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2013

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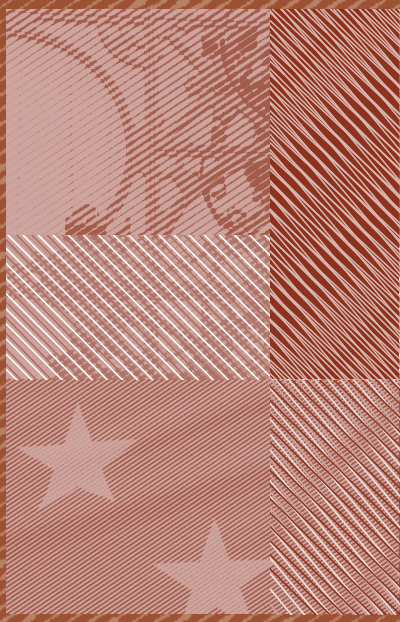

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Abstract

Do laws to protect borrowers curb foreclosures? This question is addressed by analysing the impact of foreclosure laws on default rates at state level in the US mortgage market. Using panel data techniques, we find a statistically significant effect of regulation on the different stages of the foreclosure process. More precisely, we analyse the effect of regulation on 60-day delinquencies and foreclosure starts, with a focus on three protective elements commonly found in state foreclosure laws, namely requiring a judicial process, granting a redemption period and banning a deficiency judgment. We find that, whereas protective states exhibit, on average, lower 60-day delinquency rates, more protection does not ultimately bring about lower foreclosure rates. Lenders seem to ration credit to mitigate costly protective laws, thereby reducing delinquency rates; but this effect is overshadowed by a moral hazard problem since, once borrowers are delinquent, they have incentives to take advantage of the protection due to the lower costs of foreclosure. We also find that the recent housing market crisis has exacerbated that behaviour. Finally, we show that lengthening the foreclosure process is no cure for the foreclosure crisis.

Keywords: foreclosure laws, borrower protection, credit rationing, moral hazard.

JEL Classification: E44, G21, G28, K11, R20, R30.

Resumen

¿Una regulación que protege a los prestatarios consigue realmente reducir las ejecuciones hipotecarias? En este documento respondemos a dicha pregunta mediante el análisis del impacto que la regulación de ejecuciones hipotecarias tiene sobre las tasas de impago a escala estatal en Estados Unidos. Mediante el uso de un modelo de datos de panel, encontramos un efecto significativo sobre las distintas fases del proceso de ejecución hipotecaria. En concreto, estudiamos los efectos sobre la tasa de morosidad y las nuevas ejecuciones iniciadas, con el foco puesto en tres elementos protectores comúnmente presentes en la legislación estatal: la exigencia de un proceso judicial, la existencia de un período de redención para el prestatario y la prohibición del derecho de recurso para el prestamista. Los resultados muestran que, si bien los Estados considerados protectores presentan tasas de morosidad menores en media, una mayor protección no acaba finalmente repercutiendo en una tasa de ejecución hipotecaria menor. Ante una ley protectora, los prestamistas parecen racionar el crédito para mitigar los mayores costes asociados a aquella, lo que reduce la tasa de morosidad; sin embargo, este efecto es más que compensado por la aparición de un problema de riesgo moral en el prestamista, ya que, una vez que este entra en mora, tiene incentivos para acogerse a la protección debido a los menores costes que asumiría en caso de que se ejecutara su hipoteca. Adicionalmente, encontramos que la crisis reciente del mercado inmobiliario ha exacerbado este comportamiento. Finalmente, se muestra cómo alargar el proceso de ejecución no es la solución a la crisis.

Palabras clave: leyes estatales de ejecución hipotecaria, protección al deudor hipotecario, racionamiento del crédito, riesgo moral.

Códigos JEL: E44, G21, G28, K11, R20, R30.

1 Introduction

Every state in the United States has experienced a sharp increase in mortgage foreclosures since the beginning of the housing market crisis. As the economic recession deepened and home price depreciation mounted, many households were heading for default and foreclosure on their properties. And this epidemic has proved to be persistent. According to Corelogic (2012), the percentage of homeowners nationally who were more than 90 days late on their mortgage payments, including homes in foreclosure and real estate owned (REO) properties, stood at 7.3 percent in February 2012. Furthermore, 11.1 million, or 22.8 percent, of all residential properties with a mortgage were in negative equity at the end of the fourth quarter of 2011, putting more upward pressure on foreclosure trends.

Taking into consideration the negative externalities of foreclosure on individuals, lenders and communities, it is not surprising that "foreclosure" has emerged as one of the most debated topics among government officials, professionals and scholars since 2006. While the Federal Government tried to conceive of measures to curb foreclosure, states put their own solutions on the table, basically enacting laws to protect homeowners and make the foreclosure process more costly for lenders. For example, in April, 2008, officials from Maryland signed an emergency package to fight foreclosures. One important aspect of this legislation was to lengthen the foreclosure process from 15 to 150 days. Some states followed the same philosophy, such as Georgia, Massachusetts and Illinois, while others strengthened protection by imposing mediation programmes before foreclosure (e.g. Washington and South Carolina), among other measures.

As states worked on new rules, doubts began to be raised about the effectiveness of such measures. The most common criticism is that tighter rules may make mortgages more expensive, especially in cases where foreclosure time periods are extended and more judicial procedures are required. In this paper, we go a step further and directly address the question of whether state borrower-protective laws ultimately achieve their intended goals, i.e. if they are successful in protecting homeownership and reducing the number of foreclosures.

Interestingly, after six years of crisis in the mortgage market, this analysis is still controversial. Many US states are debating or have recently passed modifications to their state foreclosure laws. At the same time, a debate on the convenience of unifying foreclosure regulation at federal level is growing among lenders, lawyers and politicians. Furthermore, although the focus of our analysis is state regulation in the United States, the conclusions could be of interest to the policy-makers of any country suffering the effects of a housing market collapse. Specifically, some countries are questioning their mortgage laws, with the focus on protecting mortgagors, encouraging deed-in-lieu practices or promoting loan modification and refinancing programmes, which according to the IMF (2012) may help avert self-reinforcing cycles of household defaults, further house price declines and additional contractions in output.

We study the effects of state laws on foreclosures using a two-stage approach. Firstly, we consider how laws affect rates of default (defined as 60-day delinquency), which are a consequence of decisions made by the debtor and creditor at loan origination and by the borrower at the time of default; secondly, we look at how laws affect the pass-through from delinquency to foreclosure, i.e. the negotiation process between borrower and lender

once default has occurred. As far as we know, this is the first attempt to estimate the different effects of regulation on each stage of the foreclosure process in an integrated framework. This distinction is useful to help achieve an optimal design of effective foreclosure laws, ensuring that such effects are as intended.

In order to estimate those effects, we make use of a panel data model of mortgage default at state level. We look at differences in delinquency and foreclosure rates between states, in the light of the degree of protection provided to borrowers by state laws. The sample covers a complete credit cycle (2000-2010), which allows us also to analyse whether protective regulation has been effective during the current crisis. As a proxy of the level of protection, three state-level dummy variables are included in the model. A state is classified as borrower-protective if its laws require court intervention in the foreclosure process (judicial foreclosure), grants a redemption right to the borrower (redemption period after the foreclosure sale) or bans a deficiency judgment for the lender (right to go after other assets if the sale price is not enough to recover the whole of the unpaid debt). These dummies change by state (between dimension) but do not change over time (within dimension) in the sample, which means that the traditional endogeneity problem of regulation due to inverse causation is avoided. In order to deal with the estimation of parameters associated with time-invariant variables in panel data models, which are deleted in the within transformation of the traditional fixed-effects estimator, we make use of an extension of the Random Effects Mundlak transformation model proposed by Krishnakumar (2004). This model expands the original panel regression with an auxiliary equation that takes into account the relationship between the explanatory variables and the individual effects. Once we combine the two regressions, the parameters of time-invariant variables, along with those of time-variant variables, can be consistently estimated with the GLS estimator.

The empirical findings contradict officials and legislators who argue that stricter regulation reduces foreclosure rates. After controlling for a set of economic and socio-demographic variables that are classic in the default literature, we find that, in the United States, a higher degree of protection does not lead to lower foreclosure rates at state level, although the transmission channels are not straightforward. Firstly, protective regulation reduces delinquency rates. As protection is costly for lenders, it encourages borrower discrimination through the underwriting process, which ultimately reduces delinquency rates, ceteris paribus.[1] Those rates are 16% lower in states with redemption periods and 24% lower in states that prohibit a deficiency judgment. Surprisingly, we do not find any statistically significant difference in delinquency rates between judicial and non-judicial states. But, once a borrower has defaulted, the pass-through from delinquency to foreclosure is higher in borrower-friendly states, where borrowers have incentives to seek protection and lenders have less bargaining power to avoid a costly and lengthy foreclosure process. The pass-through may be as much as 5% higher in judicial states and 4% higher in states where redemption periods are granted or deficiency judgments are prohibited. Given the opposite impact of regulation on the two different stages of the foreclosure process, the final effect on foreclosure starts will depend on the magnitude of these two impacts. We find that this final effect is positive but weak. In particular, foreclosure rates are 9% higher in judicial states, though the difference is negligible for the other protective elements.

1. We do not address the welfare effects of protective regulation in this paper, but only its final effect on foreclosure rates. At first glance, protective regulation may be socially beneficial since it reduces the overall risk of the economy through borrower discrimination. Nevertheless, it also introduces mortgage market distortions and credit restrictions, through more restrictive covenants and more expensive loans. Furthermore, although more protection may initially reduce delinquencies at the expense of tighter credit, the final effect on foreclosures may be not be as desired.

Furthermore, we propose a difference in difference regression model to analyse whether protective regulation has been effective during the current crisis. We find that the crisis has exacerbated the reaction to protective laws of both lenders and borrowers and that, finally, protective regulation has not actually protected borrowers, since the difference in foreclosure rates between protective and non-protective states has not decreased – and in some cases has even increased – since the crisis.

Several studies show that the core element of protection is the length of the foreclosure process. On this basis, many modifications to state laws have focused on lengthening the foreclosure process, which was expected to work as an incentive for lenders to renegotiate with borrowers, since going through the foreclosure process would be more costly, while also giving borrowers more time to recover from financial distress. We analyse the empirical evidence and conclude that lengthening the foreclosure process is not the answer. A 100-day increase in the duration of the foreclosure process produces a 7% increase in the foreclosure rate.

All these results suggest that new foreclosure legislation needs to be reconsidered, and that the current debate should look at new solutions, while acknowledging the adverse effect of regulation on every part of the foreclosure process. When analysing the effects of borrower-protective laws our ultimate aim is to give useful insights for devising more effective regulatory frameworks.

The paper is organised as follows. Section 2 reviews the literature. Section 3 presents the legal framework that regulates foreclosures at state level and the different stages of the foreclosure process. Section 4 discusses the theoretical approach of our working hypothesis. Section 5 describes the data sources and variables used in the model. Section 6 explains the empirical approach used to test our hypothesis. Section 7 reports the main findings. And Section 8 concludes.

2 Review of the literature

Economic literature has documented the negative impact of foreclosure on borrowers and lenders – it is a time-consuming and costly process for all parties – and its spillover effects on neighbourhoods, such as increases in crime rates and depreciation of house prices [see, for instance, Moreno (1995), Apgar et al (2005), Immergluck and Smith (2006), Lin et al (2007) and Campbell, et al. (2011)]. Some politicians, trying to remedy the negative effects of foreclosure, have enacted legislation that protects homeowners from this undesirable event. The proponents of such legislation argue that protective regulation makes the foreclosure process fairer and delays foreclosure, so that borrowers have a chance to overcome bad times and lenders are more willing to renegotiate with borrowers. Unfortunately, such legislation does not always contribute to social welfare.

Part of the credit market literature has focused on the study of how regulatory frameworks affect market conditions and the behaviour of economic agents. Alston (1984) looks back at the 1930s and examines the negative impact that legislation had on farm foreclosures. He argues that while legislation was implemented to protect farmers, it actually led to fewer farm loans and higher mortgage rates. Meador (1982) and Jaffe (1985) find that mortgage rates are higher in states where foreclosure takes longer. Barth et al (1986) argue that restrictions on the use of default remedies do not confer net benefits on the typical borrower but rather impose net costs. Clauretie and Herzog (1990) demonstrate that loan losses for lenders are greatly affected by foreclosure laws and affirm that lenders protect themselves with higher interest rates and more restrictive covenants. Lawrence (1993) notes that in a period of sizable house-price declines, the prohibition of deficiency judgments can increase the incidence of default by two or three times over a period of several years. Khan and Yavas (1994) analyse renegotiation in foreclosure processes and argue that it can change the effective interest rate that the lender receives; reforms that favour defaulting debtors will raise interest rates on mortgages to compensate for that change. More recent studies reassert these findings. For example, Pence (2003) estimates that loans are 7% smaller in defaulter-friendly states; her results also suggest that defaulter-friendly laws impose material costs on borrowers at the time of loan origination. Cutts and Merrill (2008) show that foreclosure costs increase significantly with the length of the foreclosure timeline and that the likelihood a borrower will cure the loan falls as that length increases.

Nevertheless, the literature has paid less attention to the direct effect of state foreclosure laws on delinquency and foreclosure rates themselves. Furthermore, the results are not conclusive and sometimes contradictory. For example, in a pioneering empirical study, Clauretie (1987) found that foreclosure is more likely in states where the legal costs for lenders are lower (for instance, due to the existence of non-judicial proceedings), since lenders appear less willing to work with delinquent borrowers. But, at the same time, as Cutts and Merrill (2008) point out, lengthy foreclosure processes provide an incentive for borrowers to forego reinstatement of the loan even if they have the necessary means. In this sense, Goodman and Smith (2010) use a hierarchical regression model to examine the effects on foreclosure of laws regarding predatory lending and foreclosure proceedings. They affirm that laws that are costly for lenders impose credit discrimination at origination and, therefore, should reduce default rates. They conclude from their estimation that foreclosure rates are lower in states where foreclosure processes are longer and redemption periods are granted. Nevertheless, other authors have found that the effect of borrower protection goes in the

opposite direction. For example, Jones (1993), by analysing data from Alberta (Canada), found that the prohibition of deficiency judgments increases default rates during times of house price decline. More recently, Ghent and Kudlyak (2011) have analysed the effect of recourse on default and found that borrowers are 30% more likely to default in states that ban deficiency judgments; additionally, in non-recourse states, defaults are more likely to occur through a lender-friendly procedure, such as a deed in lieu or a short-sale, instead of a contested foreclosure. Other authors have indirectly analysed the effects of state laws on foreclosures. For instance, Mian et al (2011) estimate a difference model to analyse the effect of foreclosure during the recent crisis on a set of macroeconomic variables. They use state laws requiring a judicial foreclosure as an instrument for actual foreclosures and find that states that require a judicial process for a foreclosure sale have significantly lower foreclosures rates than states that have no such requirement. Surprisingly, they do not find any statistically significant effect on delinquency rates.

In summary, the question of whether foreclosure regulation to protect borrowers achieves the intended goals of curbing foreclosures and preserving homeownership is still unresolved. The aim of this paper is to shed some light on that issue.

3 State regulation of foreclosure and the foreclosure process

3.1 Basic elements of state foreclosure laws

Foreclosure laws are unique to each state and represent an often perplexing amalgam of English legal history, common law, and legislation [Nelson (2010)]. Although terms, procedures and timeframes differ from one state to another, most foreclosure regulation can be fitted into one of two frameworks: borrower protective and non-protective laws,[2] referring to the level of protection provided by the law to borrowers in default. The main difference between them relates to whether legislation requires court intervention for foreclosure, whether borrowers have redemption rights and whether deficiency judgments are available to lenders.[3]

According to Nelson et al (2007), a judicial foreclosure involves a court procedure and is characterised by the sale of a property in a court action in equity. When a borrower defaults, the lender must file a complaint specifying the amount of the debt and the due date. She also needs to notify other parties, such as tenants and second or junior mortgagees, and file a public notice of action called a "lis pendens" (pending legal action). The borrower simultaneously has an opportunity to defend herself. If the court finds that the lender has the right to foreclose, it will issue a judgment against the borrower. After foreclosure the property will be sold through a sheriff´s sale or public auction. At the end of the auction, the highest bidder will be the owner of the property.

A non-judicial foreclosure, on the other hand, requires no court ruling. This speeds up the process, which is frequently completed within four to eight months (half the length of a judicial foreclosure). Such foreclosures are based on the "power of sale" of the mortgagee, which allows it (or the trustee) to sell the property, without court intervention, to satisfy the outstanding debt. Once the sale has taken place, the buyer has full title to the property. A notice of default is first sent to the borrower. If the borrower does not respond to the notice, or does not cover the amount and expense of the default during the legally required time, the lender can initiate the foreclosure and the auction sale.

Legal theory has traditionally distinguished between "title states", where the lending institution holds title to the property in the name of the borrower through a deed of trust;[4] and "lien states", where the deed remains with the borrower and the lender places a lien on the property using the mortgage instrument. Generally, foreclosure in title states occurs through a non-judicial procedure, while in lien states it is conducted via a judicial process. Nevertheless, this distinction is not that clear, since the laws of many states allow both methods of foreclosure, although usually one of these methods is more commonly used in practice.

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2. Other authors have used the term defaulter-friendly laws (Pence 2003). We prefer the term protective, to emphasise the intention of law promoters.

3. There are other protection provisions in state laws (such as prompt return of surplus, accounting for sale proceeds, etc.) but the literature assigns them a minimal role in characterising the level of protection or the behaviour of homeowners.

4. A deed of trust is a type of secured real-estate transaction that is used in some states instead of a mortgage. It involves three parties: a lender, a borrower, and a trustee. The borrower gives the lender a promissory note in exchange for the borrowed money. As security for the promissory note, the borrower transfers a real property interest to a third-party trustee (in many cases, the borrower actually transfers legal title to the trustee, who holds the property in trust for the use and benefit of the borrower). A deed of trust always includes a power-of-sale clause: if the borrower defaults on the terms of her loan, the trustee may exercise the power of sale, take full control of the property and sell it to compensate for the borrower's default.

There are two additional elements that protect borrowers by imposing restrictions on lenders in the foreclosure process. A common mechanism is the provision for a statutory right of redemption, which provides the borrower with a longer period of time after the foreclosure sale to redeem the property if she is able to pay back the sale price at auction plus foreclosure expenses and fees [Singer (2002)]. During the redemption period (usually from 75 days to 18 months), the borrower continues living in the property and the lender receives no income from the owner. Proponents claim that statutory redemption encourages those who bid at the sale to bid a fair price. Nevertheless, redemption periods extend the foreclosure process and, in practice, depress bids at the foreclosure sale since the buyer cannot occupy the property until the redemption period has expired [Clauretie and Herzog (1990)]. Statutory redemption may be available in both judicial and power-of-sale states.

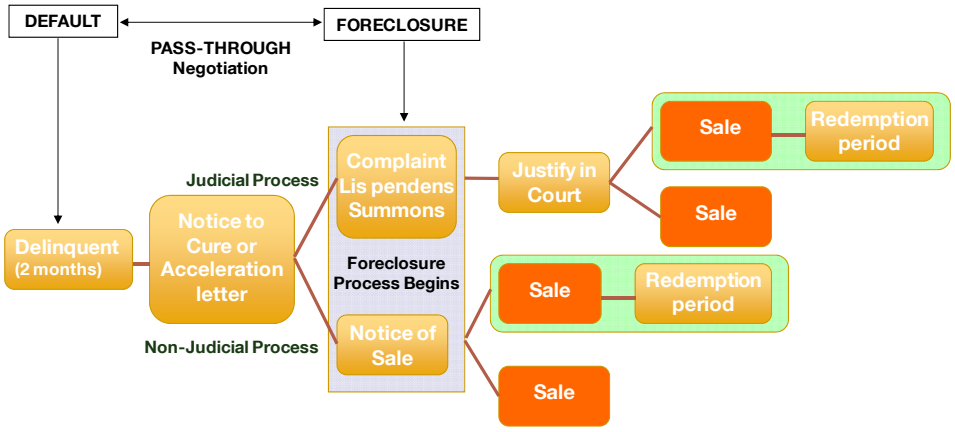
To complicate the foreclosure process further, there exists a third mechanism in state laws, known as a "deficiency judgment", which is the right of the lender to go after the borrower's remaining assets when the proceeds of the collateral sale do not suffice to cover the debt. In states where deficiency judgments are forbidden the lender's recourse is restricted to the value of the mortgaged property; the borrower has a put option on the property and is more likely to default. The absence of a deficiency-judgment option reduces the lender's expected return from a foreclosure action. Although most states allow lenders to appeal in court for deficiency judgments, they are rarely observed and certain mechanisms can mitigate their impact [Ghent and Kudlyak (2011)]. For example, in some states judgments are costly to obtain, or their value is limited to the difference between the unpaid debt and the fair market value of the property, which could be higher than the sale price at auction. Nevertheless, recourse involves a threat that may affect borrower behaviour and result in mitigation of lender losses through renegotiation [Ghent and Kudlyak (2008), Clauretie and Herzog (1990), and Kennedy (2004)].

New foreclosure laws are intended to prevent foreclosures from spiking and to protect borrowers when they face financial difficulties. However, judicial procedures and redemption rights lengthen the foreclosure process, thereby increasing costs for lenders and borrowers [Cutts and Merrill (2008)]. Higher costs and delays have encouraged alternative legislative approaches (such as power-of-sale clauses) to speed up the foreclosure process and protect the value of properties from excessive depreciation. As Nelson (2010) points out, while many states authorise a variety of non-judicial or power-of-sale foreclosure procedures that are relatively efficient and fair, about 40 percent of states still use judicial foreclosure, a process that is costly, time-consuming and inefficient. In 2002, the National Conference of Commissioners on Uniform State Laws approved and recommended the Uniform Nonjudicial Foreclosure Act. The Act provides that foreclosures should be handled by a real estate broker and not by a court. Non-judicial foreclosure is seen in this Act as mutually beneficial, because it protects the borrower and is efficient for the lender, since it preserves the value of the property and ensures that the sale proceeds are as high as possible. However, other experts advocate more borrower-protective regulation on the basis that borrowers should be provided with a secure and fair process that protects their rights [Rao and Walsh (2009)]. The UNFA has not been adopted by many states, but it is at the centre of debate.

3.2 The steps to foreclosure

As shown in Graph 1, the path to foreclosure starts when the borrower technically defaults on her loan, i.e. when the borrower stops making the scheduled loan payments [Giliberto and Houston (1989)]. As Quercia and Stegman (1992) highlight, when payments are first missed it is not possible to know whether the borrower has defaulted or is just temporarily delinquent. To avoid this problem, we assume in this paper that the borrower has decided to stop payment completely (i.e. is in default) if payments are not met for two consecutive months (60-day delinquent).

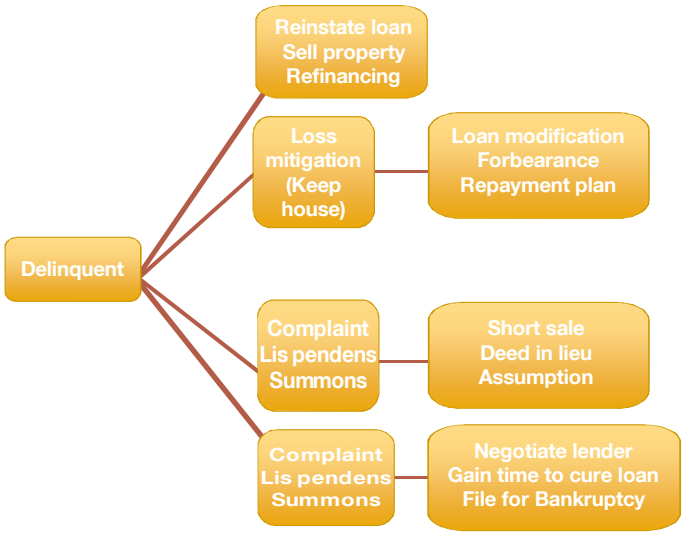
Graph 1. The foreclosure process



SOURCE: Own elaboration

After default, the parties are likely to engage in some kind of negotiation and a set of bargaining tools (or "threats") are available to them in order to protect and pursue their interests in the negotiation [Kennedy (2004)]. The parties will choose to renegotiate the loan terms or to start the foreclosure process on the basis of the expected losses associated with these actions [Foote et al. (2008) and Quercia and Stegman (1992)]. Lenders are usually willing to work out with borrowers since they maximise their profit by taking payments from the debtor and not by managing foreclosed properties, which usually involves large costs. Nevertheless, the key element of renegotiation is that it can benefit the lender, i.e. if the reduction in the value of the loan is lower than the loss the lender would sustain in a foreclosure. Therefore, not all loans in default will end up in foreclosure; some of them will be cured, while others will be definitively in default and will enter into foreclosure. This pass-through from delinquency to foreclosure will be a key variable in our study.

Graph 2. How to avoid foreclosure



SOURCE: Own elaboration

There are many ways to avoid foreclosure and the loss of the property (see Graph 2) once a loan is in arrears. When a borrower misses some payments, the lender will send a notice to accelerate the due date of the loan and typically the borrower and the lender will initiate conversations to explore the options available. At this point, the borrower can reinstate the loan, sell the property and cancel the loan, or refinance the outstanding debt before the foreclosure process starts. Furthermore, the lender and the borrower have the option to agree a loss mitigation scheme, which could include a loan modification, forbearance, repayment plan, or loss of the property via short sale, deed in lieu or loan assumption. All of those cases will avoid foreclosure and not dramatically harm the borrower's credit rating. If the borrower ignores the acceleration and demand letters and does not agree a solution with the lender, the latter will file a formal foreclosure notice with the court (in a judicial state) or will send a notice of sale (if a power-of-sale clause is included in the contract). Once foreclosure is started, the procedure will depend on the state laws relating to judicial involvement, the existence of a right of redemption for the borrower and whether the lender has the right to seek a deficiency judgment against the borrower.

4 Theoretical approach

4.1 The effect of state laws on default

State foreclosure laws affect the way lenders and borrowers behave. Following Pence (2003), in the mortgage market lenders aim to maximise their profits on the basis of their cost structure, which is partially dictated by the risk of not getting repaid. In other words, lenders adjust the supply of credit according to the expected value of their loans, which is determined by: (i) the present value of future payments; (ii) the probability of obtaining those future payments; and (iii) the costs of enforcing payment when necessary, combined with the portions that may be impossible to recover. In a competitive market, those profits will be zero in equilibrium:

$$P[No\ Default]\ \{(1+r)M\} + P[Default]\ \{E[z(DP+M)] - k\} - M = 0$$

where M is the outstanding mortgage loan balance, DP is the down-payment, r is the interest rate, z is the stochastic change in house value, and k is the foreclosure cost for the lender. It is clear that foreclosure laws have a direct impact on lender costs through the third determinant mentioned above. In states that require judicial foreclosure it is more expensive for lenders to enforce repayment. Additionally, states with long redemption periods impose additional costs on the lender, who has to wait longer for payments, probably without compensation in the form of additional interest or rent. Finally, when the law bans the possibility of a deficiency judgment, lenders may never recover part of the loan, since the market value of the property is all they can obtain from the borrower. Moreover, foreclosure laws may indirectly affect lender costs through the riskiness of loans. If borrowers are aware of the protection provided by laws they will find it safer to default in more protective states. Lenders are certainly aware of those risks and of the differences in state laws so they adjust in various ways [see Jones (1993), Wood (1997) and Pence (2003)]. By requiring borrowers to meet stricter conditions of financial stability, decreasing loan-to-value ratios or lowering the supply of credit, lenders can reduce *a priori* the probability of default.

However, default is ultimately a borrower's decision. Once the loan has been granted, homeowners who face a change in their financial conditions may default on their mortgage. From the borrower's perspective, we follow a "double trigger" model for default [see, for example, Aron and Muellbauer (2010) or Jackson and Kassrman (1987)]. Borrowers default if they cannot afford to continue making payments (cash-flow problems) and if they owe more than the property is worth (excessive debt relative to equity). The model is a combination of two approaches. On the one hand, the equity model, or option pricing approach, which states that a household will default once housing equity falls below the mortgage debt level by a certain percentage (the borrower's tolerance to negative equity on her house):

$$P[D(t)] = P[equity(t)/\ mortgage(t) < C_t] \quad , C_t < 0$$

This behaviour is associated with a strategic default, which occurs when the negative equity level hits a trigger threshold. That level of tolerance to negative equity will increase with the expected growth rate of house prices, with removal costs and with the expected interest rate movements.

On the other hand, the ability-to-pay model states that a household will default if its current income net of essential expenses is not enough to cover the periodic mortgage payments:

$$P[D(t)] = P[income(t) < P]$$

Bajari et al (2009) introduce a more accurate approach based on cash-flow problems and argue that borrowers default when a function of the debt service ratio (*dsr*) exceeds a certain threshold. This default trigger function also depends on employment status (*ur*), creditworthiness (*cs*) and the expected growth rate of household income (*ye*):

$$f(dsr, ur, cs, ye) > 0$$

Both circumstances (negative equity and cash-flow problems) are to some extent necessary for default since: (i) if there is equity remaining the borrower has incentives to refinance the mortgage or sell the house, pay off the debt and keep the difference; and (ii) if the borrower can afford the payments but there is negative equity she will generally keep servicing the debt (unless that negative equity is excessive) because renting is costly, her credit rating could be seriously damaged after default, while keeping the house preserves the option of future gains in the property's value and moving costs are substantial [Cutts and Merrill (2008)]. Furthermore, Guiso et al. (2009) consider that the most important variables in predicting strategic default are moral and social considerations. They find that no household would default if the equity shortfall is less than 10% of the value of the house. Yet, 17% of households would default, even if they can afford to pay their mortgage, when the equity shortfall reaches 50% of the value of their house.

In principle, state foreclosure laws can be introduced in both models. According to Ambrose et al. (1997), defaulter-friendly regulation makes default less costly for borrowers. Therefore, it increases the probability of strategic default – reducing the tolerance to negative equity – or lowers the threshold in the default trigger function.

To sum up, at the time of loan origination, lenders are aware of the costs associated with protective regulation and tighten credit and grant less risky mortgages, thereby reducing the probability of borrower default. But, once the property has been purchased, borrowers who suffer cash-flow problems and negative equity are more likely to default in states where they feel protected by the law, simply because, ceteris paribus, the cost of defaulting is lower. The final effect on default rates is ambiguous. Nevertheless, as Pence (2003) points out, it is unlikely that debtors are aware of and consider foreclosure laws at the time of debt origination. Furthermore, Cutts and Merryl (2008) show that generally borrowers are unaware of work-out options when they stop making payments and, by the same token, it seems implausible that they will simultaneously be aware of foreclosure regulation. If that is the case, the theory predicts that borrower-protective regulation will induce lower default rates.

4.2 The effect of state laws on the pass-through from delinquency to foreclosure

Once the borrower defaults (i.e. stops making regular mortgage payments) the borrower and lender initiate a negotiation process. Again, state foreclosure laws may affect the way borrowers and lenders behave during that negotiation process. Borrowers will usually contact a counselling service or an attorney to advise them of the best options to avoid foreclosure and the loss of the property. Protective regulation favours the debtor in the post-default negotiations and reduces the bargaining power of the creditor by reducing its ability to make

credible threats to injure the debtor. To the extent that debtors are aware of the state statute regime, and depending on their susceptibility to "moral hazard" in relation to their obligation to the creditor, borrower-protective laws ought to increase the foreclosure rate, other things being equal [Kennedy (2004)]. The same idea exists in Cutts and Merryl (2008), who suggest that excessive protection gives borrowers incentives to "go for foreclosure", since they may feel protected by the court, get extra time to negotiate, can rule out a deficiency judgment or enjoy a free rent during the lengthy foreclosure process. On the other hand, if foreclosure resolution is fast and the borrower can lose her home quickly, the borrower has incentives to reinstate the loan or negotiate with the lender. In this context, Ghent and Kudlyak (2011) show that in protective states borrowers are less likely to resume payments following the delinquency that precedes the foreclosure and lenders have less power to negotiate a quick resolution of the default. In contrast, lenders in non-protective states have better bargaining positions and foreclosure is more likely to occur through a lender-friendly procedure, such as a short sale, with a lower cost to lenders. Hence, our theory predicts that in borrower-protective states the pass-through from default to foreclosure is likely to be higher than in non-protective states.

In short, according to our theoretical approach, there is a two level implication of state laws. On the one hand, lenders impose tighter credit standards at time of loan origination and give less risky mortgages in order to compensate for the higher costs associated with borrower-friendly regulation. Therefore, the theoretical implication is that default rates are lower in protective states. Then, once the borrower defaults, protection implies a higher pass-through from delinquency to foreclosure. The final result on the foreclosure rate is uncertain.

5 Data sources and variables

We use a panel data set that includes 50 states plus Washington D.C. and a time-span of 11 years, dating from 2000 to 2010. We analyse mortgage default and foreclosure rates at state level. Default rate is defined as the ratio of the number of loans 60 days past due to the total number of outstanding mortgages. Foreclosure rate is defined as the ratio of the amount of loans entering the foreclosure process in the period in question (foreclosure starts) to the total amount of outstanding mortgage loans. We also analyse the pass-through from defaulted loans to new foreclosures, measured as the ratio of foreclosure starts to 60-day delinquent loans.

Mortgage loans include all types of loans granted for mortgage purposes, such as fixed- and adjustable-rate mortgages, prime and sub-prime mortgages, etc. Data on delinquency rates and foreclosure rates at state level come from the National Delinquency Survey (NDS), conducted by the Mortgage Bankers Association of America (MBA). The NDS provides two foreclosure measures for each period: foreclosure inventory over total outstanding loans and new foreclosures over total outstanding loans. In this study, we consider the latter measure of foreclosure rate to be more relevant to our needs. Since we want to relate the foreclosure decision to its main determinants, this analysis can only be carried out by taking the new foreclosures initiated in each period and not through the inventory of properties in foreclosure, which may include foreclosures initiated in previous periods. Furthermore, the foreclosure inventory is dependent on the type of foreclosure procedure allowed by state law and therefore the model would suffer from an identification problem, i.e. it will be always higher in judicial states where foreclosure takes longer to conclude, resulting in a higher foreclosure inventory.

The explanatory variable of interest is the level of borrower protection at state level. To characterise that level of protection, three dummy variables are included: (i) the existence of judicial procedures; (ii) the inclusion of a redemption period in state regulation; and (iii) ban on a deficiency judgment after foreclosure sale. But that simple classification of states between protective and non-protective turned out to be a difficult and challenging task. As mentioned in Section 2, state regulation is complex and heterogeneous. For instance, the statutes of some states allow both judicial and non-judicial methods of foreclosure – although usually one of them is more commonly used in practice – and no common rules are set to include redemption and deficiency rights in state statutes. Additionally, different databases use different classifications, which makes it necessary to check and filter several sources of information. The only results admitted were those with the highest rate of agreement between several databases (see Table 1). Pence (2003) and Corelogic (2012b) are the basic databases used to construct both judicial and redemption period dummy variables. The classification for “recourse states” (those that admit a deficiency judgment) was collected from Ghent and Kudlyak (2011). In order to filter and clean-up discrepancies between sources, several on-line information service providers were also used, such as foreclosures.com, e-foreclosuresearch.com and the National Mortgage Servicer’s Reference Directory. Finally, we also include the duration of the foreclosure process, from foreclosure referral to termination of the redemption period, as a proxy of the costliness of the laws. The data are gathered from Cutts and Merril (2008) and come from the Freddie Mac Analysis of Expected Optimal Statutory Timeline for Foreclosure.

Table 1. Descriptive statistics

	Obs	Mean	Std. Dev.	Min	Max
Dependent variables					
60-day Delinquency Rate (%)	612	3.65	1.61	1.11	9.73
Foreclosure Rate (%)	612	2.25	1.49	0.49	13.85
Pass-Through ratio	612	0.59	0.17	0.21	1.78
Control variables					
Unemployment Rate (%)	612	5.40	1.97	2.28	14.85
House Price (% y-o-y)	612	4.13	6.79	-25.41	29.40
Income per capita ($)	612	34322.39	7218.82	20554.76	69817.42
Subprime Share (% total loans)	612	3.23	2.35	0.06	13.43
LTV ratio	612	77.09	3.71	64.84	88.71
Interest Rate (%)	612	6.31	0.88	4.66	8.46
FICO score	612	681.10	15.07	648.00	709.00
Divorce Rate (%)	612	4.43	1.39	2.00	9.60
Higher Education (%)	612	24.04	4.70	14.55	39.10
Black pop. (% total)	612	11.16	11.80	0.30	61.10
Hispanic pop. (% total)	612	9.15	9.41	0.90	44.00
Urban Population (% total)	612	72.25	15.14	38.18	100.00
Regulatory variables					
Length of foreclsoure process (# days)	612	292	80.96	183.00	462.00
Judicial	21 states	41%			
Redemption Period	11 states	22%			
Deficiency Judgment	40 states	80%			
Very Protective	15 states	12%			
Protective	6 states	29%			
Non-Protective	5 states	10%			
Very Non-Protective	25 states	49%			
# States	51				
Sample period	1999-2010				

The control variables used in the model are common in the foreclosure literature and relate to the "double trigger" model of default. They include average state-level economic and mortgage-market variables such as unemployment rate, income per capita, house price appreciation,[5] mortgage interest rates, FICO score (a measure of the borrower´s credit rating), LTV ratio and the proportion of urban population. They are gathered from the US Bureau of Labor Statistics, Moody's economic state-level database and the Federal Housing Finance Agency (FHFA). Some sectors of society (lower income families, less educated people, and minorities) show high financial distress and tend to suffer from predatory lending, which increases the probability of default. In order to control for the effect of these groups, we also include the proportion of minority ethnic groups in the population of each state and the level of education at state level (measured as the percentage of population with higher education). Additionally, we include the divorce rate, which, along with unemployment and unexpected medical expenses, is usually mentioned in national surveys as a key variable explaining default

5. House price appreciation is calculated using the OFHEO Conventional and Conforming House Price Index. The OFHEO index weights sales prices differently than other measures, incorporates data from a wider geographic area, and is focused on single-family homes with conventional, conforming loans purchased or securitised by Fannie Mae and Freddie Mac.

decisions, since all of them approximate the level of a borrower´s financial distress. All those variables were obtained from the U.S. Census Bureau.

Finally, Dagher and Fu (2011) show that lightly regulated non-bank mortgage originators contributed to a large extent to the recent boom-bust housing cycle and their higher market participation in some states is associated with increased foreclosure filing rates. Consequently, in order to control for excessive risk-taking and the development of housing bubbles in specific states which may increase default and foreclosure rates, we also include as a control the proportion of sub-prime loans, gathered from the MBA. Furthermore, in the sub-prime sector, borrowers are more vulnerable to life events, have lower equity on their homes, and their bargaining power is low. Also, sub-prime lenders are less willing to renegotiate and prefer quick resolution of foreclosure [Kennedy (2004)].

6 Methodology and empirical strategy

6.1 Effect of state laws on the foreclosure process

The main aim of this paper is to analyse the effect of state laws on default and foreclosure rates at state level. We make use of a panel data model that takes into account different regulatory characteristics of borrower protection between states. Since foreclosure laws show strong regional variation, such between-state heterogeneity may be a good predictor of the variation of delinquency and foreclosure rates among states. Additionally, a set of explanatory variables considered in the literature as the main drivers of defaults and foreclosures is also included. The panel data model is formulated as the following linear regression equation:

$$y_{it} = \alpha_i + T_t + X_{it}\beta + L_i\pi + \varepsilon_{it} \qquad i = 1...51 \text{ states}, t = 1...11 \text{ years (1)}$$

In panel data literature, equation (1) is called a two-way error component regression model [Baltagi (2005)], and has the advantage of including unobservable time effects (T_t) and unobservable individual effects (α_i) responsible for default and foreclosure variations across time and states. Since our purpose is to analyse the whole foreclosure process, we estimate three different equations in which y_{it} is, respectively: (1) the default rate, (2) the pass-through from default to new foreclosures and (3) the foreclosure rate. X_{it} is a vector of control variables as described in Section 5 above. L_i measures borrower protection by foreclosure laws and is a vector of three dummy variables: (1) *Judicial* = 1 if foreclosure is conducted under judicial procedures, and 0 if non-judicial procedures are the norm; (2) *Redemption* = 1 if a redemption period is granted in the state regulation, and 0 otherwise; and (3) *Deficiency* = 1 if the state law bans a deficiency judgment, and 0 otherwise. And ε_{it} is the stochastic disturbance, assumed to be $IID(0, \sigma_\varepsilon^2)$. All control and legislative variables are repeated in the three equations, since the general determinants of default and post-default negotiation are all related to general market conditions. For instance, according to cash-flow problem theory, unemployment is important in explaining a borrower´s probability of default; but it is also key information for lenders if they have to decide whether to modify the loan after default. Or, if residential property values are in decline, a debtor may opt for strategic default and at the same time be in a good position to obtain concessions, making foreclosure less desirable for the creditor [Kennedy (2004)].

The parameters of unemployment rate, mortgage interest rate, proportion of sub-prime mortgages, LTV and proportion of minority population are expected to have a positive sign in the default, pass-through and foreclosure rate equations. By contrast, income level, house price appreciation, FICO score and educational level should have a negative effect. According to the theoretical discussion in Section 3, the variables included in vector L_i (judicial, redemption and deficiency) should have a negative effect on default – meaning that borrower-protective states tend to show lower default rates than non-protective states –, but a positive effect on the pass-through to foreclosure, with an ambiguous final effect on foreclosure rates.

6.2 Base model: estimation and identification issues

If it is assumed that equation (1) is the right model, the ordinary least square estimator obtained by simply pooling the observations of the sample would be inconsistent, since ignoring the unobservable effects will give rise to a missing variable problem (Green 2008). Nevertheless, even under that assumption, we still have to tackle several estimation drawbacks.

The first one derives from the time-invariant nature of the regulatory variables and emerges as an estimation problem. If α_i is correlated with all other regressors, then equation (1) represents a two-way fixed effects (FE) error component model.[6] In this model, the coefficients of all time-variant variables can be estimated consistently and efficiently using the within estimator. Nevertheless, the within transformation deletes from the model the time-invariant variables and therefore the parameters associated with them cannot be estimated. A similar problem arises with nearly time-invariant variables (regulatory changes are not a common event and demographic variables are fairly stable in short samples). Due to the fact that the within estimator makes use of within-group variance, if this variance is small, the within estimator is inefficient (Wooldridge 2002). Inefficiency not only leads to non-reliable point estimates, but also to wrong inferences about the parameter's significance. In our case, these are crucial drawbacks, since we are interested in the marginal effects on foreclosure rates of regulatory variables that show little, if any, within variance.

The alternative scenario to the FE model is a situation in which individual effects are random variables, independent of each other and independent of the set of regressors. In this case, equation (1) represents a random effect (RE) model. This regression model can be consistently and efficiently estimated using the general least squares (GLS) estimator. For our purpose, the RE model has an obvious advantage over the FE model: time invariant variables are not wiped out from the regression in the estimation procedure and consistent and efficient estimates can be obtained. Nevertheless, we have run several tests for effects in the model (specifically, a Hausman test and a Wald-type test) and the results tend to reject that the RE model is the correct model (see Section 7).

In order to overcome this limitation imposed by time invariant variables on the estimation of FE models, some methods have been developed and reported in the econometric literature. For instance, Hausman and Taylor (1981) provide an efficient estimator when some of the time invariant regressors are correlated with the individual effects (HT estimator). The main drawback is that the regressors that are exogenous and not correlated with α and ε have to be distinguished *a priori* from those that are endogenous due to their correlation with α but not with ε. Baltagi et al. (2002) propose a pre-test estimator which is based on the HT and FE estimators and therefore has the disadvantage of the HT model. Plümper and Troeger (2007) report a new vector decomposition estimator for time-invariant variables in panel FE models (FEVD), although Breush et al. (2011) show that estimates are inefficient under general assumptions. Krishnakumar (2004) analyses an extension of Mundlack's model (1978) which includes time-invariant variables (MK estimator). And Chatelain and Ralf (2010) describe a pre-test estimator (CR) which is designed to overcome the disadvantage of the HT estimator and in which, accordingly, no prior information on the endogeneity of time-variant variables is needed. They use the MK model to test for endogeneity of each time-variant variable by a simple t-test and then select those that are exogenous as instruments in a HT ("unrestricted") estimator.

6. In our case, for instance, certain characteristics of the states included in α (cultural or economic background, etc.) could lead legislators to choose stricter regulations.

In this paper, we apply the MK model, which expands the original regression with an auxiliary equation (2):

$$y_{it} = \alpha_i + T_t + X_{it}\beta + L_i\pi + \varepsilon_{it}$$

$$\alpha_i = X_{i.}\eta + L_i\theta + \omega_i \quad (2)$$

where ω_i is the disturbance and where $X_{i.}$ is, for each individual *i,* the average over time of the time-varying variables, such that $E(\omega_i \mid X_{i.}) = 0$. Combining regressions (1) and (2) yields the MK regression model:

$$y_{it} = \alpha_i + T_t + X_{it}\beta + L_i(\pi + \theta) + X_{i.}\eta + \varepsilon_{it} \quad (3)$$

Mundlack (1978) and Krishnakumar (2006) prove that when individual effects are correlated with the explanatory variables, the GLS estimator of equation (3) is given by the FE estimator and therefore estimates are consistent and efficient. Regarding the time-invariant variables, as Krishnakumar (2006) and Chatelain and Ralf (2010) point out, if $\theta \neq 0$, then one can only estimate the sum $\pi + \theta$ in equation (3) and cannot identify them separately, without *prior* information. Nevertheless, Krishnakumar (2006) proposes retrieval of the coefficient θ by regressing the means of the within residuals on $X_{i.}$ and L. Furthermore, this author proves that, when $\eta \neq 0$ and when $\theta = 0$, the best linear unbiased estimator for equation (3), and therefore for the π parameter, is the general least squares estimator. In this paper, we use the CR methodology to test the null hypothesis that $\eta \neq 0$; and then use the GLS estimator for the MK model in equation (3), assuming that $\theta = 0$ ("restricted" MK model). We also compare the results with those of the OLS, RE and CR (or "unrestricted" HT) estimators. There are two reasons (or *prior* information) for imposing such restriction ($\theta = 0$) on our model. First, L is a vector of regulatory variables related to state foreclosure laws. As Nelson (2010) explains, "mortgage law varies substantially from state to state and represents an often perplexing amalgam of English legal history, common law, and legislation". Hence, state foreclosure laws are not a product of any special unobservable feature of the state in question which could have an effect on default or foreclosure rates at state level. Furthermore, due to the fact that we include in the model a complete set of observable time-invariant variables that the literature considers key drivers of foreclosures, the assumption $E(L_i \mid \alpha_i) = \theta = 0$ is plausible.

The second drawback relates to the simultaneity between foreclosure rate and changes in regulations. Our model predicts that state laws have an impact on foreclosure; the existence of a restrictive regulatory framework can affect foreclosures by making it more difficult for the lender to foreclose on a property. The endogeneity problem arises when periods of high foreclosure rates put pressure on legislators to change regulations [see Mian et al. (2010) for an example of political voting behaviour in the passage of the American Housing Rescue and Foreclosure Prevention Act (AHRFPA) by US Congress in 2008]. In such a case, foreclosure rates and regulation are simultaneously determined and the regulatory variables are correlated with the error term (ε_{it}); as a result, estimates would be inconsistent. Nevertheless, there is a caveat against this argument. In general, state regulation is not a variable that changes over time. Once a state chooses a type of foreclosure law, it is kept invariant for a long time, and only major events make legislators change the regulatory framework. In our sample (from 2000 to 2010), we have only identified one state that made regulatory changes related to the three dummy variables considered in our study, Nevada, which amended the state law in 2009 through the prohibition to pursue a deficiency judgment in case of first-residence dwellings, the introduction of a compulsory mediation process

before foreclosure and an extension of the cure period before foreclosure. Once we exclude Nevada State from our sample, the endogeneity problem does not arise in practice.

In addition, we have to cater for the possibility that house prices are endogenous in the model. Previous studies point to reverse causation between prices and foreclosures [e.g. Calomiris & Higgins (2011) or Miat et al. (2011)]. Nevertheless, in the model, house price appreciation is a sequentially exogenous variable and there is no contemporaneous correlation with foreclosures. House price appreciation has a direct effect on default and foreclosure decisions; nevertheless, new delinquencies and foreclosure starts do not have an immediate, but rather a delayed, effect on house appreciation, since the foreclosure process takes a long time before a property to be definitely foreclosed and released to the market again, presumably in a distressed sale as an REO property. To confirm this intuition, we have run a Wu-Hausman-type test for endogeneity [Wooldridge (2000) and Immergluck and Smith (2006)] using the proportion of land farm in the state as an instrument for house price appreciation (see Appendix 1). The result of the test (Table 1-Appendix 1) confirms that house price appreciation may be treated as an exogenous variable in our model. Furthermore, as Calomiris and Higgins (2011) remark, the effect of foreclosure on prices is weak and local and "declines in housing prices cause foreclosures much more than foreclosures cause price declines". In any case, we use a traditional lagged value of house price appreciation as a means of mitigating the possible existence of a simultaneity problem.

6.3 The effectiveness of regulation during the crisis

The base model of Section 6.2 above analyses the effect of protective regulation on foreclosure rates. The results will tell us if states with excessive protection show on average a higher or lower foreclosure rate than less strict states. Nevertheless, the model does not tell us about the effectiveness of regulation in protecting borrowers when a crisis event occurs, i.e. if at least protective regulation is effective in crisis times. In order to answer that question we make use of a difference-in-difference (DiD) estimator, which is a powerful and simple tool for estimating treatment effects in econometrics, in our case the effect of borrower-protective regulation ("the treatment"). The logic behind this approach is the following. The sample contains "treated" states (those with protective regulation) and "control" states (those not implementing the "treatment" or protective regulation). We estimate the difference between the outcomes at two points in time (before and after the crisis) for both groups and then compare the difference between the groups. Specifically, we estimate the increase in default and foreclosure rates among borrower-protective states before and after the crisis (years 2006 and 2010) and compare it to the increase in default and foreclosure rates among non-protective states in the same period. If the DiD effect is statistically significant and negative, then protective regulation is effective. The DiD model relies on the crucial assumption that, in the absence of the crisis, the trend among protective states would have been similar to that of the non-protective states. Tables 3 and 3 (bis) show how regulation (specifically the judicial process requirement) is not correlated with almost any of the observable variables in the model, so states are similar in terms of the other explanatory variables. We can also relax that assumption by incorporating other control variables that influence the delinquency and foreclosure rates at state level.

Empirically, the DiD model is formulated as follows:

$$y_{it} = \alpha_i + X_{it}\beta + C_t\mu + L_i\pi + (C\,x\,L)_{it}\lambda + \varepsilon_{it} \quad (4)$$

where y_{it} denotes the outcome (default rate, pass-through and foreclosure rate) for each state in each period; C_t is a dummy variable coded 1 if the observation is in the crisis period (after 2006) and 0 if it is in the initial period (before 2006); the vector of legislative variables L_i represents the "treatment" and is coded 1 if the state is protective and 0 if it is non-protective; and finally the interaction term *(C x L)* is coded 1 if the state is protective and is in the crisis period, and 0 otherwise. We include a set of control variables X_{it} to account for heterogeneous dynamics among states not related to the treatment. Parameters are described in Table 8. λ is the parameter of interest (DiD estimator) and measures the effect of protective regulation on the variation in the variable *y* between the two periods (before and after the crisis). If λ is positive it means that the gap between the foreclosure rates of protective and non-protective states has increased after the crisis and, therefore, the protection has been ineffective (i.e. the increase in foreclosure rates in protective states as a consequence of the crisis is higher than the increase observed in non-protective states).

7 Empirical results

This section discusses the main empirical results. Firstly, we carry out a descriptive statistical analysis of the variables, and show the main empirical features of the database. Secondly, we present a detailed discussion of the findings following the estimation of the proposed models.

7.1 Descriptive statistics

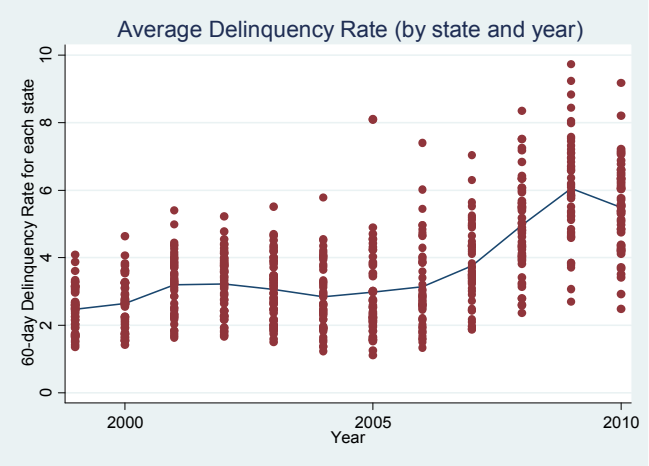
Table 1 presents the basic statistics of the dummy regulatory variables. 21 out of 51 states are classified as judicial states (41% of the population); 11 out of 51 states include a redemption period in their foreclosure laws (22%); and, contrary to popular opinion, the majority of states (40 out of 51) allow for a deficiency judgment and are classified as "recourse" states (78% of the population). Furthermore, regulation is somewhat heterogeneous in terms of mix of borrower-protection elements, since not all states that require judicial procedures include redemption periods or allow for deficiency judgments in their foreclosure laws. Table 2 shows a complete list of the states by degree of protection of borrowers. As an example of the mix of borrower protection, we consider the following classification: (i) "very protective states" are states with judicial procedures and redemption period; (ii) "protective states" are states with judicial procedures and non-existence of a redemption period; (iii) "non-protective states" are states which allow non-judicial procedures and have a redemption period; and (iv) "very non-protective states" are states with non-judicial procedures and non-existence of a redemption period. The number of "very non-protective" states is 25 (49% of the population); 5 states (10%) are "non-protective"; another 6 are included in the category "protective" states (12%), and finally 15 states (29%) are considered "very protective". Finally, it is interesting to note that the vast majority of judicial states allow for deficiency judgment in their legislation (19 out of 21, i.e. 90%), whereas that figure is lower for non-judicial states (21 out of 30, i.e. 70%).

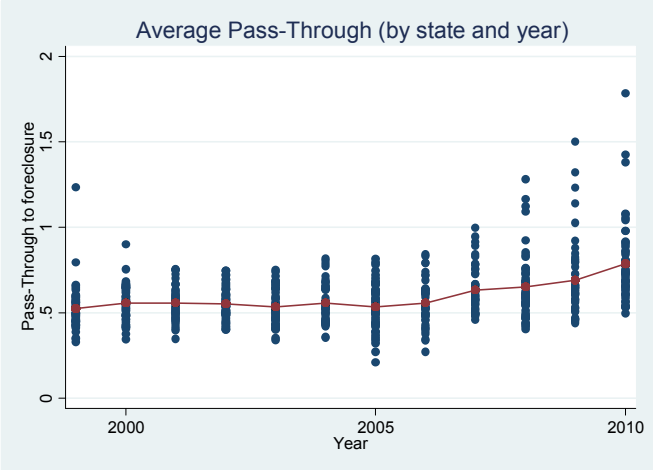
Aggregating for all states and years in the sample, Table 1 shows that the yearly average rates of delinquency and foreclosure are 3.7% and 2.3%, respectively. Both rates are displayed in Graph 3, which shows a large between-variation among states and within-variation in the time variable. The highest rates are concentrated around 2000-2002 and, more importantly, 2008-09, in line with the two recessions that hit the US economy in the last decade. In 2009, the peak of the foreclosure crisis, the highest delinquency rate was in Mississippi (9.7%), followed by Nevada (9.2%), Georgia (8.8%) and Michigan (8.4%). According to our classification, all of them are characterised as being "very non-protective" or "non-protective" and recourse states. The states with the lowest delinquency rates are North Dakota (2.7%) and South Dakota (3.1%), Montana (3.7%) and Alaska (3.8%), three of them classified as "very protective" states without provision for a deficiency judgment. Regarding foreclosure starts, the states with the highest rates are Nevada (13.8%), Florida (10.6%), Arizona (9.8%) and California (7.6%), all of them, except Florida, classified as "very non-protective" states but without any right of lenders to pursue a deficiency judgment. The states with the lowest rates are North Dakota (1.4%), Alaska (1.9%), South Dakota (2%) and Wyoming (2.2%), two of them "protective" states without the right to a deficiency judgment. The rate of pass-through to foreclosure has an average value of 0.59 during the whole sample period, although this variable displays a noticeable within and between heterogeneity (Graph 3). The states with the highest rates in 2009 are Nevada (1.5), Florida (1.3), Arizona (1.2) and California (1.1), whereas in 2003 the highest pass-through rates correspond to Utah (0.8), Ohio (0.7), Kansas (0.7) and Indiana (0.7). Finally, the average length of the foreclosure process is 292 days, with a wide range between the minimum of 183 days in Tennessee, a "very non-protective" state, and the maximum of 462 days in Iowa, a "protective" state.

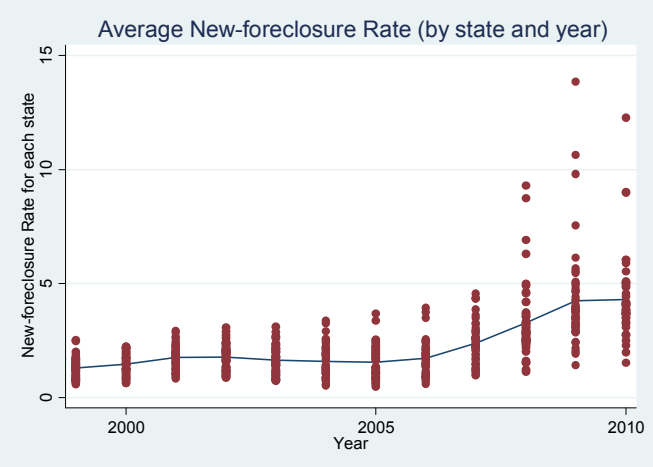
Table 2. State classification by borrower-protection rules

State	Judicial	Redemption	Category	Deficiency
ND	Yes	Yes	Very Protective	Yes
NJ	Yes	Yes	Very Protective	Yes
NM	Yes	Yes	Very Protective	Yes
KS	Yes	Yes	Very Protective	No
SD	Yes	Yes	Very Protective	Yes
WI	Yes	Yes	Very Protective	Yes
CT	Yes	No	Protective	Yes
DE	Yes	No	Protective	Yes
FL	Yes	No	Protective	Yes
IA	Yes	No	Protective	Yes
IL	Yes	No	Protective	Yes
IN	Yes	No	Protective	No
KY	Yes	No	Protective	Yes
LA	Yes	No	Protective	Yes
MD	Yes	No	Protective	Yes
ME	Yes	No	Protective	Yes
NY	Yes	No	Protective	Yes
OH	Yes	No	Protective	Yes
PA	Yes	No	Protective	Yes
SC	Yes	No	Protective	Yes
VT	Yes	No	Protective	Yes
AL	No	Yes	Non-Protective	Yes
CO	No	Yes	Non-Protective	Yes
MI	No	Yes	Non-Protective	Yes
MN	No	Yes	Non-Protective	No
WY	No	Yes	Non-Protective	Yes
AK	No	No	Very Non-Protective	No
AR	No	No	Very Non-Protective	Yes
AZ	No	No	Very Non-Protective	No
CA	No	No	Very Non-Protective	No
DC	No	No	Very Non-Protective	Yes
GA	No	No	Very Non-Protective	Yes
HI	No	No	Very Non-Protective	Yes
ID	No	No	Very Non-Protective	Yes
MA	No	No	Very Non-Protective	Yes
MO	No	No	Very Non-Protective	Yes
MS	No	No	Very Non-Protective	Yes
MT	No	No	Very Non-Protective	No
NC	No	No	Very Non-Protective	No
NE	No	No	Very Non-Protective	Yes
NH	No	No	Very Non-Protective	Yes
NV	No	No	Very Non-Protective	No
OK	No	No	Very Non-Protective	Yes
OR	No	No	Very Non-Protective	No
RI	No	No	Very Non-Protective	Yes
TN	No	No	Very Non-Protective	Yes
TX	No	No	Very Non-Protective	Yes
UT	No	No	Very Non-Protective	Yes
VA	No	No	Very Non-Protective	Yes
WA	No	No	Very Non-Protective	No
WV	No	No	Very Non-Protective	Yes

Graph 3. Dependent variables dynamics







Regarding the main explanatory variables of the "double-trigger" model for default, house prices average an annual 4.2% appreciation in the whole sample. The range of variation goes from a 25% depreciation to a 29% appreciation. The plot by state and year (Graph 4) shows the boom from 2000 to 2005, the steep decline in subsequent years, and the heterogeneity among states. The highest average annual appreciation rates over the whole sample period are around 2004-05 in Arizona (29.4%), Nevada (28.9%), Florida (24.7%), Hawaii (24.1%) and California (22.9%). These states show also the biggest house price collapse in

2008, e.g. Nevada (-25.4%), California (-24.2%), Florida (-21.4%) and Arizona (-17.8%). The lowest rates during the boom years are in Michigan (1.6%), Ohio (2.9%), Indiana (3.1%) and Nebraska (3.4%). And states showing mild house price appreciation during the bust are North Dakota (3%), South Dakota (1.7%) and Wyoming (0.9%).

The unemployment rate averages 5.4% in the whole sample, with a variation from 14.8% to 2.3%. The most important feature is the presence of a large variation over time and across states. The states with the highest unemployment rate during the crisis are Nevada (14.8%), Michigan (13.4%), California (12.3%) and Rhode Island (11.6%). The states with the lowest rates are North Dakota (3.9%), Nebraska (4.6%), South Dakota (4.8%) and Iowa (5.6%).

Finally, since our main interest is the effect of regulation on foreclosure rates, we report in Table 3 separate statistics for judicial and non-judicial states, in an attempt to capture contrasting behaviours in states with different regulatory frameworks. If, for instance, shocks to house prices or income are more common in judicial states than in non-judicial states, we may observe differences in foreclosure rates that are not due to the regulatory framework. In that case, the effect of regulation on foreclosure would be difficult to isolate and estimate. According to Table 3, on average, the states look quite similar, independently of the foreclosure regulatory framework. We have run regressions of judicial requirement on all the observable variables of the model. The results are displayed in Table 3 (bis) and show that there are no statistically significant differences in the observable variables between judicial and non-judicial states. In all cases, the coefficients are not statistically different from zero.

Graph 4. Main explanatory variables dynamics

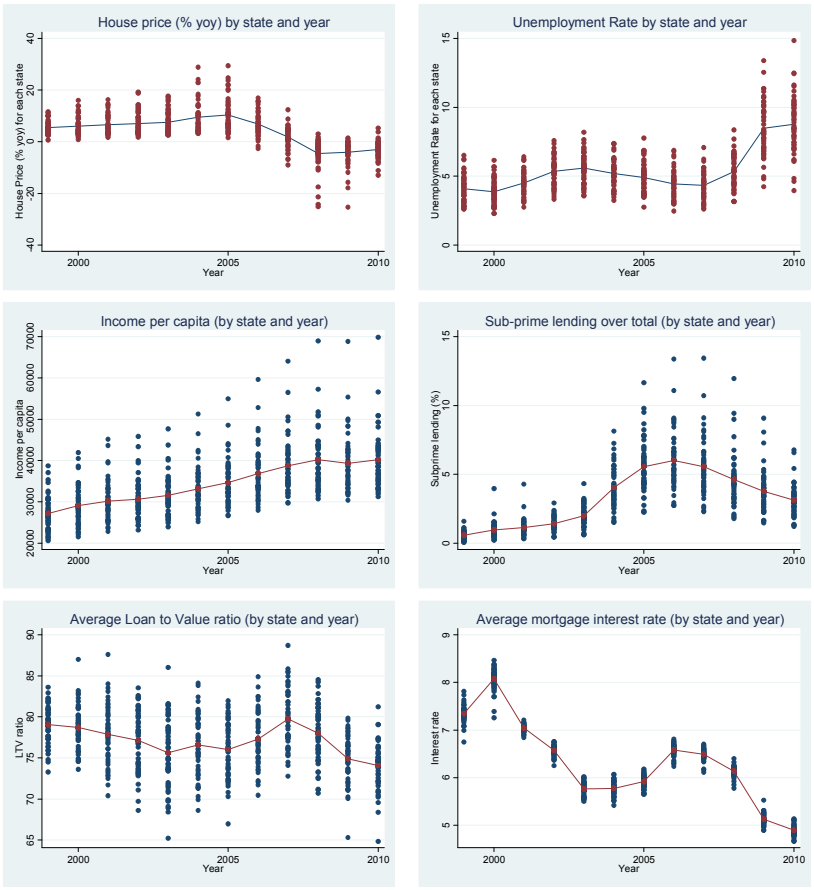


Table 3. Comparison of main variables by State protection (year < 2007)

States with Judicial Procedures					
Variable	**Obs**	**Mean**	**Std. Dev.**	**Min**	**Max**
60-day Delinquency Rate (%)	168	2.92	0.98	1.37	8.10
Foreclosure Rate (%)	168	1.67	0.64	0.59	3.93
Unemployment Rate (%)	168	4.55	1.06	2.28	6.88
House Price (% y-o-y)	168	7.09	3.90	0.84	24.74
Income Level ($)	168	31939.17	5668.92	21461.00	52818.80
Subprime Share (%)	168	2.61	2.11	0.06	9.00
LTV ratio	168	77.69	3.24	68.40	86.00
Interest Rate (%)	168	6.65	0.78	5.57	8.35
FICO score	168	685.00	14.37	660.00	709.00
Divorce Rate (%)	168	4.08	1.36	2.00	8.60
Minority Race (% total)	168	11.38	9.65	0.50	32.70
Education Level (%)	168	23.81	4.02	16.75	31.40
Urban Population (%)	168	70.90	15.76	38.18	94.35

States with Non-Judicial Procedures					
Variable	**Obs**	**Mean**	**Std. Dev.**	**Min**	**Max**
60-day Delinquency Rate (%)	240	2.97	1.09	1.11	8.09
Foreclosure Rate (%)	240	1.55	0.58	0.49	3.49
Unemployment Rate (%)	240	4.87	1.20	2.30	8.18
House Price (% y-o-y)	240	7.65	5.30	-2.65	29.40
Income Level ($)	240	31488.86	5863.80	20554.76	59583.00
Subprime Share (%)	240	2.79	2.53	0.07	13.37
LTV ratio	240	77.02	3.78	65.20	87.60
Interest Rate (%)	240	6.63	0.79	5.42	8.46
FICO score	240	678.37	14.99	648.00	706.00
Divorce Rate (%)	240	4.68	1.37	2.40	9.60
Minority Race (% total)	240	11.01	13.12	0.30	61.10
Education Level (%)	240	24.17	5.13	14.55	39.10
Urban Population (%)	240	73.19	14.66	46.05	100.00

Table 3 (bis). Correlation between Judicial Requirement and other observable variables

Judicial Foreclosure	Coef. Est.	Std. Err.	R-sqr.
House price appreciation	-0.005	0.011	0.002
Unemployment rate	-0.078	0.055	0.025
Income per capita	0.005	0.014	0.003
Interest rate	0.090	0.129	0.002
Subprime share	-0.035	0.037	0.007
Loan to Value	0.013	0.017	0.007
FICO score	0.007	0.005	0.037
Divorce rate	-0.072	0.071	0.031
Black proportion	0.000	0.006	0.000
Hispanic proportion	-0.003	0.008	0.003
Education level	-0.006	0.014	0.004
Urban population	-0.002	0.005	0.004
Farm land proportion	0.398	0.268	0.041
Period	2000-2006		
#observation	400		

Regressions are estimated using robust standard errors.

7.2 Base model: the effects of borrower-protection legislation on the foreclosure process

This section presents the estimation results of the base model, i.e. the GLS estimation of the MK model, equation (3), for the period 2000-2010. The main findings are: (i) state foreclosure regulation has a statistically significant impact on the various stages of the foreclosure process (default, pass-through and foreclosure); and (ii) more protection lowers the delinquency rate but increases the pass-through from delinquency to foreclosure. The final result on foreclosure depends on the type of protective element considered but, overall, the effect is positive, i.e. more protection implies more foreclosures. Therefore, if regulators intend to protect borrowers with tighter laws (increasing the cost of foreclosure for lenders and lessening it for borrowers), they ultimately bring about the contrary effect.

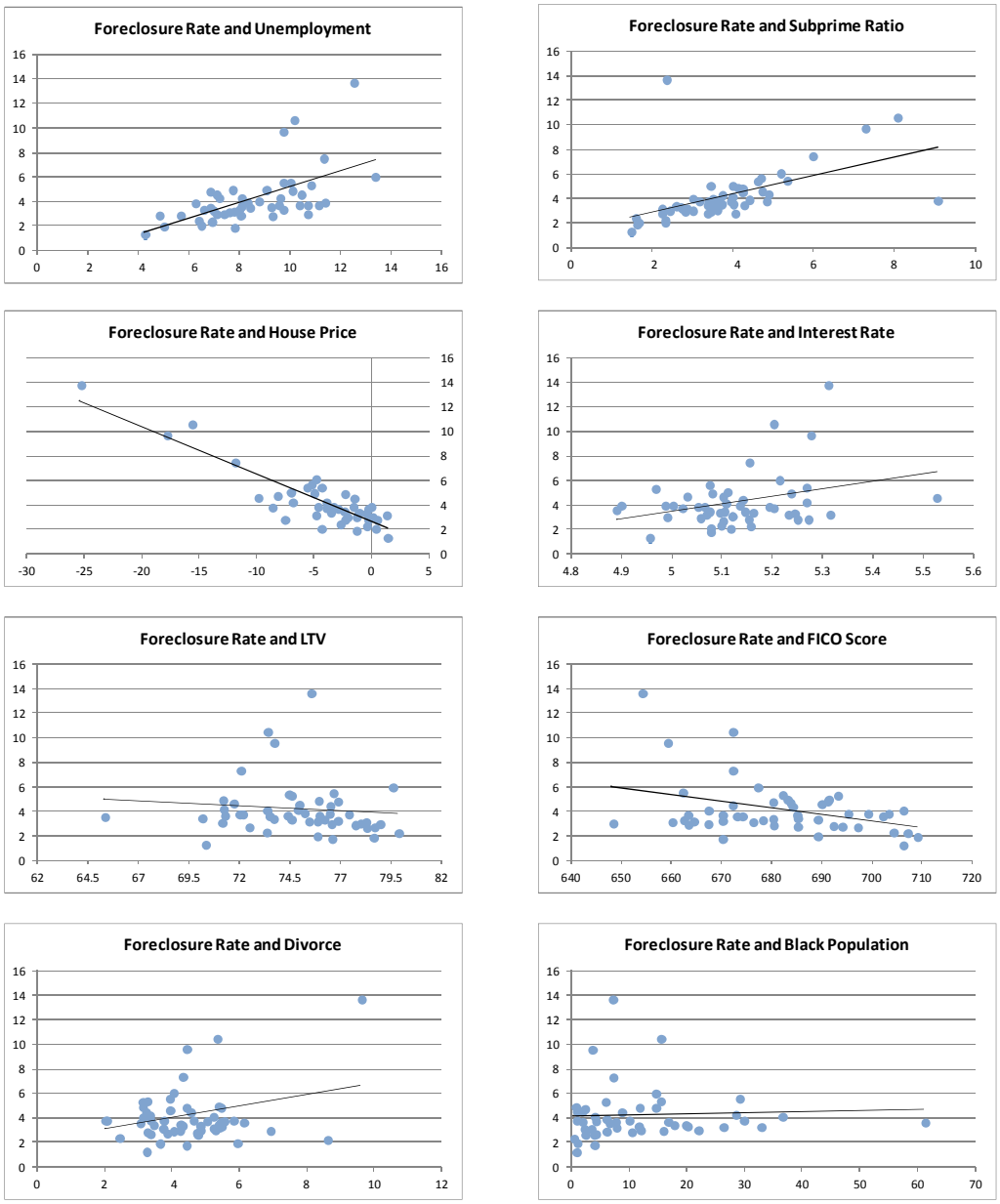
Results are presented in Table 4. Firstly, we run several specification tests to decide which of the possible models at hand is the most appropriate to describe the data-generating process (bottom of Table 4). The Breush-Pagan test does not reject the existence of random effects (versus no effects) and the Hausman test is not conclusive in rejecting the RE with respect to the FE model. In order to check for the suitability of the MK model, we follow a similar philosophy to that of Chatelain and Ralf (2010) and run a Wald-type test for the null hypothesis that the means of the time-variant variables are not statistically significant (H_0: $\eta = 0$). According to the result of the test, the null is rejected and a standard RE estimation of equation (1) would be inconsistent. In this setting, the GLS estimation of the extended Mundlack transformation model described by equation (3) would be appropriate and consistent. Finally, we test for the existence of cross-sectional dependence in the panel using a Pesaran test. This issue may cause the standard errors of the coefficients to be smaller than they actually are and, therefore, can lead to bias in test results. This issue is of particular interest since shocks to a mortgage market in one state may be transmitted to another,potentially causing an identification problem in the model. According to the Pesaran test, the null hypothesis that residuals across entities are not correlated cannot be rejected.

Table 4. Mundlack-Krishnakumar (MK) "restricted" model estimation results

	Delinquency Rate (1)	Pass-Through Delinq-Forecl. (2)	Foreclosure Rate (3)	Foreclosure Rate (4)
REGULATORY VARIABLES				
Judicial procedure required	-0.064	**0.046****	**0.217****	**0.197****
	(0.173)	**(0.023)**	**(0.097)**	**(0.089)**
Redemption Period granted	**-0.616****	**0.048***	0.046	-0.147
	(0.250)	**(0.026)**	(0.089)	(0.105)
Deficiency Judgment prohibited	**-0.881*****	**0.040****	0.088	**-0.188***
	(0.194)	**(0.02)**	(0.123)	**(0.104)**
CONTROL VARIABLES				
Delinquency Rate			**0.314*****	
			(0.098)	
Unemployment Rate (UR)	**0.231*****	-0.001	**0.091****	**0.157*****
	(0.044)	(0.007)	**(0.043)**	**(0.049)**
House Price Appreciation (HP)	**-0.077*****	**-0.027*****	**-0.142*****	**-0.172*****
	(0.007)	**(0.002)**	**(0.017)**	**(0.019)**
Income per Capita (IC)	**-0.097*****	**-0.006****	**-0.064****	**-0.099*****
	(0.018)	**(0.003)**	**(0.023)**	**(0.024)**
Interest Rate (IR)	0.018	**0.115*****	**0.820*****	**0.873*****
	(0.026)	**(0.036)**	**(0.233)**	**(0.231)**
Subprime Share (SS)	-0.023	0.002	0.042	-0.001
	(0.026)	(0.0116)	(0.074)	(0.065)
LTV	0.009	-0.002	-0.015	-0.13
	(0.008)	(0.002)	(0.015)	(0.015)
Mean UR (i)	**0.223****	-0.004	-0.024	0.052
	(0.101)	(0.013)	(0.072)	(0.070)
Mean HP (i)	**-0.128****	**0.026****	**0.114****	0.080
	(0.073)	**(0.011)**	**(0.052)**	(0.054)
Mean IC (i)	**0.103*****	-0.004	0.032	**0.069*****
	(0.032)	(0.003)	(0.024)	**(0.029)**
Mean IR (i)	**2.462****	-0.203	0.033	0.753
	(1.037)	(0.170)	(0.697)	(0.514)
Mean SS (i)	0.001	0.019	**0.141*****	**0.179*****
	(0.093)	(0.013)	**(0.044)**	**(0.049)**
Mean LTV (i)	0.045	-0.002	0.014	0.028
	(0.043)	(0.006)	(0.026)	(0.031)
Education Level	-0.013	0.005	0.016	0.005
	(0.037)	(0.005)	(0.017)	(0.018)
Urban Population	0.009	**0.002****	**0.018*****	**0.017*****
	(0.009)	**(0.001)**	**(0.006)**	**(0.005)**
Divorce Rate	-0.051	-0.005	0.009	-0.031
	(0.084)	(0.009)	(0.053)	(0.039)
Period	2000-2010	2000-2010	2000-2010	2000-2010
#observations	550	550	550	550
R-square	83.97	63.57	88.86	87.8
Specification Test (+):				
Wald Test for time fixed-effects	386.88	375.83	281.25	300.83
Breush-Pagan (No effects vs. RE)	1300.3	656.92	154.32	156.81
Hausman (RE vs. FE)	-	-	12.86	17.62
Wald Test (RE vs FE)	28.69	10	23.48	29.67
Pasaran (cross-sectional depen.)	-1.522	-1.34	-0.905	-0.855

**** p-value<0.01; ** p-value<0.05; * p-value<0.1.*
Regressions are estimated using robust standard errors.
(+) All specification tests have p-values lower than 0.01.

Graph 5. Regressions of foreclosure rate on its main determinants



Secondly, it is worth noting that in all equations the main variables of the "double trigger" model for default are statistically significant with the right sign (see Table 4 and Graph 5). Higher unemployment, lower income and higher interest rates imply higher delinquency and foreclosure rates, since borrowers are more constrained to continue making mortgage payments and it is more difficult for them to re-negotiate loan terms in order to avert foreclosure. At the same time, house price growth is negatively correlated with delinquency (since negative equity is less likely), the pass-through is also lower (since refinancing is always an option in the event of payment problems) and, therefore, foreclosure is a rare event. These results are in line with the main stream of the literature that has analysed default rates and the recent mortgage market crisis.

Regarding the regulatory variables, the first column of Table 4 shows the estimation results of the 60-day delinquency rate equation. The main conclusion is that states that prohibit a deficiency judgment are less likely to default. Specifically, 60-day delinquency rates

are 0.9 percentage points (pp) lower. This figure represents a 24% reduction relative to the average delinquency rate. Additionally, delinquency rates are 0.6 pp lower on average in states with redemption periods, which represents a 17% reduction with respect to the average rate. Nevertheless, states do not show any significant difference in delinquency rates owing to the existence of judicial procedures. The coefficient of the judicial dummy variable is not statistically different from zero, though the sign is also negative. Therefore, empirical results match the theory. Since states with strict protective rules for borrowers impose severe costs on lenders, the latter seem to protect themselves through tighter credit standards and less risky loans. The final result is a reduction in delinquency rates in relation to non-protective states. It is surprising that the judicial dummy variable is not significant, since the judicial requirement is a major drawback for lenders in the foreclosure process. The fact that in many states both judicial and power-of-sale foreclosures are allowed and only prevailing customs or agreements between parties make one of them more common could be a plausible explanation for that result.

The estimation results of the pass-through equation are shown in the second column of Table 4. All regulatory variables are statistically significant and their coefficient is positive, which means the pass-through to foreclosure rates is higher on average in states with protective legislation. The magnitude of the effect is similar among all the protective elements and approximates 0.05 points, i.e. the pass-through in protective states is almost 10% higher than in non-protective states. Once again, empirics match the theory. In states with protective legislation, lenders have less bargaining power to avoid a costly and lengthy foreclosure process and borrowers have incentives to search for that protection and "go for foreclosure", especially if they have cash-flow problems or are financially constrained. And, according to the estimation results, that is exactly what happens. During the foreclosure process, the borrower can enjoy a free rent – especially if the process is lengthy –, re-negotiate the loan terms, or simply wait and even avoid a deficiency judgment if state legislation prohibits it.

At this point, results show that, on the one hand, borrowers are less likely to default in states with protective legislation; but, on the other hand, once borrowers default they seem to embrace the protection provided by laws and pass a higher proportion of loans to foreclosure. The final result of these two opposite effects on foreclosure rates is shown in Columns 3 and 4 of Table 4. Foreclosure rates are 0.2 pp higher in judicial states, which means a 9% increase relative to the average rate. Results are similar whether the 60-day delinquency rate is included as a regressor (column 3) or not (column 4). Regarding the redemption period, foreclosure rates are not statistically different between states. This result, as shown in columns 3 and 4, is robust to the inclusion of the 60-day delinquency rate as a regressor. Therefore, the existence of redemption periods imposes a cost to lenders but does not ultimately seem to protect borrowers from losing their properties. Finally, in non-recourse states, where deficiency judgments are prohibited, foreclosure rates are lower on average than in recourse states. In this case, the initial negative effect on delinquency dominates the positive effect on the pass-through. Nevertheless, that coefficient is lower than the coefficient of the judicial dummy, less significant and not robust to the inclusion of the 60-day delinquency rate as a regressor (column 3).

In applied research with time-invariant variables, when testing leads to the rejection of the RE model vs. the FE model, the OLS estimator of the pooled regression or the random effects estimator are natural alternatives, due to the fact that the FE-consistent estimator eliminates the time-invariant variables in the within transformation. In Table 5, different estimators

Table 5. Robustness test: comparison of different estimation methods

Regulatory Variables	MK restricted (1)	OLS Cluster (2)	HT unrestricted (3)	Random Effects (4)
Delinquency Rate				
Judicial procedure	-0.064	-0.127	-0.119	-0.125
	(0.173)	(0.177)	(0.217)	(0.199)
Redemption Period granted	**-0.616****	**-0.511****	**-0.568****	**-0.556****
	(0.250)	**(0.217)**	**(0.244)**	**(0.227)**
Deficiency Judgment prohibited	**-0.881*****	**-1.001*****	**-1.155*****	**-1.141*****
	(0.194)	**(0.211)**	**(0.264)**	**(0.238)**
Period	2000-2010	2000-2010	2000-2010	2000-2010
#observations	550	550	550	550
R-square	83.97	81.50	78.22	78.33
Pass-Through Delinquency to Foreclosure				
Judicial procedure	**0.046****	**0.052****	**0.053****	**0.054****
	(0.023)	**(0.023)**	**(0.023)**	**(0.024)**
Redemption Period granted	**0.048***	0.025	0.021	0.021
	(0.026)	(0.024)	(0.026)	(0.023)
Deficiency Judgment prohibited	**0.040****	**0.046****	**0.054***	**0.055****
	(0.02)	**(0.024)**	**(0.029)**	**(0.025)**
Period	2000-2010	2000-2010	2000-2010	2000-2010
#observations	550	550	550	550
R-square	63.56	60.37	54.20	59.66
Foreclosure Rate				
Judicial procedure	**0.197****	**0.193****	**0.213***	**0.202***
	(0.089)	**(0.095)**	**(0.113)**	**(0.107)**
Redemption Period granted	-0.147	**-0.214****	**-0.256****	**-0.214****
	(0.105)	**(0.089)**	**(0.128)**	**(0.104)**
Deficiency Judgment prohibited	**-0.188***	**-0.279****	**-0.358*****	**-0.330*****
	(0.104)	**(0.113)**	**(0.138)**	**(0.121)**
Period	2000-2010	2000-2010	2000-2010	2000-2010
#observations	550	550	550	550
R-square	87.80	86.99	39.92	86.48

**** p-value<0.01; ** p-value<0.05; * p-value<0.1.*

Regressions are estimated using robust standard errors.

are compared: the baseline model of equation (3), the RE estimator and the Hausman-Taylor "unrestricted" (CR) estimator, all of which allow for estimation of the effect of time-invariant variables in panel data settings. We find that, in qualitative terms, estimations are quite similar. They all display a negative effect of regulation on delinquency rates (see top panel of Table 4), though the values of the coefficients differ from that of the MK estimator. Similarly, estimations of the pass-through effect and the impact on foreclosure rates have the same sign and are all alike (see central panel of Table 4) for all three regulatory elements.

7.3 Robustness check: the length of the process as a protective element in foreclosure laws

The empirical literature broadly reaches the conclusion that the core element of protection relates to the duration of the foreclosure process [see, for instance, Meador (1982), Jaffe (1985), Clauretie (1987) and Cutts and Merrill (2008)]. Actually, the regulatory variables included in the model are to some extent related to the length of the foreclosure process. In the sample used in this paper, judicial foreclosures take on average 110 days longer than power-of-sale foreclosures. If a redemption period is added to the process, which has on average a duration of six months or longer, the total length of the process could be substantially greater. Based on those grounds, it is common to observe that many legal amendments to state laws during the present crisis have focused on the delay of the foreclosure process and not necessarily on the modification of the protective elements per se. The mechanism is expected to work as an incentive for lenders to renegotiate with borrowers, since going through the foreclosure process proves to be more costly, and at the same time gives borrowers more time to recover from financial distress and repay the debt. We analyse empirically the evidence of this formulation and, as a robustness test, substitute in the model one variable measuring the length of the foreclosure process for the regulatory variables representing the level of borrower protection.

Results are displayed in Table 6. The first column presents the estimation of the 60-day delinquency rate equation. It shows that the longer the process, the lower the delinquency rate. For every 100-day increase in the foreclosure process, the delinquency rate decreases 0.15 pp. Noting that the difference between the shortest and the longest duration is 280 days, this effect could reach a magnitude of 0.45 pp, equivalent to a 12% reduction with respect to the average delinquency rate. The effect on the pass-through to foreclosure is also statistically significant. If the process takes 100 days longer, the pass-through increases by 0.055 points, which is equivalent to a 9% increase relative to the average pass-through ratio. If we extrapolate that result to the 280-day maximum difference between states, the pass-through may increase by 27% with respect to the average ratio. Finally, the duration has a positive effect on the foreclosure rate. A 100-day longer process translates into a 0.14 pp higher foreclosure rate, which is equivalent to a 6% increase relative to the average rate. Again, the extrapolation could reach an 18% increase with respect to the average foreclosure rate.

Therefore, results are consistent with the theoretical model. Delaying foreclosure has the opposite impact on the different stages of the foreclosure process. More importantly, delaying the process is no cure, since states with longer foreclosures exhibit higher foreclosure rates. This result questions the policy response observed in several states during the current crisis.

7.4 Robustness check: the effect of foreclosure laws before and after the crisis

So far, results take into account the whole sample period between 2000 and 2010, which covers a complete credit cycle, from the credit boom before 2006 to the credit bust thereafter. Nevertheless, it is worth investigating whether the behaviour of delinquency and foreclosure in relation to state regulation is qualitatively different across this time period. A first approach is to estimate separately all equations for each sub-sample. Results are shown in Table 7. In columns 1 and 2, estimation results of the 60-day delinquency rate equation are shown. Again, delinquency rates are lower in borrower-protective states, both before and during the crisis. Although the element "judicial" is not statistically significant, it has the right sign. Protection is also statistically significant in the pass-through equation, as shown in columns 3 and 4. In this case, the pass-through is higher in judicial states before the crisis,

though the variable is not significant during the crisis. On the contrary, the dummies "redemption period" and "deficiency judgment" are not significant before the crisis, but have a positive and very significant estimated coefficient after 2006. Finally, as shown in the estimation of the foreclosure rate equation, columns 5 and 6, the redemption and deficiency dummy variables are significant and negative before the crisis, but not significant after the crisis. Regarding the judicial dummy, it has a significant and positive effect on foreclosure, both before and during the crisis.

Two conclusions can be drawn. First, empirical results are consistent with the theory, in the sense that the data capture the opposite effect of regulation on delinquency and pass-through to that predicted by the theoretical model. Second, during the crisis protective elements emerge as crucial in the negotiation process. The latter point suggests that regulation may to some extent have changed the rules of the game during the crisis or, more bluntly, that the current mortgage crisis may have exacerbated the reaction of borrowers and lenders in relation to the state laws on foreclosure. The next section takes a closer look at this issue.

Table 6. Robustness test for the length of the foreclosure process (MK GLS)

	Delinquency Rate (1)	Pass-Through Delinq-Forecl. (2)	Foreclosure Rate (3)	Foreclosure Rate (4)
REGULATORY VARIABLES				
Length of foreclosure process ('00 days)	**-0.145*** **(0.082)**	**0.055***** **(0.010)**	**0.139***** **(0.044)**	**0.106***** **(0.045)**
CONTROL VARIABLES (a)				
Delinquency Rate			**0.226*** **(0.135)**	
Unemployment Rate (UR)	**0.194**** **(0.096)**	0.004 (0.011)	**0.033*** **(0.035)**	**0.078**** **(0.041)**
House Price Appreciation (HP)	**-0.087***** **(0.014)**	**-0.023***** **(0.004)**	**-0.089***** **(0.018)**	**-0.108***** **(0.014)**
Income per Capita (IC)	**-0.096***** **(0.037)**	**-0.009**** **(0.004)**	**-0.069***** **(0.028)**	**-0.091***** **(0.025)**
Interest Rate (IR)	0.342 (0.256)	0.037 (0.045)	0.203 (0.137)	**0.281*** **(0.151)**
Period	2000-2006	2000-2006	2000-2006	2000-2006
#observations	350	350	350	350
R-square	80.39	71.90	81.52	77.27
Specification Test (+):				
Wald Test for time fixed-effects	371.01	375.43	265.31	311.33
Breush-Pagan (No effects vs. RE)	657.24	312.56	117.70	104.86
Hausman (RE vs. FE)	-	-	3.51	0.10
Wald Test (RE vs FE)	31.05	16.14	35.74	38.50
Pasaran (cross-sectional depen.)	-1.601	-1.33	-0.915	-0.967

**** p-value<0.01; ** p-value<0.05; * p-value<0.1.*
Regressions are estimated using robust standard errors.
(a) Only the main control variables are reported.
(+) All specificaiton test have p-values lower tahn 0.01.

Table 7. MK "restricted" model estimation results (pre-crisis vs. post-crisis period)

	Delinquency Rate (1)	Delinquency Rate (2)	Pass-Through Delinq-Forecl. (3)	Pass-Through Delinq-Forecl. (4)	Foreclosure Rate (5)	Foreclosure Rate (6)
	Pre-crisis	Post-crisis	Pre-crisis	Post-crisis	Pre-crisis	Post-crisis
REGULATORY VARIABLES						
Judicial procedure	-0.053	-0.089	**0.054****	0.037	**0.157*****	**0.287***
	(0.164)	(0.197)	**(0.023)**	(0.031)	**(0.064)**	**(0.180)**
Redemption Period granted	**-0.646*****	**-0.562****	0.028	**0.085*****	**-0.321*****	0.061
	(0.240)	**(0.291)**	(0.026)	**(0.038)**	**(0.098)**	(0.158)
Deficiency Judgment prohibited	**-0.763*****	**-1.109*****	0.007	**0.096*****	**-0.373*****	0.032
	(0.180)	**(0.269)**	(0.022)	**(0.032)**	**(0.089)**	(0.204)
CONTROL VARIABLES (a)						
Unemployment Rate (UR)	**0.192****	**0.090****	0.005	0.001	**0.072***	**0.136*****
	(0.098)	**(0.044)**	(0.011)	(0.008)	**(0.038)**	**(0.053)**
House Price Appreciation (HP)	**-0.083*****	**-0.065*****	**-0.023*****	**-0.021*****	**-0.109*****	**-0.185*****
	(0.015)	**(0.010)**	**(0.003)**	**(0.002)**	**(0.013)**	**(0.026)**
Income per Capita (IC)	**-0.105*****	**-0.083****	**-0.009***	-0.003	**-0.095*****	-0.039
	(0.036)	**(0.040)**	**(0.004)**	(0.011)	**(0.024)**	(0.067)
Interest Rate (IR)	0.319	**-0.545****	0.033	0.084	**0.274****	0.548
	(0.249)	**(0.229)**	(0.045)	(0.059)	**(0.139)**	(0.396)
Period	2000-2006	2007-2010	2000-2006	2007-2010	2000-2006	2007-2010
#observation	350	200	350	200	350	200
R-square	69.31	82.43	41.13	71.28	78.38	85.47

**** p-value<0.01; ** p-value<0.05; * p-value<0.1.*

Regressions are estimated using robust standard errors.

(a) Only the main control variables are reported.

7.5 Diff-in-Diff estimation: the effectiveness of protective regulation during the crisis

In this section, we investigate the effectiveness of protective regulation during the crisis. Tables 8, 9 and 10 present the estimation results of the diff-in-diff regression model of equation (4). Specifically, we estimate the variation in default and foreclosure rates among borrower-protective states (the "treated group") as a consequence of the crisis and compare it to the percentage variation in the same variables among non-protective states (the "control group"). Regarding the dummy "judicial", Table 8 (column 1) shows that delinquencies in states with judicial procedures did not behave differently from delinquencies in states with power-of-sale procedures as a consequence of the crisis (the λ-parameter is not statistically significant). Furthermore, despite the fact that the gap in the pass-through ratio was reduced after the crisis (λ-parameter is negative and significant, column 2), that reduction does not ultimately have any effect on the foreclosure rate (column 3). Therefore, the protection provided by law to borrowers was not effective: the gap in foreclosure rates between judicial and non-judicial states was unchanged if compared before and after the crisis.

Tables 9 and 10 present the results for the redemption and deficiency dummies, respectively. The estimation shows that the λ-parameter (diff-in-diff estimator) is negative and statistically significant in the delinquency equation (column 1), but positive in the pass-through (column 2) and foreclosure (column 3) equations. Therefore, it seems that the crisis exacerbated the reaction of borrowers and lenders to the protective laws. First, the gap in delinquency rates between protective and non-protective states widened after the crisis, probably due to the fact that lenders tightened credit standards more than proportionally in protective states. Second, the gap in the pass-through increased, meaning that borrowers in protective states searched even harder for the protection provided by law after the crisis than before. Finally, the difference in foreclosure rates between protective and non-protective states increased after the crisis. Therefore, it can be said that protection was ineffective during the crisis.

Table 8. Diff-in-Diff estimation results for Judicial Procedure

	Delinquency Rate (1)	Pass-Through Delinq-Forecl. (2)	Foreclosure Rate (3)
REGULATORY VARIABLE			
Judicial x Crisis (λ-parameter)	-0.014	**-0.038*** **	-0.016
	(0.055)	**(0.010)**	(0.049)
CONTROL VARIABLES (a)			
Judicial procedure required	**-0.010**	**0.069*** **	**0.228*** **
	(0.146)	**(0.021)**	**(0.084)**
Unemployment Rate (UR)	**0.4313*** **	0.004	**0.295*** **
	(0.014)	(0.003)	**(0.013)**
House Price Appreciation (HP)	**-0.051*** **	**-0.016*** **	**-0.105*** **
	(0.003)	**(0.001)**	**(0.003)**
Income per Capita (IC)	**-0.028*** **	**-0.008*** **	**-0.030*** **
	(0.006)	**(0.003)**	**(0.006)**
Interest Rate (IR)	**0.183*** **	**-0.023*** **	-0.009
	(0.029)	**(0.005)**	(0.026)
Subprime Share (SS)	**0.0308*** **	**0.012*** **	**0.078*** **
	(0.009)	**(0.002)**	**(0.008)**
Mean UR (i)	**-0.349*** **	0.015	**-0.165*** **
	(0.089)	(0.013)	**(0.051)**
Mean HP (i)	-0.105	0.011	0.023
	(0.066)	(0.009)	(0.037)
Mean IC (i)	**0.064** **	-0.004	-0.020
	(0.029)	(0.003)	(0.017)
Mean IR (i)	**2.082** **	0.049	**1.689*** **
	(1.022)	(0.150)	**(0.582)**
Mean SS (i)	**0.214*** **	-0.009	**0.156*** **
	(0.082)	(0.013)	**(0.047)**
Crisis Dummy	**0.642*** **	-0.011	**0.371*** **
	(0.062)	(0.011)	**(0.056)**
Education Level	-0.034	**0.014*** **	0.014
	(0.034)	**(0.005)**	(0.019)
Urban Population	0.002	**0.004*** **	**0.017*** **
	(0.009)	**(0.001)**	**(0.005)**
Divorce Rate	-0.022	-0.003	-0.018
	(0.072)	(0.010)	(0.041)
Period	1999q2-2010q4	1999q2-2010q4	1999q2-2010q4
#observations	2350	2350	2350
R-square	83.88	44.09	80.58

**** p-value<0.01; ** p-value<0.05; * p-value<0.1.*
Regressions are estimated using robust standard errors.

(a) Only main control variables are reported

Table 9. Diff-in-Diff estimation results for Redemption Period

	Delinquency Rate (1)	Pass-Through Delinq-Foreecl. (2)	Foreclosure Rate (3)
REGULATORY VARIABLE			
Redemption x Crisis (λ-parameter)	-0.049	**0.027****	**0.107***
	(0.065)	**(0.012)**	**(0.059)**
CONTROL VARIABLES (a)			
Redemption period granted	-0.290	0.031	-0.078
	(0.185)	(0.029)	(0.084)
Unemployment Rate (UR)	**0.4312*****	0.004	**0.295*****
	(0.014)	(0.003)	**(0.013)**
House Price Appreciation (HP)	**-0.051*****	**-0.016*****	**-0.106*****
	(0.003)	**(0.001)**	**(0.003)**
Income per Capita (IC)	**0.029*****	**-0.008*****	**-0.032*****
	(0.007)	**(0.001)**	**(0.006)**
Interest Rate (IR)	**0.183*****	**-0.023*****	-0.009
	(0.029)	**(0.005)**	(0.026)
Subprime Share (SS)	**0.0302*****	**0.012*****	**0.079*****
	(0.009)	**(0.002)**	**(0.008)**
Mean UR (i)	**-0.374*****	0.013	**-0.193*****
	(0.085)	(0.014)	**(0.056)**
Mean HP (i)	-0.153	0.016	0.013
	(0.070)	(0.011)	(0.045)
Mean IC (i)	**-0.050***	-0.004	-0.012
	(0.029)	(0.005)	(0.019)
Mean IR (i)	**1.865***	0.052	**1.571****
	(0.989)	(0.155)	**(0.643)**
Mean SS (i)	**0.171****	-0.004	**0.148*****
	(0.083)	(0.013)	**(0.054)**
Crisis Dummy	**0.661*****	-0.012	**0.338*****
	(0.006)	(0.011)	**(0.053)**
Education Level	-0.034	**0.012****	0.008
	(0.032)	**(0.005)**	(0.021)
Urban Population	0.001	**0.003****	**0.016*****
	(0.009)	**(0.001)**	**(0.005)**
Divorce Rate	-0.017	-0.008	-0.037
	(0.068)	(0.011)	(0.044)
Period	1999q2-2010q4	1999q2-2010q4	1999q2-2010q4
#observations	2350	2350	2350
R-square	80.96	42.70	80.07

**** p-value<0.01; ** p-value<0.05; * p-value<0.1.*
Regressions are estimated using robust standard errors.

(a) Only main control variables are reported

Table 10. Diff-in-Diff estimation results for Deficiency Judgment

	Delinquency Rate (1)	Pass-Through Delinq-Forecl. (2)	Foreclosure Rate (3)
REGULATORY VARIABLE			
Def. Judg. x Crisis (λ-parameter)	**-0.361*** **	**0.060*** **	**0.101***
	(0.068)	**(0.012)**	**(0.061)**
CONTROL VARIABLES (a)			
Deficiency Judgment prohibited	-0.217	-0.031	-0.169
	(0.192)	(0.032)	(0.126)
Unemployment Rate (UR)	**0.425*** **	0.004	**0.296*** **
	(0.014)	(0.003)	**(0.013)**
House Price Appreciation (HP)	**-0.053*** **	**-0.016*** **	**-0.105*** **
	(0.003)	**(0.001)**	**(0.003)**
Income per Capita (IC)	**0.028*** **	**-0.008*** **	**-0.031*** **
	(0.006)	**(0.001)**	**(0.006)**
Interest Rate (IR)	**0.173*** **	**-0.022*** **	-0.006
	(0.029)	**(0.005)**	(0.026)
Subprime Share (SS)	**0.0304*** **	**0.012*** **	**0.079*** **
	(0.009)	**(0.002)**	**(0.008)**
Mean UR (i)	**-0.298*** **	0.010	**-0.174*** **
	(0.087)	(0.014)	**(0.057)**
Mean HP (i)	-0.098	0.001	0.021
	(0.063)	(0.011)	(0.041)
Mean IC (i)	**0.066** **	-0.003	-0.016
	(0.027)	(0.005)	(0.019)
Mean IR (i)	**1.655***	0.016	**1.415*** **
	(1.001)	(0.167)	**(0.651)**
Mean SS (i)	**0.192** **	-0.018	**0.146*** **
	(0.079)	(0.013)	**(0.051)**
Crisis Dummy	**0.716*** **	-0.017	**0.345*** **
	(0.059)	(0.011)	**(0.053)**
Education Level	-0.031	**0.012** **	0.008
	(0.032)	**(0.005)**	(0.021)
Urban Population	0.001	**0.004** **	**0.014*** **
	(0.009)	**(0.001)**	**(0.006)**
Divorce Rate	-0.054	-0.009	-0.051
	(0.070)	(0.012)	(0.045)
Period	1999q2-2010q4	1999q2-2010q4	1999q2-2010q4
#observations	2350	2350	2350
R-square	81.25	42.30	80.18

**** p-value<0.01; ** p-value<0.05; * p-value<0.1.*
Regressions are estimated using robust standard errors.

(a) Only main control variables are reported

8 Conclusions

This paper shows that the level of protection provided by state laws is a key element in explaining differences in delinquency and foreclosure rates across US states. Specifically, we find that delinquency rates are lower in protective states, although the size of the effect depends on the type of protective element and ranges from 0 to -0.9 percentage points. This represents a decrease in delinquency rates of between 0% (judicial states) and 24% (non-recourse states) relative to the average delinquency rate. Additionally, we find that more protection induces a higher pass-through to foreclosure, with this effect ranging from 0.04 to 0.05 points, equivalent to an increase of 7% to 10% in relation to the average. Once again, the final effect of protection on the foreclosure rate depends on the type of protective element. Foreclosure rates are 9% higher in judicial states; on the contrary, states with redemption periods do not exhibit a significant difference in foreclosure rates when compared to states without redemption rights. Finally, non-recourse states show lower foreclosure rates, although this result is not robust to the inclusion of the delinquency rate as a regressor.

These results are consistent with the theory. Protective regulation reduces delinquency rates, which could be the consequence of tighter credit standards and borrower discrimination due to higher foreclosure costs. At the time of loan origination, lenders are aware of the costs associated with protective regulation and would grant less risky mortgages, thereby reducing the probability of borrower default. But, once the borrower defaults, the protection increases the pass-through from delinquency to foreclosure. Borrowers try to take advantage of the protection provided by state laws, meaning that moral hazard problems arise owing to the lower costs of foreclosure. This paper does not provide a formal empirical test of this theoretical approach, but the estimation results are in the direction suggested by this behavioural model of lenders and borrowers.

Furthermore, we investigate the effect of the length of foreclosure on delinquency and foreclosure rates. This element is a good proxy of the protection provided to borrowers by state laws. Results are consistent with the regulatory dummy results and strengthen the opinion that excessive protection ultimately increases foreclosure rates.

Finally, in order to analyse whether protection was effective at least during the current crisis, we estimate a difference in difference regression model. Results show that excessive protection may have induced lenders to over-protect themselves, reducing to a greater extent the delinquency rates in protective states in relation to non-protective states. But, at the same time, borrowers may have embraced protection more aggressively, which increased the gap in the foreclosure rate between protective and non-protective states. Therefore, protection was ineffective during the crisis as a means of preserving home ownership and reducing foreclosures.

Ultimately, protective regulation may protect borrowers in default but does not prevent borrowers from losing their homes, since foreclosure rates are not reduced. Additionally, it may introduce distortions into the mortgage market. Furthermore, delaying the foreclosure process is no cure. These results question the policy response observed in several states during the current crisis and suggest that new mortgage foreclosure legislation needs to be rethought. The current debate should bring new solutions to the table, acknowledging the effects of regulation on every part of the foreclosure process.

APPENDIX 1

A Wu-Hausman Test for Endogeneity of house price appreciation

As mentioned in section 6.2, there may be a concern about reverse causality between foreclosures and house prices in equation (1). If simultaneity is the problem, the complete model should include an additional equation explaining the effect of foreclosure on prices:

$$Price_{it} = \alpha_i + T_t + I_{it}\,\psi + \ Foreclosure_{it}\,\rho + \upsilon_{it} \quad (5)$$

where l_{it} is a set of instruments not correlated with the error term (ε) in equation (1). A variable that fulfills this criteria, apart from the controls X_{it}, is the proportion of farm land in the state. A low density of farm land is related to relative scarcity of developable land in the state. Saiz (2010) shows how scarcity of urban development is a constraint for housing supply and, therefore, a determinant of house price variation. We can conclude that the proportion of farm land is correlated with house price, but not with delinquency or foreclosure.

The test goes as follows. In stage 1, We estimate the equation:

$$Price_{it} = \alpha_i + T_t + I_{it}\,\psi_1 + X_{it}\,\psi_2 + \eta_{it} \quad (6)$$

Endogeneity concerns the correlation between ε and η. In a second stage, We include the residuals of equation (6) as an additional independent variable in equation (1). So equation (1) is expanded:

$$y_{it} = \alpha_i + T_t + X_{it}\,\beta + L_i\,\pi + \delta\,Residual(\eta)_{it} + \zeta_{it} \quad (1a)$$

If the parameter of the residual (δ) is statistically significant, the null hypothesis that there is no simultaneity can be rejected. As shown in Table 1- Appendix 1, the results indicate that this is the case and that house prices can be treated as exogenous in my model of foreclosure.

Table 1 - Appendix 1. Results of Test for Endogeneity: estimation of equations (6) and (1a)

Stage 1: House price	Coef. Est.	Std. Err.	t-stat
Unemployment rate	-1.004	0.211	-4.770
Income per capita	-0.068	0.081	-0.840
Interest rate	1.096	2.268	0.480
Subprime share	-1.184	0.188	-6.310
Loan to Value	-0.197	0.070	-2.800
FICO score	0.033	0.022	1.470
Divorce rate	0.227	0.139	1.630
Black proportion	0.048	0.027	1.810
Hispanic proportion	0.049	0.025	1.93
Education level	0.061	0.089	0.690
Urban population	0.057	0.028	2.030
Farm land proportion	***-3.907***	***1.074***	***-3.640***
Period	2000-2010		
#observation	550		
R-squared	69.91		

Regressions are estimated using robust standard errors.

Stage 2: Foreclosure rate	Coef. Est.	Std. Err.	t-stat
House price appreciation	-0.073	0.049	-1.490
Unemployment rate	0.198	0.048	4.120
Income per capita	-0.047	0.011	-4.500
Interest rate	1.142	0.273	4.180
Subprime share	0.201	0.070	2.890
Loan to Value	0.014	0.016	0.890
FICO score	0.006	0.007	0.910
Divorce rate	-0.026	0.062	-0.410
Black proportion	0.015	0.006	2.550
Hispanic proportion	0.001	0.007	0.120
Education level	-0.007	0.019	-0.390
Urban population	0.019	0.007	2.570
Residual (1st stage eq.)	***-0.017***	***0.047***	***-0.370***
Period	2000-2010		
#observation	550		
R-squared	84.07		

Regressions are estimated using robust standard errors.

APPENDIX 2

The parameters of the Diff-in-Diff model

$$y_{it} = \alpha_i + X_{it}\,\beta + C_t\,\mu + L_i\,\pi + (C \times L)_{it}\,\lambda + \varepsilon_{it}$$

	Variable of interest (Delinquency, Pass-Through, Foreclosure)		
	Pre-Crisis (2000-2006)	Post-Crisis (2007-2010)	Difference between periods
Protective states	$\alpha + \pi$	$\alpha + \mu + \pi + \lambda$	$\mu + \lambda$
Non-protective states	α	$\alpha + \mu$	μ
Difference between groups	π	$\pi + \lambda$	λ

The difference **(π)** *measures the differential effect of protective regulation on the dependent variable (e.g. foreclosure rate) before the crisis period (2000-2006).*

The difference **($\pi + \lambda$)** *measures the differential effect of protective regulation on the dependent variable (e.g. foreclosure rate) after the crisis started (2007-2010).*

The difference **(μ)** *measures the differential effect of the crisis on the dependent variable (e.g. foreclosure rate) for non-protective states, i.e. the difference between the foreclosure rate before and after the crisis for non-protective states.*

The difference **($\mu + \lambda$)** *measures the differential effect of the crisis on the dependent variable (e.g. foreclosure rate) for protective states, i.e. the difference between the foreclosure rate before and after the crisis for protective states.*

λ *is the parameter of interest, obtained by the difference between differences (diff-in-diff estimator) and measures the effect of protective regulation on the foreclosure rate variation before and after the crisis for each type of state. If* **λ** *is positive this means that the gap between foreclosure rates of protective and non-protective states has increased after the crisis and, therefore, the protection has been ineffective.*

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