Exploring Determinants Of U.S. Household Debt

Erin Turinetti, Indiana University South Bend, USA
Hong Zhuang, Indiana University South Bend, USA

ABSTRACT

The fast growing household debt in the U.S. has become a concern to the general public and policy makers. This paper attempts to explore the factors influencing the U.S. household indebtedness using quarterly data over the period of 1980-2010 and controlling for the time series issues. The estimated results show that the unemployment rate, interest rate, disposable personal income per capita, share of retiring population, and educational attainment are negatively associated with the household debt, while housing prices, consumer confidence, and the share of working-age population are positively related to the household borrowing.

Keywords: Household Indebtedness; Household Debt

I. INTRODUCTION

The average U.S. households have consistently spent much more than their incomes and borrowed to make up the difference in an era of easy credit (Wolf, 2009). An increasing practice of spending-beyond-one's means and expanding asset-price bubbles fueled each other. Yet, when the expansion of real estate bubbles came to an end, this spending behavior could not continue and U.S. households suffered the bitter consequences. The debt service ratio (DSR) – consumer debt service payments to consumer disposable income - indicates the financial impact of the debt on households. Figure 1 illustrates the rapid increase in the DSR from 1980 to 2007, with a sharp upturn beginning in the mid-1990s and continuing with only slight interruptions ever since. The high DSR is unhealthy for individual households and the national economy, as it assisted in the accumulation of equity market bubbles which predicated the economic recession of 2007-2009 and increased the financial vulnerability of households to economic shocks. Furthermore, the increase in household borrowing is not sustainable, which may result in instability for the financial system and the macroeconomy. In light of the fast growing household debt and its harmful effects, it is important to understand the factors determining the household debt.

The issues over the rising household debt and its causing factors have been examined by studies including Soman and Cheema (2002), Debelle (2004), Hurst and Stafford (2004) and Dynan and Kohn (2007). Soman and Cheema (2002) focus on consumer credit and examine the impact of credit limits, age, education, interest rate, gender, wage and income from all sources on the outstanding credit card balance using the Survey of Consumer Finances (SCF) in 1998. Debelle (2004) employs a simple simulation to examine the influence of inflation, taxes and debt-service constraints on aggregate household debt levels and finds that changes in inflation and liquidity constraints can induce a large rise in the debt-to-income ratio. Hurst and Stafford (2004) study the probability of refinancing for households using micro data from the Panel Study of Income Dynamics (PSID). They find that households who experienced unemployment between 1991 and 1996 and who had zero liquid assets going into 1991 were 25% more likely to refinance than otherwise similar households. Dynan and Kohn (2007) discuss the factors influencing household indebtedness of mortgage and consumer debt using the SCF data conducted by the Federal Reserve Board in 1983, 1989, 1992, 1995, 1998, 2001 and 2004. Those factors include impatience, precautionary saving, interest rates, expected income, demographics, house prices and financial innovation.

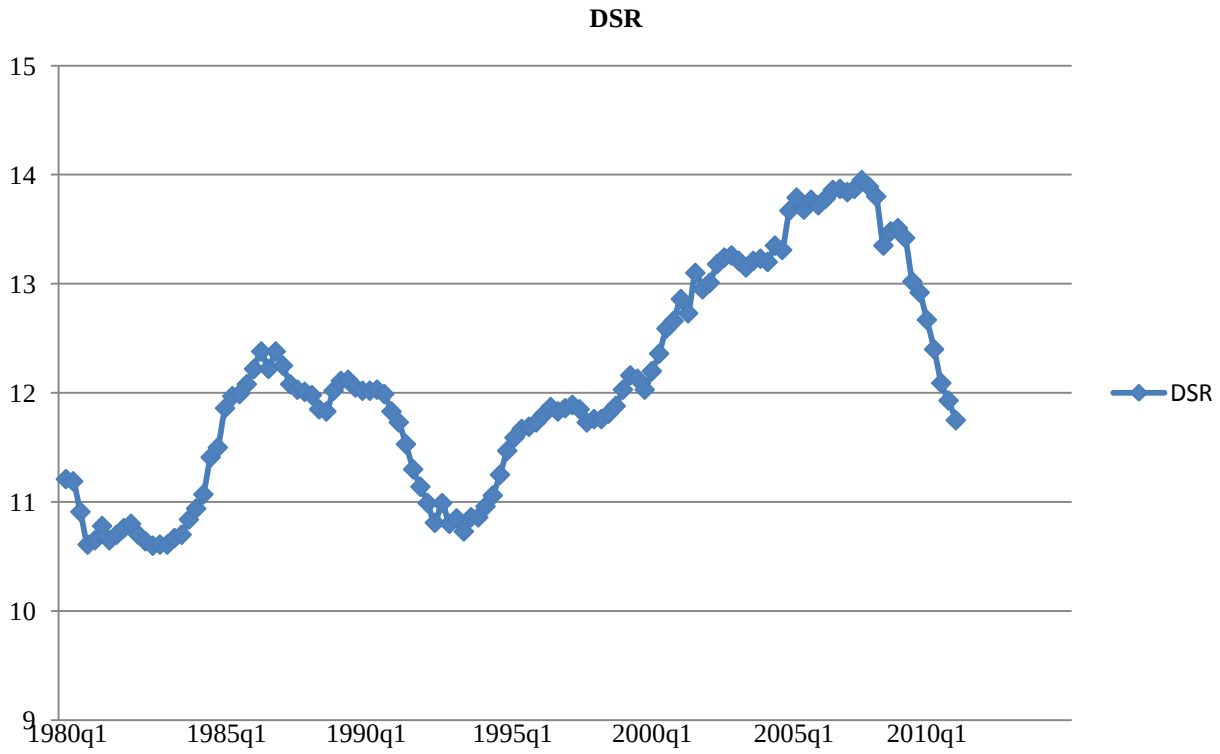

Figure 1

However, there are limitations in the previous studies. First, the basic descriptive statistics and scatter diagram are employed to describe the relationship between household indebtedness and the influential factors. Dynan and Kohn (2007) use bar graphs and line charts to analyze the relationship between impatience, precautionary saving, expected income, demographics, house prices, financial innovation and debt. Yet, the regression analysis does not include factors discussed in descriptive statistical analysis, such as impatience, precautionary saving, and financial innovation. Second, the regression analyses in Dynan and Kohn (2007) and Soman and Cheema (2002) fail to take into account the macroeconomic factors, such as unemployment rate and interest rate. Third, the cross-country study in Debelle (2004) may have an inconsistent measure of household debt and therefore undermine the estimated results.

This paper intends to explore factors affecting household indebtedness in the U.S. accounting for the macroeconomy, housing prices, demographics, and educational attainment. To address for the time series issues related to quarterly data, the regression analysis includes the contemporaneous and up to 4-period lagged values of the independent variables and controls for time trend and seasonality. The unemployment rate, interest rate, disposable personal income per capita, the share of retiring population and the share of population aged 25 and over with at least 4-year high school education appear to be negatively associated with household debt, while consumer sentiment index and the share of working age population are positively related to household borrowing. The housing price index exhibits a positive effect on household debt related to mortgage payment. Yet, the share of population aged 25 and over with college education and more presents mixed effects on household debt.

The structure of the remainder of the paper is organized as follows. Section II presents the econometric model. Section III describes the data used in this study. Section IV analyzes the regression results. Section V concludes the paper.

II. ECONOMETRIC MODEL

The following model is utilized to explore influential factors of household debt.

$$DSR_t = \beta_0 + \beta_1 U_t + \beta_2 FF_t + \beta_3 HPI_t + \beta_4 CSI_t + \beta_5 DPI_t + \beta_6 Working_t + \beta_7 Retire_t + \beta_8 High_t + \beta_9 College_t + \epsilon_t \quad (1)$$

Where
- DSR_t = Debt service ratio
- U_t = Unemployment rate
- FF_t = Federal funds rate
- HPI_t = Housing price index
- CSI_t = Consumer sentiment index
- DPI_t = Per capita disposable personal income
- $Working_t$ = Percent of working age population in the population
- $Retire_t$ = Percent of retiring age population in the population
- $High_t$ = Percent of population aged 25 and over who completed 4 years of high school and over
- $College_t$ = Percent of population aged 25 and over who completed 4 years of college and over
- ϵ_t = Random Error Term

The dependent variable is the household debt service ratio (DSR) that measures household indebtedness. The DSR is an estimate of the ratio of debt payments to disposable personal income. Debt payments consist of the estimate required payments on outstanding mortgage and consumer debt. Further investigation utilizes various measures of household debt, including the financial obligations ratio (FOR) that adds automobile lease payments, rental payments on tenant-occupied property, homeowners' insurance, and property tax payments to the debt service ratio. In addition, the FORs for homeowners and renters are used to examine the impact of the independent variables on different types of household debt.[1] Furthermore, the homeowner FOR is further divided into the homeowner mortgage FOR including payments on mortgage debt, homeowners' insurance, and property taxes and the homeowner consumer FOR including payments on consumer debt and automobile leases to reflect different components of homeowner indebtedness.

An increase in the unemployment rate implies a tighter budget for households and curbs household consumption from all perspectives. Historical data show that the personal saving rate increases during recessions, indicating that households consume less and thus borrow less. Therefore, the unemployment rate is expected to have a negative effect on the DSR.

Based on the Keynesian theory, the interest rate is inversely related to household consumption and positively related to household saving. As the interest rate decreases, household tend to consume more and save less, implying more debt accumulation. Hence, the interest rate is anticipated to have a negative coefficient.

The housing price index is a measure of house prices and is expected to have a positive sign: higher housing prices lead to higher mortgage payments and a higher DSR.

The consumer sentiment index measures consumer attitudes and expectations. A higher index rate implies greater consumer confidence on economic future. Therefore, consumers may incur greater borrowing and a higher DSR.

As disposable personal income per capita is positively related to household consumption, higher disposable income is likely to lead to higher borrowing and household debt. However, the DSR is a ratio of debt payment to disposable personal income. The sign of disposable personal income is undetermined depending on whether the increase in household borrowing exceeds the increase in disposable personal income.

[1] The above definition about household DSR and FOR is cited from the website of the Federal Reserve Board. http://www.federalreserve.gov/releases/housedebt/

Debt use varies substantially across age groups and across households with different levels of education (Dynan and Kohn, 2007). The percent of working and retiring age populations in the total population intends to measure the impact of demographics on the DSR.[2] The higher percent of working age population is expected to relate to a higher DSR, as the working age population is likely to incur more consumption and borrowing. The higher percent of retiring age population is associated with a lower DSR, as the retiring age population is assumed to be more conservative about consumption and borrowing than other populations.

The percent of population aged 25 and over who has completed at least 4 year high school or college measures the educational attainment in the population. The signs of the educational attainment variables are ambiguous as the prior studies have contradicting predictions. Soman and Cheema (2002) suggest a negative coefficient of educational attainment on outstanding credit card balance using the SCF dataset in 1998. Dynan and Kohn (2007) propose a positive relationship between higher education and greater debt use based on the time series SCF dataset over 1983 to 2004.

Due to the time series data used in this study, a few estimation issues need to be addressed in the regression analysis. First, the original model only includes the contemporaneous value of explanatory variables, assuming that all of the interactions among the variables of the model take place within the same time period. However, it may take time for the dependent variable, DSR to respond to changes in the explanatory variables. Therefore, a finite distributed lag model will be used in the estimation to capture the relationship between current and past values of explanatory variables and the dependent variable. Considering that the data are in quarterly basis, four periods of lagged values of each independent variable are added in the estimation. Furthermore, as the lagged values of the variables are highly correlated, the individual lag coefficient is often insignificant. Hence, the joint coefficients of current and past values and the joint significance will be presented in the section of data analysis. Second, a trend variable will be added to the econometric model to detrend the data. This practice is necessary to avoid spurious results, as many economic time series are trending: growing over time (Wooldrige, 2009). Third, quarterly data are likely to present seasonality features. Therefore, three dummy variables are included in the estimation to adjust for seasonal factors.

III. DATA

This study uses quarterly data in the U.S. over the period 1980 to 2010 from various sources, resulting in 124 observations.

The data on the DSR, FOR, renter and homeowner FORs, and homeowner mortgage and homeowner consumer FORs are from the website of the Federal Reserve Board and available from 1980 forward. The data on the federal funds rate are from the website of the Federal Reserve Bank where the monthly data are available. The federal funds rate used in this study is the quarterly average.

The unemployment rate is obtained from the website of the Bureau of Labor Statistics (BLS), where the monthly data are available. The unemployment rate in this study is the quarterly average.

The housing price index (HPI) is a broad measure of the movement of single-family house prices. The quarterly data on HPI are available from the website of Federal Housing Finance Agency and the base year of HPI is 1980. As the data on HPI only retrospect to 1991, the missing values between 1980 and 1989 are filled in via a linear interpolation.

The consumer sentiment index (CSI) is obtained from the website of the Survey of Consumers, University of Michigan. The quarterly data are available at the website.

Per capita disposable personal income is obtained from the website of the Bureau of Economic Analysis (BEA). This variable is in chained (2005) dollars.

[2] The working age population is defined as the population aged between 18 and 64 and the working age population is defined as the population aged 65 and over.

The data on demographics and educational attainment are obtained from the website of the U.S. Census Bureau. As the age and education data are available at the yearly basis, the quarterly observations take the same value during the same year.

Table 1 presents descriptive statistics for all variables.

Table 1 Descriptive Statistics

Variable	Observation	Mean	Standard Deviation	Minimum	Maximum
DSR	124	12.07	0.99	10.60	13.95
FOR	124	17.20	0.89	15.45	18.85
Renter FOR (FORR)	124	25.73	2.00	22.41	31.05
Homeowner FOR (FORH)	124	15.25	1.07	13.40	17.55
Homeowner mortgage FOR (FORM)	124	9.59	0.77	8.18	11.29
Homeowner consumer FOR (FORC)	124	5.66	0.62	4.56	6.66
Unemployment Rate	124	6.30	1.64	3.90	10.67
Interest Rate	124	5.83	3.84	0.12	17.78
Housing Price Index	124	131.32	45.71	81.08	224.03
Consumer Sentiment Index	124	86.96	12.66	54.40	110.10
Disposable Personal Income Per Capita	124	26023.38	4548.90	18629.00	33480.00
The Share of Working-age Population	124	61.87	0.68	60.58	63.13
The Share of Retiring Population	124	12.38	0.43	11.28	12.90
The Share of Population Aged 25 and over who has completed 4-year High School and Over	124	79.96	5.39	68.60	86.70
The Share of Population Aged 25 and over who has completed 4-year College and Over	124	23.37	3.90	17.00	29.50

IV. DATA ANALYSIS

Table 2 presents the regression results. The estimated coefficients in the table are the joint coefficients of contemporaneous and one- to four- period lagged values of independent variables.[3] The robust standard errors of the joint coefficients are presented in the parentheses. Column 1 shows the results using DSR as the dependent variable. The financial obligations ratio (FOR) including automobile lease payments, rental payments, homeowners' insurance and property tax payments is used as the dependent variable to explore the impact of the explanatory variables on a broader measure of household debt. The regression results are presented in column 2. To further investigate the influence of the explanatory variables on various components of FOR, the renter FOR, homeowner FOR, the homeowner mortgage FOR and the homeowner consumer FOR are included as the dependent variables and the results are displayed in columns 3, 4, 5 and 6 respectively.

Overall, the econometric model fits the data well with the independent variables showing the expected signs and statistical significance in a large number of regressions and the coefficient of determination above 95 percent in all regressions. As for the macroeconomic variables, the joint coefficients of unemployment rate, interest rate, and disposable personal income per capita are negative and statistically significant throughout all regressions, which imply negative relationships between the unemployment rate, interest rate, household income and household debt. The consumer sentiment index presents positive and significant joint coefficients in all regressions, except for the homeowner mortgage FOR.

The joint coefficients of the housing price index are significantly positive for homeowner FOR and homeowner mortgage FOR, significantly negative for renter FOR, and insignificant for other measures of household debt. The housing price index reflects the movement of single-family house prices and is more closely related to

[3] Due to the higher correlation between the current and lagged values of the independent variables, the estimated coefficients are mostly insignificant that results in little meaningful discussions. Therefore, the joint coefficients are computed and discussed in this section. The original regression results are available upon request.

households' mortgage payments than other types of household debt. Therefore, the variable exhibits positive and significant coefficients for homeowner and homeowner mortgage FORs respectively. As for the renters, the debt burden may be alleviated as the rental payment is likely to be lower than the mortgage payment undertaken by the homeowners under the increasing housing prices. Therefore, a negative impact of housing price index is observed for the renter FOR.

As for the demographic variables, the total effects of the share of working age population and its lagged values are significantly positive in all regressions, indicating that the higher share of working age population is associated with increasing household debt in the U.S. The share of retiring population has significantly negative joint coefficients for all regressions, except for the regression regarding homeowner FOR and homeowner mortgage FOR.

The educational attainment variable measuring high school education and higher presents negative and significant joint coefficients in all regressions, except for the renter FOR. However, the joint coefficients of college educational attainment are mixed with insignificant coefficients for DSR, FOR, homeowner FOR, and homeowner mortgage FOR, statistically negative coefficients for renter FOR, and statistically positive for homeowner consumer FOR.

Table 2: Regression Results

	(1)	(2)	(3)	(4)	(5)	(6)
	DSR	**FOR**	**FORR**	**FORH**	**FORM**	**FORC**
Unemployment Rate	-0.5339	-0.6240	-0.9087	-0.5940	-0.1721	-0.4189
	(0.0490)***	(0.0601)***	(0.1817)***	(0.0518)***	(0.0275)***	(0.0374)***
Interest Rate	-0.1782	-0.2043	-0.1457	-0.2114	-0.0197	-0.1907
	(0.0267)***	(0.0321)***	(0.1019)	(0.0264)***	(0.0125)	(0.0187)***
Housing Price Index	0.0039	-0.0025	-0.1354	0.0203	0.0239	-0.0035
	(0.0059)	(0.0071)	(0.0188)***	(0.0060)***	(0.0028)***	(0.0043)
Consumer Sentiment Index	0.0288	0.0403	0.0948	0.0280	-0.0081	0.0358
	(0.0059)***	(0.0071)***	(0.0186)***	(0.0059)***	(0.0026)***	(0.0043)***
Disposable Personal Income Per Capita	-0.0010	-0.0013	-0.0007	-0.0014	-0.0005	-0.0008
	(0.0002)***	(0.0002)***	(0.0007)	(0.0002)***	(0.0001)***	(0.0001)***
The Share of Working-age Population	1.4964	1.9442	2.2224	1.9041	1.4610	0.4314
	(0.2551)***	(0.3037)***	(0.7852)***	(0.2790)***	(0.1387)***	(0.1901)**
The Share of Retiring Population	-1.3383	-1.5453	-10.7549	0.0554	1.4533	-1.3879
	(0.4324)***	(0.5069)***	(1.3858)***	(0.4603)	(0.2304)***	(0.3077)***
High School Education and Over	-0.3114	-0.3190	0.6482	-0.5205	-0.0807	-0.4367
	(0.0904)***	(0.1088)***	(0.3360)*	(0.0895)***	(0.0439)*	(0.0622)***
College Education and Over	0.1196	-0.1825	-2.3014	0.2501	-0.0879	0.3367
	(0.1537)	(0.1817)	(0.4271)***	(0.1626)	(0.0718)	(0.1103)***
Trend	0.142***	0.205***	0.455***	0.158***	0.0307	0.126***
	(0.0377)	(0.0461)	(0.130)	(0.0398)	(0.0194)	(0.0290)
Quarter 1	0.0322	0.0510	0.127	0.0182	0.0469	-0.0231
	(0.138)	(0.165)	(0.458)	(0.139)	(0.0590)	(0.108)
Quarter 2	0.102	0.122	0.185	0.0854	0.0576	0.0350
	(0.171)	(0.205)	(0.508)	(0.178)	(0.0826)	(0.126)
Quarter 3	0.0508	0.0626	0.165	0.0297	-0.0221	0.0529
	(0.125)	(0.145)	(0.470)	(0.128)	(0.0660)	(0.0972)
Constant	-22.58**	-31.10***	30.84	-42.39***	-79.80***	37.57***
	(9.708)	(11.36)	(32.80)	(10.36)	(5.316)	(6.835)
R-squared	0.981	0.965	0.957	0.981	0.991	0.975
Observations	120	120	120	120	120	120

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

V. CONCLUSION

Considering the fast rising U.S. household debt and its harmful effects on the economy, this paper intends to explore the factors determining household indebtedness in the U.S. to provide a better understanding of the causes of household borrowing behavior. Using quarterly data in the U.S from 1980 to 2010, this paper finds that the higher unemployment rate, interest rate, disposable personal income per capita, better education, and the larger share of retiring population help suppress household debt, while stronger consumer confidence and the greater share of working age population are associated with more household borrowing. The higher housing price is related to greater household mortgage debt, yet it presents little impact on the broader measures of household debt.

The educational attainment variable regarding college education and over displays mixed results in the regressions. A further examination on the impact of educational attainment is necessary to provide a better understanding on the effect of various levels of educational attainment on household indebtedness. Furthermore, a further study on the consequences of household debt on the economy should be considered.

AUTHOR INFORMATION

Erin Turinetti received a Bachelor's degree in Economics from Indiana University South Bend.

Hong Zhuang is an Assistant Professor of Economics at Indiana University South Bend. Dr. Zhuang received her PhD from University of Oregon, Oregon, U.S.A. Her specialized field is international economics and economic growth. Email: zhuangh@iusb.edu

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