

# Collateral Damage: How Mortgage Loans Decrease U.S. Savings\*

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**Abstract:** We investigate the determinants of the saving rate in the US, with a special focus on the role of mortgage debt. We believe that mortgage debt is an important determinant of saving rate. On the one hand, mortgage payments can serve as a disciplining device for borrowers to save for monthly mortgage payments and accumulate home equity. On the other hand, households could potentially decrease their savings in other forms as they save for their mortgage payments. The results show that mortgage payments have a substantial negative impact on both personal and private saving rates in the US. Furthermore, the recent financial crisis has magnified the negative impact of mortgage debt on the two saving rates. In addition, including mortgage debt as an explanatory variable leads to significant changes in the impact of other variables, further reinforcing our claim that mortgage debt is important for the analysis of saving rate. Comparing mortgage payments with non-mortgage payments, we find that mortgage payments have a larger impact on private saving rate while non-mortgage payments have a larger impact on personal saving rate. We also find partial but robust crowding out effect of public saving rate on the two saving rates. Our results have implications for monetary policy and government policies that encourage mortgage borrowing.

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\*The views expressed here are those of the authors and do not necessarily represent the views of the Central Bank of the Republic of Turkey.

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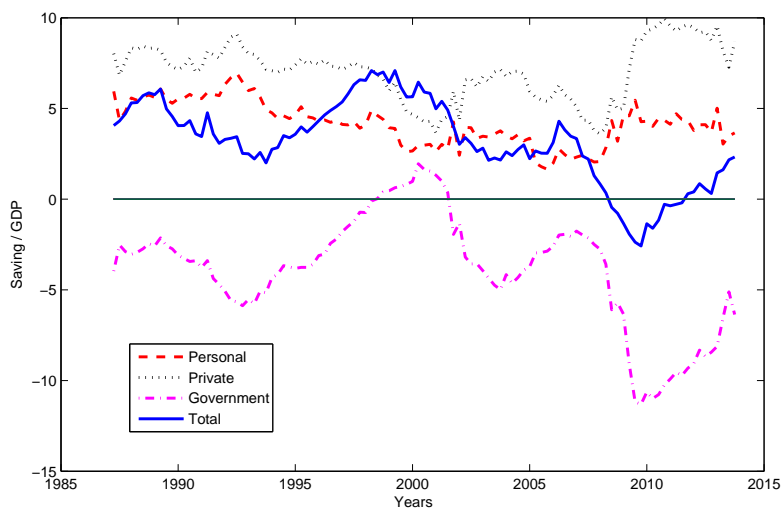
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# 1 Introduction

The US saving rate has experienced a dramatic decrease in the last three decades. Figure 1 shows the annual personal, private (i.e. personal and corporate), government, and aggregate saving rates at quarterly frequency between 1987 and 2013. Personal saving rate decreased from about 8 percent to almost 2 percent from 1987 to 2007. Despite the upward trend after the 2008 financial crisis, personal saving rate was slightly over 3.5 percent as of the third quarter of 2013. Private saving rate, which is the sum of personal and corporate saving rates, shows a similar pattern over the same period except for a distinctively stronger increase after 2007, rising from 3.6 percent to 8.7 percent. The US government saving rate, on the other hand, has almost always been well below zero except for the mid-1998 to mid-2001 period. The aggregate saving rate has also decreased over time and reached negative levels during the financial crisis.



**Figure 1:** US Saving Rates (1987-2013), Source: BEA

While private saving rates in the US has been on a declining trajectory, we observe substantial increases in mortgage debt. The ratio of home-mortgage debt to GDP in the US increased from around 30 percent in the 1980s to more than 75 percent by 2009. The rise in the ratio of total debt to GDP has also been striking in the US, in parallel with many other economies of the world. In this study we analyze potential determinants of both personal and private saving rates in the US between

1987 and 2013 period. Our focus will be on the role of mortgage debt on these two savings rates. More specifically, we investigate whether an increase in mortgage debt, as a percentage of GDP, lead to a rise or a drop in personal and private saving rates. In addition, we examine how these two saving rates are affected by non-mortgage debt, financial deepening and such macro variables as income growth, interest rate, capital gains and market uncertainty. To the best of our knowledge, we offer the first analysis of the impact of mortgage debt, and compare it with the impact of non-mortgage debt, on personal and private saving rates.

Our results illustrate some interesting effects of mortgage payments on personal and private saving rates in the US. Increasing mortgage payments by ten percent leads to a contraction in the personal saving rate by 9.1 percent. On the other hand, a similar increase in mortgage payments decreases the private saving rate in the US by 12.4 percent. Furthermore, we find that including mortgage payments in the empirical model leads to significant changes in the impact of some of the other determinants of the saving rate, further reinforcing the importance of mortgage debt for the analysis of saving decisions. For instance, including mortgage payments in the empirical model leads to a sizable drop in the persistence (inertia) of both private and personal saving rates. In addition, it leads to a larger crowding out effect of government savings. We also find that the recent financial crisis in the US has magnified the negative impact of mortgage debt on both personal and private saving rates. We further find that government saving rates display robust, but partial, crowding out effect on private saving rates. Comparing mortgage payments with non-mortgage payments, we find that mortgage payments have a larger impact on private saving rate while non-mortgage payments have a larger impact on personal saving rate. Finally interest rate have positive impact on both saving rates.

The current study has some important policy implications. Following the financial crisis, there is a heated debate in the U.S. over some of the government policies that subsidize mortgage borrowing. Examples of these policies include the tax deductibility of mortgage interest payments and implicit government guarantees for mortgages purchased by such government agencies as Freddie Mac and Fannie Mae. The current study highlights an important economic impact of these government policies that have been overlooked by earlier studies. There are various arguments for and against government subsidies in mortgage markets. This study adds another argument and shows that policies designed to

encourage mortgage borrowing will have an impact on future economic growth through their impact on the saving rate. Clearly, the impact of increased mortgage debt on the economy will differ from one country to another, depending on the current level of the saving rate in that country. For instance, any given impact of mortgage debt on the saving rate will have different implications for the economy in the US versus China, due to very different current saving rates in these two countries. It is also possible that increased mortgage debt could be associated with improved ability of the borrowers to smooth their consumption over their life cycles. Thus, the current results cannot be used to reach any welfare implications of higher mortgage debt. We simply offer evidence on the impact of mortgage debt on personal and private saving rates, two important components of the national saving rate. The current study is important for monetary policy as well. Many economies suffer from current account deficit problems as their saving rate is not sufficiently high enough to finance their high rates of investment and economic growth. Interest rate policy and macroprudential measures can have not only a direct impact on saving rate, but also an indirect impact through their influence on the growth of mortgage and non-mortgage credit.

The rest of the paper is organized as follows. In the next section, we discuss the motivation for this study and briefly review the related literature. In the third section, we discuss the possible determinants of saving rate. The empirical analysis of the saving rates is performed and discussed in the fourth section. We offer some concluding remarks in the final section.

## **2 Motivation and Background**

Mortgage obligation is potentially an important determinant of the personal saving rate as mortgage payments would serve as a disciplining device for the borrower to accumulate home equity on a monthly basis. Moreover, having access to a mortgage loan would also induce young households to save for the initial deposit. However, mortgage payments could also lead households to lower their savings. Consider an agent who wants to be a homeowner. In the absence of a mortgage loan, she will have to put aside some amount every month in order to save towards the purchase price. Since she will have to save for the entire purchase price, and since she will not be able to make the purchase for years to come, she faces an uncertain purchase price. If, on the other hand, she has access to a

mortgage loan, she can purchase the house as soon as she has enough saved for a down-payment. Once she has the down-payment and finds a house to purchase, the purchase price and the monthly mortgage payments are determined.<sup>1</sup> Thus, purchasing the house with a mortgage loan reduces the uncertainty that the agent faces regarding how much to save each month in order to be able to own a house. In the spirit of Aiyagari (1994), this reduced uncertainty about future cash flows leads to lower monthly savings for the purpose of buying a house.<sup>2</sup> In addition, the ability of the homeowners in the US to take out home equity loans enables them to cash in on the equity that they accumulate through their mortgage payments and through appreciation in the market value of their homes.

Why should we be concerned about a low saving rate? The primary reason is that a low saving rate constraints the amount of investment that the economy can undertake. There is a very close association between national saving and investment rates (Feldstein and Horioka (1980)). To achieve high rates of investment and economic growth, low saving rate makes it necessary to rely on foreign capital. However, foreign capital inflows are highly volatile as they respond fairly rapidly to changes in earning opportunities across countries. In addition, assuming positive rates of returns for foreign capital, foreign capital inflows today would eventually mean bigger foreign capital outflows in the future. Low rates of capital formation and heavy borrowing from abroad will have a negative impact on economic growth and inhibit the standard of living over time.<sup>3</sup>

Saving and investment also have distributional effects as they impact the consumption possibilities and economic opportunities of different generations differently. For instance, current low saving rate, and the resulting scarcity of capital in the future, will hurt young generations as they will be seeking employment in the future. However, older generations and retirees will not be much affected because they will not be seeking employment. In fact, they may benefit from low saving rates as it increases returns on their existing assets

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<sup>1</sup>If the borrower takes out an adjustable mortgage loan, she will face uncertainty about the mortgage payments in future years. However, this uncertainty is still less significant than the price uncertainty she would face in the absence of a mortgage loan.

<sup>2</sup>Aiyagari (1994) reports that for sufficiently high variability and persistency in earnings, aggregate saving rate could be higher by as much as seven to fourteen percentage points.

<sup>3</sup>Carroll et al. (2000) incorporate habit formation in consumption into a standard growth model to show that high growth leads to high saving, not the other way around.

The decline in the US saving rate since 1980s has received substantial attention in the literature. However, no clear consensus has reached about the main reasons of this decline. An early study by Summers et al. (1987) offers an informal discussion of this issue and points out that the primary motivation for saving is the desire to provide for old age and for rainy days, the desire to accumulate for big-ticket item purchases, the desire to leave bequests, and the expected changes in income later in life. Juster et al. (2003) use PSID (Panel Study of Income Dynamics) data to investigate the role of capital gains on the personal saving rate and find that part of the decline in the personal saving rate since mid-1980s is due to the significant capital gains in corporate equities. A very similar conclusion is suggested by Lusardi et al. (2001). According to Bunting (2009), however, the decline in the personal saving rate is due to collapsing middle income savings and increasing low income dissavings despite stable savings by high income groups. Guidolin and Jeunesse (2007) take into account the measurement problems about the saving definitions of both NIPA and FRB. The authors conclude that none of the problems of measures currently used fully account for the steep decline in the U.S. saving rate since the mid-90s.

There is also a growing literature on the cross-country determinants of personal and private saving rates. An important study by Loayza et al. (2000), using panel data of 69 countries from 1965 through 1994, shows that private saving rate exhibits inertia, public savings partially crowd out private savings, and income, inflation, dependency ratio and financial deepness have sizable impact on private saving rate.<sup>4</sup> Similarly Masson et al. (1998) employ a panel data of both developed and developing countries to analyze the determinants of private saving rate. Their results also suggest partial crowding out of private saving by public saving. They also report that while demographics and growth are important determinants, interest rate and terms of trade have positive but less robust effect on private saving rate. Similar conclusions are reached by Hondroyiannis (2006) for 13 European countries for the 1961-1998 period and by Edwards (1996) for 36 countries for the 1970-1992 period. Choi et al. (2014) argue that that the difference in the income growth rate between China and the US is more critical for explaining saving rate differences than differences in income risk faced by the households in the two countries. The authors predict the China's household saving rate to decrease as its growth

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<sup>4</sup>Dependency ratio is the ratio of the population not in the labor force (aged 0-14 and over the age of 65) to population in the labor force (aged 15-64).

begins to taper.

Some recent studies that examine the determinants of the saving rate for individual countries have obtained similar results. Among these studies are Harris et al. (2002) for Australia, Paiva and Jahan (2003) for Brazil, Athukorala and Sen (2004) for India, Horioka and Wan (2007) for China, Ozcan et al. (2010) for Turkey, and Ang (2011) for Malaysia.

The role of mortgage debt in agents' saving behavior has been ignored by the previous studies. There have been some studies that looked at the impact of down payment requirements on the consumption behavior of households. Japelli and Pagano (1994) and Engelhardt (1996) show that requiring larger down payments leads to significant increases in household savings. Aron et al. (2012) offer a comparison of the U.K., U.S. and Japan and show that credit market liberalization and lower down payment requirements in the U.K. and U.S. have increased the average consumption-to-income ratio. Financial innovations in the U.S. and U.K, such as home equity loans, also led to a positive impact of higher home prices on consumption. In Japan, by contrast, there has been no credit market liberalization or financial innovation since the 1970s. As a result, there is no evidence of increasing consumption-to-income ratio and increasing house prices have negative impact on consumer spending. Studies by Case et al. (2005), Ludwig and Slok (2004), Campbell and Cocco (2007) (2007) and Carroll et al. (2011) estimate how an increase in housing wealth and financial wealth affect the marginal propensity to consume. They report conflicting results on the relative size of the coefficient on housing wealth to that of financial wealth. Studies by Muellbauer (2007), Aron. et al. (2006) and Benjamin et al. (2004) also investigate housing wealth effects on consumption and how these effects depend on the credit supply conditions. Recent work by Guerrieri and Lorenzoni (2012) and Eggertsson and Krugman (2012) argue that a sharp reversal in credit conditions played a critical role in the recent rise in saving rate. An earlier study by Manchester and Poterba (1989) focuses on the correlation between a household's stock of second mortgage debt and its net worth and reports that each additional dollar of second mortgage borrowing leads to a 75 cents decline in household net worth. A recent study by Mian and Sufi (2014) examines the effect of rising U.S. house prices on borrowing and spending from 2002 to 2006 and find that low income households aggressively cash in on their home equity and increase their spending substantially when house prices rise while high



income households are unresponsive to house prices in their borrowing and spending behavior. None of these studies, however, examines the impact of mortgage debt and how it compares with the impact of other types of debt on agents' saving behavior.

### **3 Determinants of Saving Rate**

In this section, we provide a brief discussion of the variables we use and their expected relationship with saving rate. The potential determinants of saving rate have been outlined by earlier theoretical and empirical studies in the literature. These determinants include lagged saving rate, income growth rate, public (government) saving rate, macroeconomic uncertainty, interest rate, terms of trade, return on stock market and recession periods. In addition to these determinants, the current study takes into account a number of mortgage and non-mortgage debt related variables. These variables include mortgage payments as a percentage of GDP, mortgage debt/total debt ratio, share of mortgage interest payments in total mortgage payments, non-mortgage debt payments as a percentage of GDP, and total personal and private debt, as percentages of GDP.

As the main focus of this study is on the effects of mortgage debt on saving rate, the effect of mortgage payments / GDP ratio is of particular importance. On the one hand, an increase in mortgage payments by a borrower would lead to accumulation of more equity in the house, and equity in the house is a form of saving. On the other hand, the mortgage payments could be coming out of other forms of savings the borrower has. Hence the net effect is ambiguous.

In addition, as stated earlier, access to a mortgage loan significantly reduces the uncertainty about how much one needs to save each month to own a house. Uncertainty is one of the main motivators of saving, and this reduced uncertainty can significantly reduce saving rate. Furthermore, availability of home equity loans and reverse mortgages enable homeowners to 'consume' the equity they have accumulated in their house through price appreciation as well as mortgage payments. As a result, one could argue that the decrease in personal saving rate in response to a percentage increase in mortgage payments could even exceed the percentage increase in mortgage payments. For these same reasons, the effect of mortgage payments on private saving rate, the sum of personal and corporate saving rates, is also ambiguous.

It has been empirically established that saving rate shows strong inertia. These earlier studies use annual data. Thus, we expect to find even stronger inertia in saving rate since we utilize quarterly data. The inertia in the saving behavior could be an outcome of consumption habits and/or consumption smoothing.

The theoretical view on the relationship between income growth and saving rate is not clear as the life-cycle hypothesis and the permanent income hypothesis have different views on the effects of income growth on saving rate. According to the life-cycle hypothesis, aggregate savings would increase in response to an increase in the growth rate of income because it increases savings of younger households more than it decreases savings of older households. According to the permanent income hypothesis, consumers spend a constant proportion of their permanent income, and since an increase in income growth would imply higher anticipated future income, this would encourage households to spend more and save less today. Given these opposite predictions, it becomes an empirical question to determine the net effect of income growth on saving rate.

An important determinant of private and personal saving rates is the public saving rate. According to the Ricardian theory, an increase in the public saving rate has no impact on aggregate national saving rate because private saving rate will decrease by an amount exactly equal to the increase in the public saving rate. The theory is based on the argument that while government bonds are an asset to those who hold them, they are an exactly offsetting liability to the taxpayers who will ultimately redeem them. Thus, a policy that expands or contracts the outstanding stock of government debt will not lead to any change in total spending. This argument is built on the assumption that consumers smooth consumption over time and that they foresee and internalize future tax implications of a change in today's government spending. They recognize that higher government spending (saving) today means more (less) taxes in the future, and they increase (reduce) the amount they need to save today to pay for future taxes. Earlier empirical studies have confirmed that government savings have a crowding out effect on personal and private savings. However, they found the crowding out effect to be less than one-to-one. Based on these earlier studies, we expect to find partial crowding out effect, but we do not expect the full Ricardian Equivalence to hold.

Saving rate is expected to increase when households and firms perceive increases in macroeco-

conomic uncertainties. In such an environment, agents prefer to hedge against macroeconomic risks by increasing their savings. Earlier studies use interest rate volatility, exchange rate volatility or inflation rate as a proxy for macroeconomic uncertainty. For our analysis of saving rate in the US, we use VIX Index as a proxy for macroeconomic uncertainties. VIX is the Chicago Board Options Exchange (CBOE) Volatility Index and is constructed using the implied volatilities of a wide range of S&P 500 index options. The VIX is widely used a measure of market risk and is often referred to as the fear index or the fear gauge. We believe this index is a better and broader measure of macroeconomic uncertainty for the US than interest rate volatility, exchange rate volatility or inflation rate.

Another potential determinant of saving rate is the real interest rate. At first glance one would assume that a higher real interest rate would increase saving rate. However, due to the opposing forces of substitution and income effects, the net impact of a higher real interest rate is ambiguous. On the one hand, an increase in the interest rate increases the return on savings, which encourages households to partly postpone today's consumption and increase savings (substitution effect). On the other hand, a higher real interest rate reduces the savings needed to achieve a given income (income effect). The net effect depends on which affect outweighs the other. Earlier studies have found mixed results and hence it is left to empirical exercise to determine the sign and the magnitude of the effect of a higher real interest rate on saving rate.

We use the ratio of total debt to GDP as a proxy for the financial deepness. This variable is expected to have a negative impact on saving rate because as households can access credit markets more easily, they will have less incentives to save for future emergencies and for purchases of big-ticket items.

In order to differentiate how mortgage payments might differ from other debt obligations of households, we include non-mortgage debt (credit card, car loans, and other consumer loans) in the analysis. An important difference between mortgage payments and other loan payments is that part of the mortgage payment goes into accumulating equity (wealth) in the house. However, this equity, alongside with the equity generated by house price appreciation, could also be used as collateral to obtain additional credit for further consumption, thus partially, or fully, or even more than fully, offsetting the wealth (saving) accumulated in the house. Non-mortgage consumer loans, however, tend to be purely

for consumption purposes. Therefore, we expect non-mortgage loan payments to have a larger negative impact on personal saving rate than mortgage payments, while the same comparison may not be true for the impact of the two loan payment types on private saving rate.

When studying the determinants of saving rate, particularly of the decline in private and personal saving rates in the US, we need to take into account the potential impact of capital gains as these gains are not included in definition of savings in the NIPA (National Income and Product Account). Earlier studies by Garner (2006) and Juster et al. (2003) argue that the decline in the personal and private saving rates in the US since mid 1980s is largely due to the capital gains in corporate stocks. In order to capture the impact of capital gains in the stock market, we include the growth rate of the Dow Jones Industrial Average Index in the analysis.

We use terms of trade, defined as the ratio of nominal exports/imports to real exports/imports, to test the prediction that positive terms of trade shocks have positive impact on saving rate through their positive effect on both wealth and income. Finally, we use recession dummies to capture the impact of the three recessions that the US economy went through during the study period. We expect recessions to make agents more cautious and induce higher savings.

## **4 Model and Data**

### **4.1 Data**

For the study of personal and private saving rates in the US, we use quarterly data from the first quarter of 1987 through the third quarter of 2013. The analysis cover the period after which the Tax Reform Act of 1986 became effective. The reason to start the analysis in 1987 is to avoid both the impact of this major tax reform and the expectation of it on saving decisions of households and firms; 1986 Tax Reform Act drastically reduced the number of deductions and the number of tax brackets, and eliminated many tax shelters for real estate investments.

Table 1 provides data definitions and their sources. We obtain saving rate data from Bureau of Economic Analysis's Table 5.1 of NIPA. Personal saving rate is the ratio of personal savings to GDP. Private saving rate is defined as the sum of personal saving rate and the corporate saving rate.

Quarterly mortgage payments and non-mortgage loan payments as a percentage of GDP are calculated from the debt service ratios provided by the Federal Reserve. Both personal and private total debt, as a percentage of GDP, are obtained from Financial Accounts of the United States provided by the Federal Reserve. Mortgage interest payment is calculated by multiplying the total mortgage stock-to-GDP ratio with the mortgage interest rate.<sup>5</sup> Terms of trade variable is calculated as the ratio of nominal exports/imports to real exports/imports. We obtain recession dates from NBER. The US economy experienced three recessions during the sample period: 1990Q3-1991Q1, 2001Q1-2001Q4, and 2007Q4-2009Q2. We use the growth rate of Dow Jones Industrial Average as a proxy for the capital gains. As stated earlier, these capital gains are not included in the saving definition of NIPA.

Table 2 presents the descriptive statistics for the variables. The mean value of personal and private saving rates are positive while the mean value of the public saving rate over this period is -3.89 with the minimum value of -11.31. The table also shows that both personal debt and private debt, as a percentage of GDP, are quite high with the mean values of 73.76 and 184.04, respectively. Furthermore, mortgage debt constitutes more than two-thirds of household total debt. Another interesting observation from the table is that mortgage interest payment is about half of the total mortgage payment on average and it fluctuates from 32.80 percent to 63.16 percent over the sample period.

We apply Augmented Dickey-Fuller test to examine the unit roots in the variables. The results of the test presented in Table 3 show that total personal and private debt ratios, mortgage debt/total debt ratio, the share of mortgage interest payment in the total mortgage payment, and non-mortgage loan payments are not stationary. Hence we take the first difference of these variables and use the level of the other variables in our analysis.

## 4.2 Econometric Analysis

We use two econometric models to study the determinants of saving rate. In the first model, we use variables that have been commonly utilized by earlier studies in the literature. In the second model, we incorporate mortgage payments and other mortgage-related variables into the first model. We

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<sup>5</sup>Mortgage interest rate is the National Average Contract Mortgage Rate provided by Federal Housing Finance Agency (FHFA).

**Table 1:** Definitions and Data Sources of the Variables Used in the Analysis

Variable	Definition	Source
Personal Saving Rate	Personal Saving / GDP	NIPA
Private Saving Rate	Private Saving / GDP	NIPA
Growth Rate of Per Capita Real Income	Growth Rate of Per Capita Real Income	St. Louis FED
VIX	Volatility Index	St. Louis FED
Interest Rate	Federal Funds Rate	St. Louis FED
Terms of Trade	Nominal(export/import)/Real(export/import)	St. Louis FED
Public Saving Rate	Public Saving / GDP	NIPA
Growth Rate of DJIA	Growth Rate of Dow Jones Industrial Average	St. Louis FED
Recession Dummy	NBER Official Recession Dates	NBER
Mortgage Payments	Mortgage Payments / GDP	FED <sup>1</sup>
Total Personal Debt	Total Personal Debt / GDP	FED
Total Private Debt	Total Private Debt / GDP	FED
Mortgage Debt / Total Personal Debt	Households' Outstanding Mortgage Debt / Total Personal Debt	FED
Mortgage Debt / Total Private Debt	Households' Outstanding Mortgage Debt / Total Private Debt	FED
Share of Mortgage Interest Payment	Mortgage Interest Payment / Mortgage Payment	FED and FHFA
Non-Mortgage Loan Payments	Non-Mortgage Loan Payments / GDP	FED

<sup>1</sup> This data specifically comes from Household Debt Service and Financial Obligations provided by FED.

perform our analysis for both personal and private saving rates separately.

*Model1*

$$PS_t^i = \beta_0 + \beta_1 PS_{t-1}^i + \beta_2 Y_t^g + \beta_3 VIX_t + \beta_4 INT_t + \beta_5 ToT_t + \beta_6 GS_t + \beta_7 REC_t + \varepsilon_t. \quad (1)$$

*Model2*

$$PS_t^i = \beta_0 + \beta_1 PS_{t-1}^i + \beta_2 Y_{t-1}^g + \beta_3 VIX_t + \beta_4 INT_t + \beta_5 ToT_t + \beta_6 GS_t + \beta_7 REC_t + \beta_8 MP_t + \beta_9 \Delta TD_t^i + \beta_{10} \Delta MDTD_t^i + \beta_{11} \Delta MIP_t^i + \beta_{12} \Delta NMP_t + \varepsilon_t \quad (2)$$

**Table 2:** Discriptive Statistics

Variable	Mean	Std. Dev.	Median	Maximum	Minimum
Personal Saving Rate	4.23	1.24	4.29	6.95	1.65
Private Saving Rate	7.09	1.56	7.22	9.96	3.60
Growth Rate of Per Capita Real Income	0.40	0.61	0.49	1.64	-2.39
VIX	20.63	7.84	19.92	61.86	10.60
Interest Rate	3.69	2.41	4.39	8.54	0.01
Terms of Trade	100.76	2.64	100.28	106.46	92.80
Public Saving Rate	-3.89	3.06	-3.59	1.95	-11.31
Growth Rate of DJIA	10.18	16.54	11.04	46.88	-37.95
Mortgage Payments	4.30	0.38	4.21	5.24	3.59
Total Personal Debt	73.76	14.28	68.00	99.00	52.85
Total Private Debt	184.04	24.78	177.66	228.93	152.10
Mortgag Debt / Total Personal Debt	68.70	3.36	68.36	75.01	61.88
Mortgag Debt / Total Private Debt	27.42	3.14	26.66	33.12	21.50
Share of Mortgage Int. Payment	48.39	6.85	46.96	63.16	31.80
Non-Mortgage Loan Payment	4.16	0.38	4.19	4.89	3.40

We denote the saving rate in period (quarter)  $t$  by  $PS_t^i$  where  $i$  denotes whether it is personal or private saving rate. For other variables,  $Y_t^g$  denotes the growth rate of per capita real income,  $VIX_t$  stands for VIX index and  $INT_t$  represents the real interest rate. The public saving rate and the terms of trade are denoted by  $GS_t$  and  $ToT_t$  respectively.  $REC_t$  is a dummy variable indicating whether period  $t$  is a recession period,  $MP_t$  denotes the mortgage payments-to-GDP ratio,  $MDTD_t^i$  denotes the ratio of total mortgage debt to total personal debt in personal saving rate analysis and denotes the ratio of total mortgage debt to total private debt in private saving rate analysis. Mortgage interest payment is  $MIP_t$ , and  $NMP_t$  denotes non-mortgage debt payments-to-GDP ratio. The degree of financial deepening is captured by  $TD_t$ , the ratio of total personal debt to GDP in personal saving rate analysis and the ratio of total private debt to GDP in private saving rate analysis. Since the interest part of mortgage payments are tax deductible in the US, one can argue that after-tax mortgage payments are more relevant for agents' saving decisions in the US than before-tax mortgage payments. For this

**Table 3:** Augmented Dickey-Fuller Test

Variable	p-value <sup>1</sup>
Private Saving Rate	0.06 <sup>a</sup>
Personal Saving Rate	0.10 <sup>a</sup>
Growth Rate of Per Capita Real Income	0.00 <sup>a</sup>
VIX	0.00 <sup>a</sup>
Interest Rate	0.00 <sup>b</sup>
Terms of Trade	0.08 <sup>a</sup>
Public Saving Rate	0.09 <sup>a</sup>
Growth Rate of DJIA	0.044 <sup>a</sup>
Mortgage Payments	0.035 <sup>a</sup>
Total Private Debt	0.73 <sup>a</sup>
Total Personal Debt	0.29 <sup>a</sup>
Mortgage Debt / Total Private Debt	0.36 <sup>a</sup>
Mortgage Debt / Total Personal Debt	0.21 <sup>a</sup>
Share of Mortgage Interest Payment	0.27 <sup>a</sup>
Non-Mortgage Loan Payments	0.23 <sup>a</sup>

<sup>1</sup> Superscript <sup>a</sup> denotes the presence of only intercept in the regression while <sup>b</sup> denotes the presence of both intercept and trend.

reason, we repeat our analysis for the US using after-tax mortgage payments. We calculate the tax deduction on mortgage payments using the tax rates data provided by NBER.<sup>6</sup>

There has been a sharp increase in both personal saving rate and private saving rate in the US during the recent great recession. In order to capture the impact of the great recession, we conduct the analysis for the pre-recession sample period of 1987-2007 as well as for the full sample period of 1987-2013. This will enable us to examine how the great recession that started in 2007 affected the impact of the variables of interest on the two saving rates.

One can argue for a possible endogeneity problem in our analysis; the independent variable (mort-

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<sup>6</sup><http://www.nber.org/~taxsim>



gage payment), at least the equity part of it, can be considered as a form of saving, hence is included in the dependent variable (saving rate). However, while this could be an issue at micro-level analysis, this is not an issue at the aggregate level as all savings are summed up and the net aggregate changes in saving rate are considered. Nevertheless, in order to check for this possible endogeneity issue, we repeated our analysis with a revised definition of saving rate where we subtracted the principal payment (equity) component of mortgage payments from saving rate calculations. We found the results to be similar to the results reported in this paper.

## 5 Results

In this section, we present the results for personal and private saving rates in the US. Table 4 displays the results for the personal saving rate for both the full sample period 1987-2013 and for the period ended just before the recent financial crisis (1987-2007). The first and fourth columns of the table correspond to Model 1 where we use variables commonly utilized in the literature, while the other columns correspond to Model 2 where we include mortgage debt and other debt related variables.

According to Table 3, in the absence of mortgage-related variables, the main determinants of personal saving rate are lagged saving rate, interest rate, and public saving rate. As expected, personal saving rate exhibits strong inertia. The effect of lagged saving rate is stronger than the effect found in earlier studies with the coefficients exceeding 0.7. This is mainly due to the fact that we are using data at quarterly frequency while earlier studies utilized data at annual frequency.

As discussed earlier, the effect of a change in the real interest rate on the saving rate will depend on the magnitudes of the substitution and income effects. The results show that real interest rate has positive impact on personal saving rate, suggesting that the substitution effect overweighs the income effect. Another important determinant of personal saving rate is the public saving rate. As expected, the results indicate that public savings crowd out personal savings. An increase in the public saving rate by ten percent leads to a decline in the personal saving rate by 1.4 percent in the full sample and by 2.2 percent in the sub-sample of pre-crisis period. As the magnitudes of these declines are smaller than the increase in the public saving rate, the full Ricardian Equivalence does not hold. The effect of VIX index, terms of trade, growth rate of DJIA, per capita income growth rate, and recession

dummies are insignificant during both sample periods.

The second and the fifth columns of Table 3 display the results when we include mortgage payments in the analysis. The statistically significant coefficients of mortgage payments indicate that a ten percent increase in the mortgage payments-to-GDP ratio decreases personal saving rate by 4.7 percent and 6.8 percent for the 1987-2013 and 1987-2007 periods, respectively. These two coefficients suggest that increases in mortgage borrowing lead to highly substantial reductions in households' saving rate. These two coefficients also indicate that the effect of mortgage payments on personal saving rate has become smaller after the recent financial crisis.

Next, we include additional debt related variables that we consider as important in analyzing the determinants of saving rate and the role of mortgage payments. These variables are the total personal debt-to-GDP ratio, the ratio of outstanding mortgage debt to total personal debt, the share of mortgage interest payments in total mortgage payments, and the ratio of non-mortgage debt payments to GDP. The results are displayed in the third and the sixth columns of Table 4. We find that including these variables significantly magnifies the negative impact of mortgage payments; an increase in mortgage payments by ten percent decreases personal saving rate by 9.1 percent for the full sample period and by 8.8 percent for the sub-sample period of 1987-2007.

We find that the share of mortgage interest payment has a significant and negative impact on personal saving rate. Personal saving rate decreases by 28.3 percent when the share of mortgage interest payment in total mortgage payment increases by ten percent for the full sample period. However, the same effect is insignificant for the pre-crisis period. The difference between two cases indicates that interest payment has become very important in households' saving decisions following the recent financial crisis. This should not be surprising since a higher interest share in mortgage payments means a smaller principal payment (equity) share, and the lack of sufficient equity played a critical role in large number of mortgage loans becoming delinquent during the crisis period.

Furthermore, the effect of total personal debt-to-GDP ratio, a commonly used measure of financial deepening, is significant in both sample periods, but it is positive for the full sample period and negative for the sub-sample of pre-crisis period. Finally, the effect of non-mortgage debt payments has significantly negative impact on personal saving rate in both sample periods. It is important to

note that the negative impact of non-mortgage debt is much larger than that of the mortgage debt on personal saving rate. This is not surprising as non-mortgage debt is used more for consumption purposes than mortgage debt.

The inclusion of the mortgage payments and other debt related variables has also led to changes the explanatory power of the other variables. Comparing column 1 with column 3, and column 4 with column 6, in Table 3, we observe a significant change in the persistence (inertia) of the personal saving rate. When mortgage payments are not included, the inertia is quite high. However, adding mortgage payments and other debt related variables decreases the role of inertia considerably. Adding these variables also amplifies the crowding out effect of public saving rate and the impact of interest rates.

In Table 5, instead of using (before-tax) mortgage payments we use after-tax mortgage payments. Comparing the results of tables 3 and 4, we find that the negative effect of after-tax mortgage payments on personal saving rate is larger than the negative effect of (before-tax) mortgage payments.

As anticipated, an increase in macroeconomic uncertainty, as captured by the VIX variable, has positive impact on personal saving rate for the full sample period, when mortgage-related variables are included in the analysis. However, the same effect is insignificant for the sub-sample period of 1987-2007. Furthermore, the effect of terms of trade has a positive impact on saving rate, but only for the sub-sample period of 1987-2007.

We report the results of the analysis for private saving rate in Table 6 and 7. Private saving rate is the sum of personal and corporate saving rates. Table 6 reports the results when we use before-tax mortgage payments while Table 7 reports the results when we use after-tax mortgage payments in the analysis.

The effect of mortgage payments on private saving rate is statistically significant and negative for both sample periods, and the effect is larger in absolute terms than the effect in the case of personal saving rate. An increase in mortgage payments by ten percent decreases private saving rate by 10.3 percent for the 1987-2013 period and by 8.8 percent for the 1987-2007 period.

One explanation for the large negative impact of mortgage payments on the two saving rates in the US is the fact that mortgage activity tends to be higher during booming house prices. Thus, an

observed increase in mortgage debt may be capturing an increase in household wealth. It has been well established that a rise in wealth is expected to increase consumption and lead to lower savings. This is particularly true in the US where home equity loans and home equity lines of credit are prevalent and enable homeowners to borrow against their equity and consume any increase in the value of their homes.

The other determinants of private saving rate are, by and large, similar to the determinants of personal saving rate with some exceptions. Including mortgage debt related variables leads to a larger change in the explanatory power of the variables for private saving rate than it does for personal saving rate. It is worth noting that public saving rate has stronger crowding out effect on the private saving rate than on the personal saving rate. This result is intuitive in the sense that corporations respond more promptly than households to the tax and spending decisions of the government. Contrary to the case of personal saving rate case, the share of mortgage interest payment has no significant influence on private saving rate. The effect of non-mortgage payments on private saving rate is negative in the full sample period and insignificant in the sub-sample period, highlighting the impact of the great recession on the role of non-mortgage debt payments for private saving rate.

It is interesting to point out that mortgage payments have a larger negative effect on private saving rate than non-mortgage payments. This is in contrast to our earlier result for personal saving rate where non-mortgage debt payments have a larger negative effect than mortgage payments.

Table 7 reports the results when after-tax mortgage payments are used instead of before-tax mortgage payments. Similar to the personal saving rate analysis, after-tax mortgage payments have a larger impact on private saving rate than before-tax mortgage payments. Furthermore, the effect is larger for the full sample analysis than the sub-sample analysis of 1987-2007 period. The other results of Table 6 are very similar to the results reported in Table 6 where we use before-tax mortgage payments.

As a diagnostic test for possible endogeneity of the regressors (nonorthogonality between regressors and errors), we repeat the analysis using the generalized method of moments (GMM). The results are reported in tables 8-11 in the appendix. The signs and the magnitudes of the coefficients of the variables in tables 8-11 are very similar to those reported in tables 4-7.

## 6 Conclusion

This paper examines the main determinants of the personal and private saving rates in the US, with a special focus on the role of mortgage payments. We believe that mortgage debt is an important determinant of saving rate. On the one hand, mortgage payments can serve as a disciplining device for borrowers to save for monthly mortgage payments and accumulate home equity. On the other hand, households and firms could potentially decrease their savings in other forms as they save for their mortgage payments. Furthermore, they can use the equity in their house, accumulated either through mortgage payments and/or through price appreciation, to obtain additional debt. Thus, the net impact of increased mortgage debt on saving rate is ambiguous and requires empirical investigation.

Our results show significant impact of mortgage debt on personal and private saving rates in the US. Increasing mortgage debt payments by ten percent leads to a 9.1 percent contraction in the personal saving rate and a 12.4 contraction in the private saving rate. We also find that the recent financial crisis in the US has magnified the negative impact of mortgage debt on both personal and private saving rates. Furthermore, we discover that including mortgage related variables as an explanatory variable leads to sizable changes in the impact of some of the other variables on both saving rates in the US. The other determinants of both saving rates are public saving rate with negative impact and interest rate and terms of trade with positive impacts.

The current study has important policy implications for monetary policy and government policies that subsidize mortgage borrowing. It shows that government policies designed to encourage mortgage borrowing, such as tax deductibility of mortgage interest payments, will have an impact on future economic growth through their impact on saving rate. It also shows that interest rate policy and macroprudential measures can have not only a direct impact on saving rate, but also an indirect impact through their influence on the growth of mortgage and non-mortgage credit.

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**Table 4: Personal Saving Rate (Independent Variable: Mortgage Payments)**

	1987-2013			1987-2007		
Lagged Personal Saving Rate	0.713*** (0.062)	0.619*** (0.072)	0.523*** (0.083)	0.727*** (0.064)	0.594*** (0.078)	0.367*** (0.095)
Growth Rate of Per Capita Real Income	0.003 (0.12)	-0.034 (0.118)	-0.001 (0.119)	0.037 (0.133)	-0.016 (0.129)	-0.084 (0.122)
VIX	0.013 (0.008)	0.013* (0.008)	0.024** (0.009)	0.016 (0.01)	0.015 (0.01)	0.014 (0.01)
Interest Rate	0.168*** (0.049)	0.222*** (0.053)	0.282*** (0.057)	0.203*** (0.057)	0.25*** (0.057)	0.294*** (0.076)
Terms of Trade	0.029 (0.029)	0.035 (0.028)	0.026 (0.03)	0.074* (0.037)	0.073** (0.036)	0.134*** (0.037)
Public Saving Rate	-0.139*** (0.042)	-0.193*** (0.047)	-0.226*** (0.051)	-0.219*** (0.058)	-0.298*** (0.063)	-0.387*** (0.064)
Growth Rate of DJIA	0 (0.004)	-0.002 (0.004)	-0.004 (0.004)	0.001 (0.004)	0 (0.004)	-0.002 (0.004)
Recession Dummy	0.137 (0.228)	0.288 (0.231)	0.374 (0.254)	0.083 (0.232)	0.176 (0.225)	0.468* (0.237)
Mortgage Payments		-0.471** (0.195)	-0.909*** (0.262)		-0.679*** (0.249)	-0.885*** (0.323)
Total Personal Debt			0.09* (0.048)			-0.153** (0.064)
Mortgage Debt / Total Personal Debt			-0.161 (0.102)			-0.074 (0.109)
Share of Mortgage Int. Payment			-0.0283* (1.512)			0.0185 (1.901)
Non-Mortgage Loan Payments			-1.184** (0.523)			-1.042* (0.553)
<i>Adj. R</i> <sup>2</sup>	0.799	0.809	0.818	0.875	0.885	0.901
N	106	106	106	83	83	83

**Table 5: US Personal Saving Rate (Independent Variable: After-tax Mortgage Payments)**

	1987-2013			1987-2007		
Lagged Personal Saving Rate	0.713*** (0.062)	0.663*** (0.067)	0.572*** (0.079)	0.727*** (0.064)	0.663*** (0.069)	0.434*** (0.09)
Growth Rate of Per Capita Real Income	0.003 (0.12)	-0.018 (0.119)	-0.002 (0.122)	0.037 (0.133)	0.026 (0.13)	-0.032 (0.121)
VIX	0.013 (0.008)	0.013 (0.008)	0.019** (0.009)	0.016 (0.01)	0.016 (0.01)	0.013 (0.011)
Interest Rate	0.168*** (0.049)	0.207*** (0.053)	0.265*** (0.058)	0.203*** (0.057)	0.248*** (0.059)	0.307*** (0.077)
Terms of Trade	0.029 (0.029)	0.034 (0.028)	0.034 (0.031)	0.074* (0.037)	0.083** (0.037)	0.152*** (0.039)
Public Saving Rate	-0.139*** (0.042)	-0.2*** (0.053)	-0.245*** (0.059)	-0.219*** (0.058)	-0.302*** (0.068)	-0.412*** (0.07)
Growth Rate of DJIA	0 (0.004)	-0.002 (0.004)	-0.005 (0.005)	0.001 (0.004)	-0.001 (0.004)	-0.003 (0.004)
Recession Dummy	0.137 (0.228)	0.257 (0.235)	0.424 (0.269)	0.083 (0.232)	0.183 (0.231)	0.512** (0.252)
Mortgage Payment		-0.572* (0.308)	-1.312*** (0.451)		-0.653** (0.298)	-1.031** (0.469)
Total Personal Debt			0.05 (0.045)			-0.167** (0.065)
Mortgage Debt / Total Personal Debt			-0.118 (0.102)			-0.027 (0.108)
Share of Mortgage Int. Payment			-0.0263* (1.541)			0.0122 (1.999)
Non-Mortgage Loan Payment			-1.326** (0.58)			-1.049* (0.586)
<i>Adj. R</i> <sup>2</sup>	0.799	0.804	0.811	0.875	0.882	0.898
N	106	106	106	83	83	83

**Table 6: US Private Saving Rate (Independent Variable: Mortgage Payments)**

	1987-2013			1987-2007		
Lagged Private Saving Rate	0.682*** (0.058)	0.428*** (0.07)	0.335*** (0.081)	0.73*** (0.073)	0.551*** (0.083)	0.447*** (0.098)
Growth Rate of Per Capita Real Income	0.213* (0.115)	0.168 (0.103)	0.118 (0.104)	0.078 (0.145)	0.02 (0.134)	0.026 (0.135)
VIX	0.011 (0.008)	0.012* (0.007)	0.009 (0.007)	0.019* (0.011)	0.016 (0.01)	0.007 (0.011)
Interest Rate	0.155*** (0.039)	0.238*** (0.038)	0.238*** (0.038)	0.14** (0.056)	0.175*** (0.053)	0.245*** (0.079)
Terms of Trade	0.074*** (0.027)	0.074*** (0.024)	0.079*** (0.027)	0.069* (0.039)	0.058 (0.036)	0.069* (0.038)
Public Saving Rate	-0.266*** (0.043)	-0.424*** (0.048)	-0.419*** (0.052)	-0.248*** (0.063)	-0.352*** (0.065)	-0.303*** (0.081)
Growth Rate of DJIA	0.001 (0.004)	0.002 (0.004)	0.002 (0.004)	0.003 (0.005)	0.003 (0.004)	0.002 (0.004)
Recession Dummy	0.168 (0.231)	0.16 (0.204)	0.286 (0.222)	0.039 (0.251)	0.012 (0.232)	0.089 (0.244)
Mortgage Payments		-1.034*** (0.195)	-1.236*** (0.255)		-0.923*** (0.247)	-0.876** (0.402)
Total Private Debt			-0.025 (0.022)			-0.038 (0.031)
Mortgage Debt / Total Private Debt			-0.004 (0.06)			0.08 (0.116)
Share of Mortgage Int. Payment			0.072 (1.191)			-0.0183 (2.106)
Non-Mortgage Loan Payments			-0.685* (0.412)			-0.633 (0.531)
<i>Adj. R</i> <sup>2</sup>	0.891	0.915	0.917	0.855	0.877	0.88
N	106	106	106	83	83	83

**Table 7: US Private Saving Rate (Independent Variable: After-tax Mortgage Payments)**

	1987-2013			1987-2007		
Lagged Private Saving Rate	0.682*** (0.058)	0.567*** (0.06)	0.487*** (0.072)	0.73*** (0.073)	0.643*** (0.075)	0.518*** (0.091)
Growth Rate of Per Capita Real Income	0.213* (0.115)	0.183* (0.107)	0.132 (0.109)	0.078 (0.145)	0.066 (0.137)	0.069 (0.135)
VIX	0.011 (0.008)	0.011 (0.007)	0.006 (0.008)	0.019* (0.011)	0.018* (0.01)	0.008 (0.011)
Interest Rate	0.155*** (0.039)	0.214*** (0.038)	0.22*** (0.04)	0.14** (0.056)	0.189*** (0.055)	0.266*** (0.079)
Terms of Trade	0.074*** (0.027)	0.077*** (0.025)	0.089*** (0.028)	0.069* (0.039)	0.077** (0.037)	0.088** (0.041)
Public Saving Rate	-0.266*** (0.043)	-0.405*** (0.052)	-0.423*** (0.062)	-0.248*** (0.063)	-0.365*** (0.07)	-0.317*** (0.098)
Growth Rate of DJIA	0.001 (0.004)	-0.001 (0.004)	-0.002 (0.004)	0.003 (0.005)	0.001 (0.004)	0 (0.004)
Recession Dummy	0.168 (0.231)	0.263 (0.215)	0.462* (0.248)	0.039 (0.251)	0.108 (0.239)	0.193 (0.275)
Mortgage Payments		-1.177*** (0.285)	-1.659*** (0.467)		-0.952*** (0.303)	-0.95 (0.637)
Total Private Debt			-0.017 (0.025)			-0.043 (0.033)
Mortgage Debt / Total Private Debt			-0.037 (0.063)			0.083 (0.12)
Share of Mortgage Int. Payment			0.0655 (1.253)			-0.0197 (2.254)
Non-Mortgage Loan Payments			-0.958* (0.532)			-0.711 (0.629)
<i>Adj. R</i> <sup>2</sup>	0.891	0.906	0.908	0.855	0.871	0.875
N	106	106	106	83	83	83

## 7 Appendix: GMM Estimation

**Table 8:** Personal Saving Rate (Independent Variable: Mortgage Payments) - GMM

	1987-2013			1987-2007		
Lagged Personal Saving Rate	0.73*** (0.098)	0.624*** (0.147)	0.525*** (0.144)	0.771*** (0.091)	0.601*** (0.162)	0.344* (0.194)
Growth Rate of Per Capita Real Income	0 (0.086)	-0.037 (0.087)	0 (0.092)	0.013 (0.093)	-0.037 (0.09)	-0.044 (0.086)
VIX	0.014* (0.007)	0.014* (0.008)	0.024** (0.009)	0.017** (0.007)	0.015* (0.008)	0.015 (0.011)
Interest Rate	0.139*** (0.042)	0.21*** (0.072)	0.284*** (0.083)	0.115*** (0.037)	0.207*** (0.078)	0.294*** (0.088)
Terms of Trade	-0.001 (0.003)	0.019* (0.011)	0.033** (0.013)	-0.003 (0.003)	0.03* (0.018)	0.057** (0.022)
Public Saving Rate	-0.109*** (0.035)	-0.181*** (0.062)	-0.228*** (0.073)	-0.138*** (0.049)	-0.264*** (0.093)	-0.341*** (0.097)
Growth Rate of DJIA	0 (0.004)	-0.002 (0.003)	-0.004 (0.003)	0.001 (0.004)	0 (0.004)	-0.003 (0.004)
Recession Dummy	0.075 (0.172)	0.263 (0.21)	0.385 (0.288)	-0.022 (0.172)	0.13 (0.147)	0.279 (0.198)
Mortgage Payments		-0.494** (0.243)	-0.886*** (0.324)		-0.771** (0.386)	-1.243*** (0.444)
Total Personal Debt			0.088*** (0.033)			-0.088 (0.054)
Mortgage Debt / Total Personal Debt			-0.164** (0.075)			-0.038 (0.111)
Share of Mortgage Int. Payment			-0.027** (0.012)			-0.029** (0.014)
Non-Mortgage Loan Payments			-1.178** (0.536)			-1.083** (0.531)
<i>J – test</i>	0	0	0	0	0	0
N	106	106	106	83	83	83

**Table 9: Personal Saving Rate (Independent Variable: After-tax Mortgage Payments) - GMM**

	1987-2013			1987-2007		
Lagged Personal Saving Rate	0.73*** (0.098)	0.67*** (0.13)	0.572*** (0.134)	0.771*** (0.091)	0.697*** (0.119)	0.49*** (0.156)
Growth Rate of Per Capita Real Income	0 (0.086)	-0.021 (0.087)	-0.003 (0.091)	0.013 (0.093)	0.003 (0.094)	0.02 (0.108)
VIX	0.014* (0.007)	0.014* (0.008)	0.019** (0.008)	0.017** (0.007)	0.017** (0.007)	0.015 (0.01)
Interest Rate	0.139*** (0.042)	0.191*** (0.068)	0.265*** (0.077)	0.115*** (0.037)	0.174*** (0.067)	0.258*** (0.084)
Terms of Trade	-0.001 (0.003)	0.015 (0.011)	0.033** (0.015)	-0.003 (0.003)	0.016 (0.012)	0.04** (0.018)
Public Saving Rate	-0.109*** (0.035)	-0.186** (0.073)	-0.245*** (0.081)	-0.138*** (0.049)	-0.238*** (0.091)	-0.322*** (0.1)
Growth Rate of DJIA	0 (0.004)	-0.002 (0.004)	-0.005 (0.004)	0.001 (0.004)	-0.001 (0.004)	-0.004 (0.005)
Recession Dummy	0.075 (0.172)	0.226 (0.192)	0.423 (0.291)	-0.022 (0.172)	0.099 (0.166)	0.261 (0.225)
Mortgage Payments		-0.613 (0.379)	-1.316** (0.538)		-0.71 (0.433)	-1.381** (0.588)
Total Personal Debt			0.05* (0.027)			-0.089 (0.066)
Mortgage Debt / Total Personal Debt			-0.118 (0.077)			0.022 (0.132)
Share of Mortgage Int. Payment			-0.026** (0.013)			-0.028* (0.016)
Non-Mortgage Loan Payments			-1.327** (0.609)			-0.985* (0.571)
<i>J – test</i>	0	0	0	0	0	0
N	106	106	106	83	83	83

**Table 10: Private Saving Rate (Independent Variable: Mortgage Payments) - GMM**

	1987-2013			1987-2007		
Lagged Personal Saving Rate	0.688*** (0.116)	0.417*** (0.124)	0.33** (0.134)	0.757*** (0.167)	0.55*** (0.165)	0.451** (0.199)
Growth Rate of Per Capita Real Income	0.215** (0.099)	0.166* (0.086)	0.118 (0.084)	0.058 (0.102)	0.016 (0.094)	-0.006 (0.09)
VIX	0.012** (0.006)	0.013* (0.007)	0.01 (0.007)	0.021*** (0.008)	0.016* (0.009)	0.009 (0.011)
Interest Rate	0.105*** (0.035)	0.231*** (0.058)	0.236*** (0.062)	0.071 (0.051)	0.168** (0.07)	0.183** (0.077)
Terms of Trade	0.007 (0.006)	0.059*** (0.014)	0.074*** (0.017)	0.003 (0.006)	0.05** (0.02)	0.063** (0.031)
Public Saving Rate	-0.209*** (0.056)	-0.42*** (0.084)	-0.417*** (0.087)	-0.184** (0.091)	-0.346*** (0.113)	-0.308** (0.148)
Growth Rate of DJIA	0.001 (0.004)	0.002 (0.004)	0.002 (0.004)	0.003 (0.004)	0.003 (0.004)	0.003 (0.004)
Recession Dummy	0.031 (0.27)	0.129 (0.235)	0.274 (0.239)	-0.029 (0.27)	0.003 (0.236)	0.107 (0.241)
Mortgage Payments		-1.083*** (0.262)	-1.26*** (0.307)		-0.947** (0.376)	-1.055* (0.582)
Total Private Debt			-0.025 (0.021)			-0.041 (0.03)
Mortgage Debt / Total Private Debt			0.002 (0.05)			0.01 (0.127)
Share of Mortgage Int. Payment			0.006 (0.012)			0.006 (0.011)
Non-Mortgage Loan Payments			-0.694 (0.423)			-0.575 (0.619)
<i>J - test</i>	0	0	0	0	0	0
N	106	106	106	83	83	83

**Table 11: Private Saving Rate (Independent Variable: After-tax Mortgage Payments) - GMM**

	1987-2013			1987-2007		
Lagged Personal Saving Rate	0.688*** (0.116)	0.559*** (0.109)	0.48*** (0.125)	0.757*** (0.167)	0.655*** (0.149)	0.549*** (0.171)
Growth Rate of Per Capita Real Income	0.215** (0.099)	0.18* (0.093)	0.131 (0.088)	0.058 (0.102)	0.052 (0.106)	0.058 (0.102)
VIX	0.012** (0.006)	0.012* (0.006)	0.008 (0.007)	0.021*** (0.008)	0.019** (0.008)	0.011 (0.01)
Interest Rate	0.105*** (0.035)	0.195*** (0.048)	0.209*** (0.049)	0.071 (0.051)	0.146** (0.061)	0.187** (0.081)
Terms of Trade	0.007 (0.006)	0.044*** (0.014)	0.065*** (0.021)	0.003 (0.006)	0.033** (0.015)	0.048* (0.027)
Public Saving Rate	-0.209*** (0.056)	-0.391*** (0.086)	-0.42*** (0.096)	-0.184** (0.091)	-0.329*** (0.108)	-0.286** (0.143)
Growth Rate of DJIA	0.001 (0.004)	-0.001 (0.004)	-0.002 (0.005)	0.003 (0.004)	0.001 (0.005)	0 (0.005)
Recession Dummy	0.031 (0.27)	0.205 (0.238)	0.424 (0.284)	-0.029 (0.27)	0.067 (0.239)	0.15 (0.293)
Mortgage Payments		-1.294*** (0.396)	-1.819*** (0.611)		-1.016** (0.421)	-1.247 (0.837)
Total Private Debt			-0.014 (0.025)			-0.044 (0.032)
Mortgage Debt / Total Private Debt			-0.016 (0.062)			0.071 (0.114)
Share of Mortgage Int. Payment			0.003 (0.014)			-0.002 (0.011)
Non-Mortgage Loan Payments			-1.034* (0.596)			-0.581 (0.738)
<i>J – test</i>	0	0	0	0	0	0
N	106	106	106	83	83	83