[0.00633]
%Value$3-$5					-0.520***	-0.326***
					[0.0328]	[0.00799]
%Value$5+					-0.464***	-0.526***
					[0.0816]	[0.00801]
Observations	97,029	97,165	99,462	99,396	99,462	99,396
R^2	0.428	0.337	0.509	0.496	0.072	0.225

Table A4: Prepayment penalties and loan rates – sample split by household income

This table presents the results of probit and 2SLS regressions using loan-level data for subprime fixed-rate mortgages originated during 2003-2006 with the sample split by *Income*. Specifications are identical to those in Table 4. Levels of significance are indicated by *, **, and *** for 10%, 5%, and 1%, respectively.

Model:	Probit		2SLS		2SLS	
Dependent variable:	*PP*		*InitialRate*		*LTV*	
	Income below median	*Income* at or above median	*Income* below median	*Income* at or above median	*Income* below median	*Income* at or above median
Pr(PP)			-0.570***	-0.188***		
			[0.0737]	[0.0300]		
LTV			0.0126***	0.00895***		
			[0.000612]	[0.000501]		
InitialRate					-8.355***	-4.524***
					[0.574]	[0.511]
FICO	-6.75E-05	-0.000131	-0.00876***	-0.00819***	-0.0506***	-0.0231***
	[0.000159]	[0.000161]	[5.04e-05]	[4.57e-05]	[0.00498]	[0.00423]
LowNoDoc	-0.0756***	-0.156***	0.384***	0.372***	1.611***	0.131
	[0.0147]	[0.0176]	[0.00636]	[0.00618]	[0.242]	[0.215]
RelLoanSize	0.247***	-0.0102	-0.513***	-0.254***	15.38***	11.09***
	[0.0240]	[0.0145]	[0.0112]	[0.00595]	[0.225]	[0.115]
OwnerOcc	-0.0763***	-0.131***	-0.479***	-0.492***	-4.422***	-3.075***
	[0.0267]	[0.0450]	[0.0107]	[0.0135]	[0.327]	[0.335]
RefiCash	-0.0352	0.0484*	-0.322***	-0.195***	-13.58***	-9.692***
	[0.0301]	[0.0258]	[0.0106]	[0.00938]	[0.296]	[0.196]
RefiNoCash	0.0722**	-0.0128	-0.403***	-0.296***	-13.28***	-9.402***
	[0.0283]	[0.0202]	[0.0132]	[0.0115]	[0.368]	[0.261]
30Year	0.176***	0.290***	0.192***	0.164***	9.163***	10.45***
	[0.0170]	[0.0220]	[0.0118]	[0.0123]	[0.238]	[0.223]
%Refinance	0.394***	0.163				
	[0.0773]	[0.103]				
%ShortTenure	-0.248**	0.0279				
	[0.0969]	[0.0724]				
APL_Dur	0.805***	1.308***				
	[0.126]	[0.119]				
PrimeRate			0.248***	0.251***		
			[0.00759]	[0.00741]		
%Age18-34					-0.257***	-0.0762***
					[0.0202]	[0.0167]
%Age35-44					-0.345***	0.206***
					[0.0466]	[0.0357]
%Age45-59					-0.326***	-0.0107
					[0.0395]	[0.0270]
%Age60+					-0.0687***	-0.0870***
					[0.0157]	[0.0158]
%Value$1-$2					-0.180***	-0.167***
					[0.00387]	[0.00487]
%Value$2-$3					-0.294***	-0.282***
					[0.00925]	[0.00613]
%Value$3-$5					-0.462***	-0.350***
					[0.0181]	[0.00823]
%Value$5+					-0.452***	-0.571***
					[0.0245]	[0.00830]
Observations	96,920	97,274	99,289	99,569	99,289	99,569
R^2	0.410	0.349	0.511	0.486	0.024	0.229

Table A5: Prepayment penalties and loan rates – sample split by APL_Dur

This table presents the results of probit and 2SLS regressions using loan-level data for subprime fixed-rate mortgages originated during 2003-2006 with the sample split by *APL_Dur*. Specifications are identical to those in Table 4 except *APL_Dur* is omitted. Levels of significance are indicated by *, **, and *** for 10%, 5%, and 1%, respectively.

Model:	Probit		2SLS		2SLS	
Dependent variable:	*PP*		*InitialRate*		*LTV*	
	APL_Dur equals 1	*APL_Dur* equals 0	*APL_Dur* equals 1	*APL_Dur* equals 0	*APL_Dur* equals 1	*APL_Dur* equals 0
Pr(PP)			-2.016***	-0.886***		
			[0.135]	[0.208]		
LTV			0.0123***	0.0126***		
			[0.000382]	[0.00124]		
InitialRate					-7.871***	-6.061***
					[0.457]	[0.819]
FICO	-7.13E-05	-0.000395*	-0.00836***	-0.00935***	-0.0481***	-0.0305***
	[0.000171]	[0.000235]	[3.69e-05]	[8.91e-05]	[0.00381]	[0.00752]
LowNoDoc	-0.112***	-0.0647**	0.339***	0.387***	1.455***	0.421
	[0.0124]	[0.0328]	[0.00551]	[0.0119]	[0.189]	[0.360]
RelLoanSize	0.0235	0.264***	-0.366***	-0.360***	13.38***	7.041***
	[0.0174]	[0.0485]	[0.00532]	[0.0135]	[0.120]	[0.286]
OwnerOcc	-0.220***	0.554***	-0.584***	-0.468***	-4.115***	-3.110***
	[0.0301]	[0.0343]	[0.0114]	[0.0341]	[0.264]	[0.574]
RefiCash	-0.0516*	0.346***	-0.251***	-0.262***	-12.18***	-10.61***
	[0.0302]	[0.0341]	[0.00783]	[0.0233]	[0.196]	[0.413]
RefiNoCash	0.00337	0.155***	-0.329***	-0.363***	-12.12***	-9.752***
	[0.0231]	[0.0456]	[0.00968]	[0.0216]	[0.257]	[0.490]
30Year	0.273***	0.114***	0.248***	0.216***	10.09***	9.839***
	[0.0189]	[0.0383]	[0.0125]	[0.0197]	[0.187]	[0.365]
%Refinance	-0.0261	0.202**				
	[0.0702]	[0.0996]				
%ShortTenure	0.238***	-0.637***				
	[0.0615]	[0.159]				
PrimeRate			0.246***	0.279***		
			[0.00574]	[0.0138]		
%Age18-34					-0.205***	-0.0312
					[0.0145]	[0.0258]
%Age35-44					0.153***	0.259***
					[0.0279]	[0.0637]
%Age45-59					-0.211***	0.0236
					[0.0258]	[0.0433]
%Age60+					-0.118***	0.0833***
					[0.0124]	[0.0217]
%Value$1-$2					-0.172***	-0.0995***
					[0.00318]	[0.00566]
%Value$2-$3					-0.284***	-0.228***
					[0.00513]	[0.0129]
%Value$3-$5					-0.380***	-0.320***
					[0.00728]	[0.0208]
%Value$5+					-0.583***	-0.445***
					[0.00788]	[0.0237]
Observations	159,116	35,078	163,070	35,788	163,070	35,788
R^2	0.393	0.459	0.509	0.445	0.079	-0.008

Table A6: Prepayment penalties and loan rates – sample split by APL_Amt

This table presents the results of probit and 2SLS regressions using loan-level data for subprime fixed-rate mortgages originated during 2003-2006 with the sample split by *APL_Amt*. Specifications are identical to those in Table 4 except *APL_Dur* is omitted. Levels of significance are indicated by *, **, and *** for 10%, 5%, and 1%, respectively.

Model:	Probit		2SLS		2SLS	
Dependent variable:	*PP*		*InitialRate*		*LTV*	
	APL_Amt equals 1	*APL_Amt* equals 0	*APL_Amt* equals 1	*APL_Amt* equals 0	*APL_Amt* equals 1	*APL_Amt* equals 0
Pr(PP)			-2.512***	-0.621***		
			[0.127]	[0.129]		
LTV			0.0122***	0.0117***		
			[0.000457]	[0.000642]		
InitialRate					-6.056***	-9.695***
					[0.454]	[0.749]
FICO	-1.77E-06	-0.000441***	-0.00831***	-0.00884***	-0.0321***	-0.0647***
	[0.000178]	[0.000171]	[4.24e-05]	[5.80e-05]	[0.00378]	[0.00654]
LowNoDoc	-0.105***	-0.0977***	0.319***	0.389***	0.624***	2.204***
	[0.0137]	[0.0218]	[0.00614]	[0.00766]	[0.188]	[0.321]
RelLoanSize	0.0397**	0.154***	-0.349***	-0.369***	12.31***	11.48***
	[0.0177]	[0.0282]	[0.00598]	[0.00870]	[0.129]	[0.212]
OwnerOcc	-0.276***	0.419***	-0.658***	-0.502***	-3.130***	-5.998***
	[0.0314]	[0.0234]	[0.0136]	[0.0196]	[0.262]	[0.508]
RefiCash	-0.147***	0.302***	-0.284***	-0.296***	-10.23***	-14.62***
	[0.0328]	[0.0189]	[0.0102]	[0.0151]	[0.184]	[0.387]
RefiNoCash	-0.0449*	0.120***	-0.333***	-0.394***	-10.10***	-14.15***
	[0.0260]	[0.0240]	[0.0111]	[0.0152]	[0.247]	[0.463]
30Year	0.271***	0.198***	0.284***	0.211***	9.396***	11.26***
	[0.0198]	[0.0233]	[0.0136]	[0.0143]	[0.193]	[0.317]
%Refinance	-0.0124	0.561***				
	[0.0777]	[0.0748]				
%ShortTenure	0.313***	-0.556***				
	[0.0683]	[0.113]				
PrimeRate			0.253***	0.246***		
			[0.00658]	[0.00897]		
%Age18-34					-0.179***	-0.116***
					[0.0153]	[0.0229]
%Age35-44					0.234***	0.249***
					[0.0297]	[0.0520]
%Age45-59					-0.176***	-0.104***
					[0.0279]	[0.0380]
%Age60+					-0.0609***	0.00034
					[0.0147]	[0.0177]
%Value$1-$2					-0.152***	-0.162***
					[0.00335]	[0.00499]
%Value$2-$3					-0.269***	-0.285***
					[0.00527]	[0.00945]
%Value$3-$5					-0.344***	-0.412***
					[0.00762]	[0.0139]
%Value$5+					-0.569***	-0.534***
					[0.00845]	[0.0145]
Observations	121,135	73,059	124,141	74,717	124,141	74,717
R^2	0.388	0.245	0.540	0.424	0.161	-0.087