SWITCHING COSTS AND ENTRY

IN THE

MORTGAGE INDUSTRY

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Abstract

The paper investigates the impact of switching costs and entry on the interest rate spread in the mortgage industry. We use the enactment of the anti-predatory lending laws across the U.S. to measure a reduction in borrowers' switching costs. The empirical findings show that a decline in switching costs influences the interest rate spreads in two ways: directly and indirectly. The direct effect causes the refinancing interest rate spread to rise because low-quality applicants will be more likely to approach outside banks than high-quality ones and thereby obtain financing. In the indirect effect, the decrease in switching costs induces more banks to enter the market, which allows low-quality borrowers to get financing and hence increases the average interest rate spread. The results suggest that lower switching costs exacerbate adverse selection problem, so policies that reduce may not produce clear benefits.

1. INTRODUCTION

In the literature switching costs are usually defined as costs that a consumer incurs when changing from one supplier to another. According to Klemperer (1987) "consumers display brand loyalty when faced with a choice between functionally identical products". As a result, products which are ex-ante homogenous become heterogeneous after the purchase is made. For example, all computers perform the same basic functions; however switching brands can lead to learning and adjustment costs caused by some differences in features between two brands of computers. Being accustomed to a specific good, an individual needs some form of incentive in order to change to another product brand. These incentives are commonly found in the form of lower prices or discount coupons. An individual may find it worthwhile to purchase a different brand of computer if the price differential covers the person's cost of learning and adjusting to the new product.

One of the main questions literature is trying to address is whether lower switching costs are always welfare inducing? Should public policies encourage activities that lower switching costs and reduce barriers to entry? Klemperer (1995) argues that in some settings, such as airline and technology industries, switching costs generally raise prices, increase deadweight loss, and discourage entry. Park (2009) shows that in the wireless industry a reduction in switching costs increases competition and lowers wireless prices. While decline in switching costs has positive welfare benefits in some industries, the question is whether the outcome is different in industries characterized by informational asymmetries (see Vesala 2007). Examining these types of settings

will have important implications on the direction of policies targeting a reduction in switching costs in industries where informational market failures are present.

To answer this question we find a natural experiment in the mortgage industry to measure switching costs. We use the enactment of the anti-predatory lending law – an act intended to protect borrowers from unfair and deceptive loan practices – as a policy instrument for the switching costs. The empirical findings of the paper show that in the presence of adverse selection, lower switching costs cause the refinancing rate spreads to rise. We identify two ways through which switching costs impact the market rate spread. First, the anti-predatory lending policy lowers switching costs which directly lowers the refinancing rate spread. Second, a reduction in switching costs increases entry and the increase in entry leads to higher average interest rate spreads. These results are driven by the presence of the adverse selection problem in the lending industry. When switching costs decline, high-quality borrowers have a greater desire to stay with their existing bank than low-quality ones, because it is difficult for them to convey information about their superior type to outside banks. Thus, their existing bank on average makes the best offer. The low-quality customers will be more likely to approach outside banks and in doing so obtain financing. As the proportion of low-quality applicants seeking an outside lender increases, the adverse selection worsens and the market responds by increasing the average spread. These findings lead us to conclude that the effectiveness of policies targeting lower switching costs is jeopardized by the adverse selection. As a result, government policies should try and address this market failure before encouraging activities that reduce switching costs.

The outline of the paper is as follows: Section 2 provides information on anti-predatory lending laws. Section 3 discusses past literature. Section 4 describes data and the model. Section 5 presents results. Section 6 presents alternative specifications and robustness checks. Section 7 concludes.

2. SWITCHING COSTS AND ANTI-PREDATORY LENDING LAW

In 1999 North Carolina was the first state to pass an anti-predatory lending law. Since then twenty five states have also instituted anti-predatory laws. There are two main types of anti-predatory lending laws. Some states have only enacted laws for the protection of high cost loans, while others cover all loans (the all-inclusive policy). High cost loans are mostly considered loans whose interest rate is 6% above treasury for the first lien and 8% for the second lien. The main focus of this research is to examine the impact of the all-inclusive anti-predatory lending laws on the lending market.

In the mortgage industry many customers are reluctant to change lending providers because they may be taken advantage of. The anti-predatory lending laws establish protections for these borrowers by protecting them from unfair, deceptive or fraudulent lending practices during the loan process. Most often these protections forbid "loan flipping" and refinancing unless a tangible net benefit has been established for the borrower. The practice of "loan flipping" refers to the act of repeatedly refinancing mortgage loans with no net benefit to the consumer. In addition, the laws prohibit lenders from making loans without establishing the borrower's ability to pay and also require lenders to provide financial literacy counseling if necessary.

For example, in 2007 Ohio enacted a predatory lending law, which expanded the Consumer Sales Practice Act to cover residential mortgage loan transactions. Under the new law, "unfair or deceptive acts or practices" in connection with residential mortgage lending are punishable. In particular, mortgage firms or brokers are not allowed to knowingly or intentionally engage in the act or practice of "flipping" a mortgage loan. They are not allowed to recommend or encourage consumers to default on a mortgage or any consumer transaction. Also, mortgage firms are not permitted to process transactions knowing there is no reasonable probability of loan re-payment.

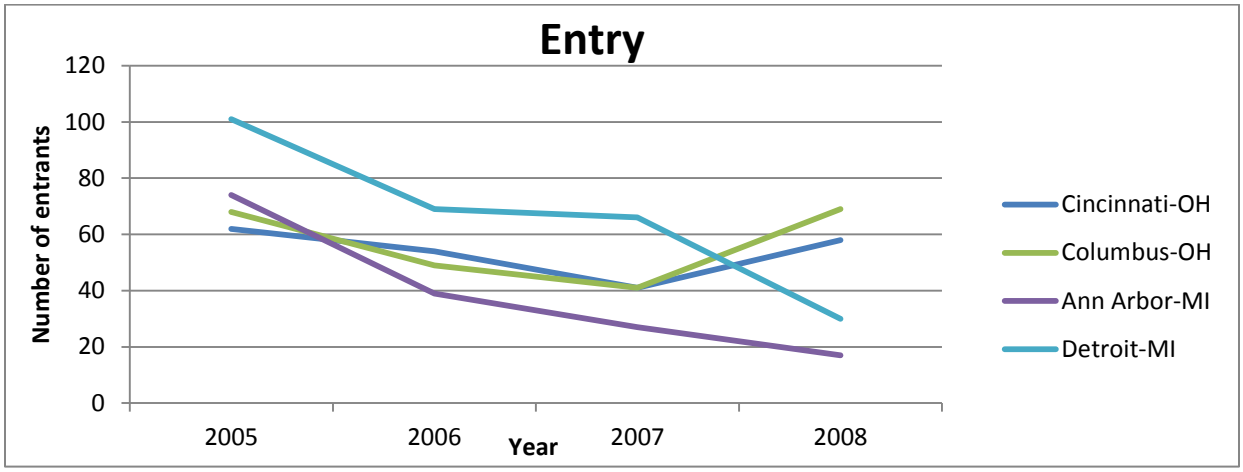
In the absence of these regulatory measures the asymmetry of information is present on the supply side of the market. The borrower is not able to determine if the lender is working in their best interest. Nothing prevents a lender from taking advantage of the homeowner, as a law protecting the consumer against unfair practices does not exist. A borrower is unlikely to change lenders if they have established a relationship with a bank and are familiar with its lending practices. The anti-predatory lending law mends this information asymmetry by requiring lenders to engage in fair and consumer beneficial practices. The consumer is no longer concerned about being treated unfairly and is more likely to pursue other lenders. These government policies provide more transparency in the lending process, thus lowering switching costs. For this reason, we use enactment of the predatory lending law as a policy instrument to measure a decline in switching costs.

Before we continue with the empirical model, we observe graphically whether the policy had an impact on firm entry and market rate spreads. According to Klemperer (1988), Beggs and Klemperer (1991), Farrell, and Shapiro (1988) the switching costs act as a barrier to entry. These

costs provide firms with a degree of monopoly power over their customers, making it harder for other firms to enter the market. We would expect the policy enactment to lower switching costs, reduce barriers, and increase firm entry. Figure 1 illustrates the impact of the Ohio's 2007 predatory policy on the firm entry in the two largest metropolitan areas. We use two largest metropolitan areas in Michigan, the state without a predatory lending law, as controls[1]. Michigan is demographically, geographically, and structurally similar to Ohio. This leads us to believe that any differences in the entry behavior between the two states are mainly due to the dissimilarity in their anti-predatory policy. The policy is expected to create more transparency in the mortgage lending process and increase the likelihood of people switching. Accordingly, we anticipate the market entry to behave similarly in both states in the pre-law years, with diverging trends in the post-law years. As Figure 1 indicates, Ohio and Michigan both follow a downward trend prior to 2007. While Michigan continued with the downward trend after 2007, Ohio's entry increased. This observation gives us some confidence that the anti-predatory policy may have encouraged entry.

[1] For the comparison we just choose two largest MSAs from Ohio and Michigan. The same interpretation follows for all the other MSAs in the two states.

Figure 1



Similarly, Figure 2 illustrates that the refinancing interest rate spread increased in Ohio after 2007, while the average interest rate spread in Ohio's MSAs continued the downward trend (see Figure 3). The implications of these results will be discussed in Section 5.

Figure 2

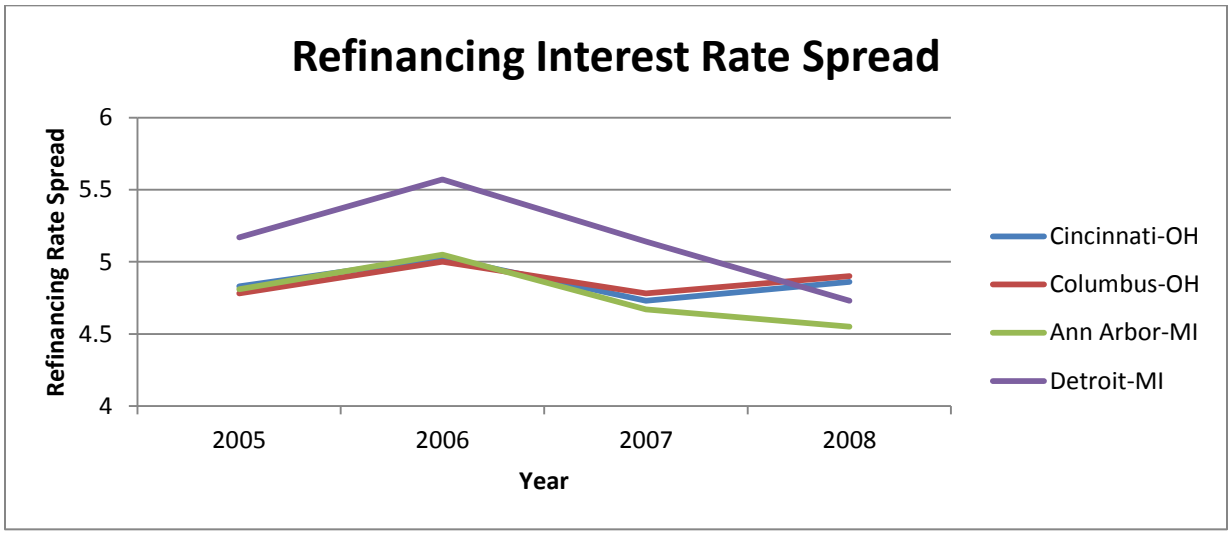
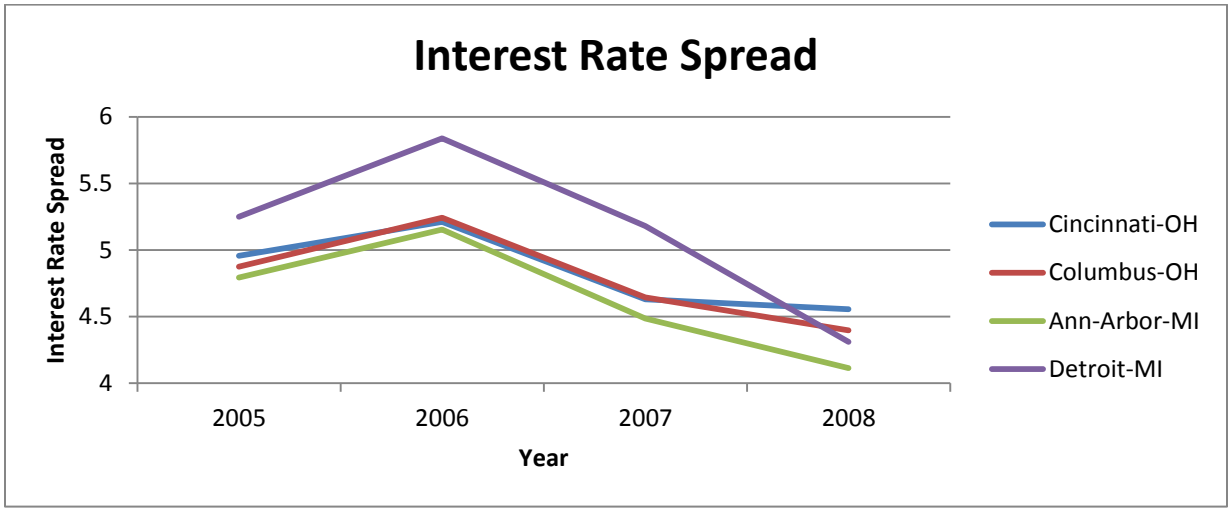


Figure 3



3. LITERATURE REVIEW

A vast theoretical literature is available on switching costs. One of the leading experts in this field, Klemperer (1987a) examines a two period differentiated duopoly in which consumers are partially locked in. He assumes firms offer differentiated products that are substitutes. In the market where switching costs are present, firms compete more aggressively to gain market share in the first period because it will be valuable later. Once consumers are locked in, firms can charge a higher price in the market with switching costs. Klemperer shows firms' profits can either be higher if consumers' preferences remain constant, or lower if consumers' tastes change between periods. His most interesting conclusion is that the market can be less competitive in both periods than a market with no switching costs.

Klemperer (1987b) studies how the threat of new entry affects incumbent's behavior in the market with switching costs. He acknowledges that high switching costs do not always deter entry. For example, in the presence of high switching costs, the incumbent will have less incentive to fight aggressively for new customers in later periods. Such a strategy will encourage entry into the market. On the other hand, when switching costs are high, incumbents are also more likely to charge prices below the monopoly price to increase their market base and deter entry. He concludes that a monopoly faced by consumers with switching costs will not be able to exercise its monopoly power. The incumbent will charge a lower price in order to increase its market share and deter entry from taking place. If this is true in practice, then firms may be inclined to create products and pricing policies with the intent to increase switching costs, thereby locking in consumers, and making the industry less competitive. These strategies may have a negative effect on the social welfare.

While the theoretical framework has been widely explored, the empirical models are scarce. The main challenge in this research area is finding a way to measure switching costs. Kaserman and Mayo (1991), Borenstein (1991), Stango (2002) have focused on identifying different ways to measure switching costs in various industries and explore their effect on pricing competition. Kim et al. (2003) uses a firm's market share correlation between two periods to measure customer loyalty. They find switching costs to account for a third of the value of the average interest rate on the loan. Sharpe (1997) analyzes the effect of switching costs on the interest rates in the bank deposit market. He uses the percentage of people who move between metropolitan areas as a proxy for switching costs. The empirical model specifies deposit interest rates as a linear function of explanatory variables estimated via OLS. Sharpe discovers switching

costs increase competition in the market. This could be explained by the fact that firms in the bank deposit market are unable to price discriminate and keep consumers locked in.

Very few empirical and theoretical papers address brand loyalty problems in the lending industry. Vesala (2007) provides a theoretical model which demonstrates a V-shaped relationship between switching costs and profitability. Sharpe (1990) and Van Thadden (2004) discuss adverse selection problem in the lending industry. They argue that high-quality borrowers are "informationally captured" because outside banks do not have informational privileges of the inside bank and will on average charge higher rates than the inside bank. Our empirical findings are in line with the theory set forth by Vesala, Sharpe, and Van Thadden.

More recently, Viard (2007) offers a unique way of identifying switching costs. He employs the 1-800 number portability policy enacted in 1993 to estimate the effect of switching costs on the price competition under a single price regime. He learns that in a homogeneous market, firms reduce their prices in response to a decline in switching costs. In her working paper, Minjung Park (2009) also uses a policy instrument, the introduction of number portability in the wireless telephone market, to measure an industry wide exogenous decline in switching costs. Viard and Park's methodology can apply to many other industries, where availability of data for determining switching costs is not available. In this paper, we use their research as an inspiration to recover a good policy instrument for switching costs in the mortgage industry.

4. DATA & THE MODEL

The data employed in this study contains market information from 175 Metropolitan Statistical Areas (MSA) observed yearly from 2004 to 2008. The majority of data is collected

from the Housing Mortgage Disclosure Act (HMDA) public data and Mortgage Data Web. The new 2009 data will be published by the end of 2010. I intend to incorporate this additional data into the sample once it becomes accessible.

The HMDA, enacted by the Congress in 1975, requires lending institutions to report public loan data. The aggregate MSA and firm level data are available online from 1999 to the present. However, the information on interest rate spread, the difference between the rate at which banks lend and borrow funds, has only been available since 2004. The HMDA also provides the list of all the lending institutions present in the market starting with the year 2004. Mortgage Data Web makes use of the HMDA data to provide market share, loan values, demographic characteristics, and other information by state, county, and metro area. The information on MSA income is obtained from the Census Bureau. The policy instrument, enactment of anti-predatory lending law, is collected through the Community Investment Network. Due to the differences in laws across states, we make a distinction between the laws which target high cost loans and those that encompass all loans.

This paper estimates the impact of a decline in switching costs on industry interest rate spread. The dependent variable, *SPREAD*, is defined as the weighted average of the housing purchase and refinancing interest rate spreads. The interest rate spread measures the difference between the rates at which banks lend and borrow funds. The dependent variable is determined by market characteristics, entry barriers, and post-entry market structure (see Amel et al. 1997 and Berger et al. 1989). Market entry affects interest rate spread directly and indirectly through the market composition. We will instrument for *ENTRY* for there is a possibility that market entry is an endogenous covariate in the model. We posit a system of two equations where both

dependent variables have a continuous outcome. The dependent variables are: interest rate spread (*SPREAD)* and number of entries (*ENTRY). ENTRY* is defined as the number of reporting lending institutions who have opened a home or a branch office in the give market. We exclude lending firms that enter by acquiring an existing firm because the acquired firm is already competing in the market.

The model we will examine in this paper is as follows:

$$y_{it1} = x_{it}^{'}\beta_1 + \beta_2 y_{it2} + \varepsilon_{it1}$$
$$y_{it2} = x_{it}^{'}\gamma_1 + z_{it}\gamma_2 + \varepsilon_{it2} \qquad (1)$$

where *i* is an index for a metropolitan statistical area, *t* denotes a year, y_{1it} is *SPREAD*, y_{2it} is *ENTRY*, x_{it} are the exogenous variables in the *SPREAD* equation, and z_{it} are the instruments for *ENTRY*.

Our main interest lies in examining the effect of the all-inclusive and high-cost anti-predatory lending policies, *SREG* and *SHC,* on firm's pricing decisions. We believe that the policy instrument impacts the market rate spread both directly through the policy mechanism and indirectly through its impact on entry. It is unclear whether the sign on the policy instrument's coefficient is positive or negative. A reduction in switching costs usually increases competition and lowers market spread. However, in the lending market the adverse selection problem may arise and have an opposite effect on market spread. We hope this model will provide a better understanding of these market issues.

As a measure of market structure we include HHI. We expect a positive relationship between market concentration and spread. We use population size and growth to assess the market demand characteristics. The population size and growth, *MKT* and *MTKGWTH*, are included to account for the possibility that rapid market growth should expand profit opportunities of existing banks and increase the market spread.

According to Peters et al. (2002), low income and minority borrowers have higher default rates. We expect markets with a higher percentage of risky borrowers to have higher spreads in order to compensate for the risk of default. The variables we include are *RACEW* and *INCL50K* to determine customers' ability to pay for the loans. The variable *RACEW* represents the percentage of Caucasian consumers in the market, while *INCL50K* measures the percentage of customers earning less than fifty thousand dollars a year. We anticipate that the markets with the lower percentage of racial minorities and higher income have lower interest rate spreads.

In addition to these covariates we include previous year's interest rate spread, because the spread appears to be correlated from one period to the next.

When deciding how to properly instrument for *ENTRY* we need to analyze the covariates that are correlated with entry and are exogenous to the spread equation. Entry by a firm is assumed to be a function of the firm's future expected profits, entry barriers and market characteristics. The expected market conditions are usually characterized as a function of pre-entry market conditions. We assume that the pre-entry environment is an indicator of the expected post-entry market conditions. The firm's decision to enter the market at time *t* is presumed to be made at time *(t-1)* because of the time required to raise capital, apply for a

charter, and open for business. Therefore, a firm's entry decision is based on the market information observed at *t-1* (Amel et al. 1997, Berger et al. 2004, Ilmakunnas et al. 1999).

Higher entry barriers increase costs and reduce the likelihood of entry. These barriers can be established by incumbents' strategic choices or exogenous market restrictions. The pre-entry market concentration HHI_{t-1} may be an entry barrier because it reflects non-competitive behavior and superior product differentiation. Brozen (1982), Demsetz (1973) argue that firms which possess a comparative advantage in a production process will increase in size, obtain a high market share, and make it more difficult for other firms to enter the market. We include a market share variable $MSL100M_{t-1}$ as a proxy for the comparative advantage.

The market demand characteristics include market size and growth potential. These characteristics can generate excess demand and encourage new firms to enter the market. Previous research has found that entry is more frequent in large and growing markets. As a measure for market growth, $MKTGWTH_{t-1}$, we use the population growth of the given area. We include the total value of mortgages, population size, and market value dummies ($LMKTSIZE_{t-1}$, MKT_{t-1}, $MVL100M_{t-1}$, and $MV100M_{t-1}$) to account for the market size.

Firm's decision to enter the market can be impacted by the customer's composition. Firms may be more reluctant to enter if the market consists of high risk borrowers. For this reason, we include lagged values of *RACEW* and *INCL50K* to account for these market characteristics.

Both equations include time and state dummies to account for any other market variations over time.

In addition, we want to examine, as illustrated by Figure 1, whether the policy had a positive impact on entry. A relationship between the policy instrument and entry will establish an indirect relationship between the policy and the average market spread. If a decline in switching costs increases entry, which in turn causes a rise in the average market spread, we can conclude that switching costs have also an indirect impact on spread through entry. To explore this question we will develop a similar model to (1) where the dependent variable of interest is entry and the interest rate spread is the endogenous covariate we will instrument for. The covariates we include in the entry equation are the same as discussed earlier in this section except for $SPREAD_{t-1}$. Once we instrument for *SPREAD* in the equation, the coefficient on $SPREAD_{t-1}$ becomes insignificant. For this reason, we exclude the lag of the interest rate spread from the model. Before proceeding with the estimation, we need to find relevant instruments for the *SPREAD* variable that are also exogenous to the model. After careful examination we use market concentration index PCINCOME, *RACE*, and $SPREAD_{t-1}$. These instruments pass both the relevance test and the test for overidentifying restrictions.

The description and the summary of the variables are provided in Tables 1 and 2. According to Table 2, the average number of firms entering the market is 35. Some markets have as low as 3 entries, while others have experienced substantial entry of 149 firms. Approximately, half of the observations have either an all-inclusive or a high-cost predatory lending law in effect. The average refinancing rate spread is higher than the home purchase spread, which is consistent with the ability of lenders to extract higher rents from existing customers due to switching costs.

Table 1

Variable	Explanation	Source
SREG	*1 if predatory lending policy is in effect for all inclusive law and 0 otherwise*	Community Investment Network
SHC	*1 if predatory lending policy is in effect for high cost loans and 0 otherwise*	Community Investment Network
ENTRY	*Number of firms that have opened up a first branch in the given MSA*	HMDA
SPREAD	*Weighted average of the housing purchase and refinancing interest rate spreads*	HMDA Mortgage Data Web
RefSPREAD	*Refinancing interest rate spread*	HMDA
HpSPREAD	*Home purchase interest rate spread*	HMDA
MKTGROWTH	*Income growth of the given MSA*	US Census Bureau
PCINC	*Per capita income in the given MSA/1,000*	US Census Bureau
MKT	*Population size of the given MSA/100,000*	US Census Bureau
LMKTSIZE	*Logarithm of the total value of mortgages in the given MSA*	Mortgage Data Web
RACEW	*Percentage of loans in the market whose applicants are Caucasians*	Mortgage Data Web
RACE	*Percentage of the population in the given MSA that is Caucasian*	US Census Bureau
INCL50K	*Percentage of loans in the market whose applicants earn less than $50,000 a year*	Mortgage Data Web
HHI	*Herfindahl-Hirschman Index/1,000*	Mortgage Data Web
MSL100K	*Total percentage of firms in the market which hold less than $100 million in mortgage loans*	Mortgage Data Web
MVL100K	*1 if the market's total value is less than $100 million*	Mortgage Data Web
MV100K	*1 if the market's total value is between $100 million and $ 1 billion*	Mortgage Data Web

Table 2

Variable	Mean	SD	Min	Max
SREG	0.23	0.42	0.00	1.00
SHC	0.22	0.41	0.00	1.00
ENTRY	35.20	20.57	3.00	149.00
SPREAD	4.66	0.41	2.58	5.84
RefSPREAD	4.77	0.34	3.65	5.57
HpSPREAD	4.53	0.60	0.25	6.22
MKTGROWTH	0.01	0.08	-0.02	2.24
PCINC	32.42	5.15	22.73	56.51
MKT	6.13	12.02	0.72	116.65
LMKTSIZE	14.09	1.33	11.42	18.62
RACEW	0.92	0.08	0.48	1.00
RACE	0.63	0.13	0.39	0.98
INCL50K	0.23	0.08	0.00	0.44
HHI	0.04	0.02	0.01	0.43
MSL100K	0.79	0.24	0.07	1.00
MVL100K	0.30	0.46	0.00	1.00
MV100K	0.57	0.50	0.00	1.00

5. RESULTS

In this section we observe that switching costs impact interest rate spread both directly and indirectly through firm entry. The indirect effect occurs when a reduction in switching costs increases entry, which then increases the average spread in the mortgage industry. Section 5.1 examines the indirect effect, while section 5.2 studies the direct impact of switching costs on interest rate spread. Section 5.3 advises on the overall size of the switching costs in the mortgage industry. We conclude with Section 5.4 by discussing the implications of these findings.

The models are estimated using an IV estimator. The instruments are valid as they pass both the test for significance and overidentifying restrictions. We have also estimated the model using Bayesian estimation techniques. The inference between the two techniques is identical. The Bayesian estimates are presented in the appendix together with the explanation of the estimation technique.

5.1 The indirect effect of switching costs on the interest rate spread

Initially, a reduction in switching costs increases entry, which in turn causes a change in the average market spread. Therefore, a reduction in switching costs has an indirect effect on the interest rate spread. Tables 3 and 4 inform us about the size and the direction of the indirect effect.

Table 3 reports results obtained by regressing entry on exogenous covariates and the instrument for *SPREAD*. The data is strongly consistent with the hypothesis that the anti-predatory lending law is associated with the subsequent increase in entry. The anti-predatory

laws lower non-financial transaction costs by giving consumers a more transparent lending process (see Bennett et al. 2001). As a result, consumers are more likely to refinance with other lenders, thereby encouraging other firms to enter the market. The coefficient on the policy instrument *SREG* in the entry equation is positive and statistically significant at 5%. This result confirms our expectation that a decline in switching costs increases market entry. The coefficient of 4 implies that states with anti-predatory lending laws experienced on average 4 more firm entries than states with no law. Given the mean value of *ENTRY* is 32.74; the coefficient of 4 translates to a 12% increase in the number of entrants in states with all inclusive lending laws. The results are very robust to changes in the model specification and the estimation method.

Table 3

Dependent variable: entry		
Var List	*Coef.*	*S.E.*
CONST	-173.3845***	48.5873
SREG	4.0211**	2.1339
SHC	0.0919	1.4590
R	15.6745**	7.4902
HHI(-1)	-14.4172***	3.8405
MSL100K(-1)	-0.5687	5.4320
MKTGWTH(-1)	195.6905***	56.4773
MKT	0.0370	0.1012
LMKTSIZE(-1)	11.0656***	1.5482
MVL100K(-1)	-2.7920	3.8321
MV100K(-1)	-5.6495**	2.8302
Rsq	*0.83*	
State Fixed Effects	*yes*	
Time Fixed Effects	*yes*	
Observations	*700*	

* Significantly different from zero at 10%

** Significantly different from zero at 5%

*** Significantly different from zero at 1%

The all-inclusive anti-predatory laws appear to have a greater impact on entry than the laws targeting only high-cost loans. There are a few ways to explain these findings: the broader scope of the law and the problem of adverse selection. When switching costs decline, a greater number of bad borrowers can afford to switch lenders. In states whose policy targets only high-cost loans, only high risk borrowers have experienced a decline in switching costs. The potential entrant understands that the increase in market demand is mostly due to low quality borrowers seeking new financiers. Accordingly, new firms may not find it beneficial to enter such a market. These results suggest that all inclusive anti-predatory lending laws are more effective in reducing entry barriers than high cost lending laws. State governments should take these findings into consideration when implementing lending policies.

The model in Table 4 yields some interesting conclusions about the direction of the policy's indirect effect. An increase in entry can have two opposite effects on the average market spread in the mortgage industry. First, entry can increase competition, which tends to lower the spread. Second, suppose high quality borrowers are served first, then as more firms enter the market, the number of borrowers being served increases. The increase in the number of customer's being served comes mostly from the low-quality borrowers. The banks respond by increasing the interest rate spread. The positive and significant coefficient on *ENTRY* implies that the second effect dominates and that an increase in entry increases the average spread. The coefficient of 0.0017 implies that an average sample entry of 32 firms would increase the spread by approximately 0.06%. This analysis can help in understanding the impact of policies whose aim is to encourage industry entry.

Table 4

Dependent variable: interest rate spread		
Var List	*Coef.*	*S.E.*
CONST	4.4674***	0.2769
SREG	0.0072	0.0308
SHC	0.0232	0.0294
ENTRY	0.0018**	0.0009
HHI	-0.0874	0.1189
*HHI*D2006*	-0.2910**	0.1227
*HHI*D2007*	-0.0513	0.1666
*HHI*D2008*	0.1434	0.1220
MKTGWTH	-2.5722***	0.9418
MKT	-0.0026***	0.0010
RACEW	-1.2908***	0.3755
INCL50K	0.6900***	0.1662
Rsq	*0.7600*	

First stage equation

Dependent variable: entry		
Var List	*Coef.*	*S.E.*
CONST	-79.5209***	19.0526
SREG	3.2727*	1.8067
SHC	0.5303	1.2868
R(-1)	0.4601	1.7069
HHI(-1)	-2.1429	3.1488
MSL100K(-1)	2.2504	3.9045
MKTGWTH(-1)	31.5976	60.2869
MKT	-40.9006***	7.9181
LMKTSIZE(-1)	10.5947***	1.0571
MVL100K(-1)	-4.3655*	2.4967
MV100K(-1)	-5.5368***	1.9929
Rsq	*0.86*	
State Fixed Effects	*yes*	
Time Fixed Effects	*yes*	
Observations	*700*	

* Significantly different from zero at 10%

** Significantly different from zero at 5%

*** Significantly different from zero at 1%

5.2 The direct effect of switching costs on the interest rate spread

We expect lower switching costs to promote entry, increase price competition and lower overall industry profits. However, the coefficients on both *SREG* and *SHC* are statistically insignificant. The findings are very robust to changes in the model specification and they suggest that the anti-predatory lending policies do not directly affect the average market spread. We can conclude that the policy does not impact the average market interest rate spread directly, but only indirectly through its positive impact on entry. While these conclusions are unusual, we may find some answers by examining how the policy instrument impacts the refinancing interest rate spread[2]. Table 5 presents the results of a model similar to (1), where the dependent variable is refinancing interest rate spread.

The policy coefficients, *SREG* and *SHC*, when regressed on refinancing rate spread, yield positive and significant values of 0.07 and 0.065 respectively. The positive coefficients on the policy instruments in the refinancing spread equation demonstrate the presence of an information asymmetry problem in the mortgage industry. These findings are in the agreement with the work done by Vesala (2007), who claims that lower switching costs increase the adverse selection problem. Outsider banks do not have the informational privileges of insider banks and cannot fully assess the future success probability of a new customer repaying their loan. For this reason, the outsider is on average more likely to charge higher spreads to new customers. In addition, the insider banks have privileged information on their customers so they can better assess the quality

[2] We also perform a regression on the home purchase interest rate spread. The coefficient on SREG and SHC are insignificant while on entry it is positive and significant. These findings indicate that anti-predatory lending policy does not directly impact home purchase spreads. However, the impact may be indirect through entry, because the policy increases entry in the market.

of their borrower. The high-quality borrowers have a lower desire to switch banks than low-quality one, because they face difficulty conveying information about their superior performance to other lenders. Consequently, their own bank is likely to make the best offer. The low-quality applicants will be more likely to seek outside lenders and obtain financing when switching costs are low. For this reason, the increase in the number of customers switching lenders will be driven mostly by the low-quality borrowers. The banks will respond by raising the refinancing interest rate spread.

Table 5

Dependent variable: refinancing interest rate spread		
Var List	*Coef.*	*S.E.*
CONST	3.2648***	0.2642
SREG	0.0708**	0.0368
SHC	0.0657*	0.0398
ENTRY	0.0011**	0.0005
HHI	-0.2492**	0.1113
*HHI*D2006*	-0.0209	0.1049
*HHI*D2007*	0.2863	0.1076
*HHI*D2008*	0.3335***	0.1262
MKTGWTH	-1.4098	0.9069
MKT	-0.0027***	0.0007
RACEW	-1.2040***	0.4781
INCL50K	0.2434**	0.1286
Rsq	*0.57*	
State Fixed Effects	*yes*	
Time Fixed Effects	*yes*	
Observations	*700*	

* Significantly different from zero at 10%

** Significantly different from zero at 5%

*** Significantly different from zero at 1%

We have shown that the enactment of anti-predatory lending policy has raised the interest rate spread both directly and indirectly though the increase in market entry. These results will prove to be of value when deciding whether to implement policies targeting a reduction in switching costs in the lending industry. Before further discussing the policy implications, we first infer the overall size of the switching costs in the mortgage industry.

5.3 The size of the switching costs in the mortgage industry

When switching costs are low, poor quality applicants are more likely to receive financing. On the other hand, when switching costs are high, even the good quality applicants will not find it beneficial to seek another lender. Vesala concludes that the most efficient allocation of financial resources is likely to be under moderate switching costs. Following this claim he shows that the insider's loan rate and bank profits in the lending industry are a 'V-shaped' function of the switching costs. When switching costs are very high, banks can charge high interest without the fear of losing their customer base. As switching costs decline, competition increases between firms. A bank will need to lower prices to keep current customers and attract new ones. There is a threshold c_1 below which the problem of adverse selection becomes prevalent and the bank will begin increasing the rates to ensure against risk. These findings suggest the industry is the most competitive under moderate switching costs. Vesala defines expected profits as a function of the spread, the difference between the expected loan rate and the rate at which banks borrow funds. For this reason, we can infer the overall size of the

switching costs in the mortgage industry. Our model shows that a decline in switching costs increases the interest rate spread, which places the switching costs in the mortgage industry to the left of c_1.

5.4 Policy Implications

These results indicate that public policy aimed at reducing switching costs in the mortgage industry may not produce clear benefits. A reduction in switching costs generally increases competition and lowers deadweight loss. In the mortgage industry a decline in switching costs will increase entry. However, it will also exacerbate the adverse selection problem, causing a raise in the interest rate spread and hurting borrowers. Cole (1998) provides empirical evidence that insider banks have privileged information about their customers, whereas outsider banks must rely on information common to all banks. To overcome these market failures, government could construct policies which will allow all banks to gain access to borrower's private information. In addition, the government can provide banks with incentives to invest in the accuracy of private information to counterbalance the inefficiencies that arise from the adverse selection problem.

6. ROBUSTNESS CHECKS

To assure confidence in our outcomes, we run two separate robustness checks. We present some robustness results in the appendix 2. We first examine the performance of the model under a different estimation technique. We estimate the model using Bayesian estimation

techniques. The inference between the two techniques is identical. The Bayesian estimates are presented in the appendix.

The second robustness check uses alternative specifications of the exogenous variables. We tried changing the specification of market growth and size. We use total quantity of market loans and growth in market loans as a measure of market size and growth. We also examine the model where a market's total personal income and growth are used as measures of market size and growth. We observe the model where market share is included because some profit-concentration studies use it as a way of measuring firm efficiency (see Smirlock 1985). We add second and third-order terms on the continuous exogenous variables to allow for nonlinearities (e.g. HHI). The inclusion of any of these variables does not change our main results. The impact of the anti-predatory policy on entry is still positive and significant, while entry exhibits a positive relationship with interest rate spread. The estimates in this model are very robust to changes in variable specifications and their structural forms. These two robustness checks offer evidence that the model is well defined. Future research may provide further examination of the model by utilizing a larger data set.

7. CONCLUSION

The paper studies how switching costs and entry affect interest rate spreads in the mortgage industry. We use a natural experiment, enactment of an anti-predatory lending law, as a policy instrument to measure a decline in switching costs. We discover that switching costs work via two channels to cause an increase in the interest rate spread. We define these two channels as indirect and direct effect of switching costs on the spread. . The indirect effect occurs when a reduction in switching costs increases entry, which then increases the average spread in the mortgage industry. A reduction in switching costs also has a direct effect on the refinancing rate spread causing it to rise. The explanation for this phenomena lies in the presence of the adverse selection problem in the lending industry. In the lending market, it is more difficult for low-quality customers to obtain financing than the high-quality ones. In addition, high-quality borrowers have a lower incentive to switch lenders; because their bank is the one that hold informational privileges, prefers their type, and will on average offer them better rate than outside banks that are less able to differentiate high from low-quality borrowers. When the switching costs in the lending industry decline and the number of firms entering increases, the low-quality applicants will be more likely to approach outside banks and thereby obtain financing, thus forcing these outside banks to increase their interest rate spreads. The results suggest that the policies targeting a reduction in switching costs may not be effective due to market's information asymmetries.

This research can offer a better insight into the mortgage industry and the tools necessary to remedy these market failures. The government can help by creating laws which require consumers' previous lending and banking practices to be available to all the banks. The

government can also encourage firms to invest in the accuracy of private information through financial support. By targeting policies which lessen the informational gap between lenders and borrowers, the government can improve the effectiveness of policies targeting a reduction in switching costs.

There are a few possible extensions and avenues for future research. One possibility is to explore the impact of switching costs with the firm level data. Perhaps the easiest extension and the one which we plan to pursue in the future is collection of more data points to improve the accuracy of our results. Although the results only pertain to the mortgage industry, the model can easily be applied to other industry settings. We hope this research can provide more insight into behavior of switching costs in the mortgage market as well as other industries which face adverse selection problems.

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APPENDIX 1

The estimation of the model relies both on the classical and the Bayesian techniques. We employ Bayesian Markov chain Monte Carlo algorithm to estimate the restricted model that utilizes only 4 years of data. Below we provide a brief description of the Bayesian technique.

The model of interest presented in the previous section can be rewritten as:

$$\begin{aligned} y_{it1} &= x_{it}^{'}\beta_1 + \beta_2 y_{it2} + \varepsilon_{it1} \\ y_{it2} &= x_{it}^{'}\gamma_1 + z_{it}\gamma_2 + \varepsilon_{it2} \end{aligned} \qquad (2)$$

There are $i = 1, \ldots, N$ Metropolitan Statistical Areas in the sample across T time periods denoted by $t = 1, \ldots, T$. Each x and z have k_1 and k_2 covariates respectively. We assume that ε is normally distributed $\varepsilon_{it} \sim N(0, \Omega)$ across observations, where $\Omega = \{\omega_{ij}\}$.

Before we proceed with estimation of the model, we need to specify the prior and posterior distribution of β, γ, and Ω. According to Greenberg (2008), we assume that the prior distribution for Ω is distributed inverse Wishart with parameters v and Q. The prior distribution for β is $N_{k_1+1}(\beta_o, B_o)$. For γ we specify a Gaussian prior $N_{k_1+k_2}(\gamma_o, G_o)$.

The posterior for Ω is

$$\pi(\Omega \mid \beta, \gamma, y) \propto |\Omega|^{-\frac{n}{2}} \exp\left[-\frac{1}{2} \sum (y_{1i} - X_i^{'}\beta, y_{1i} - Z_i^{'}\gamma) \Omega^{-1} \begin{pmatrix} y_{1i} - X_i^{'}\beta \\ y_{1i} - Z_i^{'}\gamma \end{pmatrix} \right]$$
$$\times |\Omega|^{-\frac{(v-3)}{2}} \exp\left[-\frac{1}{2} tr(Q^{-1}\Omega^{-1}) \right]$$

where $X_i = (x_{it1}^{'}, y_{it2})$ and $Z_i = (x_{it1}^{'}, z_{it}^{'})$.

The posterior for β is

$$\pi(\beta \mid \Omega, \gamma, y) \propto \exp\left[-\frac{1}{2\left(\omega_{11} - \frac{\omega_{12}^2}{\omega_{22}} \right)} \sum_i \sum_t \left(y_{1it} - \frac{\omega_{12}}{\omega_{22}} (y_{2it} - Z_{it}^{'}\gamma) - X_{it}\beta \right)^2 \right]$$

$$\times \exp\left[-\frac{1}{2} (\beta - \beta_0)' B_0^{-1} (\beta - \beta_0) \right]$$

The posterior for γ is

$$\pi(\gamma \mid \Omega, \beta, y) \propto \exp\left[-\frac{1}{2\left(\omega_{22} - \frac{\omega_{12}^2}{\omega_{11}} \right)} \sum_i \sum_t \left(y_{2it} - \frac{\omega_{12}}{\omega_{11}} (y_{1it} - X_{it}\beta) - Z_{it}^{'}\gamma \right)^2 \right]$$

$$\times \exp\left[-\frac{1}{2} (\gamma - \gamma_0)' G_0^{-1} (\gamma - \gamma_0) \right]$$

According to Greenberg (2008) it is straightforward to derive the conditional distributions of or the Gibbs algorithm:

$$\Omega \mid y, \beta, \gamma \sim IW(\nu_1, Q_1)$$

$$\beta \mid y, \Omega, \gamma \sim N(\hat{b}, \hat{B})$$

$$\gamma \mid y, \Omega, \beta \sim N(\hat{\gamma}, \hat{G})$$

where

$$v_1 = v_0 + N$$

$$Q_1 = \left[Q_0^{-1} + \sum_i \sum_t \begin{pmatrix} y_{1i} - X_i^{'}\beta \\ y_{1i} - Z_i^{'}\gamma \end{pmatrix} (y_{1i} - X_i^{'}\beta, y_{1i} - Z_i^{'}\gamma) \right]^{-1}$$

$$\hat{b} = \hat{B}\left[B_o^{-1} b_o + \left(\omega_{11} - \frac{\omega_{12}^2}{\omega_{22}} \right)^{-1} \sum_{i=1}^{n} \sum_{t=1}^{T} X_i \left(y_{1it} - \frac{\omega_{12}}{\omega_{22}} (y_{2it} - Z_{it}^{'}\gamma) \right) \right]$$

$$\hat{B} = \left[B_o^{-1} + \left(\omega_{11} - \frac{\omega_{12}^2}{\omega_{22}} \right)^{-1} \sum_{i=1}^{n} \sum_{t=1}^{T} X_{it} X^{'}_{it} \right]^{-1}$$

$$\hat{\gamma} = \hat{G}\left[G_o^{-1}\gamma_o + \left(\omega_{22} - \frac{\omega_{12}^2}{\omega_{11}} \right)^{-1} \sum_{i=1}^{n} \sum_{t=1}^{T} Z_{it} \left(y_{2it} - \frac{\omega_{12}}{\omega_{11}} (y_{1it} - X^{'}_{it}\beta) \right) \right]$$

$$\hat{B} = \left[B_o^{-1} + \left(\omega_{22} - \frac{\omega_{12}^2}{\omega_{11}} \right)^{-1} \sum_{i=1}^{n} \sum_{t=1}^{T} Z_{it} Z^{'}_{it} \right]^{-1}$$

The estimation of the model relies on Bayesian Markov Chain Monte Carlo algorithms. The general algorithm works in the following way:

1. Sample Ω from the distribution $\Omega \mid \beta, \gamma, y$.
2. Sample β from the distribution $\beta \mid y, \gamma, \Omega$.
3. Sample β from the distribution $\gamma \mid y, \beta, \Omega$.

From these procedures one can obtain posterior values for β,γ, and Ω . We reject the first 10,000 replications that constitute the "burn-in" phase and report results using subsequent 15,000 draws.

APPENDIX 2

Table 6 presents the Bayesian estimation of the system of equations (1).

Table 6

Dependent variable: interest rate spread		
Var List	*Coef.*	*S.E.*
CONST	5.0529***	0.3142
SREG	0.0208	0.033567
SHC	0.0112	0.028833
ENTRY	0.0014*	0.000844
HHI	0.0084	0.078233
*HHI*D2006*	-0.3927***	0.1068
*HHI*D2007*	-0.2165	0.1982
*HHI*D2008*	0.0447	0.107633
MKTGWTH	-2.8861***	0.6375
MKT	-0.0029***	0.000733
RACEW	-1.2178***	0.324433
INCL50K	0.8217***	0.181933
State Fixed Effects	*yes*	
Time Fixed Effects	*yes*	
Observations	*700*	

* Significanlty different from zero at 10%

** Significanlty different from zero at 5%

*** Significanlty different from zero at 1%

The regression reported in Table 7 and Table 8 tests the robustness of our results to the change in the specification of market growth and size. If we use total quantity of mortgage loans and the growth in mortgage loans or total income and income growth instead of population size and growth, the estimates and the inference remain the same.

Table 7

Var List	*Coef.*	*S.E.*
CONST	4.5321	0.3094
SREG	0.0044	0.0297
SHC	0.0207	0.0300
ENTRY	0.0002	0.0007
HHI	-0.1232	0.1210
*HHI*D2006*	-0.2846	0.1265
*HHI*D2007*	-0.0239	0.1682
*HHI*D2008*	0.1768	0.1237
MKTGWTH	-0.0025	0.0009
MKT	0.0000	0.0000
RACEW	-1.3857	0.3757
INCL50K	0.7615	0.1651
Rsq	*0.75*	
State Fixed Effects	*yes*	
Time Fixed Effects	*yes*	
Observations	*700*	

* Significantly different from zero at 10%

** Significantly different from zero at 5%

*** Significantly different from zero at 1%

*** Significantly different from zero at 1%

Table 8

Dependent variable: interest rate spread		
Var List	*Coef.*	*S.E.*
CONST	4.6136***	0.3032
SREG	0.0020	0.0299
SHC	0.0219	0.0300
ENTRY	0.0011**	0.0005
HHI	-0.0990	0.1263
*HHI*D2006*	-0.2885**	0.1274
*HHI*D2007*	-0.0480	0.1705
*HHI*D2008*	0.1389	0.1358
MKTGWTH	0.0581	0.0547
MKT	0.0000	0.0000
	-	
RACEW	1.4850***	0.3838
INCL50K	0.8110***	0.1650
Rsq	*0.75*	
State Fixed Effects	*yes*	
Time Fixed Effects	*yes*	
Observations	*700*	

* Significantly different from zero at 10%

** Significantly different from zero at 5%

*** Significantly different from zero at 1%

*** Significantly different from zero at 1%

Market share has been included in some profit-concentration studies as a way of measuring firm efficiency (see Smirlock 1985). The inclusion of variable measuring the percentage of market held by small firms was found to make not material difference to the model. Table 9 displays these results.

Table 9

Dependent variable: interest rate spread		
Var List	*Coef.*	*S.E.*
CONST	4.3372***	0.3125
SREG	0.0031	0.0309
SHC	0.0253	0.0295
ENTRY	0.0029**	0.0015
HHI	-0.0532	0.1284
*HHI*D2006*	-0.2972**	0.1233
*HHI*D2007*	-0.0702	0.1611
*HHI*D2008*	0.1206	0.1259
MKTGWTH	-2.7419***	0.9257
MKT	-0.0025**	0.0011
RACEW	-1.2654***	0.3721
INCL50K	0.6741***	0.1660
Rsq	*0.76*	
State Fixed Effects	*yes*	
Time Fixed Effects	*yes*	
Observations	*700*	

* Significantly different from zero at 10%

** Significantly different from zero at 5%

*** Significantly different from zero at 1%

*** Significantly different from zero at 1%

Table 10 presents the results when including the second and the third order terms on the concentration variable, HHI.

Table 10

Dependent variable: interest rate spread		
Var List	*Coef.*	*S.E.*
CONST	4.2530***	0.2961
SREG	0.0067	0.0441
SHC	0.0239	0.0372
ENTRY	0.0040**	0.0017
HHI	0.0155	0.2011
HHI^2	-0.0202	0.1706
HHI^3	0.0063	0.0304
MKTGWTH	-1.4461***	0.3506
MKT	0.6854***	0.1674
RACEW	-2.8508***	1.1701
INCL50K	-0.0028***	0.0010
Rsq	*0.75*	
State Fixed Effects	*yes*	
Time Fixed Effects	*yes*	
Observations	*700*	

* Significantly different from zero at 10%

** Significantly different from zero at 5%

*** Significantly different from zero at 1%

*** Significantly different from zero at 1%