

# **Interstate Risk Sharing and Mortgage Loan Securitization**

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This Draft: December 27, 2011

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## **Abstract**

This paper contributes to the continuing debate on the impact of financial innovations on the real economy. In particular, we examine the role of banks' mortgage loan securitizations in aggregate interstate risk sharing. Using data for U. S. banks' mortgage loans securitizations during 1989-2008, we identify consumption smoothing as an important channel through which loan securitization affects the interstate risk sharing. The results in the paper suggest that the positive relationship between loan securitizations and aggregate risk sharing enhances, rather than jeopardizes, financial stability.

**Key Words:** Securitization, Risk Sharing, Mortgage Loans, Consumption Smoothing

**JEL Classification:** G18, G21

**EFMA Classification:** 560, 440, 510, 520

## Interstate Risk Sharing and Mortgage Loan Securitization

### 1. Introduction

Mortgage loans are major funding sources for households in their house purchases and mortgage debt payments account for about 60 percent of total household debt payments<sup>1</sup>.

Banks issuing mortgage loans typically face significant risks arising from the fluctuation in housing value and the potential default of mortgage debts, and banks historically rely on active management of mortgage loan portfolios to manage the credit risks of these loans.

Securitization of mortgage loans, as a newly developed financial tool to allow mortgage loans to be traded nation-wide, provides another vehicle for banks to effectively manage the credit risk of the loan portfolios by diversifying the risks across state borders.

There has been an ongoing debate over the role that asset securitizations have played in the economy. Before the 2007- 2009 financial crisis, some policy makers and researchers argue that securitizations allow banks to disperse credit risk, reduce information asymmetry, and therefore enhance financial stability (Hill, 1997; Greenspan, 2005)<sup>2</sup>, while other studies have suggested potential agency problems and distorted incentives introduced by

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<sup>1</sup> See the Consumer Expenditure Survey conducted by the Bureau of Labor Statistics (BLS) for detailed analysis. As part of the expenditure data collection, the BLS asks households to report payments on household debt, including mortgage debts, vehicle loans, and other consumer debts.

<sup>2</sup> The former Federal Reserve System Chairman Alan Greenspan (2005) remarked that “Perhaps the most significant development in financial markets over the past ten years has been the rapid development of credit derivatives. . . . Moreover, this growth has been accompanied by significant product innovation, notably the development of synthetic collateralized debt obligations (CDOs),...As is generally acknowledged, the development of credit derivatives has contributed to the stability of the banking system by allowing banks, especially the largest, systemically important banks, to measure and manage their credit risks more effectively” (Remarks by Chairman Alan Greenspan: *Risk Transfer and Financial Stability*, to the Federal Reserve Bank of Chicago's Forty-First Annual Conference on Bank Structure, Chicago, Illinois, May 5, 2005).

securitization (Dahiya *et al.*, 2003). Some studies even suggest that the recent 2007- 2009 financial crisis was caused by mortgage securitizations for allowing assets of poor credit quality to spread to unsophisticated and unprotected investors, and eventually leading to the historical financial turmoil (Bank of International Settlement, 2008; Brunnermeier, 2009; Taylor, 2008).

This paper contributes to the continuing debate by examining the effect of the securitizations of mortgage loans made by US banks on aggregate risk sharing. We focus on mortgage loans because mortgage loans tend to be made to local home buyers whose debt payments heavily rely on their wage compensation generated in the same community in which the bank operates. Hence banks issuing mortgage loans are exposed to local output risk that is hard to be diversified away. If securitizations, as designed for the purposes for mortgage loans to be traded nationally, they would facilitate risk diversification which in turn could increase credit supply and therefore have a positive effect on real economy (Loutskina and Strahan, 2009; Mian and Sufi, 2009; Demyanyk and Van Hermert, 2011; Keys *et al.*, 2009 and 2010). Furthermore, the extant literature on risk sharing suggests the development in credit markets contributes to aggregate risk sharing by preventing reductions in consumptions. We therefore hypothesize that the positive impact of mortgage securitizations on credit supply further contributes to risk sharing through the consumption smoothing channel and thus we conduct the analyses by using the conventional tests in the risk sharing and consumption smoothing literature.

Our main objective is to examine whether bank's securitization of mortgage loans have a positive impact on interstate risk sharing. We estimate the effect of loan securitizations on interstate risk sharing by using the annual state-level data compiled from U.S. Bank Call Reports for the period 1989-2008. The results in our study suggest that banks' sales and securitization of mortgage loans have a significantly positive effect on risk sharing through consumption smoothing. Moreover, the results reveal that the impact of loan securitization on risk sharing is more pronounced in states where the housing market value is relatively low.

The paper contributes to the extant literature on risk sharing. Very few papers have empirically estimated the effect of financial innovations, specifically, *securitizations*, on real economy such as private expenditure and we examine this relationship in this paper. The paper is also closely related to the study of Demyanyk *et al.* (2007) which documents the impact of banking deregulation on interstate risk sharing in the U.S. The study of Demyanyk *et al.* (2007) provides evidence showing that the development of *mortgage-backed assets* enhances personal income insurance, while our paper suggests an alternative channel of risk sharing through consumption smoothing.

The rest of the paper is organized as follows: In Section 1 we discuss how the sales and securitizations of mortgage loans contribute to the interstate risk sharing through consumption smooth channel. In Section 2 we present the empirical specification for

testing for risk sharing. Data descriptions are provided in Section 3 and empirical results are presented in Section 4. We conclude the paper in Section 5.

## **2. Motivation and literature review**

Before the 2007- 2009 financial crisis, proponents of securitizations mainly support securitization for its benefits in allowing banks to actively manage the credit risk and therefore in improving financial stability. For instance, Neal (1996) wrote that

“...the development of markets for securitized assets and for loan sales has provided another method for managing credit risk. In the asset securitization approach, bonds or loans with credit risk are pooled together and sold to an outside investor... From an investor’s perspective, purchasing part of the package is attractive because the diversification across many loans reduces the overall credit risk. In addition, to the extent that returns from the package are not closely correlated with the investor’s other holdings, diversification allows the investor to reduce the credit risk of his overall portfolio” (*Economic Review*, Federal Reserve Bank of Kansas City, Second Quarter 1996, pp.18-19).

Moreover, the former Federal Reserve System Vice Chairman Donald Kohn (2007) pointed out that

“...the securitization of mortgages and other assets has been transforming regulated depository institutions from holders of interest rate and credit risk to originators and distributors of such risk... There are good reasons to think that these developments have made the financial system more resilient to shocks originating in the real economy and have made the economy less vulnerable to shocks that start in the financial system.” (Speech at the Federal Reserve Bank of Atlanta's 2007 Financial Markets Conference, Sea Island, Georgia, May 16, 2007)

However, the extant literature has also suggested potential agency problems and distorted incentives introduced by securitization. For example, Dahiya, Puri and Saunders (2003) show that stock market responded negatively to firms whose loans were sold by their

lending banks. They also find that a large portion of these firms even filed for bankruptcy a few years after the loan sales, suggesting that banks may have prior information about the potentially poor performance and therefore sell these loans to avoid future losses.

Some studies after the recent 2007- 2009 financial crisis suggest that the process of asset securitization introduces several layers of agency problems that contributed to the financial crisis (Ashcraft and Schuermann, 2008). Duffie (2008) points out that loan sales and securitizations reduce banks' incentive to monitor and manage the credit risk of the securitized loans. The lack of incentive to monitor leads to higher default rate in securitized loans than the un-securitized loans. Furthermore, Piskorski *et al.* (2010) report that given that a mortgage loan becomes seriously delinquent, securitized loans tend to experience a significantly higher foreclosure rate than similar loans held by banks. The results of these studies suggest that the sale of loans and assets tends to be associated with higher level of foreclosure rate, poor performance of the firms, leading to a lower level of monitoring on borrowers, lower level of risk management, and therefore contributes to financial instability.

While the above studies have suggested the potential agency problem associated with asset securitization, other studies have identified the benefits of securitizations by examining the impact of securitization on banks' lending behavior and credit supply. These studies have documented that securitizations, when used by banks to actively management their liquidity and credit risk, have led to a higher level of credit supply (Loutskina and Strahan, 2009; Mian and Sufi, 2009; Demyanyk and Van Hermert, 2011; Keys *et al.*, 2009 and 2010).

In addition, the literature on risk sharing has also suggested that increased borrowing and lending in the credit markets contribute to aggregate risk sharing from the smoothing of consumptions (Asdrubali *et al.*, 1996). In this stream of research, studies have found that aggregate consumption is positively correlated with the availability of household debts. For instance, Bacchetta and Gerlach (1997) report that expected growth in mortgage and consumer credit is positively correlated with the growth in *non-durable* goods and services expenditures, and McCarthy (1997) finds a significant link between availability of credit and *durable* goods expenditures. Coulibaly and Li (2006) observe that while households do not increase their non-durable consumption following the retirement of their mortgage, they do, however, increase durable goods consumptions, such as home furnishings and entertainment equipment.

Based on above discussions, we conjecture that the securitizations of mortgage loans contribute to interstate risk sharing through a consumption smoothing channel. When banks pool and securitize their mortgage loans, they can transfer some of the state-specific output risks to the financial institutions in other states. The reduction in credit risk allows banks to originate more loans or at a lower cost which may prevent reduction in consumptions, and leading to smoothed consumptions.

## **2. Empirical methodology**

To test the impact of securitization of mortgage loans on interstate consumption risk sharing, we follow the methodology developed by Asdrubali *et al* (1996) and used extensively in the literature. The consumption risk sharing across states is measured through a panel regression model in the following form:

$$\Delta \ln Consumption_t^k = \gamma \Delta \ln GSP_t^k + \varepsilon_t^k \quad (1)$$

Where  $\Delta \ln Consumption_t^k$  denotes the state-specific growth rates of private consumption for state  $k$  in year  $t$ , and  $\Delta \ln GSP_t^k$  is the state-specific growth rates of gross state product for state  $k$  in year  $t$ , and All of the variables are measured in per capita terms. The growth rates of real per capita variables are calculated as the first differences of the natural logarithm of per capita-level values. The state-specific variables are constructed using state-level variables minus the mean across states minus the mean across time.

Based on Asdrubali *et al.* (1996), if full risk sharing is achieved via consumption smoothing, all states should have identical growth rates of consumption because the consumption does not co-move with output; and a one-to-one co-movement between consumption and output implies zero risk reduction through consumption smoothing. Thus the coefficient  $\gamma$  in equation (1) measures the uninsured idiosyncratic output risk, a value of  $\gamma=0$  indicates perfect insurance through consumption smoothing, and a value of  $\gamma=1$  indicates zero insurance through consumption smoothing.

The objective of this study is to examine whether bank's mortgage loan securitization contributes to the reduction of idiosyncratic output, we thus include an additional variable

$MBS_t^k$ , which represents banks' activities in securitizing mortgage loans, and we also allow this variable vary by state and over time in the following regression equation:

$$\begin{aligned} \Delta \ln Consumption_t^k = & \alpha + \gamma_0 \Delta \ln GSP_t^k + \gamma_1 MBS_t^k * \Delta \ln GSP_t^k \\ & + \gamma_2 MBS_t^k + \delta^k + \tau_t + \varepsilon_t^k \end{aligned} \quad (2)$$

Where  $MBS_t^k$  measures the degree of securitization of mortgage loan in state  $k$  in year  $t$ .

It is defined as the ratio of the aggregate outstanding balance of securitized mortgage loans of a state  $k$  in year  $t$  to the aggregate amount of total outstanding mortgage loans of the same state in the same year.  $\delta^k$  and  $\tau_t$  are dummy variables measuring state and time fixed effects, respectively.

In this regression, the key variable of interest is  $MBS_t^k * \Delta \ln GSP_t^k$ , the interaction term between output growth and banks' securitization of mortgage loans. The regression coefficient  $\gamma_1$  measures the uninsured idiosyncratic output risk associated with a one-unit increase in mortgage loan securitization. The regression coefficient  $\gamma_0$  measures the average degree of uninsured idiosyncratic output risk without mortgage loan securitization, and  $\gamma_0 + \gamma_1$  measures the total uninsured idiosyncratic output risk after banks have engaged in securitization activities. Note that the regression coefficient  $\gamma_2$  measures the contribution of mortgage loan securitization to the average consumption growth, which is not of interest of this study. We include it following the normal regression technique that includes the linear term accompanied with the interaction term.

### 3. Data and sample statistics

We collect annual state-level data for all of the 50 U.S. states and Washington D.C. from 1995 to 2008 from various sources. The data about banks' loan issuance and securitization activities are compiled from U.S. Bank Call Reports. Macroeconomic data are mainly obtained from Bureau of Economic Analysis (BEA) and U.S. Census Bureau. The variables in the analysis are described as follows:

*Gross State Product (GSP):* GSP is divided by population in a given state and deflated by the consumer price index to obtain real per capita state gross domestic product.

*State Personal Income (SPI):* Similarly, we use BEA state-level personal income per capita deflated by consumer prices to obtain real per capita personal income by state.

*Housing Price Index:* To measure the local housing market, we use the Housing Price Index, obtained from GeoFRED database supplied by Federal Reserve Bank of St. Louis. Based on the housing price index in 1988, we divide the states into two equal-sized categories (upper half and lower half) and refer these two categories as “high- housing value” vs. “low- housing value” categories. We partition the sample in this way to capture the impact of the size threshold in mortgage loan securitization on banks' securitization activities. A large part of mortgage securitization is conducted through the government-sponsored enterprises (GSEs, i.e., Fannie Mae and Freddie Mac). However, by regulation, the GSEs only buy mortgages below a given size threshold (the jumbo loan cutoff), therefore mortgages below this threshold are more likely to be securitized than those above the

threshold. Because the data on individual mortgage loans are not publically available, we use housing price index as a proxy of the average size of the mortgage loans. The idea here is that in low-value housing markets, the average size of mortgages may to be smaller than that in high-value housing markets, hence the securitizations of mortgage loans may be more active, and the risk sharing contribution of securitizations would be prominent in “low-housing value” states.

*Mortgage loan Securitization (MBS):* We collect annual data on the outstanding balance of total residential mortgage loans and securitized mortgage loans from Call report. We first obtain the data for individual banks and then aggregate to the state level. We measure banks’ activities of mortgage loan securitizations in a given state for a given year by using the ratio of the aggregate outstanding balance of securitized loans to the aggregate amount of total outstanding mortgage loans in that state for that year.

[Insert Figure 1 about here]

Figure 1 displays the average growth rates of GSP and SPI across states for each year from 1989 to 2008. The figure reveals a lead-lag relationship between the GSP and the SPI growth rates. For example, the declines in GSP growth rate in year 2000, 2002, and 2007 are followed by lagged reductions in the personal income growth rate soon after, reflecting the effect of interstate income insurance. In Figure 2 we show the heat maps for the average GSP growth rate and SPI growth rate for the study period 1989-2008. The maps also suggest a close relationship between the GSP and SPI growth rates.

[Insert Figure 2 about here]

[Insert Table 1 about here]

Table 1 presents the mean ratios of securitized mortgage loans to total mortgage loans, the average GSP growth rates, and the average SPI growth rates for each state and Washington DC from 1989 to 2008. It is evident that banks manage their credit risk in mortgage loans actively in recent years. The average ratio of securitized mortgage loans across state over time is about ten percent. In addition, the data reveal that the use of securitization varies significantly across states. Among the 50 states and Washing D.C in the sample, all the states have banks securitizing mortgage loans with various extents.

Figure 3 plots the time average of banks' mortgage loan securitization activities across states. It shows that banks' mortgage loan securitization activities are volatile with a significant drop in the early 90s, reflecting the dramatic impact of the economic recession and the credit crunch; the securitization activities reached to the peak in years around 2002, a time when the bubble started to form in the housing market.

Figure 4 presents the heat map of the average mortgage loan securitization for each state based on the time average over the sample period. Similar to the pattern revealed in Table 1, the degree of loan securitization varies significantly across states.

[Insert Figure 3 about here]

[Insert Figure 4 about here]

#### 4. Empirical results

To examine whether banks' management of credit risk in mortgage loans through securitization contributed to interstate risk sharing through smoothing personal consumption, we estimate the regression Equation (2). Follow the methodology used by Demyanik, Ostergaard, and Sorensen (2007), we use a two-step GLS: we first run a pooled OLS regression to estimate the variance of the error terms based on the residuals; we then run the second regression, weighting the state-level variables by the estimated standard error. Table 3 presents the results of the second step of regression. In reporting the results, we multiply the estimated  $\gamma$  value by 100, and refer to  $\gamma$  as the percentage of risk shared.

[Insert Table 2 about here]

The results of Table 2 suggest that loan securitization significantly contributes to consumption smoothing. The average impact of idiosyncratic output risk on consumption, as measured by  $\gamma_0$ , is about 19% without the securitization of mortgage loans. This estimate is both economically and statistically significant. The regression coefficient for key variable in the study, the interaction term  $MBS_t^k * \Delta \ln GSP_t^k$ ,  $\gamma_1$  (= -14%) has the expected negative sign and is statistically significant. The results show that with the securitization of mortgage loans, the degree of the shock to the consumption due to idiosyncratic output risk reduces to 5% (19% -14%), a significant improvement in smoothing the consumption.

[Insert Table 3 about here]

We next examine whether the consumption smoothing effect of mortgage loan securitization is conditional to the housing market. We separate the states into two categories based on the value of local housing market (“high-housing value” vs. “low-housing value” states) as described in Section 2 of the paper. We then estimate the relationship between consumption smoothing and securitization separately for the two sub-groups and report the results in Table 3. For states where housing values are low (i.e. “high- housing value” states), it is likely that more mortgage loans are below the jumbo loan cutoff and can be sold to the GSEs, so banks’ securitization activities may be more active than in the states where the average size of mortgage loans is larger, as indicated by the high housing price. Therefore, it is likely that the benefit of securitization in smoothing personal consumption in “low-housing” value states would be larger than in “high-housing value” states.

In Panel A of Table 3 we present the results of Equation (2) for the “high-housing value” states, and Panel B shows the results for the “low-housing value” states. The results are consistent with the expectations. While both “high-housing value” and “low-housing value” states show reduction in output risk by mortgage loan securitization, only the “low-housing value” states have a significant regression coefficient associated with  $MBS_t^k * \Delta \ln GSP_t^k$ . Moreover, the average income insurance without loan securitization, represented by regression coefficient  $\gamma_0$ , is higher in states with high value housing market (63%) than in states with low value housing market (18%), a result consistent with the hypothesis that better risk sharing through consumption smoothing.

## 5. Conclusions

In this paper, we investigate the benefits of bank's activities in loan securitization from the borrower's perspective. Specifically, we examine whether the securitization of major type of loans, mortgage loans, contributes to the consumer's risk sharing across states. We find that the securitization of mortgage loans helps reduce the idiosyncratic output risk to consumers by smoothing their consumptions. There has been an ongoing debate on whether derivative securities in general and securitizations in particular enhance the growth of economy or cause financial instability. This paper makes contributions to the literature in providing the evidence to the debate on the pros and cons of securitizations to the economy. To the best of our knowledge, this is the first study that examines the relationship between loan securitizations and real economy and the results in the study suggest that banks' loan securitization facilitates aggregate risk sharing through consumption smoothing. The results in this paper hence suggest that the positive relationship between loan securitizations and aggregate risk sharing enhances, rather than jeopardizes, financial stability.

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**Table 1: Summary Statistics:** This table summarizes banks' average securitization of mortgage loans and small business loans across states using data from Call Report. The data for mortgage loans are from 1989 to 2008, while the earliest data for small business loan are from 1995. For each type of loan, we aggregate the total mortgage loans and loan securitizations at the state level by summing the amount of loans reported by individual banks in the state. The percentage of securitized loans in each state is measured as the ratio of securitized loans to the total loans originated in that state. We also report the mean GSP growth rate and private consumption growth rate for each state during 1989-2008.

<b>State</b>	<b>Securitized mortgage loans as a % of total mortgage loans</b>	<b>GSP Growth (%)</b>	<b>SPI Growth (%)</b>
Alabama	6.17	1.35	4.35
Alaska	0.75	-0.12	3.77
Arizona	0.54	1.18	3.93
Arkansas	39.38	1.44	4.52
California	41.70	0.97	3.99
Colorado	1.57	1.84	4.47
Connecticut	1.38	1.31	4.19
Delaware	43.25	2.00	3.57
District of Columbia	0.48	2.58	5.37
Florida	3.70	1.20	3.89
Georgia	46.97	0.89	3.89
Hawaii	6.85	0.71	3.84
Idaho	0.35	1.08	4.29
Illinois	1.72	1.26	4.04
Indiana	1.57	1.13	3.84
Iowa	2.53	1.86	4.31
Kansas	2.42	1.56	4.34
Kentucky	0.35	1.14	4.17
Louisiana	10.95	2.05	5.05
Maine	2.92	0.98	4.11
Maryland	4.07	1.22	4.21
Massachusetts	8.16	1.28	4.43
Michigan	28.19	0.67	3.47
Minnesota	1.18	1.61	4.37
Mississippi	0.87	1.34	4.68
Missouri	0.53	0.94	4.06
Montana	1.04	1.70	4.56
Nebraska	1.76	1.78	4.46

( to be continued)

<b>State</b>	<b>Securitized mortgage loans as a % of total mortgage loans</b>	<b>GSP Growth (%)</b>	<b>SPI Growth (%)</b>
Nevada	38.30	0.94	4.03
New Hampshire	5.68	1.20	4.04
New Jersey	1.33	1.08	4.17
New Mexico	13.37	1.89	4.58
New York	28.72	1.44	4.14
North Carolina	11.80	1.23	4.02
North Dakota	0.63	2.98	5.37
Ohio	12.48	1.47	4.10
Oklahoma	4.63	1.33	3.99
Oregon	0.49	0.78	4.12
Pennsylvania	9.01	2.53	5.11
Rhode Island	0.97	1.29	4.21
South Carolina	1.01	1.88	4.47
South Dakota	43.15	1.86	4.36
Tennessee	41.39	1.03	4.27
Texas	9.18	1.51	4.28
Utah	0.44	1.50	4.45
Vermont	2.04	1.57	4.52
Virginia	3.80	1.39	4.14
Washington	7.60	2.24	5.72
West Virginia	1.16	1.47	4.10
Wisconsin	5.42	1.33	3.99
Wyoming	1.14	0.78	4.12
Average	9.90		

**Table 2: Mortgage Loan Securitization and Risk Sharing**

This table presents the results of the regression:

$$\Delta \ln Consumption_t^k = \alpha + \gamma_0 \Delta \ln GSP_t^k + \gamma_1 MBS_t^k * \Delta \ln GSP_t^k + \gamma_2 MBS_t^k + \delta^k + \tau_t + \varepsilon_t^k,$$

where  $\Delta \ln Consumption_t^k$  denotes the state-specific growth rates of private consumption for state k in year t and  $\Delta \ln GSP_t^k$  is the state-specific growth rates of gross state product for state k in year t.  $\Delta \ln Consumption_t^k$  and  $\Delta \ln GSP_t^k$  are measured in per capita terms. The growth rates of real per capita variables are calculated as the first differences of the natural log of per capita-level values.  $MBS_t^k$  measures the degree of mortgage loan securitization of state k in year t and is defined as the ratio of the aggregate outstanding balance of securitized mortgage loans in a state to the aggregate amount of total outstanding mortgage loans in that state.  $\delta^k$  and  $\tau_t$  are dummy variables measuring state and time fixed effects, respectively.

<b>Variables</b>	<b>Expected Sign</b>	<b>Regression Coefficient</b>	<b>t-Statistics</b>	<b>p-Value</b>
$\Delta \ln GSP_t^k (\beta_0)$	+	18.66	2.17	0.0301
$MBS_t^k * \Delta \ln GSP_t^k (\beta_1)$	-	-14.06	-1.92	0.0559
$MBS_t^k$	-	-0.46	-1.58	0.1142
State Dummies		Yes		
Year Dummies		Yes		
N		1020		
R <sup>2</sup>		0.35		

**Table 3: Mortgage Loan Securitization and Risk Sharing: subsamples**

This table presents the results of the regression using two subsamples based on the housing market:

$$\Delta \ln Consumption_t^k = \alpha + \gamma_0 \Delta \ln GSP_t^k + \gamma_1 MBS_t^k * \Delta \ln GSP_t^k + \gamma_2 MBS_t^k + \delta^k + \tau_t + \varepsilon_t^k,$$

where  $\Delta \ln Consumption_t^k$  denotes the state-specific growth rates of private consumption for state  $k$  in year  $t$  and  $\Delta \ln GSP_t^k$  is the state-specific growth rates of gross state product for state  $k$  in year  $t$ .  $\Delta \ln Consumption_t^k$  and  $\Delta \ln GSP_t^k$  are measured in per capita terms. The growth rates of real per capita variables are calculated as the first differences of the natural log of per capita-level values.  $MBS_t^k$  measures the degree of mortgage loan securitization of state  $k$  in year  $t$  and is defined as the ratio of the aggregate outstanding balance of securitized mortgage loans in a state to the aggregate amount of total outstanding mortgage loans in that state.  $\delta^k$  and  $\tau_t$  are dummy variables measuring state and time fixed effects, respectively. We split the states into two equal-sized categories based on the housing market: “High (Low)-Housing value” are states in which housing markets are more (less) valued, as defined in Section III of the paper. The degree of value of local housing market in a given state is based on Housing Price Index (HPI) data obtained from GeoFRED data base from Federal Reserve Bank of St. Louis.

<b>Variables</b>	<b>Regression Coefficient</b>	<b>t-Statistics</b>	<b>p-Value</b>
<i>Panel A: High-housing Value States</i>			
$\Delta \ln GSP_t^k (\beta_0)$	63.17	3.45	0.0007
$MBS_t^k * \Delta \ln GSP_t^k (\beta_1)$	-15.39	-1.10	0.2723
$MBS_t^k$	-0.484	-1.05	0.2965
State Dummies	Yes		
Year Dummies	Yes		
N	520		
R <sup>2</sup>	0.32		
<i>Panel B: Low-housing Value States</i>			
$\Delta \ln GSP_t^k (\beta_0)$	18.65	2.17	0.0301
$MBS_t^k * \Delta \ln GSP_t^k (\beta_1)$	-14.06	-1.92	0.0559
$MBS_t^k$	-0.463	-1.58	0.1142
State Dummies	Yes		
Year Dummies	Yes		
N	500		
R <sup>2</sup>	0.46		

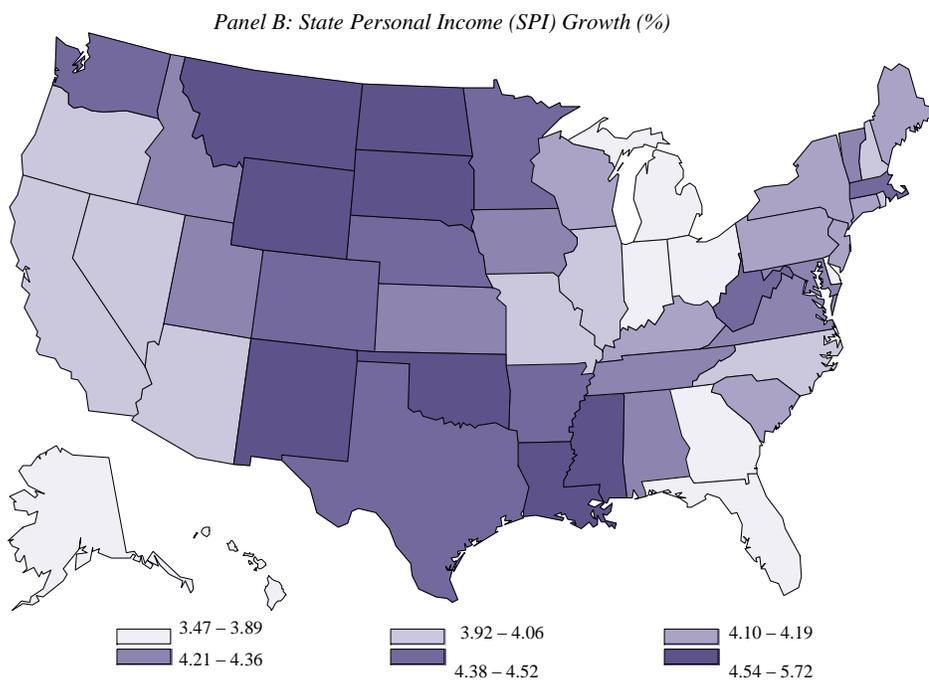
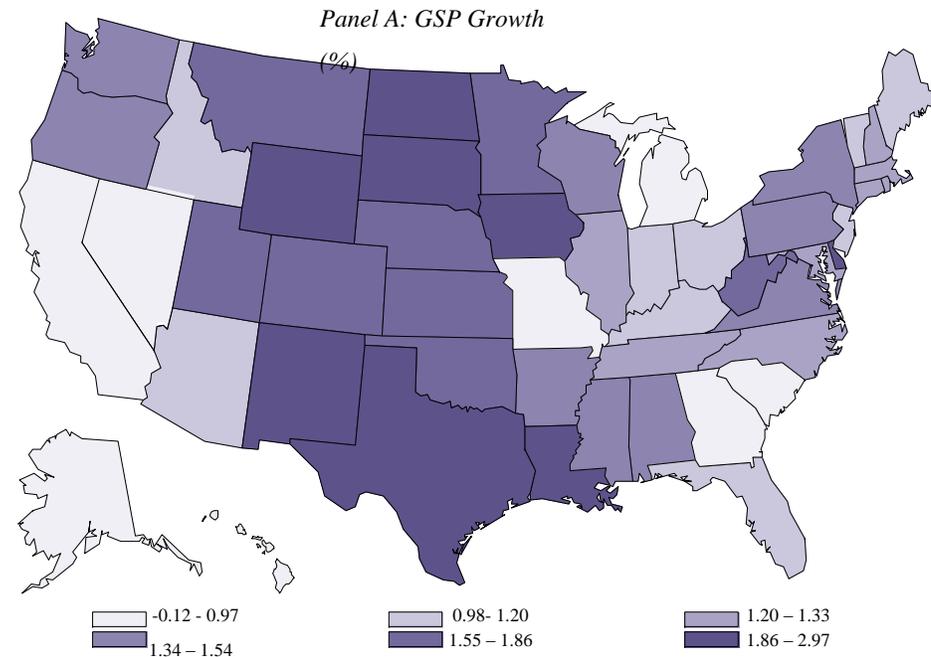
### Figure 1: The Growth rates of GSP and SPI over Time

This figure shows the average growth rate of GSP and SPI across the 50 states and Washington D.C. during 1990-2008.



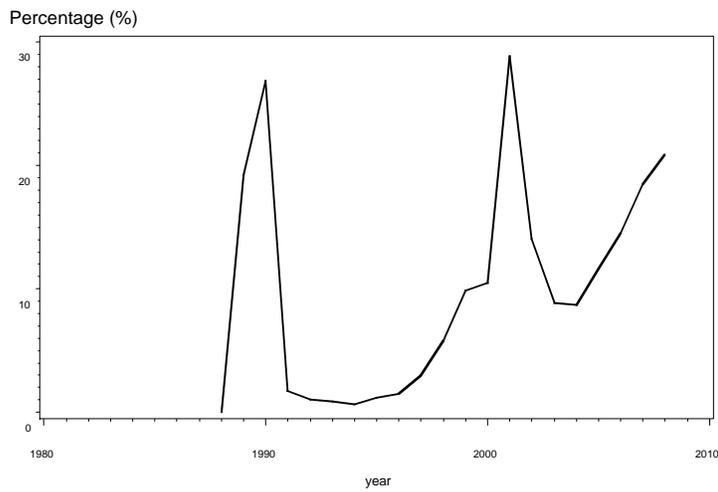
## Figure 2: The Growth rate of GSP and SPI across States

The following two figures show the average growth rates of GSP and SPI respectively over the period from 1990 to 2008 in each of the 50 states and Washington D.C., respectively.



### Figure 3: Bank's Loan Securitization over Time

This figure shows banks' mortgage securitization activities for the 50 states and Washington D.C. during 1989-2008. The total issued loans and securitized loans are aggregated at the state level by summing the amount of loans reported by individual banks in each state. The percentage of securitized loans in a given state is measured by the ratio of total securitized mortgage loans to the total originated mortgage loans in that state.



#### Figure 4: Bank's Loan Securitization across States

This graph shows average banks' mortgage loan securitization during 1989-2008 in each of the 50 states and Washington D.C. The total loans and securitized loans are aggregated at the state level by summing the amount of loans reported by individual banks in each state. The percentage of loan securitization in a given state is measured by the ratio of total securitized mortgage loans to the total mortgage loans in that state.

