The Impact of a Liquidity Shock on Bank Lending: The Case of the 2007 Collapse of the Private-Label RMBS Market

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Abstract

The evaporation of the private-label residential mortgage-backed securities market in the third quarter of 2007 was associated with a substantial reduction in jumbo lending. The goal of this paper is to evaluate the link between these two aspects of the mortgage crisis. We find that the drop in jumbo lending associated with the liquidity shock was significantly more pronounced at banks that ex-ante were more dependent on the secondary market. This finding is viewed as evidence that dependence on the secondary market resulted in amplification of the financial shock embodied by the shutdown of the jumbo securitization market. Another important finding is that banks that ex-post were less well capitalized incurred a larger drop in jumbo originations after the shock. Conversely, banks that had little dependence on the secondary market ex-ante and were well capitalized ex-post partly compensated for this drop with a substantial increase in their jumbo mortgage originations. This finding highlights how bank capital mitigates the amplification of financial shocks and the potential value of capital requirements that are higher during periods of robust economic growth.

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1 Introduction

The recent financial crisis has caused economists and financial modelers to reconsider various notions concerning financial markets and institutions and related macroeconomic perspectives. These include views on the benefits and costs of securitization and the effectiveness of credit default swaps or other mechanisms for insuring credit risk. They also include views on the adequacy of governance and incentive structures of financial institutions and markets and the appropriate role of government and government sponsored enterprises such as Fannie Mae and Freddie Mac (the GSEs).

This paper focuses on one particular issue highlighted by the crisis: the potential systemic cost of bank dependence on securitization for liquidity or as a means of funding loan production. Banks dependent on securitization for funding mortgage originations were particularly impacted by the shutdown of the private label residential mortgage-backed securities (RMBS) market, an important component of the crisis.

Our research uses the evaporation of the private-label RMBS market in the third quarter of 2007 to help understand the impact of a liquidity shock on the supply of mortgage loans. That market was created primarily to facilitate the sale of prime-grade mortgages that exceed the conforming loan size limit—commonly referred to as prime jumbo mortgages—thus not eligible for purchase by the GSEs. It also encompassed near-prime or non-traditional mortgages that may or may not be jumbo but did not meet GSE credit standards or for which the private market was willing to offer a higher price (the so-called Alt-A segment).[1]

The evaporation of the private-label RMBS market was rapid. Collapse of the subprime mortgage market during the first half of 2007 reverberated through the residential and commercial mortgage markets more broadly, with investors fleeing private label securitizations. Between the beginning and the end of the third quarter of 2007, private-label RMBS market had transformed from a fully functioning securitization

[1]The credit quality of Alt-A borrowers was considered to be below prime but not as low as subprime, who had seriously impaired credit histories (or reduced credit quality due to combinations of risk factors.) Subprime mortgage securitizations were not classified as RMBS but rather as a category of asset-backed securities (ABS). A number of recent papers have focused on the role of the subprime mortgage ABS market in increasing the unexpected losses to the banking system during the crisis. See, for instance, Ashcraft and Schuermann (2008), and Acharya, Schnabl, and Suarez (2010).

market to one that had shutdown entirely. The GSE (Agency) securitization market, of course, continued to function due to implicit government backing and, eventually, due to interventions by the Federal Reserve and Treasure Department culminating in government conservatorship of the GSEs.

While no doubt influenced by credit-related factors, especially concerns about the impact of falling prices on mortgage credit risk, such a complete and rapid shutdown of the private-label RMBS market was primarily a liquidity event. Not surprisingly, we observe that the liquidity shock in the non-Agency secondary market was associated with a substantial reduction in jumbo lending. Our goal in this paper is to evaluate the link between these two aspects of the mortgage crisis, thereby shedding light on the role of securitization markets in the amplification of financial shocks. We analyze the link by applying a panel data analysis that relates an institution's response to the event in relation to measures of reliance on the secondary market and indicators of financial condition including the regulatory tier one capital ratio.

A key finding is that the drop in jumbo lending associated with the liquidity shock was significantly more pronounced at banks that ex-ante were more dependent on the secondary market. For instance, we find that about 80 percent of the drop in the jumbo share of the median bank is accounted by the shutdown of the private-label RMBS market. This finding is robust to restricting the sample in various ways so as to mitigate potential endogeneity problems. We view this finding as evidence that dependence on the secondary market resulted in amplification of the financial shock embodied by the shutdown of the jumbo securitization market.

Another important finding is that banks that ex-post were less well capitalized incurred the largest drop in jumbo originations after the shock. For instance, a bank with a 2 percentage point decline in its capital ratio experiences about a 60 percent larger drop in jumbo share of total originations, relative to a bank that is similarly situated ex-ante but maintains its capital ratio. Conversely, banks that had little dependence on the secondary market ex-ante and were well capitalized ex-post, partly compensated for this drop with a substantial increase in their jumbo mortgage originations. This finding highlights how bank capital mitigates the amplification of financial shocks and the potential value of capital requirements that are higher during periods of robust economic growth.[2]

[2]This finding supports arguments presented in several recent papers examining the merits of procyclical capital buffers, such as Kashyap and Stein (2004), and Gordy and Howells (2006).

Our paper builds on previous research by Loutskina and Strahan (2009), which also uses loan level mortgage originations to examine the relationship between jumbo mortgage lending and bank financial condition. In particular, that paper employs a panel analysis with similar data sources from an earlier time period and finds that banks with more internal liquidity, more capital, and lower deposit costs are more likely to originate jumbo loans. Our paper employs a similar econometric framework but focuses on bank jumbo lending and its reliance on the secondary market, in the period surrounding the recent financial crisis. Whereas the focus of Loutskina and Strahan (2009) was on the comparative liquidity of the secondary market for jumbo versus conforming mortgages and the role of the GSEs, our goal is to investigate the impact of the shutdown of the jumbo mortgage RMBS market on jumbo lending.

Two other papers addressing questions related to ours are Loutskina (2010) and Cornett, McNutt, Strahan, and Tehranian (2010). The first analyzes panel Call Report data and demonstrates that securitization reduces banks' holdings of liquid securities and provides a buffer against monetary policy shocks. The paper concludes that securitization enhances bank lending potential but also makes a bank vulnerable to a shutdown of the securitization market. Our paper provides a direct test and supporting evidence for this latter conclusion. The second of these papers examines bank lending before and during the financial crisis, distinguishing among banks based on their funding sources. The study demonstrates that banks with more stable sources of funds (core deposits and capital) were better able to sustain their lending relationships during the crisis.

Finally, our paper contributes to the macroeconomic literature on the financial amplification mechanism of the type described by Krishnamurthy (2010). This mechanism in one in which small shocks lead to a large real effect in the macroeconomy. In particular, our results suggest that the shutdown of jumbo RMBS market has likely amplified banks' responses to the crisis. The existence of this amplification mechanism provides a justification for liquidity provision through a lender of last resort.

The rest of the paper is organized as follows. Section 2 introduces our data sources and provides an overview of the private-label RMBS market and the 2007 collapse of this market. Section 3 describes the empirical, panel data approach used to analyze the impact of the shock, and section 4 presents the empirical results. Section 5 provides additional analysis to assess robustness of the empirical findings. Section 6

concludes.

2 Data Sources and Background

Our study examines the jumbo mortgage origination activity of depository institutions in relation to the breakdown of the prime jumbo securitization market in the summer of 2007. We rely on the Home Mortgage Disclosure Act (HMDA) and Call Report data of individual banking organizations. HMDA data are submitted annually in early spring by mortgage lending institutions, providing information on each home purchase and refinance loan application and origination of the institution during the preceding year. HMDA mandatory filers include all commercial banks, savings and loan institutions, credit unions, and mortgage companies that meet minimum asset size thresholds and have a branch in a metropolitan area.[3] For institutions with mortgage subsidiaries that report separately, we combine the HMDA data of the institution and its subsidiary.

HMDA data provide the action taken on each loan application (whether it was approved, denied, or withdrawn); the application and action date; the loan amount; the income of the applicant; whether the application is single or joint (with a co-applicant); the racial and ethnic classification of the applicant (and co-applicant); and the state, county, and Census tract location of the subject property. HMDA data also indicate whether an originated loan was sold prior to year-end, which we use in our study to construct a proxy measure of jumbo loans sold to the secondary market. This proxy incorporates loans sold through private securitization; to non-affiliate commercial or savings banks; insurance, mortgage, or finance companies; or other types of purchasers.

Call Report data are reports on the income and financial condition of federally-regulated commercial banks and savings institutions, filed quarterly with the institution's regulatory agency. These data provide detailed information on assets, liabilities, income and expenses, including regulatory capital ratios and the components of profitability and return-on-assets. We match the HMDA data to Call Report data based on the identity of the HMDA reporting bank (RSSD number). Since HMDA data are submitted at year-end, whereas Call Reports are quarterly, we aggregate the Call Report data of institutions that merge during a year, for those quarters where the

[3]See the Federal Financial Institutions Examination Council (2010) for details.

Call Reports were filed separately (but only for the year when the merger occurred.)[4]

Jumbo mortgages and private-label RMBS. As noted in the introduction, the private-label RMBS market was created primarily to fund prime jumbo mortgages, which are not eligible for purchase by the GSEs because they exceed the conforming size limit. Figure 1 shows number of jumbo mortgages as a share of total U.S. conventional home purchase loans, during the period 2000 through 2009, based on monthly HMDA data. The chart distinguishes two categories of depository institutions: commercial banks and savings institutions.[5] Jumbo mortgage share for commercial banks (and the overall market) remained roughly constant at about 8 percent through 2006 and the first of half of 2007. Beginning in mid-2007, jumbo shares dropped sharply, reflecting impacts of the mortgage crisis, including the collapse of the jumbo RMBS market. Of course, jumbo shares vary substantially by state; for instance, jumbo mortgage share in California historically has been about triple the national share, while in some states with relatively low-priced homes it has generally been close to zero.

The conforming loan size limit, which determines eligibility for sale to the GSEs, remained constant during 2006 and 2007, at $417,000 nationwide with the exception of a 50 percent higher limit in Alaska and Hawaii.[6] It was unchanged until July 2008, when it was temporarily expanded in metropolitan areas identified as "high cost" in accordance with the provisions of the Housing and Economic Recovery Act of 2008.[7] However, GSE jumbo mortgage securitization was only around $10 billion in 2008, which was significantly below the $219 billion of prime jumbo securitized during 2006.[8]

The private-label RMBS market has also provided a channel for sale of near-prime

[4]In some cases, mergers were associated with gaps or inconsistencies in the Call Report data between end of the previous quarter and the quarter during which the merger occurred.

[5]The jumbo mortgage share of overall home purchase lending, inclusive of mortgage companies and credit unions, closely coincides with the commercial bank share, and for the sake of visual clarity is not shown.

[6]Prior to 2006, the conforming loan limit typically was adjusted annually in line with the national rate of house price appreciation. The pre-2006 year-end declines in jumbo share seen in Figure 1 reflect these annual increases in the conforming loan limit.

[7]These increases were subsequently reinstituted for 2009 and 2010 in accordance with provisions of the American Recovery and Reinvestment Act of 2009.

[8]It took some time for the GSEs to get programs in place to purchase such mortgages. The origination volume of these newly conforming loans remained modest through 2009, reflecting relatively tight credit standards and relatively high interest rates applied to these loans.

and non-traditional mortgages (so-called Alt-A), both jumbo and non-jumbo, that traditionally were eschewed by the GSEs, such as low-documentation and interest-only mortgages. In the pre-crisis period of 2005-2007, the Alt-A sector expanded substantially, stimulated by expanded non-Agency, Alt-A RMBS issuance, as well as by a large-volume of GSE purchases of Alt-A, reflecting a general relaxation of credit standards, including those of the GSEs.[9] During this period, Alt-A grew to become a dominant share of private-label RMBS issuance, according to data collected by Inside ABS and MBS (see Figure 2). Overall, however, the prime jumbo segment remained larger in dollar volume than the (jumbo plus non-jumbo) Alt-A segment. Moreover, the majority of the loans packaged into Alt-A RMBS during this period, and by extension most Alt-A mortgages were non-jumbo.[10]

Figure 2 also depicts the sharp drop in private-label RMBS issuance that occurred in the second half of 2007. The non-Agency RMBS market has recovered little since then. This secondary market liquidity shock affected all jumbo mortgages, although the supply of subprime, Alt-A, and non-traditional loan products had already dwindled prior to the collapse of the private-label RMBS market.[11]

Relation to jumbo mortgage lending. Our study examines the association between this event and origination of jumbo mortgages. We draw on HMDA data from the first quarter of 2006 through the fourth quarter of 2008, restricting attention to conventional, home purchase and refinance lending.[12] We also limit attention to the

[9]For example, Freddie Mac's 2007 Annual Report indicates that the company "increased our securitization volume of non-traditional mortgage products, such as interest-only loans and loans originated with less documentation in the last two years in response to the prevalence of these products within the origination market. Total non-traditional mortgage products, including those designated as Alt-A and interest-only loans, made up approximately 30 percent and 24 percent of our single-family mortgage purchase volume in the years ended December 31, 2007 and 2006, respectively. Our increased purchases of these mortgages and issuances of guarantees of them expose us to greater credit risks."

[10]For instance, around 58 percent of the loans packaged into non-Agency Alt-A pools in 2006 were non-jumbo loans. ("More Jumbo Mortgages Finding Their Way into MBS in 2007; Jumbo Deals Becoming Purer," Inside MBS and ABS, June 29, 2007.) As noted previously, an additional large share of Alt-A loans were purchased by the GSEs.

[11]The supply of high-risk loan products evaporated in the second quarter of 2007, amidst deepening concerns about the state of the housing market and the value of the collateral backing these risk loans. For example, in April 2007, New Century Financial Corporation, a leading subprime mortgage lender, filed for Chapter 11 bankruptcy protection.

[12]Residential mortgages in the U.S. typically are categorized as either conventional or government-insured, where the latter mostly consist of loans insured by the Federal Housing Administration and Veterans Administration.

500 largest institutions with respect to number of such mortgages originated in 2008, along with any of their predecessors within the 2006-2008 period—those that merged into or were acquired by these institutions during 2006-2008. We then drop from the sample any institution that originated fewer than 24 jumbo mortgages in 2006. The final panel contains 198 entities, and includes all large commercial and savings banks with the exception of failed institutions that no longer had mortgage operations in 2008 but had not yet been merged into another institution (most notably, Washington Mutual.)

Figure 3 shows the dollar share of jumbo mortgages sold to the secondary market during this period for this HMDA sample.[13] Here, we see the collapse of the private-label RMBS market in August of 2007 reflected in a sharp drop in the percentage of jumbo mortgages sold to the secondary market. Namely, prior to the crisis the percent of jumbo mortgages securitized or sold (not including loans sold to affiliates) was around 50 percent; it dropped to about 10 percent during the financial crisis.

Figure 4 shows the monthly dollar volume of jumbo mortgage originations as a percent of total dollar amount of conventional mortgages originated for this sample. Consistent with the count data in Figure 1, this ratio fell significantly in the second-half of 2007. It was about 30 percent before the start of the financial crisis, dropped to around 15 percent in the later part of 2007, and remained relatively constant during 2008.

Figure 5 splits the HMDA sample into banks dependent on the jumbo secondary market and banks not dependent on the jumbo secondary market prior to the collapse of the private-label RMBS market.[14]As shown, banks dependent on the jumbo secondary market reduced originations of jumbo mortgages relative to all mortgages after the liquidity shock to the market. Conversely, banks that were not dependent on the secondary market increased their share of jumbo mortgages. Most likely, the non-dependent banks picked up the slack left over by banks that were dependent on the secondary market which—in response to the liquidity shock—originated fewer jumbo mortgages. The results are similar if we exclude loans used to refinance a home. These patterns suggest that the shutdown of the private-label RMBS market contributed to the accentuated decline in jumbo mortgages relative to all mortgages.

[13]Given the muted response of the GSEs to the increase in the conforming loan size limit that took effect in July 2008, we apply the beginning-of-year loan size threshold to all of 2008.

[14]For Figure 5, this distinction is based on whether the bank sold one or more jumbo loans to the secondary market.

In the next section we expand on this analysis. We develop a panel data regression model, incorporating measures of bank financial condition based on Call Report data along with the measure of secondary market dependence and other several HMDA control variables, to further explore the impact of the liquidity shock in the private-label RMBS market on jumbo mortgage lending.

3 Empirical Strategy

We explore the impact of the liquidity shock in the jumbo RMBS market on bank jumbo mortgage lending by means of a panel data regression model relying on quarterly data from 2006:Q3—2008:Q4 for the set of 198 institutions described above. The model focuses on the pace of jumbo relative to total conventional loan originations before and after the shutdown of the private-label RMBS market, examining the impact of the shock across institutions distinguished by their dependence on jumbo mortgage securitization ex-ante and their financial condition ex-post.[15]

Our empirical strategy hinges on two important assumptions. First, as in Loutskina and Strahan (2009) we assume that factors affecting the mortgage market generally, such as household sentiment regarding home purchase, can be controlled for using aggregate originations (jumbo plus non-jumbo). By focusing on the number of jumbo relative to total originations, we are implicitly isolating those factors unique to the jumbo market. Second, we assume that we can identify the effect of the collapse of the secondary market by analyzing differences in the behavior of banks that used to sell jumbo loans versus banks that did not securitize jumbo loans prior to the start of the crisis. As discussed in the previous section, prior to the 2007-2008 financial crisis, the secondary market for jumbo mortgages was comprised primarily of private-label securitizations; smaller banks lacking direct access to this market relied primarily on loan sales via conduit or correspondent relationships. RMBS issuance on prime jumbos collapsed spectacularly in the third quarter of 2007, and has remained subdued throughout 2008. Banks that did not sell jumbo loans prior to the start of the crisis, and therefore were not directly impacted by the shutdown of jumbo RMBS issuance, can act as a "control" group in assessing the impact of the collapse of the secondary

[15]We prefer to measure origination activity using counts rather than dollar volumes, since the latter are directly affected by the level of house prices. Results reported below for counts are robust to using dollar amounts for originations.

market for jumbo loans, akin to a difference-in-difference set up. Similarly, banks dependent on the secondary market prior to the crisis can as act as the "treatment" group.

The challenge, of course, in interpreting our results as a pure difference-in-difference method is that banks are not randomly assigned between the control and treatment groups conditional on observable variables. More specifically, the decision to sell jumbo loans in the secondary market was likely influenced by unobserved factors which also may have affected the volume of jumbo loans the bank continued to originate as market conditions deteriorated. For instance, banks with larger concentrations of Alt-A may have depended more heavily on securitization of jumbo mortgages, and their declines in jumbo lending might reflect the elimination of Alt-A rather than loss of access to the secondary market. Also, banks more active in securitization markets generally may have cut back on jumbo lending as well as other traditional banking activities because of distractions or disruptions related to the broader financial crisis. To address such concerns, after presenting our baseline results we carry out (in the next section of the paper) a series of robustness tests evaluating potential alternative explanations of the findings.

We represent the collapse of the jumbo secondary market with an "event" dummy defined as

$$d_t = \begin{cases} 1 & \text{if } t \geqslant \text{2007:Q3} \\ 0 & \text{otherwise.} \end{cases} \tag{1}$$

We are interested in quantifying the impact of this event on jumbo originations relative to total mortgage originations across banks. One would expect that the more a bank relies on the jumbo secondary market, the greater the impact of this event on its jumbo originations. To evaluate this conjecture, we construct a bank specific variable, rely_i, which proxies the bank's reliance on the secondary market. We define this variable as the average of the percentage of jumbo loans sold by bank i through private securitization; to other commercial and savings banks; to insurance, mortgage and finance companies; or other purchasers during 2006:Q1–2006:Q2. With the regression analysis performed using data from 2006:Q3–2008:Q4, this definition mitigates potential endogeneity problems. We interact $d_t \times \text{rely}_i$ in order to evaluate the impact of the event across banks with different levels of secondary market utilization.

In addition, we are interested in the impact on jumbo lending of the quarterly Call report measures of bank capital, liquidity, profitability, and total assets (represented

by $CALL_{i,t-1}$), as well as the interaction of these variables with the collapse of the jumbo RMBS market. This allows us to gauge whether banks that shifted away from jumbo originations (relative to conforming) after the event were distinguished by their financial circumstances from banks that moved in to fill the void. Capital is measured as the ratio of tier 1 capital to risk-weighted assets, profitability with the return-on-assets, and liquidity is defined as the ratio of cash plus securities plus federal funds sold to total assets.

Each of our model specifications are fixed effect (FE) regressions, which incorporate bank-specific indicator variables to capture unobserved bank characteristics that tend to remain constant over time and may correlate with the explanatory variables:

$$\begin{aligned} \%\ \text{Jumbo}_{it} &= \alpha_i + \beta_d d_t + \beta_{d,r} d_t \times \text{rely}_i + \beta_h^{'} HMDA_{it} + \\ &\quad + \beta_g^{'} GEO_{i,t-1} + \beta_c^{'} CALL_{i,t-1} + \beta_{d,c}^{'} d_t \times CALL_{it-1} + \varepsilon_{it}. \end{aligned} \tag{2}$$

To control for population characteristics that might affect the demand for jumbo relative to conforming size mortgages, we follow Loutskina and Strahan (2009) and include (from HMDA data) the percentages of the bank's jumbo applicants who are females; who are minorities; who are single; and whose potential home purchase is located in an MSA. We also include the weighted average median income and percentage minority population across the metropolitan areas (or states, for non-metro areas) where the institution is originating mortgages.[16] These variables are collected in $HMDA_{it}$. Because of the difference-in-difference approach, we include analogous variables for conforming-size loan applications.

Some states experienced comparatively steep declines in home prices during 2007 through 2008, including a number of states where jumbo mortgages had been relatively common due to high home prices. To control for the direct and indirect (risk) effects of home values, we include as separate control variables the percentages of the bank's jumbo mortgages during the prior quarter that were originated in each of five groups of states experiencing relatively steep house price declines: California, Arizona and Nevada, Florida, Connecticut and New Jersey, and Washington D.C. and Maryland. Analogous share variables are constructed for conforming size loans, and collectively these variables constitute $GEO_{i,t-1}$.

The FE regressions are estimated by standard within estimators. To enhance the

[16] Weighting is by number of originations in the metropolitan area or state.

robustness of the statistical inference, we cluster standard errors by both firm and time. This two-way clustering has been discussed by Petersen (2009), Thompson (2011) and Cameron, Gelbach, and Miller (2006). We adopt the standard errors proposed by Cameron, Gelbach, and Miller (2006). In our empirical analysis, we confirm that such standard errors decrease the t-statistics relative to the usual robust standard errors with clustering only by firm.

Table 1 presents summary statistics for variables employed in the study, calculated separately for the periods before and after the secondary market shock. In particular, jumbo mortgage share of total conventional mortgage originations at the median institution was 8 percent prior to the shock; afterward, it was 6 percent. The median institution ex-ante sold 17 percent of its jumbo mortgage originations (median value of rely). The summary statistics also indicate that institutions grew in size over the period of the analysis, which in part reflects growth occurring prior to the shock, but possibly also reflects reduced ability to move assets off balance sheet subsequent to the shock.

4 Results

The first column of Table 2 contains the baseline regression results. Two findings confirm the impact of the shock observed in section 2. First—as shown by the negative sign of the event dummy—jumbo originations were significantly and negatively impacted by the collapse of the private-label RMBS market. Second—as shown by the negative sign of the interaction term—the decline in jumbo origination activity was much more pronounced for banks that were ex-ante more reliant on the jumbo secondary market. For instance, for a bank that sells 20 percent of its jumbo originations (approximately the median value of rely, from Table 1) and ex-post exhibits a Tier 1 ratio of 10 percent, the estimated coefficient on the interaction term accounts for about 80 percent of the drop in jumbo share. These effects are highly statistically significant, highlighting the fact that the collapse of the private-label RMBS market had a negative impact on jumbo origination overall, and a substantially larger impact at banks that were more reliant on the secondary market.

Another important finding is that prior to the collapse of the non-Agency securitization market, a bank's jumbo share of total mortgage originations responded inversely to changes in the bank's tier one capital ratio, whereas the shock attenuated

this relationship. One interpretation is that prior to the onset of the mortgage crisis, jumbo mortgages had been viewed as having acceptable risk exposure in addition to having a relatively low regulatory capital requirement. Hence, they were viewed favorably by banks seeking to enhance their regulatory capital position.[17] Thus, prior to the shock, jumbo as a share of total mortgage originations tended to rise following a decline in a bank's capital ratio.

The positive and statistically significant coefficient on the interaction of the regulatory capital ratio with the event dummy indicates a weakening of this relationship subsequent to the secondary market shock. Moreover, the positive coefficient on this interaction term implies that, holding constant the bank's average tier one ratio during 2006:Q3–2008:Q4 (which is incorporated into the fixed effect term), the response of a bank's jumbo lending to the secondary market shock varied inversely with the bank's ex-post regulatory capital position. Banks that succeeded in maintaining relatively strong regulatory capital positions subsequent to the shock experienced relatively small declines or even increases in jumbo share.

These effects are illustrated in Table 3, which summarizes the impact of the secondary market shock in relation to several alternative calibrations of ex-ante dependence on the secondary market and ex-post regulatory capital ratio, as implied by the estimated regression coefficients.[18] For instance, a bank that sold all of its jumbo mortgage originations ex-ante and had an 8 percent tier one capital ratio ex-post shows a drop in jumbo loan share of 8 percentage points. Holding the capital ratio constant, if the bank sold none of its jumbo mortgages ex-ante, its jumbo share decline is 1.3 percentage points. In contrast, jumbo share increases by 2.9 percentage points for a bank that sold none of its jumbo mortgages ex-ante and had a 15 percent tier one capital ratio ex-post.

Altogether, these results imply that jumbo mortgage activity more adversely affected those banks that were more dependent on the secondary market ex-ante and experienced erosion of their regulatory capital positions ex-post. Conversely, there

[17]This finding contrasts with Loutskina and Strahan (2009), who observe that the relative volume of jumbo originations increases with a bank's capital ratio. One important difference between that paper and ours that is a likely explanation for the different findings is the greater emphasis in that paper on cross-sectional differences; institution fixed effects were not included. Moreover, the jumbo securitization was less common during much of the extended (1992-2004) period examined in that study, compared to the pre-crisis period in our study.

[18]Only the event dummy variable and the statistically significant interaction terms (the interactions of the event dummy with rely and the regulatory capital ratio) are included in this calculation.

appears to be a substitution effect after the collapse of the non-Agency secondary market: banks that had little ex-ante dependence and were better positioned in terms of ex-post capital increased their jumbo mortgage lending (as a share of total mortgage originations.) The latter moved in to "pick up the slack" in jumbo market after the private-label RMBS market collapsed.

These findings are consistent with a view that the collapse of the private-label RMBS market was a liquidity shock. It precipitated a drop in jumbo mortgage lending beyond what may be attributable to other demand or supply factors. Moreover, the liquidity shock did not uniformly impact all banks; banks with the capacity in their balance sheet to originate jumbo loans without having to offload them via securitization responded with an increase in jumbo lending. As noted previously, however, the findings may also reflect unobserved variables such as the reduction in the volume of Alt-A lending; we address this limitation of the analysis in section 6 below.

Other findings. The estimated coefficient on bank size as measured by total assets is negative and statistically significant, indicating an inverse association between balance sheet growth and jumbo lending as a share of an institution's total conventional mortgage originations. This relationship might reflect endogeneity of bank growth—banks less active in origination of non-conforming mortgages may have experienced more robust growth over this period. Importantly, when the model is re-estimated excluding this potentially endogenous variable, little change is observed in other estimated coefficients.

In contrast to Loutskina and Strahan (2009), we find that balance sheet liquidity does not have a statistically significant impact on jumbo originations, although the coefficient estimate indicates a positive association which is consistent with that study. The apparent lack of explanatory power of the liquidity measure may be a result of our focus on an unusual time period, when the jumbo securitization market was especially active and then collapsed. Liquidity may have been less important to the bank's jumbo origination decision during this period. Alternatively, the fixed effects approach applied here (but not in that study) might absorb the variables' effect, a possibility also noted in Loutskina and Strahan (2009).

Several of the control variables are indicated to have statistically significant coefficient estimates. Not surprisingly, weighted average median income of the metropoli-

tan areas where the bank is originating mortgages is strongly associated with jumbo share of originations, reflecting the natural tie between mortgage amount and borrower income. A larger proportion of single applicants for jumbo mortgages is associated with a lower jumbo share of total originations. Geographic shifts in mortgage demand also appear to affect banks' jumbo lending; for instance, increased California share of jumbo mortgages is associated with a larger jumbo share of total originations. One interpretation of this result is that compared to other states, demand for jumbo mortgages in California remained relatively strong despite or perhaps (due to an affordability effect) because of declining home values.

Alternative model specifications. The second and third columns of Table 2, and Table 4, provide results for several alternative model specifications. The first (column 2 in Table 2) incorporates one-quarter lagged deposit costs, a factor considered by Loutskina and Strahan (2009). We omitted this variable from our baseline specification due to concerns about potential endogeneity in the context of the period surrounding the mortgage crisis. The estimated coefficient indicates a positive and statistically significant relationship to jumbo mortgage share, possibly reflecting endogeneity, whereby large depositors during this period may have viewed jumbo mortgages as an increasingly risky balance sheet asset and demanded a corresponding risk premium. Other coefficient estimates show little change compared to the baseline.

The third column in Table 2 reports results when, instead of jumbo share, the dependent variable is relative denial rate, defined as jumbo loan application denial rate minus conforming-size loan application denial rate. Denial rates may be viewed as reflecting the impact of evolving credit supply conditions on the marginal borrower, thus offering a distinct perspective on the impact of the liquidity shock. Of course, denial rates can also be strongly influenced by demand conditions; that is, by risk characteristics of the applicant pool. The estimated coefficient on the event dummy indicates that jumbo loan application denial rates rose relative to non-jumbo following the shock, consistent with the finding of a drop in jumbo share of bank mortgage originations. Moreover, like the jumbo share decline, the increase in jumbo application denial rate was more pronounced at banks that ex-ante were more reliant on the secondary market.

Neither the regulatory capital ratio nor its interaction with the event dummy vari-

able exhibit statistically significant relationships to the relative denial rate, although the signs on the estimated coefficients of these variables are consistent with their relationships to jumbo share. Interestingly, balance sheet liquidity becomes a significant driver of relative denial rates after the shock, where increased balance sheet liquidity is associated with a reduced denial rate on jumbo loans.

Finally, Table 4 aggregates each of the (HMDA-reported) mortgage applicant characteristics as well as each of the measures of geographic concentration ($HMDA_{it}$ and GEO_{it}) across jumbo and non-jumbo, in place of the separate measures for jumbo and non-jumbo. Thus, we control for overall average applicant and geographic characteristics, rather than separately for jumbo and conforming. The first column in Table 4 shows the results using the percent jumbo as the dependent variable, whereas the second column shows the results for the denial rate regression. In neither case are the estimated coefficients on the event dummy and its interactions with variable rely and with regulatory tier 1 capital substantially affected.

The first column of Table 4 shows a few, notable changes relative to the baseline specification. Each of the weighted averages of the HMDA measures, with the exception of percent of applications from non-metropolitan areas, is statistically significant. Percent female and percent single applicants and percent of applications from minority neighborhoods are inversely associated with jumbo share of total mortgage applications. Percent minority applicants is positively correlated with jumbo share; since minority applicants disproportionately seek non-jumbo loans, the latter relationship likely reflects reduced demand for non-jumbo mortgage in areas with relatively large minority populations. One other important change that the response of a bank's jumbo lending to the secondary market shock now appears directly related to bank profitability after the event, as indicated by the positive coefficient on the event dummy interacted with return-on-assets.

In addition to the specifications shown in table 4, we estimated the baseline regression equation using a balanced panel, effectively cutting out 20 banks that do not have complete time series due to missing data (or no mortgage originations) in one or more quarters. Balancing the panel does not quantitatively or qualitatively change the results. This indicates that the occurrence of missing data is non-systematic. We also tested the interaction of ex-ante jumbo share (measured over the first half of 2006) with the event dummy variable, by adding this interaction term to the baseline equation. It was not statistically significant and had little impact on the estima-

tion results. As noted earlier, due to endogeneity concerns we also re-estimated the baseline regression equation dropping bank size, and verified that the results were robust.

5 Robustness Analysis

As discussed above, our identification strategy does not allow us to definitively pin down the causal relationship between the shutdown in the jumbo RMBS market and subsequent reductions in jumbo loan originations by banks. A remaining concern is that bank reliance on sale of jumbo loans to the secondary market may be endogenously associated with other bank characteristics (i.e., banks are not randomly assigned between control and treatment groups). In this section, we make an attempt to mitigate the potential endogeneity issues by investigating whether our findings are robust to more restrictive sample selection criteria and to an additional event dummy variable controlling for prior credit shocks. Tables 5 and 6 summarize the results from this analysis.

High priced loans and small loans. One source of unobserved heterogeneity in the sample is the degree to which an institution had been involved in originating higher risk or non-traditional mortgages. Banks more active in higher risk lending ex-ante might have been more reliant on the jumbo secondary market, and reduced jumbo share of mortgage origination among such banks ex-post might have resulted from changed perceptions of credit risk rather than from the collapse of the jumbo RMBS market. High priced loans—those with an APR spread of 300 basis points or more over the 30-year treasury rate and roughly corresponding to subprime—are identified in HMDA. A first, simple step to mitigate heterogeneity is to exclude the high priced loans. As shown in column 1 of Table 5, this exclusion has little impact on the estimated coefficients of the baseline regression equation.

Many higher risk, nonprime or non-traditional mortgages, including many Alt-A, would not have an APR spread in excess of the HMDA threshold, and would continue to be a source of unobserved heterogeneity after exclusion of the high priced loans. Although, as noted previously, non-traditional loans were distributed among both jumbo and non-jumbo, to the extent that non-traditional and Alt-A lending was associated with larger loan amounts, the demise of such lending might have

contributed to declines in jumbo share. We can mitigate potential effects of such heterogeneity by restricting the non-jumbo segment of the sample to large (near-jumbo) loans. Column 2 of Table 5 reports the results from re-estimating the baseline regression equation after excluding loans with an original balance less than 80 percent of the conforming loan limit. Again, we find that the exclusion has little impact on estimated coefficients. Together, these results provide support for the hypothesis that the shutdown of the private-label RMBS market triggered a drop in jumbo originations.

Large banks. The next robustness exercise we consider repeats our analysis for large banks (defined as the top 25 banks by total assets averaged during 2006:H1) and other banks separately. Among large banks, our identification strategy may be particularly vulnerable, due to their close association with the recent financial crisis. For instance, among the large banks, ex-ante dependence on non-Agency RMBS issuance might be associated with exposure to various distractions or disruptions related to the financial crisis, aside from the liquidity shock associated with collapse of the private-label RMBS market. Therefore, it is of interest to determine whether our results hinge on inclusion of large banks in the sample. More broadly, it is of interest to investigate how reactions to the collapse of the non-Agency RMBS market differed between large banks, which directly accessed this market through private-label issuance, and small banks, which typically would have accessed it indirectly through conduit or correspondent relationships.

As shown in column 3 of Table 5, excluding the 25 largest institutions has only a marginal impact on the estimated coefficients of the baseline regression equation. The estimated coefficient on the event dummy variable is marginally smaller in absolute value, while the estimated coefficient on the interaction of the event dummy with degree of reliance on the jumbo secondary market is marginally larger in absolute value. Thus, the results do not depend on inclusion of large banks, providing further support for our identification strategy.

Column 4 of Table 5 reports the estimation results for the large bank sample. It is interesting to note that large banks appear to have decreased their jumbo shares more sharply than the other banks in our sample in response to the crisis. This result likely is driven by the effect of other shocks that occurred during this period, such as the rescue of Bear Sterns and its acquisition by JPMorgan Chase and the collapse of

Lehman Brothers. In addition, the impact of the tier 1 capital ratio on bank responses to the secondary market shock appears to be stronger at larger banks. Interestingly, the interaction between the crisis dummy and the degree of reliance in the secondary market is not statistically significant for large banks separately, contrary to our initial concern that this interaction effect might be especially strong at large banks. Thus, it appears that the impact of the broader financial crisis on large banks was of sufficient severity and scope to obscure any differences among them in relation to ex-ante dependence on the jumbo secondary market. Of course, one should be cautious in drawing conclusions from the large bank sample, given the somewhat arbitrary size threshold and the relatively small sample size.

High-risk regions. Several studies have documented an association between rapid house price appreciation and relaxation of lending standards or supply of non-traditional loan products.[19] Thus, endogenous associations among reliance on the secondary market, high risk lending, and jumbo lending may be particularly strong in areas with high house price appreciation.[20] To mitigate these potential correlations, we repeat the baseline regression analysis dropping banks that had a 25 percent or higher concentration of jumbo originations in California, Nevada, Arizona, and Florida during 2006:H1.

The estimation results are reported in column 1 of Table 6. The estimated coefficients of the event dummy variable and its interactions with rely and the tier 1 capital ratio are smaller in magnitude but remain statistically and economically significant. Thus, the results continue to support the finding that the crisis had a larger impact on banks with greater ex-ante reliance on the secondary market and those with lower ex-post capital ratios.

For instance, a bank that sold all of its jumbo mortgage originations ex-ante and had an 8 percent tier one capital ratio ex-post has a drop in jumbo loan share of 6.5 percentage points, which compares to the 8 percentage point decline from the baseline regression as shown in Table 3. Holding the capital ratio constant, if the bank sold none of its jumbo mortgages ex-ante, its jumbo share decline is 1.3 percentage points, same as in Table 3. As another comparison, if the bank sold none of its jumbo

[19]See, for instance Brueckner, Calem, and Nakamura (2011), Mian and Sufi (2009), and Pavlov and Wachter (2011).

[20]Note that the direct effect of reduced lending in areas with steeper house price declines is already captured in the baseline regression by the variables in $GEO_{i,t-1}$.

mortgages ex-ante and had an ex-post capital ratio of 15 percent, its jumbo share would increase by 2.5 percentage points, slightly less than the corresponding Table 3 amount.

Subprime and Alt-A credit shocks. As noted in section 2, collapse of the private-label RMBS market was preceded by collapse of the subprime and Alt-A loan markets in the previous quarter. Therefore, another way to address the potential unobserved heterogeneity associated with origination of higher risk or non-traditional mortgages is to incorporate an additional event dummy separating originations before and after the first quarter of 2007. To the extent that decline in jumbo share is tied to collapse of high-risk lending as opposed to the collapse of the non-Agency secondary market, this would by captured by the first quarter event dummy along with its interactions with the rely variable and the variables in $CALL_{i,t-1}$. Note that this is a conservative approach, as the estimated equation will likely attribute some of the effect of the collapse of the jumbo RMBS market to the earlier, credit-related event.

Results from inclusion of the first quarter, credit event dummy variable and its associated interaction terms are shown in Table 6, column 2. The estimated coefficient on this dummy variable has a positive sign and is of marginal statistical significance, indicating that collapse of the high-risk mortgage market had a positive impact on jumbo share of total mortgage originations. The estimated coefficient of the second quarter, liquidity event dummy variable remains negative, increasing in absolute value to balance out the effect of including the first quarter, credit event dummy. We continue to observe an inverse relationship, statistically and economically significant, between jumbo share and the interaction of the second quarter, liquidity event with rely. The estimated coefficient on this interaction term decreases in absolute value, as part of the original interaction effect now is borne by the interaction of the first quarter, credit event with rely. Qualitatively, the results are quite consistent with the results from the baseline regression equation.

6 Summary and Conclusions

Our research examines the evaporation of the private-label RMBS market in the third quarter of 2007 and its impact on the supply of jumbo mortgage loans. While no doubt influenced by credit-related factors, especially concerns about the impact

of falling prices on mortgage credit risk, this complete and rapid shutdown of the non-Agency securitization market was primarily a liquidity event. We find that the liquidity shock triggered a substantial reduction in jumbo lending, where the impact varied significantly in relation to characteristics of the originating institutions. Banks that ex-ante were more dependent on securitization for funding jumbo mortgage originations and those that ex-post were less well capitalized, incurred the largest drop in jumbo originations after the shock. Conversely, banks that had little dependence on the secondary market ex-ante and were well capitalized ex-post partly compensated for this drop with an increase in their jumbo mortgage originations.

These findings are consistent with the notion that the drop in jumbo lending subsequent to the shutdown of the non-Agency RMBS market was in large measure a consequence of loss of access to secondary market funds, and not simply a reaction to worsening perceptions of mortgage credit risk.[21] Moreover, the strength of a bank's capital position was a key factor determining the extent to which jumbo lending was curtailed. This finding highlights how bank capital mitigates the amplification of financial shocks and the potential value of capital requirements that are higher during periods of robust economic growth.

We also conduct a rigorous robustness analysis designed to mitigate the impact of unobserved differences in institutions' lending practices. In particular, we seek to address unobserved heterogeneity with respect to involvement in higher-risk or non-traditional lending that might affect both ex-ante reliance on the secondary market and ex-post response to the liquidity shock. The set of robustness tests include the use of certain restrictive, sample selection criteria, such as excluding smaller loan sizes and dropping the 25 largest institutions, and inclusion of an additional event dummy variable controlling for prior credit shocks. In each case, the main findings are confirmed.

The robustness analysis also indicates that for the group of large (top 25) banks, the decline in jumbo lending was relatively steep and broad based, and for these banks we observe no relation to dependence on the secondary market. One possible interpretation is that the impact of the crisis on the largest banks was of sufficient severity and scope to obscure any differences tied to degree of ex-ante reliance on

[21] This aspect of the financial crisis is also highlighted in a recent paper by Campbell, Covitz, Nelson, and Pence (2011), which demonstrates the success of the U.S. Treasury's Term Asset Liquidity Facility program (TALF). The paper presents evidence that TALF provided requisite backup liqudity without generating long-run losses requiring government subsidy.

jumbo mortgage securitization.

The findings have implications for views on securitization, and may also contribute to understanding the amplification of financial shocks. In particular, they highlight the sensitivity of bank lending to secondary market liquidity shocks, suggesting that securitization potentially can be a destabilizing factor in macroeconomic cycles. One possible policy response could be higher capital or liquidity requirements for banks that are overly concentrated in a single source of liquidity, such as securitization. The study also points to a benefit of a diversified banking system that preserves a role for smaller banks and for banks engaged in traditional deposit taking and lending activities—that is, the comparative steadfastness of such institutions in the face of systemic shocks to financial markets.

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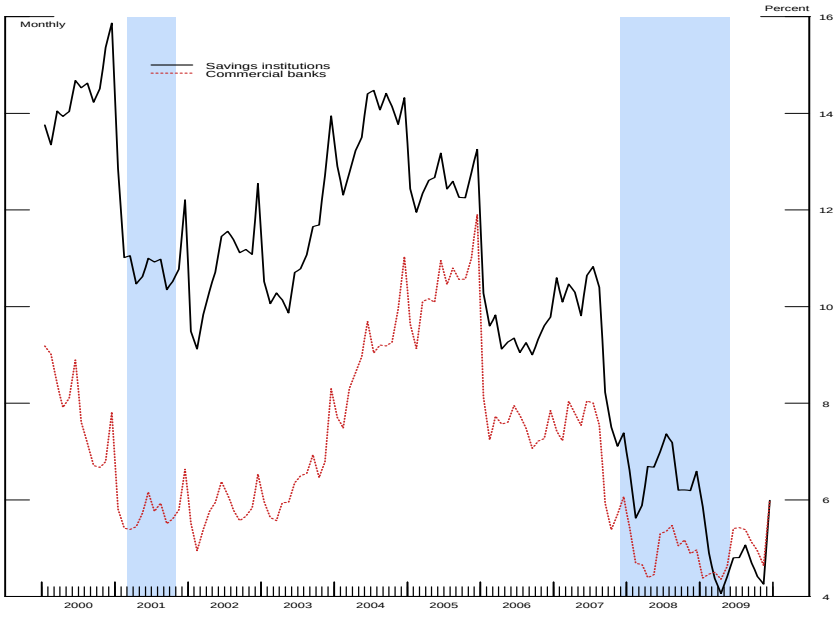
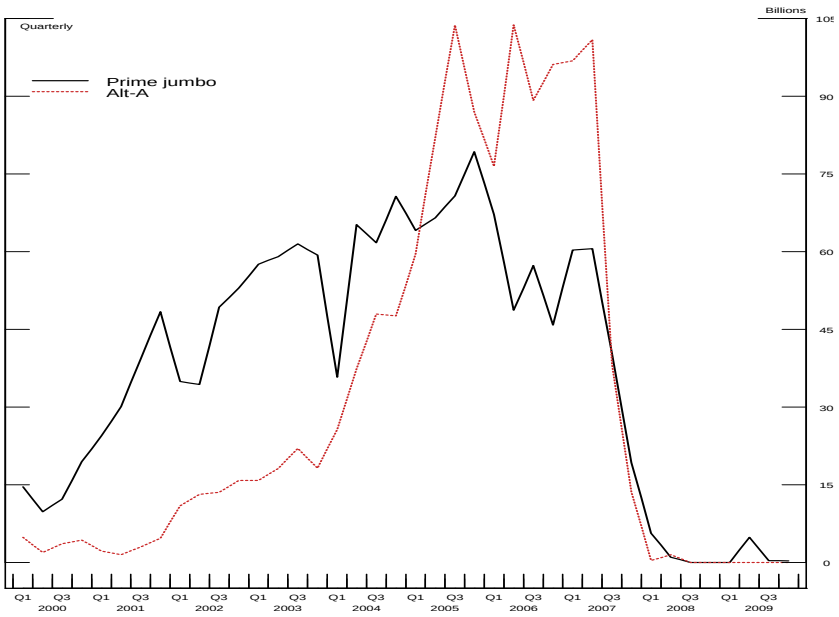
Figure 1: Jumbo Percent of All Home Purchases



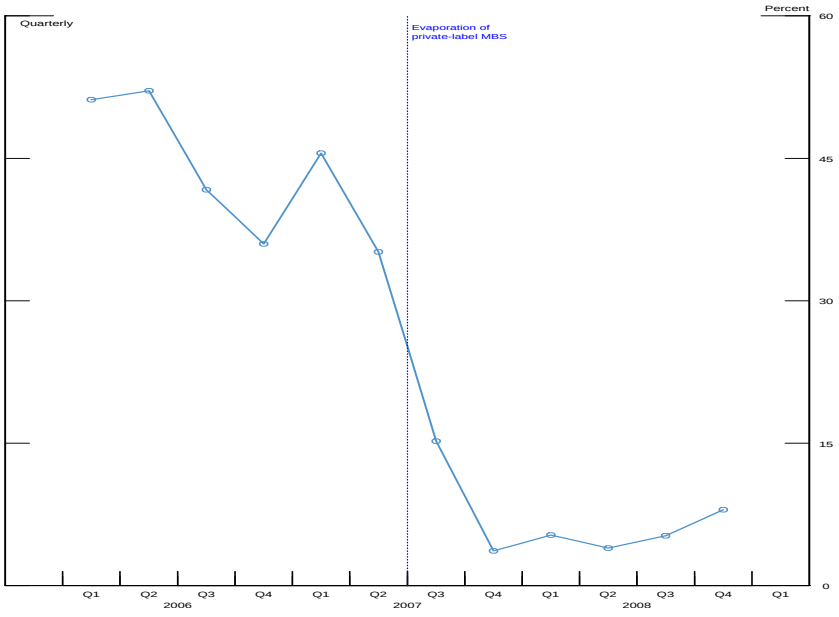
SOURCE: HMDA.

Figure 2: Prime Jumbo and Alt-A MBS Issuance



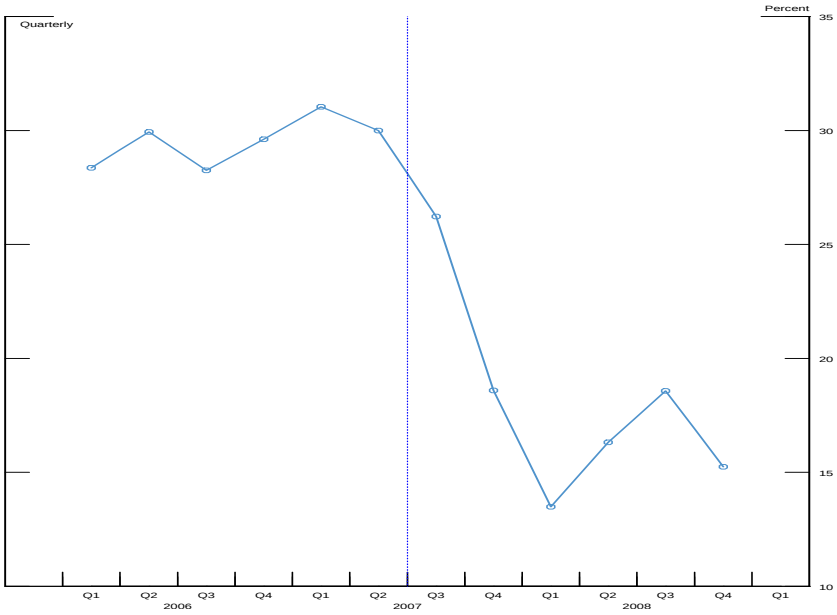
SOURCE: Inside Mortgage Finance MBS database.

Figure 3: Dollar Share of Jumbo Mortgages Sold in the Secondary Market



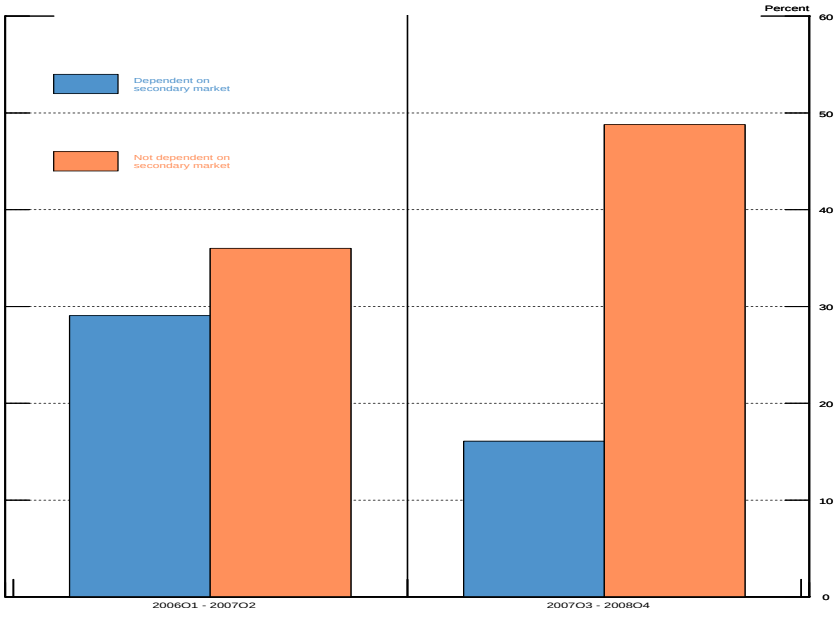
SOURCE: HMDA.

Figure 4: Dollar Volume of Jumbo Mortgages to Total Mortgages



Source: HMDA.

Figure 5: Dollar Volume of Jumbo Mortgages to Total Mortgages by Bank Type



Source: HMDA.

Table 1: Summary Statistics

	Before Crisis (2006:Q1 - 2007:Q2)					After Crisis (2007:Q3 - 2008:Q4)				
	min	25%	median	75%	max	min	25%	median	75%	max
% Jumbo (count-based)	0.9	3.5	8.3	19.1	90.9	0.0	2.8	6.0	17.2	100.0
Relative denial rate	-42.1	-3.4	2.1	7.9	44.6	-45.2	-1.8	6.0	14.6	61.2
Rely	0.0	0.0	16.5	57.2	100.0	—	—	—	—	—
Size	0.2	1.8	3.6	10.6	1186.3	0.2	1.9	4.4	11.9	1405.1
Liquidity	2.1	14.2	20.2	27.9	82.6	1.8	13.5	18.5	24.4	79.3
ROA	-0.5	0.8	1.1	1.4	2.4	-7.3	-0.4	0.5	0.9	2.2
Tier 1 Capital ratio	6.6	9.6	10.5	11.9	46.2	6.7	9.3	10.0	11.4	41.5
Deposit Costs	0.4	2.4	2.9	3.4	4.7	0.3	2.2	2.7	3.3	4.4
Metro	25.7	80.6	91.6	98.5	100.0	20.6	80.6	92.0	98.8	100.0
Minority	2.5	7.8	14.5	25.0	98.7	0.0	7.4	13.8	21.6	99.1
Female	13.1	23.7	26.9	31.1	47.8	0.0	22.4	25.7	29.2	43.8
Single	30.6	40.6	47.2	54.7	78.1	26.0	41.3	46.9	52.1	76.8
MNTR	0.0	3.0	8.6	20.1	100.0	0.0	2.8	8.4	17.7	100.0
MSA Median Income	18.6	55.2	62.4	69.7	92.7	0.0	55.8	63.9	71.3	96.0
CA	0.0	0.0	0.0	1.7	100.0	0.0	0.0	0.0	1.4	100.0
FL	0.0	0.0	0.0	0.4	73.5	0.0	0.0	0.0	0.3	72.6
AZNV	0.0	0.0	0.1	1.0	89.4	0.0	0.0	0.0	0.6	86.1
CTNJ	0.0	0.0	0.0	1.5	99.3	0.0	0.0	0.0	0.7	100.0
DCMD	0.0	0.0	0.1	6.4	100.0	0.0	0.0	0.0	6.8	100.0

NOTE: Units are all in percentages except for size (in billions of dollars) and median MSA income (in thousands of dollars). The relative denial rate is equal to the denial rate on jumbo mortgages less the denial rate on conforming mortgages. HMDA and GEO variables are weighted averages of jumbo and conforming loans.

Table 2: Baseline Regression Results

	(1)		(2)		(3)	
Explanatory Variable	Coef.	t-stat	Coef.	t-stat	Coef.	t-stat
d_t	-6.05	*[3.02]*	-10.12	*[2.99]*	6.19	*[2.46]*
$d_t \times \text{rely}_i$	-0.07	*[4.03]*	-0.07	*[4.30]*	0.07	*[3.25]*
Size	-0.03	*[1.89]*	-0.03	*[2.01]*	0.08	*[2.27]*
Liquidity	0.08	*[0.84]*	0.05	*[0.55]*	-0.13	*[0.92]*
ROA	-0.50	*[0.61]*	-0.93	*[1.05]*	0.18	*[0.16]*
Tier 1 ratio	-0.94	*[3.44]*	-0.90	*[3.49]*	0.30	*[1.11]*
Deposit costs	—		-0.38	*[0.38]*	—	
$d_t \times$ Size	0.00	*[0.58]*	0.00	*[1.15]*	0.00	*[0.16]*
$d_t \times$ Liquidity	-0.01	*[0.17]*	0.01	*[0.28]*	-0.12	*[1.81]*
$d_t \times$ ROA	1.02	*[1.26]*	1.43	*[1.60]*	-0.84	*[0.76]*
$d_t \times$ Tier 1 ratio	0.60	*[4.09]*	0.53	*[3.86]*	-0.10	*[0.72]*
$d_t \times$ Deposits costs	—		1.34	*[1.80]*	—	
MSA Median Income	0.08	*[2.43]*	0.10	*[2.78]*	-0.59	*[4.49]*
Jumbo mortgages:						
% Metro	0.00	*[0.19]*	-0.01	*[0.63]*	-0.06	*[0.91]*
% Minority	-0.01	*[0.23]*	-0.01	*[0.21]*	0.07	*[1.31]*
% Female	-0.04	*[1.31]*	-0.04	*[1.39]*	0.08	*[1.58]*
% Single	-0.03	*[1.86]*	-0.03	*[1.93]*	0.06	*[1.47]*
% MNTR	0.00	*[0.00]*	0.00	*[0.04]*	0.04	*[0.64]*
CA	0.04	*[2.23]*	0.03	*[1.93]*	-0.06	*[0.88]*
FL	0.07	*[1.59]*	0.07	*[1.65]*	-0.18	*[2.62]*
AZNV	0.10	*[1.63]*	0.09	*[1.52]*	-0.17	*[1.66]*
CTNJ	-0.04	*[1.05]*	-0.04	*[1.01]*	-0.09	*[1.47]*
DCMD	0.04	*[1.11]*	0.04	*[0.97]*	0.09	*[1.18]*
Conforming mortgages:						
% Metro	-0.03	*[0.99]*	-0.03	*[0.83]*	0.25	*[2.34]*
% Minority	0.07	*[0.80]*	0.07	*[0.80]*	-0.20	*[1.89]*
% Female	0.08	*[1.62]*	0.07	*[1.37]*	-0.03	*[0.45]*
% Single	-0.02	*[0.31]*	-0.02	*[0.34]*	-0.10	*[1.17]*
% MNTR	-0.13	*[1.40]*	-0.13	*[1.47]*	0.06	*[0.58]*
CA	0.00	*[0.04]*	0.01	*[0.20]*	0.28	*[1.72]*
FL	-0.14	*[1.54]*	-0.14	*[1.58]*	-0.11	*[0.87]*
AZNV	-0.15	*[0.43]*	-0.14	*[0.40]*	0.83	*[2.14]*
CTNJ	0.22	*[3.67]*	0.21	*[3.65]*	0.11	*[1.01]*
DCMD	-0.26	*[2.49]*	-0.25	*[2.41]*	0.32	*[1.64]*
Within R-squared	0.18		0.19		0.22	
Number of firms	198		198		198	
Observations	1736		1736		1782	

NOTE: The dependent variable in columns (1) and (2) is the share of jumbo originations relative to all originations by entity i. The dependent variable in column (3) is equal to the denial rate of jumbo originations minus the denial rate of conforming originations. The t-statistics are inside the brackets and are constructed using standard errors clustered by both entity and time.

Table 3: Comparative Statics

		Specifications	Tier 1 Capital (%)				
			6	**8**	**10**	**12**	**15**
	0	Baseline	-2.5	-1.3	-0.1	1.1	2.9
		Excl. high-risk regions	-2.4	-1.3	-0.2	0.9	2.5
		Excl. subprime and Alt-A shocks	-3.3	-2.1	-0.9	0.3	2.1
% Sold	**50**	Baseline	-5.8	-4.6	-3.5	-2.3	-0.5
		Excl. high-risk regions	-5.0	-3.9	-2.8	-1.7	-0.1
		Excl. subprime and Alt-A shocks	-5.8	-4.6	-3.4	-2.2	-0.4
	100	Baseline	-9.2	-8.0	-6.8	-5.6	-3.8
		Excl. high-risk regions	-7.6	-6.5	-5.4	-4.3	-2.7
		Excl. subprime and Alt-A shocks	-8.3	-7.2	-6.0	-4.8	-3.0

NOTE: Each cell in the table shows the impact (in percentage terms) of the shutdown of the RMBS market on the share of jumbo mortgage originations, for five different values of the tier 1 capital ratio and three different levels of the share of jumbo loans sold in the secondary market.

Table 4: Alternative Model Specifications

	(1)		(2)	
Explanatory Variable	Coef.	t-stat	Coef.	t-stat
d_t	-6.35	*[3.47]*	5.36	*[1.76]*
$d_t \times \text{rely}_i$	-0.07	*[4.51]*	0.09	*[3.53]*
Size	-0.03	*[1.84]*	0.07	*[1.84]*
Liquidity	0.07	*[0.89]*	-0.15	*[1.05]*
ROA	-0.79	*[1.05]*	0.51	*[0.43]*
Tier 1 ratio	-0.85	*[3.47]*	0.36	*[1.25]*
$d_t \times$ Size	0.00	*[0.53]*	0.00	*[0.77]*
$d_t \times$ Liquidity	0.01	*[0.27]*	-0.08	*[0.91]*
$d_t \times$ ROA	1.31	*[1.76]*	-1.17	*[0.97]*
$d_t \times$ Tier 1 ratio	0.54	*[4.14]*	-0.14	*[0.86]*
% Metro	0.02	*[0.37]*	0.14	*[1.05]*
% Minority	0.21	*[2.46]*	-0.29	*[2.18]*
% Female	-0.17	*[2.60]*	0.01	*[0.09]*
% Single	-0.14	*[2.13]*	0.05	*[0.51]*
% MNTR	-0.36	*[3.33]*	0.24	*[1.73]*
MSA Median Income	0.08	*[2.45]*	-0.62	*[4.16]*
CA	0.20	*[2.20]*	0.46	*[2.88]*
FL	0.00	*[0.02]*	-0.28	*[1.92]*
AZNV	0.41	*[1.68]*	0.06	*[0.22]*
CTNJ	0.13	*[1.34]*	-0.05	*[0.27]*
DCMD	-0.14	*[1.59]*	0.40	*[2.32]*
Within R-squared	0.22		0.16	
Number of firms	198		198	
Observations	1782		1782	

NOTE: The dependent variable in column (1) is the share of jumbo originations relative to all originations by entity i. The dependent variable in column (2) is equal to the denial rate of jumbo originations minus the denial rate of conforming originations. The t-statistics are in parenthesis and standard errors are clustered by both entity and time.

Table 5: Robustness Analysis

	(1)		(2)		(3)		(4)	
Explanatory Variable	Coef.	t-stat	Coef.	t-stat	Coef.	t-stat	Coef.	t-stat
d_t	-6.21	*[3.12]*	-6.57	*[3.37]*	-5.97	*[2.65]*	-11.87	*[4.33]*
$d_t \times \text{rely}_i$	-0.07	*[3.99]*	-0.07	*[3.99]*	-0.07	*[4.22]*	0.00	*[0.16]*
Size	-0.03	*[1.88]*	-0.03	*[1.85]*	-1.21	*[2.06]*	-0.02	*[1.47]*
Liquidity	0.08	*[0.84]*	0.07	*[0.77]*	0.19	*[1.72]*	-0.15	*[0.98]*
ROA	-0.52	*[0.64]*	-0.56	*[0.70]*	-0.81	*[0.79]*	-0.58	*[0.79]*
Tier 1 ratio	-0.94	*[3.45]*	-0.90	*[3.41]*	-1.16	*[3.73]*	-0.01	*[0.03]*
$d_t \times$ Size	0.00	*[0.62]*	0.00	*[0.65]*	0.15	*[1.39]*	0.00	*[1.13]*
$d_t \times$ Liquidity	0.00	*[0.10]*	0.00	*[0.05]*	-0.01	*[0.22]*	-0.05	*[0.70]*
$d_t \times$ ROA	1.06	*[1.32]*	1.13	*[1.44]*	1.39	*[1.36]*	0.50	*[0.72]*
$d_t \times$ Tier 1 ratio	0.60	*[4.10]*	0.60	*[4.10]*	0.56	*[3.73]*	1.04	*[4.39]*
MSA Median Income	0.08	*[2.45]*	0.08	*[2.35]*	0.11	*[3.00]*	-0.08	*[0.62]*
Jumbo mortgages:								
% Metro	0.00	*[0.18]*	0.00	*[0.01]*	-0.02	*[0.99]*	0.14	*[1.50]*
% Minority	-0.01	*[0.28]*	-0.01	*[0.32]*	-0.01	*[0.49]*	0.23	*[1.54]*
% Female	-0.04	*[1.30]*	-0.03	*[1.21]*	-0.03	*[1.40]*	-0.18	*[1.84]*
% Single	-0.03	*[1.80]*	-0.03	*[1.79]*	-0.03	*[1.81]*	0.00	*[0.01]*
% MNTR	0.00	*[0.02]*	0.01	*[0.16]*	0.00	*[0.02]*	-0.09	*[0.63]*
CA	0.04	*[2.32]*	0.03	*[2.25]*	0.03	*[1.99]*	0.10	*[2.81]*
FL	0.06	*[1.54]*	0.05	*[1.38]*	0.06	*[1.36]*	0.15	*[1.42]*
AZNV	0.09	*[1.24]*	0.07	*[1.08]*	0.10	*[1.49]*	0.26	*[5.89]*
CTNJ	-0.04	*[1.08]*	-0.04	*[0.91]*	-0.05	*[1.15]*	0.07	*[1.08]*
DCMD	0.04	[1.12]	0.04	*[0.96]*	0.05	*[1.10]*	0.02	*[0.35]*
Conforming mortgages:								
% Metro	-0.03	*[1.02]*	-0.01	*[0.31]*	-0.02	*[0.55]*	-0.09	*[0.40]*
% Minority	0.07	*[0.79]*	0.06	*[0.65]*	0.08	*[0.81]*	-0.27	*[1.45]*
% Female	0.08	*[1.61]*	0.08	*[1.67]*	0.05	*[1.14]*	0.38	*[4.35]*
% Single	-0.02	*[0.32]*	-0.02	*[0.44]*	0.02	*[0.35]*	0.08	*[0.00]*
% MNTR	-0.13	*[1.41]*	-0.12	*[1.38]*	-0.24	*[2.11]*	0.08	*[2.49]*
CA	0.00	*[0.04]*	-0.01	*[0.11]*	0.01	*[0.23]*	-0.05	*[0.28]*
FL	-0.11	*[1.59]*	0.06	*[0.27]*	-0.13	*[1.41]*	-0.31	*[0.75]*
AZNV	-0.19	*[0.52]*	0.99	*[3.60]*	-0.17	*[0.49]*	-0.49	*[1.30]*
CTNJ	0.22	*[3.67]*	0.21	*[3.82]*	0.16	*[1.71]*	0.20	*[2.32]*
DCMD	-0.26	*[2.52]*	-0.23	*[2.06]*	-0.18	*[1.59]*	-0.72	*[5.08]*
Within R-squared	0.18		0.19		0.19		0.57	
Number of firms	198		198		173		25	
Observations	1782		1782		1557		225	

NOTE: The dependent variables in all columns is the share of jumbo loans originations relative to all originations. The results in column (1) excludes high-priced loans and small loans. The results in column (2) excludes all loans with an original balance less than 80 percent of the conforming loan limit. The results shown in column (3) exclude the top 25 banks during 2006:H1. Finally, column (4) reports the estimation results for the large bank sample. The t-statistics are inside the brackets and are constructed using standard errors clustered by both entity and time.

Table 6: Robustness Analysis (Cont.)

	(1)		(2)	
Explanatory Variable	Coef.	t-stat	Coef.	t-stat
d_t	-5.56	*[2.85]*	-6.84	*[3.42]*
$d_t \times \text{rely}_i$	-0.05	*[2.85]*	-0.05	*[3.14]*
2007:Q2	—		1.16	*[1.73]*
2007:Q2×rely_i	—		-0.02	*[2.45]*
Size	-0.08	*[1.09]*	-0.03	*[1.91]*
Liquidity	0.15	*[1.33]*	0.08	*[0.87]*
ROA	-0.09	*[0.10]*	-0.51	*[0.61]*
Tier 1 ratio	-1.04	*[3.89]*	-.94	*[3.42]*
$d_t \times$ Size	0.01	*[0.73]*	0.00	*[0.64]*
$d_t \times$ Liquidity	0.00	*[0.04]*	-0.01	*[0.16]*
$d_t \times$ ROA	0.69	*[0.72]*	1.03	*[1.24]*
$d_t \times$ Tier 1 ratio	0.53	*[4.19]*	0.60	*[4.11]*
MSA Median Income	0.10	*[2.63]*	0.08	*[2.38]*
Jumbo mortgages:				
% Metro	-0.01	*[0.86]*	0.00	*[0.16]*
% Minority	0.01	*[0.34]*	0.00	*[0.17]*
% Female	-0.01	*[0.50]*	-0.04	*[1.31]*
% Single	-0.03	*[1.89]*	-0.03	*[1.91]*
% MNTR	-0.01	*[0.14]*	0.00	*[0.02]*
CA	0.03	*[1.24]*	0.04	*[2.21]*
FL	0.06	*[1.76]*	0.07	*[1.55]*
AZNV	0.11	*[1.67]*	0.10	*[1.61]*
CTNJ	-0.06	*[1.24]*	-0.04	*[1.04]*
DCMD	-0.02	*[0.54]*	0.04	*[1.07]*
Conforming mortgages:				
% Metro	-0.01	*[0.33]*	-0.03	*[1.00]*
% Minority	0.02	*[0.20]*	0.07	*[0.80]*
% Female	0.09	*[1.48]*	0.08	*[1.64]*
% Single	0.00	*[0.06]*	-0.02	*[0.33]*
% MNTR	-0.07	*[0.67]*	-0.13	*[1.42]*
CA	0.15	*[0.74]*	-0.00	*[0.01]*
FL	-0.16	*[1.16]*	-0.14	*[1.53]*
AZNV	-0.25	*[0.71]*	-0.14	*[0.41]*
CTNJ	0.23	*[2.49]*	0.22	*[3.70]*
DCMD	-0.02	*[0.11]*	-0.25	*[2.46]*
Within R-squared	0.18		0.18	
Number of firms	161		198	
Observations	1449		1782	

NOTE: The dependent variable is the share of jumbo originations relative to all originations. Column (1) reports the estimation results by excluding banks with a 25 percent or higher concentration of jumbo originations in CA, NV, AZ and FL. Column (2) includes an additional dummy for the second quarter of 2007. The t-statistics are inside the brackets and are constructed using standard errors clustered by both entity and time.