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Credit to private sector, household debt and economic growth: An empirical investigation of EU countries

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Abstract

This paper investigates how the credit to private sector affects the impact of household debt on economic growth in 25 European Union countries over the period 1995-2018. The findings reveal that the positive effect of household debt on economic growth turns to negative with the onset of the 2008 global financial crisis (GFC) and beyond a certain point at around 58% of GDP, thus suggesting that their relationship is non-linear. Interestingly, the adverse effect subjects to the increased pressure of the credit to private sector when it is above 70%, and the pressure becomes even higher when the ratio is above 90%.

Keywords: Credit to private sector; Household debt; Economic growth; Fixed effects; Panel threshold
JEL Classification Codes: G50, E51

1. Introduction

After the 2008 financial crisis, the impact of household debt on economic growth has received a considerable investigation in the empirical literature. Recent theoretical research recognizes that a large increase in household debt could lower output growth in the presence of credit expansion (Farhi and Werning 2016; Korinek and Simsek 2016; Schmitt-Grohe and Uribe 2016; and Guerrieri and Lorenzoni 2017).

While the existing studies contribute to the literature for the relationship between household debt and GDP growth, two different perspectives are addressed. The first becomes from the earlier studies showing that household borrowing improves economic growth and enhance financial stability through investment (Hall, 1978; Beck and Levine, 2004; Levine et al., 2000).

The second perspective, is documented by later studies arguing that an over-indebted household sector hinders economic activity, leads to banking crises, and the causes are credit market deregulation, financial innovation and the failure of central banks to increase interest rates in the early 2000s (Mian and Sufi, 2009; Crotty, 2009; Taylor, 2009; Purnanandam, 2011; Schularick and Taylor, 2012; Borio, 2014; Justiniano et al., 2015; Mian et al., 2017; Jordà et al., 2016; Alter et

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al., 2018). On another dimension, it has been argued that the credit expansion predicts a non-linear relationship between household debt and GDP growth (Mian et al., 2017).

However, it is worth noticing that early studies use data before the 2008 financial crisis, whereas later studies include data from the crisis period. Also, the role of credit expansion on the non-linear relationship between household debt and economic growth is examined only after the crisis and no certain thresholds have been contributed to the empirical literature. The relationship between household debt and economic growth in view of the financial crisis remains scarce, and their non-linear relationship conditional to credit supply is under-explored.

Our contribution to the above two perspectives in the literature is twofold. First, we examine the effect of household debt on economic growth and the impact of credit expansion on household debt in view of the financial crisis. Second, we investigate the non-linear relationship between household debt and economic growth conditional to credit to private sector by introducing certain thresholds. From an empirical perspective, our results highlight the importance of real effects of borrowing-driven by credit supply levels as a channel for business cycle fluctuations.

The following section includes the data and Section 3 presents the model specification. Section 4 provides the empirical results and discussion, while Section 5 concludes.

2. Data

A balanced[1] panel dataset is used containing 25 EU countries over the period 1995–2018.[2] We use a sample of a homogeneous group of countries with harmonized national legislation and integrated financial system, thus avoiding any significant panel heterogeneities. Table 1 presents the list of variables and countries. Summary statistics and correlation matrix are provided in Appendix A (Tables A1 and A2).

Table 1. List of variables.

variables	***Description of variables***
gdpg	The annual percentage GDP growth rate (%).
credit	Credit to private sector as percentage to GDP (% of GDP), by deposit money banks and other financial institutions.
hhd	Total stock of debt liabilities issued by households, including all debt instruments, as a share of GDP (% of GDP).
inf	Inflation rate as measured by the consumer price index (%).
unem	Unemployment refers to the share of the labor force that is without work but avail- able for and seeking employment (% of total labor force).
open	Trade openness to GDP (% of GDP), which is the sum of exports plus imports and measures the degree of international trade.
gcons	Annual growth of household consumption expenditure per capita (%).
irt	Annual borrowing interest rates (%).

Note: Data are obtained from the European Commission (2009) AMECO database and World Bank Data. The 25 EU countries are: Austria (AT), Belgium (BE), Bulgaria (BG), Croatia (HR), Cyprus (CY), Czechia (CZ), Denmark (DK), Fin- land (FI), France (FR), Germany (DE), Greece (EL), Hungary (HU), Ireland (IE), Italy (IT), Latvia (LV), Lithuania (LT), Netherlands (NL), Poland (PL), Portugal (PT), *Romania (*RO), Slovakia (SK), Slovenia (SI), Spain (ES), Sweden (SE), United Kingdom (UK).

[1] Panel threshold techniques can only be used for balanced panel data.
[2] The availability of data for all countries to get a full balance panel was between 1995 and 2018.

3. Model specification

A panel data regression model is employed to analyse the effect of house- hold debt on economic growth:

$$gdpg_{it} = a_{0i} + a_1 hhd_{it} + a_2 inf_{it} + a_3 unem_{it} + a_4 gcons_{it} + a_5 open_{it} + a_6 irt_{it} + u_{it} \quad (1)$$

where the dependent variable is $gdpg_{it}$, measured by the annual GDP growth rate, i and t subscripts denote the country and time respectively, while a_{0i} denotes the vector of the country-specific fixed effect., a_s are the coefficients of the explanatory variables, and u_{it} captures the error term.

In order to analyse the impact of credit to private sector on household debt the following panel regression model is applied:

$$hhd_{it} = \varphi_{0i} + \varphi_1 credit_{it} + \varphi_2 inf_{it} + \varphi_3 unem_{it} + \varphi_4 gcons_{it} + \varphi_5 open_{it} + \varphi_6 gdpg_{it} + \varphi_7 irt_{it} + e_{it} \quad (2)$$

In model (1), credit supply is not included to exclude any multi-collinearity[3] adverse effects on the estimated coefficients.

4. Estimation results

4.1. Panel fixed-effects

To investigate relationship between household debt and economic growth in view of the financial crisis, we use two sub periods: one over the period 1995-2008, and the other over the period 2008-2018. To check the robustness of the results, different samples along the time dimensions are applied: (i) the whole sample period (1995-2018); (ii) two ranges for the pre-crisis period (1995-2006 and 1995-2007) and (iii) two ranges for the post-crisis period (2007-2018 and 2008-2018). The results of the empirical models (1) and (2) are presented in Tables 2 and 3 respectively.

Table 2. Fixed effects estimation results from model (1).

Dependent variable: annual GDP growth rate					
	whole period	***pre-crisis period***		***post-crisis period***	
variables	***1995-2018***	***1995-2006***	***1995-2007***	***2007-2018***	***2008-2018***
Δhhd	-0.0930	0.0142	-8.54e-05	-0.266**	-0.302**
	(0.0681)	(0.0218)	(0.0206)	(0.109)	(0.113)
inflation	0.00521***	-0.00264	-0.00196	0.229***	0.225***
	(0.00161)	(0.00178)	(0.00164)	(0.0498)	(0.0581)
Δunem	-0.534***	-0.515***	-0.536***	-0.297*	-0.211*
	(0.105)	(0.122)	(0.111)	(0.141)	(0.102)
gcons	0.599***	0.376***	0.397***	0.627***	0.544***
	(0.0453)	(0.0420)	(0.0365)	(0.0677)	(0.0549)
Δopen	0.0777***	0.0538**	0.0429**	0.0766**	0.0856***
	(0.0202)	(0.0185)	(0.0177)	(0.0257)	(0.0252)
irt	0.0205	-0.0315	-0.0436	-0.0901	-0.217**
	(0.0303)	(0.0230)	(0.0255)	(0.130)	(0.0954)
Constant	0.806***	2.193***	2.257***	0.448	0.861*
	(0.251)	(0.222)	(0.254)	(0.410)	(0.400)
Observations	575	275	300	300	275
R-squared	0.700	0.580	0.582	0.770	0.770

Note: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. A Hausman test is applied, and the preferred model is the fixed effects. Driscoll and Kraay (1998) estimator is employed, which produces heteroscedasticity-and autocorrelation-consistent standard errors robust to cross-sectional. The Greek letter Δ denotes the first difference operator used for the variables that were transformed to become stationary.

[3] Credit and household debt are found to be highly correlated 91% (See correlation matrix Table A2).

Table 3. Fixed effects estimation results from model (2).

	Dependent variable: household debt				
	whole period	***pre-crisis period***		***post-crisis period***	
variables	***1995-2018***	***1995-2006***	***1995-2007***	***2007-2018***	***2008-2018***
Δcredit	0.180***	0.0673**	0.0687***	0.199***	0.176***
	(0.0397)	(0.0228)	(0.0212)	(0.0406)	(0.0372)
inflation	0.00762**	0.00429	0.00434*	0.139*	0.100
	(0.00329)	(0.00287)	(0.00240)	(0.0772)	(0.104)
Δunem	0.474***	0.204**	0.169**	0.395***	0.393***
	(0.132)	(0.0856)	(0.0678)	(0.102)	(0.116)
gcons	0.417***	0.214**	0.228***	0.445**	0.359**
	(0.143)	(0.0703)	(0.0711)	(0.150)	(0.131)
Δopen	-0.0423**	-0.0191	-0.0142	-0.0279	-0.0116
	(0.0196)	(0.0121)	(0.0150)	(0.0287)	(0.0309)
growth	-0.229	0.0259	-0.00552	-0.463**	-0.542***
	(0.165)	(0.0575)	(0.0556)	(0.161)	(0.151)
irt	-0.0230	-0.264***	-0.280***	0.0826	-0.0398
	(0.0727)	(0.0620)	(0.0574)	(0.107)	(0.104)
Constant	0.703	2.954***	3.079***	-0.263	0.242
	(0.596)	(0.395)	(0.371)	(0.526)	(0.544)
Observations	575	275	300	300	275
R-squared	0.380	0.142	0.149	0.590	0.592

Note: See note in Table 2.

The overall findings suggest that the positive and insignificant effect of household debt on economic growth becomes significantly negative after 2007 (Table 2), which might be attributed to credit expansion that led to financial crisis (Table 3). However, non-linearity is a possible explanation for this relationship, and we further investigate the relationship between household debt and economic growth for certain threshold effects conditional to the level of credit to private sector.

4.2. Panel threshold effects

To examine the non-linearity between household debt, and economic growth the following fixed-effect panel threshold model is employed, as proposed by Hansen (1999):

$$gdpg_{it} = \mu_i + \boldsymbol{\beta_1'} \boldsymbol{X_{1it}} + \beta_2 \Delta hhd(I)(hhd \leq \gamma_1) + \beta_3 \Delta hhd(I)(\gamma_1 \leq hhd \leq \gamma_2) + \beta_4 \Delta hhd(I)(hhd \geq \gamma_2) + \varepsilon_{1it} \quad (3)$$

where $gdpg$ is the dependent variable and stands for the economic growth, i and t denote country and time subscripts, μ_i is the vector of the country-specific fixed effect, X_{1it} is a matrix that includes the control variables (inflation, unemployment, household consumption growth, trade openness, interest rate and economic growth) and ε_{1it} is an error term. Then, Δhhd is the variable used as the regime-dependent variable, used to split the sample into regimes, and hhd as threshold variable, while γ_s are the unknown threshold parameters. *I(·)* is the indication function, which takes the value 1 if the argument in parenthesis is valid, and 0 otherwise.

Next, fixed-effect panel threshold model is applied to examine the non-linearity between household debt and economic growth conditional to credit to private sector:

$$gdpg_{it} = \nu_i + \boldsymbol{\delta_1'} \boldsymbol{X_{2it}} + \delta_2 \Delta hhd(I)(credit \leq \theta_1) + \delta_3 \Delta hhd(I)(\theta_1 \leq credit \leq \theta_2) + \delta_4 \Delta hhd(I)(credit \geq \theta_2) + \varepsilon_{2it} \quad (4)$$

where $gdpg$ is the dependent variable, ν_i is the vector of the country-specific fixed effect, X_{2it} is a matrix that includes the control variables (inflation, unemployment, household consumption

growth and trade openness) and ε_{2it} is an error term. Then, Δhhd is the variable used as the regime-dependent and $credit$ as threshold variable, while θs are the unknown threshold parameters.

Both models are examined for a triple-threshold, which divide the equations into three regimes with β_2, β_3 and β_4 coefficients for model (3), and δ_2, δ_3 and δ_4 for model (4). The F-test statistics along with their bootstrap p-values (300-replications) are reported in Table 4.

The points estimates of the thresholds and their asymptotic 95% and 99% confidence intervals are reported in Table 5.

The regression slopes estimates for both models are reported in Tables 6 and 7. We are mainly interested in the coefficients of the regime dependent variables, which is household debt-to-GDP.

In Table 6, the overall results suggest a non-linear effect of household debt on economic growth is examined, and the results show that below 59%, household debt positively affects growth, while above this level, the relationship converts to negative. It is important to note, that household debt-to-GDP-ratio above 63% becomes detrimental for economic activity.

In Table 7, the positive and significant effect of household debt on economic growth exists when credit is lower than 85.73%, turns to negative when credit lies between 85.73% and 92%, and becomes detrimental when credit is greater than 92%.

Table 4. Tests for threshold effects.

Tests	***Model (3): Threshold variable: household debt***	***Model (4): Threshold variable: credit to private sector***
Single threshold		
F_1	17.58	19,81
p-value	0.020	0.020
(10%, 5%, 1% critical values)	(8.75, 13.29, 17.72)	(7,53 8,96 13,59)
Double threshold		
F_2	100.32	60,34
p-value	0.000	0.000
(10%, 5%, 1% critical values)	(7.03, 9.17, 13.21)	(8.00 10.38 11.97)
Triple threshold		
F_3	6.08	5,64
p-value	0.746	0.880
(10%, 5%, 1% critical values)	(79.85, 91.48, 130.99)	(64.92 74.52 76.17)

Note: The test for a single threshold F_1 is significant with a bootstrap p-value less than 5% for both models 3 and 4, and the test for a double threshold F_2 is highly significant with a bootstrap p-value of 0.000 for both models as well. The test for a third threshold F_3 is not statistically significant, with bootstrap p-values of 0.746 and 0.880.

Table 5. Threshold estimates.

Threshold	***Estimate***	***95% confidence interval***	***99% confidence interval***
	Model (3): Threshold variable: household debt-to GDP		
$\hat{\gamma}_1'$	59.08	[58.50 59.37]	[57.63 59.37]
$\hat{\gamma}_2'$	62.80	[62.18 62.83]	[60.95 62.83]
	Model (4): Threshold variable: credit to private sector		
$\hat{\theta}_1'$	85.73	[72.44 88.74]	[70.04 88.74]
$\hat{\theta}_2'$	92.26	[88.74 93.29]	[88.74 93.29]

Table 6. Regression estimates: Double threshold model for household debt.

Dependent variable is economic growth.			
Regressors	***coefficient***	***t-statistics***	***SE***
inflation	0.005***	(2.62)	(0.001)
Δunem	-0.556***	(-9.20)	(0.06)
gcons	0.568***	(20.88)	(0.027)
Δopen	0.071***	(6.52)	(0.010)
irt	0.028	(1.19)	(0.023)
constant	0.753***	(5.22)	(0.144)
Δhhd(hhd≤ 59.08)	0.098**	(2.09)	(0.047)
Δhhd(59.08 ≤hhd≤ 62.80)	-0.053	(-1.21)	(0.043)
Δhhd(62.80 ≤ hhd)	-0.683***	(-11.80)	(0.058)

Note:* p < 0.10, ** p < 0.05, *** p < 0.01.

Table 7. Regression estimates: Double threshold model for credit.

Dependent variable is economic growth			
Regressors	***coefficient***	***t-statistics***	***SE***
inflation	0.005***	(2.96)	(0.001)
Δunem	0.551***	(8.82)	(0.101)
gcons	0.572***	(20.52)	(0.027)
Δopen	0.078**	(7.01)	(0.011)
irt	0.028	(1.19)	(0.023)
constant	0.753***	(4.99)	(0.096)
Δhhd(credit≤ 85.73)	0.168**	(2.28)	(0.074)
Δhhd(85.73 ≤credit≤ 92.26)	-0.071	(-0.21)	(0.033)
Δhhd(92.26 ≤ credit)	-0.518***	(-9.89)	(0.052)

Note: See note in Table 6.

However, the non-linear relationship between credit and growth has already been discussed and its contribution falls to the existing literature (Loayza and Ranciere, 2006; Fink, Haiss and Vuksic, 2009; Cecchetti, S. and Kharroubi, E., 2012; Arcand, Berkes and Panizza, 2015; Demetriades, Rousseau and Rewilak, 2017; Creel, Hubert and Labondance, 2021). Our study differs from the existing ones on the regime-dependent variable and examines the relationship between household debt and economic growth subject to the excessive pressure of credit expansion to household debt. To check the robustness of this effect the following panel threshold model is employed:

$$hhd_{it} = \kappa_i + \boldsymbol{\zeta' X_{3it}} + \zeta_2 \Delta credit(I)(credit \leq \omega_1) + \zeta_3 \Delta credit(I)(\omega_1 \leq credit \leq \omega_2) + \zeta_4 \Delta credit(I)(credit \geq \omega_2) + \varepsilon_{3it} \quad (5)$$

Table 8 shows the results from model (5) and suggest that higher credit to private sector increases the household debt across all regimes. It is important to notice that countries with lower level of credit (≤ 70%) have a very small coefficient (0.053). When the level of credit lies between 70% and 92%,4 the estimated coefficient is 0.131, and above 92% becomes twice as big (0.381), thus indicating that countries with high levels of lending lead to higher levels of household debt.

In general, the most important implication drawn from the results is that the household debt is subject to excessive pressure of borrowing (over-lending) beyond certain points. To give a better understanding and clearly present the overall interpretation, all results are collected and displayed through Figure 1.

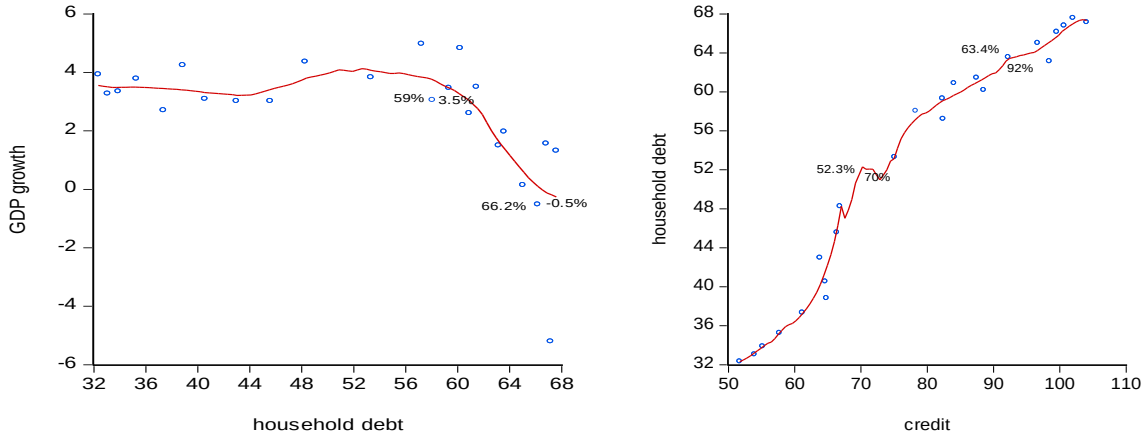
[4] The lower point estimate confirms the lower bound of confidence interval in Table 4, while the higher point estimate confirms the results in Tables 4 & 6.

Table 8. Regression estimates: Double threshold model for credit.

Dependent variable is household debt-to-GDP			
Regressors	***coefficient***	***t-statistics***	***SE***
inflation	0.005*	(1.90)	(0.003)
Δunem	0.444***	(4.20)	(0.105)
gcons	0.354***	(6.14)	(0.057)
Δopen	-0.045**	(-2.42)	(0.018)
growth	-0.168**	(-2.58)	(0.065)
irt	-0.006	(-0.17)	(0.039)
constant	0.761***	(2.98)	(0.255)
Δcredit(credit≤ 70.44)	0.053**	(2.25)	(0.023)
Δcredit(70.44 ≤credit≤ 92.3)	0.131***	(4.16)	(0.031)
Δcredit(92.3 ≤ credit)	0.381***	(9.07)	(0.042)

Note: See note in Table 5.

Figure 1. The left graph above illustrates the threshold effects of household debt on economic growth. From the scatterplots, it can easily be seen that growth falls when household debt is higher than 59%. The right graph shows the impact of credit on household debt, and we can easily observe that higher credit levels lead to higher household debt levels.



5. Conclusions

In this study, we investigate the impact of household debt on economic growth in light of financial crisis conditional to credit supply to private sector, for 25 European Union countries over the period 1995 to 2018.

The novelty of this paper is the different thresholds, above which excessive pressure of borrowing (over-lending) starts to create higher household debt, which in turn, affects the economic growth in a non-linear manner.

That is, household debt-to-GDP-ratios above 63%, negatively affects the economic growth. Furthermore, the findings reveal that the household debt is subject to increased pressure when the credit supply-to-GDP-ratio is above 70% and the pressure becomes even higher when the ratio is beyond 90%, broadly supporting the above findings. In addition, the findings suggest that household debt began to hurt the economy during the economic downturn and this negative effect remains unchanged eleven years after the onset of the financial crisis. The findings call for a further investigation in forecasting the impact of household debt on economic activity after the pandemic recession.

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Appendix A - Data analysis

Summary statistics is presented in Table A1. It is worth noticing that the coefficients of variation (CV) are relatively small in trade openness, unemployment rate, credit supply and household debt, indicating that are less dispersed than the rest of the variables. Also, it can be easily observed that economic growth and consumption growth have similar means and coefficients of variation, thus implying a strong correlation between them, which is also detected in correlation analysis.

Correlation analysis is presented in Table A2. Credit supply is found and to be very highly and positively correlated with household debt (91%) , while with the rest of variables is found to be weakly negative correlated. The second high correlation is found between economic growth and consumption growth, which is positive and approximately 75%. The high correlation between credit supply and household debt, will have a relatively large standard error, which is the situation known as multicollinearity, thus undermining their statistical significance in the regression model. However, for the rest of variables no other high correlation is detected.

Table A1. Summary statistics.

variable	***Mean***	***Std. Dev.***	***Min.***	***Max.***	***CV***	***Obs***
gdpg	2.58	3.363	-14.814	25.163	1.305	600
credit	78.233	45.908	0.186	260.704	0.586	600
hhd	52.42	34.177	-12.9	149.695	0.651	600
inf	5.756	44.164	-4.478	1058	7.672	600
unem	9.209	4.414	2.119	27.466	0.479	600
open	96.460	38.131	37.108	221.157	0.329	600
gcons	2.514	3.943	-32.406	29.065	1.568	600
irt	5.265	3.805	0.090	27.780	0.722	600

Table A2. Correlation matrix.

variables	***gdpg***	***credit***	***hhd***	***inf***	***unem***	***open***	***gcons***	***irt***
gdpg	1.000							
credit	-0.308	1.000						
hhd	-0.262	0.910	1.000					
inf	-0.198	-0.112	-0.123	1.000				
unem	-0.115	-0.115	-0.218	0.043	1.000			
open	0.186	-0.079	0.033	-0.029	-0.180	1.000		
gcons	0.748	-0.256	-0.240	-0.340	-0.150	0.072	1.000	
irt	-0.0129	-0.2491	-0.3044	0.137	0.275	0.179	0.054	1.000