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Exploring the link between household debt and income inequality: an asymmetric approach

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Abstract

We investigate the relationship between household debt and income inequality in the US allowing for asymmetry, using data over the period 1913-2008. We find evidence of an asymmetric cointegration between household debt and inequality for different regimes. Our results indicate that household debt only responds to positive changes in income inequality while there is no evidence of falling inequality significantly affecting household debt. The presence of asymmetry provides further empirical insights into the emerging literature on household debt and inequality.

1. Introduction

It is widely argued that household debt rises with inequality. But do falls in inequality repress household debt proportionately? Investigating the relationship between these two variables is of particular importance as the 2008 crisis is largely attributed to over-borrowing by the US

households.¹ Several explanations have been proposed to explain the rising levels of household debt, with income inequality amongst one of the most important contributors.

There are three main channels through which inequality relates to household debt. First, higher inequality leads to a higher supply of credit as the top income groups with higher propensities to save reinvest in the loanable funds market (see, Kumhof et al., 2015). Second, poorer households tend to maintain their living standards by borrowing in response to stagnating real wages (see, Iacoviello, 2008; Krueger, D. and Perri, F., 2006). Third, as income inequality increases, low- and middle-class households tend to borrow to keep their consumption at the levels of the upper social classes (see, Christen and Morgan, 2005); Frank and Levine, 2010); Georgarakos et al., 2014); Carr and Jayadev, 2015).

There are several empirical studies suggesting a positive relationship between household debt and inequality. However, most of these studies have assumed a linear combination between the two variables (e.g. Christen and Morgan, 2005; Barba and Pivetti, 2009; Berisha et al, 2015). Whatsoever, several macroeconomic variables are found to have non-linear combinations and exhibit asymmetry i.e. the increasing effects of a variable are different than its decreasing effects.²

Our paper contributes to the developing empirical literature on the relationship between household debt and inequality by allowing for asymmetric effects in the model. In terms of econometric methodology, we employ the recent approach of Shin *et al* (2014), using non-linear (NARDL) framework for US data. The remainder of the paper is organised as follows. Section 2 discusses the data and methodology. Section 3 discusses the results, and Section 4 concludes the paper.

2. Data and Methodology

We use annual data over the period 1913 to 2008 for the US. Household debt to GDP data are taken from Philippon (2015) while the Pareto Index capturing inequality is provided by The World Top Income Database.

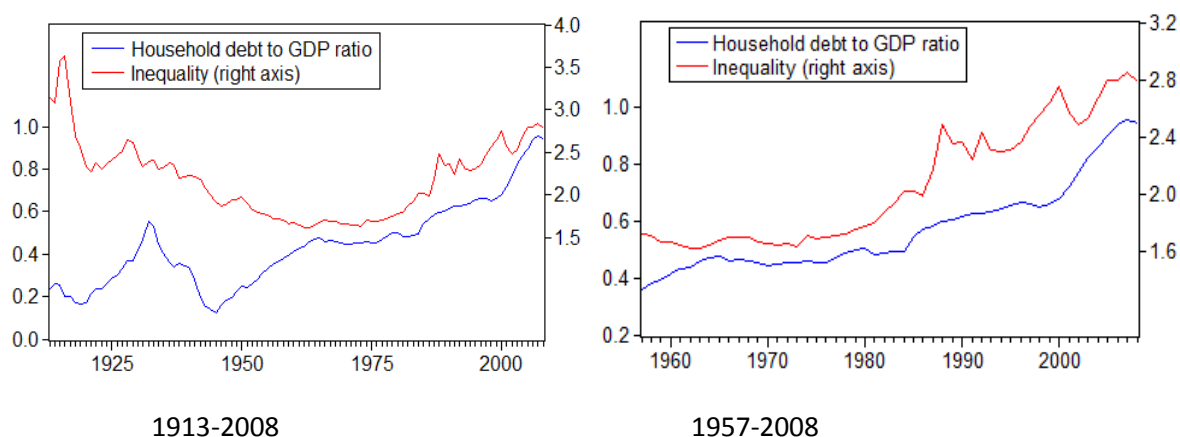
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¹ See Treeck (2014) and Mian and Sufi (2015, pp.4-30) for detailed discussions on household debt and crisis.

² See Neftci (1984) and Falk (1986).

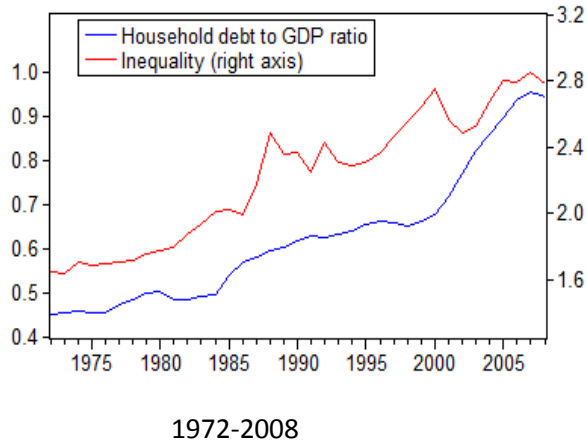
Figure 1 shows the historical time series of household debt and income inequality in the US. The figure indicates that inequality and household debt historically shared a similar trend. The periods preceding the two major crises, the Great Depression in 1930s and the Great Recession in 2007-09, are characterised by accumulating large stocks of household debt. This pattern in the US and other crisis hit countries is also highlighted by other studies e.g. Mian and Sufi (2015).

There is a clear indication of an exogenous structural break that occurred during World War II. Furthermore, in the post-war period until late 1950s, the series apparently suggest a shift in the dynamics of inequality and household debt as the variables seem to have moved in the opposite directions.³ The gap between the two lines has narrowed as inequality fell steadily while household debt rose sharply during 1945 to 1957. This might reflect the era of Great Compression, characterized by the implementation of progressive tax policies.⁴ From late 1950s onwards, both the variables have followed a similar trend.



³ We formally test this using a simple scattered plot, finding a strong negative relationship between the household debt and inequality under this regime as shown in the appendix, Figure A1. Hence, we will not include this regime in our post-war sample. In addition, there is a change in the frequency of data collection for the household series in 1953.

⁴ During this period, the overall inequality levels in the US fell due to rises in the income of the bottom 90%, while the income of the top of the income distribution remained stagnant (see Goldin et al (1991)).



Data Source: Philippon (2015)

We investigate the relationship between household debt and inequality for four different regimes in the US. First, we test the relationship for the whole sample i.e., 1913-2008. Second, we confine our analysis to the post-war sample 1957-2008.⁵ Third, we investigate the relationship for the sample 1972-2008, which marks the beginning of financial liberalisation in the US.⁶ Finally, we use the sample 1980-2008, which reflects a shift towards more liberalised markets.

Model

Following the recent approach of Shin *et al* (2014), the nonlinear asymmetric cointegrating regression is represented as follows.

$$HHD_t = \alpha_0 + \beta_1^+ INEQ_t^+ + \beta_1^- INEQ_t^- + \varepsilon_t \quad (2)$$

$$INEQ_t = INEQ_0 + INEQ_t^- + INEQ_t^+ \quad (3)$$

where $INEQ_t^-$ and $INEQ_t^+$ are partial-sum processes of negative and positive changes in $INEQ_t$, defined as:

$$INEQ_t^+ = \sum_{j=1}^t \Delta INEQ_j^+ = \sum_{j=1}^t \max(\Delta INEQ_j, 0) \quad (4)$$

⁵ We exclude the post-war regime, where the relationship seems to have changed as discussed earlier.

⁶ Although 1980 is generally perceived as the period of liberalisation, the tendency towards liberalisation of the financial sector did begin in 1970s as discussed in Orhangazi (2015). We consider this regime for the purpose of comparison with the sample of 1980s, representing more wide spread liberalisation of the economy.

$$INEQ_t^- = \sum_{j=1}^t \Delta INEQ_j^- = \sum_{j=1}^t \min(\Delta INEQ_j, 0) \quad (5)$$

If there exists a vector $\beta' = (\beta_1^+, \beta_1^-)$ with $\beta_1^- \neq \beta_1^+$ such that ε_t is a stationary process in equation 2, then there exists an asymmetric cointegration.

Asymmetric cointegration is determined in the nonlinear ARDL (NARDL) framework of Shin *et al* (2014) as follows.

$$\begin{aligned} \Delta HHD_t = & \alpha_0 + \rho HHD_{t-1} + \theta_1^+ INEQ_t^+ + \theta_1^- INEQ_t^- + \sum_{i=1}^p \phi_i \Delta HHD_{t-i} \\ & + \sum_{i=1}^p \pi_{1,i}^+ \Delta INEQ_{t-i}^+ + \sum_{i=1}^p \pi_{1,i}^- \Delta INEQ_{t-i}^- + \varepsilon_t \end{aligned} \quad (7)$$

Using F-test, the joint null hypothesis of long-run symmetry, $\rho = \theta_1^+ = \theta_1^- = 0$, is tested against the alternative of an asymmetric cointegration between variables.⁷

The above approach to determine asymmetric cointegration is valid irrespective of whether the regressors are $I(0)$, $I(1)$ or mutually cointegrated. However, studying integration properties of the variables is still essential to ensure that the series are not $I(2)$, in which case the test is invalid.⁸ We therefore perform unit root analyses to determine the order of integration before estimation of the model.

Unit root test

To test the unit root hypothesis, we perform Zivot and Andrews (ZA) (1992) which endogenously determines a single break in the series. We extend our analysis to Lumsdaine and Papell (LP) (1997) test which accounts for two structural breaks in the series.

The ZA model with a dummy for the shift in mean and trend (originally referred to as 'Model C' by ZA) is represented as follows

⁷ Wald test is used to test for the presence of an asymmetric cointegration in each country.

⁸ See Pesaran et al (2001) for a detailed discussion.

$$\Delta y_t = c + \alpha_1 y_{t-1} + \beta t + \theta_1 DU_t + \gamma_1 DT_t + \sum_{j=1}^k d_j \Delta y_{t-j} + \varepsilon_t \quad (6)$$

where Δ is the lag operator, ε_t is a white noise term, t is the time index ($t=1, \dots, T$). DU_t in the model is a dummy for a shift in mean at a potential break point TB , and DT_t is a dummy for the shift in trend, where $DU_t = 1$ and $DT_t = t - TB$ if $t > TB$ and zero otherwise.

3. Empirical results

Table 1 reports the unit root structural break tests. Both the single and two break unit root tests indicate that the inequality index is non-stationary at 5% significance level and has $I(1)$ order of integration. Regarding household debt, the single break using ZA test indicate stationarity at levels, while the LP test indicates non-stationarity and supports the series being $I(1)$. Since none of the series is $I(2)$, we can proceed to test the asymmetric cointegration the Shin et al (2014) framework.⁹

Table 1: Unit root structural break test

ZA test	Households debt to GDP		Income inequality	
	<i>HHD</i>	ΔHHD	<i>INEQ</i>	$\Delta INEQ$
Break	1932	1932	1966	1922
Statistics	-5.723***	-6.152***	-4.884*	-8.697***
LP test	Households debt		Income inequality	
	<i>HHD</i>	ΔHHD	<i>INEQ</i>	$\Delta INEQ$
Break1	1925	1933	1938	1925
Break2	1933	2002	1970	1930
Statistics	-5.551	-7.673***	-6.770*	-9.839***

Null hypothesis: Series has a unit root.

Note: ***, ** and * indicate that the null hypothesis of unit is rejected at the 1%, 5% and 10% levels, respectively.

⁹ Moreover, we perform unit root analyses for all the selected samples, finding that none of the series are $I(2)$. This implies that the asymmetric cointegration test is valid.

Table 2 presents the asymmetric cointegration tests. Using Wald-test, we find strong evidence of asymmetric cointegration in our models.

Table 2: Asymmetric cointegration test

Model	F-statistics	Outcome
1913-2008	4.508***	Cointegrated
1957-2008	4.757***	Cointegrated
1972-2008	4.081**	Cointegrated
1980-2008	3.202**	Cointegrated

Null hypothesis: There is no asymmetric cointegration.

Note: ***, ** and * indicate that the null hypothesis of unit is rejected at the 1%, 5% and 10% levels, respectively.

Before obtaining long-run coefficients, we perform diagnostic and stability analyses. All the models are stable, as can be seen in Figure 2, which shows the CUSUM and CUSUM SQ test of the recursive residuals. Our models reject any misspecification (Ramsey test) and are free of autocorrelation (Breusch-Godfrey test) as shown in Table A1 in the appendix. Moreover, Newey-West estimation method is used to account for any heteroskedasticity in the models.

Table 3 reports the long-run coefficients obtained from asymmetric cointegration for different regimes. The selected NARDL models are reported in Table A1 in the appendix.

Our results clearly suggest that a rise in the income inequality significantly affects the household debt in all regimes while a fall in the inequality has no statistical impact on the household debt. Our findings are seemingly counter-intuitive from an economic theory viewpoint. As noted earlier, the main channels through which inequality affects household debt accumulation are the following: increased pool of loanable funds as the richer households have the tendency to save more, the household's tendency to borrow to smooth their consumption when they face unexpected income shocks, and "keeping up with the Joneses" imitating behaviour which leads poorer households to

mimic the consumption patterns of richer ones by means of borrowing. No matter which of the three channels is primarily driving household debt up with income inequality, one would expect that reverses in inequality should lead households to deleverage. Nevertheless, it is important to note that another major driver of debt accumulation is access to credit. It has well been reported that higher income allows households to borrow more (INSERT CITATIONS). Therefore, while low income households would be expected to borrow less as inequality falls, higher income makes them more reliable borrowers and allows them to borrow more. On the contrary, in the 30 year period that preceded the financial crisis the access to credit was less of an obstacle to more borrowing due to the widening impact of financial liberalization and the subsequent easing of credit constraints for poorer households.

Table 3: Long run coefficients

	1913-2008	1957-2008	1972-2008	1980-2008
<i>INEQ</i>⁺	0.281***	0.170**	0.202***	0.232***
	(0.070)	(0.082)	(0.077)	(0.079)
<i>INEQ</i>⁻	0.006	-0.124	-0.014	0.038
	(0.075)	(0.188)	(0.182)	(0.178)

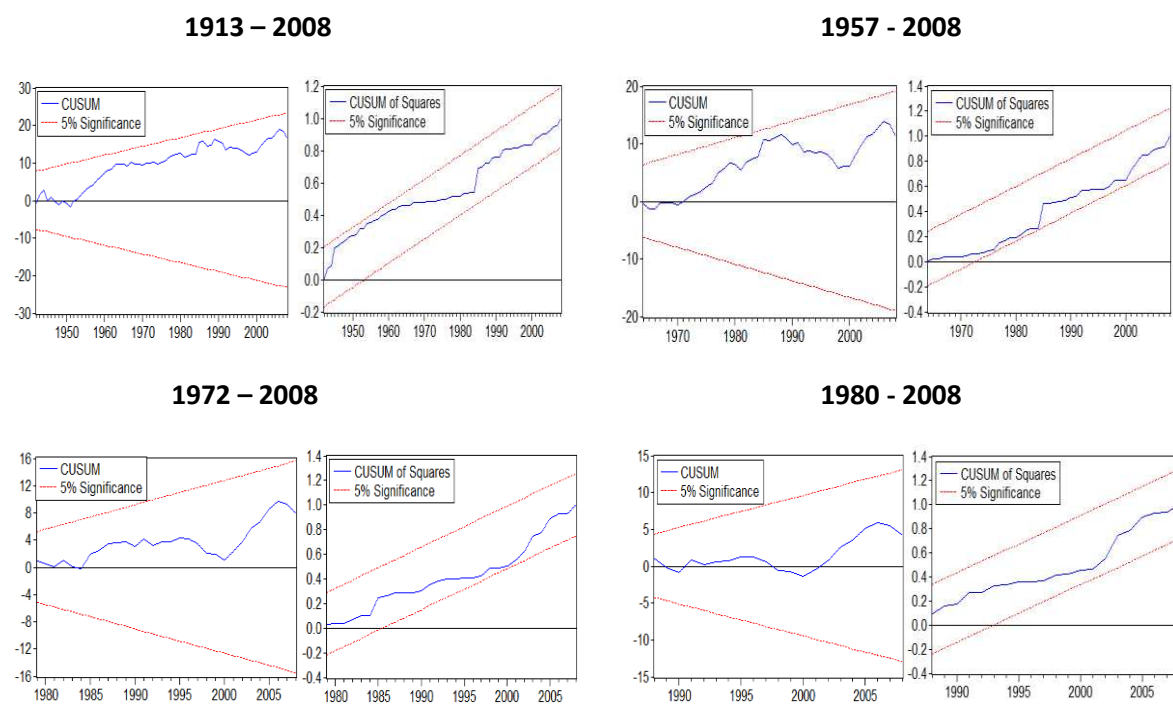
Dependent variable: Household debt to GDP. Note: ***, ** and * indicate that the null hypothesis of unit is rejected at the 1%, 5% and 10% levels, respectively.

Our results indicate that the relationship between income inequality and household debt varies over different regimes. For the whole sample (1913-2008), a unit rise in the index of inequality increases household debt to GDP ratio by 0.28 (i.e. 28 % of GDP). For the post-war regime (1957 – 2008), the coefficient has considerably decreased, where a unit rise in the inequality index increases the household debt to GDP ratio by 0.17.

However, the results indicate that the relationship strengthens soon after the financial liberalisation process commences. In particular, for the period (1972-2008) a rise in the inequality index increases the household debt by 0.20. A shift towards more liberalised economy strengthens the relationship

further i.e. over the period 1980-2008, a unit rise in inequality increases household debt to GDP ratio by 0.23.

Figure 2: Stability Test



Conclusion

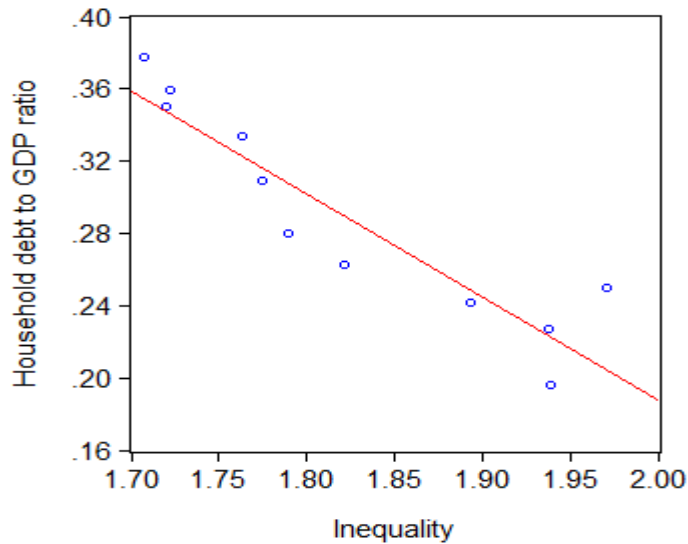
This paper explored the link between household debt and income inequality allowing for asymmetry in the long-run. We found that the household debt in the US only responds to rises in inequality. On the other hand, we found no evidence of a fall in inequality reducing household debt. The presence of asymmetric effects has important implications for policies aimed to repress household debt. While the rise in inequality should raise concerns, fall in inequality should not be expected to reduce the household debt alone.

Appendix

Table A1

	1913-2008	1957-2008	1972-2008	1980-2008
Model	NARDL(1,1,0)	NARDL(1,0,0)	NARDL(1,0,0)	NARDL(1,0,0)
HHD_{t-1}	-0.089***	-0.154***	-0.242***	-0.189***
$INEQ_{t-1}^+$	0.0253***	0.026*	0.086***	0.044**
$INEQ_{t-1}^-$	0.0006	-0.019	0.010	0.007
ΔHHD_{t-1}	0.501***	0.762***	0.786***	0.923***
$\Delta INEQ_t^+$	0.038	-0.015	-0.012	-0.019
$\Delta INEQ_{t-1}^+$	-0.083***			
$\Delta INEQ_t^-$	-0.027	0.005	0.057	0.033
C	0.008	-0.020	0.840	0.042
$dummy$	-0.041***			
R^2	0.45	0.52	0.52	0.48
X_{SC}^2	0.146 (0.963)	0.730 (0.576)	1.565 (0.213)	1.122 (0.376)
X_{RAMSEY}^2	2.52 (0.115)	3.920 (0.055)	1.145 (0.293)	1.600 (0.219)

Figure A1: 1948 - 1957



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