Securitization Market Share and Bank Mortgages

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This study focuses on the relationship between the growth in securitized mortgages and bank-held mortgages from 1976 to mid-2004. Market share ratios are developed from the Federal Reserve's *Financial Accounts of the United States*, which estimates the U.S. securitization market share of aggregated mortgages separately from the bank-held mortgage share of aggregated mortgages. The results of the study show that the growth rates in the market share of securitized mortgages in the U.S. appear to be pro-cyclical with the growth rates of bank-held mortgages at smaller asset-size banks, despite the relative decline in the overall ratio of bank-held mortgages to total mortgages. The growth of the securitization market share may also reduce the effectiveness of monetary policy on bank real estate loans at small banks.

JEL classification: E44; E52; G21
Keywords: Securitization, Mortgages, Bank Loans, Monetary Policy

1. Introduction

The growth in securitized mortgages from 1976 until the financial crisis in 2008-09 grew steadily as well as the market share of securitized mortgages to total mortgages in the U.S. The purpose of this paper is to examine the relationship between the growth in mortgage securitization and the growth of bank-held mortgages in the U.S., by market share. Aggregated U.S. mortgage data was obtained from the Federal Reserve's *Financial Accounts of the United States*. The analysis in this study estimates the aggregated securitized mortgage market share of total U.S. mortgages. Conversely, the banking share of held mortgages to total mortgages is also compared to the securitization market share. These mortgage market share variables are empirically tested to see if they have a significant relationship with bank-held mortgages. The study uses aggregated banking data (the Yamashiro data described below) from 1976 to mid-2004, which covers the rise of securitization in the U.S. prior to the collapse of the U.S. real estate market in 2007. What was the relationship between the growth in securitization and bank-held mortgages prior to the Great Recession?

The main findings of this study are that the rise of securitization had a positive and significant relationship with the growth of smaller banks' mortgage holdings prior to the financial crisis of 2008-09. Real estate loan growth among the top one percent of U.S. banks (by asset size) appears not to be significantly affected by the growth in the securitization market share. Thus, the study's findings suggest that

there is a pro-cyclical relationship between securitization and small bank-held mortgages' growth rates, despite an overall decline in the banks' share of held mortgages. Another observation emerging from this study is that the changing size of the securitization market share may have reduced the significance of the federal funds interest rates (FFR) as an effective monetary tool for bank-held loans.

The paper is structured as follows. Section 2 reviews the related literature and U.S. mortgage trends. Section 3 describes the data, model components, and predictions. Section 4 specifies the models and shows the empirical results. The final section concludes the paper.

2. Related Empirical Literature and U.S. Mortgage Trends

This study contributes to the securitization literature by analyzing the relationship between the growth in the market share of securitized mortgages and the growth in bank-held mortgages. Zarutskie (2013) finds that the rise in securitization led to most banks increasing their loan portfolio holdings of real estate loans, across a similar time period to the one in this study. Other than that study, research specific to the relationship between securitization and bank-held mortgages is limited, and needs to be expanded. Most of the related securitization research is focused on securitization and liquidity as they relate to the monetary transmission mechanism, and/or on analyzing securitization around the financial crisis. Gorton and Matrick (2012), as well as Altunbas, Kara, and Ozkan (2014) provide outstanding overviews of the literature on securitization.

This paper supports related studies concerning the monetary transmission mechanism and securitization by confirming some of their results. Most of these studies are concerned with how securitization increases liquidity for banks, and how this may affect monetary transmission channels as well as the bank's portfolio holdings. Diamond and Dybvig (1983), for instance, show that securitization may have an effect on the liquidity transformation function at banks. These studies have implications for the monetary transmission mechanism[1] because if securitization brings about liquidity at banks, it may be a substitute for deposits and federal funds. Specifically, the traditional bank lending channel (BLC) model assumes that monetary policy can shift the loan supply at banks via bank reserves and deposits, as outlined by Bernanke and Blinder (1988).

Altunbas, Gambacorta, and Marques (2009) argue that securitization has changed the traditional bank lending mechanism by increasing the banks' liquidity in European markets. Loutskina and Stahan (2009) and Loutskina (2011) show that securitization increases the liquidity at banks, and find that banks with more liquid loan types were less influenced by the monetary authority. Securitization has helped

[1] See Mishkin (1995) for a full description of the many plausible channels for monetary transmission mechanisms in the economy. He suggests three broad channels: the traditional interest rate channel, the other asset pricing effects channel, and the credit view channel. Similar overviews are offered by Kuttner and Mosser (2002) and others.

small banks create liquidity in loan products that were only available to big banks. Kashyap and Stein (2000) conclude that the BLC is more influential on smaller banks with less liquidity. Egly, Jackson, and Johnk (2015) similarly show that securitization is a cost-effective source of liquidity for large banks. My measure of securitization market share may be interpreted as a measure of liquidity (in mortgages) that is somewhat similar to the liquidity variables used by Loutskina (2011) and Zarutskie (2013), but their instruments are weighted by other variables. The securitization market share variable used in this study is not adjusted and is tested directly in the model. I hope my approach may thus add to the literature.

Other securitization measures were developed by Estrella (2002), who examines the impact monetary policy has on the securitization of mortgage assets, mortgage interest rates, and output. Estrella's securitization ratio measures securitized mortgages to the aggregated value of residential homes. He argues that the increase in securitization has made the reaction of mortgage rates to monetary policy stronger because when credit markets become volatile, banks become an important source of credit.

The present paper offers some supporting conclusions about large banks' sensitivity to federal funds rates, as indicated by the monetary transmission studies of Altunbas, Gambacorta, and Marques (2009), since it divides banks by asset size. DeYoung and Rice (2004) argue that securitization has reduced institutional factors (such as a bank's size) that influence the traditional dependence on interest rates and the BLC. My study is different from these studies because the analysis uses all U.S. banking data, as opposed to adjusted bank samples that can drop a significant amount of bank data due to bank mergers over time. In other words, my study does not use panel data for select banks, but a pooled regression approach of aggregated banking data with aggregated securitization data, which may complement these other studies and add to the literature.

Finally, this analysis of long-term trends in the U.S. mortgage industry may complement studies such as those by Greenwood and Scharstein (2013) and Gorton and Matrick (2010). According to Greenwood and Scharstein (2013), the financial sector's contribution to U.S. GDP went from 4.9% in 1980 to 8.3% in 2006, with a noticeably greater amount coming from securitization fees since 2000. Gorton and Matrick (2010) show that the rise of securitization within the shadow banking system was a major source of instability because of insufficient regulatory oversight. This study hopes to contribute to this general financial literature by analyzing long-term trends in the mortgage industry between the shadow banking system and the banks. For the purpose of this study, "shadow banks" mean any non-insured FDIC bank depository institutions.

2.1 Mortgage Banking Trends in the United States

According to the Federal Reserve's *Financial Accounts of the United States*, aggregate U.S. mortgages amounted to $10 trillion, including $4.6 trillion in securitized mortgages by mid-2004 (Figure 1). Total U.S. securitized mortgage

credit as a percentage of aggregated mortgages went from 3.9% in 1976 to 46.2% by mid-2004 (Figure 2). Privately issued mortgage asset-backed securities (ABS_m) likewise grew rapidly as a percentage of aggregated mortgages, from less than 1.0% in 1984 to 12.0% by mid-2004.

Figure 3 illustrates the relationship between bank-held mortgages and aggregate mortgages in nominal U.S. dollars. Mortgages held at U.S. charted depository institutions have decreased over time as a percentage of total mortgage. Bank holdings of mortgages were 61.9% of aggregated mortgages in 1976 and had decreased to 33.6% by mid-2004 (Figure 4). Note that most of the rapid decline in the banks' market share was over by 1993, well before the rapid rise of securitized mortgages, followed by much smaller declines.

Figure 1

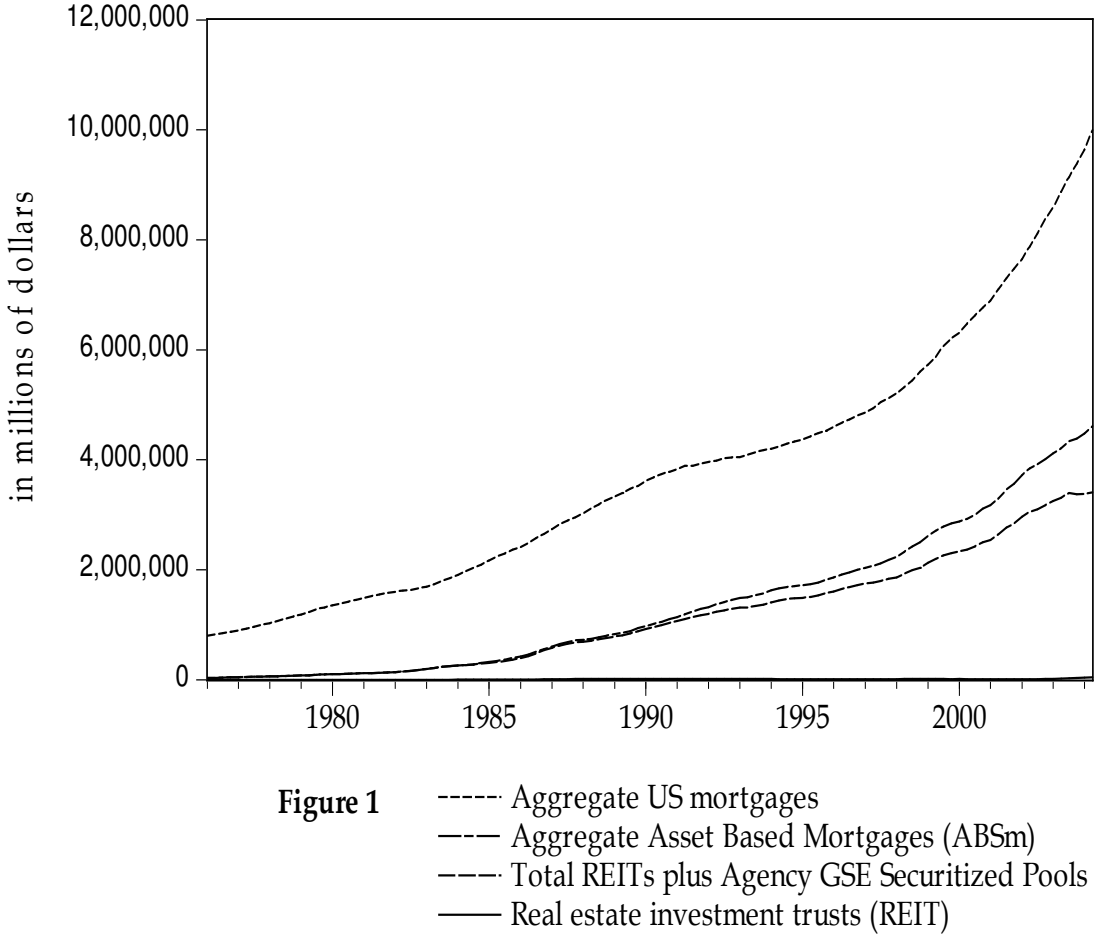

Figure 1

Source: Federal Reserve's Financial Accounts of the United States

Figure 1: Aggregated US mortgages, broken down into the three main components of securitized vehicles (Agency GSE, private issuers of securitized mortgages, and real-estate investment trusts). The space between Aggregate Asset-Based Mortgages (ABS_m) and Total REITs plus Agency GSE Securitized Pools represents the amount of private issued mortgages. Data shown is in nominal dollars, taken from the Federal Reserve's *Financial Accounts of the United States* from 1976:1 to 2004:2.

Figure 2

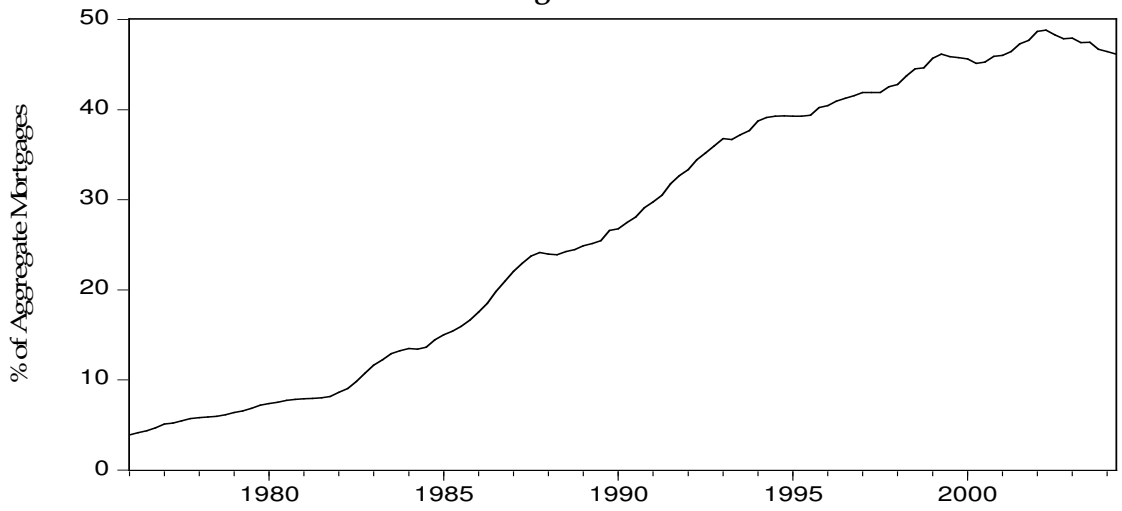

Figure 2 U.S. Securitized Mortgages (SEC) as a percentage of Aggregated Mortgages

Source: Federal Reserve's Financial Accounts of the United States

Figure 2: The ratio of securitized mortgages to aggregate mortgages. Data shown is in nominal dollars, taken from the Federal Reserve's *Financial Accounts of the United States* from 1976:1 to 2004:2.

Figure 3

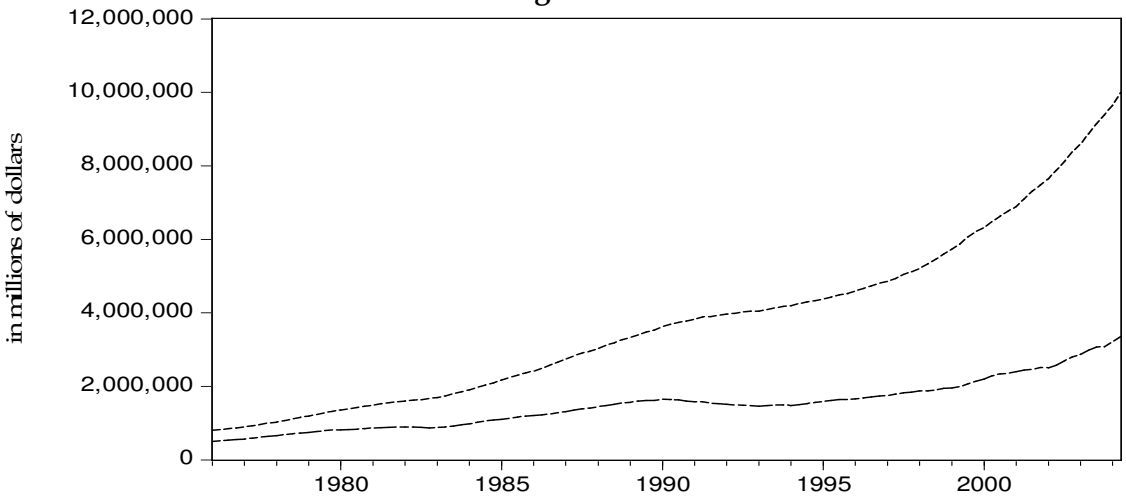

Figure 3 ---- Aggregate US mortgages
—-- U.S. Chartered Depository Institutions held mortgages

Source: Federal Reserve's Financial Accounts of the United States

Figure 3: Aggregated US mortgages and aggregated US Charted Depository Institutions-held mortgages. Data shown is in nominal dollars, taken from the Federal Reserve's *Financial Accounts of the United States* from 1976:1 to 2004:2.

Figure 4

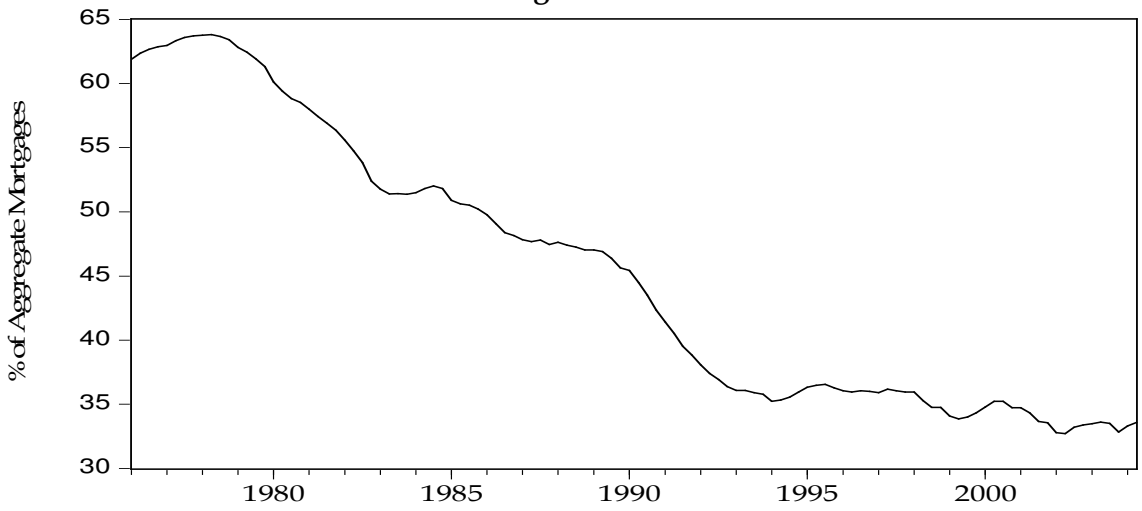

Figure 4 U.S. Charted Depository Institutions held mortgages as a percentage of Aggregate Mortgages

Source: Federal Reserve's Financial Accounts of the United States

Figure 4: The ratio of bank-held mortgages to aggregate mortgages. Data shown is in nominal dollars, taken from the Federal Reserve's *Financial Accounts of the United States* from 1976:1 to 2004:2.

3. Data and Variables

This analysis uses quarterly call reports from the Federal Deposit Insurance Corporation (FDIC).[2] Call report data from 1976 to mid-2004 came from Den Haan, Sumner, and Yamashiro, and is maintained by Yamashiro at the University of California; thus, it is referred to as the Yamashiro data.[3] The Yamashiro data is used in Den Haan, Sumner, and Yamashiro (2007 and 2011). Here the 'level' database is used, which divides banks into four percentile groups based on the bank's asset size: 100th, 99th, 95th, and 90th. Real estate loans (R/E), the loan loss reserves (LnLs), and bank deposits are used in the analysis from this dataset. Data is unavailable after mid-2004.

The Yamashiro data consolidates nearly all commercial U.S. banks and groups them by percentile asset size. Den Haan, Sumner, and Yamashiro (2007) establish a consistent time series and adjust some reporting line items. This allows for the use of all U.S. banking data, but three time dummies are required to adjust for merger activity that abruptly propels part of the data into another percentile group. These one-time events result in outliers that make for a non-normal distribution.

Conversely, the majority of the related literature on securitization and mortgages emphasizes bank- and loan-level data. The typical analysis focuses on individual

[2] The Call Report covers the quarterly financial statement filings by each member bank with the FDIC.
[3] See Den Haan, Sumner, and Yamashiro's (2002) data manual for details.

banks and their securitized portfolios, which are subsequently grouped for examination to show the banks' relative sensitivity to monetary policy changes on loan growth. Many studies, such as Loutskina (2011), end up dropping nearly half their banks when mergers take place, since it becomes difficult to pair banks or accounting line items into a consistent time series.[4]

3.1 Construction of Market Share Ratios

This study develops two market share ratios, shown in Figures 2 & 4 above. The first market share ratio reflects the size of the securitized mortgage market vs. all U.S. mortgages (see Data Appendix for details). Securitized mortgages (*SEC*) are divided by aggregated mortgages to determine the ratio ($MktS_{SEC,t}$) at time *t*. The ratio can be expressed as:

$$MktS_{SEC,t} = \frac{Aggregated \quad securitized\ (SEC)\ mortgages}{Aggregated\ US\ mortgages} \tag{1}$$

The second ratio represents the proportion of bank-held mortgages (*BM*) to aggregated mortgages to determine a bank market share ratio ($MktS_{BM,t}$) at time *t*, expressed as:

$$MktS_{BM,t} = \frac{Aggregated\ bank\text{-}held\text{-}mortgages\ (BM)}{Aggregated\ US\ mortgages} \tag{2}$$

3.2 Credit Standard Controls

The model attempts to control for changing credit standards that may become too optimistic during booms and too pessimistic during recessions. Bernanke and Gertler (1989) show that credit standards change over the business cycle. Credit standards can involve non-priced variables such as consideration for collateral positions, cash flow levels, and character issues. Stiglitz and Weiss (1981) argue that credit rationing is not determined by interest rates alone. Credit standards attempt to mitigate asymmetrical information problems. In order to control for these changes, the present model uses the interest rate spreads between Moody's BAA seasoned corporate bonds and the 3-month U.S. Treasury bill as the proxy for forward-looking credit standards (CrSp). Rates are obtained from the Federal Reserve's website using the H.15 series. Lown and Morgan (2006) show that there is a significant positive link between commercial loan standards and credit spreads.

Although credit spreads tend to widen with recessions and narrow with expansions (Krainer, 2004), these movements may not be fully related to default risk. Collin-Dufresne, Goldstein, and Martin (2001) consider several macroeconomic

[4] In other related monetary transmission studies, various methodologies are used to adjust banks for mergers. For example, Peek and Rosengren (1995) treated bank mergers as if they occurred at the beginning of the period.

factors and attribute only 25% of the explanation of credit spreads to default risk. Houweling, Mentink, and Vorst (2005) indicate that the liquidity risk of bond issues is a significant factor in determining credit spreads. However, the use of the actively traded Moody's composite rates and T-bills should avoid most of these liquidity concerns. The model also uses the loan loss reserve (LnL) as a backward-looking proxy to reflect past loan decisions. Higher loan loss provisions tend to reduce profits and depress market capitalization. Neir and Zicchino (2006) find that banks that increase their provisions for loan losses tend to slow future loan growth.

3.3 Prediction

The study anticipates certain outcomes based on the related literature and theoretical constructs of the securitization market. The market share ratios ($MktS_{SEC}$) are anticipated to have a negative relationship with real estate loans at banks, or $\partial L/\partial MktS_{SEC} < 0$. The idea of a negative relationship is rooted in a simple zero-sum game view of credit, such that alternative non-bank credit grows at the expense of bank loan growth or banks simply take advantage of the secondary market to sell down their mortgage holdings. The $MktS_{BM}$ is expected to be $\partial L/\partial MktS_{BM} > 0$.

4. Model and Results

In the full model, the loan growth for the log of real mortgages for each asset size percentile group is regressed separately on: (i) four lags of itself; (ii) four lags of the growth rate of the log of the real Gross Domestic Product (GDP); (iii) four lags of the change in the FFR; (iv) four lags of the percentage change in the market share variable; (v) four lags of the change in the credit spread; (vi) four lags of the second growth rate of the log of the real loan loss provision;[5] and (vii) various time dummies. The equations can be specified as:

$$\Delta \log (L_{i,t}) = \alpha_i + \sum_{j=1}^{4} \beta_j \Delta \log (L_{i,t-j}) + \sum_{j=1}^{4} \gamma_j \Delta \log (GDP_{t-j}) + \sum_{j=1}^{4} \delta_j \Delta FFR_{t-j} + \sum_{j=1}^{4} \lambda_j \Delta MktS_{k,t-j} + + \sum_{j=1}^{4} \psi_j \Delta CrSp_{t-j} + \sum_{j=1}^{4} \xi_j \Delta^2 \log (LnLs_{i,t-j}) + \Theta Time_t + \sum_{q=1}^{3} \eta_q Quarter_{q,t} + \varepsilon_{i,t} \quad (3)$$

[5] A second growth rate, denoted by Δ^2 or the growth rate of the growth rate, was needed to eliminate unit root problems that were present in the first growth rate of the LnL.

where L represents outstanding real estate loans, GDP is real GDP, FFR is the federal funds rate, MktS is the market share ratios, CrSp is credit spreads, LnLs is the real loan loss provision, Time is a set of time dummies, and Quarter is a set of quarterly dummies.

$i = 1, \ldots, 4$ refers to each i^{th} banking percentile group, $k = SEC$ or BM refers to each k MktS ratio, $q, \ldots, 3$ refers to the calendar quarter time period, and t refers to the current time period.

The regression analysis uses a pooled generalized least square (GLS) technique to estimate the equations. The models use four lags of the dependent variable in order to control for serial correlation and to minimize endogenous concerns, although some endogenous concerns may be possible. Lag selection was determined by performance measurements such as the Akaike information criterion, Schwartz criterion, Hannan-Quinn informational, Final predictor error, and the sequential modified LR test statistic, by looking at the average of these tests. All loan variables are deflated by GDP chain-weighted 2009 dollars.

The models consist of a four-period lag of the log of the real GDP growth rates (obtained from the US Department of Commerce) to control for loan demand shocks due to economic fluctuations. The first difference of the FFR, the proxy for monetary policy, is used. Bernanke and Blinder (1992) indicate that the FFR is a good proxy for monetary policy. The percentage change in the MktS ratio is used, since it lends itself to an easier interpretation and is consistent with the loan growth rates being analyzed.

Various time dummies are needed to control for outliers in the loan growth rates due to large bank mergers. The Riegal Neal Act (1994) allowed easier interstate bank acquisitions and was phased in over time. In the immediate years after its implementation, a large amount of merger activity took place. A Riegal Neal Act dummy is coded 1 for the second quarters of 1996 and 1997 and the fourth quarter of 1998, and otherwise 0. An additional dummy (also coded 1; otherwise 0) is needed for the fourth quarter of 1992 to reflect the full implementation of the Basel Accords of 1988. A time trend dummy as well as seasonal quarterly dummies are also used in the analysis.

4.1 Empirical Results

Table 1 shows the results for testing the $MktS_{SEC}$ variable by using Equation (3). Table 2 shows the results for testing the $MktS_{BM}$ variable. The sum of the coefficients on the individual variables are reported in Tables 1 and 2. Each table divides the banks into four asset size percentile groups and each table has three panels that represent different model specifications, starting with the full model shown in the first panel. The second panel, labeled 'full model (without credit proxies),' represents Equation (3) minus the CrSp and LnLs variables. The third panel or 'baseline model' eliminates both credit risk controls and the MktS variable to focus only on the FFR.

Table 1A: Bank Real Estate Loans & Securitized Mortgage Market Share

	Full Model				Full Model (without credit proxies)			
	100th	99th	95th	90th	100th	99th	95th	90th
Variables:	Percentile	Percentile	Percentile	Percentile	Percentile	Percentile	Percentile	Percentile
$\sum \Delta GDP_{(t-1, t-4)}$	0.718**	0.034**	0.031***	0.030***	0.718***	0.045***	0.035***	0.023***
$\sum \Delta FFR_{(t-1, t-4)}$	-1.709	-0.248***	-0.186***	-0.202***	-1.189	-0.120**	-0.094**	-0.087*
$\sum \Delta MktS_{SEC\ (t-1, t-4)}$	0.325	0.011	0.009	0.002	0.628	0.039**	0.031**	0.040**
$\sum \Delta CrSp_{(t-1, t-4)}$	0.325	-0.175**	-0.082	-0.083				
$\sum \Delta LnLs_{(t-1, t-4)}$	-6.434	-2.832	-1.012	-2.407				
Time Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R^2	0.483	0.644	0.746	0.778	0.501	0.650	0.747	0.812

Notes: * = significance at the 10% level, ** = significance at the 5% level, and *** = significance at the 1% level. Sample period is quarterly data points from 1976:1 to 2004:2, with t referring to the current time period. Real estate loans are regressed on the lags of the dependent variable, the gross domestic product (GDP), the federal funds rate (FFR), the market share of credit instrument (MktS), the credit spread (CrSp) and the loan loss (LnLs) as indicated in equation (3) for the 'full model.' The model uses a pooled panel GLS model to estimate the equation. The $\sum\Delta$ of the lagging dependent variables were left out to save space, but were nearly always significant at better than the 1% level of significance. Various time dummies are included in the equation.

Table 1B:Bank Real Estate Loans & Securitized Mortgage Market Share

	Baseline Model			
	100th	99th	95th	90th
Variables:	Percentile	Percentile	Percentile	Percentile
$\sum \Delta GDP_{(t-1, t-4)}$	0.737***	0.045***	0.034***	0.032***
$\sum \Delta FFR_{(t-1, t-4)}$	-2.488**	-0.185***	-0.151***	-0.156***
Time Dummies	Yes	Yes	Yes	Yes
Adj. R^2	0.458	0.616	0.737	0.760

Notes: * = significance at the 10% level, ** = significance at the 5% level, and *** = significance at the 1% level. Sample period is quarterly data points from 1976:1 to 2004:2, with t referring to the current time period. Real estate loans are regressed on the lags of the dependent variable, the gross domestic product (GDP), the federal funds rate (FFR), the market share of credit instrument (MktS), the credit spread (CrSp) and the loan loss (LnLs) as indicated in equation (3) for the 'full model.' The model uses a pooled panel GLS model to estimate the equation. The $\sum\Delta$ of the lagging dependent variables were left out to save space, but were nearly always significant at better than the 1% level of significance. Various time dummies are included in the equation.

Table 2A:Bank Real Estate Loans & Bank Held Mortgages Market Share

	Full Model				Full Model (without credit proxies)			
	100th	99th	95th	90th	100th	99th	95th	90th
Variables:	Percentile	Percentile	Percentile	Percentile	Percentile	Percentile	Percentile	Percentile
$\sum \Delta GDP_{(t-1, t-4)}$	0.904**	0.027**	0.036***	0.028***	0.836**	0.038***	0.041***	0.031***
$\sum \Delta FFR_{(t-1, t-4)}$	-3.570	-0.302***	-0.247***	-0.220***	-2.455	-0.208***	-0.141**	-0.172***
$\sum \Delta MktS_{BM\ (t-1, t-4)}$	-1.943	0.062	0.004	0.022	-0.818	0.055	-0.009	0.022
$\sum \Delta CrSp_{\ (t-1, t-4)}$	-1.099	-0.178**	-0.118*	-0.080				
$\sum \Delta LnLs_{(t-1, t-4)}$	0.699	-0.879	-2.936	-1.510				
Time Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R^2	0.432	0.643	0.645	0.773	0.466	0.634	0.638	0.751

Notes: * = significance at the 10% level, ** = significance at the 5% level, and *** = significance at the 1% level.Sample period is quarterly data points from 1976:1 to 2004:2, with t referring to the current time period. Real estate loans are regressed on the lags of the dependent variable, the gross domestic product (GDP), the federal funds rate (FFR), the market share of credit instrument (MktS), the credit spread (CrSp) and the loan loss (LnLs) as indicated in equation (3) for the 'full model.' The model uses a pooled panel GLS model to estimate the equation. The $\sum\Delta$ of the lagging dependent variables were left out to save space, but were nearly always significant at better than the 1% level of significance. Various time dummies are included in the equation.

Table 2b: Bank Real Estate Loans & Bank Held Mortgages Market Share

	Baseline Model			
Variables:	100th Percentile	99th Percentile	95th Percentile	90th Percentile
$\sum \Delta GDP_{(t-1, t-4)}$	0.737***	0.045***	0.034**	0.032***
$\sum \Delta FFR_{(t-1, t-4)}$	-2.488**	-0.185***	-0.151***	-0.156***
Time Dummies	Yes	Yes	Yes	Yes
Adj. R^2	0.458	0.616	0.737	0.760

Notes: * = significance at the 10% level, ** = significance at the 5% level, and *** = significance at the 1% level. Sample period is quarterly data points from 1976:1 to 2004:2, with t referring to the current time period. Real estate loans are regressed on the lags of the dependent variable, the gross domestic product (GDP), the federal funds rate (FFR), the market share of credit instrument (MktS), the credit spread (CrSp) and the loan loss (LnLs) as indicated in equation (3) for the 'full model.' The model uses a pooled panel GLS model to estimate the equation. The $\sum\Delta$ of the lagging dependent variables were left out to save space, but were nearly always significant at better than the 1% level of significance. Various time dummies are included in the equation.

The 100th percentile category (or all banks), dominated by the top 1% largest banks,[6] does not appear to be significantly related to the growing securitization market. However, the securitization variable or $MktS_{SEC}$ is significant for smaller banks (with asset sizes at or below the 99th percentile) in the second panel (without credit standards). This $\sum\Delta MktS_{SEC}$ variable was positive, contrary to the prediction. Thus, securitization market share growth occurred along with growth in bank mortgages. This conclusion supports similar findings by Zarutskie (2013), who found that securitization market share and bank-held mortgages had a significant positive relationship in her model. The full model showed no statistical significance for the $MktS_{SEC}$ variable, possibly because of too many insignificant credit proxies introduced in this model's original specification. The decline in the market share of bank-held mortgages or $MktS_{BM}$ was insignificant.

The interpretation of these sums of coefficients in terms of $MktS_{SEC}$ would be as follows: from Table 1, second panel, using the 99th percentile group, a 100% increase in the securitized market share ($MktS_{SEC}$) will coincide with a roughly 3.9% (the sum of the coefficients was 0.0388) increase in bank-held mortgages, assuming the other variables are fixed.

The credit proxies were mostly insignificant, except for some of the credit spread variables. LnLs was never significant in these models and was subsequently dropped.[7] $\sum\Delta CrSp$ was significant in Table 1 for only the 99th percentile group and Table 2 for the 99th and 95th percentile groups. Although the CrSp was somewhat informative, it had a strong correlation with the FFR. The correlation test for multicollinearity indicated a strong relationship of −0.6 between CrSp and the FFR. Thus, the variable was dropped in subsequent regression runs in the second panel, to be conservative.

The FFR coefficients in the full models were not statistically significant for all banks or the 100th percentile, which is dominated by very large banks. Thus, large banks may be better able to insulate themselves from the FFR than smaller banks. However, the FFR was significant for all banks in the last panel. In contrast, smaller banks (with asset sizes at or below the 99th percentile) had mostly significant negative coefficients on the $\sum\Delta FFR$, ranging from -0.303 to -0.087 in all the panels. This weak reading is similar to findings in the broadly related literature: Altunbas, Gambacorta, and Marques (2009) show that large banks were less affected by monetary policy.

Curiously, many of the $\sum\Delta FFR$ coefficients were slightly diminished in significance when comparing the baseline model to the full model (without credit proxies) using the $MktS_{SEC}$ variable. In general, this shows that when the $MktS_{SEC}$

[6]According to the Yamashiro data, the top 1% of the largest banks owned 40% to 45% of the total bank mortgages in this sample for most of the period, up until 1995. After 1995, the top 1% bank share of mortgages grew rapidly to 55% by 1998, and to 62.7% by mid-2004.

[7]My initial study experimented with commercial and industrial (C&I) loans that showed the LnLs to be highly significant, but the overall C&I loans model using securitized business credit was not significant.

variable was with the FFR, there was a slight reduction in the size of the sum of the coefficients on the FFR. For example, looking at the 99th percentile group in Table 1, last panel, shows that the ∑ΔFFR was significant at better than 1% p-values with a sum of the coefficients of

-0.185. However, combining the FFR with the $MktS_{SEC}$ variables shows the ∑ΔFFR to be at a 4.4% p-value with the sum of the coefficients being -0.112. A similar result is seen with the 90th and 95th percentile group. The 100th percentile comparison was mixed since the inclusion of the growth rate of the securitization market share variable seems to shut off the impact of the FFR, but neither variable is significant. These findings are consistent with general observations drawn by Estrella (2002), Loutskina and Stahan (2009), Altunbas, Gambacorta, and Marques (2009), Aysun and Hepp (2011), Loutskina (2011), and others that the presence of the securitization market establishes liquidity to a point that the effect of the FFR would be diminished. Further research is needed to establish more details on the extent of interaction between these variables.

5. Conclusion

This study examines U.S. banking mortgage activity and the rise of the mortgage securitization market share from 1976 to mid-2004. The study concludes that the growth of securitization appears to have a significant pro-cyclical relationship with the growth of bank holdings of real estate mortgages at smaller asset-size banks. This finding supports a similar conclusion drawn by Zarutskie (2013) regarding the nature of securitization and bank-held mortgages. This would indicate that a simple trade-off (or negative relationship) between securitization and bank-held mortgages, ala zero-sum game theory, is not evident despite the overall decline in the ratio of bank-held mortgages to aggregated mortgages. Both credit instruments can grow together and possibly reinforce each other by supporting real estate asset prices and activity via the credit creation process.

Although this study is mainly focused on the relationship between securitization and bank holdings of mortgages, the study complements related findings on securitization and the monetary transmission channel, i.e. that monetary policy is less effective for larger asset-sized banks, as indicated by Altunbas, Gambacorta, and Marques (2009) and others. Future studies may wish to use the securitization market share measure in other monetary studies as a control variable, to reflect changes in the securitized mortgage market over time.

Overall, bank regulators and monetary policymakers should take into consideration the size and conditions of the securitization market and its strength relative to the total mortgage market. This study can support efforts in the Dodd-Frank Act to establish the Financial Stability Oversight Council and related data collection efforts, since this study shows the interrelationship between the composition of the mortgage market, banking, and monetary policy.

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Data Appendix

Market Share Ratios

This appendix provides detailed notes on the construction of the two market share ratios used in the regression models. Data was obtained from the Federal Reserve's *Financial Accounts of the United States* (or Z.1 series).

1. Securitized Mortgages – Equation (1)

The market share ratio for securities mortgage credit is estimated by adding together: Table L.124 – Agency- and GSE-Backed Mortgage Pools, line 6 (total pool securities) [FL413065005], Table L.125 – Issuers of Asset-Backed Securities, line 5 (Mortgages (private issued)) [FL673065005], and Table L.128 – Real Estate Investment Trusts, line 19 (securitized assets included above) [FL643065045] as the numerator. The denominator is estimated by taking the total mortgage credit from Table L.217 – Total Mortgages, line 1 (total mortgages) [FL893065005].

2. Bank Mortgages – Equation (2)

The market share ratio for bank-held mortgage credit is estimated by comparing the total bank mortgage credit to the total mortgage credit. The numerator was estimated by taking the amount from Table L.110 – US-Chartered Depository Institutions, excluding Credit Unions, line 22 ('bank' mortgages) [FL763065005]. The denominator is estimated by taking the total mortgage credit from Table L.217 – Total Mortgages, line 1 (total mortgages) [FL893065005].

Notes: The Prentices term (line item name) is the line item's name used in the Financial Accounts of the United States Tables; bracketed term [FL000000000] is the specific code used by the Flow of Funds Tables to identify line items.