620 FICO, Take II: Securitization and Screening in the Subprime Mortgage Market

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Abstract:

This paper presents three main findings that reconfirm that securitization had an effect on subprime mortgage lenders' screening standards around the FICO score of 620. First, using data on securitized and bank-held loans, we document a consistent and robust discontinuity in both securitization and default rates at the 620 threshold in the low documentation subprime market which confirms results established in our previous work. No such pattern exists in full documentation subprime loans or prime loans. Some recent work pools mortgages across prime and subprime markets, thereby obscuring this connection between the ease of securitization and screening in the low documentation subprime market. Second, we provide new evidence from the time series evolution of the securitization market for subprime loans that reinforces the role of ease of securitization on lenders' screening standards. Finally, we explain that there are other dimensions besides securitization rates that impact the ease of securitization. Importantly, these dimensions are more likely to be captured by the number of securitized loans (unconditional securitization rates) which we analyzed in our earlier work. On examining one such aspect – the time it takes to securitize a loan -- we identify discontinuities that are consistent with greater ease of securitization above the 620 threshold in the low documentation subprime market.

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Executive Summary

Despite the prevalent view that securitization played a leading role in weakening lenders' screening standards, empirically documenting such a linkage has proved challenging. Analyzing the cross-section from 2001-2006, Keys, et al. (2010) observed twice as many low documentation loans securitized in the non-agency market with FICO scores just above 620 than below it. Arguing that the distribution of potential applicants is similar around the threshold, we interpreted this discontinuous difference as a greater unconditional securitization rate above 620 for these loans (we called it greater "ease of securitization"). We then showed that despite no differences in loan terms, low documentation subprime loans just above the 620 threshold defaulted 20% more frequently than their counterparts just below the cutoff. These effects were dampened for full documentation subprime loans where screening on soft information may not be as important. We concluded that lenders performed differential screening of soft information in the low doc subprime market driven by differences in how easily they could sell loans to investors.

Critics, most notably Bubb and Kaufman (2009), have questioned the robustness of this finding using data that includes both securitized and unsold loans. When they pool all loans regardless of which secondary market purchased the loan, Bubb and Kaufman find no difference in the pooled securitization rate around FICO=620 in several subsamples, while nonetheless finding a jump in default rates as in Keys, et al. Their conclusion is that without a discontinuity in the securitization rate at 620, the argument that ease of securitization produced screening differences is likely untrue.

In this paper, we extend the analysis in Keys et al. and address the critique in three ways:

1) Using Bubb and Kaufman's data (McDash/LPS), we replicate their results and show that their findings come from pooling different types of loans, instead of focusing on just the set of loans we analyzed. In particular, the findings in Keys, et al. are confirmed, as we observe discontinuities in both securitization and default rates, once we focus on low documentation non-agency loans. The differences arise because loans that are sold to the GSEs and full doc subprime loans have no discontinuity in either securitization or default rates around 620. We explain the economic reasons why loans sold to the GSEs and full doc subprime loans would be expected to behave differently. By pooling agency and non-agency loans, Bubb and Kaufman get different findings, but they are not appropriately applicable to any given segment of the market, particularly the low doc subprime market we studied previously.

2) We also provide new evidence from the time series evolution of the securitization market for non-agency subprime loans that reinforces our earlier findings. Our original hypothesis relied on the weak incentives that were in place when securitization was booming and markets were very liquid. But the private mortgage backed securities market has operated at other times -- when subprime loans were relatively new and after the crisis began -- where securitization was more difficult and the incentives to screen would have been high. During these times, we document no anomalies around the 620 threshold. These tests are similar in spirit to the time series New Jersey/Georgia test used in Keys et al. which led us to reach a similar conclusion.

3) We explain that there are other dimensions besides securitization rates that impact the ease of securitization -- and therefore lenders' screening effort. Importantly, these dimensions are more likely to be captured by the number of securitized loans (unconditional securitization rates) which we analyzed in our earlier work. Further, we identify a discontinuity around the 620 threshold in one of these dimensions (the time it takes to securitize a loan) in the low doc subprime market that supports our interpretation that the ease of securitization was systematically different around FICO=620.

I. Introduction

Despite the prevalent view that securitization played a leading role in weakening lenders' screening standards, empirically documenting such a linkage has proved challenging. In Keys, et al. (2010, henceforth KMSV), we focused on the non-agency segment of the mortgage market given that the housing boom was largely a subprime phenomenon.[1] Analyzing the cross-section from 2001-2006, we observed twice as many low-documentation loans securitized in the non-agency market with FICO scores just above 620 than below it. If the distribution of potential applicants is approximately similar around the threshold, this difference can be interpreted as a greater unconditional securitization rate above 620, which we argued reflected a greater "ease of securitization" for these loans. We then showed that despite no differences in loan terms, low documentation loans just above the 620 threshold defaulted 20% more frequently than their counterparts just below the cutoff. These effects were dampened for full documentation loans where additional hard information about the borrowers was collected and screening on soft information may not be as important. We concluded that lenders performed differential screening of soft information in the low documentation subprime market motivated in part by the knowledge that they would easily be able to sell these loans to investors.

An alternative explanation for the patterns documented in our paper is that the 620 cut-off might be a rule of thumb at the lender level that is independent of the securitization process. This hypothesis was considered, tested, and rejected in KMSV using the passage of anti-predatory lending laws in New Jersey and Georgia as a natural experiment to vary access to non-agency securities markets (see pp. 341-344 in KMSV). When the laws were in effect, the ease of securitization as measured by the discontinuity in the number of sold loans at FICO=620 was attenuated relative to the periods when the law was not in effect. Importantly, the performance results followed the same pattern, as default differences above 620 attenuated during the period of enforcement and reverted after the laws were repealed. These results suggested that lenders' differential screening patterns coincided with periods when the ease of securitization in the subprime market was relatively high.

A recent paper by Bubb and Kaufman (2009, henceforth BK) revisits the alternative hypothesis that was rejected by KMSV. They argue that the ease of securitization should be fully captured by the securitization rate of originated loans around the threshold (i.e., in the conditional securitization rate). BK use the McDash/LPS dataset which, unlike the LP data on securitized subprime loans used in KMSV, contains information on unsold loans, loans securitized by Government Sponsored Entities (henceforth GSEs), and loans securitized through private investors.[2] When they pool all loans regardless of which secondary market purchased the loan, BK find no difference in the pooled securitization rate around FICO=620 in several subsamples, while nonetheless finding a jump in default rates as in KMSV. Their conclusion is that without a discontinuity in securitization rate at the FICO cutoff, KMSV's argument that ease of securitization produced screening differences is not likely to be true.

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[1] The securitization rate of subprime mortgages increased from 54% to 74% over the period from 2001-2005, and the subprime market accounted for over 50% of the growth of the overall mortgage market over the same period (a growth of $465 billion of the subprime market, relative to $905b overall [Inside Mortgage Finance 2008]), see also Mian and Sufi [2009]).

[2] We use the terms "GSE", "prime", and "agency" interchangeably, as well as "subprime", "private investors", and "non-agency" or "non-GSE."

In this paper we establish that this conclusion is driven by pooling loans across the prime and subprime mortgage markets. Using the same data as BK, we document discontinuities in both securitization rates and default rates in the low documentation non-agency market, which support the results found in KMSV. Importantly, we find no differences in securitization or default rates for agency loans or full documentation subprime loans. Thus in the LPS data that BK use, low documentation non-agency loans display discontinuities with respect to both securitization and default rates. This connection between the ease of securitization and screening is obscured when these loans are pooled together with agency loans and full documentation subprime loans.

There is also a strong economic basis for separately analyzing these markets. Because the securitization process -- and in particular the incentive provisions for lender underwriting (see Kling [2009]) -- in these markets differs substantially, it is important to consider whether loans were originated with an intent to sell to private investors in the non-agency market or to GSEs. For instance, the basic loan terms and features, such as the prevalence of interest-only payment structures or prepayment penalties, are considerably different across the two markets. Furthermore, even among non-agency loans, KMSV showed the importance of separating low documentation and full documentation loans because the value of screening soft information in these markets varies dramatically.

We then clarify that from the lender's perspective, the ease of securitization is reflected not only in the conditional securitization rate but also in several other dimensions that securitization introduces into a lender's payoffs. When we examine one such aspect -- the time it takes to securitize a loan -- we identify discontinuities that are consistent with greater ease of securitization above the 620 threshold in the low documentation subprime market. Finally, we explain that various dimensions that impact the ease of securitization are more likely to be captured by the number of securitized loans (unconditional securitization rates) which we analyzed in KMSV.

In Section II, we describe the challenges in computing relevant securitization rates for loans sold to agency and non-agency segments in the LPS/McDash data (the problems with this database not withstanding[3]). Although we observe data on loans sold to GSEs and non-agencies, separate securitization rate computations also require knowledge of which loans on the bank's balance-sheet were originated with the intent to sell to GSEs or to private investors. We adopt two strategies to address this complication. First, we use propensity score re-weighting to attribute unsold loans to either the agency or non-agency markets. Second, we exploit the fact that a large share of lending in agency and non-agency markets is done by specialized lenders[4], and that for mortgages that meet the agency loan requirements, it may be advantageous for lenders to sell the loans to the GSEs. As a result, securitization rates can be estimated relatively easily for segments of the market where lending is primarily done by lenders that specialize in either market (e.g., low documentation loans with option ARMs or with a prepayment penalty are predominantly non-agency).

[3] The LPS data significantly under represents the subprime market before 2005 and even after 2005 covers only about 30% of originated loans. Our analysis in Section II (and Appendix III) discusses the limited coverage of the LPS database and potential non-random missing data in more detail.

[4] For instance, large non-agency lenders (accounting for a significantly large part of the subprime market) only sell about 0.5% of loans to GSEs. Similarly, large prime lenders (accounting for 60% of the loans sold to GSEs) only sell about 20% of loans to non-GSEs.

The differences in lender screening based on the intended secondary market are borne out in the data. Regardless of the strategy employed, we document a large and significant discontinuity in the low documentation non-agency securitization rate at FICO=620 (see Figures 1d, 3d and 5e). This result is also confirmed independently in other academic studies that use the same data as BK (e.g. Krainer and Laderman [2009]), as well as in evidence we present from two anonymous non-agency lenders who were among the top 20 lenders in terms of origination volume during the subprime boom. Correspondingly, there is a jump in default rate of low documentation non-agency loans around the cutoff for each of the low documentation non-agency subsamples

At the same time, there is no discontinuity in securitization or default rates around the 620 threshold in the sample of agency loans or in the sample of non-agency full documentation loans (see Figures 3 and 4). This evidence clarifies that the discontinuities in defaults that BK observe when they pool non-agency and agency loans are driven entirely by low documentation non-agency loans, thus leading to misleading inferences about the screening behavior of lenders in the subprime market and confirming the results in KMSV. We reach the same conclusion when examining the findings presented by BK from matching HMDA data to LPS to investigate lenders' securitization intensity. We end Section II by explaining why -- given the securitization rates, default rates, and distribution of agency, non-agency, and bank-held loans just below and above the 620 cutoff -- pooling of loans by BK mechanically attenuates the discontinuity in securitization rates more than it does in default rates.

In Section III, we present two additional time-series tests in the non-agency market that are consistent with the role of ease of securitization on screening standards while being inconsistent with an optimal lender cutoff rule unrelated to securitization. First, we examine the non-agency securitization market before the subprime boom (1997 to 2000) and immediately after its decline (the second half of 2006 and first half of 2007). If lenders were solely deciding on 620 as an optimal cutoff, we should observe differences in default rates around the 620 cutoff even when securitization in the non-agency market is relatively limited. On the contrary, we find no differences in defaults between 1997 and 2000 and a decline in the extent of the discontinuity in default rates around the 620 cutoff in late 2006 and early 2007, which corresponds to the period of contraction of the market for non-agency securities.

Second, we show that the default differences around the 620 threshold increased in magnitude as the non-agency securitization market (and unconditional securitization rate) grew in size progressively from 2001 to 2006. These time series results are consistent with the evidence from the New Jersey/Georgia experiment used in KMSV to reject the hypothesis that lenders were using an optimal rule independent of securitization. In Section IV, we revisit the New Jersey/Georgia experiment to highlight the severe limitations in the LPS/McDash data for studying the subprime market during the time period of the experiment.[5] These time series tests that use variation in the ease of securitization confirm that the discontinuity in loan defaults varies with the relative access of lenders to the non-agency securities market.

In Section V, we clarify the amorphous concept of "ease of securitization." If we consider the FICO=620 cutoff in an instrumental variables framework, the correct first stage would

[5] The LPS data is heavily skewed towards agency loans, and provides dramatically incomplete coverage of the non-agency market prior to 2005. Consequently, we show that the results using the LPS data during the anti-predatory law period are (likely) entirely driven by the prime market, a market the laws were not intended to influence.

hypothetically estimate the effect of the 620 cutoff rule on the ease of securitization. This calculation would not involve *solely* examining the rate at which loans are securitized. Rather, the first stage should include other aspects of securitization that affect lenders' costs of origination, such as the time it takes to securitize loans and the likelihood that loans will be returned to the lender through post-sale audits. We end our discussion by analyzing one of these aspects and explaining that the dimensions that impact the ease of securitization are more likely to be captured by the number of securitized loans (unconditional securitization rates) which we analyzed in our earlier work.

We finally note that it is difficult to infer whether lenders screen differentially using discontinuities in default rates around the 620 cutoff for loans where the value of collecting soft information is not particularly important – as is the case for loans sold to the agency market or loans with full documentation (the latter was discussed in KMSV). While the GSEs monitor and coordinate strict and uniform underwriting guidelines, the full documentation subprime market requires verification of income and assets. As a result, in markets with sufficient hard information or additional mechanisms for monitoring, one may observe jumps in unconditional loans sold around the 620 cutoff -- reflecting an ease of securitization -- without any corresponding jumps in default rates.

Our results in this paper, together with those in KMSV, identify the presence of moral hazard in the low documentation subprime market. However, using the same methodology, we are agnostic about whether there was a moral hazard problem in cases where we do not observe a jump in default rates -- as is the case with GSE loans and the full documentation subprime market. We discuss our findings in relation to pricing by investors, welfare, and policy in Section VI.

Section II: Measuring Securitization and Default Rates

The rate at which lenders are able to securitize loans is a crucial component of their ability to succeed in the originate-to-distribute framework. In their analysis, BK calculate a pooled securitization rate as the total number of loans securitized divided by the total number of loans originated, regardless of the market to which the loans are sold. For instance, in their low documentation sample, 58% of loans are sold to the prime market, 26% are securitized privately, and 16% are kept on the balance sheet. Consequently, the pooled securitization rate is computed as (58+26)/ (58+26+16)=84%. Similarly, "total" default rates are computed by pooling data across agency and non-agency loans to make inferences on the underwriting standards of lenders.

However, the hypothesis proposed and tested by KMSV that "skin in the game" (or lack thereof) played a potentially meaningful role in the screening decisions of lenders was for the subprime market. Lending in the agency market differs primarily due to the presence of GSEs coordinating stricter and more uniform guidelines across lenders. Additional monitoring and a credible threat of exclusion from the agency market are likely to play an important role in lenders' screening decisions.[6] Moreover, even among non-agency loans, it is important to account for differences in the

[6] Specifically, Fannie Mae and Freddie Mac require a formal qualification for lenders; rules and procedures for selling are laid out in a seller-servicer guide and there are several additional mechanisms in place such as post-sale audits which ensure that their underwriting standards are followed by lenders. This includes requiring their proprietary automated underwriting software to be implemented by each lender (Kling [2009]).

value of screening soft information, since it was shown to vary dramatically across low documentation and full documentation markets in KMSV. Consequently, assuming that the "total" securitization rate or default rate applies to both agency and non-agency loans could confound inferences on loans originated with an intent to sell to private investors in the non-agency market.[7]

In this section, we show that the connection between differential securitization rates and screening exists only for low documentation subprime loans and is obscured when these loans are pooled with agency loans and/or full documentation subprime loans. In particular, we observe a discontinuous difference in the securitization rate and an analogous jump in the default rate for low documentation loans in the subprime market. In contrast, there are no differences in securitization rates or default rates at 620 for agency loans or full documentation subprime loans -- underscoring why pooling loans across markets may lead to inaccurate conclusions about the mortgage market as a whole.

Estimating non-agency securitization and default rates

In each month of LPS data, one observes whether a given loan is sold to agencies, sold to non-agencies or is held on a bank's balance sheet.[8] Our objective from this data is to compute the securitization rate for the non-agency market. Specifically, let

$$\text{Securitization Rate of non-agency loans} = \frac{\text{\# of loans sold to non-agencies}}{\text{\# of loans sold to non-agencies+\# of loans on books}}$$

The relevant "loans on the books" for this calculation are those that are originated with an intent to sell to non-agencies. Since this information is not available in the LPS data, reasonable assumptions are necessary to calculate a securitization rate for non-agency loans. Note that the manner in which BK calculate their securitization rates also requires an assumption: they assume that lenders originate loans with no regard for whether they are intended for non-agency or agency secondary markets. Given that agency and non-agency markets differ substantially in the incentive provisions for lender underwriting, we argue that securitization rates and default rates should be computed separately for loans originated with the intent to sell privately in the non-agency market versus loans intended for sale to GSEs. Moreover, even among non-agency loans we want to separately analyze the securitization rates of low and full documentation loans, as KMSV showed the importance of

[7] A simple observation shows why the pooling of loans may lead to misleading inferences about both securitization and default rates in the non-agency market. Securitization rates in BK's analysis are observed to be around 90% on average for the entire 2001-2006 period (see their Figure 15). This seems inconsistent with aggregate data on the non-agency securitization rate that shows an increase from 55% in 2001 to 75% in 2006 (see Inside B&C Lending [2008]; Krainer and Laderman [2009]). The 90% securitization rate likely reflects the high degree of securitization in the agency market during 2001 to 2006 (see Chomsisengphet and Pennington-Cross [2006]) – which manifests itself in the LPS data since it is skewed towards agency loans (see Section IV for more details). On the other hand, the two markets have experienced very different patterns of defaults, with default rates for agency loans generally 33% lower on average than non-agency loans (16% as compared to 24%). As a result, pooled default rates are likely to be influenced to a larger degree by non-agency loans.

[8] The ownership status of loans (sold to agency, sold to non-agency, or bank-held) is dynamic over time as loans transition across states frequently. We follow the definition used in BK of taking the status as fixed at six months from origination, except in Section V where we focus on variation in the time to securitize.

separating low and full documentation loans because the value of screening soft information in these markets varies dramatically.

Method 1: Characterizing unsold loans as non-agency or agency through propensity score re-weighting

The first approach we use to separately analyze the incentives of agency and non-agency markets is to calculate the securitization rate by considering which low documentation loans on the bank's books "look like" non-agency loans. To characterize which loans look like agency loans, we run a probit regression on only sold loans that identifies which mortgage characteristics are associated with whether or not a loan is sold to the GSEs or to private investors.[9] Private loans are especially more likely to have larger loan amounts, a prepayment penalty, a non-fixed payment structure and higher interest rates than GSE loans. We then use the predicted values (that is, to what extent the loan is predicted to be sold to agency or non-agency based on its characteristics) out of sample and apply them to the distribution of loans held in the bank's portfolio. In other words, the probit regression constructs an index (propensity score) of which characteristics make a loan more or less likely to be sold on the agency market.

Do the loans in the low documentation sample look more like those loans sold to GSEs or loans sold to non-agencies? We plot the distribution of predicted values in Figure 1b. The distribution of "predicted GSE" characteristics for unsold low documentation loans looks nearly identical to the distribution for non-GSE loans. A simple summary measure of these distributions further supports the results in the figure. For the loans which are in fact sold to the agency market, the predicted rate of sale to the agency market is 86% (the average of the predicted values). On the other hand, the predicted rate of sale to GSEs for loans not sold to the agency market is 26%.[10] The rate for unsold loans is 36%, much more similar to the non-agency distribution than the agency distribution.

We apply these predicted values as weights to the portfolio sample to re-compute non-agency securitization rates. This is equivalent to a semi-parametric propensity-score re-weighting approach to address the compositional issues with the unsold segment of loans (see, e.g. DiNardo, Fortin, and Lemieux [1996]). In contrast to the pooled securitization rate in Figure 1a, Figure 1d documents a clear discontinuity in the low documentation non-agency securitization rate using those unsold loans that are likely to be non-agency. The unsold loans in this segment are heavily weighted toward the non-agency market, and the estimated discontinuity in the securitization rate is 5.4%.[11] Once unsold loans are appropriately classified, a large discontinuity in the low documentation non-agency securitization rate is apparent. This suggests that low documentation loans being sold to the non-agency market are confronted with discontinuous access to the secondary market at the FICO=620 threshold.

At the same time, we observe no discontinuity in securitization rates for low documentation loans sold to GSEs at the 620 cutoff. Figure 1c shows the re-weighted securitization rate for the GSEs, with no estimated difference around FICO=620. Moreover, the securitization rates for GSE loans

[9] Specifically, the regression includes FICO score, loan-to-value ratio, interest rate, loan size, debt-to-income ratio, ARM status, presence of a prepayment penalty, year of origination, a dummy for whether the loan was made in a high-cost state (CA, AZ, NV, or FL), and whether the loan is interest only or negative amortization. Our sample selection criteria are the same as in KMSV and BK: non-FHA/VA, non-buydown, owner-occupied single family first lien purchase loans.
[10] If the model was perfectly predictive, these values would be 100% and 0%, respectively.
[11] All estimated regression discontinuity coefficients mentioned in the text and figures are available upon request.

are high, as might be expected (see Chomsisengphet and Pennington-Cross [2006]), an average of 92% compared to 74% in the non-agency market.

Following the same method to examine default rates shows the dramatic differences in underwriting standards across loans in the agency and non-agency markets. The pooled default rate across the FICO distribution presented in Figure 2a obscures the differences between the two markets. When unsold loans are attributed to the appropriate market, the data clearly show in Figure 2c that the jump in default rates at FICO=620 in pooled data is driven solely by low documentation non-agency loans (as we found in KMSV). Correspondingly, in the GSE market, there is no difference in default rates at FICO=620 (Figure 2b).

To underscore the importance of looking at low documentation loans in the non-agency sector, we do a similar re-weighting exercise with all of the loans in the LPS/McDash purchase sample, regardless of documentation status. The results are shown in Figures 3 and 4. This decomposition method shows that there are no differences in securitization rates or default rates for GSE loans around the 620 threshold (Figures 3b and 4b). Moreover, within non-agency loans, there is no difference in securitization rates or default rates around the cutoff for full documentation loans (Figures 3c and 4c). It is only in the non-agency, low documentation sample of loans that we find a difference in the willingness of investors to purchase loans on either side of the 620 threshold (Figure 3d), and only in this sample where we observe a difference in default rates around the cutoff (Figure 4d).

These patterns obtain in any cut of the LPS data (such as "conforming"[12], jumbo, or low doc that BK consider) and show how pooling can obscure the differences in non-agency and agency markets. Re-weighting loans on the basis of their ex ante characteristics exposes differences in the ease of securitization and loan performance around the 620 threshold in the low documentation part of the non-agency market while revealing no such pattern in the agency market or full documentation part of the non-agency market.

Method 2: Segmentation and specialized subsamples in LPS data

We now turn to another method of attributing unsold loans to a particular market that is simpler to implement than the first method (and does not require any parametric assumptions), though it also makes some limiting assumptions. In a given low documentation segment of the market dominated by non-agency sales, method 2 designates all unsold loans to the non-agency market. This assignment exploits the fact that a large share of the lending in agency and non-agency markets is done by specialized lenders, and that for virtually all mortgages that meet the agency loan requirements, it may be advantageous for lenders to sell the loans to the GSEs.[13] However, one has

[12] Note that the loans considered "conforming" by BK are only "non-jumbo" loans, because the GSEs not only consider the loan amount as a criteria for defining a loan as conforming (which BK use), but also evaluate other information such as documentation, LTV and DTI ratios to define a loan that conforms to the GSEs standards for securitization. In fact, this explains why about 25% of the "non-jumbo" loans in BK's sample end up being sold to the non-agency market and many of the 15% on bank's books also look more like non-agency loans than agency loans based on these other characteristics.

[13] An alternative justification for the assumption that bank-held loans are largely originated with an intent to sell to the non-agency market is the role of the automated underwriting system in lender decision-making. In particular, since most GSE purchases occur only if the loan satisfies the criteria in their automated underwriting system, lenders can check whether a given loan meets the GSE criteria even before it is originated. For loans that do not meet the criteria, the

to be careful to apply this method to low documentation segments which are non-agency dominated -- otherwise the issues with pooling across markets (agency and full documentation non-agency loans) re-emerge.[14] In Appendix I, we briefly discuss the two assumptions underlying this method – that markets are segmented and that it may be advantageous for lenders to sell all qualified loans to the GSEs.

We use this method to compute the non-agency securitization rate for low documentation loans. Figure 5a reproduces the pooled securitization rate that BK use for low documentation loans. As the figure shows, there is no discontinuity in the total low-documentation securitization rate. However, as shown in Figure 5b, when the securitization rate is recomputed for low documentation non-agency loans by removing those loans sold to the GSEs, we observe a large and significant discontinuity at the FICO score of 620. This evidence is consistent with the estimate reported in Krainer and Laderman [2009], who use LPS data from home purchase loans originated in California and find a discontinuity of 4.5 percentage points at FICO=620, the only significant jump in the non-agency securitization rate distribution. Correspondingly, as is shown in Figures 5c and 5e, all of the discontinuity in pooled default rates is driven by the discontinuity in default rates for non-agency loans (roughly 8%). Consistent with the results reported using propensity score re-weighting, there is no estimated discontinuity in agency loan performance at 620 (Figure 5d).

Next, we examine the market for jumbo loans, a segment that is dominated by loans sold to non-agencies. As reported in Table 1, less than 3% of all jumbo loans in the LPS database are sold to the agency market. More importantly, the low-documentation jumbo loan segment has fewer than 2% of loans sold to the agency market. Consequently, examining the low-documentation jumbo loan segment offers a subsample that is essentially free of pooling across agency and full documentation non-agency loans. Figure 6 shows the securitization and default rate for this segment, documenting a large and significant discontinuity in the low documentation jumbo non-agency securitization rate of 22.7% (Figure 6b) and default rate of 19.5% (Figure 6e) at the FICO score of 620. In contrast, there is no such discontinuity in the full documentation jumbo loan segment (Figure 6d). Note that BK find similar jumps in both securitization and default rates in the jumbo market, because this sample is (essentially) 100% non-agency and has many low documentation loans.

We can extend the same methodology to other subsamples which are dominated by low documentation non-agency loans. For instance, we can analyze low documentation loans with adjustable interest rates (ARMs), because very few of these loans seem to be intended for the agency market (Table I). We observe a sharp discontinuity in the willingness of investors to purchase these loans around FICO=620 as well as in the default rate differences around the cutoff (not shown for brevity). Similar results obtain in other subsamples with similar features (e.g., low documentation

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lender would then screen based on the ease with which the loan eventually would be sold to the non-agency market. Using this idea, one could potentially apply the arguments above to the low documentation market (with a sufficient sample of non-agency loans) without relying on any assumptions of lender segmentation.

[14] Note that in this approach we have been careful to examine segments that are dominated by non-agency low documentation loans. The reason to do so follows from KMSV (and was confirmed earlier) which shows that the difference in default rates at the 620 threshold is a low documentation subprime loan phenomenon. Inferences are quickly obscured when segments with a sizeable presence of agency loans or full documentation non-agency loans are pooled with low documentation subprime loans.

loans with option ARMs or low documentation loans with a prepayment penalty are predominantly non-agency; see Table I).

We contrast the findings in the low documentation non-agency segment of the market with results from segments that are dominated by agency or full documentation loans. In Figures 7a and 7c we plot the pooled securitization and default rates in the non-jumbo "conforming" market (about 68% of loans in this segment are agency loans, see Table I). Note that these loans are not truly "conforming" in other dimensions of the loan and may still be intended for sale in the non-agency market. When we separate the non-agency low documentation loans from the pooled "conforming" market data the usual pattern emerges. In particular, the agency market shows no difference in the default rate (Figure 7d), while the non-agency low documentation loans exhibit a sharp discontinuity in the non-agency securitization rate of 6.6% and 4.8% in the default rate (Figures 7b and 7e, respectively). [15] Correspondingly, the full documentation non-agency loans show no discontinuities in securitization rates or default rates (not reported for brevity). These findings again confirm that the aggregate jump in defaults in BK's "conforming" (non-jumbo) sample is entirely driven by low documentation non-agency loans when we split this sample into agency and non-agency loans.

Finally, to provide additional evidence on the securitization and default rates among low documentation non-agency loans, we obtained data from two large subprime lenders (who requested anonymity) to estimate their securitization rates and default rates across the FICO distribution. These two lenders made up roughly 10% of the non-agency market, and were almost exclusively focused on subprime-originations. For these lenders, we can use method 2 (assign unsold loans to the subprime market) without having to make assumptions because there is no ambiguity on the market for which these loans are largely intended.

Using method 2, we observe a discontinuity in the low documentation securitization rate of 2.8% in the loans which Lender Y originated around a FICO score of 620, and an 1.7% discontinuity in the rate of low documentation securitization at FICO=620 for Lender X (Figures 8a and b). This result is also confirmed in the analysis of Jiang, et al. [2009] who use data from an anonymous large subprime lender. In fact, the graphs look very similar to the non-agency low documentation securitization rates calculated using LPS/McDash data when the pooling of agency and non-agency loans is taken into account. Correspondingly, there is also a jump in default rates for these lenders around the 620 threshold.

Method 3: Using LPS data with Lender Matching via HMDA

An alternative manner in which one could compute securitization rates and default rates would be to identify individual lenders by matching LPS data on loan observables (such as loan issuance date and location) to information in HMDA data that includes lender IDs.[16] One could then directly identify

[15] These estimates are based on a sample that combines both purchase and refinancing loans, as sample sizes for low documentation non-jumbo loans assigned to non-agency are relatively small. Nonetheless, the results are qualitatively similar for purchase only loans.

[16] We note here that the match rate of LPS loans to HMDA is very low, on the order of 30-40% depending on the matching criteria. Given that the LPS/McDash data significantly under-represents the subprime portion of the mortgage market, the securitization rates calculated by BK and replicated here are thus incomplete and likely heavily biased towards the agency portion of the market. Figures 15a and 15b compare the coverage of non-GSE data in LP used by KMSV and the coverage of non-GSE data in LPS used by BK across years from 2001 to 2006. As is evident, the

the screening behavior of lenders around the 620 threshold. BK use this match in their analysis in an effort to sort lenders based on their prevalence of securitization. However, our above results confirm that lenders' behavior should be assessed in relation to their intent to sell to the non-agency market. The analysis undertaken by BK instead sorts lenders based on their pooled securitization rate, which does not allow for this possibility and makes inference on lender behavior in the subprime market difficult.

We start by replicating the LPS-HMDA match used by BK and sort lenders into four quartiles based on their pooled securitization rate. BK establish (in their Table 5) that lenders that securitize the smallest fraction of their loans are the most likely to have differences in the number of originations around the threshold. And indeed, as shown in Table 2, the lowest quartile of pooled securitization rates is where we find the largest discontinuity in pooled default rate (See also Figure 9). However, sorting by the level of pooled securitization rate ignores that the differences in low documentation non-agency loans around FICO=620 are, as we showed above, the only loans where default differences occur.

Examining the types of loans originated by lenders sorted by pooled securitization rates clarifies the results. Lenders in the below median group of pooled securitization originate the largest fraction of low documentation non-agency loan and these loans drive the default differences in this group. In particular, as Figures 9b and 9c present, the pooled default rate differences in the below median group (Figure 9a) are not driven by agency loans and full documentation non-agency loans.[17] Figure 9d also shows that the largest securitization rate difference in low documentation non-agency loans is in the first group, the group with the lowest rate of pooled securitization.[18] Simply put, sorting lenders based on their pooled securitization rates puts the lenders who focus on the low documentation subprime market in the below median group -- thereby generating a seemingly puzzling pattern in BK.

A more transparent way to examine the intensity of lenders' differential behavior around FICO=620, would be to re-sort the lenders in the LPS data by the "ease of securitization" in the low documentation non-agency market. This could be captured, as in KMSV, by the magnitude of the discontinuity in the number of originated low documentation non-agency loans around 620. When the lenders are sorted into two groups along these lines (Figure 10a), the relationship between unconditional loans originated, securitization rates, and default rates for these loans is clear. In Figures 10b and 10c, we show that there are large discontinuities in both low documentation non-agency default rates and securitization rates among those lenders with the largest discontinuities in the number of low documentation loans securitized. The estimated discontinuities are reported in Table 3.

Thus, by replicating the LPS-HMDA match of BK, we show that their reported results based on quartiles of lenders' pooled securitization intensity does not shed any light on the behavior of lenders making low documentation non-agency loans. Low documentation non-agency loans that

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coverage of non-GSE low documentation loans in LPS is significantly limited throughout the sample period. See Appendix III.

[17] The jump in default rates in the "above median" group is relatively small, imprecisely estimated, and can most likely be explained by differences in the time to securitize around 620, a concept we discuss in more detail in Section V.

[18] We sort into only two groups instead of four as in Table 2 because many lenders have very small differences in their securitization rates. Using quartiles yields nearly identical results, but the differences across the middle groups are less visible graphically.

drive the differences in default around the 620 cutoff tend to get sorted into the lowest quartile. Sorting lenders based on the ease of securitization around 620 for these non-agency low documentation loans yields a clear relationship between the magnitude of differential securitization rates and differential default rates. We now comment on three issues related to the results in this section.

Using KMSV method to infer screening requires screening on soft information to be valuable

One might wonder how to reconcile the fact that there is a jump in the unconditional number of securitized GSE loans at FICO=620 (the proxy for "ease of securitization" in KMSV), while there is no corresponding jump in the default rate for these loans. This evidence is consistent with results in KMSV that examine the market for full documentation non-agency loans and show that for these loans, despite jumps in the unconditional number of securitized loans, default differences are attenuated or nonexistent. The reason is that conditional on lenders collecting more hard information, the value of soft information might not be as important. Thus the lack of a discontinuity in default rates in the agency market suggests that because more hard information about the borrower is collected due to stricter underwriting standards, lenders gain relatively little from screening these borrowers on the basis of soft information.

Performance comparisons of securitized and bank-held loans around 620 cutoff is not useful

It is tempting to conclude that examining the performance of securitized loans relative to loans that one observes on the bank's balance sheet could help to test the KMSV hypothesis. We now briefly discuss why this is unlikely to be the case. Although we are interested in examining the role of ease of securitization on ex-ante screening decisions, the patterns observed in unsold loans are ex-post outcomes that are influenced by the *intent* with which the loan was originated. In other words, a lender may screen its loans with an "intent to securitize" some or all of them to a particular market.

However, due to demand uncertainty and/or early delinquency prior to being sold, the lender may be able to sell only a fraction of the loans originated. If so, the loans that remain unsold on bank's books will also depict the same patterns as the loans that are sold by the bank. For instance, under the hypothesis that securitization affects screening (as in KMSV), if a lender intended to securitize 100 percent of originated loans, the entire set of loans below 620 would be screened better than those above 620. If any of the loans were unsold, they would depict the same screening pattern as those sold. Consequently, unless one accounts for the ex-ante intent behind originating every loan, observing screening patterns on loans on bank's balance-sheet ex-post is not likely to be informative per se about the role securitization had on lenders' ex-ante screening decisions.

Pooling mechanically dampens jumps more in securitization rates relative to default rates

The pooled measures of securitization and default rates used by BK are weighted averages of agency and non-agency components: $y_{pooled}=w_{agency}*y_{agency}+w_{non\text{-}agency}*y_{non\text{-}agency}$, where w's are the share of loans intended for each market and add up to 1. There are two compositional issues at work when one moves from 620- to 620+ along the FICO distribution. First, the composition of the sample changes the weights discontinuously at 620, as there is an increase in the proportion of non-agency securitized loans at the threshold, i.e., $w^{620+}_{non-agency} > w^{620-}_{non-agency}$ (and correspondingly, $w^{620+}_{agency} < w^{620-}_{agency}$).

Second, default rates and securitization rates (i.e., *y*'s) have different levels in the two markets, and themselves also change around the 620 threshold. We now discuss how these issues impact the estimation of discontinuities in the pooled data.

For the default rate, we established above that non-agency loans show a jump at 620 while agency loans do not. Now consider the two components of the weighted average default rate. The first component is $w_{non\text{-}agency}*default_{non\text{-}agency}$. As we move from 620- to 620+, this component increases because both the weight on non-agency loans rises and the default rate at 620+ is higher than at 620-, i.e., $w_{non-agency}^{620+} * default_{non-agency}^{620+} > w_{non-agency}^{620-} * default_{non-agency}^{620-}$. We call this component the "expanding" force, since it pushes the weighted data towards exhibiting a jump in default rates at 620+. The other component is $w_{agency}*default_{agency}$. As we move from 620- to 620+, this component decreases because the weight on the agency loans falls, and the agency default rates around the cutoff are similar, i.e., $w_{agency}^{620+} * default_{agency}^{620+} < w_{agency}^{620-} * default_{agency}^{620-}$. We call this component the "compressing" force, since it dampens the discontinuity in the weighted data. Whether one observes discontinuities in the pooled data is a function of how the two forces compare in terms of magnitudes. As one moves to 620+, the compression force is dominated by the expansion force, because $default_{agency}$ is low in magnitude relative to other terms in the two forces. As a result, one observes discontinuities in default rates even in the pooled data.

For the securitization rate, as was the case in default rates, the expansion force ($w_{non\text{-}agency}*sec\text{-}rate_{non\text{-}agency}$) still pushes the data towards exhibiting a jump in pooled data. However, the compression force is now larger in magnitude. Though the weight on agency loans falls when one moves to 620+, the securitization rate levels are very high (95%). As a result, the compression force ($w_{agency}*sec\text{-}rate_{agency}$) is large in magnitude relative to the expansion force and in fact dominates it in the data. As a result, we observe no jumps in the securitized rate.

In summary, as one moves from 620- to 620+, $w_{agency}*sec\text{-}rate_{agency}$ decreases relative to $w_{non\text{-}agency}*sec\text{-}rate_{non\text{-}agency}$ by more than $w_{agency}*default_{agency}$ falls relative to $w_{non\text{-}agency}*default_{non\text{-}agency}$. Therefore, despite the presence of significant discontinuities in both non-agency default and securitization rates, pooling mechanically dampens jumps more in securitization rates than it does in default rates. An example underlying this discussion is shown in the Appendix II.

Overall, using the same data as BK, we document discontinuities in securitization rates and default rates of low documentation subprime loans at the 620 threshold. We find no such pattern in agency loans or full documentation subprime loans; thus pooling across these markets obscures the connection between the ease of securitization and screening in the low documentation subprime market.

Section III: Additional Time-series Evidence

The time series increase of securitization in the non-agency market during 2001 to 2006 allows for additional tests of the hypothesis that access to securities markets influences lenders' screening standards. In this section, we establish that in periods when there were limited opportunities for lenders to securitize to the non-agency sector, as captured by no or small discontinuities in the number of loans securitized (i.e., in the ease of (unconditional) securitization), there is also no difference in the default rates of loans around the FICO=620 threshold. We document this

empirical regularity both before and after the subprime boom. In contrast, during the ramp up of securitization, as one progressively observes larger jumps in securitized loans – reflecting increasing ease of securitization from 2001 to 2006 -- there is a corresponding increase in the jump in defaults of loans around the 620 threshold as well.

If lenders were solely deciding on 620 as an optimal cutoff rule independent of securitization, we instead should have observed differences in the number of loans and loan performance even during periods when the non-agency securitization market was not available. This pattern is not observed in the data. Our time series results, which vary the access of lenders to securitization, directly test the central hypothesis of KMSV and confirm that the results are subprime-specific and driven by the relative access of lenders to non-agency securities markets.

a. Pre Subprime Boom: 1997 to 2000 and growth years: 2001 to 2006

In the years prior to the housing boom, the subprime market was in its infancy. Although increases in homeownership rates began in the mid-1990s, there was relatively little demand for subprime ABS in the investor market (see Gramlich [2007]). In this pre-boom period, securitizing loans in this market was relatively difficult and, as Figure 11a shows using the LP data, relatively few subprime loans were sold on the secondary market.

As is shown in the top panel of Figure 11a, during the period 1997-2000, there is no difference in the unconditional number of low documentation loans securitized around 620 – suggesting that the ease of securitization on either side of the 620 cutoff is highly constrained by demand for subprime ABS. At the same time, as shown in the bottom panel of Figure 11a, there is no differential performance of low documentation loans around 620 during 1997-2000 (estimate is -0.006). This evidence suggests that when securitization markets were relatively limited, the 620 cutoff rule did not affect lender behavior in terms of screening standards.[19]

We now extend the LP data to study the time series movement in jumps of unconditional low documentation loans as well as the jumps in defaults of loans around the 620 threshold.[20] Figure 11b and Figure 11c plot the progressive discontinuities in the number of loans securitized and in the default rates across the FICO spectrum. For comparisons with the 1997-2000 period, we consider two sub-periods of the boom years, 2001-2003 and 2004-2006. As is evident, one progressively observes larger jumps in loans securitized from 2001-2003 to 2004-2006. Correspondingly, the magnitude of the discontinuity in defaults of low documentation loans around the 620 threshold also shows an increasing pattern over the period (estimate is 0.006 for 2001-2003 and 0.024 for 2004-2006). This result follows the patterns established in Figures 10a and 10b in Section II; The magnitude of default differences increases as the discontinuities in the number of loans around the 620 threshold increases.

[19] Most large lenders who were active in the non-agency market during 1997-2000 period were also active in the subprime boom period (2001-2006). Consequently, this pattern is not likely to be driven solely by different lenders entering the subprime market in the post-2000 period.

[20] The data analyzed in KMSV ended in Q2 2007, limiting the ability to make default rate comparisons across years on a consistent basis with a 24 month time horizon. With data through 2008, we can now consistently track every vintage up to 24 months after origination to examine if the loan became delinquent or not.

Overall, the pattern in the subprime market for low documentation loans suggests that as the "ease of securitization" captured by the jumps in unconditional loans securitized around the threshold increases, so do the default differences around the threshold. This is consistent with the claims in KMSV that securitization access led to changes in lenders' underwriting standards as measured by higher defaults above the 620 threshold.

b. Early Signs of Collapse: Last half of 2006 and first half of 2007

After the first half of 2006, the subprime securitization market began to decelerate. In particular, subprime lending in states such as California and Florida dramatically reduced in size with the general economic slowdown. The impact was widespread for large non-agency lenders such as New Century, who began facing economic pressures around this time period (Creswell and Bajaj [2007]). This slowdown is visibly seen in the unconditional number of securitized subprime loans, as there are roughly half as many loans securitized in the second half of 2006 relative to the second half of 2005.

Figure 12b shows that the ease of securitization, as measured by the unconditional jump in the number of loans securitized, gradually began to diminish starting in the second half of 2006. Specifically, relative to last half of 2005 and first half of 2006 (Figure 12a), the latter part of 2006 and the first half of 2007 saw much smaller jumps in number of loans securitized around the 620 threshold. Strikingly, the default jumps around the 620 threshold follow the same pattern – they are attenuated in the second half of 2006 and in the first half of 2007 relative to the second half of 2005 and first half of 2006, precisely when the ease of securitization around the threshold attenuates (estimate is 0.020 for 05H2 and 06H1 and is -0.005 for 06H2 and 07H1).

Thus the evidence from before, during, and after the subprime boom evokes a consistent pattern: Around the FICO threshold, the differences in the number of loans securitized (reflecting greater ease of securitization) and the differences in default rates are highly correlated over time. This relationship further supports the characterization provided by KMSV that the ease of securitization was directly related to the performance of loans around the FICO threshold in the subprime mortgage market.

Section IV: Revisiting the NJ/GA Anti-Predatory Lending Law Experiment

In KMSV, the timing of the passage of anti-predatory lending laws in New Jersey and Georgia were used to test whether the results were being driven by lenders using FICO=620 as an optimal rule of thumb unrelated to securitization. We now build on our discussion of securitization rates in Section II and highlight how pooling data across agency and non-agency markets confounds inferences on lending standards in the non-agency market around the passage of these laws. In addition, we highlight the shortcomings of LPS data to make <u>any</u> inferences about the non-agency market in the period which constitutes the experiment in KMSV (2002-2003), since the data coverage is skewed towards agency loans in general and the coverage of non-agency loans improves only after 2004.

a. Empirical Results

The basic motivation of anti-predatory lending laws is to affect the terms and costs of lenders originating high-cost loans. The laws very clearly were targeted at the non-agency (subprime) portion

of the market (Bostic, et al. [2008]), while leaving the agency market relatively unaffected. Consequently, KMSV investigated the impact of these laws in the non-agency market. They find that when the laws were in effect, the ease of securitization as measured by the discontinuity at FICO=620 in the number of securitized loans dramatically attenuates -- reflecting the well-known fact that non-agency security markets were wary of buying loans from these states (e.g., S&P, April 15, 2003). During the period of enforcement, the evidence of greater default rates just above the FICO threshold dampens. In addition, after the laws were weakened or revoked, there was a rapid return of a discontinuity in the number of non-agency loans. Notably, the performance results follow the same pattern; that is, screening differentials attenuated only during the period of enforcement.

An empirical analysis of the securitization rate in these markets requires us to calculate the securitization rate for non-agency loans (i.e., the loans that were affected the most by these laws). The issues associated with pooling across markets described above are compounded due the fact that the coverage of the LPS data for non-agency loans during the period when the anti-predatory lending laws were in place in New Jersey and Georgia is particularly limited (i.e., while the laws were passed in 2002 and 2003, the coverage of non-agency mortgages becomes somewhat better in LPS only after 2004). Consequently, we show that the BK analysis during this period likely represents lending activity in the agency market.

To highlight this issue clearly, in Figure 13a we repeat the analysis in KMSV that shows a steep drop in the number of low documentation loans securitized around the 620 threshold while the law is in effect. The discontinuity in the number of loans made at FICO=620 disappears relative to periods before and after the law. In stark contrast, as shown in Figure 13b, the LPS sample that BK use is not able to replicate this fundamental pattern. In other words, the BK data does not show a reduction in securitized loans (agency or non-agency) over the period when the laws are in effect, nor does the data show a discontinuity in the number of loans at the FICO threshold when laws are not in effect. In fact, the coverage of the data BK use is so limited that there are not enough low documentation observations to make any meaningful inferences.

How do we know that the data used in KMSV is closer to what truly occurred in the non-agency market? We offer two main reasons. First, the fact that the non-agency securitization market in these states suffered dramatic declines during the period when anti-predatory laws were in effect is well known. For example, the Georgia Fair Lending Act (GFLA) had a direct effect on the willingness of investors to purchase high cost "covered" loans by altering the liability of purchasers of loans (such as securitization trusts) and assignees in the case of borrower default. These laws explicitly restricted the ability of lenders to securitize their loans. As a result, the ratings agencies were so concerned with the liability issues of anti-predatory laws that they effectively refused to rate any non-agency MBS transactions which included high-cost loans from Georgia (S&P, April 15, 2003).[21]

The decline in non-prime activity during the enforcement of anti-predatory lending laws can also be confirmed using HMDA data. Although HMDA data does not provide a distribution of the loans by FICO score, the aggregate trend in the volume of loans originated around the timing of the laws' enforcement dates is very similar to that shown in the LP data used by KMSV (not shown). In

[21] Similarly, loans defined as "High-Cost Home Loans" by the New Jersey Home Ownership Security Act (NJHOSA) were excluded by Standard & Poor's for similar concerns regarding assignee liability (S&P, May 2, 2003; S&P, May 13, 2004).

contrast, the aggregate trends induced by the enactment of anti-predatory lending laws cannot be found in the LPS data used by BK.

Second, the coverage of LPS sample, especially of the non-agency market, is incomplete and unlikely to be a random sample of this market before 2005. This fact was verified by several conversations with the vendor (see also Figures 15a and 15b). To empirically confirm that this is indeed the case, we document the differences between the coverage of the LP dataset used in KMSV vs. the LPS/McDash dataset used by BK for New Jersey and Georgia during the duration of the experiment in Figures 13. As can be seen from the figures, the pattern of lending during and after the passage of these laws as captured by LP is very different from LPS. There are almost no loans in the LPS sample with low documentation during this period (see Figure 13b). In fact, almost all of the loans in LPS during the time period are either full documentation loans (Figure 13c) or agency loans (see Figure 13d and note the expanded scale of the y-axis) – suggesting that the effects BK document are likely driven by agency loans in their sample.[22]

In conclusion, how should we interpret the empirical results presented by BK on the role of anti-predatory lending laws? Given the coverage of the LPS sample is skewed towards agency loans in general and given the absence of sufficient non-agency data before 2005, BK's results for Georgia and New Jersey are likely entirely driven by agency loans. The test in BK shows that anti-predatory lending laws primarily targeted to impede the subprime market (and confirmed in KMSV) had minimal effect on the prime market. The test, while interesting, cannot empirically be used to rule out conclusions about the patterns in the non-agency market drawn from the LP data in KMSV.

b. Conceptual issues

We now address a concern raised by BK that these anti-predatory laws are not a good natural experiment because they were designed to "have an effect on the level of defaults independently of their consequences for securitization." Anti-predatory lending laws were intended to identify and prohibit predatory practices for high-cost home loans. These laws, passed at the state level, were designed to change the terms of the contract rather than the outcomes of the contract (see Ho and Pennington-Cross [2006]; Bostic, et al. [2008]).

In other words, to fail the exclusion restriction (that the law had no direct effect on the 620 cutoff rule in and of itself) these laws had to differentially affect loans made to those above and below a FICO score of 620. If there were more "predatory" terms above 620 than below 620, one could argue that outlawing these terms would differentially affect the distribution of loans on one side of 620 versus the other. Our finding of similar contract terms on either side of the 620 cutoff (KMSV 2010, Figures III, IV, and IX, Appendix Table 1.A) suggests that loans above and below 620 would not have been seen as a priori more or less predatory based on the legal definitions of high-cost loans outlined in the New Jersey and Georgia laws.

[22] Furthermore, from a time-series perspective, the LPS data also misses the dramatic growth in the non-agency market in Georgia and New Jersey. For instance, the number of non-agency loans in Georgia increases by more than ten-fold from 2002-2005 in the LP data, the LPS data only shows a growth rate of roughly 250%. Any time series analysis using LPS data has to account for this limited coverage and potentially non-random increases to the sample size as non-agency servicers were progressively added over time starting in 2005 by LPS.

Overall, given the similar contract terms for borrowers around the FICO threshold in New Jersey and Georgia before the law was passed, it is difficult to conclude that anti-predatory lending laws were differentially targeted directly to impact loans made to borrowers just above or below the FICO score of 620.

Section V: Understanding "Ease of Securitization"

KMSV use the FICO=620 threshold as a measure of exogenous variation in the ease of securitization in the non-agency market. In order to confirm that this cutoff indeed does induce variation in the securitization market in the predicted direction, the ideal first stage of an instrumental variables framework would hypothetically estimate the effect of the FICO cutoff rule on the "ease of securitization." Even if one could circumvent the problems highlighted in Section II with respect to securitization rates and estimate the securitization rate of a lender catering to the non-agency market correctly, capturing the relative ease of securitization is not equivalent to *solely* measuring the securitization rate. Instead, there are several other dimensions that securitization introduces into lenders' payoffs – and hence lenders' ex-ante screening effort. In this section, we discuss two additional aspects of "ease of securitization" around the 620 threshold.

(a) Two Additional Dimensions that Securitization Introduces into Lenders' Payoffs

Aspect 1: Time to Securitize a loan

A lender's ex ante screening effort depends both on the securitization rate and on the payoffs conditional on securitization. An additional aspect of securitization that lenders consider is the time it takes to securitize a loan. The longer it takes for a loan to be securitized, the costlier it may be for the bank. This cost could come from the opportunity cost to the bank of not being able to invest elsewhere. In addition, if the loan becomes delinquent before it is securitized, the likelihood of subsequent securitization is reduced dramatically (see Piskorski, et al. [2009]). If so, this would further tie up the bank's capital on its balance sheet. In other words, a longer time to securitize carries with it inventory (or "warehouse") risk and this inventory risk could provide the appropriate incentives for lenders to carefully screen borrowers. More importantly, these costs could vary with loan characteristics (such as FICO) and impact the payoff a lender faces even if the loan was eventually securitized.

To illustrate how the time to securitize varies around the 620 threshold, we plot the variable constructed from time of origination to time of first securitization for non-agency low documentation loans.[23] As shown in Figure 14d, there is a large decrease in the time it takes to securitize a low documentation non-agency loan around the FICO threshold in the LPS data. In particular, it takes about 60 more days (1.9 months) to securitize a loan that is just below 620 than a loan just above 620 (on a base of 6.8 months). In sum, the loans just below 620 take roughly 28% longer on average to be sold. Notably, there is very limited evidence for differential time to securitize in the agency market (there is a small jump for GSE loans at FICO=620 in Figure 14b) and in the full documentation non-agency market (no jump in Figure 14c). Finally, consistent with the results in this section, Figure 10d confirms that the difference in time to securitize is highest for

[23] To capture the heterogeneity in the timing of securitization, we allow the time of first securitization to be any time in the first 48 months after origination, although qualitatively similar results hold with shorter time horizons.

those lenders who screen low documentation loans most differentially around 620 (refer back to Section II).[24]

How costly is it for lenders to keep low documentation non-agency loans for an extra 25% longer on their balance sheet? Using the data from McDash/LPS on defaults by month of origination, we can compare the differences in defaults from the average time to securitize for 620+ (roughly 5 months after origination) to the average time to securitize for loans with FICO scores at 620- (roughly 7 months). Between month 5 and month 7, an average of 7.1% of low documentation non-agency loans enter some stage of delinquency (30 days or more delinquent). The lender directly bears the cost of these additional defaults as it makes it difficult for these loans to be subsequently sold. This calculation shows that there is a significant cost to additional time to securitize from the lender's perspective, which could directly affect their origination and screening decisions. Note that these losses are in addition to the opportunity cost that lenders bear for having their capital tied up for an extra 1.9 months.

Aspect 2: Loan Comebacks

Another aspect that potentially impacts a lender's screening payoffs is that even after securitization the loans may be returned to the balance sheet of the lender. These "comeback" or "kick-out" loans are returned based on post-sale audits done by the trust of the SPV that buys the loan. Repurchase and Warranty agreements typically allow 90-120 days for trusts to conduct random audits on certain loans to confirm their veracity. If these audits occur more intensively depending on loan characteristics, it may impact lender's screening decisions for two reasons. First, the audits may differentially affect the rejection rates of certain types of securitized loans – and in turn may impact the overall securitization rate around the 620 threshold. Second, once these loans come back, even if they are re-securitized (which does not always occur, Piskorski et al. [2009]), there is an additional warehousing risk that lenders have to bear for the comeback loans and that could in turn force them to screen the loans below 620 more carefully. While it is difficult to measure the intensity of these audits, this is an additional aspect that varies with securitization and could potentially impact screening decisions of lenders around the 620 threshold.[25]

Overall, we find that in addition to the securitization rate, another aspect of securitization also varies systematically and discontinuously around the FICO=620 threshold. Lenders take longer to securitize low documentation loans just below the 620 threshold in the non-agency market, which increases the costs of originating these loans relative to those just above the 620 cutoff. In addition, there might be differences in post-sale audits based on FICO scores which may also impact the costs of originating the loans around the cutoff. Both these aspects are related to securitization and, in addition to the rate of securitization, may impact lenders' screening effort around the threshold.

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[24] As an additional check on the differences in warehouse risk around the FICO threshold, we obtained data from a competitor of LPS on the time to securitize mortgages found in subprime private pools (this data corrects for "imputed origination date" problem that plagues several datasets). Results suggest a similar striking decrease in the time to securitize for low documentation loans at FICO=620. Loans just below 620 stay on lenders' balance sheets for 25% longer than loans just above 620.

[25] Data on post-sale audit intensity is difficult to acquire. One proxy for how this intensity varies around the 620 cutoff is to examine the proportion of kick-out loans around the threshold. We were able to obtain information on kick-out loans for ten deals from a competing data vendor, and the analysis suggests a higher proportion of kick-out loans below the 620 threshold (about 1.5% higher) in the low-documentation non-agency segment.

(b) Why may the Unconditional Securitization Rate be a Better Measure of "Ease of Securitization"?

We now argue that various aspects that impact "ease of securitization" are more likely to be captured by unconditional securitization rates as in KMSV rather than solely in conditional securitization rates. First, we can decompose the unconditional probability that loan is securitized as

$$P(S=1) = P(A=1) * P(L=1|A=1) * P(S=1|A=1, L=1),$$

where P (A=1) is the application rate, P (L=1|A=1) is the acceptance rate of the lender and P(S=1|A=1, L=1) is the conditional securitization rate. Our claim is that any of the aspects through which securitization potentially affects lender's payoffs – and hence its screening effort -- would show up in the unconditional securitization rate, P(S=1), thus serving as a more complete measure of "ease of securitization."[26]

To see this note that any change in conditional securitization rates is captured in the unconditional rate. In addition, any other aspects that may not impact conditional securitization rates such as inventory risk based on the time to securitize or loan comebacks would also be captured in P(S=1). These aspects are instead more likely to alter lender's acceptance rates, P(L=1|A=1), and therefore P(S=1). In other words, lenders might internalize the higher cost of securitizing these loans in their origination decisions.[27]

The downside of using the unconditional rate is (as BK point out) that if there are no differences in any of the variables through which securitization impacts a lender's payoff, this probability could be measuring only the acceptance rates of the lender -- which might vary independent of securitization. If one does not have the micro data to measure all such variables accurately, the only way to confirm this conjecture would be to do a time series test which would vary the "ease of securitization" and examine if changes in P(S=1) correspond to changes in the screening behavior of the lender. KMSV conduct this time series test in New Jersey and Georgia precisely to rule out this alternative. In this paper, we have extended those time series tests to confirm that there is a relationship between "ease of securitization," the unconditional rate of securitization, and the default differences around the 620 threshold.

Thus, while it is true that the conditional securitization rate (even if correctly measured taking into account issues in Section II) is an important variable that affects screening effort, it is not likely to measure every aspect of securitization that influences a lender's payoff from selling the loan. In contrast, the unconditional probability of securitization ("ease of securitization") is likely to capture the complete impact.

Section VI: Conclusion

We document discontinuities in both securitization rates and default rates in the low documentation non-agency market, which supports the results found in KMSV. Importantly, we find no

[26] Note that as explained in KMSV, the measure we have available is N(S=1), the number of securitized loans. The assumption is that one can proxy for the unconditional securitization probability if the number of potential applicants at 620- and 620+ is similar.

[27] This change in a lender's acceptance rate could in turn also alter the borrower's application decision P(A=1). In particular, if borrowers know that they are less likely to be approved, they might be dissuaded from applying.

differences in securitization or default rates for agency loans or full documentation subprime loans. The connection between the ease of securitization and screening in the low doc non-agency market is obscured when these loans are pooled together with agency loans and full documentation subprime loans. The time series evidence we present further confirms these patterns using variation over time in the intensity of the non-agency securities market. In the pre-boom and post-boom years, we observe no differences in securitization rates or default rates, whereas the differences are particularly acute when the subprime market was booming from 2004 to 2006.

Our finding that there is no default rate difference at FICO=620 in the prime market or full documentation subprime market, but differences in the low documentation subprime market, can best be explained by differences in the value of screening soft information across the securitized assets in these segments. The GSEs monitor and coordinate strict and uniform underwriting guidelines which include following a proprietary underwriting system and a credible threat of exclusion from the agency market. These stringent guidelines make the value of screening soft information for these loans relatively small. Similarly, as was suggested in KMSV, for full documentation non-agency loans, conditional on lenders collecting more hard information, the value of soft information may not be as important. As a result, in markets with sufficient hard information or additional mechanisms for monitoring, one may observe jumps in unconditional loans sold (due to jumps in conditional securitization rates and/or time to securitize for instance) around the 620 cutoff without any corresponding jumps in default rates.

Exploring the underlying costs that lenders face when they operate in the originate-to-distribute framework, we note three crucial aspects: the rate at which loans are securitized (which reflects investors' demand), the time that it takes to securitize, and the likelihood of the loan being returned through post-sale audits. From the lender's perspective, the ease of securitization is reflected in all these dimensions and these are more likely to be captured by the number of securitized loans (unconditional securitization rates) which we analyzed in KMSV.

While the data available cannot determine if investors accurately priced lenders' differential screening behavior around the 620 threshold in their payments to lenders or the prices of asset-backed securities, our results are agnostic toward this issue. On the one hand, it is possible that investors could have rationally anticipated and priced the moral hazard into their payments. Lenders in turn may have chosen to respond to this scenario for reasons related to regulatory arbitrage or capturing market share in the short-run, among others (see Parlour and Plantin [2008] and Rajan, et al. [2008]). On the other hand, developing an arbitrage strategy for exploiting this opportunity may have been prohibitively difficult for investors, given that loans were pooled across the FICO spectrum before they were traded. Furthermore, these fine differences in performance around the FICO threshold could have been obscured by the performance of other complex loan products in the pool. Examining which of these alternatives occurred during the run up to the subprime crisis is a fruitful area of research.

It is important to note that while we refrain from making any welfare claims, there could have been distortions introduced in the real economy due to the effects we document, even if the effect was rationally priced by investors. In particular, it is possible that regulators and rating agencies may have perceived some securitized assets to be less risky than they actually were if they relied on pre-securitization boom data to evaluate the quality of loans above FICO of 620. As a result, banks' capital requirements may not have adjusted sufficiently for the risk of some of securitized assets.

Understanding the behavior of regulators and rating agencies in the period before and during the crisis remains another promising area of research.

Finally, our conclusions should be directed at securitization as practiced in the low documentation subprime market during the subprime boom, rather than at the optimally designed originate-to-distribute model. We believe securitization is an important innovation and has many merits. It is often asserted that securitization improves the efficiency of credit markets. The additional insight of our paper is to argue that the benefits of securitization may be limited in environments when the value of screening on soft information by intermediaries is potentially high.

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Appendix I

Market segmentation and sale to GSEs

Previous research has emphasized the segmentation between the agency and non-agency markets (e.g., Nichols, et al. [2005]). To assess how segmented the market is, we examine the extent of originations by lenders who primarily cater to the non-agency market. The U.S. Department of Housing and Urban Development (HUD) provides a list that classifies lenders as subprime lenders based on the extent of their specialization in the subprime lending (Gerardi, et al. [2007]; Sherlund, et al. [2008]). Using this data, and consistent with the literature, we find that lenders who primarily originate loans to be sold to the subprime market make almost no loans that are sold to the agency sector.

To show this empirically, we merge the data from HMDA on lenders' loan sales with whether the lender specialized in subprime lending, as defined by HUD to make our assessment. Lenders who appear on the HUD subprime lender list (*non-agency lenders*) sold less than 1% percent of their originated loans to the agencies during the peak years of the subprime market, 2004-2006 -- an average of only 0.5% of their originations. In addition, if we take the total securitization rate that BK calculate at its face value, a typical lender in the BK sample looks very similar to a lender catering to agencies. In their LPS sample, about 60% of loans are sold to agencies, 25% to private market and 15% are unsold, which is consistent with the HMDA data for non-HUD lenders who are heavy providers (in the top 1% of all lenders).[28,29]

The assumption that it may be advantageous for lenders to sell qualified mortgages to the GSEs may be sensible for two reasons. First, as we showed with the distributions of propensity scores, if one observes the interest rates and type of contracts of loans on the bank's balance sheet, the characteristics look closer to those found in the non-agency market. For example, Krainer and Laderman [2009] use the same data and find "large differences between the mortgages sold to the GSEs on the one hand, and on the other hand mortgages either retained by lenders or securitized through the non-agency channel." Second, this assumption is equivalent to acknowledging the fact that these mortgages are expressly underwritten to meet the securitizer's standards (e.g. Passmore and Sparks [2000]).

[28] These calculations are consistent with the previous literature on this issue. See Canner, et al. [1999] on the growth of specialized lenders prior to the subprime boom, Calem, et al. [2004] on the geographic and racial segmentation of the agency and non-agency markets, Rosenthal and Gabriel [2007] on the linkage between subprime lenders and the secondary market, and Gerardi, et al. [2007] who also show that lenders on the HUD subprime list originate few prime loans.

[29] Another simple way to quantify this segmentation is to compare lists of the top lenders in each of the two markets. Using the data compiled by the publication "Inside Mortgage Finance," on average there are only six lenders who appear on both the top 50 prime and subprime originations lists for the years 2001-2006. Note that the top 25 subprime (B&C) lenders accounted for more than 90% of the market, while the top 20 conventional conforming lenders accounted for over 80% of the prime market (Inside Mortgage Finance). These results again point to strong segmentation of the mortgage market between non-agency and agency-focused lenders.

Appendix II

Why pooling leads mechanically to more dampening of securitization rates relative to default rates

To show the mechanical relationship between pooling agency and non-agency loans and the attenuation of securitization rate differences relative to default rates at the threshold, we use the estimated values from the LPS/McDash data used by BK. Let us define the tuple (x,y,z) where x is the number of loans on the portfolio, y is the number of loans that are securitized to the private (non-agency) market and z be the number of loans that are securitized to the agency market. Let us further assume for simplicity that the securitization rate for the agency market is 100% (as in Method 2). For the non-agency market let us assume that the default rate at 620- is 8 percent and its 16 percent at 620+ for both portfolio and securitized loans. Let us further assume for simplicity that the default rates at 620- and 620+ for agency loans is 4%.

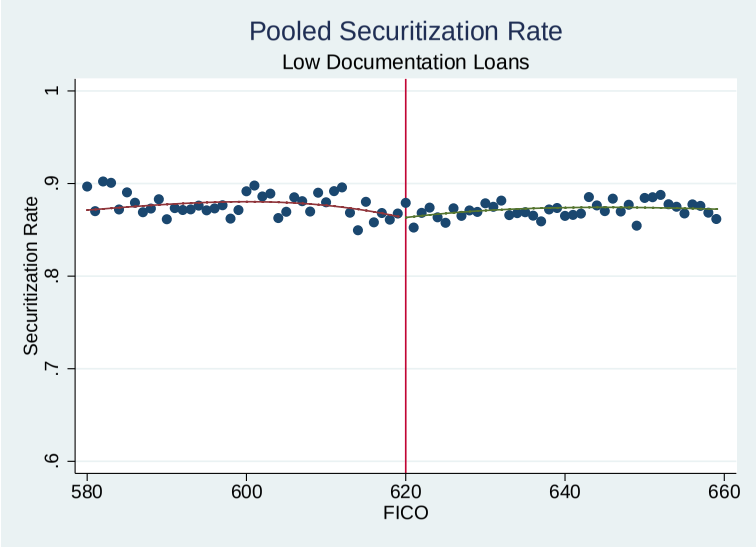
At 620- and 620+ the aggregate number of loans are (123, 364, 717) and (258, 933, 1246), respectively. As we move from 620- to 620+, w_{agency} falls from 59.5% to 51.1% (with a corresponding increase in $w_{non\text{-}agency}$). If we calculate the total securitization rate using BK's definition, (in essence a weighted average of the two securitization rates) the difference comes out to be -0.4 percent, i.e., the 620- loans in the aggregate sample have a slightly lower securitization rate than the 620+ loans. Under our assumptions of securitization rates in the agency market, we can calculate the non-agency securitization rate as 74.7 percent at 620- and 78.3 percent at 620+, a difference of 3.6%, nearly 10 times larger than the pooled difference. The difference in default rates is the weighted average of the default rates of the different type of loans, approximately 4.2 percent, or half of the true difference in non-agency loans, but nonetheless large relative to the difference in the pooled securitization rate. Thus, as explained in the text, even though both securitization rates and default rates are simple arithmetic means, pooling across markets has different effects on these variables.

Appendix III

Data differences between LoanPerformance (used in KMSV) vs. LPS/McDash (used in BK and a large part of this paper)

The LoanPerformance (LP) data used in KMSV (2010) is a database of non-agency securitized loans. The database is the only source that provides a detailed perspective on the non-agency securities market. The data include information on issuers, broker dealers/deal underwriters, servicers, master servicers, bond and trust administrators, trustees, and other third parties. As of December 2006, more than eight thousand home equity and nonprime loan pools (over seven thousand active) that include 16.5 million loans (more than seven million active) with over $1.6 trillion in outstanding balances were included. LoanPerformance estimates that as of 2006, the data covered over 90% of the subprime loans that were securitized. The data set includes all standard loan application variables such as the loan amount, term, LTV ratio, credit score, and interest rate type—all data elements that are disclosed and form the basis of contracts in nonagency securitized mortgage pools.

In contrast, the McDash/LPS data used in BK and in this paper contains loan-level information on unsold loans, loans securitized by Government Sponsored Entities (GSEs), and loans securitized through private investors. Although there are clear advantages to observing loans still on banks' balance sheets, the McDash/LPS database significantly under-represents the subprime market before 2005 and even after 2005 covers only about 30% of originated non-agency loans. Figures 15a and 15b compare the coverage of non-GSE data in LP used by KMSV and the coverage of non-GSE data in LPS used by BK across years from 2001 to 2006. As is evident, the coverage of non-GSE low documentation loans in LPS is significantly limited throughout the sample period. Thus the pooled securitization rates calculated by BK and replicated here are likely heavily biased towards the agency portion of the market. Furthermore, as we discussed in Section IV, results using the LPS data during the anti-predatory law period (that is, prior to 2005) are nearly entirely driven by loans sold to the prime market, a market the laws were not intended to influence.



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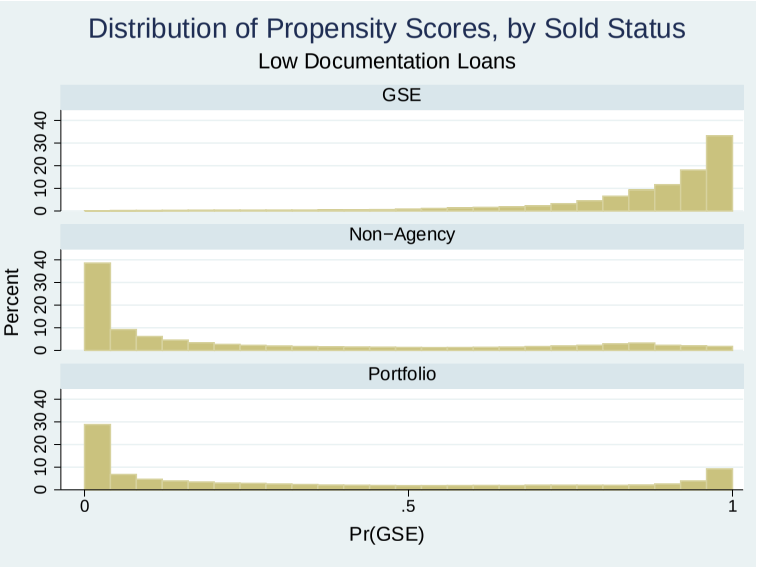

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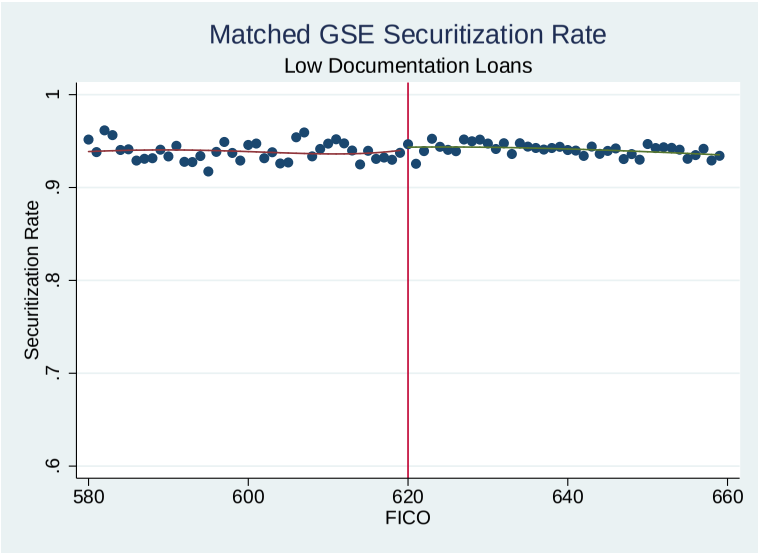

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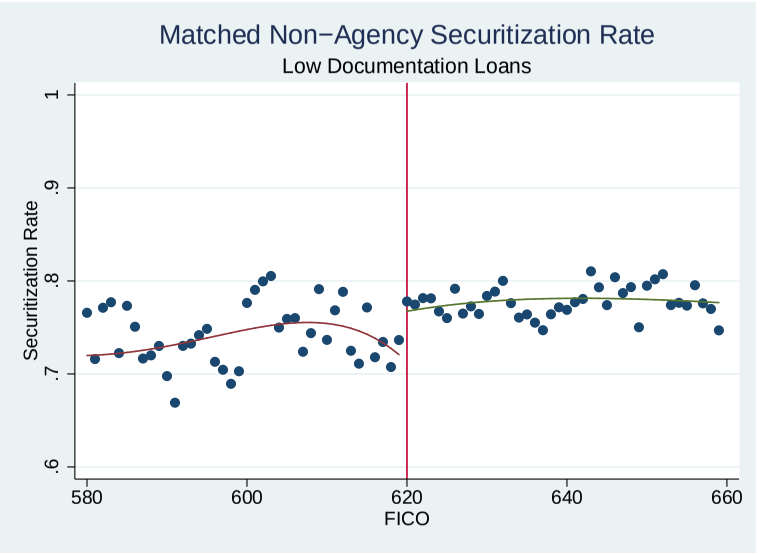
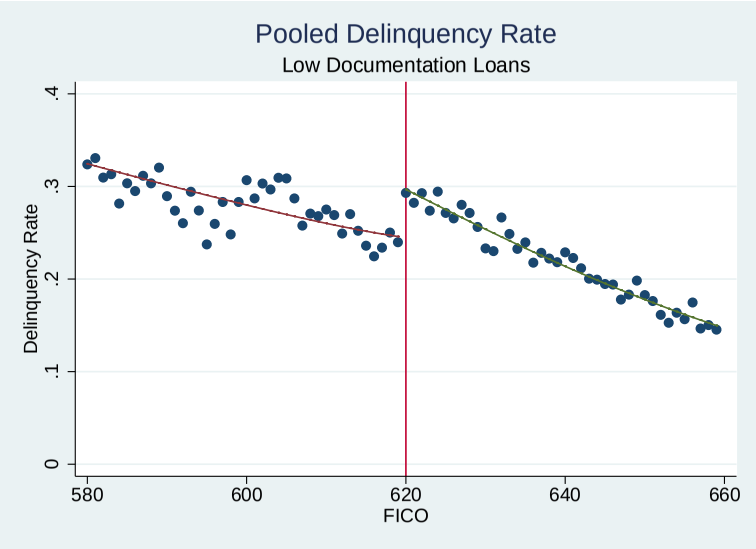


1d

Figure 1 (a)-(d): The figure depicts pooled (non-GSE and GSE together) and separated securitization rates for low documentation loans in the LPS database originated between 2001 and 2006. The pooled securitization rate in Figure 1a is similar to Bubb and Kaufman (2009) and exhibits no discontinuity around 620. Propensity score matching is used to attribute unsold loans to GSEs or to non-GSEs [Method 1]. The distribution of loans based on their likelihood of being sold to the GSEs is shown in Figure 1b. Portfolio loans are unsold loans on books of banks, and their distribution is very similar to that of non-agency loans. When these propensity scores are applied to separately calculate agency [1c] and non-agency [1d] securitization rates, the figures show that there is no jump in GSE securitization rates at 620, while there is a large and significant jump in the non-agency securitization rate at the threshold.



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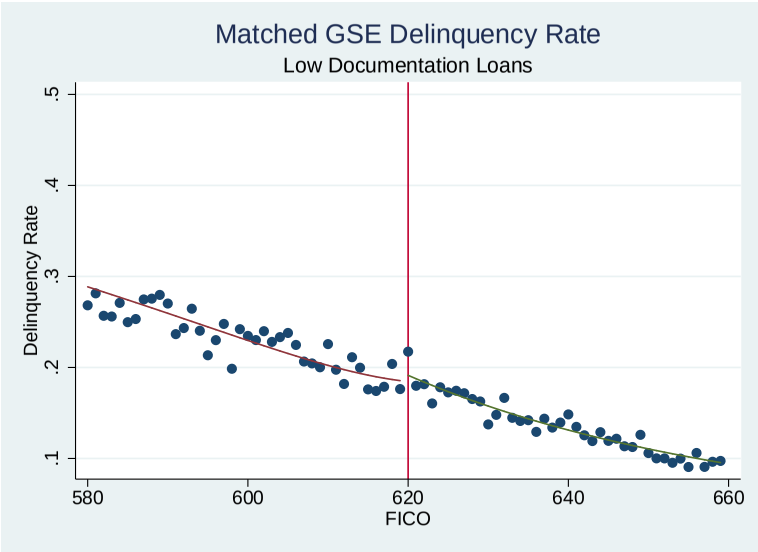

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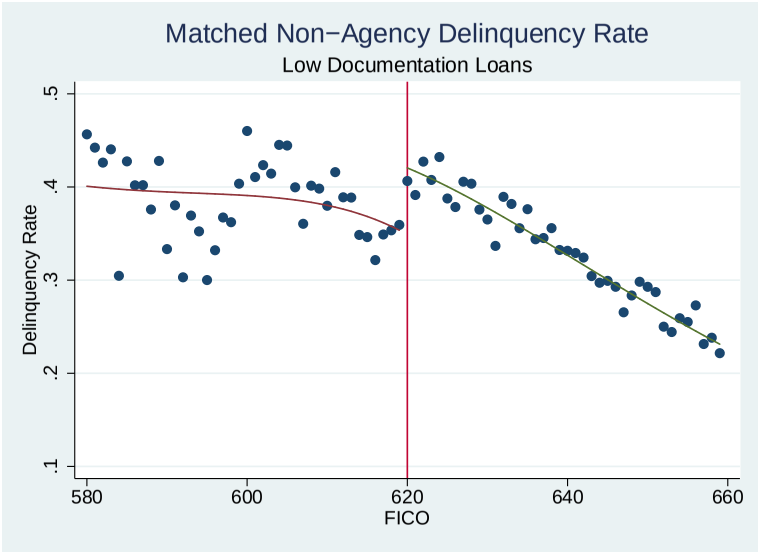
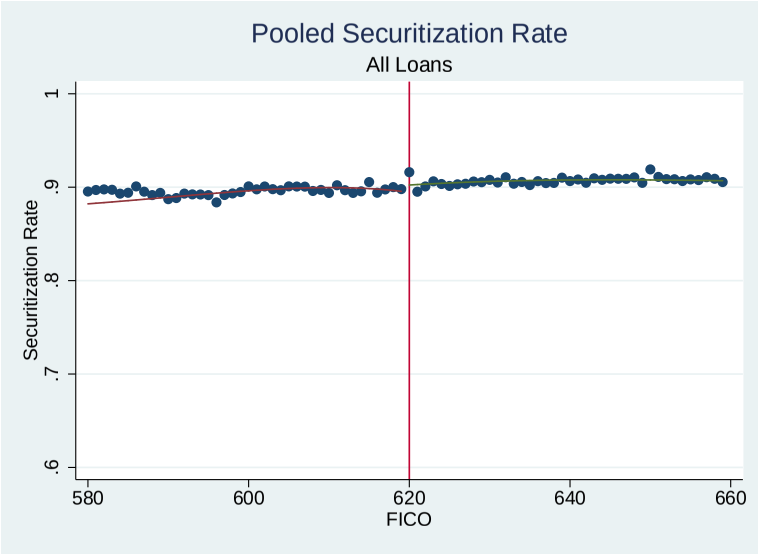


2c

Figure 2 (a)-(c): The figure depicts pooled (non-GSE and GSE together) and separated 60+ day delinquency rates for low documentation loans in the LPS database originated between 2001 and 2006. The pooled delinquency rate in Figure 1a is similar to Bubb and Kaufman (2009) and exhibits a large discontinuity around 620. Propensity score matching (using the distribution shown in Figure 1b) is used to attribute unsold loans to GSEs or to non-GSEs [Method 1]. When these propensity scores are applied to separately calculate agency [2b] and non-agency [2c] delinquency rates, the figures show that there is no jump in GSE delinquency rates at 620, while there is a large and significant jump in the non-agency delinquency rate at the threshold.



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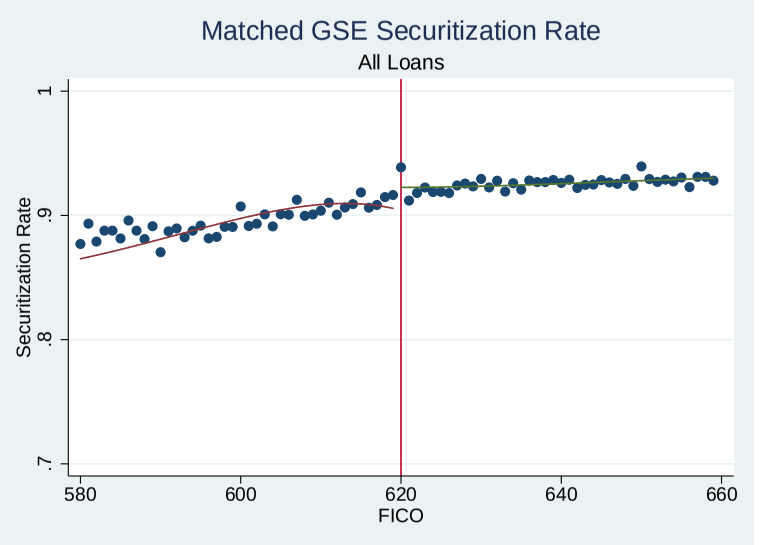

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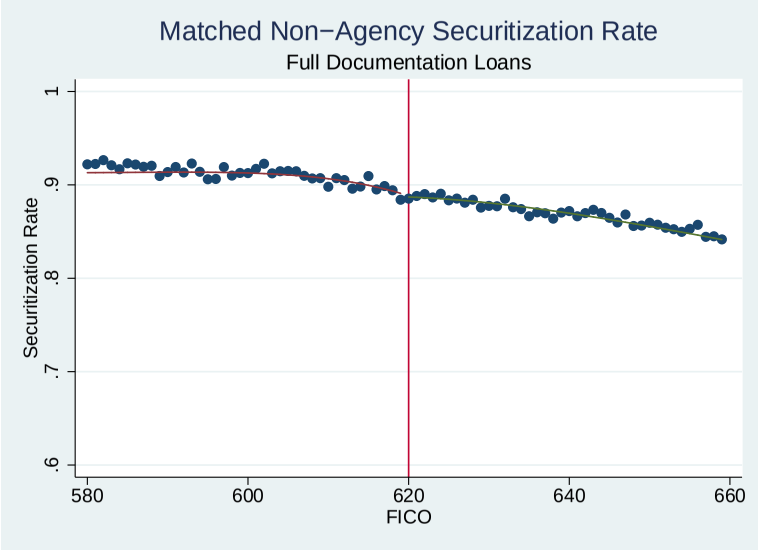

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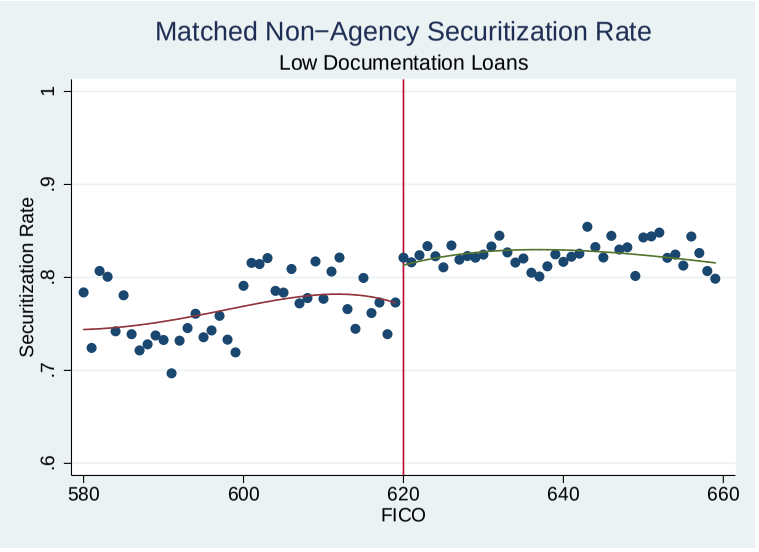
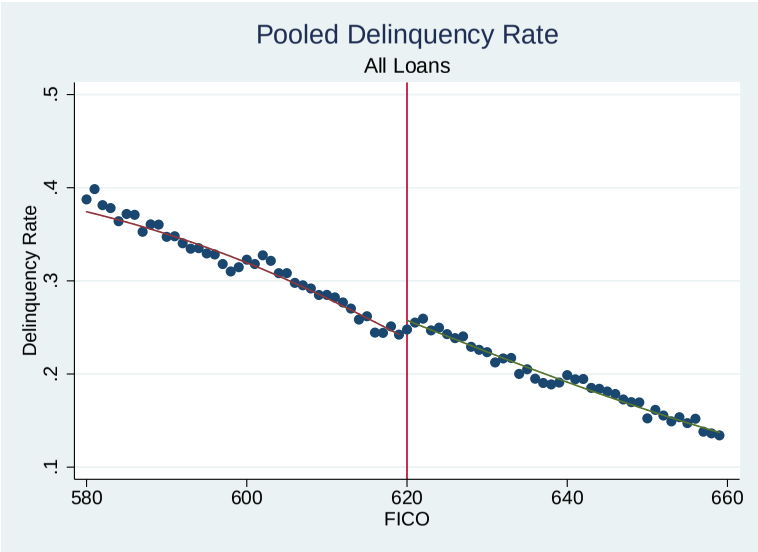


3d

Figure 3 (a)-(d): The figure depicts pooled (non-GSE and GSE together) and separated securitization rates for *all* loans in LPS database originated between 2001 and 2006. The pooled securitization rate for all loans is shown in Figure 3a and is smooth through FICO=620. Propensity score matching is used to attribute unsold loans to GSEs or to non-GSEs [Method 1]. When propensity scores are applied to separately calculate securitization rates, the GSE loans [3b] and full-documentation non-agency loans [3c] have no differences around 620, while there is a large discontinuity in securitization rates for low documentation non-agency loans [3d].



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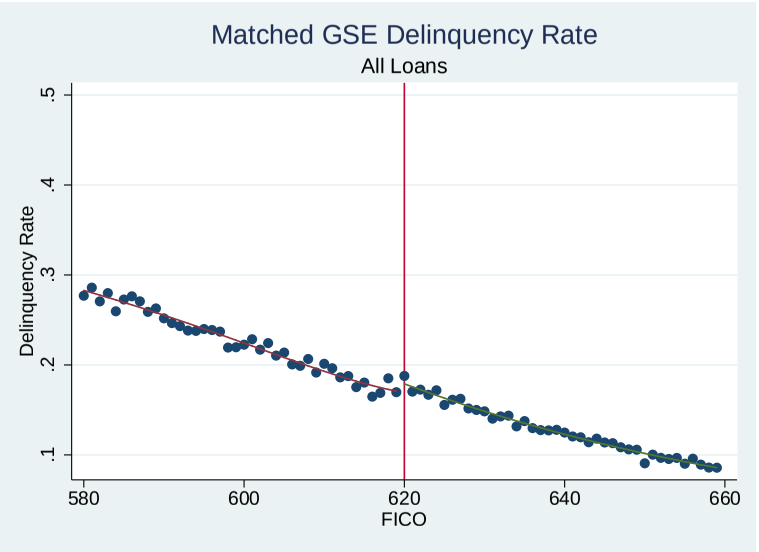

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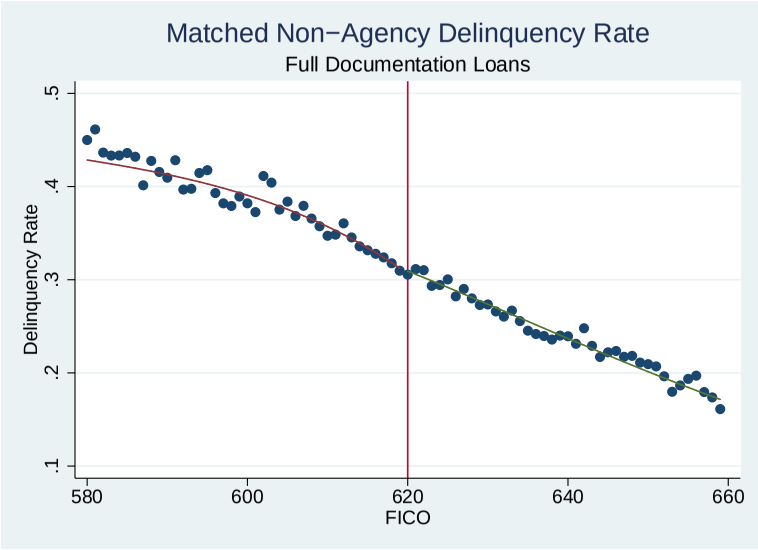

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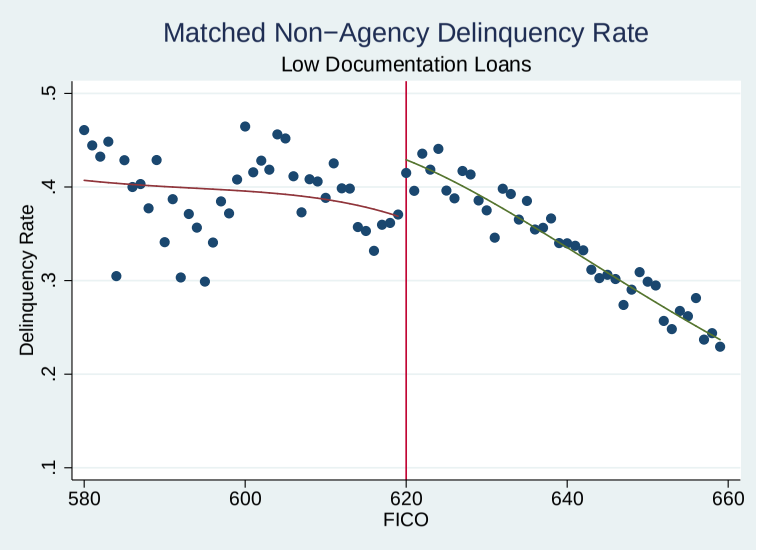
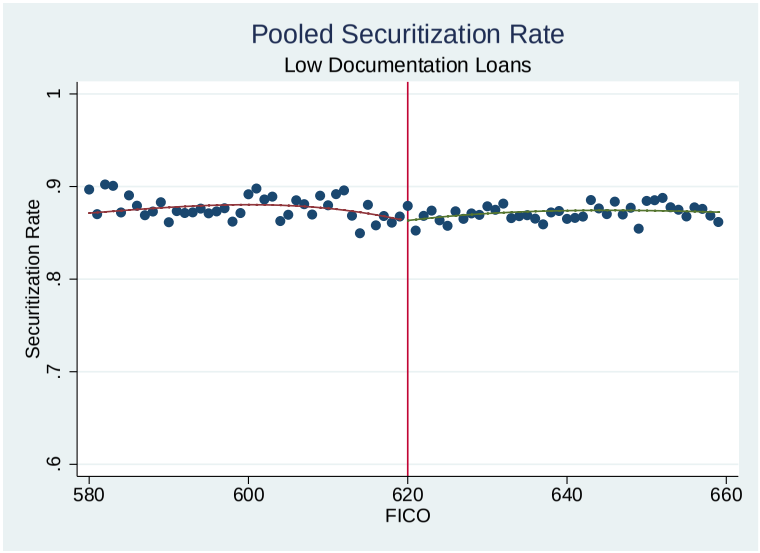
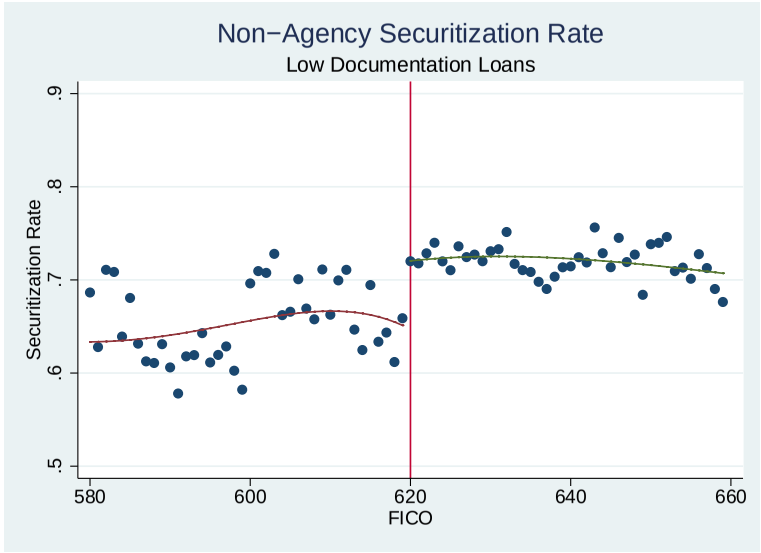


4d

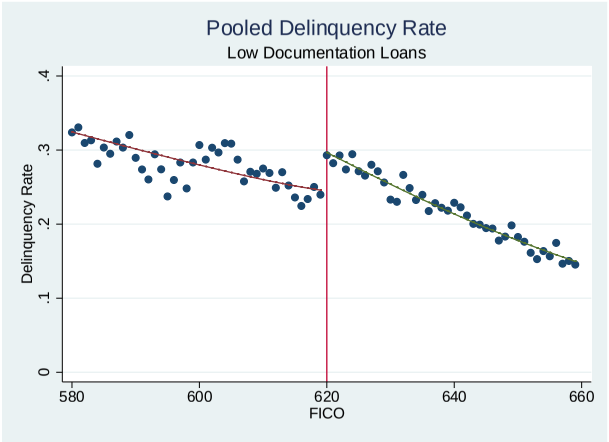
Figure 4 (a)-(d): The figure depicts pooled (non-GSE and GSE together) and separated 60+ day delinquency rates for *all* loans in LPS database originated between 2001 and 2006. The pooled delinquency rate [4a] shows a small jump in default rates. Propensity score matching is used to attribute unsold loans to GSEs or to non-GSEs [Method 1]. When these propensity scores are applied to separately calculate delinquency rates, agency loans [4b] and full documentation non-agency loans [4c] exhibit no differences around 620, while there is a large discontinuity in delinquency rates for low documentation non-agency loans [4d].



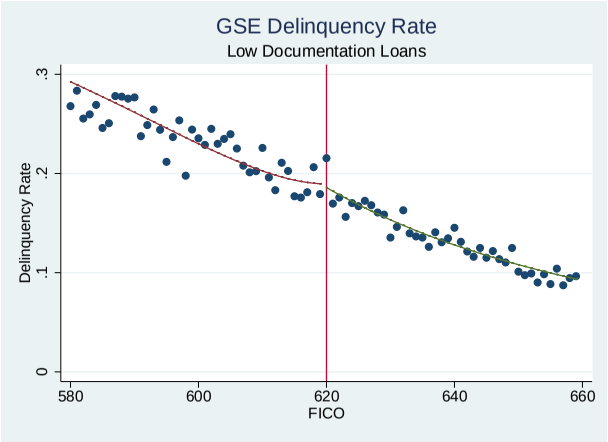
5a



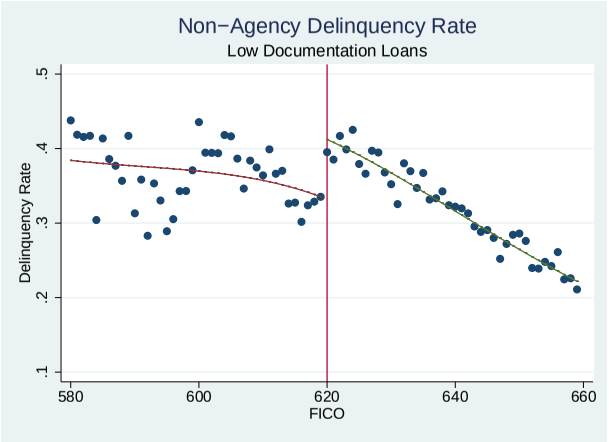
5b



5c

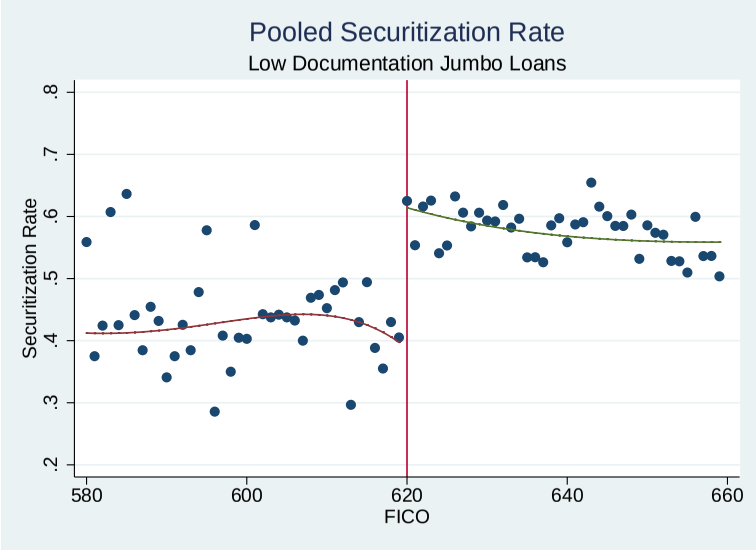


5d

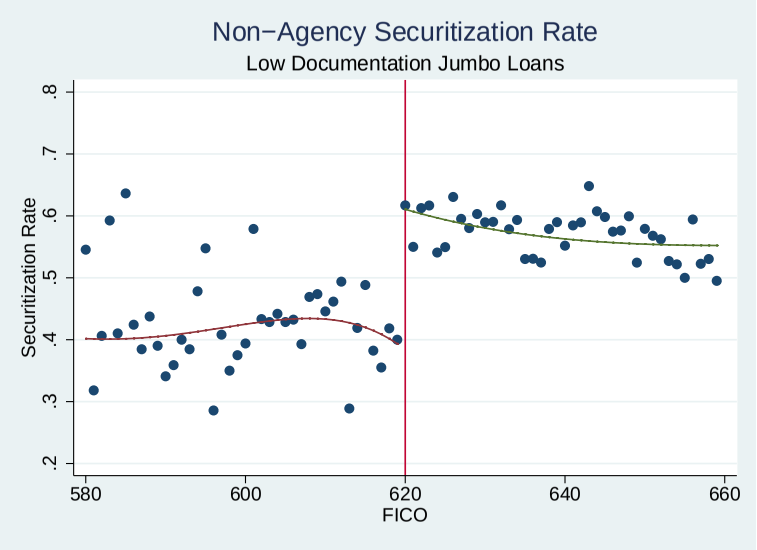


5e

Figure 5 (a)-(e): The figure depicts pooled (non-GSE and GSE together) and separated securitization and default rates for low documentation loans in the LPS database originated between 2001 and 2006. The pooled graphs [5a for securitization, 5c for delinquency] are similar to Bubb and Kaufman (2009). The separated securitization and delinquency rates are constructed assuming that all mortgages that meet the GSE loan requirements are sold [Method 2]. Figure 5b shows that the pooled securitization rate obscures a large jump in the low documentation non-agency securitization rate, while Figures 5d and 5e present the smooth agency delinquency rate and discontinuity in non-agency delinquency rates.



6a



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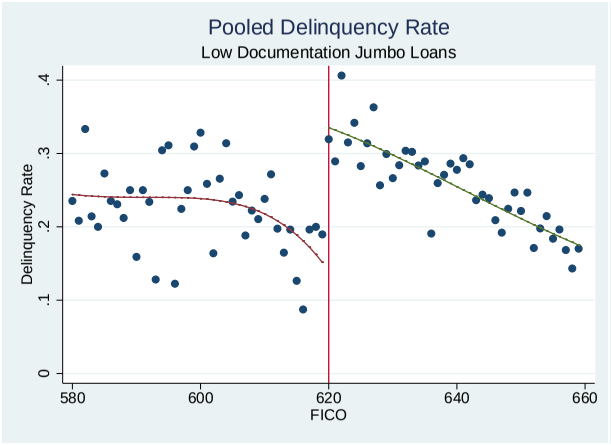

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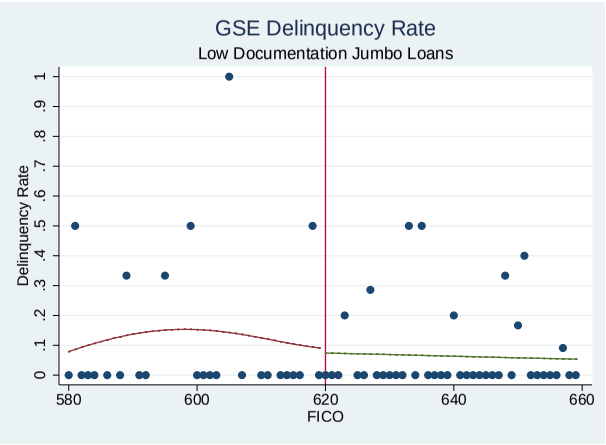

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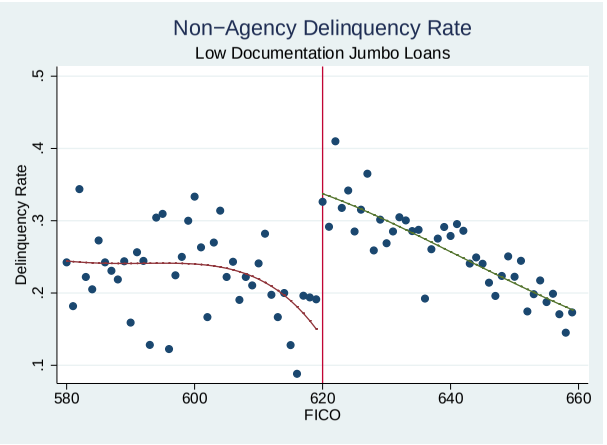
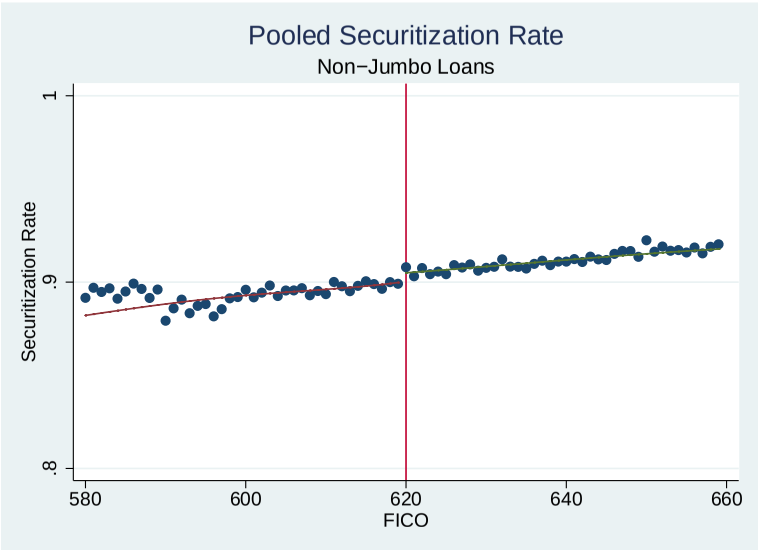
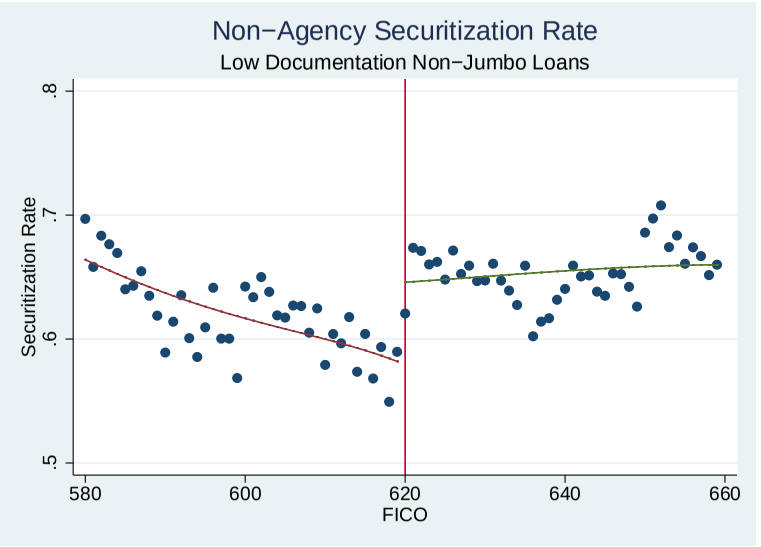


6e

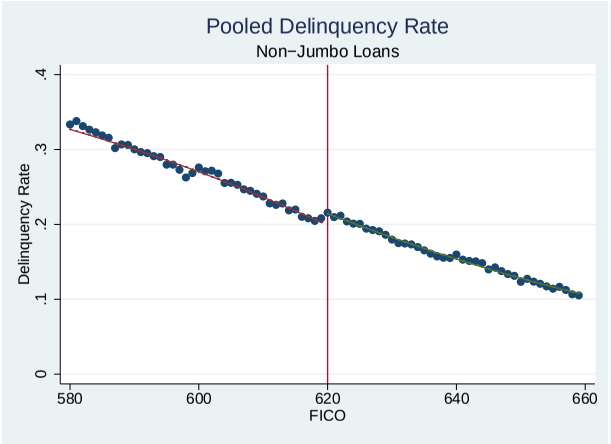
Figure 6 (a)-(e): The figure depicts pooled (non-GSE and GSE together) and separated securitization and default rates for low documentation jumbo loans in the LPS database originated between 2001 and 2006. The pooled graphs [6a for securitization, 6c for delinquency] are similar to Bubb and Kaufman (2009). The separated securitization and delinquency rates are constructed assuming that all mortgages that meet the GSE loan requirements are sold [Method 2]. Note: The delinquency rate for GSE low documentation loans is smooth through the discontinuity, similar to Figure 2b (not shown). Figure 6b shows a large jump in the low documentation non-agency securitization rate, while Figures 6d and 6e present the smooth agency delinquency rate (albeit noisily measured due to extremely low sample size) and sharp discontinuity in non-agency delinquency rates.



7a



7b



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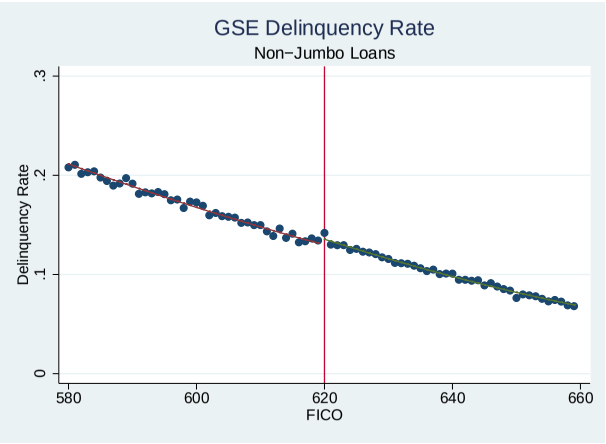
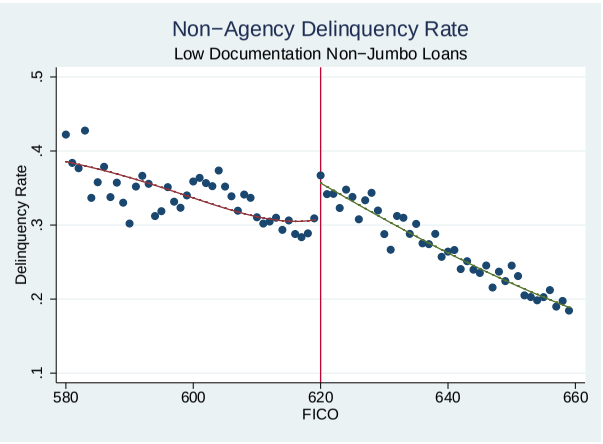
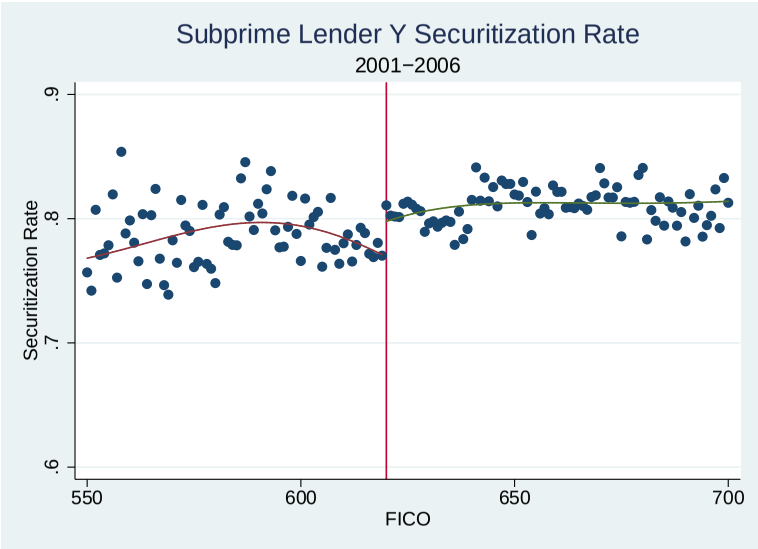


7d

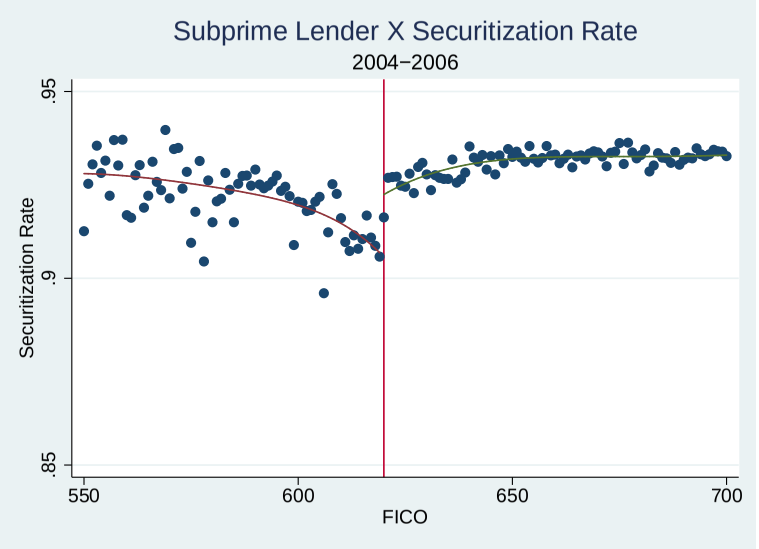


7e

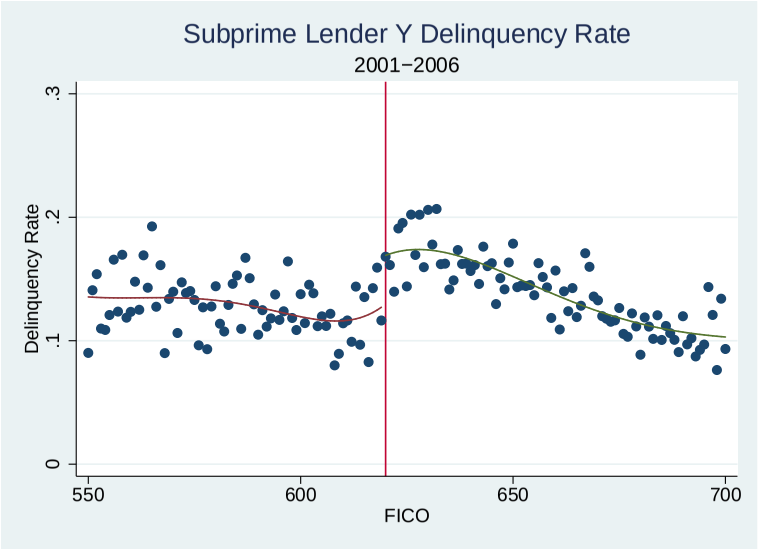
Figure 7 (a)-(e): The figure depicts pooled (non-GSE and GSE together) and separated securitization rates for non-jumbo loans in the LPS database originated between 2001 and 2006. The pooled graphs [7a for securitization, 7c for delinquency] are similar Bubb and Kaufman (2009). The separated securitization and delinquency rates are constructed assuming that all mortgages that meet the GSE loan requirements are sold [Method 2]. Figure 7b shows a large and significant difference in non-agency securitization rates around the threshold. For delinquencies, there is no discontinuity for agency loans [7d], whereas there is a large jump in the delinquency rate for non-agency loans around the threshold [7e].



8a



8b



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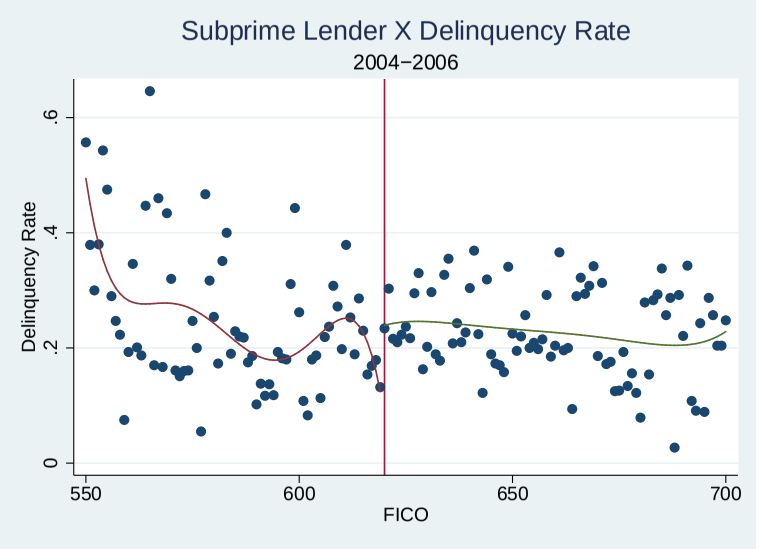
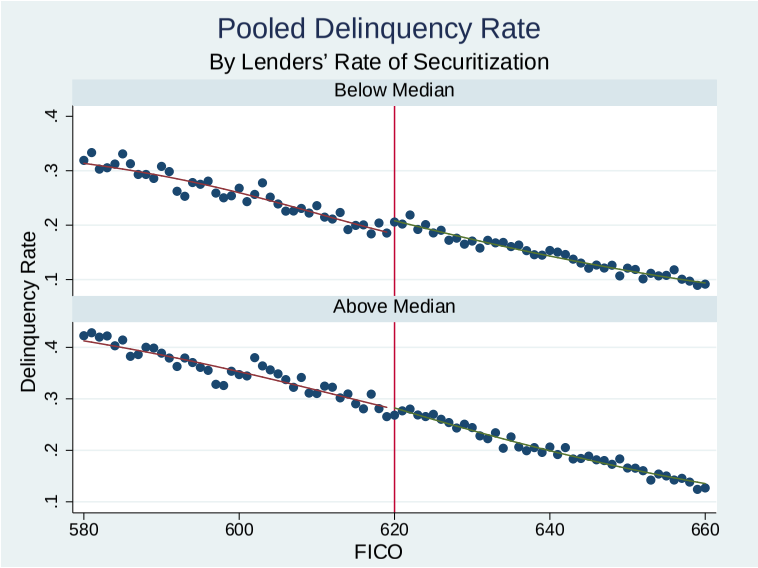
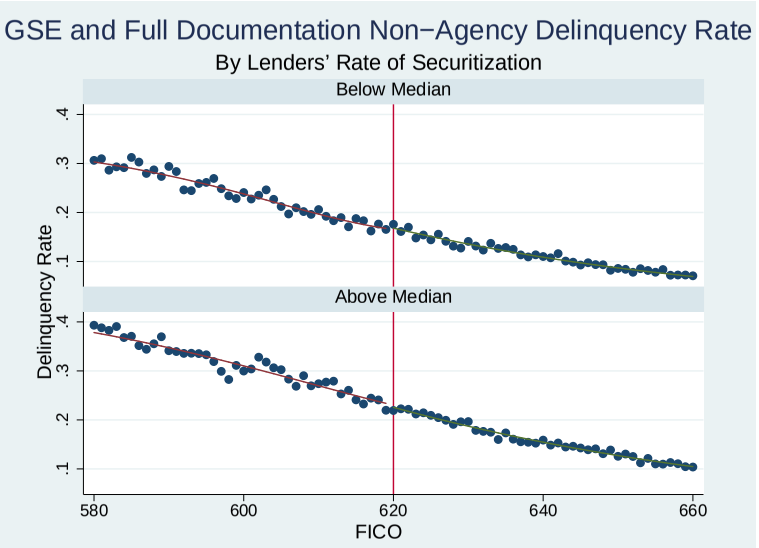


8d

Figure 8 (a)-(d): The figure depicts securitization and 60+ day delinquency rates for low documentation loans of two large subprime lenders (names withheld). Both the lenders were among the top 20 largest subprime lenders in the U.S. as of 2006. Data is for loans originated between 2001 and 2006 for lender Y, 2004 and 2006 for lender X. Figures 8a and 8b show that both lenders securitized a greater fraction of their loans just above the 620 threshold. Figures 8c and 8d show that loans just above the 620 threshold were more likely to default than just below it, a pattern that holds for both lenders.



9a



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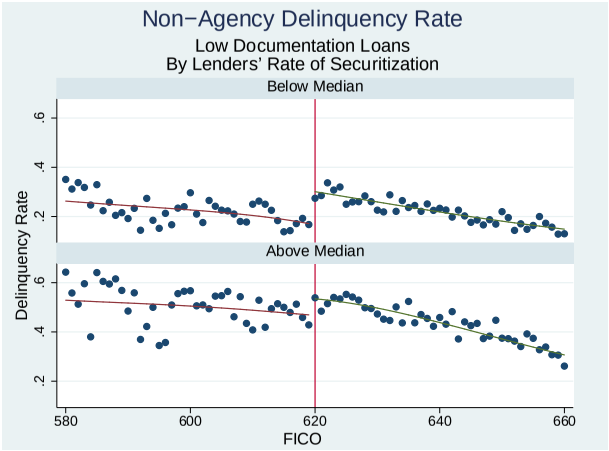
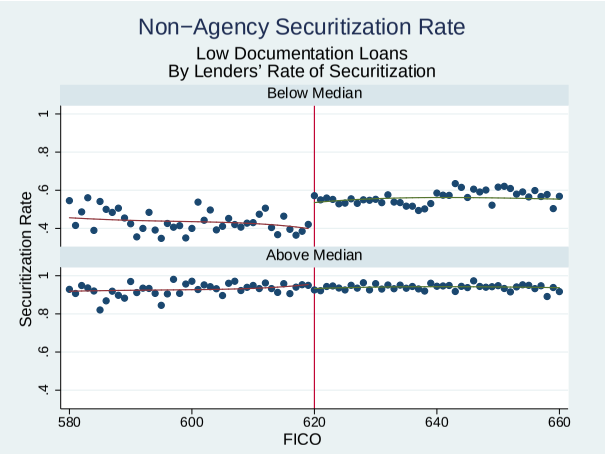
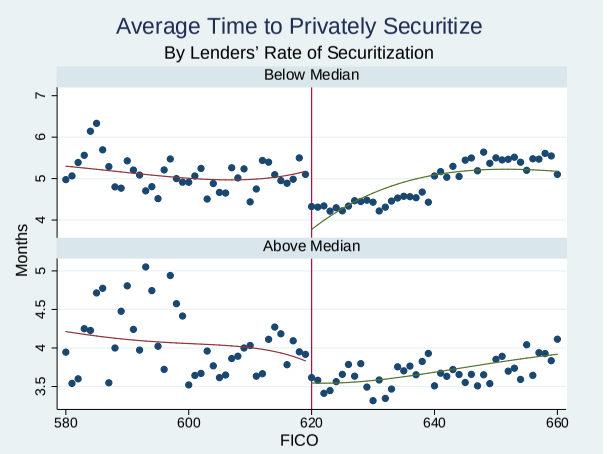


9c

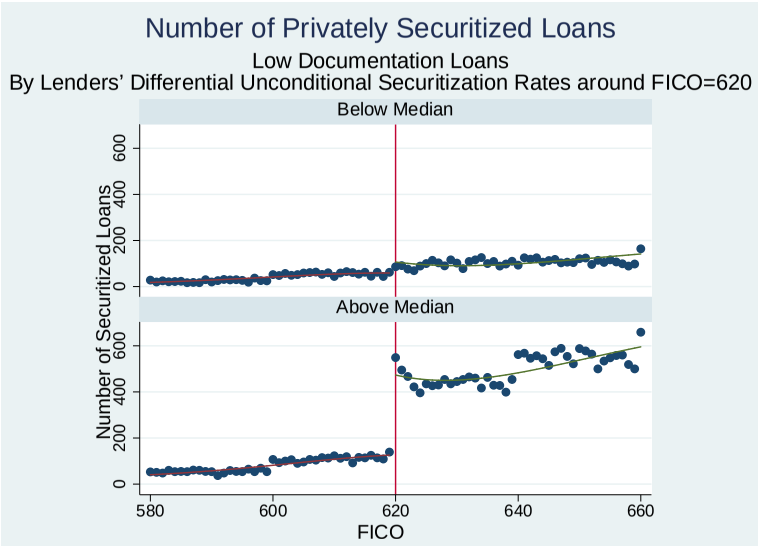


9d

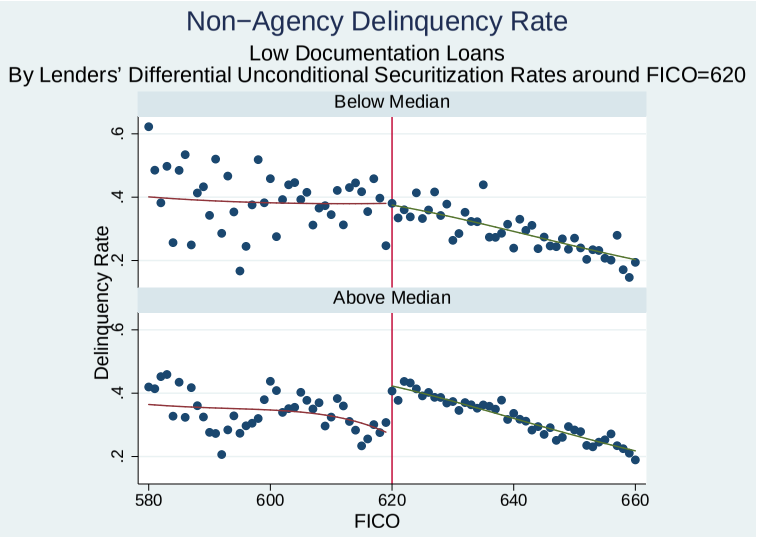


9e

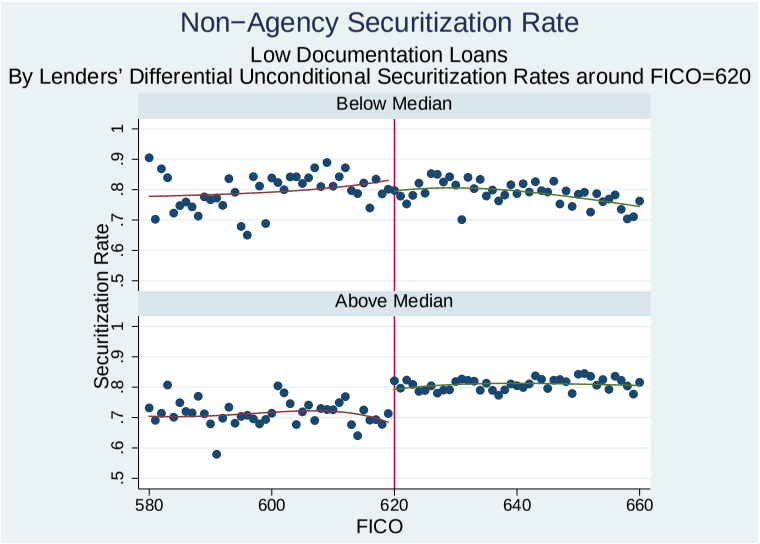
Figure 9 (a)-(e): The figure depicts 60+ day delinquency [9a - 9c], securitization rates [9d] and time it takes to securitize a loan [9e] for lender groups formed on the basis of 'pooled' securitization intensity as in Bubb and Kaufman (2009). Group 1 (2) consists of loans from lenders that have below (above) median pooled (across GSE and non-GSE loans) securitization rate. Propensity score matching is used to attribute unsold loans to GSEs or to non-GSEs. The jump in delinquency rates around the cutoff [9a] are driven entirely by low documentation non-agency loans [9c]. These loans also exhibit large jumps in either the securitization rate [9d] or the time it takes to securitize a loan or both. Figures use loans from the LPS database originated between 2001 and 2006.



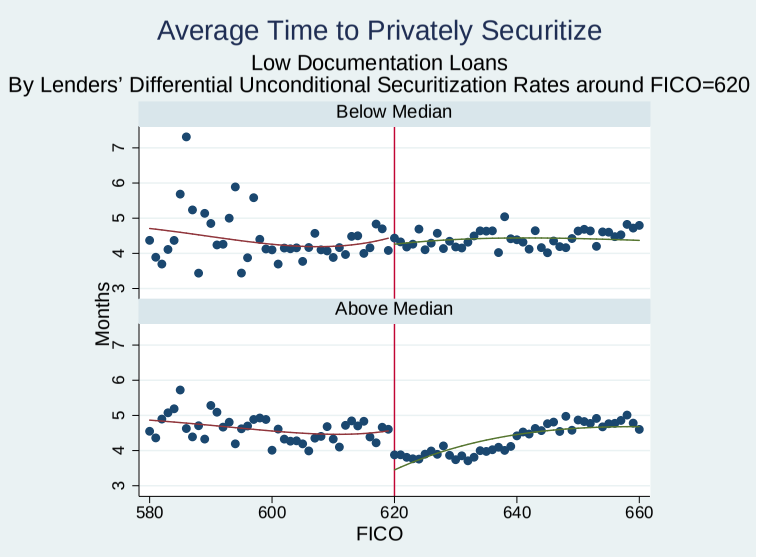
10a



10b

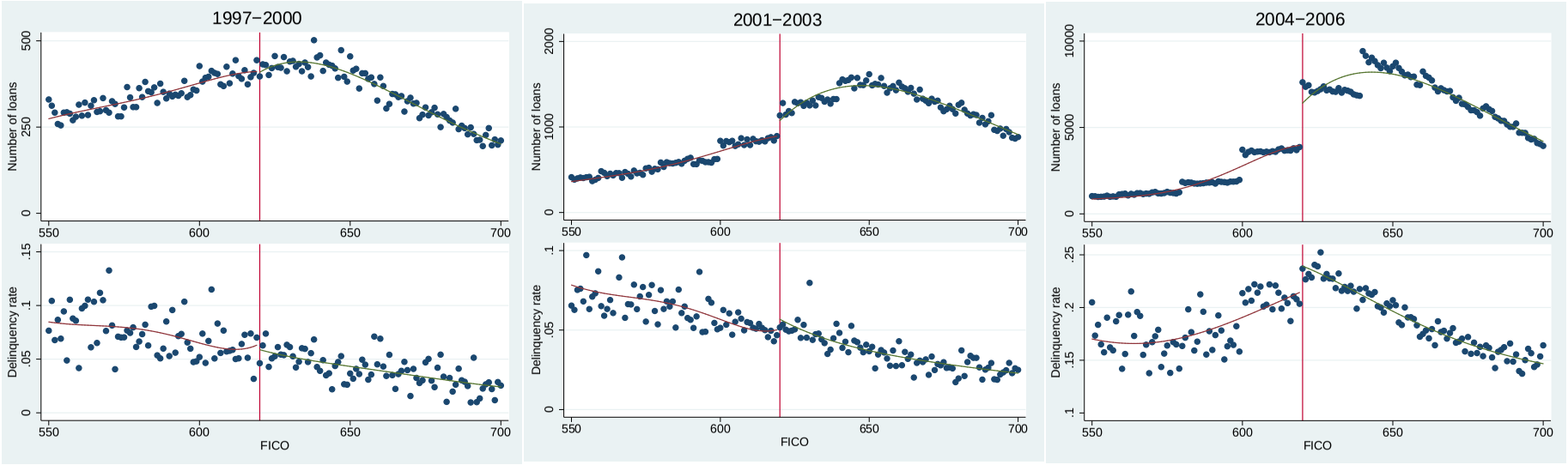


10c



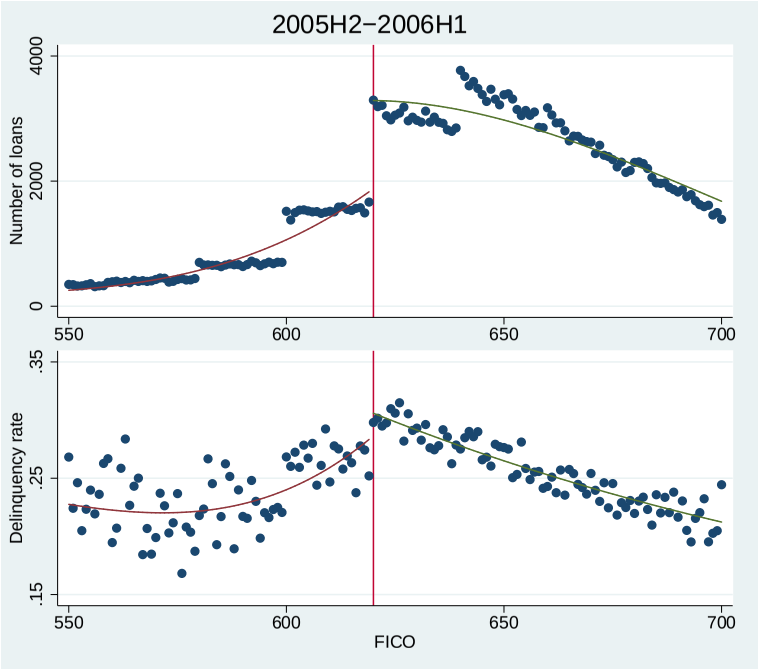
10d

Figure 10 (a)-(d): The figure depicts the number of securitized loans (i.e., unconditional securitization rates) [10a], default rates [10b], conditional securitization rates [10c] and time in months it takes to securitize loans [10d] for low documentation loan sub-samples formed on the basis of differential unconditional securitization rates around FICO of 620. Group 1 (2) consists of loans originated by lenders that have below (above) median differential unconditional securitization rates around the 620 cutoff. Propensity score matching is used to attribute unsold loans to GSEs or to non-GSEs. The discontinuity in delinquency rates around the cutoff increases as the ease of securitization – measured by conditional securitization rates and the time it takes to securitize a loan – goes up across the two samples. Figures use loans from the LPS database originated between 2001 and 2006.

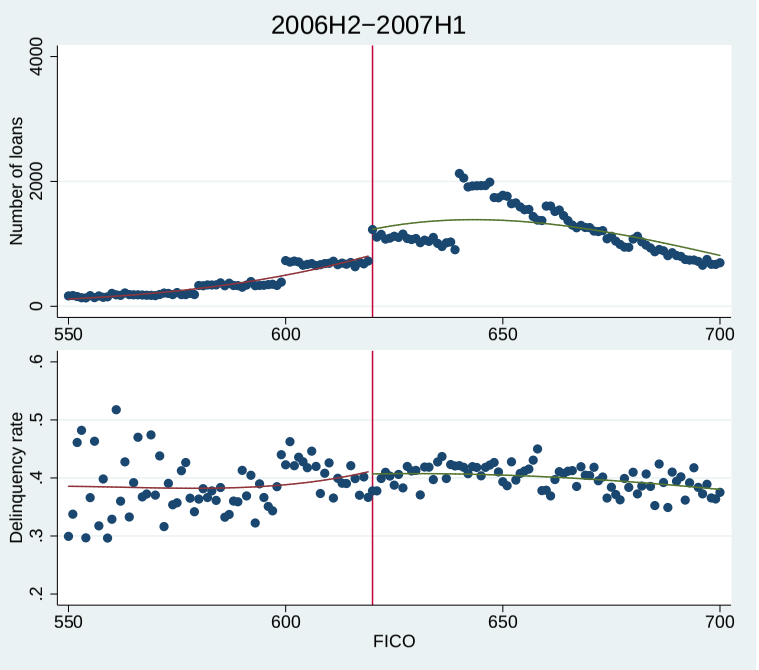


11a 11b 11c

Figure 11 (a)-(c): The figure depicts time series evidence on the number of securitized loans (i.e., unconditional securitization rates) and delinquency rates in the subprime market over time. The figures use data from the LP database originated during three periods: 1997-2000 [11a], 2001-2003 [11b], and 2004-2006 [11c]. The figure shows that the unconditional securitization rate and delinquency jumps around the cutoff start from zero and increase together over time as the subprime market grew in size.

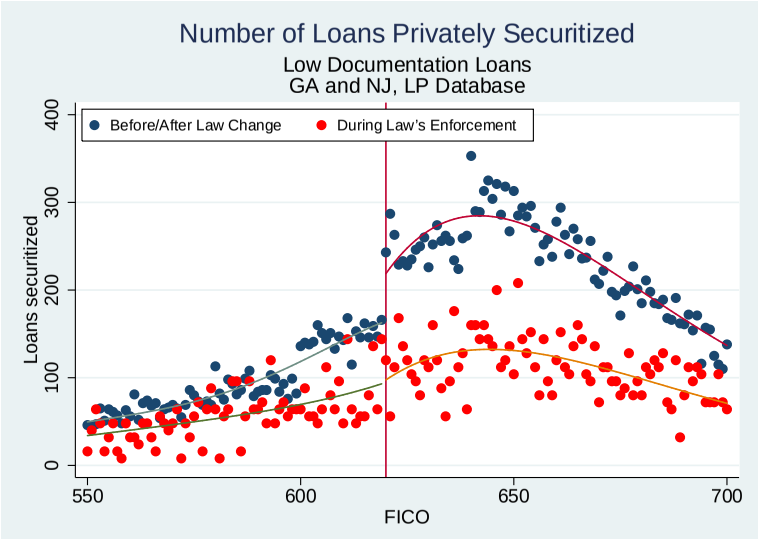


12a

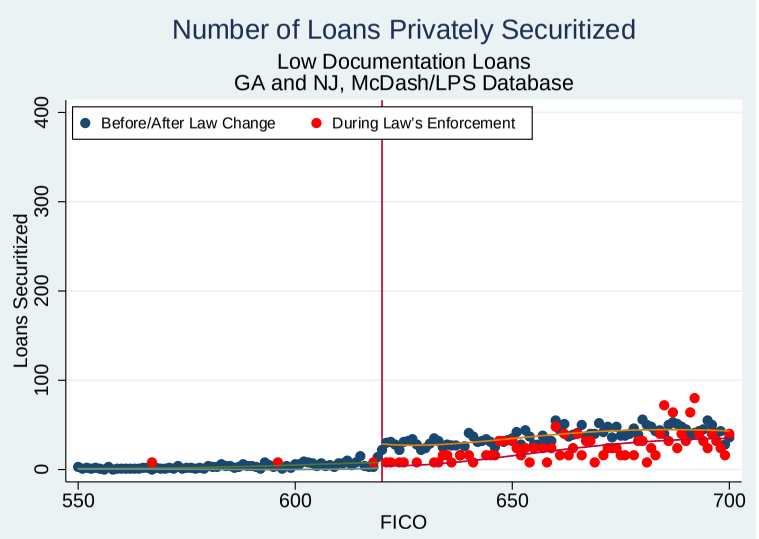


12b

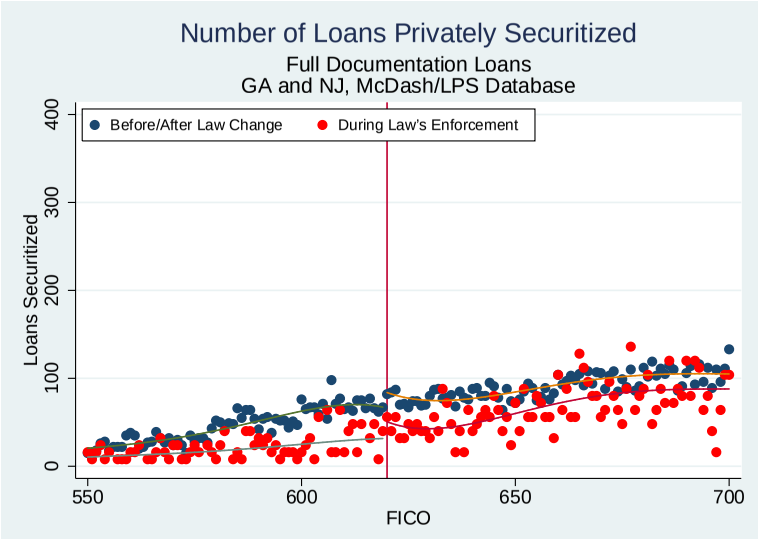
Figure 12 (a)-(b): The figure depicts time series evidence on the number of securitized loans (i.e., unconditional securitization rates) and delinquency rates in the subprime market over time. The figures use data from the LP database originated during two periods: 2005:H2-2006:H1 [12a] and 2006:H2-2007:H1 [12b]. The figure shows that the unconditional securitization rate and delinquency jumps around the cutoff are large when the subprime market is at its peak [12a] and these jumps begin to attenuate as the subprime market slowed down [12b].



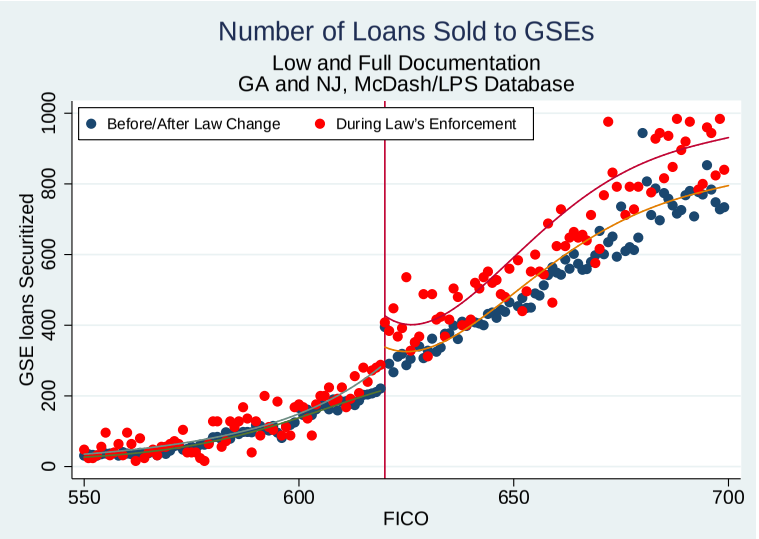
13a



13b

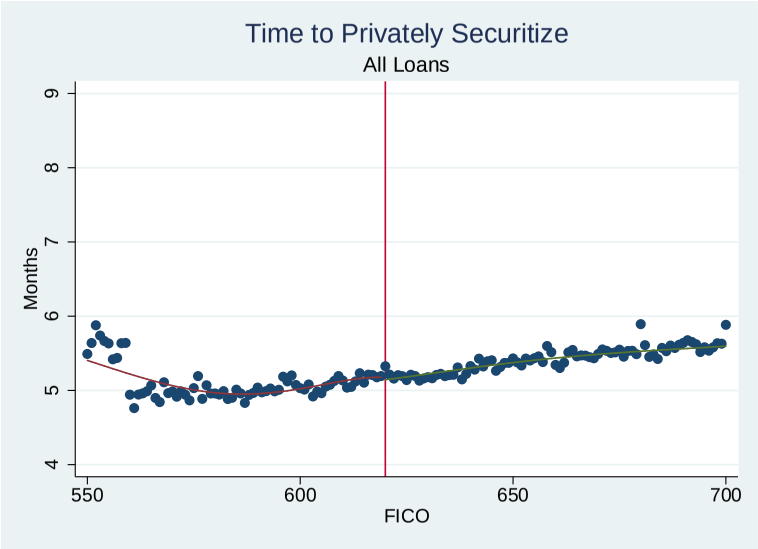


13c

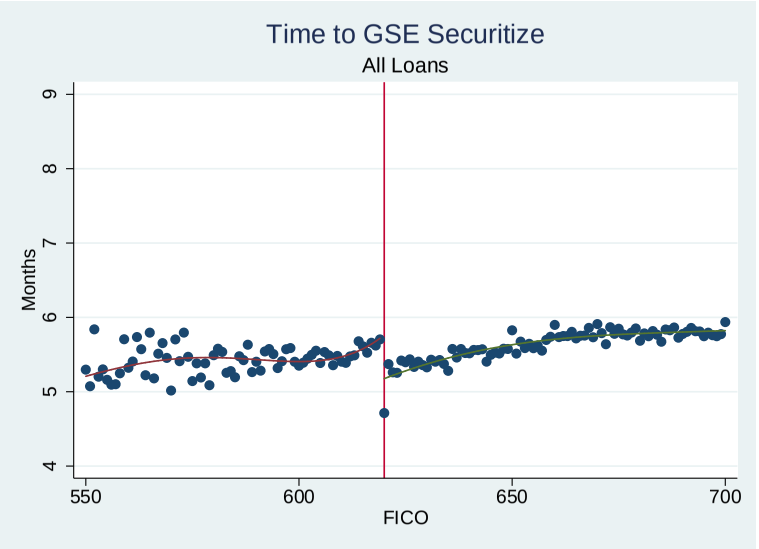


13d

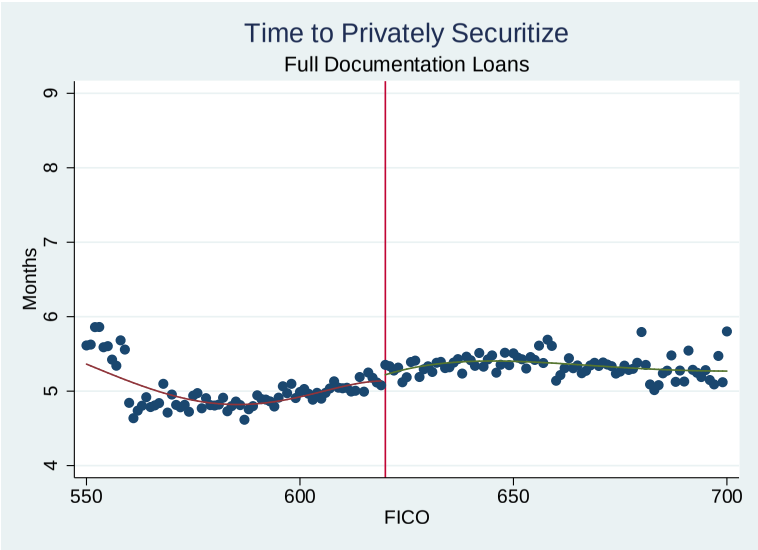
Figure 13 (a)-(d): The figure compares the coverage of LP data in KMSV and the coverage of LPS data used by Bubb and Kaufman (2009) in reference to the New Jersey/Georgia experiment used by KMSV. Figure [13a] shows the low-documentation non-GSE loan sample used in KMSV for the period when the anti-predatory laws were in effect and when the laws were not in effect. Figure [13b] shows the low-documentation non-GSE loan sample used in BK for the period when laws were in effect and when the laws were not in effect. Figure [13c] and [13d] shows the full-documentation non-GSE loan sample and the GSE sample (all GSE loans) used in BK for the period when laws were in effect and when the laws were not in effect. As is evident, the coverage of low-documentation non-GSE loans is significantly limited in BK data. Nearly all of the identification in BK comes from the full-documentation non-GSE and GSE loans.



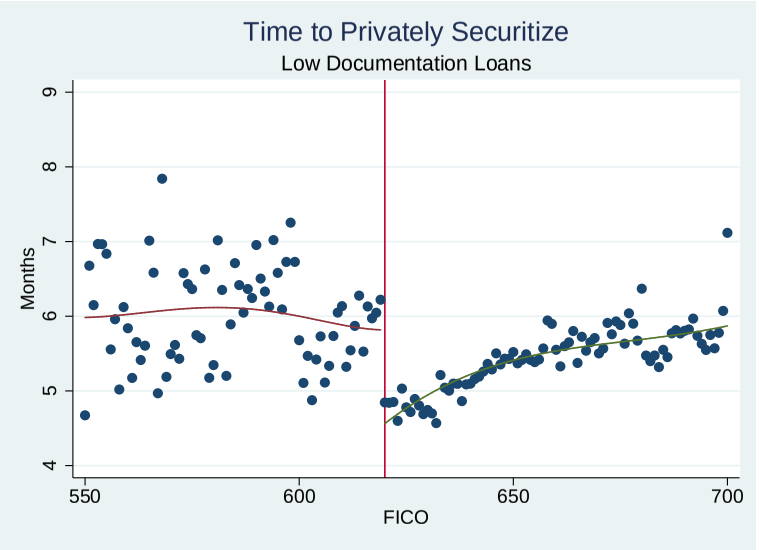
14a



14b

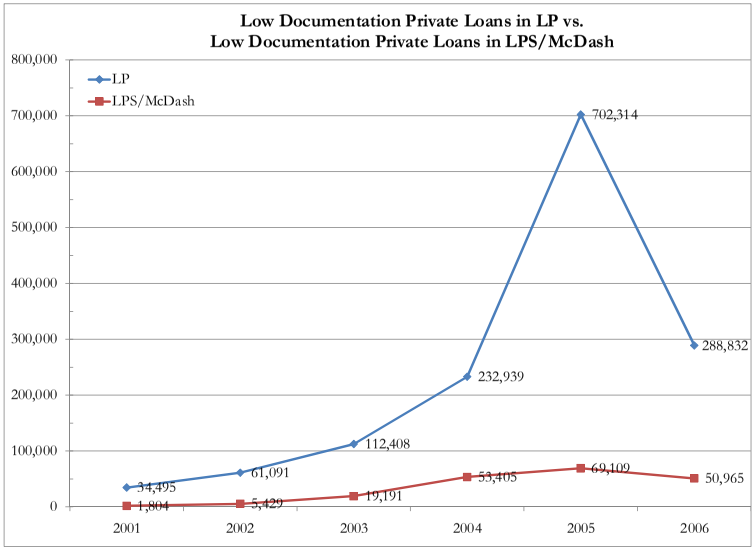


14c

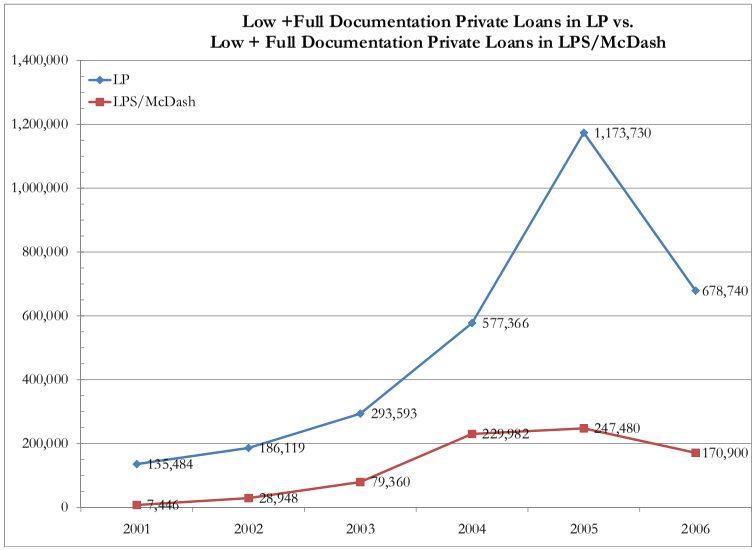


14d

Figure 14 (a)-(d): The figure depicts the average time it takes for loans in the LPS database originated between 2001 and 2006 to be securitized. The longer it takes for a loan to be securitized, the costlier it may be for the bank. This cost could come from the opportunity cost to the bank of not being able to invest elsewhere. In addition, if the loan becomes delinquent before it is securitized, the likelihood of subsequent securitization is reduced dramatically. For the pooled (non-GSE and GSE together) sample [14a], and full documentation non-GSE sample [14c], there are no differences in the time to securitize around the 620 threshold. For the GSE sample [14b], there is a small decrease in the time to securitize at FICO=620. In contrast, there is a large discontinuity in the average time to securitize for the low documentation non-agency sample [14d].



15a



15b

Figure 15 (a) and (b): The figure compares the coverage of non-agency data in the LP database used by KMSV (in blue) and the coverage of non-agency data in LPS/Mcdash database used by Bubb and Kaufman (2009, in red) across years from 2001 to 2006. The coverage of non-agency low documentation loans in LPS is significantly limited, and more so before 2005 [15a]. The limitation in coverage with respect to all non-agency loans regardless of documentation status (full documentation and low documentation loans) is also evident [15b].

Table I.
Composition of Agency and Non-agency loans across subsamples of LPS/McDash data

This table presents summary statistics of various sub-samples based on for-purchase loans originated between 2001 and 2006 using LPS/McDash. Loans are assigned to either agency, non-agency, or portfolio based on investor status at 6 months after origination. Non-jumbo loans conform to the GSE loan amount restrictions (and consist of the sample considered "conforming" by Bubb and Kaufman [2009]).

Sample	% Agency	% Non-Agency	% Portfolio
All Loans	**61.1%**	**29.4%**	**9.5%**
Low Documentation	58.6%	26.5%	14.9%
Full Documentation	55.6%	32.1%	12.3%
Jumbo	**2.9%**	**71.1%**	**26.0%**
Low Documentation	1.9%	53.7%	44.4%
Full Documentation	3.3%	68.7%	28.0%
Non-Jumbo	**68.6%**	**24.1%**	**7.4%**
Low Documentation	69.6%	21.2%	9.1%
Full Documentation	61.8%	27.8%	10.4%
Low Documentation + Option ARM	6.7%	56.8%	36.4%
Low Documentation + Prepayment Penalty	5.3%	67.9%	26.8%

Table II.
Discontinuities in Default and Securitization Rates in Quartiles by Lenders' Pooled Rate of Loan Securitization

This table presents discontinuity estimates in quartiles formed using lenders' pooled securitization rates as in Bubb and Kaufman. The top panel shows the default and securitization rate differences in the pooled data manifest themselves in the lowest pooled securitization rate quartiles. The bottom panel shows that this is due to this quartile having the largest share of non-GSE low documentation loans and that low-documentation loans in these quartiles have the largest jump in their securitization and default rates. Propensity score matching is used to attribute unsold loans to GSEs or to non-GSEs. Data is from 2001 to 2006.

	(1) Low Pooled Securitization Rate	(2)	(3)	(4) High Pooled Securitization Rate
Pooled				
Default	0.031***	-0.006	0.024	-0.015
	(0.010)	(0.020)	(0.015)	(0.013)
Securitization	0.043***	-0.013	-0.004	0.003
	(0.011)	(0.013)	(0.005)	(0.003)
Non-agency low documentation loans				
Share Non-Agency Lowdoc	0.17	0.02	0.04	0.03
Default	0.143***	0.032	0.051	-0.032
	(0.028)	(0.082)	(0.046)	(0.080)
Securitization Rate	0.161***	-0.080	-0.024	-0.006
(conditional rate)	(0.030)	(0.090)	(0.024)	(0.040)
Non-agency full documentation and Agency loans				
Default	-0.004	0.005	0.005	-0.011
	(0.010)	(0.021)	(0.012)	(0.011)

Table III.
Discontinuities in Default and Securitization Rates in Subsamples by Lenders' Differential Number of Securitized Low documentation Loans around FICO=620

This table presents discontinuity estimates in subsamples formed using lenders' differential number of securitized loans (i.e., unconditional securitization rates) around FICO of 620. Propensity score matching is used to attribute unsold loans to GSEs or to non-GSEs. Data is from 2001 to 2006.

	(1) Low Unconditional Securitization Rate (below median)	(2) High Unconditional Securitization Rate (above median)
Number of loans	47.8***	346.3***
	(9.7)	(20.0)
Default Rate	-0.006	0.155***
	(0.066)	(0.029)
Securitization Rate	-0.039	0.116***
(conditional rate)	(0.050)	(0.022)
Time to Securitize	-0.220	-1.14***
	(0.526)	(0.224)