# Bank Delays in the Resolution of Delinquent Mortgages:

# The Problem of Limbo Loans

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## Abstract

Limbo loans are defined as delinquent mortgage loans that have not progressed either to foreclosure (non-foreclosure limbo) or to resolution (foreclosure limbo). We find that 21.79% (representing $24.8 billion in principal) of the subprime loans originated in Florida during 2004-2008 were in limbo as of December 2010. We utilize a unique legal docket database and find no support for either bottlenecks or bank capital constraints as explanations for the limbo loan phenomenon. Rather we find support for an operational risk hypothesis in which the impairment of property rights contributes to both the likelihood that a loan will remain in limbo and the length of time spent in limbo. In particular, we find that the presence of the Mortgage Electronic Registration System (MERS) in both assignment and foreclosures significantly increases both the likelihood and severity of the time spent in limbo, such that a 10% increase in the presence of MERS in county foreclosures and assignments adds around 8 months (3.5 months) to the time spent in foreclosure limbo (non-foreclosure limbo). Lost documentation affidavits are found to be required to move these loans to resolution more quickly.

**Keywords**: Mortgage, MERS, foreclosure **JEL Codes**: G21, G28

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During the summer of 2007, a sharp increase in the number of delinquencies on subprime mortgages in the United States marked the start of a prolonged global financial crisis. Many financial crises in the past have been triggered by the onset of credit problems in particular sectors of the economy (e.g., Mexican sovereign debt in 1994, real estate and mortgage problems in Japan during the "lost decade" of the 1990s, Russian sovereign debt in 1998, the bursting of the Internet high tech bubble in 2000, etc.).

Financial crises typically pass through stages: the initial shock, followed by contagious market breakdowns, followed by stabilization and recovery. The first stage in these credit crises is triggered by an initial shock that leads to rapidly declining asset and security prices, which typically fall below fundamental underlying valuations as risk premiums temporarily increase.[1] During this initial market breakdown stage of the crisis financial markets often freeze and prices decline more than is warranted by fundamentals when risk premiums return to non-crisis levels. Thus, distressed asset investors can buy assets at fire sale prices and then restructure them in order to recoup their investment plus profits, thereby triggering the second stage of the crisis. During this second stabilization stage, vulture funds, sovereign wealth funds and workout specialists begin to hunt for bargains to purchase securities selling at these depressed prices. By purchasing distressed assets, distressed asset investors place a floor under the market, and remove the overhang of unresolved delinquent loans and distressed assets that depress bank lending activity. This allows the third stage of recovery to begin.

[1] Shleifer and Vishny (1997) show that asset prices can fall below fundamental value if uninformed investors remove their capital after a crisis, thereby reducing institutional capacity for investment. Similarly, Shleifer and Vishny (1992) show that if groups of asset buyers (say industry peers) together suffer a liquidity crisis, assets may sell below their best use value. Diamond and Rajan (2010) find that banks in danger of insolvency have incentives to retain undervalued assets rather than sell them at fire sale prices.

Although this process of distressed asset investment began as early as fall of 2007, it has been unsuccessful in reinvigorating either the mortgage market or global financial markets. For example, as of this date, the private label mortgage securitization market has not even approached its pre-crisis levels. The failure of this important market impedes banks' abilities to recycle their balance sheets. Years after the initial credit shock, banks' balance sheets remain filled with troubled and nonperforming loans that cannot be sold or packaged into securitizations.[2] Indeed, banks are still holding billions of dollars of nonperforming loans in which the borrowers have made no payments of either interest or principal for extended periods of time. However, rather than resolving these loans via foreclosure or property sale (e.g., short sale), the banks are holding the loans "in limbo" for extended periods of time.

In this paper, we examine the phenomenon of "limbo loans," defined as loans that have been delinquent for extended periods of time, but have not progressed to any form of resolution.[3] Specifically, we define a mortgage to be a "limbo loan" if it is delinquent for 90 days and has not progressed to property sale, refinancing, modification, or has an open (non-resolved) foreclosure case outstanding. The recovery of macroeconomic conditions to pre-crisis levels is impeded by the existence of these limbo loans on bank balance sheets, since they increase bank risk exposure, drain bank capital resources and restrict aggregate lending activity.[4]

There appears to be little incentive for banks to delay resolution of nonperforming loans, as even a partial recovery of loan value should be preferred to the zero recovery value of a limbo loan. This paper examines the motivation behind resolution delays that lead to banks' holdings

[2] "Over the past two years less than $25 billion of delinquent mortgages have been sold to investors who specialize in the area….This is only about 0.25% of U.S. home loans outstanding." "Vultures' Save Troubled Homeowners," James Hagerty, *Wall Street Journal*, August 18, 2010, page A6.

[3] We do not take a stand on the issue of whether loan resolution takes the form of property repossession and sale, modification or foreclosure. Instead, we examine loans that are stuck in limbo and remain delinquent without resolution of any kind.

[4] Allen, Bali and Tang (2012) show that excessive risk taking in the financial sector forecasts macroeconomic downturns one year into the future.

of substantial amounts of limbo loans. We utilize a unique database generated by Legalprise that tracks all legal entries regarding mortgages in the State of Florida in order to understand why banks continue to hold limbo loans. We are the first to document the magnitude of the limbo loan problem as of December 2010 using this database, which covers mortgages originated in Florida over the period from 2004-2008.

We offer three possible explanations for the limbo loan phenomenon. First, the *bottleneck hypothesis* specifies that the sheer size of the banks' nonperforming loan portfolios taxed the workout resources of the banking system. Thus, the size of the limbo loan phenomenon is related to the volume of mortgages that become delinquent at any point in time. As the crisis dragged on, Fannie Mae and Freddie Mac, as well as other ABS underwriters became more aggressive in forcing originating banks to repurchase loans that violated the "representations and warranties" specified in the original securitization covenants. These "reps and warranties" can trigger loan buybacks if it is subsequently found that there were errors in the original loan applications, such as undisclosed debt, faulty appraisals, or income and employment errors on loan applications. If it is expected that the loan will be repurchased by the issuing bank, there may be no resolution activity during the period of buyback negotiation between the holder and the originator of the loan. The longer time to resolution observed during this crisis may be related to a bottleneck caused by the aggressive pursuit by ABS investors of covenantal rights such as reps and warranties. Related to this is the possibility that servicers may have limited incentives to resolve delinquent mortgages since their fees are a function of the volume of loans in the ABS pool.[5] We examine this hypothesis for the entire sample of Florida

[5] However, Mayer and Gan (2006) find that the special servicer responsible for handling problem loans resolves delinquencies more efficiently (liquidating larger proportions of loans) when it holds the first-loss provision. Moreover, Piskorski, Seru and Vig (2010) find that seriously delinquent loans that are securitized are more likely to be foreclosed than bank-held mortgages.

mortgages, as well as for individual banks and servicers to ascertain whether particular financial intermediaries have bottlenecks in resolving problem mortgages.

A second hypothesis, *the bank capital constraint hypothesis*, relates the bank's holdings of limbo loans to a reluctance to write down nonperforming loans and take capital charges since this may make the bank deficient in meeting its regulatory capital requirements. Diamond and Rajan (2010) show that banks may rationally refuse to sell distressed assets at fire sale prices if a permanent loss in asset valuation is enough to cause the bank to become insolvent. That is, bank shareholders would optimally refuse to undertake liquidity enhancing actions when the benefits accrue to debt holders, rather than equity holders, under states of the world when the bank is insolvent. Findings that the banks with the largest limbo loan portfolios have binding regulatory capital constraints and higher risks of insolvency are consistent with this hypothesis. Moreover, a finding that a bank's economic capital holdings are inversely related to its holdings of limbo loans is consistent with the bank capital constraint hypothesis.

Finally, a third explanation for the existence of limbo loans is the *operational risk hypothesis*. Back office operations in the mortgage origination business consist of verifying liens and titles and obtaining the proper legal documentation for the loans in ABS issues. The operational risk hypothesis considers the possibility that in the frenzy of the recent housing boom, lenders got careless about keeping track of the paperwork. For example, in a sample of recent chapter 13 bankruptcy filings, Porter (2008) finds that a majority of residential property loans are missing at least one piece of the required paperwork; more than 40% of residential property loans were missing the promissory note while 20% of residential property loans were missing evidence of security interest in the property (either a mortgage or a deed of trust). As loans got packaged into mortgage backed securities (MBS), repackaged, and then sold perhaps

several times, the paperwork required to establish the existence of the debt (the promissory note) or the lender's right to foreclose if the terms of the note are not met (the mortgage or deed of trust) may not have been passed to the holder of the security or the trustee for all of the loans in each pool of mortgages.[6]

The *operational risk hypothesis* considers the possibility that banks are holding limbo loans and delaying the resolution of foreclosures because of the missing paperwork backing the loans. Lenders fear that either they will be challenged in foreclosure proceedings or that title will be clouded subsequent to the foreclosure proceeding. Moreover, if fraud or lack of due diligence is shown for government-insured mortgages, the bank may be liable for treble damages, thereby making pursuit of delinquency claims risky. These concerns increase the transaction costs associated with resolving nonperforming loans and may explain the incidence of limbo loans.

When the foreclosing bank is missing critical documents, such as the original note, some jurisdictions require the filing of a lost note affidavit to attest that the bank owns the mortgage and should be permitted to proceed with the foreclosure.[7] During October 2010, it was revealed that these affidavits themselves were often inaccurate, having been signed by "robo-signers" who were responsible for the signing of hundreds of affidavits each day, and therefore could not be expected to investigate and verify each affidavit's claims. The robo-signer scandal, however, understates the severity of potential operational problems in mortgage originators and underwriters. Many jurisdictions do not require the foreclosing bank to produce the original

[6] Hunt, Stanton and Wallace (2011) describe the legal requirements that require two contracts (the promissory note and the deed of trust) to establish property rights under a "mortgage."

[7] In most states, residential property lenders are required to have at a minimum the promissory note and evidence of a lien to foreclose. In some states (for example, Florida) the lender is required to have the original promissory note, rather than simply a copy. Further, some states (such as Florida) are judicial states that require all foreclosures to be granted by a judge.

note. Moreover, banks may rationally decide not to initiate foreclosure proceedings for limbo loans with missing documentation for fear that their operational problems will be revealed, or may choose not to re-file foreclosure proceedings once a case has been dismissed. Thus, the *operational risk hypothesis* suggests that limbo loan problems are more pervasive than the incidence of lost note affidavits would suggest. However, in order to test this hypothesis, we examine the filings of lost document affidavits in order to assess a lower bound estimate of the operational component of the limbo loan problem. We also examine the incidence of dismissed cases to test this hypothesis.

Another aspect of the *operational risk hypothesis* emanates from the origination of the mortgage-backed securities. In 1995, a group of financial institutions (including Fannie Mae, Freddie Mac, Bank of America and JP Morgan Chase) banded together to create the Mortgage Electronic Registration System, or MERS. The objective was to streamline the mortgage recording process by bypassing county offices that were slow to process legal documents regarding ownership of mortgages. Rather than record the mortgage with the county clerk, it was instead registered in the name of MERS, which became the owner of record. MERS could transfer the mortgage at will as many times as desired to accommodate the speed of securitization that characterized the boom years. Transfers were to be recorded in the MERS database. Thus, MERS was a form of book entry for mortgages. However, MERS did not actually build the computer infrastructure required to carefully record and monitor the transfers of all of the mortgages in its system. Indeed, although MERS has a full-time staff of fewer than 50, it claims to hold 60 million loans.[8] Moreover, Hunt, Stanton and Wallace (2011) show that the MERS structure violates legal requirements and may undermine the bankruptcy remoteness

[8] Powell, M. and G. Morgenson, "MERS? It May Have Swallowed Your Loan," *New York Times*, March 6, 2011, Sunday Business pages 1, 6.

legal foundation crucial to the viability of mortgage securitization.[9] In our analysis, we find that the presence of MERS significantly contributes to the incidence of limbo loans and constitutes operational risk.

Using CoreLogic data, a fairly comprehensive database of all securitized mortgages originated in United States (including the State of Florida), we define three groups: (1) current loans, (2) delinquent loans that have been resolved (either through foreclosure resolution, modification or refinancing) and (3) limbo loans (either stuck in the foreclosure process or in limbo without even entering into foreclosure). We find that 21.79% of the loans in our Florida sample, totaling $24.8 billion in original mortgage value, can be classified as limbo loans. Most of these loans (representing 19.07% of the total number of mortgages in our sample) were in foreclosure limbo for close to 26 months.[10] In contrast, foreclosure resolution (for the 22.96% of our sample in the resolved delinquency group) lasted about 19 months, indicating some impediment to timely resolution of these limbo loans. As expected, the CoreLogic data show substantial increases in the rate of delinquency for mortgages originated during 2005, 2006 and 2007. Descriptive statistics show that delinquent loans of vintages 2005, 2006 and 2007 have approximately the same likelihood of being resolved in foreclosure as being left in limbo. We analyze the likelihood that a loan remains in limbo as of December 2010 using an ordered logit model. Our results are consistent with the *operational risk hypothesis*. We find that a loan is significantly more likely to remain in limbo if it has been assigned to MERS. Moreover, our

[9] Bankruptcy remoteness protects the special purpose vehicle (SPV), or any other party, from claims by securitization investors in the event of ABS default, so that only the underlying assets themselves are available to make payments to the ABS investors. Moreover, bankruptcy remoteness insures that ABS investors can obtain clear title to the assets underlying the securitization without undergoing bankruptcy proceedings even if the SPV or the originator becomes insolvent. Hunt, Stanton and Wallace (2011) show that by violating legal registration requirements, the presence of MERS may violate the "true sale" requirements necessary to secure bankruptcy remoteness.

[10] We consider a loan to be delinquent if CoreLogic specifies its status as 90 days delinquent and there are no cash flows in the following months. Thus, an additional three months should be added to our descriptive statistics in order to determine the length of time from the date at which the loan first became delinquent.

findings reveal that the filing of a lost documentation affidavit significantly reduces the likelihood that a troubled mortgage will remain in limbo.

We also examine the length of time each loan spends in each state using survival analysis. Our results are robust to the presence of lost documentation affidavits, robo-signers and MERS, consistent with the *operational risk hypothesis*. We found that a 10% increase in the presence of MERS in county-level foreclosures increases the length of time a loan spends in limbo by around 10 months. Moreover, larger-value mortgages take longer to become delinquent, but once delinquent remain in limbo longer, such that each 1% increase in loan value increases the time spent in limbo by about 4%. Survival analysis findings are generally inconsistent with the *bank capital constraint hypothesis* and the *bottleneck hypothesis*.

The paper is organized as follows. Section 2 describes our unique database comprised of all legal entries recorded in Florida's official county records. Because of the uniqueness of this database, we provide detailed descriptive statistics to measure the incidence of current, resolved and limbo loans. Section 3 analyzes the likelihood that loans remain in limbo using an ordered logit model to test our three hypotheses. In Section 4, we use survival analysis to analyze the length of time a loan spends in limbo, with robustness checks provided in Section 5. Finally, Section 6 offers conclusions and policy implications.

## 2. The Legal Environment for Mortgages in the State of Florida

All property transactions are governed by the legal code of the state in which the property is located. Since our database is limited to properties in the State of Florida, this section briefly reviews the legal steps in Florida's mortgage foreclosure process.

The first step in the foreclosure process involves the filing of the Lis Pendens – which means "litigation pending." This denotes that the lender has declared the borrower to be in

default on the mortgage. This filing entitles the lender to accelerate the mortgage and demand full payment of the balance owed. The Clerk of the Court records the Lis Pendens in the public record, and forwards a Summons and Complaint to the borrower (typically served by the County Sheriff or process server). The borrower has 20 days from the date of the receipt of the Summons to file an Answer. At the end of this period, if the borrower does not file an Answer, the court can enter a default judgment, which forfeits the borrower's right to contest the foreclosure. If an Answer is filed, then a preliminary hearing is held.

If the borrower does not file an Answer or if the judge rules against the borrower at the preliminary hearing, the lender will then file a motion for a Summary Judgment hearing. Upon hearing the facts of the case, if a Final Summary Judgment is entered in favor of the lender, the judge will set a foreclosure sale date and specify the terms of the foreclosure sale. For example, the judge may require that the foreclosure sale be publicized via a legal advertisement or newspaper notice. It is the lender's responsibility to meet the court's terms. After the foreclosure sale takes place, the court verifies that the sale terms have been met. If the terms of the sale order have been satisfied, then ownership of the property legally transfers from the borrower to the buyer/lender upon the filing of a certificate of title. Only then is the foreclosure case fully resolved, and the property actually changes hands. At any point in this process, the borrower can file motions with the court to stay the foreclosure proceedings. Moreover, the borrower and lender can come to terms and request that the case be dismissed.

### *2.1 The Subprime Crisis in Florida*

In 2007, the U.S. experienced a mortgage crisis that proliferated to global financial markets. While the collapse of the subprime market was felt across all states in United States, these problems were most severe in areas that experienced housing booms. Large coastal states

such as California and Florida were significant epicenters of these housing problems responsible for a substantial increase in home foreclosures nationwide.

To more closely investigate subprime problems in Florida, we utilize the CoreLogic database to generate a sample of first lien mortgages on 1-4 family homes. Most of the loans in CoreLogic are subprime credits, although the database occasionally includes alt-A and jumbo loans. Our analysis focuses on loans originated during the 2004-2008 period and were subsequently securitized in non-agency mortgage-backed market.[11] The database provides some information on borrower characteristics (e.g., FICO score), and loan terms (e.g., loan to value, LTV), as well as traces the payment history and performance status of each loan. We examine the history of each loan from origination until December 2010.

Restricting our analysis to mortgages borrowed in the State of Florida, we obtain a sample of 512,392 mortgages with a total origination amount of $113.6 billion. Using the CoreLogic delinquency status variable as of December 2010, we classify these loans into three groups: (1) current loans, (2) resolved delinquent/foreclosed loans (mortgages that entered and exited the foreclosure process through resolution via property sale, modification or refinancing) and (3) limbo loans, i.e., unresolved delinquent loans. The last category of limbo loans is further broken into two subgroups: (A) limbo loans that transitioned into foreclosure and (B) non-foreclosure limbo loans (that is, loans that have stopped paying for 90 days but have not yet moved into foreclosure).

**Table 1 around Here**

The top panel in Table 1 provides descriptive statistics of our sample in terms of the number of loans, whereas the bottom panel describes the data using loan values. The table demonstrates the severity of the subprime problems in Florida with only 55.2% in terms of value

[11] On their website, CoreLogic claims to have 97% of the mortgage loans in non-agency securitizations.

(58.3% in terms of number) of loans classified as current as of the end of 2010. Out of the remaining loans, 22.9% of the value of the loans in the Florida sample was classified as resolved. The limbo loan category amounts to $24.7 billion (21.7%) of the total value of the mortgages in our sample. Out of these unresolved limbo loans, 88,614 mortgages valued at $21.6 billion (representing 19.07% of the total value of the mortgages) were in foreclosure limbo, while 2.7% ($3 billion in value) of the Florida sample remained unresolved in delinquency (i.e., remained in non-foreclosure limbo).

The bottom panel of Table 1 shows that the subset of unresolved delinquent mortgages has been in foreclosure limbo for an average of 25.93 months, while non-foreclosed limbo loans have been in limbo for an average of 11.28 months. In contrast, foreclosure resolutions average 18.78 months for the resolved foreclosure group, which is statistically significantly less than the average length of time already spent in limbo foreclosure. Indicating the vintage of origination, limbo loans are older than either current or resolved loans. The findings reveal that the average age of limbo loans is 53.3 months whereas the average age for current (resolved foreclosure) loans is 30 (35.1) months. These findings suggest that limbo loans were likely to be originated during the period of extremely lax credit standards (2006 to first half of 2007), whereas the mortgages that were either resolved or not delinquent were more likely to be originated after the start of the financial crisis in the summer of 2007.

Table 2 classifies the sample of subprime loans in Florida by year of mortgage origination. The deterioration in lending standards is clearly visible. The bottom panel of Table 2 shows that 90.4% of the mortgages originated in 2004 were current as of the end of 2010. This percentage declines monotonically over the 2005-2007 period, and only increases in 2008, possibly indicating a slight improvement in lending standards during 2008 (although there were

only 129 originated in 2008). Further, the proportion of limbo loans increases dramatically for mortgages originated in later years during the 2004-2008 period despite the substantial increase in mortgage foreclosures over the 2004-2007 period. Table 2 reveals that 5.2% of 2004 vintage mortgages remained in limbo as of the end of the sample period. In contrast, this proportion increases to 14.4% for mortgages originated in 2005, 27.5% for 2006 vintage mortgages, 34.9% for 2007 vintage mortgages and 50.7% for mortgages originated in 2008.

In each year except 2008 originations, we observe an increased incidence of foreclosure resolutions: 4.4% in 2004, 14.5% in 2005, 31.6% in 2006, and to 33.6% in 2007. However, the increased delinquency rate experienced on the 2005- 2007 vintage mortgages was divided fairly equally between resolved foreclosures and limbo loans in each of the years, suggesting that delinquent 2005-2007 vintage loans have approximately the same likelihood of being resolved in foreclosure as being left in limbo. Moreover, the increase in limbo loans over the 2005-2007 vintage years applies to both non-foreclosure and foreclosure limbo loan groups, suggesting that the problem is not limited to longer foreclosure periods. Banks appear to be increasingly reluctant to resolve delinquencies for loans of more recent origination vintages.

**Table 2 around Here**

Although the mortgage delinquency problem is pervasive throughout the State of Florida, the concentrated distribution of limbo loans across the entire state of Florida is shown in Figure 1. For example, 17.7% of the mortgages in our sample (totaling $20.148 billion) were originated in Miami-Dade county located in the southeast corner of the state. Limbo loans from Miami-Dade accounted for 17.8% of the total limbo loans in the sample, as well as 17.7% (17.8%) of the current (resolved delinquent) loans in the sample. After (and just north of) Miami-Dade county, the next largest county is Broward, with 14.3% of all mortgages and 14.3% of all limbo

loans. The third largest county is Palm Beach, with 7.9% of all mortgages and 8.0% of all limbo loans. The top three counties in terms of mortgage origination value account for a total of 40.1% of the limbo loans in our sample.

**Insert Figure 1 around Here**

The mortgage origination market in Florida was dominated by the major mortgage banking firms (each with more than 5% of originations in our sample): Countrywide, Argent, New Century, Fremont, First Franklin and Option One. Servicing is also highly concentrated in Florida, with Countrywide managing 11.1% of the mortgages in the sample. The top three servicers (Countrywide, Wells Fargo and EMC, a division of Bear Stearns) controlled 24.7% of the servicing in the sample.

*2.2 The Legalprise Florida Database*

Descriptive statistics obtained using the CoreLogic database suggest that limbo loans are a substantial problem, impacting around one fifth of Florida subprime mortgages originated from 2004 to 2008. This implies that, as of December 2010, around $24.8 billion of subprime mortgages in Florida remain in foreclosure limbo for extended periods of time or simply remain delinquent without even being entered into foreclosure proceedings. In order to differentiate among our three hypotheses explaining the limbo loan phenomenon, we must examine the legal record depicting the mortgage recording, assignment and resolution process. Legalprise has gathered these data by downloading the records of 22 counties in the State of Florida for the period of 2004-2010.

The database is divided into two components: (1) the legal docket and (2) the county records. The legal docket records every court action undertaken in any legal proceeding involving property in each county. Legal proceedings are either mortgage assignments or

foreclosures. We have data on 940,422 distinct legal proceedings.[12] Out of this total, 7.77% represent assignments, whereas the remaining 92.23% involve foreclosures. We focus on these 867,373 foreclosure records in our analysis, although we also use the assignment data in formulating control variables.

We perform analysis using the Legalprise data on a county and year basis. Privacy law prevents the disclosure of address or zip code information in the legal docket, and thus the fundamental link between the Legalprise database and the CoreLogic databases is the county in which the property is located. Since more granular geographic information is not available, we construct variables using the Legalprise database on a county and year basis. Given the heterogeneity of a particular county, this methodology should bias against finding any results.

### *2.2.1 Descriptive Statistics of the Legalprise Foreclosure Database*

The Legalprise legal docket database consists of 27,341,529 entries corresponding to each county's docket of legal proceedings. Each entry consists of a single legal action, such as the filing of a motion, the unique case number identifying the legal proceedings and the date on which the action occurred. During any given court appearance involving any specific mortgage foreclosure claim, multiple actions are recorded in the docket, each of which appears as a separate entry. Thus, over the time that a case is active, there may be dozens of individual entries with each entry corresponding to an individual legal action. The sum of these legal actions comprises the legal proceedings in each case. We specify the case as the fundamental unit of analysis in the Legalprise database. We analyze each foreclosure case by examining over time the full array of actions recorded in the legal docket for that case.

[12] We cannot rule out the possibility that more than one case is filed on a single mortgage loan. That is, if the first case was dismissed, the lender may re-file under another case number. We thus perform our analysis of the legal data using distinct cases rather than distinct loans.

Since we focus on bank incentives to foreclose on delinquent borrowers, we first separate the cases in which the borrower declared bankruptcy, since legal control passes to bankruptcy courts upon filing. That is, a declaration of bankruptcy triggers legal proceedings that are distinct from mortgage foreclosure proceedings. We then classify the remaining cases into three foreclosure categories: (1) resolved cases, (2) dismissed cases and (3) unresolved cases. In order to classify the non-bankrupt foreclosure cases into these three categories, we create a list of keywords that denote either resolution or dismissal. Since each county (and indeed, each clerk) records the legal proceedings slightly differently, we manually read through hundreds of cases to construct a classification algorithm based on a keyword list (see Appendix Table 1). The algorithm involves reading through the record for each case starting from the most recent (last) entry. When one of the designated keywords is reached, we conditionally classify the case. Then we check to make sure that there was no reversal or cancellation of that classification in the entries following the keyword entry date using the reversal and cancellation keywords. If there is no cancellation, we retain the classification. If a case cannot be classified as either resolved or dismissed, it is grouped into the unresolved category. Details regarding this classification algorithm are found in Appendix 1.

**Insert Table 3 around here**

Table 3 shows the results of the classification process. There are 198,346 resolved cases, comprising 22.9% of the total foreclosure cases.[13] There are 166,726 dismissed cases, comprising 19.2% of the total. The number of unresolved cases is 502,301, amounting to 57.9% of the cases. Table 3 also shows that the mean (median) time to resolution is 453 (398) calendar days. This is substantially shorter than the 35 month median resolution period in the CoreLogic database (see Table 1). Since CoreLogic focuses on subprime loans, whereas the Legalprise

[13] The Legalprise legal docket database does not report the mortgage value.

database includes all mortgage foreclosures, it is reasonable that the resolution times may differ substantially across the databases. Moreover, the shorter median resolution period in the Legalprise database reflects a delay between delinquency and the initiation of legal action (when the observation first enters the Legalprise database).

In order to describe the time series of foreclosure cases in the Legalprise database, we classify cases by the year in which the first legal entry occurred.[14] That is, Table 3 presents descriptive statistics of the three classifications – resolved cases in Panel A, dismissed cases in Panel B, and unresolved cases in Panel C – according to the year that the mortgaged property first entered into foreclosure. Panel C shows that the unresolved foreclosures filed in 2008 (2009) were in limbo an average of 880 (586) days as of December 2010. In contrast, foreclosures filed in 2008 (2009) took an average of 439 (284) days to be dismissed or 514 (383) days to be resolved. Thus, the unresolved foreclosures filed in 2008 and 2009 were in limbo for extended time periods that exceeded average resolution time requirements.

One of the three explanations we have advanced to explain the limbo loan phenomenon is the *operational risk hypothesis* in which we hypothesize that missing documentation has impeded the resolution of problem loans. In order to develop a variable that will be used to measure this, we consider lost document affidavits that are filed during foreclosure proceedings. Florida is a judicial state, requiring that the original note and title be filed during legal proceedings leading to foreclosure. When the lender (the plaintiff) does not have the proper documentation, an affidavit is filed with the court. We identify these affidavits using keywords (listed in Appendix Table 1) that are associated with lost documents across different county dockets. Table 4 shows that 141,137 cases (representing 16.27% of all foreclosure cases)

[14] We do not have data on the year of origination of the mortgages that are the subject of the legal action, only the year in which the foreclosure case was filed.

included some lost document affidavit with most of the lost document affidavits filed in 2008 and 2009. This is likely to understate the extent of the lost documentation problem, since some courts in Florida waived the requirement.[15]

**Insert Tables 4 and 5 around here**

The legal records of all mortgage transactions and legal proceedings that formulate the Legalprise database are entered into each county's database manually by county clerks. This process is cumbersome and costly. MERS was created to circumvent this process. Table 5 shows the incidence of MERS participation in both assignments and foreclosures. Out of the total number of foreclosures, 7.34% (63,652 cases) recorded MERS participation. Out of the total cases reporting lost document affidavits, 12.92% reported MERS participation. Overall, 92% of the unresolved foreclosures involving MERS were filed in 2008, 2009 or 2010. Moreover, 86.64% of the foreclosure cases with lost documentations that involved MERS were filed in 2007, 2008 or 2009. Panel C of Table 5 shows that 40.65% (42.07%) of foreclosures involving MERS were resolved (unresolved), with 17.28% of MERS foreclosures dismissed. In 2009 (2010), 59.3% (81.33%) of foreclosures involving MERS were unresolved.

In October 2010, the financial press reported a phenomenon dubbed "robo-signing" by publishing examples of mortgage affidavits purportedly signed by the same individual with markedly different signatures. This led to an investigation, which revealed that unscrupulous legal processing firms were hiring individuals to repeatedly sign documents without ascertaining

[15] For example, overwhelmed courts in Florida assigned foreclosures to retired judges responsible for "rocket docket" foreclosures that resolved cases in as little as 15 seconds. See M. Corkery, "A Florida Court 'Rocket Docket' Blasts Through Foreclosure Cases," *Wall Street Journal Online*, February 18, 2009, http://online.wsj.com/article/SB123491755140004565.html. The rocket docket was discontinued in May 2011 in the face of legal challenges brought by the ACLU.

the veracity of the claims in the affidavits. A list of common robo-signers identified in the press is provided in Appendix Table 2.[16] We utilize this list to test the *operational risk hypothesis*.

## 3. A Multinomial Logit Model Specification

The first phase of our empirical analysis examines the likelihood that a mortgage loan would remain in limbo. We model the path-dependent decision tree in which all loans are defined as current upon origination, but eventually (as of December 2010 in our analysis) can end up in one of four states: (1) Current, (2) Delinquency, (3) Foreclosure, and (4) Resolved. The ordered logit model examines the probability that a loan will be classified into each one of the four possible states. More formally, consider the following specification:

$$y_i^* = x_{i\bullet}\beta + \varepsilon_i . \tag{1}$$

The dependent variable $y_i^*$ is a latent index measuring the underlying default risks of the mortgage; $x_{i\bullet}$ is a vector of covariates; and $\varepsilon_i$ represents the random error term. Loans with higher latent index values are more likely to transition into delinquency, foreclosure, and resolution (via property sale, refinancing, or modification), and therefore, less likely to remain in limbo. We specify four possible mortgage outcomes j such that:

$$y_i = j \quad \text{if} \quad \theta_{j-1} < y_i^* \le \theta_j \quad j = 1,\ldots,4 \tag{2}$$

A current mortgage is denoted as j=1 in the model. The loan may proceed to delinquency (j=2), which is classified in the CoreLogic database as 90 days delinquent. The next stage in the ordered logit model (j=3) is the CoreLogic classification that the loan is in foreclosure. The final outcome (j=4) is resolution in which either the lender repossesses and/or resells the property, or

[16] In July 2011, we obtained the list of robo-signers from Kate Berry, a reporter for *American Banker*. However, the identities of the most egregious robo-signers were not revealed until after December 2010, the end of our sample period.

the loan is refinanced and/or modified. The ordered logit efficiently captures the probability of the transition decision through each of the states j=1,…,4.[17]

The focus of the multinomial logit model is the probability of transitioning to one of the nonperformance states $P(y_1 = j \mid x_{i\bullet}, \beta)$ from the current state. This transition probability is inversely related to the probability that a loan remains in limbo. By definition, a limbo mortgage is any loan that unexpectedly fails to resolve through delinquency, foreclosure or resolution. In the ordered logit framework, a bank can hold a loan in limbo by slowing down the transition at any phase of insolvency. That is, a delay can occur when the loan is delinquent, foreclosed, or even when it is current as banks may try to keep it from falling into delinquency.[18] Thus, $x_{i\bullet}$ comprises the variables (obtained from both CoreLogic and Legalprise) hypothesized to be related to the likelihood that a loan remains in limbo. A negative (positive) coefficient denotes a variable that is correlated to a greater (lower) likelihood that the loan will remain in limbo, i.e., a lower (greater) probability that the loan transitions through each of the stages to final resolution.[19]

### *3.1 Explanatory Variables*

To derive the variables in the explanatory vector $x_{i\bullet}$ of the ordered logit model equations (1) and (2), we merge the CoreLogic database of individual loans with the county by county data

[17] Although there are a handful cases in which the loans bypass particular states, i.e., jump from delinquency to resolution, most loans transition in an orderly way. It should be noted that sometimes loans might transition in and out of delinquency/foreclosure to being current. Using the CoreLogic "last payment" variable, however, we are able to identify the final delinquency event (point of no return) after which the loan does not return to a current state. Because $y_i^*$ is an unbounded continuous index, it follows that $\theta_0 = -\infty$ and $\theta_4 = \infty$.

[18] Banks must follow accounting rules that limit their ability to delay the resolution process. However, the bank has discretion over the decision to bring a current loan into delinquency, a delinquent loan into foreclosure (i.e., non-foreclosure limbo) and whether to resolve a foreclosure case (foreclosure limbo).

[19] It is not feasible to correct for any clustering error effects at the borrower level because our sample is cross-sectional. Nevertheless, the problems of overstating the standard errors are still possible because there are underlying strata in our sample. To mitigate these error clustering problems, all parameter estimate standard errors were corrected for lender-level clustering effects using a robust-variance estimation methodology.

from Legalprise. For each individual loan in the CoreLogic database, we merge the Legalprise variable by county and by the year in which the loan was originated. This combination creates a unique database of individual loans, each of which contains legal docket descriptive information for the county in which the loan was made and for the year in which the loan was originated.[20]

3.1.1 Basic Model Explanatory Variables

Merton (1974) introduced an options-theoretic structural model of default in which a loan is modeled as a put option on the underlying asset value. In the case of mortgage loans, the choice of default can be modeled as a put option on the value of the house, such that the homeowner has the right to put back the house to the lender at the current balance of the mortgage. The value of this option is more valuable when the home's value is less than the current balance (i.e., negative house equity). Deng, Quigley and Van Order (2000) and Bennett, Peach and Peristiani (2001) have empirically shown that the presence of negative equity is a key determinant in the decision to prepay or default. The impact of negative equity on the willingness to default is captured in our model by the loan-to-value (the variable LTV) at the time of origination. Higher LTV loans are expected to exhibit a greater likelihood of default *ceteris paribus*.

The intensity of negative equity is also magnified by housing price appreciation (the variable HOUSE_PRICE_CHANGE), measured by the annual change in housing prices in Florida. We also incorporate the impact of borrower creditworthiness using the variable FICO, which denotes the borrower's FICO score at origination. The mortgage spread (variable denoted SPREAD), defined as the difference between the original mortgage rate and a maturity matched Treasury rate, is typically important in the decision to refinance, as well as an indicator of a

[20] Since we do not have year of origination in the Legalprise database, we utilize the year the loan first appears in the legal docket as the year merging variable.

borrower's creditworthiness. We also control for the size of the loan by including the logarithm of the mortgage amount at the time of origination (SIZE). The variable UNEMPLOYMENT is defined as the unemployment rate in Florida in each year. In the ordered logit model estimation, the HOUSE_PRICE_CHANGE and UNEMPLOYMENT variables are estimated as the average annual change from each loan's year of origination to 2010 (the end of our sample period). In the survival analysis, these variables represent the average annual change from each loan's origination year to the end of the state period.

The propensity to default on a mortgage also depends on the age of the loan (AGE), measured from the time of origination. On average, the empirical hazard of mortgage default rises with loan age at a declining rate, since entrenched borrowers may have a lower probability of default *ceteris paribus*. To capture this nonlinear path in hazard rates over the life of the loan, we include a quadratic specification of AGE.[21] In addition, our basic ordered logit model includes year dummy controls based on the date of loan origination.

3.1.2 Explanatory Variables for Hypothesis Testing

Additional explanatory variables constructed from both CoreLogic and Legalprise data are added to the basic model in order to test our three specific hypotheses regarding the limbo loan phenomenon.[22] In Florida, the first legal step in the foreclosure process is the default judgment. Thus, a bunching of default judgments in a particular county during a particular year may create a resolution bottleneck. To test this *bottleneck hypothesis*, we define DEFAULT as the number of default judgments entered as a percent of each county's total foreclosures in any

[21] Shumway (2001) demonstrates that the inclusion of controls for loan age in a logistic regression framework is equivalent to a proportional hazard model.

[22] Because of concerns about multicollinearity, we also estimated the model with each of the Legalprise variables in a separate regression, with no qualitative change in our results.

given year. As a further test of the *bottleneck hypothesis*, we utilize the explanatory variable FORECLOSURE, defined as the incidence of foreclosure cases in each county in each year.

Since a declaration of bankruptcy triggers a legal proceeding that is distinct from the real estate foreclosure process, bankruptcy filings may alleviate bottlenecks in mortgage resolution by taking delinquent loans out of the foreclosure pool. Thus, we define BANKRUPTCY to be the percentage of bankruptcy filings as a percentage of total foreclosures in each county in each year.

We test the *bank capital constraint hypothesis* by including a bank-specific explanatory variable measuring the lender's equity-to-assets ratio (BANKCAPITAL). To further explore the premise that banks with the largest nonperforming limbo loan portfolio face regulatory capital constraints, we include a variable consisting of the ratio of total loan charge-offs as a fraction of total assets (CHARGEOFFS) to measure the dynamic aspects of growing capital deficiencies.

We test the *operational risk hypothesis* using an explanatory variable denoted LOSTDOC, defined as the number of lost documentation affidavits filed as a percent of total foreclosures in a given county in a given year. We utilize a list of names of prolific robo-signers to create a variable denoted SIGNER, which is computed as the percent of foreclosure cases with mention of at least one of the names on the frequently-used robo-signer list. Another indication of operational problems is the presence of MERS in either a mortgage assignment or foreclosure. We define MERS_ASSIGNMENT (MERS_FORECLOSURE) as the number of instances MERS appears in an assignment (foreclosure) case in the Florida legal docket as a percent of total county/year assignments (foreclosures).

Since foreclosure dismissals are often triggered by operational problems which may induce the voluntary withdrawal of the lender's claim, we define the variable DISMISSED as the

percentage of dismissed cases out of each county's total number of foreclosure cases in any given year. We also define the length of time between the first entry in the legal docket and the final entry. For cases resolved with a transfer of title, we construct LENGTH_RESOLVED to be the natural log of the average length of time (in months) from the first docket entry until the certificate of title entry date.

Table 6 presents summary statistics for all the regression variables included in the ordered logit model. The sample available for estimating the ordered logit and survival models is smaller than the full CoreLogic sample size because the Legalprise database does not span the entire set of counties in Florida. Moreover, the sample size declines further because only about 41% of the loans were granted by commercial bank lenders with available balance sheet information from Call Reports required to test the *bank capital constraint hypothesis*.

**Insert Table 6 around here**

Summary statistics provided in Table 6 reveal that the average age of the mortgage loan in our sample is 46 months, with an average FICO score of 690, average loan LTV of 81.66% and an average loan spread (over comparable maturity US Treasury rate) of 4.1%. Focusing on the call report variables measuring a bank's financial strength, we find that the median equity-to-assets and charge-offs-to-assets ratios are about 17.5%, and 0.058%, respectively. The economic decline in the state of Florida during our sample period is indicated by an average annual housing price decline of 4.1% and an average annual unemployment rate of 6.2%. The importance of housing price declines in understanding mortgage delinquencies is indicated in Table 6 by the average value of the HOUSE_PRICE_CHANGE variable of -10.5% (-10.3%) for Level 1 (2) mortgages that are delinquent (foreclosed).

The average foreclosure rate (across Florida counties) shown in Table 6 is 4.3%. Default judgments were granted in 48% of all foreclosures on average across counties, and bankruptcies declared in 7.2% of all Florida foreclosures in our sample. Lost document affidavits were filed in 11.8% of the cases, and MERS participated in 7.1% (1.6%) of the foreclosures (assignments), whereas 19.5% of the foreclosure cases were dismissed. The average time from first entry to title resolution was 403 days ($e^{6.09}$).

*3.2 Results of the Ordered Logit Analysis*

The results of the estimation of the ordered logit model are presented in Table 7 and are robust across model specifications. The significant quadratic coefficients of AGE reveal a nonlinear hazard function for mortgage default. These results also suggest that mortgage loans of later vintages are more likely to remain in limbo (negative and significant coefficients on AGE), but this effect diminishes over time (positive and significant coefficients on $AGE^2$). This is consistent with descriptive statistics that show higher delinquency rates for vintage 2006 and 2007 loans as compared to 2004, 2005 and 2008.

**Insert Table 7 around here**

The coefficients for variables measuring loan risk such as SPREAD, LTV and SIZE are all positive and significant, indicating higher credit risk exposure and greater resolution likelihood for riskier high-spread, larger loan-to-value and bigger balance mortgages. Thus, a riskier loan has a greater likelihood that it will be processed through to foreclosure and resolution, and thus a smaller chance that it will remain in limbo. Similarly, the coefficients on the FICO variable are negative and significant, indicating that banks are more likely to allow mortgages issued to high FICO borrowers to remain in limbo.

To better understand the economic significance of the ordered logit model results, Table 7 presents the odds ratio for each explanatory variable.[23] Using the all variables specification, a one-standard-deviation increase in loan spreads (from Table 6, an increase of 1.521%) is associated with a 29.6% increase in the probability that a mortgage will become delinquent and progress through to final resolution (odds ratio of 1.296). Similarly, a one-standard-deviation increase in LTV (corresponding to about a 9.2% rise in LTV) is associated with a 28.8% increase in the probability that a loan will move through the delinquency and resolution process. In contrast, a one-standard-deviation increase in FICO (roughly a 62 point drop in the FICO score) is associated with a 29% decrease in the probability that the loan transitions to delinquency and beyond (0.712 odds ratio).

The negative coefficients on the HOUSE_PRICE_CHANGE and UNEMPLOYMENT variables demonstrate that more loans remain in limbo when both housing prices and unemployment rates increase. However, the UNEMPLOYMENT variable was only significant in the all variables regression, whereas the HOUSE_PRICE_CHANGE variable was more robust for a subset of the specifications.

### 3.2.1 Hypothesis Testing Using the Ordered Logit Model

We isolate the explanatory variables designed to test each of our three hypotheses in the columns of Table 7. The *bottleneck hypothesis* is tested using the DEFAULT, FORECLOSURE, and BANKRUPTCY variables. Only BANKRUPTCY is statistically significant in the hypothesis test model, with a negative coefficient that suggests that the more bankruptcies in a particular county, the less likely the bank will bring a delinquent loan to foreclosure and

[23] The odds ratios are defined as follows: $\text{Odds Ratio} = \frac{\text{P(Loan Event} / \bar{x} + \text{std}_x)}{\text{P(Loan Event} / \bar{x})}$.

resolution, a result inconsistent with the *bottleneck hypothesis*. The coefficient on FORECLOSURE is consistent with the *bottleneck hypothesis* in the all variables regression (the more foreclosures in a county during a particular year, the greater likelihood that a loan remains in limbo), but insignificant in the hypothesis test regression.

The *bank capital constraint hypothesis* is tested using the CHARGEOFFS and BANKCAPITAL variables. The coefficient of CHARGEOFFS has the expected negative sign, but is not statistically significant. The statistically significant negative coefficient estimate on the BANKCAPITAL variable indicates that the higher the bank's capital ratio, the lower the likelihood that the loan will be processed to foreclosure and resolution. Undercapitalized banks are, therefore, more likely to bring a troubled loan through delinquency and foreclosure to resolution. Thus, possible deficiencies in the bank's risk-adjusted capital ratio do not appear to be an impediment to resolution, a result that does not support the *bank capital constraint hypothesis*.

The last hypothesis testing model presented in Table 7 presents results of the ordered logit test of the *operational risk hypothesis.* The positive and significant sign for the LOSTDOC variable shows that delinquent loans are more likely to progress through the foreclosure process to resolution in counties with a higher fraction of filed lost document affidavit. The odds ratio presented in the last column of Table 7 (1.103) shows that a one-standard-deviation increase in lost documentation affidavits (corresponding to a 7.1% increase) increases the likelihood that a loan will be resolved by 10.3%. For loans without such affidavits, delinquency resolution was hampered by questions about the availability of loan documentation. We further tested the validity of the lost document affidavits using the SIGNER variable, and found positive and significant results. Since the identities of the discredited robo-signers were not made public

during our sample period, this result suggests that robo-signing was somewhat effective in resolving delinquencies.

The negative and significant signs on the MERS_ASSIGNMENT variable suggest that the presence of MERS makes a delinquent loan more likely to end up in limbo (either foreclosure or non-foreclosure limbo). Indeed, the odds ratio presented in the last column of Table 7 (0.902) indicates that a one-standard-deviation increase in MERS participation (2.1% from Table 6) is associated with a 9.8% increase in the likelihood that a loan will remain limbo.

In addition, the negative and significant coefficient on the DISMISSED variable suggests that the greater incidence of foreclosure case dismissals (resulting from legal and operational problems) is associated with a greater likelihood that a loan remains in limbo. A one-standard-deviation increase (14.2%) in dismissals is associated with a 9.4% increase in the probability that a loan remains in limbo. Finally, the coefficient on the LENGTH_RESOLVED variable is positive although insignificant, suggesting that the longer time it takes for foreclosure cases to be resolved in a particular county, the more likely that the loan will proceed to resolution. The probability of a limbo classification, either foreclosure or non-foreclosure limbo, decreases as the length of foreclosure proceedings increases. This result is inconsistent with the *bottleneck hypothesis* since lengthy foreclosure proceeds would be expected to increase the probability of a loan remaining in limbo as overcrowded court dockets stress resolution resources. In contrast, the result is consistent with the *operational risk hypothesis* since documentation problems and other operational lapses would require longer foreclosure proceedings for the loan to be resolved.

## 4. Survival Models of the Length of Time within Each Transition State

The ordered logit model analyzes the likelihood that any given loan will progress through the four specified states ranging from current to delinquent to foreclosure to final resolution. In

this section, we use a survival model to analyze the length of time the loan spends in each of these states. We utilize survival analysis to conduct pairwise comparisons of the number of months spent in each transition state. In each pair of outcomes, there is a terminal state (e.g., delinquency, foreclosure or resolution) and a censored state in which the loan remains in limbo (i.e., in a non-terminal state). We conduct the analysis on three levels of the decision tree shown in Figure 2. Level 1 represents the bottom of the decision tree shown in Figure 2, examining the choice between foreclosure limbo (censored state=3) and foreclosure resolution (terminal state=4). The middle level of the decision tree, Level 2 represents the choice between non-foreclosure limbo delinquency (censored state=2) and foreclosure (terminal state=3). Finally, Level 3 represents the choice between current and delinquent states, as shown in the top branch of the tree in Figure 2. The terminal event in Level 3 is delinquency (terminal state=2) and the alternative is when the loan remains current (censored state=1). Level 3 is very similar to the ordered logit specification with exception that the three termination choices now have to transition through delinquency.

**Insert Figure 2 Around Here**

The dependent variable in the survival model is the duration or length of time (T) in the corresponding four states outlined by the decision tree shown in Figure 2. For each of the terminal states (resolution in Level 1, foreclosure in Level 2 and delinquency in Level3), $T_{ji}$ represents the number of months in the state j for loan i. For the censored states (foreclosure in Level 1, delinquency in Level 2 and current in Level 3), the length of time in the state is either the number of months spent within that state or the number of months from the entrance of the loan into the given state until December 2010, the end of our sample period.

More formally, the survival model used in our analysis can be simply defined in log-linear form as follows:

$$\log(T_{ji}) = x_{ji\bullet}\beta + \theta\varepsilon_{ji}, \quad (3)$$

where $x_{ji\bullet}$ represents the same vector of covariates used in the ordered logit model equations (1) and (2), and $\theta$ is a variance scale parameter that depends on the particular distribution used for estimation.[24] The above log-linear specification assumes an accelerated failure time (AFT) structure (see Cox and Oakes (1983)). The AFT model asserts that the influence of the independent variables on two time events is multiplicative. Typically, the scale is $\exp(x_{i\bullet}\beta)$ such that, if the baseline event (corresponding to zero values for the covariates) is $T_0$, then $T = \exp(x_{i\bullet}\beta)T_0$. A logarithmic transformation of this multiplicative relationship provides the log-linear specification. Because survival outcomes are censored, the AFT model is estimated using a maximum likelihood approach determined by the survival distribution of the random error variable $\varepsilon_i$. An empirical analysis of the length of time the mortgage remains in a given state across the different levels of decision tree generally reveals a kernel density estimate that most often resembles a fat-tail log-normal distribution. As a result, we assume a log-normal distribution for the maximum likelihood estimation.

To avoid the possible overstatement of the statistical significance of the explanatory variable coefficients, our estimates are again modified to assume some form of clustering at the bank (lender) level. Because of the non-linear nature of the maximum likelihood, we calculate

[24] We use the same explanatory variables for the ordered logit and survival models since the three levels of the survival model are collectively related to the ordered logit model. In fact, a nested logit approach would in theory offer a more appealing way to estimate three-level mortgage termination decision. Unfortunately, the nested logit is more complex to estimate because of its convoluted maximum likelihood structure. The task of obtaining convergence for full information maximum likelihood version of this nested model (in which parameters are assumed to change at each level of the decision tree) was even more difficult in our framework given our large sample size.

this variance correction using a two-step maximum likelihood estimation approach. In the first stage, we use the maximum likelihood estimates to compute residuals between actual and forecasted values of duration. The second stage uses the bank-level standard deviation of these residuals to derive a modified weighted maximum likelihood estimate.

### *4.1 Results of the Survival Analysis*

Table 8 presents the results of the estimation of the survival model for all three levels of the decision tree. Panel A of Table 8 compares current to delinquent loans (Level 3); Panel B compares delinquency to foreclosure (Level 2); and Panel C compares the foreclosure to resolution decisions (Level 1). For each of the levels of analysis, we utilize the same variables as in the ordered logit model to test each of our three hypotheses. A positive (negative) coefficient suggests that the explanatory variable is correlated with a longer (shorter) duration in non-terminal state. Since the non-terminal (censored) state is the limbo state, a positive (negative) coefficient is associated with more (less) time in limbo. For our sample, Table 6 shows that the average time a mortgage is current (in delinquency) at Level 3 is 43.54 (27.83) months. At Level 2, the average time a mortgage is in non-foreclosure limbo (foreclosure) is 18.65 (16.48) months. Finally, at Level 1, the length of time in foreclosure limbo (time to final resolution) is an average of 18.76 (13.62) months.

**Insert Table 8 Around Here**

The analysis at Level 3 is inherently similar to the ordered logit model because it estimates the transition of a loan from current to non-performing. Consistent with the ordered logit results, the results of the Level 3 survival analysis (in Panel A of Table 8) show that lower risk loans (higher FICO and lower LTV) are significantly associated with longer periods during which the loan is current and therefore a lower likelihood of default. Levels 2 and 1 examine

uniquely different termination choices focusing on the intermediate decisions to move from delinquency to foreclosure to eventual resolution. In contrast to Level 3, which is strongly influenced by the embedded put option available to borrowers, the decision to transition a loan to resolution is determined by the lender's willingness to move the loan along these states.

The evidence reveals that the likelihood of resolution is not greatly affected by loan characteristics. The coefficients on FICO are statistically insignificant at Level 2 and Level 1 (Table 8, Panel B and C), suggesting that FICO delinquent loans do not move more quickly into foreclosure and final resolution. However, the survival model results indicate that higher LTV riskier loans are more likely to become delinquent, and once they enter that state, are more likely to progress to foreclosure and resolution, thereby spending less time in foreclosure limbo. The positive coefficient of SPREAD at both Levels 1 and 2 indicates that riskier loans with higher spreads are more likely to remain in foreclosure limbo longer.

The negative and significant coefficients of the loan SIZE at Level 3 (Table 8, Panel A) suggest that larger loans are more likelihood to fall into delinquency. However, once they become delinquent, larger size mortgages spend significantly more time in limbo at both Level 2 (non-foreclosure delinquency limbo) and Level 1 (foreclosure limbo). Because the variable SIZE is measured by the logarithm of loan origination amount, the regression coefficients are equivalent to standard elasticity measures.[25] Thus, the parameter estimate of 0.04 for SIZE in the first column of Table 8, Panel B indicates that a 1% change in mortgage principal amount increases the duration of the delinquency limbo state by 4%. Increased unemployment rates are

[25] In particular, the impact of the independent variable is determined by $\frac{dT}{T} = \beta \frac{dx}{x}$.

also associated with longer periods in limbo at all three levels, as indicated by the positive and significant coefficients on the UNEMPLOYMENT variable.[26]

4.2.1 Hypothesis Testing Using Survival Analysis

The survival analysis results presented in Table 8 can also be used to study our three hypotheses explaining the limbo loan phenomenon. Looking at the *bottleneck hypothesis*, we find mostly robust positive and significant coefficients on the FORECLOSURE, BANKRUPTCY and DEFAULT variables in the Level 3 regressions (Table 8, Panel A), suggesting that the greater the percentage of foreclosures, bankruptcies and default judgments, the longer the loan remains current. This result is consistent with the *bottleneck hypothesis*, since banks with loans in counties with bottlenecks may be more likely to roll over a loan to keep it current in order to delay the start of the delinquency process. For example, the coefficient estimate on the DEFAULT variable (1.003) suggests that a 10% rise in a county's default judgments increases the length of time a loan remains in foreclosure limbo by around 10%.[27] Therefore, the average loan in our Level 3 delinquent (current) sample with duration of 43.54 (27.83) months would experience an additional four (three) month stay in limbo. The impact of these bottleneck-specific variables is inconsistent at Levels 1 and 2 of the mortgage termination choices.

The survival model results on the effect of the CHARGEOFFS variable are consistent with the *bank capital constraint hypothesis*. The positive, significant coefficients on

[26] The positive significant (at the 1% level) coefficients on the UNEMPLOYMENT variable in the Level 3 regressions suggest that the higher the unemployment rate, the greater the length of time that the mortgage remains current. These results are inconsistent with the economics of credit risk, which would suggest that the greater the level of macroeconomic distress (e.g., higher unemployment), the more quickly a loan will deteriorate into delinquency. An explanation of these results is that during times of high unemployment, banks roll over troubled loans in an attempt to avoid the foreclosure resolution problems, thereby keeping the loans current longer.

[27] Because the relationship between T and DEFAULT is in semi-log form, the impact of the independent variable is determined by $\frac{dT}{T} = \beta x$.

CHARGEOFFS in the Levels 3 and 2 regressions (Panel A and B, Table 8) reveal a longer duration in the limbo state for banks with larger amounts of real estate write-downs, suggesting that loans granted by high charge-off banks appear to spend longer time in non-foreclosure limbo. However, the BANKCAPITAL variable is positive and marginally significant at Level 3. This result indicates that better capitalized are less likely to move their problem loans toward delinquency, a finding that is inconsistent with the bank capital premise. An alternative interpretation for this weak positive link is that better capitalized banks are also more efficient risk managers having lower nonperforming loan problems. Further, BANKCAPITAL is insignificant at Levels 1 and 2, suggesting that capital strength does not influence the decision of banks to move loans through foreclosure and resolution, a result that is inconsistent with the *bank capital constraint hypothesis*.

Focusing on the *operational risk hypothesis,* the negative, significant coefficients on the LOSTDOC variables in all levels (Panels A, B and C of Table 8) imply that foreclosures involving lost document affidavits proceeded more expeditiously to loan resolution and spent less time in limbo at each level. For example, the -1.066 coefficient on the LOSTDOC variable in the Level 1 analysis (Table 8, Panel C) implies that a 10% increase in the availability of lost document affidavits reduces the average time in foreclosure limbo (18.76 months from Table 6) by around two months. Similarly, the coefficients on the SIGNER variable were negative and significant at all levels. Thus, the presence of lost document affidavits and robo-signers (as courts accepted the fraudulent affidavits during the period before the robo-signer scandal broke) is associated with faster transition to delinquency (Level 3), faster progress from delinquency to foreclosure (Level 2) and quicker resolution (Level 1). Further, the absence of lost document affidavits and robo-signers is correlated with greater time in both foreclosure limbo (Level 1) and

non-foreclosure limbo (Level 2). These results are inconsistent with a purely mechanical effect in which sloppy or missing paperwork lengthens the required resolution period, but may reflect operational malfeasance if documentation is intentionally destroyed to hide loan irregularities. Thus, prior to the robo-signing scandal that cast doubts on their veracity, lost document affidavits played a significant role in the verification of loan information so as to reduce both the likelihood and time in limbo, similar to the role of due diligence in Brown, et al. (2012).

Table 8 also shows that the presence of MERS in foreclosure proceedings is associated with operational risk problems at all three levels of the survival analysis. That is, the positive, significant coefficients on both the MERS_ASSIGNMENT and MERS_FORECLOSURE variables in Panels A, B and C of Table 8 reveal the finding that loans with MERS involvement during the foreclosure proceedings spend more time in limbo at all levels. Thus, operational problems associated with MERS increases the length of time in limbo at all stages: at the current stage (Level 3, Panel A), at the non-foreclosure delinquency stage (Level 2, Panel B) and at the foreclosure resolution stage (Level 1, Panel C). Considering the Level 1 MERS_ASSIGNMENT coefficient estimate of 2.635 from Table 8, Panel C, a 10% increase in MERS assignments increases the time in foreclosure limbo by an average of five months. In addition, the Level 1 MERS_FORECLOSURE coefficient estimate of 1.546 implies that a 10% increase in the participation of MERS in foreclosures adds around three months to the time spent in foreclosure limbo. Analogously, at Level 2 of the analysis (Panel B of Table 8), a 10% increase in MERS' presence in both assignments and foreclosures increases the time in non-foreclosure limbo by around 3.5 months.

The negative and significant coefficients on the LENGTH_RESOLVED variable at all three levels of the survival model results are consistent with shorter time periods in limbo when

foreclosure cases take longer to resolve. This result is inconsistent with the *bottleneck hypothesis*. It is consistent, however, with the *operational risk hypothesis* since operational problems extend the length of time required to resolve foreclosure proceedings. Finally, the negative and significant coefficients on DISMISSED in the Levels 1 and 2 regressions (Panels B and C of Table 8) indicate that loans remain in limbo for shorter periods of time when the fraction of dismissed cases is high. When courts carefully oversee the foreclosure process and strictly apply legal standards, dismissals increase and banks are forced to address operational problems. The converse is that when courts rubber stamp foreclosures (e.g., as done in the "rocket docket" counties in Florida), dismissals decline because of the lack of effective court oversight and operational problems are not addressed.

## 5. Robustness Checks

### *5.1 Removing Refinancings and Modifications*

In our analysis, we have classified either a refinanced or modified loan as resolved (state j=4) in addition to loans in which the underlying property was repossessed by the lender. However, modification and refinancing have very different mechanisms when compared to title resolution. For example, the borrower can exercise the option to refinance, and government programs (such as the Home Affordable Modification Program, HAMP, introduced in February 2009) may have altered bank behavior. In order to focus on lender incentives to resolve delinquent loans, we remove all mortgages that were either refinanced or modified from our sample and re-estimate the ordered logit model.[28]

**Insert Table 9 Around Here**

[28] We also re-estimated the survival model using the sample without refinancings and modifications and found support for the *operational risk hypothesis* but not for the other two hypotheses. Because of space constraints, the survival model results are available from the authors upon request.

Comparing the results of the ordered logit model in Table 9 indicates that our original results presented in Table 7 are robust. Not surprising, when refinancings and modifications are eliminated, the basic hazard function of the model becomes more non-linear (i.e., the coefficient estimate on the $AGE^2$ variable is significantly positive and larger in size in Table 9 as compared to Table 7) and the economic implications of most explanatory variables are stronger (i.e., the odds ratios are higher). In terms of hypothesis testing, both sets of ordered logit results are consistent with the *operational risk hypothesis,* but not the *bottleneck* or *bank capital constraint hypotheses.* For the restricted sample results presented in Table 9, the positive and significant coefficients on the DEFAULT variable are inconsistent with the *bottleneck hypothesis* since this result suggests that the greater the default judgment bottleneck, the less likely that a loan remains in limbo. Further, consistent with the results in Table 7, Table 9 results do not support the *bank capital constraint hypothesis,* as indicated by the negative and significant coefficient on the BANKCAPITAL variable and the insignificant coefficient on the CHARGEOFFS variable.

Consistent with our full sample results presented in Table 7, the ordered logit results presented in Table 9 support the *operational risk hypothesis.* That is, the presence of a LOSTDOC affidavit reduces the likelihood that a loan remains in limbo (significant positive coefficient), and the involvement of MERS (at the assignment level, but not at the foreclosure level) significantly increases the likelihood that a loan will remain in limbo.

## 6. Conclusions and Policy Implications

To our knowledge, this is the first paper to document the extent of the limbo loan problem. We define limbo loans as mortgages classified as 90 days delinquent that are held for extended periods of time in limbo without progressing toward resolution. Limbo loans are obviously problematic for banks and their shareholders because of the losses generated by non-

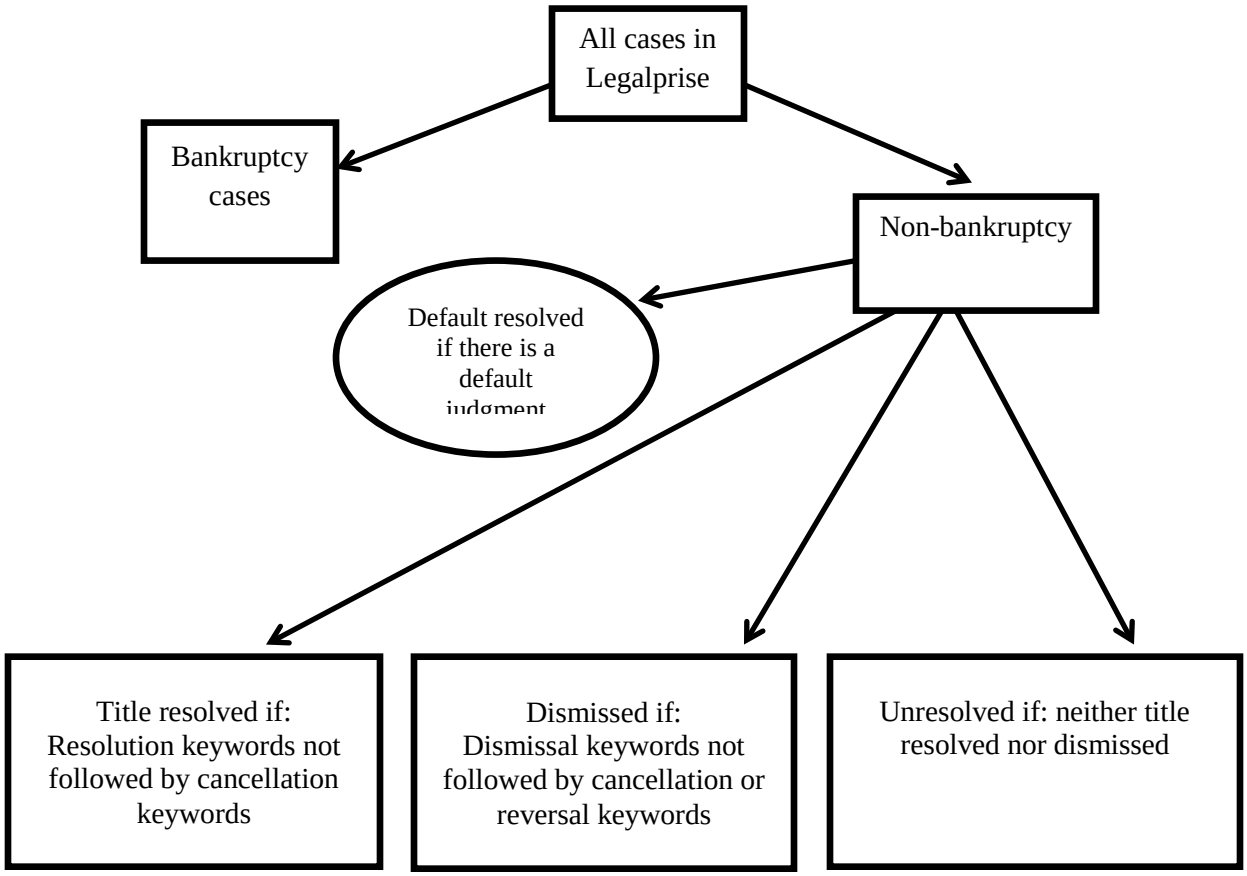
earning assets. However, the importance of limbo loans goes beyond the profitability concerns of banking firms. Indeed, the extent of the problem may explain lackluster economic conditions despite historic levels of central bank intervention and fiscal stimulus to restart the U.S. economy. Asymmetric information about the extent and incidence of limbo loans is instrumental in obstructing the issuance of private label mortgage-backed securitizations. Investors are unsure whether mortgage-backed securities contain limbo loans without property rights bundled into the deal since even effective due diligence cannot investigate the documentation on each and every loan in the securitization. Without a viable securitization channel, banks are concerned that any new loans will have to be capitalized indefinitely, and therefore, have been reluctant to use their enormous levels of liquidity to make loans, thereby stunting the lending channel stimulus to economic activity. If we are to get the economy moving, therefore, first we must tackle the challenge of limbo loans.

In this paper, we document the extent of the limbo loans problem for Florida. We find the problem to be substantial in size, impacting around $25 billion, or almost 20% of subprime mortgages as of December 2010. Importantly, we find results consistent with the *operational risk hypothesis*. Back office problems such as MERS participation and lost documentation, are shown to contribute both to the likelihood that a delinquent loan will remain in limbo, as well as to the length of time the loan remains in the limbo state. Given the costs to both the banking system and the general macro economy of the limbo loan overhang on banks' books, we establish the importance of this problem. Unfortunately, since the problem does not appear to emanate from either foreclosure capacity bottlenecks or bank capital constraints, the solution is likely to be quite protracted. The finding of results consistent with the operational risk

hypothesis suggests that until property rights are legally restored to limbo loans, the problem will remain with us.

## Appendix 1

The classification process involves the reading of the entries in the legal docket from most recent to least recent. The flow chart proceeds as follows:




Florida's foreclosure procedures specify that the borrower may lose the right to contest the foreclosure if a default judgment is entered. However, formal title to the property does not transfer from the borrower to the lender or buyer of the property until a new Certificate of Title/Sale is entered into the legal docket. This is sometimes a lengthy process. Since the foreclosure is not fully resolved until this final step occurs, we codify this condition in our resolution keywords. Resolved cases have keywords such as "CERTIFICATE OF SALE" or "CERTIFICATE OF TITLE." We classify a case as resolved if any of the resolution keywords

listed in Appendix 1 appear without being followed by a cancellation keyword. If entries including both resolution and dismissal keywords appear on the same date (with no following cancellation keywords), we codify the case as resolved.

The non-bankruptcy cases remaining after the Title Resolved cases are classified are either placed into the Dismissed or Unresolved categories. Dismissed cases have keywords such as "DISSOLVE LIS PENDENS." If a case is not resolved, we classify it as Dismissed if any of the dismissed keywords appear without being followed by either the reversal or the cancellation keywords listed in Appendix Table 1. That is, if a reversal or a cancellation keyword appears in an entry with a more recent date than the dismissal keyword, then we classify the case as Unresolved. There are cases that appear to have been dismissed, but then revert to an active state. For example, an early step in the foreclosure resolution procedure is the "NOTICE OF SALE DATE" that publicizes an impending foreclosure property sale. Thus, we denote "NOTICE OF SALE DATE" string as a reversal keyword. If any of the reversal keywords (see list in Appendix Table 1) appear in an entry with a more recent date than the dismissal keyword entry, then the case is not dismissed and we classify the case as Unresolved.

**List of Resolution Keywords**

CERTIFICATE OF SALE
CERT OF SALE
CERTIFICATE OF TITLE
CERT OF TITLE
PROOF OF SALE
PROPERTY SOLD TO PLT
PROPERTY SOLD TO PLT FOR
CERTIFICATE OF TITLE ISSUED TO PLAINTIFF
Docket_entry_type_id=36 (Denotes Certificate of Sale)
Docket entry type id=50 (Denotes Certificate of Title)
ASSIGNMENT OF MORTGAGE
ASSIGNMENT OF MTG
COFS
CERTIFICATE OF FORECLOSURE SALE
COFT
CERTIFICATE OF FORECLOSURE TITLE
Disposed by judge

**List of Dismissal Keywords**

DISMISSAL OF COUNT I or CT I
DISMISSAL OF COUNT II or CT II
DISMISSAL AS TO COUNT I or CT I
DISMISSAL AS TO COUNT II or CT II
DISMISSAL
VOLUNTARY DISMISSAL
(VOL)
DISMISSED BEFORE HEARING
Dismissed before hrg
(DB)
DISMISSED AFTER HEARING
(DA)
DISMISSING ACTION W/O PREJ
CLERK CLOSE FILE
ADMINISTRATIVELY CLOSED OUT
ACTION IS DISMISSED
DISCHARGE LIS PENDENS
DISSOLVE LIS PENDENS
DISMISS ACTION WITHOUT PREJUDICE
DISMISSED BEFORE HEARING
TO VACATE JUDGMENT DISMISS ACTION WITH PREJUDICE DISSOLVE LIS PENDENS AND TO REINSTATE THE NOTE AND MORTGAGE
JUDGMENT IS VACATED AND ACTION IS DISMISSED WITH PREJUDICE
VACATE JUDGMENT DISMISS ACTION W/PREJUDICE
DISSOLVE LIS PENDENS & RELEASE ORIG DOC'S
DISMISSING CASE
CANCELING NOTICE OF LIS PENDENS AND SETTING ASIDE FINAL SUMMARY JUDGMENT
TO VACATE JUDGMENT
DISMISS ACTION W/ PREJ
NOVD
JUDG DISMISSAL
DISCHARGING LIS PENDNES
VACATE FINAL JDGMNT & DISMISS
RELEASE/CANCEL LIS PENDENS
Docket_entry_type_id=42 (Denotes Dismissed before hearing)
Docket_entry_type_id=54 (Denotes Notice of voluntary dismissal)

**List of Cancellation Keywords**

CANCEL
AMEND
EXTEND
VACATE

**List of Reversal Keywords**

FINAL JUDGMENT FORECLOSURE
(FJFC)
SALE DATE
FORECLOSURE SALE
TITLE & DISB
WRIT OF POSSESSION (look for if WRIT was cancelled)
PROOF OF SALE
RATIFYING SETTLEMENT STIPULATION
RATIFY SETTLEMENT
PLTF IS DUE AND OWING
Docket_entry_type_id=30 (Denotes FINAL JUDGMENT FORECLOSURE)
Foreclosure Sale Fee
Notice of Sale
Proof of Publication
Docket_entry_type_id=28 (Denotes Proof of Publication)

**List of Lost Document Keywords**

LOST DOCUMENT
LOST LOAN DOCUMENT

AFFIDAVIT LOST
AFF LOST
LOST AFF
AFF AS TO TITLE W\ATT
NOT RECEIVE ORIGINAL
NO ORIGINAL
NEVER RECEIVE ORIGIN
QUIET TITLE
QUIETING TITLE
LOST ORIGIN

ORIGINAL DOC LOST
ORIGINAL LOAN DOC LOST
MISSING ORIGIN
ORIGINAL DOC MISSING
ORIGINAL LOAN DOC MISSING
MISSING DOCUMENT
DOCUMENT MISSING
DOCKET_ENTRY_TYPE_ID=38
(Denotes lost document affidavit)

**Appendix 2**
**Common Robo-Signer Names**
**Source: *The American Banker July 2011***

| | |
|---|---|
| Christine Alday | Mike Stanford |
| Elizabeth Boulton | Nura Nadarevic |
| Andrew Fuerstenbeger | Debra Lyman |
| Michelle Halyard | Marti Noriega |
| Tonya Hopkins | Bryan Bly |
| Joseph Kaminski | Vilma Castro |
| Kasea Matthews | Kim Goelz |
| Harold Nord, III | Mary Sarmiento |
| Yvette Washington | Christina Carter Lesli |
| Jan Walsh | Goodman Rene Martinez |
| Malik Basurto | M. Arndt |
| Nichole Clavadetscher | M.E. Wileman |
| Youda Crain Mercedes | Regina Alexander |
| Judilla Srbui Muradyan | John Cottrell |
| Tom Croft | Bill Koch |
| Greg Schleppy | Jeff Young |
| David Ellis | Nicholas Hoye |
| Kim Krakoviak | Janet L. Jones |
| Aaron Menne | Carissa Keeler |
| Scott Scheiner | Carla Naughton |
| Sandy Broughton | Ricky Thompson |
| Donald Dempsey | |
| Thomas Strain | |
| Noriko Colston | |
| Michael Peter | |
| Suchan Murray | |
| JC San Pedro | |
| David Rodriguez | |
| Mollie Schiffman | |

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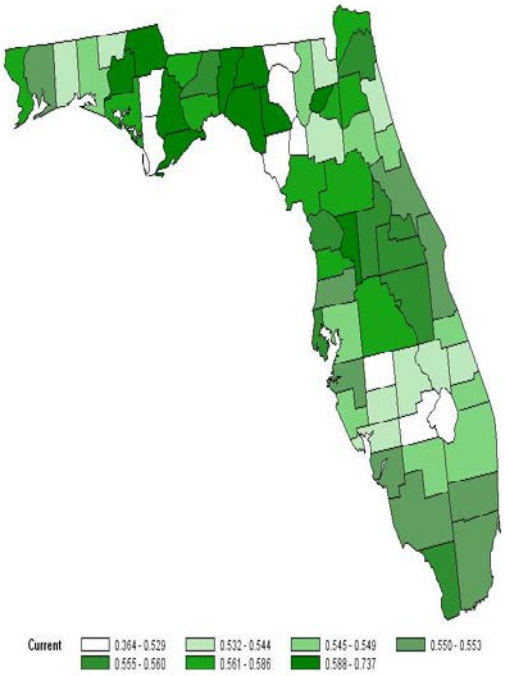
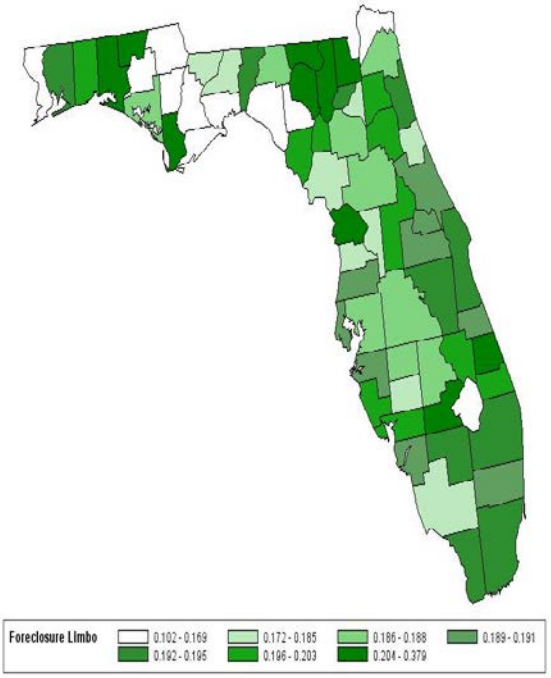
**Figure 1**
**Mortgage Performance by County within Florida**

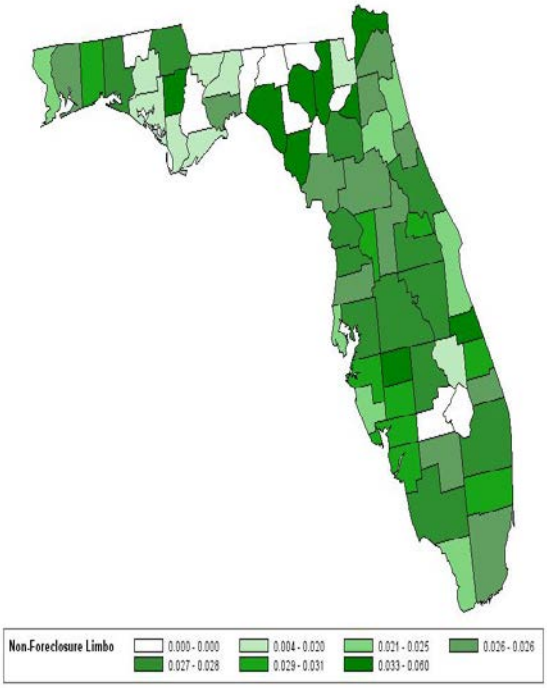
A. Current



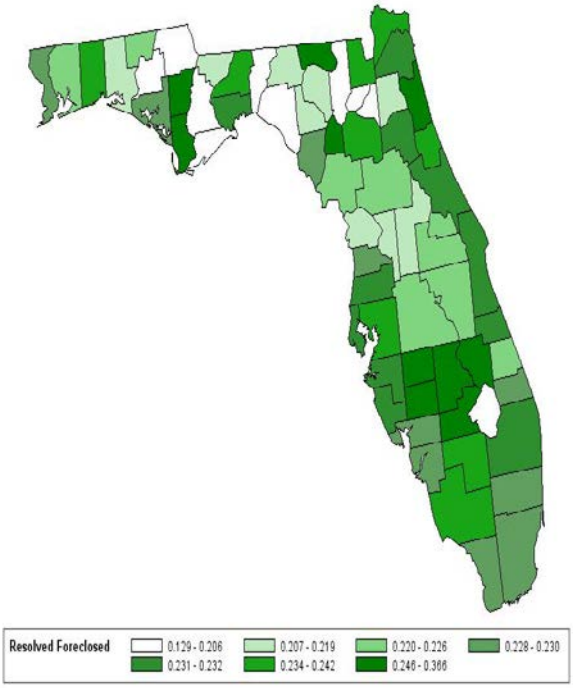

B. Foreclosed Limbo




C. Non-Resolved Limbo




D. Resolved Foreclosed




NOTES: These figures present mortgage performance within in each Florida County. Source: CoreLogic

## Figure 2

## Decision Tree in Mortgage Resolution

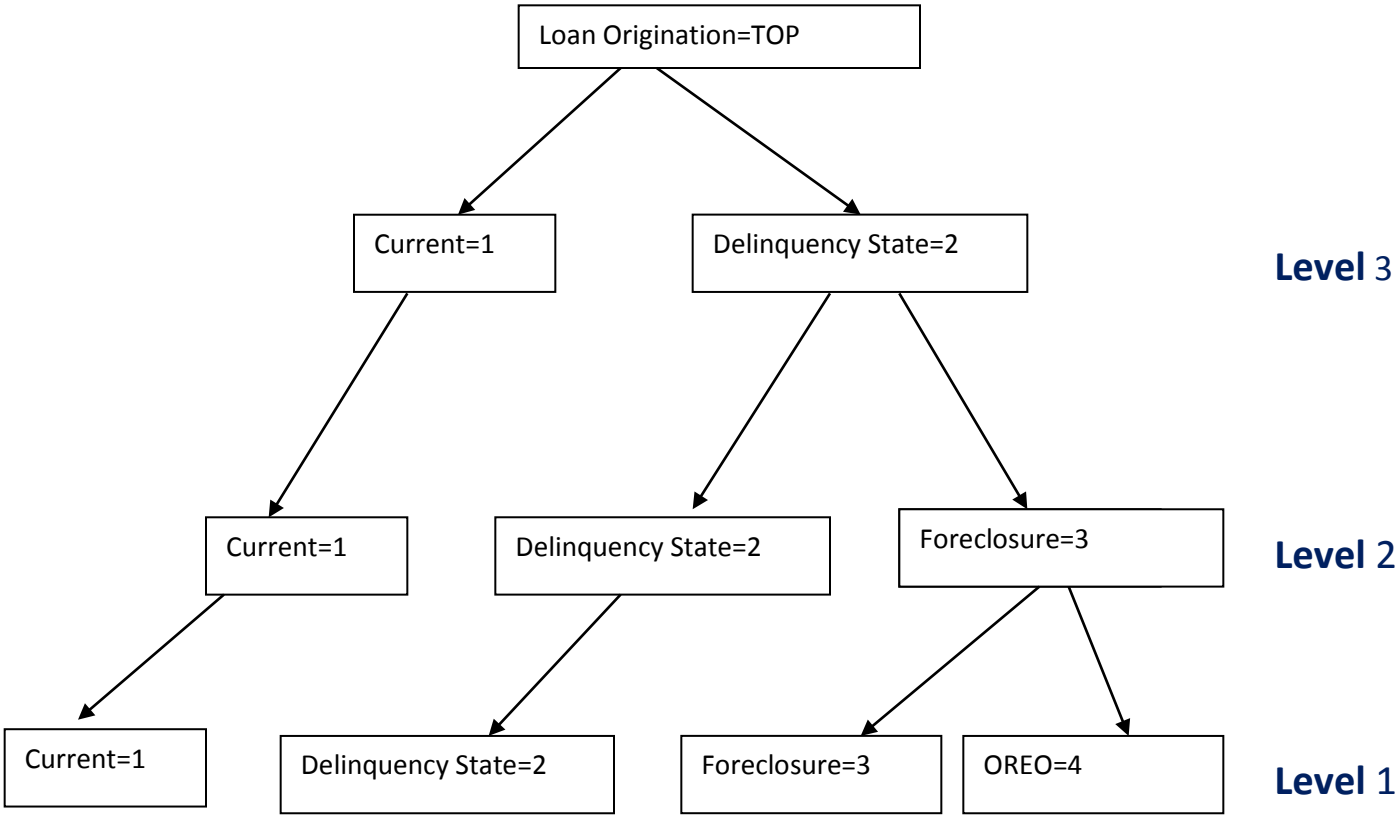


Table 1: Distribution of CoreLogic information in Florida

Table 1A: Number of Loans

| | | | Mortgage Summary Statistics: Equally Weighted | | | | | |
|---|---|---|---|---|---|---|---|---|
| | # Loans | % of Sample | Origination Amount | | Age of Loan | | Time in Classification | |
| | Originated | | Mean | Median | Mean | Median | Mean | Median |
| Current Mortgages | 298,775 | 58.3 | 209 | 164 | 30.1 | 23 | 30.11 | 23 |
| Resolved Foreclosed Mortgages | 111,415 | 21.7 | 234 | 197 | 35.4 | 36 | 19.23 | 17 |
| Limbo Loans - Total | 102,202 | 19.9 | 242 | 199 | 53.9 | 53 | 23.23 | 24 |
| • Foreclosure Limbo | 88,614 | 17.2 | 244 | 200 | 53.8 | 53 | 25.13 | 25 |
| • Non-Foreclosure Limbo | 13,588 | 2.6 | 227 | 188 | 54.5 | 53 | 10.85 | 8 |
| Total | 512,392 | 100 | | | | | | |

Table 1B: Volume of Loans

| | | | Mortgage Summary Statistics: Value Weighted | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Total | % of Sample | Origination Amount | | Age of Loan | | Time in Classification | |
| | Originated | | Mean | Median | Mean | Median | Mean | Median |
| Current Mortgages | 62.8 | 55.2 | 209 | 164 | 30.0 | 23 | 30.05 | 23 |
| Resolved Foreclosed Mortgages | 26.1 | 22.9 | 234 | 197 | 35.1 | 35 | 18.78 | 16 |
| Limbo Loans - Total | 24.7 | 21.7 | 242 | 199 | 53.3 | 53 | 24.11 | 25 |
| • Foreclosure Limbo | 21.6 | 19.0 | 244 | 200 | 53.2 | 52 | 25.93 | 26 |
| • Non-Foreclosure Limbo | 3.0 | 2.7 | 227 | 188 | 53.9 | 53 | 11.28 | 9 |
| Total | $113.6 | 100 | | | | | | |

NOTES: Total origination amounts are measured in $ billions. Origination amounts for mortgages are in $ thousands. Age of loan and time in classification are measured in months.
Source: CoreLogic

Table 2. Classification of CoreLogic Florida Loans by Year

| | 2004 | | 2005 | | 2006 | | 2007 | | 2008 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | A. Equally Weighted | | | | | |
| | # Loans Originated | % of Year | # Loans Originated | % of Year | # Loans Originated | % of Year | # Loans Originated | % of Year | # Loans Originated | % of Year |
| Non-Delinquent Mortgages | 74,886 | 91.0% | 128,979 | 72.6 | 71,547 | 40.4 | 23,308 | 30.79 | 55 | 42.6 |
| Resolved Foreclosed | 3,536 | 4.3% | 24,996 | 14.0 | 56,870 | 32.1 | 26,001 | 34.35 | 12 | 9.3 |
| Limbo Loans - Total | 3,835 | 4.6% | 23,623 | 13.3 | 48,294 | 27.3 | 26,388 | 34.86 | 62 | 48.1 |
| • Foreclosure Limbo | 3,148 | 3.8% | 20,153 | 11.3 | 42,336 | 23.9 | 22,921 | 30.28 | 56 | 43.4 |
| • Non-Foreclosure | 687 | 0.8% | 3,470 | 1.9 | 5,958 | 3.3 | 3,467 | 4.58 | 6 | 4.6 |
| Total | 82,257 | 100 | 177,598 | 100 | 176,711 | 100 | 75,697 | 100 | 129 | 100 |
| | | | | | B. Dollar Weighted | | | | | |
| | Loans Originated ($Mil) | % of Year | Loans Originated ($Mil) | % of Year | Loans Originated ($Mil) | % of Year | Loans Originated ($Mil) | % of Year | # Loans Originated ($Mil) | % of Year |
| Current Mortgages | 12,866 | 90.4% | 26,442 | 71.1 | 17,091 | 40.8 | 6,398 | 31.4 | 20 | 40.1 |
| Resolved Foreclosed | 630 | 4.4 | 5,386 | 14.5 | 13,242 | 31.6 | 6,833 | 33.6 | 5 | 9.2 |
| Limbo Loans - Total | 742 | 5.2 | 5,357 | 14.4 | 11,531 | 27.5 | 7,114 | 34.9 | 25 | 50.7 |
| • Foreclosure Limbo | 609 | 4.3 | 4,593 | 12.4 | 10,197 | 24.4 | 6,256 | 30.8 | 22 | 43.3 |
| • Non-Foreclosure | 133 | 0.9 | 764 | 2.1 | 1,334 | 3.2 | 858 | 4.2 | 4 | 7.4 |
| Total | 14,238 | 100 | 37,185 | 100 | 41,864 | 100 | 20,345 | 100 | 50 | 100. |

Source: CoreLogic

Table 3: Legalprise cases by status and year

## Panel A. Resolved

**Duration: date filed-date of last entry**

| Year | No. of cases | % of Total | Mean | Median | Std. dev. |
|---|---|---|---|---|---|
| 2004 | 254 | 7.9 | 569 | 379 | 492 |
| 2005 | 2,013 | 14.9 | 760 | 596 | 549 |
| 2006 | 8,953 | 28.3 | 459 | 315 | 372 |
| 2007 | 39,461 | 51.7 | 483 | 372 | 311 |
| 2008 | 79,176 | 35.2 | 514 | 488 | 229 |
| 2009 | 56,361 | 15.3 | 383 | 386 | 145 |
| 2010 | 12,128 | 8.1 | 222 | 222 | 84 |
| Total | 198,346 | 22.9 | 453 | 398 | 252 |

## Panel B. Dismissed cases

| Year | No. of cases | % of Total | Mean | Median | Std. dev. |
|---|---|---|---|---|---|
| 2004 | 2,177 | 68.1 | 296 | 131 | 414 |
| 2005 | 7,635 | 56.7 | 443 | 254 | 485 |
| 2006 | 16,806 | 53.1 | 338 | 164 | 395 |
| 2007 | 23,695 | 31.0 | 462 | 351 | 384 |
| 2008 | 55,460 | 24.6 | 439 | 406 | 287 |
| 2009 | 49,120 | 13.4 | 284 | 265 | 184 |
| 2010 | 11,833 | 7.9 | 152 | 138 | 89 |
| Total | 166,726 | 19.2 | 364 | 276 | 310 |

## Panel C. Unresolved cases

| | | | **Duration: date filed-12/30/2010** | | | | | |
|---|---|---|---|---|---|---|---|---|
| Year | No. of cases | % of Total | Mean | Median | Std. dev. | Mean | Median | Std. dev. |
| 2004 | 766 | 23.9 | 530 | 252 | 616 | 2,378 | 2,384 | 109 |
| 2005 | 3,811 | 28.3 | 685 | 461 | 611 | 2,006 | 1,998 | 107 |
| 2006 | 5,868 | 18.6 | 626 | 387 | 542 | 1,631 | 1,619 | 107 |
| 2007 | 13,252 | 17.3 | 805 | 944 | 389 | 1,257 | 1,249 | 102 |
| 2008 | 90,553 | 40.2 | 534 | 580 | 295 | 880 | 861 | 101 |
| 2009 | 261,829 | 71.3 | 222 | 142 | 201 | 586 | 604 | 94 |
| 2010 | 126,222 | 84.1 | 133 | 113 | 104 | 214 | 219 | 94 |
| Total | 502,301 | 57.9 | 280 | 181 | 281 | 589 | 597 | 323 |

Table 4. Number of Legalprise cases by type and year

**Panel A: Number of Cases by Case Type by Year**

| Year | Assignment | Resolved | Dismissed | Unresolved | Cases with lost doc |
|---|---|---|---|---|---|
| 2004 | 152 | 254 | 2,177 | 766 | 1,690 |
| 2005 | 464 | 2,013 | 7,635 | 3,811 | 3,217 |
| 2006 | 725 | 8,953 | 16,806 | 5,868 | 6,226 |
| 2007 | 946 | 39,461 | 23,695 | 13,252 | 19,966 |
| 2008 | 2,523 | 79,176 | 55,460 | 90,553 | 48,683 |
| 2009 | 36,493 | 56,361 | 49,120 | 261,829 | 46,519 |
| 2010 | 31,746 | 12,128 | 11,833 | 126,222 | 14,836 |
| Total | 73,049 | 198,346 | 166,726 | 502,301 | 141,137 |

**Panel B: Percent of Totals by Case Type by Year**

| Year | | | | | |
|---|---|---|---|---|---|
| 2004 | 0.21 | 0.13 | 1.31 | 0.15 | 1.20 |
| 2005 | 0.64 | 1.01 | 4.58 | 0.76 | 2.28 |
| 2006 | 0.99 | 4.51 | 10.08 | 1.17 | 4.41 |
| 2007 | 1.30 | 19.90 | 14.21 | 2.64 | 14.15 |
| 2008 | 3.45 | 39.92 | 33.26 | 18.03 | 34.49 |
| 2009 | 49.96 | 28.42 | 29.46 | 52.13 | 32.96 |
| 2010 | 43.46 | 6.11 | 7.10 | 25.13 | 10.51 |
| Total | 100 | 100 | 100 | 100 | 100 |

Table 5. MERS participation in Legalprise by year

**Panel A. Breakdown of MERS participation by case type by year**

| Year | Resolved | Dismissed | Unresolved | Cases with lost doc |
|---|---|---|---|---|
| 2004 | 42 | 394 | 146 | 364 |
| 2005 | 168 | 563 | 213 | 332 |
| 2006 | 1,249 | 538 | 224 | 628 |
| 2007 | 7,396 | 1,485 | 1,558 | 4,187 |
| 2008 | 11,404 | 4,389 | 7,429 | 7,329 |
| 2009 | 4,897 | 3,063 | 11,596 | 4,287 |
| 2010 | 718 | 570 | 5,610 | 1,113 |
| Total | 25,874 | 11,002 | 26,776 | 18,240 |

**Panel B. Percentage of MERS participation by case type by year**

| Year | % of Resolved | % of Dismissed | % of Unresolved | % of lost doc cases |
|---|---|---|---|---|
| 2004 | 0.16 | 3.58 | 0.55 | 2.00 |
| 2005 | 0.65 | 5.12 | 0.80 | 1.82 |
| 2006 | 4.83 | 4.89 | 0.84 | 3.44 |
| 2007 | 28.58 | 13.50 | 5.82 | 22.96 |
| 2008 | 44.08 | 39.89 | 27.74 | 40.18 |
| 2009 | 18.93 | 27.84 | 43.31 | 23.50 |
| 2010 | 2.77 | 5.18 | 20.95 | 6.10 |
| Total | 100 | 100 | 100 | 100 |
| | | Proportion of MERS participation in all foreclosures = | | 7.34 |
| | | Proportion of MERS participation in all lost documentation cases = | | 12.92 |

**Panel C. MERS Participation as a Percentage of Annual Case Type**

| Year | % of Resolved | % of Dismissed | % of Unresolved |
|---|---|---|---|
| 2004 | 7.22 | 67.70 | 25.09 |
| 2005 | 17.80 | 59.64 | 22.56 |
| 2006 | 62.11 | 26.75 | 11.14 |
| 2007 | 70.85 | 14.23 | 14.92 |
| 2008 | 49.11 | 18.90 | 31.99 |
| 2009 | 25.04 | 15.66 | 59.30 |
| 2010 | 10.41 | 8.26 | 81.33 |
| Total | 40.65 | 17.28 | 42.07 |

Table 6. Variable definitions and descriptive statistics: Mean (Standard Deviation)

| Variable | Definition | Ordered Logit | Survival Analysis | | |
|---|---|---|---|---|---|
| | | | Level 1 | Level 2 | Level 3 |
| **Dependent Variables** | | | | | |
| Ordered Logit | | | | | |
| $y_i$ | Logit outcomes; 1=Current/Pre-delinquency refinancing, 2=Delinquent; 3=Foreclosure, 4=REO/Post-delinquency refinancing | 2.09 (1.23) | | | |
| Survival Analysis | | | | | |
| Loan Duration, T Level 3 | Time in Current/Pre-delinquency state (months)<br>Time to Delinquency state (months) | | | | 43.54 (22.36)<br>27.83 (14.15) |
| Loan Duration, T Level 2 | Time in Delinquent state (months)<br>Time to Foreclosed state (months) | | | 18.65 (4.31)<br>16.48 (4.73) | |
| Loan Duration, T Level 1 | Time in Foreclosed state (months)<br>Time to Resolved state (months) | | 18.76 (3.65)<br>13.62 (4.37) | | |
| **Explanatory Variables** | | | | | |
| *Loan Characteristics* | | | | | |
| SPREAD | Loan rate minus maturity-matched Treasury rate | 4.1(1.52) | 5.1 (1.39) | 5.18 (1.41) | 3.77 (1.358) |
| FICO | FICO score | 690.7 (62.3) | 678.8 (57.2) | 679.2 (57.4) | 690.7 (62.3) |
| LTV | Loan-to-value ratio (percent) | 81.6 (9.2) | 83.1 (7.4) | 83.0 (7.5) | 81.6 (9.2) |
| SIZE | Logarithm of origination amount | 12.1 (0.58) | 12.1 (0.50) | 12.2 (0.52) | 12.1 (0.58) |
| AGE | Loan age (in months) | 46.3 (19.1) | | | |
| *Call-Report Bank-Year Level* | | | | | |
| BANKCAPITAL | Lender's equity-to-assets ratio (percent) | 17.5 (15.3) | 15.6 (14.4) | 15.4 (14.1) | 18.2 (16.2) |
| CHARGEOFFS | Lender's total charge-offs divided by assets (percent) | 0.058 (0.07) | 0.072 (0.09) | 0.074 (0.09) | 0.047 (0.069) |
| (Table continued next page) | | | | | |

| Variable | Definition | Ordered Logit | Survival Analysis | | |
|---|---|---|---|---|---|
| | | | Level 1 | Level 2 | Level 3 |
| *Macroeconomic State-Year Level* | | | | | |
| HOUSE_PRICE_CHANGE | House price change in Florida (percent) | -4.1 (0.099) | -10.5 (0.039) | -10.3 (0.038) | -2.0 (0.097) |
| UNEMPLOYMENT | Florida unemployment rate (percent) | 6.2 (1.74) | 7.3(1.77) | 7.4 (1.82) | 5.5 (1.48) |
| *Legalprise County-Year Level* | | | | | |
| FORECLOSURE | Foreclosures in each county (fraction in Florida) | 0.043 (0.037) | 0.038 (0.031) | 0.039 (0.031) | 0.042 (0.040) |
| DEFAULT | Default judgments (fraction of foreclosures) | 0.480 (0.150) | 0.472 (0.144) | 0.469 (0.143) | 0.484 (0.160) |
| BANKRUPTCY | Bankruptcies (fraction of foreclosures) | 0.072 (0.055) | 0.068 (0.055) | 0.066 (0.053) | 0.078 (0.066) |
| LOSTDOC | Lost documentation affidavits filed (fraction of foreclosures) | 0.118 (0.071) | 0.112 (0.071) | 0.109 (0.070) | 0.130 (0.076) |
| SIGNER | Presence of robo-signer (fraction of foreclosures) | 0.005 (0.022) | 0.005 (0.022) | 0.005 (0.022) | 0.006 (0.025) |
| MERS_ASSIGNMENT | MERS assignments (fraction of total) | 0.016 (0.021) | 0.016 (0.021) | 0.016 (0.021) | 0.015 (0.020) |
| MERS_FORECLOSURE | MERS assignments in foreclosure (fraction of foreclosures) | 0.071 (0.059) | 0.071 (0.060) | 0.070 (0.059) | 0.071 (0.062) |
| DISMISSED | Dismissed cases (fraction of foreclosures) | 0.195 (0.142) | 0.149 (0.093) | 0.146 (0.092) | 0.208 (0.149) |
| LENGTH_RESOLVED | Log time from first docket entry to certificate title entry date for resolved cases | 6.09 (0.50) | 5.99 (0.47) | 5.97 (0.51) | 6.13 (0.45) |
| Number of Observations | | 53,391 | 23,018 | 25,010 | 53,391 |

NOTES: The summary statistics for the explanatory variables are computed over the entire sample used in estimating the ordered logit and survival analysis regressions. The length of time in any state (loan duration T) is either the number of months spent within that state or the number of months from the entrance of the loan into the given state until December 2010, the end of our sample period. Delinquent loans at Level 1 also include all loans that were eventually foreclosed and resolved. Foreclosed loans at Level 2 include all loans that were eventually resolved or were refinanced after delinquency. The table presents means with standard deviations in parentheses.

Table 7. Ordered Logit Specification for Mortgage Termination

| Explanatory Variables | All Variables | | Bottleneck Variables | | Bank Capital Variables | | Operational Risk Variables | |
|---|---|---|---|---|---|---|---|---|
| *Loan Characteristics:* | Estimates | Odds Ratio | Estimates | Odds Ratio | Estimates | Odds Ratio | Estimates | Odds Ratio |
| AGE | -0.129*** | | -0.132*** | | -0.132*** | | -0.129*** | |
| | (22.89) | | (23.32) | | (23.68) | | (22.52) | |
| $AGE^2$ | 0.001** | | 0.001** | | 0.001** | | 0.001** | |
| | (5.42) | | (5.28) | | (5.40) | | (5.25) | |
| SPREAD | 0.171*** | 1.296*** | 0.188*** | 1.332*** | 0.163*** | 1.281*** | 0.196*** | 1.348*** |
| | (24.00) | | (24.53) | | (22.58) | | (24.89) | |
| FICO | -0.005*** | 0.712*** | -0.006*** | 0.692*** | -0.006*** | 0.709*** | -0.006*** | 0.695*** |
| | (31.41) | | (44.44) | | (33.28) | | (42.25) | |
| LTV | 0.027*** | 1.288*** | 0.026*** | 1.271*** | 0.027*** | 1.288*** | 0.026*** | 1.27*** |
| | (43.00) | | (36.68) | | (42.78) | | (36.75) | |
| SIZE | 0.152** | 1.093** | 0.185*** | 1.114*** | 0.154** | 1.094** | 0.184*** | 1.114*** |
| | (4.83) | | (7.58) | | (4.94) | | (7.70) | |
| *Macroeconomic Effects*: | | | | | | | | |
| HOUSE_PRICE_CHANGE | -0.074 | 0.878 | -0.329*** | 0.038*** | -0.344*** | 0.033*** | -0.329*** | 0.038*** |
| | (1.44) | | (207.15) | | (202.27) | | (188.20) | |
| UNEMPLOYMENT | -0.020*** | 0.738*** | -0.054 | 0.909 | -0.060 | 0.901 | -0.083 | 0.865 |
| | (11.42) | | (0.74) | | (1.54) | | (1.88) | |
| *Bank Lender Effects*: | | | | | | | | |
| BANKCAPITAL | -0.020*** | 0.738*** | | | -0.020*** | 0.737 | | |
| | (11.42) | | | | (11.51) | | | |
| CHARGEOFFS | -2.341 | 0.840 | | | -2.398 | 0.837 | | |
| | (1.96) | | | | (1.96) | | | |

(Table continued next page)

| Explanatory Variables | All Variables | | Bottleneck Variables | | Bank Capital Variables | | Operational Risk Variables | |
|---|---|---|---|---|---|---|---|---|
| *County Effects*: | Estimates | Odds Ratio | Estimates | Odds Ratio | Estimates | Odds Ratio | Estimates | Odds Ratio |
| FORECLOSURE | -0.907*** | 0.967*** | 0.098 | 1.015 | | | | |
| | (16.98) | | (0.70) | | | | | |
| DEFAULT | 0.298* | 1.046* | 0.400 | 1.022 | | | | |
| | (3.00) | | (0.36) | | | | | |
| BANKRUPTCY | 0.724 | 1.041 | -2.036*** | 0.928*** | | | | |
| | (1.38) | | (18.79) | | | | | |
| LOSTDOC | 0.912*** | 1.067*** | | | | | 1.379*** | 1.103*** |
| | (26.94) | | | | | | (139.60) | |
| SIGNER | 2.663** | 1.06** | | | | | 2.535* | 1.057* |
| | (6.04) | | | | | | (3.29) | |
| MERS_ASSIGNMENT | -5.397*** | 0.895*** | | | | | -5.044*** | 0.902*** |
| | (31.58) | | | | | | (15.46) | |
| MERS_FORECLOSURE | -0.177 | 0.990 | | | | | -0.030 | 0.998 |
| | (0.51) | | | | | | (0.01) | |
| DISMISSED | -0.886*** | 0.882*** | | | | | -0.694*** | 0.906*** |
| | (10.44) | | | | | | (14.04) | |
| LENGTH_RESOLVED | 0.001 | 1.000 | | | | | 0.001 | 1.000 |
| | (0.00) | | | | | | (0.00) | |
| Pseudo $R^2$ | 0.433 | | 0.419 | | 0.430 | | 0.421 | |
| Current (j=1) | 28,381 | | 28,381 | | 28,381 | | 28,381 | |
| Delinquent (j=2) | 1,992 | | 1,992 | | 1,992 | | 1,992 | |
| Foreclosed (j=3) | 12,811 | | 12,811 | | 12,811 | | 12,811 | |
| Resolved (j=4) | 10,207 | | 10,207 | | 10,207 | | 10,207 | |

NOTES: The dependent variable in the ordered logit model is a latent index of mortgage termination. A loan that was refinanced before (after) delinquency is considered as current (resolved). Variable definitions are provided in Table 6. Parameter estimate standard errors are corrected for lender-level clustering effects using a robust-variance estimation methodology. The hazard odds ratio measures the marginal effect when evaluated at the one-standard deviation change (see footnote 23). A value of odds ratio equal to 2 indicates that the loan is twice as likely to transition to default when the explanatory variable increases by one standard deviation. The maintained hypothesis is that the odds ratio is equal to 1. Numbers in parentheses represent Wald chi-square statistics. The symbols (*), (**), and (***) indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 8, Panel A: Survival Analysis Results at Level 3: Current vs. Delinquency

| Explanatory Variables | | | | |
|---|---|---|---|---|
| *Loan Characteristics:* | All Variables | Bottleneck | Bank Capital | Operational |
| SPREAD | -0.069*** | -0.075*** | -0.069*** | -0.072*** |
| | (19.37) | (22.28) | (17.69) | (20.24) |
| FICO | 0.001*** | 0.002*** | 0.002*** | 0.002*** |
| | (27.50) | (31.16) | (32.16) | (31.90) |
| LTV | -0.008*** | -0.008*** | -0.009*** | -0.008*** |
| | (17.10) | (16.63) | (20.62) | (17.33) |
| SIZE | -0.144*** | -0.148*** | -0.151*** | -0.149*** |
| | (27.21) | (27.67) | (27.43) | (28.01) |
| *Macroeconomic Effects*: | | | | |
| HOUSE PRICE CHANGE | 0.201 | -0.634* | -1.042*** | -0.720* |
| | (0.25) | (2.95) | (8.18) | (3.37) |
| UNEMPLOYMENT | 0.318*** | 0.344*** | 0.201*** | 0.273*** |
| | (288.58) | (337.24) | (179.26) | (264.28) |
| *Bank Lender Effects*: | | | | |
| BANKCAPITAL | 0.002* | | 0.002* | |
| | (3.13) | | (2.91) | |
| CHARGEOFFS | 1.841*** | | 2.168*** | |
| | (46.20) | | (58.86) | |
| *County Effects*: | | | | |
| FORECLOSURE | 0.286 | 1.897*** | | |
| | (0.36) | (21.09) | | |
| DEFAULT | 0.816*** | 1.003*** | | |
| | (45.80) | (85.63) | | |
| BANKRUPTCY | 1.486*** | 1.650*** | | |
| | (28.64) | (43.73) | | |
| LOSTDOC | -0.512** | | | -0.042 |
| | (4.97) | | | (0.04) |
| SIGNER | -2.272*** | | | -2.925*** |
| | (11.84) | | | (20.35) |
| MERS ASSIGNMENT | 3.571*** | | | 4.568*** |
| | (16.17) | | | (26.01) |
| MERS FORECLOSURE | 0.849 ** | | | 1.470*** |
| | (6.30) | | | (20.39) |
| DISMISSED | -0.027 | | | 0.323 * |
| | (0.02) | | | (3.68) |
| LENGTH RESOLVED | -0.167*** | | | -0.211*** |
| | (14.24) | | | (25.87) |
| SCALE, θ | 0.620*** | 0.637*** | 0.652*** | 0.638*** |
| | (47.83) | (47.70) | (47.54) | (47.62) |
| Log Likelihood Value | 3,485.1 | 3,590.9 | 3,686.1 | 3,612.3 |

NOTES: The dependent variable in the survival model is logarithm of the length of time spent in the current state. The number of non-censored observations (that is, loans that eventually transition to delinquency and beyond) is 25,010 and the number of censored observations (current loans) is 28,381 for a total number of 53,391 observations. Numbers in parentheses represent Wald chi-square statistics. The symbols (*), (**), and (***) indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 8, Panel B: Survival Analysis Results at Level 2: Delinquency vs. Foreclosure

| Explanatory Variables | | | | |
|---|---|---|---|---|
| *Loan Characteristics:* | All Variables | Bottleneck | Bank Capital | Operational |
| SPREAD | 0.010*** | 0.012*** | 0.012*** | 0.010*** |
| | (12.56) | (15.42) | (16.63) | (12.01) |
| FICO | -0.000 | 0.000 | 0.000 | -0.000 |
| | (0.35) | (0.05) | (0.18) | (0.49) |
| LTV | -0.001 | -0.001** | -0.001** | -0.001* |
| | (2.38) | (5.18) | (4.84) | (2.82) |
| SIZE | 0.040*** | 0.039*** | 0.038*** | 0.041*** |
| | (37.49) | (33.37) | (31.70) | (38.68) |
| *Macroeconomic Effects*: | | | | |
| HOUSE PRICE CHANGE | -1.059*** | -1.302*** | -1.193*** | -1.156*** |
| | (95.07) | (145.11) | (120.14) | (118.02) |
| UNEMPLOYMENT | 0.055*** | 0.059*** | 0.059*** | 0.057*** |
| | (490.36) | (629.18) | (853.30) | (600.06) |
| *Bank Lender Effects*: | | | | |
| BANKCAPITAL | -0.0002 | | -0.000 | |
| | (0.69) | | (0.58) | |
| CHARGEOFFS | 0.125*** | | 0.150*** | |
| | (10.80) | | (14.79) | |
| *County Effects*: | | | | |
| FORECLOSURE | -0.364*** | 0.609*** | | |
| | (7.66) | (25.37) | | |
| DEFAULT | 0.131*** | -0.103*** | | |
| | (10.24) | (14.43) | | |
| BANKRUPTCY | 0.013 | 0.116 | | |
| | (0.02) | (2.14) | | |
| LOSTDOC | -0.601*** | | | -0.508*** |
| | (100.74) | | | (95.61) |
| SIGNER | -1.421*** | | | -1.374*** |
| | (66.31) | | | (64.64) |
| MERS ASSIGNMENT | 1.109*** | | | 1.212*** |
| | (34.97) | | | (44.35) |
| MERS FORECLOSURE | 0.676*** | | | 0.653*** |
| | (66.12) | | | (65.32) |
| DISMISSED | -0.509*** | | | -0.369*** |
| | (54.85) | | | (56.94) |
| LENGTH RESOLVED | -0.031*** | | | -0.033*** |
| | (15.96) | | | (22.23) |
| SCALE, θ | 0.286*** | 0.293*** | 0.293*** | 0.286*** |
| | (116.82) | (116.68) | (116.68) | (116.81) |
| Log Likelihood Value | 3,108.5 | 3,477.2 | 3,489.9 | 3,135.5 |

NOTES: The dependent variable in the survival model is logarithm of the length of time spent in delinquency. The number of non-censored observations (that is, loans that eventually were foreclosed) is 23,018, and the number of censored (in delinquency limbo) observations is 1,992 for a total number of 25,010 observations. Numbers in parentheses represent Wald chi-square statistics. The symbols (*), (**), and (***) indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 8, Panel C: Survival Analysis Results at Level 1: Foreclosure vs. Resolution

| Explanatory Variables | | | | |
|---|---|---|---|---|
| *Loan Characteristics:* | All Variables | Bottleneck | Bank Capital | Operational |
| SPREAD | 0.025*** | 0.028*** | 0.029*** | 0.025*** |
| | (8.05) | (9.52) | (10.45) | (8.39) |
| FICO | 0.000 | 0.000 | 0.000 | 0.000 |
| | (0.02) | (0.58) | (0.80) | (0.09) |
| LTV | -0.002 | -0.003* | -0.003** | -0.002 |
| | (2.30) | (3.64) | (4.55) | (2.20) |
| SIZE | 0.100*** | 0.097*** | 0.096*** | 0.099*** |
| | (25.92) | (22.87) | (22.27) | (25.44) |
| *Macroeconomic Effects*: | | | | |
| HOUSE PRICE CHANGE | 1.117*** | 0.589** | 0.535* | 1.003*** |
| | (14.18) | (3.95) | (3.22) | (12.02) |
| UNEMPLOYMENT | 0.188*** | 0.195*** | 0.179*** | 0.178*** |
| | (479.95) | (515.67) | (602.40) | (499.11) |
| *Bank Lender Effects*: | | | | |
| BANKCAPITAL | 0.001 | | 0.001 | |
| | (0.77) | | (0.68) | |
| CHARGEOFFS | -0.050 | | -0.004 | |
| | (0.25) | | (0.005) | |
| *County Effects*: | | | | |
| FORECLOSURE | -0.370 | -0.230*** | | |
| | (1.07) | (8.42) | | |
| DEFAULT | 0.083 | 0.932*** | | |
| | (0.50) | (21.85) | | |
| BANKRUPTCY | 0.778*** | 1.817*** | | |
| | (12.94) | (29.93) | | |
| LOSTDOC | -1.066*** | | | -0.764*** |
| | (43.81) | | | (29.78) |
| SIGNER | -2.565*** | | | -2.769*** |
| | (35.24) | | | (43.75) |
| MERS ASSIGNMENT | 2.190*** | | | 2.635*** |
| | (16.67) | | | (25.29) |
| MERS FORECLOSURE | 1.437*** | | | 1.546*** |
| | (38.88) | | | (48.98) |
| DISMISSED | -0.830*** | | | -0.803*** |
| | (20.12) | | | (37.84) |
| LENGTH RESOLVED | -0.139*** | | | -0.133*** |
| | (24.78) | | | (28.77) |
| SCALE, θ | 0.443*** | 0.464*** | 0.467*** | 0.445*** |
| | (48.96) | (48.68) | (48.60) | (48.96) |
| Log Likelihood Value | 3,206.5 | 3404.8 | 3447.1 | 3224.3 |

NOTES: The dependent variable in the survival model is logarithm of the length of time spent in foreclosure. The number of non-censored observations (that is, loans that eventually were resolved) is 10,207 and the number of censored (foreclosure limbo) observations is 12,811 for a total number of 23,018 observations. Numbers in parentheses represent Wald chi-square statistics. The symbols (*), (**), and (***) indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 9. Ordered Logit Specification for Mortgage Default (Excluding Refinancings and Modifications)

| Explanatory Variables | All Variables | | Bottleneck Variables | | Bank Capital Variables | | Operational Risk | |
|---|---|---|---|---|---|---|---|---|
| *Loan Characteristics:* | Estimates | Odds Ratio | Estimates | Odds Ratio | Estimates | Odds Ratio | Estimates | Odds Ratio |
| AGE | -0.782*** | | -0.777*** | | -0.786*** | | -0.767*** | |
| | (668.66) | | (621.81) | | (709.30) | | (597.97) | |
| $AGE^2$ | 0.006*** | | 0.006*** | | 0.006*** | | 0.006*** | |
| | (559.03) | | (595.47) | | (612.18) | | (560.11) | |
| SPREAD | 0.207*** | 1.334*** | 0.220*** | 1.358*** | 0.208*** | 1.336*** | 0.225*** | 1.367*** |
| | (14.35) | | (13.38) | | (14.40) | | (13.95) | |
| FICO | -0.005*** | 0.744*** | -0.005*** | 0.73*** | -0.005*** | 0.743*** | -0.005*** | 0.731*** |
| | (26.57) | | (32.99) | | (27.20) | | (32.00) | |
| LTV | 0.025*** | 1.252*** | 0.023*** | 1.23*** | 0.025*** | 1.253*** | 0.023*** | 1.229*** |
| | (22.88) | | (18.64) | | (22.79) | | (18.89) | |
| SIZE | 0.205*** | 1.124*** | 0.235*** | 1.144** | 0.207*** | 1.125*** | 0.234*** | 1.143*** |
| | (7.89) | | (10.29) | | (7.94) | | (10.51) | |
| *Macroeconomic Effects*: | | | | | | | | |
| HOUSE_PRICE_CHANGE | -0.237*** | 0.367*** | -0.225*** | 0.384*** | -0.241*** | 0.36*** | -0.231*** | 0.376*** |
| | (25.82) | | (24.12) | | (24.91) | | (25.55) | |
| UNEMPLOYMENT | 0.060 | 1.091 | 0.071 | 1.108 | 0.027 | 1.04 | 0.030 | 1.044 |
| | (1.55) | | (2.42) | | (0.72) | | (0.45) | |
| *Bank Lender Effects*: | | | | | | | | |
| BANKCAPITAL | -0.018*** | 0.76*** | | | -0.019*** | 0.759*** | | |
| | (13.62) | | | | (13.72) | | | |
| CHARGEOFFS | -0.546 | 0.958 | | | -0.567 | 0.957 | | |
| | (0.17) | | | | (0.18) | | | |

(Table continued next page)

| Explanatory Variables | All Variables | | Bottleneck Variables | | Bank Capital Variables | | Operational Risk | |
|---|---|---|---|---|---|---|---|---|
| *County Effects*: | Estimates | Odds Ratio | Estimates | Odds Ratio | Estimates | Odds Ratio | Estimates | Odds Ratio |
| FORECLOSURE | -0.305 | 0.957 | -0.034 | 0.995 | | | | |
| | (1.93) | | (0.04) | | | | | |
| DEFAULT | 3.116*** | 1.173*** | 2.291*** | 1.125*** | | | | |
| | (26.34) | | (10.40) | | | | | |
| BANKRUPTCY | 0.066 | 1.002 | -0.676 | 0.979 | | | | |
| | (0.03) | | (0.99) | | | | | |
| LOSTDOC | 0.712*** | 1.049*** | | | | | 1.171*** | 1.081*** |
| | (19.18) | | | | | | (43.99) | |
| SIGNER | 1.298 | 1.028 | | | | | 0.117 | 1.003 |
| | (1.21) | | | | | | (0.01) | |
| MERS_ASSIGNMENT | -4.647*** | 0.909*** | | | | | -2.485** | 0.95** |
| | (27.43) | | | | | | (6.15) | |
| MERS_FORECLOSURE | -0.463 | 0.973 | | | | | 0.002 | 1.00 |
| | (1.61) | | | | | | (0.00) | |
| DISMISSED | 0.251 | 1.025 | | | | | 0.121 | 1.012 |
| | (2.14) | | | | | | (1.11) | |
| LENGTH_RESOLVED | -0.017 | 0.993 | | | | | 0.024 | 1.01 |
| | (0.19) | | | | | | (0.69) | |
| Pseudo $R^2$ | 0.495 | | 0.479 | | 0.460 | | 0.486 | |
| REO | 16,297 | | 16,297 | | 16,297 | | 16,297 | |
| Foreclosed | 1,992 | | 1,992 | | 1,992 | | 1,992 | |
| Delinquent | 12,811 | | 12,811 | | 12,811 | | 12,811 | |
| Current | 8,262 | | 8,262 | | 8,262 | | 8,262 | |

NOTES: The dependent variable in the ordered logit model is a latent index of mortgage termination. The sample excludes all refinancing and loan modifications. Parameter estimate standard errors are corrected for lender-level clustering effects using a robust-variance estimation methodology. The hazard odds ratio measures the marginal effect when it is evaluated at the one-standard deviation change (see footnote 23). A value of odds ratio equal to 2 indicates that the loan is twice as likely to transition to default when the explanatory variable increases by one standard deviation. The maintained hypothesis is that the odds ratio is equal to 1. Numbers in parentheses represent Wald chi-square statistics. The symbols (*), (**), and (***) indicate statistical significance at the 10%, 5%, and 1% levels, respectively.