The real effects of household debt in the short and long run[1]

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Abstract

Household debt levels relative to GDP have risen rapidly in many countries in the past decade. We investigate the macroeconomic impact of increases in household indebtedness, by employing a novel estimation technique proposed by Chudik et al (2016), which tackles the problem of endogeneity present in traditional regressions. Using data on 54 economies over 1990–2015, we show that household debt boosts consumption and GDP growth in the short run, mostly within one year. By contrast, a 1 percentage point increase in the household debt-to-GDP ratio tends to lower growth in the long run by 0.1 percentage points. Our results suggest that the negative long-run effects on consumption tend to intensify as the household debt-to-GDP ratio exceeds 60%. For GDP growth, that intensification seems to occur at household debt-to-GDP ratios of above 80% or so. Finally, we find that the degree of legal protection of creditors is able to account for the cross-country variation in the long-run impact.

JEL classification: E21, E44, G21.

Keywords: household debt, consumption, cross-sectional autoregressive distributed lag model, output growth, threshold effect.

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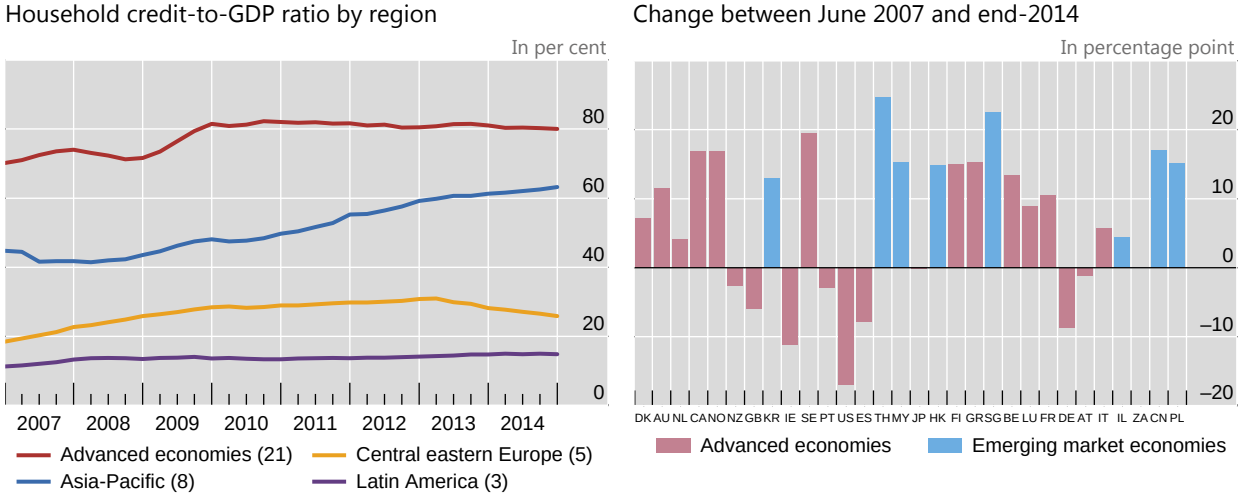
1. Introduction

In the past decade, the global economy has been confronted with two seemingly interrelated problems. First, as Graph 1 shows, following the 2008 financial crisis, household debt levels relative to GDP have risen in many countries. Not only has the deleveraging in the advanced economy (AE) household sector not proceeded as swiftly as expected, household indebtedness has also risen rapidly in many emerging market economies (EMEs) where they remained modest in the previous decades. Second, despite record low interest rates, private spending globally has remained weak and recovery illusive even a decade after the burst of the US housing bubble. The goal of this paper is to trace the link between these two developments, with a specific focus on how household debt influences private consumption and GDP growth and whether and why the impact varies across countries.

Household debt across the world — Graph 1



Twenty-one advanced economies include Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Luxembourg, the Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, the United Kingdom and the United States; five central and eastern European economies include the Czech Republic, Hungary, Poland, Russia and Turkey; eight Asia-Pacific economies include China, Hong Kong SAR, India, Indonesia, Korea, Malaysia, Singapore and Thailand; and three Latin American economies include Argentina, Brazil and Mexico. The economies shown in the right-handed panel are top 30 economies in terms of the level of the household debt-to-GDP ratio as of end-2014.

Sources: national data; BIS.

In standard macroeconomic models, household debt plays a limited role: although debt affects households' ability to smooth consumption, it is not a major determinant of consumption itself. Yet household debt has been at the centre of many recent financial crises and recessions. In the past decade, at least, three strands of evidence have emerged about household indebtedness and growth relationship.

First, in a series of recent papers, Schularick and Taylor (2012) and Jordà, Schularick and Taylor (2013, 2015 and 2016) demonstrate that high debt levels are not only a good predictor of financial crisis but also a key determinant of the intensity of the ensuing recession. Complementing these findings is the recent early warning literature, which suggests a key role of household debt servicing costs in predicting future vulnerability of countries to banking system stresses and economic recession (Drehmann and Juselius (2014)). Going a step further, Mian, Sufi and Verner (2015)

refute the basic proposition underlying the neoclassical models that debt accumulation is accompanied by expected future productivity growth. Their analysis suggests that an increase in the household debt-to-GDP ratio reduces consumption across countries, with a lag of three years, even during normal times. In other words, the unconditional correlation between household debt and growth is negative after a certain lag.

A second source of evidence has come from micro-based studies, focusing on the behaviour of US households following the recent burst of US housing bubble (Mian and Sufi (2010), Mian, Rao and Sufi (2013) and Dynan (2012))[5]. Exploiting cross-sectional heterogeneity from US household surveys, these studies show that the financial exposures of households – hence the distribution of debt and assets – played a central role in depressing US consumption. The recession was aggravated by the fact that the marginal propensity to consume out of household wealth in US localities with a loan-to-value ratio of 90% was three times higher than that in localities with a LTV ratio of only 30% (Mian et al (2013)). Besides negative wealth effects, evidence also suggest that highly-leveraged US households may have deliberately withheld consumption in order to return to a more manageable debt levels in future (Dynan (2012)).

More generally, models incorporating heterogeneous preferences are more sympathetic to the view that countries may face what is called a "debt limit" whereby, following a shock, certain frictions may cause debtors' consumption preferences to diverge significantly from those of the creditors (King (1994), Eggertsson and Krugman, (2012), Curdia and Woodford (2010), Guerrieri and Lorenzoni (2009) and Hall (2011)).[6] Those frictions arise not only because debtors are exposed to certain uninsurable income risks such as uncertain payoffs from illiquid assets but financial intermediaries may also incur losses, which can impair their capacity to intermediate credit. An excellent example of this class of models is Eggertsson and Krugman (2012). In their model, the debt limit becomes binding when the *impatient* households who borrow from the *patient* households are suddenly forced to cut spending and deleverage.

A third of source of evidence has emerged from the recent papers highlighting the supply-side effects of debt (Cecchetti and Kharroubi (2015)). For instance, Borio et al (2016) demonstrate that credit booms – particularly those in the construction sector – are accompanied by severe misallocation of resources and a slowdown in productivity growth, with long-lasting adverse effects on the real economy. They argue that "when considering the macroeconomic implications of financial booms and busts, it is important to go beyond the current focus on aggregate demand effects".

While providing important insights into the role of household debt in the economy, these studies are silent about the time path of the macroeconomic effects of debt and whether those effects are dependent on the level of debt itself. In this paper, we therefore tackle two interrelated questions about household debt. First, what are the short- and long-run effects of household debt on the economy? It is often argued that debt has positive effects on growth because it facilitates spending by credit-constrained households, particularly following a financial crisis. However,

[5] Among other studies, see Bhutta (2012), Cooper (2012) and Dynan and Edelberg (2013).

[6] For a recent review of the literature, see Sufi (2015).

this supposedly short-run positive effect should be temporary if debt adversely affects spending in the long run. Determining the impact of household debt on growth, therefore, raises a first-order question of understanding the trade-off it might pose to the economy. The second question we ask is whether the level of debt plays any role in determining its effects, consistent with the "debt limit" view discussed above. Put differently, is there a household debt level that can be considered safe for an economy? As in Cecchetti, Mohanty and Zampolli (2012) and Mian, Sufi and Verner (2015), we take an empirical approach to answer these questions.

We proceed in two stages. First, we investigate the relationship between household indebtedness and economic growth, both in the short- and long-run, and examine whether there is a threshold household debt-to-GDP ratio above which growth tends to slow down. Second, we try to explore whether the impact of household indebtedness on growth varies across countries depending on their key characteristics. Specifically, we conduct a cross-sectional analysis on the potential determinants of debt tolerance, using the country-specific coefficients obtained from the panel analysis as dependent variables. In particular, we consider the following three groups of factors: (1) the level of overall financial development; (2) economic development and long-run growth prospects; and (3) the quality of the institutional features of the legal and financial systems. To our knowledge, we are the first to go beyond the extant literature to find the long-run macroeconomic effects of debt for individual economies in a panel set up, which enables us to unravel the factors that lie behind.

Given the objective of our paper, we follow a novel estimation strategy viz., the cross-sectional autoregressive distributed lag (CS-ARDL) approach by Chudik and Pesaran (2015), to estimate short- and long-run dynamics in panel data. This approach helps us fix two major empirical problems. First, since it is based on a cointegration approach, we can clearly distinguish the short-run effect of debt from its long-run impact. Second, the use of cross-sectional averages of the dependent and explanatory variables as well as their lags help us account for cross-sectional dependence and induced feedback effects between the variables, thereby overcoming the endogeneity bias in an efficient way. Most researchers examining the relationship between debt and growth use the instrumental variable regression to deal with the endogeneity problem. However, as we show in the next section, the answers provided by these approaches are sensitive to the choice of instruments. We therefore believe that trying an alternative instrument as built into the CS-ARDL model can provide useful insights on top of what the literature has already found.

Our results suggest that debt boosts consumption and GDP in the short run, with the bulk of the impact of increased indebtedness passing through the real economy in the space of one year. However, the long-run negative effects of debt eventually outweigh the short-term positive effect, with household debt accumulation ultimately proving to be a drag on growth. Our estimates suggest that a 1 percentage point increase in the household debt-to-GDP ratio tends to lower output growth in the long run by 0.1 percentage points, suggesting that policy makers face non-trivial, real costs in stimulating the economy through credit expansion. These findings are robust to alternative lag structures and control variables. Our analysis of the threshold effects suggests that the negative long-run effects of household debt kick in at household debt-to-GDP ratios as low as 60%, while the effects appear to be most significant at debt levels above 80% of GDP. Interestingly, our findings are roughly in line with those of several recent studies on public indebtedness (eg, Cecchetti, Mohanty and Zampolli (2012) and Eberhardt and Presbitero (2015)).

Another interesting aspect of our results is the role of country-specific characteristics in determining debt limits. One key result is that the only institutional factor that is able to account for the cross-country variation is the degree of legal protection of creditors. Such a result is consistent with the general view that policies addressed to strengthening creditors' rights can play a useful role in improving the sustainability of household debt. Among the non-institutional explanatory factors, the level of overall financial development, unsurprisingly, seems to play a relevant role. In particular, we find evidence that more financially developed EMEs tend to have higher growth from higher levels of household indebtedness in the short run. By contrast, in the long run, the degree of financial development plays very little role in terms of reducing the negative impact of higher household debt on growth.

The rest of the paper is organised as follows. Section 2 provides a brief overview of facts about the recent build-up of household debt and its association with real variables such as consumption and GDP growth. Section 3 proposes a new empirical approach to study the relationship of debt and growth. Section 4 discusses the baseline empirical results. Section 5 investigates the potential nonlinear effects of household debt. Section 6 examines the role of institutional and other factors in explaining the cross-country differences in the household debt-growth relationship. Finally, section 7 concludes.

2. Household debt and growth: facts and recent evidences

2.1 Stylised facts

Our analysis is based on quarterly household data for 54 economies (23 AEs and 31 EMEs) ranging from 1990Q1 (or earliest time data are available) to 2015Q1. Household debt data, collected from national sources, measure loans extended by banks to households for purchase of housing and other assets (eg loans for vehicle purchase) as well as unsecured debt (including credit card) and student debt. In our sample, most mortgage and consumer debt constitutes lending by banks. That said, our data would likely underestimate household debt for those economies where non-bank lenders accounted for a significant share of the mortgage credit market.[7] Following the standard practice in the cross-country debt literature, we scale debt by GDP to measure aggregate indebtedness of the household sector.[8] Table A1.2 in Appendix 1 provides the exact definitions and data sources as well as the period of data availability.

Graph 2 helps to clear the myths about deleveraging in the AE household sector. As the left-hand panel of Graph 2 shows, the median household debt in AEs as a percentage of GDP has risen every decade since 1990, including the period following the 2008 crisis. Of the 23 AEs in our sample, only Germany, Ireland, Spain, the United

[7] In Table A2.5 in Appendix 2, we also consider total credit to households and non-profit institutions serving households (NPISHs), which includes both bank and non-bank loans to the sector.

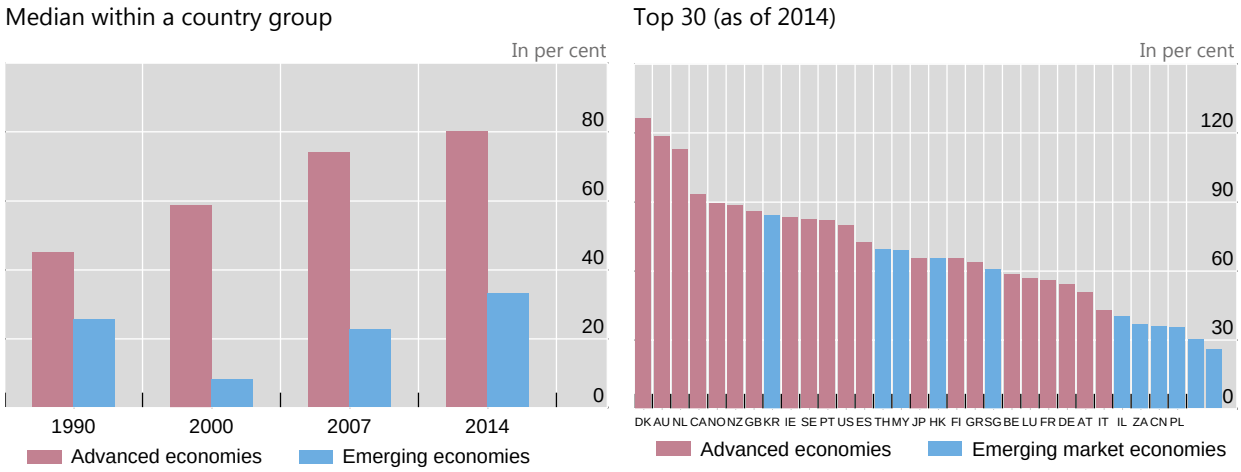
[8] When we consider a rise in aggregate household debt, it is important to differentiate the intensive margin (ie the average amount of debt per borrower) from the extensive margin (ie the number of borrowers). The former is a more accurate measure of household indebtedness, while the latter is a good indicator of the access to credit, hence of the degree of financial deepening. In principle, such a distinction is very important for unravelling the true impact of household debt in EMEs, although non-availability of detailed borrower level data constrains its use, in practice.

Kingdom and the United States have seen any significant reductions in the household debt-to-GDP ratio since 2007 (Graph 1, right-hand panel). Household debt levels have been relatively constant in relation to GDP in Austria and Japan since the recent crisis, but they have grown rapidly in Australia, Belgium and Nordic countries.

By the standards of AEs, it is true that the median household debt-to-GDP ratio in EMEs is still relatively small. But indebtedness is growing rapidly in this group of countries. And, dispersion across regions remains high: the rise in household debt is much more widespread in emerging Asia than in Latin America and central and eastern Europe. Within Asia, household indebtedness in Hong Kong SAR, Korea, Malaysia, Singapore and Thailand has now reached levels that are comparable to some of the most heavily indebted AEs.

Household debt

As a percentage of GDP — Graph 2



Twenty-one advanced economies include Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Luxembourg, the Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, the United Kingdom and the United States; and 18 emerging market economies include Argentina, Brazil, China, the Czech Republic, Hong Kong SAR, Hungary, India, Indonesia, Israel, Korea, Malaysia, Mexico, Poland, Russia, Singapore, South Africa, Thailand and Turkey.

Sources: national data; BIS.

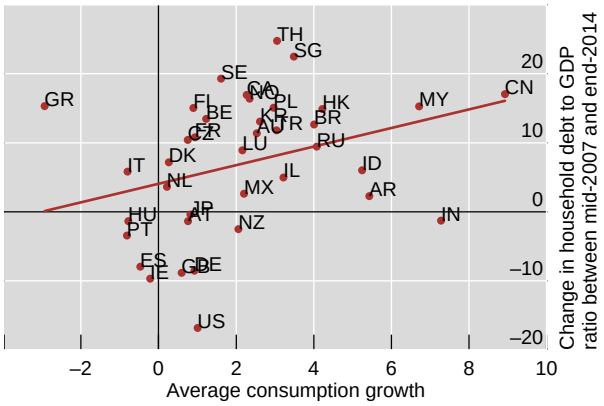
How is the recent rise in household debt related to economic growth? To shed light on the most recent evidence, in Graph 3 we show two distinct aspects of cross-country debt and growth relationship since 2007. The left-hand panel of Graph 3 shows the cross-country contemporaneous correlations between the average annual change in the household debt-to-GDP ratio and the average annual consumption growth during 2007–2015, which include one episode of severe recession and one modest expansion. What is clear from the graph is that the unconditional correlation of household debt with consumption growth is positive, which is consistent with the cross-country evidence reported elsewhere (see eg IMF (2015)) that an expansion of household credit is often associated with stronger private consumption and GDP growth.

The right-hand panel of Graph 3 presents the same correlation from a slightly different perspective. Instead of focusing on the contemporaneous relationship, the panel relates past changes in household debt to consumption in the subsequent periods. We compute correlations for each country and then average them over the

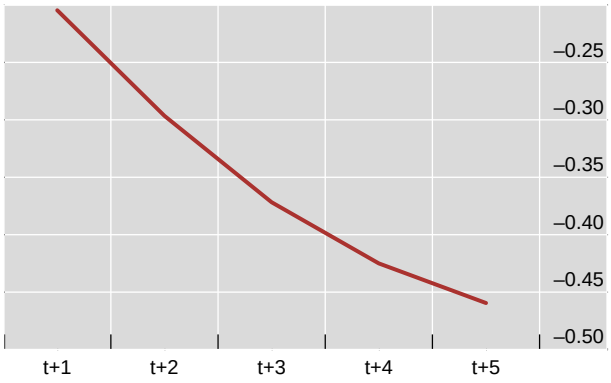
sample; hence each point on the red line shows the average correlation across all countries in our sample. The basic hypothesis is that if the neoclassical consumption hypothesis is correct, the correlation between past increases in debt and subsequent consumption growth should be positive because additional borrowing may well have been motivated by higher expected permanent income. On the other hand, if past increases in debt exposed households to potential future borrowing constraints and greater risks of bankruptcy, they are likely to be associated with lower, not higher, consumption growth. Following Mian, Sufi and Verner (2015), we choose three-year changes in household debt as a proxy for the income shock.

Instantaneous and subsequent effects of debt accumulation on consumption growth — Graph 3

Scatter plot of the change in the household debt-to-GDP ratio[1] and the average consumption growth rate[2]



Correlation between 3-year change in household debt up to year t-1 and the subsequent consumption growth[3]



[1] In percentage points. [2] In per cent. [3] The growth rate is measured as logarithmic difference of real consumption in year *t* and that in year *t*+*h*, where *h* = 1, 2, 3, 4, 5.

Sources: IMF, *World Economic Outlook*; authors' estimates.

The right-hand panel of Graph 3 makes two points very clear. First, past increases in household debt are not a good predicator of positive growth, but appear to be associated with weaker consumption and higher risks of recession. Second, the downward-sloping line suggests that the negative correlation between household debt and consumption actually strengthens over time, following a surge in household borrowing. What is striking is that the negative correlation coefficient nearly doubles between the first and the fifth year following the increase in household debt.

As is well known, simple correlation does not suggest anything about the causal effects. That said, the preliminary evidence in Graph 3 appears to be supportive of the view that credit expansions may have very different effects on the short- and medium-run economic prospects of countries. It also confirms the findings of King (1994) that large increases in private debt in the 1980s made many OECD countries vulnerable to problems of weak growth and "debt deflation". He shows that the most severe recessions since 1930s have occurred in countries that have seen the largest increases in private debt in the preceding five years.

2.2 Estimating debt and growth relationship

Yet, precisely estimating the relationship in Graph 3 is challenging because debt and consumption belong to the same structural equation system and are, therefore,

jointly determined in the equilibrium. Resolving this identification problem is not easy in a cross-country setting. A popular approach is the instrumental variable (IV) regression, which has made great strides into the literature on public debt and growth following the 2008 financial crisis (see, for instance, Panizza and Presbitero (2013) and the survey of the literature therein). Among the recent studies applying this approach to household debt data in a cross-country framework is Mian, Sufi and Verner (2015).

A key issue confronting researchers is finding a suitable instrument that is at the same time theoretically consistent and strongly correlated with the potentially endogenous debt variable but weakly correlated with the growth variable. As pointed out by Stock, Wright and Yogo (2002), the weak instrument problem remains a pervasive issue in economics, which reduces the reliability of the standard IV and generalised method of moments (GMM) estimates. Bound, Jaeger and Baker (1995) show that the weak instrument problem leads to large inconsistency in IV estimates even when the correlation of the instrument with errors in the original equation is small. Similarly, Guggenberger (2012) shows that the small-sample properties of IV estimators can be poor when we use instruments that are not strictly exogenous. Moreover, instruments that are strongly supported by theory may not work well in practice.

IV estimates of household debt and growth relationship — Table 1

Quarters ahead	1	4	8	12
		Local currency bond spread		
Coefficient	0.037	–0.047+	0.090**	–0.117**
	(*0.025*)	(*0.026*)	(*0.026*)	(*0.029*)
N	3097	2953	2757	2565
F-statistics	5.023	4.003	2.434	1.498
		Foreign currency bond spread		
Coefficient	–1.121	1.003	0.136	0.872
	(*3.360*)	(*3.039*)	(*0.575*)	(*2.630*)
N	2140	2032	1888	1744
F-statistics	0.116	0.112	0.104	0.112
		Home ownership		
Coefficient	–0.039	–0.323	0.251	–0.563
	(*0.160*)	(*0.258*)	(*0.258*)	(*0.533*)
N	2454	2349	2199	2047
F-statistics	71.041	68.381	64.776	61.288
Stock-Yogo (2005) weak ID test critical values:			*10% max IV size*	*16.38*
			15% max IV size	*8.96*
			20% max IV size	*6.66*
			25% max IV size	*5.53*

+, *, and ** denote statistical significance at the 10 percent, 5 percent and 1 percent level, respectively. Standard errors are in parentheses.

To illustrate the issue, in Table 1 we present the IV estimates of the household debt and growth relationship using three different instruments. The first is the local currency bond spread as used by Mian, Sufi and Verner (2015), measured as the difference between local currency government bond yield and the US Treasury yield.

Since a large part of the local currency bond spread constitutes anticipated changes in the exchange rate, which is likely to be correlated with growth, we also tried the foreign currency bond spread, defined as the yield on US dollar-denominated government bonds over the US Treasury yield, as our second instrument. The foreign currency bond spread is not only a cleaner measure of risk premium paid by sovereign borrowers on their debt but it is closely associated with global investors' risk appetite. As a third instrument, we use the home ownership ratio. In the past decades, policy factors played a major role in boosting mortgage credit growth and home ownership ratio in many countries (Jordà, Schularick and Taylor (2016). Because of its weak correlation with consumption, home ownership could be an ideal instrument in the regression.

The estimates reported in Table 1 suggest that the choice of instruments has a strong influence on the results. For instance, when household debt is instrumented by local currency sovereign spreads, the relationship between debt and GDP growth appears to be negative at lags above one year (first block), which is in line with the findings in Mian, Sufi and Verner (2015). The null hypothesis of weak instrument is rejected by the Stock and Yogo (2005) test. However, the results using alternative instruments clearly suggest caution. When one uses the foreign currency bond spread as the instrument, which can be arguably be more appropriate for EMEs with high level of USD borrowing, statistical significance of the results is lost, and the signs of the coefficients reverse. By contrast, if one uses home ownership as an instrument, the signs of the coefficients appear negative, but they are not statistically significant. In both cases, anyway, the Stock and Yogo (2005) test fails to reject the null hypothesis of weak instrumentation.

3. Empirical approaches

3.1 Autoregressive distributed lag (ARDL) model

In this section, we propose an alternative approach that can help overcome these inconsistencies. Our approach relies on a standard method to estimate a long-run relationship in data, which not only tackles the problems of endogeneity but also provides a useful tool to disentangle the short- and long-run role of household debt.

The most popular econometric instrument through which long-run relationships are assessed is that of cointegration (Engle and Granger (1987)). One approach to cointegration that lends itself particularly well to the analysis of panel data is the autoregressive distributed lag (ARDL) model, first proposed by Pesaran and Smith (1995). Let us illustrate it with an example, which closely follows Chudik et al (2016). Suppose we are interested in examining the long-run relationship between GDP growth (y_t) and household indebtedness (x_t), and let us assume that their joint dynamics is determined by the following VAR(1) model:

$$\begin{bmatrix} y_t \\ x_t \end{bmatrix} = \begin{bmatrix} \phi_{11} & \phi_{12} \\ \phi_{21} & \phi_{22} \end{bmatrix} \begin{bmatrix} y_{t-1} \\ x_{t-1} \end{bmatrix} + \begin{bmatrix} e_t^y \\ e_t^x \end{bmatrix}. \quad (1)$$

The innovations e_t^y and e_t^x would in general be correlated, which leads to contemporaneous correlation between y_t and x_t. So, if one were to perform a simple OLS regression of y_t on x_t, endogeneity would be a major issue. However, the innovations can be decomposed and their orthogonal component can be spelled out, for example,

$$e_t^y = E\left(e_t^y \mid e_t^x\right) + u_t = \omega e_t^x + u_t\,, \tag{2}$$

where ω=cov(e_t^y,e_t^x)/var(e_t^x). So, the innovation to the equation for y_t is decomposed into two components, one of which (u_t) is orthogonal to the innovation to x_t. By substituting equation (2) into the equation for y_t in (1), we obtain

$$y_t = \phi_{11} y_{t-1} + \phi_{12} x_{t-1} + \omega e_t^x + u_t\,, \tag{3}$$

while from the equation for x_t in (1), we obtain

$$e_t^x = x_t - \phi_{21} y_{t-1} - \phi_{22} x_{t-1}\,. \tag{4}$$

Substituting (4) into (3) yields

$$y_t = \varphi y_{t-1} + \beta_0 x_t + \beta_1 x_{t-1} + u_t\,, \tag{5}$$

where

$$\varphi = \phi_{11} - \omega\phi_{21}, \beta_0 = \omega, \beta_1 = \phi_{12} - \omega\phi_{22}\,.$$

Equation (5) is a simple ARDL specification. Since u_t is orthogonal to x_t and its lags by construction, it follows that equation (5) does not suffer from endogeneity and can be consistently estimated using OLS. In a sense, this can be seen as a consequence of the fact that the ARDL specification is derived from a VAR model for the joint dynamics of the variables. Furthermore, Pesaran and Shin (1999) also show that OLS estimates of equation (5) are consistent, irrespectively of whether variables are I(1) or I(0).

The model can also be written in a cointegrating form:

$$y_t = \theta x_t + \alpha\left(L\right)\Delta x_t + \tilde{u}_t\,, \tag{6}$$

where

$$\tilde{u}_t = \varphi\left(L\right)^{-1} u_t\,.$$

In equation (6), the long-run coefficient $\theta = (\beta_0 + \beta_1)/(1 - \varphi)$ is expressed explicitly. If the variables y_t and x_t are I(1), equation (6) is a cointegrating relationship, with cointegrating vector $(1, -\theta)'$. However, if the variables are I(0), θ can still be interpreted as a long-run impact in the sense that it represents the impact on y_t of a permanent change in the mean of x_t (Chudik et al (2016)).

The easiest approach to estimate θ is to obtain estimates of the short-run coefficients of equation (5) and plug them in the expression $\theta = (\beta_0 + \beta_1)/(1 - \varphi)$. However, it has to be kept in mind that the uncertainty on the long-run coefficient can be large, since it is determined by cumulating the standard errors of all the short-run coefficients.

An alternative is to estimate equation (6) directly, by truncating the lag polynomial $\alpha(L)$ at a sufficiently large level. This is sometimes referred to as distributed-lag (DL) approach, and has the advantage that the estimate of θ will be subject to substantially lower uncertainty, especially when the sample size is relatively small. The disadvantage, however, is that the error term in equation (6) is no longer orthogonal to x_t, which will make the estimates inconsistent whenever the variables of interest are endogenously determined.

3.2 ARDL model in a cross-sectional framework

Equations (5) and (6) are easy to be cast in a panel framework. Denoting by i the country index, the expression for a generic ARDL(p,q) model is

$$y_{i,t} = \sum_{k=1}^{p} \varphi_{i,k} y_{i,t-k} + \sum_{l=0}^{q} \beta'_{i,l} x_{i,t-l} + u_{i,t}, \tag{7}$$

while its cointegrating form would be

$$y_{i,t} = \theta_i x_{i,t} + \alpha'_i(L)\Delta x_{it} + \tilde{u}_{i,t}. \tag{8}$$

One complication of the panel framework, though, is that the errors are likely to be correlated across countries, which makes pooled estimates of the θ parameter inconsistent. One solution to this problem is to postulate a common unobserved factor structure for the errors,

$$u_{i,t} = \gamma'_i F_t + \varepsilon_{i,t}. \tag{9}$$

Chudik and Pesaran (2015) show that a straightforward way to correct for this is to augment equation (7) with cross-sectional averages of the dependent and explanatory variables, as well as their lags, which are supposed to proxy for the unobserved common factors. This approach is referred to as the cross-section augmented ARDL (CS-ARDL) model. Similarly, Chudik et al (2016) demonstrate that the same approach of augmenting the regression with cross-sectional averages also works for the direct estimation of equation (8), and denote the approach by CS-DL.[9]

4. Empirical results for the household debt-growth nexus

In this section, we apply the econometric methods detailed above to analyse the long-run interaction of household debt and economic growth as well as to look for possible nonlinearity in these relationships. To check robustness of our results, we also consider additional elements in the long-run relationship, such as the long-term interest rate, inflation, terms of trade, house prices, debt service ratio and population growth.

4.1 Long-run effects

4.1.1 Baseline results

Our baseline specification simply relates GDP growth, as well as its key components of consumption, to (changes in) the ratio of household debt to GDP. In Table 2, we report the results for the plain ARDL model with no cross-sectional correction, as well as the CS-ARDL and CS-DL models. Here we report all results for the sake of completeness, but since endogeneity is a very likely issue here, we will focus on CS-ARDL estimates in what follows. We experimented with different choices of the AR lag length. The number of lags for the cross-sectional correction was fixed to two, after having checked the results of the Pesaran (2004) test for cross-sectional

[9] Chudik et al (2017) apply this approach to study the relationship of public debt and growth.

correlation of the residuals. The rows for cross-sectional dependence (CSD) test report the *p*-values of the test. They show that the adjustment is able to mop up cross-sectional dependence at the 5% significance level.

The first three columns report the estimates for GDP growth. We note that all coefficients are statistically significant and negative, which suggests that in the long run, household indebtedness is a drag on GDP growth. Depending on the specification chosen, long-run coefficients seem to cluster around –0.1. To give the reader a sense of this magnitude, this means that a 1 percentage point increase in household indebtedness is associated, in the long run, with lowering GDP growth by 0.1 percentage points. Mian, Sufi and Verner (2015) report a somewhat higher impact of household indebtedness on GDP growth: 0.3 percentage points over a horizon of three years. In a somewhat different setup, Jordà, Schularick and Taylor (2013) find that a recession preceded by strong credit expansion implies a loss of output in the region of 0.2 to 1 percentage points, compared to a standard recession.

Regression results from the baseline specification — Table 2

	GDP growth			Consumption growth	
	ARDL	CS-ARDL	CS-DL	CS-ARDL	CS-DL
			1 lag		
Theta	–0.083**	–0.081**	–0.057**	0.049**	0.054**
	(*0.030*)	(*0.021*)	(*0.018*)	(*0.019*)	(*0.017*)
N	3754	3754	3754	3754	3754
CSD test	119.52**	1.66^{+}	0.76	–0.96	–0.65
			2 lags		
Theta	–0.104**	–0.116**	–0.060**	0.029	0.056**
	(*0.035*)	(*0.026*)	(*0.019*)	(*0.023*)	(*0.018*)
N	3723	3723	3723	3723	3723
CSD test	114.91**	1.77^{+}	0.83	–0.7	–0.42
			3 lags		
Theta	–0.146**	–0.121**	–0.062**	0.018	0.054**
	(*0.054*)	(*0.026*)	(*0.020*)	(*0.026*)	(*0.020*)
N	3691	3691	3691	3691	3691
CSD test	111.46**	1.71^{+}	0.79	–0.31	–0.16

ARDL stands for autoregressive distributed lag, CS-ARDL for cross-section augmented ARDL, and CS-DL for cross-section augmented distributed lag. $^{+}$, *, and ** denote statistical significance at the 10 percent, 5 percent and 1 percent level, respectively. Standard errors are in parentheses.

The other two columns show the estimates for consumption growth. The coefficients have actually positive sign: this seems to indicate that that high indebtedness is associated with higher consumption in the long run.[10] However, we note that the coefficients are not statistically significant in the case of CS-ARDL estimation with more than one lag in the short-run dynamics. As we show in the next subsection, this could be a sign that rising indebtedness promotes consumption in

[10] We also ran regressions using the sum of total consumption and residential investment as a proxy for households' consumption. Although the cross-sectional dimension is a bit smaller due to limited availability of such data, the regression results were virtually unchanged.

the short run rather than in the long run, and that failing to allow sufficient short-run dynamics conceals this effect.

4.1.2 Robustness under additional explanatory variables

To further verify the robustness of our results, we consider additional explanatory variables that could also play a role in explaining long-run GDP trends and their interaction with household indebtedness. More specifically, we include inflation, house price growth, long-term interest rates, terms of trade, debt service ratio and population growth.[11]

Results under CS-ARDL with additional explanatory variables Table 3

	GDP growth						
	Baseline	Inflation	House price	LT rate	ToT	DSR	Population
Theta	–0.081**	–0.099**	–0.183**	–0.114**	–0.080**	–0.106**	–0.095*
	(*0.021*)	(*0.023*)	(*0.039*)	(*0.025*)	(*0.021*)	(*0.034*)	(*0.023*)
Zeta		–0.223**	0.107**	–0.133**	0.063	–0.102**	–0.258^{+}
		(*0.054*)	(*0.021*)	(*0.033*)	(*0.053*)	(*0.025*)	(*0.148*)
N	3754	3754	2574	3168	3754	1901	3741
CSD test	1.77^{+}	1.92^{+}	2.48*	4.34**	1.87^{+}	8.96**	0.21
	Consumption growth						
Theta	0.049**	0.003	0.05	0.048*	0.017	0.037	0.044*
	(*0.019*)	(*0.018*)	(*0.033*)	(*0.021*)	(*0.016*)	(*0.026*)	(*0.021*)
Zeta		–0.460**	0.107**	–0.093*	–0.069	–0.04	–0.194
		(*0.063*)	(*0.026*)	(*0.037*)	(*0.058*)	(*0.121*)	(*0.198*)
N	3754	3754	2574	3168	3754	1873	3741
CSD test	-0.70	1.07	1.83^{+}	2.45*	0.34	1.69^{+}	0.49

$^{+}$, *, ** denote statistical significance at the 10 percent, 5 percent and 1 percent level, respectively. Standard errors are in parentheses. ToT represents terms of trade, and DSR for debt service ratio.

The results in Table 3 suggest that the long-run relationship linking GDP growth and household debt is not undermined by the inclusion of the additional explanatory variables.[12] The coefficients remain negative and statistically significant, and range from –0.08 to –0.18. The coefficients on the additional variables are broadly in line with expectations: rising inflation and interest rates depress growth, while increasing house prices boost it. A higher burden of interest payments, as summarised by the debt service ratio (Dembiermont et al (2013)), also acts as a drag on growth, which is consistent with the findings of Juselius and Drehmann (2015). By contrast, the terms of trade do not seem to play a role in the long-run relationship. The tests for cross-

[11] Inflation is measured by the GDP deflator obtained from the IMF WEO database. House prices for 51 economies are obtained from the BIS property price database. Long-term interest rates are proxied by yields on 10-year local currency government bonds obtained from the Global Financial Database and Bloomberg for 51 economies (excluding Argentina, Estonia and Serbia). Data on the terms of trade are obtained from the IMF WEO database. Data on the debt service ratio is from the Bank for International Settlements. Finally, data on population growth are from the IMF WEO database.

[12] Although we do not show in Table 3, the results using the CS-DL approach are virtually identical to those using the CS-ARDL approach reported in the table.

sectional independence of the residuals succeed at the 5% significance level for all models except the one with house prices, that with long-term interest rates (which succeeds at the 1% level, though) and that with the debt service ratio.[13]

Consistent with what we find in Table 2, the results with consumption growth are less clear-cut. The coefficients are all positive, but remain significant and in the same order of magnitude only when controlling for the long-term interest rate and population growth. Interestingly, the controls of house and consumer price inflation are significant: the former seems to act as a drag on consumption, whereas the latter seems to boost it.

4.2 Short-run effects

The models we estimated in Table 2 are based on the cointegrating form of equation (8), so in principle one could use the same specification to retrieve the short-run dynamics of the system. However, one important difference with a conventional cointegrating equation is that in the short-run equation, the contemporaneous value of the explanatory variable is also included. This is needed to account for possible endogeneity: the contemporaneous value of x_t in equation (5) disappears only when ω is zero, ie, the innovations in the VAR representation of equation (1) are orthogonal.

This has important implications for the estimates. Since the denominator of the explanatory variable is (the level of) dependent variable itself, it is not surprising that the contemporaneous relationship between the two is negative. This, however, is of limited use if one wants to investigate the short-run dynamics of the system, ie, how changes in indebtedness would spill over to GDP. To this end, we re-estimate the CS-ARDL specifications of Table 2 by explicitly dropping the contemporaneous value of the explanatory variable in the short-run equation.

Results on the short-run impact of household debt — Table 4

	GDP growth			Consumption growth		
	1 lag	2 lags	3 lags	1 lag	2 lags	3 lags
Theta	–0.15**	–0.157**	–0.146**	0.005	–0.001	0.025
	(*0.026*)	(*0.026*)	(*0.032*)	(*0.022*)	(*0.024*)	(*0.034*)
$Alpha_1$	0.022**	0.029**	0.02*	0.026**	0.032**	0.028**
	(*0.006*)	(*0.007*)	(*0.008*)	(*0.006*)	(*0.007*)	(*0.007*)
$Alpha_2$		0.01+	0.004		0.01+	0.014
		(*0.005*)	(*0.008*)		(*0.006*)	(*0.009*)
$Alpha_3$			0.004			0.016+
			(*0.010*)			(*0.008*)
N	3726	3694	3659	3726	3694	3659
CSD	1.55	1.43	1.82 +	–0.94	–0.62	1.11

+, *, and ** denote statistical significance at the 10 percent, 5 percent and 1 percent level, respectively. Standard errors are in parentheses.

[13] However, it should be noted that in this case, the sample size is much smaller due to missing data for some countries.

The results reported in Table 4 suggest that debt boosts GDP and consumption in the short run. The coefficients on the first lag of the short-run part of the cointegrating equation is positive and significant in all three cases. The second and third lags also display positive coefficients and are at times statistically significant at the 10% level, but they are anyway of smaller magnitude. The magnitude of the coefficients also suggests that the bulk of the pass-through of increased household indebtedness to GDP growth occurs in the space of one year. The estimated half-life for GDP growth is 4.2~4.6 quarters depending on the number of lags.

5. Threshold effects

In section 4, we examined the relationship between household debt and GDP growth in an inherently linear framework, finding that the accumulation of debt is a drag on long-run growth. However, there are hints that the relationship might be nonlinear: some household debt may be beneficial, but excessive indebtedness can divert a growing share of households' income to debt repayments, thus inhibiting consumption and growth (Juselius and Drehmann (2015)). In a similar spirit, several papers documented a nonlinear relationship that ties together public debt and growth (eg Cecchetti, Mohanty and Zampolli (2012), Eberhardt and Presbitero (2015) and Chudik et al (2017)).

In this section, we investigate possible nonlinearities in the relationship between household debt and GDP growth by means of simple dummy variables, which take value 1 when the household debt-to-GDP ratio surpasses a certain threshold. We then employ such dummies in the CS-DL regressions of section 4.1 to account for two possible types of nonlinearity: a change in the level, and a change in the slope of the relationship. The former accounts for the fact that growth tends to be slower (or higher) after the debt-to-GDP ratio exceeds the threshold, while the latter allows for the possibility that the impact of high debt on growth intensifies as one moves farther above the threshold. This setup is similar to the one employed by Chudik et al (2017).

We adopt a simplified procedure to evaluate possible thresholds: we simply focus on a "low", a "medium" and a "high" threshold, fixed at 20%, 60% and 80%, respectively. Chudik et al (2017) use a grid search approach: they specify a (finite) number of possible thresholds for the debt-to-GDP ratio, and select as "optimal" the one maximising the sup-*t* (or *F*, in case both types of nonlinearities are considered) statistic by Andrews and Ploberger (1994). Our simplified approach, however, is not too different: although we consider a more limited set of thresholds and we do not conduct formal maximisation tests, one can still check the values of *t*- and *F*-statistics associated with each threshold to determine their relative significance. The largest values of *t*- and *F*-statistics correspond to the most preferred debt threshold estimates.

The first hypothesis we test relates to the "low" threshold: namely, whether countries with extremely low household debt grow more slowly – low debt could be indeed a consequence of an underdeveloped financial system which is unable to sustain growth. The results reported in Table 5 do not seem to support such a claim. The level dummies have negative sign and are statistically significant in a number of cases. This signals that on average, countries with debt-to-GDP ratios below 20% experience faster growth. However, when the slope dummy is included in the specification, it has positive sign (although not statistically significant), which would point to a boost to growth when debt starts growing above the threshold. If one

considers consumption instead of GDP growth, results are qualitatively very similar, although the slope coefficient becomes larger and statistically significant.

The other hypothesis is that of household debt as a drag on growth: we may expect that the negative relationship identified in section 4 intensifies as household debt piles up. To test for this, we employ dummies set at the 60% and 80% debt-to-GDP threshold. A negative coefficient on the level dummy would signal that when the household debt-to-GDP ratio exceeds the threshold, GDP growth is on average lower, over and above the negative relationship identified in the previous section. A negative coefficient on the slope dummy would instead indicate that the negative relationship between household debt and growth intensifies as the threshold is surpassed.

Results from threshold regressions

Table 5

		GDP growth				
Threshold		Pooled	Mean group	Cross-section (CS)		
20%	Level	–0.527**	–0.372**	–0.107+	–0.140+	
		(*0.044*)	(*0.085*)	(*0.055*)	(*0.081*)	
	Interaction				0.028	–0.009
					(*0.029*)	(*0.027*)
	t/F-statistic			3.83	3.10	0.11
	N	3811	3086	2997	2997	2997
60%	Level	–0.501**	–0.575**	–0.384**	–0.250*	
		(*0.044*)	(*0.131*)	(*0.139*)	(*0.098*)	
	Interaction				–0.118	–0.433
					(*0.126*)	(*0.270*)
	t/F-statistic			7.67	9.93	2.57
	N	3811	1136	1124	1124	1124
80%	Level	–0.512**	–0.618**	–0.363**	–0.285**	
		(*0.067*)	(*0.213*)	(*0.127*)	(*0.098*)	
	Interaction				–0.066	–0.194**
					(*0.056*)	(*0.064*)
	t/F-statistic			8.16	8.75	9.26
	N	3811	499	491	491	491
		Consumption growth				
20%	Level	–0.513**	–0.360**	–0.089+	–0.174*	
		(*0.047*)	(*0.089*)	(*0.053*)	(*0.080*)	
	Interaction				0.084*	0.044
					(*0.034*)	(*0.033*)
	t/F-statistic			2.76	8.12	1.76
	N	3811	3086	2997	2997	2997
60%	Level	–0.446**	–0.698**	–0.595**	–0.467**	
		(*0.041*)	(*0.203*)	(*0.185*)	(*0.117*)	
	Interaction				–0.095	–0.534
					(*0.135*)	(*0.329*)
	t/F-statistic			10.37	20.92	2.64
	N	3811	1136	1124	1124	1124
80%	Level	–0.388**	–0.406*	–0.113	–0.076	
		(*0.055*)	(*0.206*)	(*0.095*)	(*0.098*)	
	Interaction				–0.037	–0.043
					(*0.057*)	(*0.087*)
	t/F-statistic			1.41	1.32	0.25
	N	3811	499	491	491	491

+, *, and ** denote statistical significance at the 10 percent, 5 percent and 1 percent level, respectively. Standard errors are in parentheses.

The evidence supporting this hypothesis is much stronger: the level coefficient is negative and statistically significant across all specifications, including those accounting for cross-sectional dependence. The slope is also negative in most cases, but not statistically significant except in one case. It seems that the 80% threshold is to be preferred when it comes to GDP growth, while the 60% works better for consumption growth.

Threshold regressions for emerging market economies Table 6

				GDP growth		
Threshold		Pooled	Mean group	Cross-section (CS)		
20%	Level	–0.451**	–0.605**	–0.117	–0.167	
		(*0.069*)	(*0.138*)	(*0.097*)	(*0.154*)	
	Interaction				0.018	–0.034
					(*0.035*)	(*0.027*)
	t/F-statistic			1.47	1.31	1.58
	N	2146	1502	1449	1449	1449
60%	Level	–0.288**	–0.631+	–0.69	–0.803**	
		(*0.071*)	(*0.384*)	(*0.423*)	(*0.310*)	
	Interaction				0.146	–1.922
					(*0.146*)	(*1.916*)
	t/F-statistic			2.67	6.70	1.01
	N	2146	162	162	162	162
				Consumption growth		
20%	Level	–0.428**	–0.538**	–0.058	–0.186	
		(*0.067*)	(*0.138*)	(*0.092*)	(*0.137*)	
	Interaction				0.096+	0.044
					(*0.052*)	(*0.046*)
	t/F-statistic			0.40	3.64	0.91
	N	2146	1502	1449	1449	1449
60%	Level	–0.301+	–1.133	–0.897+	–0.985*	
		(*0.173*)	(*0.737*)	(*0.497*)	(*0.409*)	
	Interaction				0.115	–2.462
					(*0.115*)	(*2.345*)
	t/F-statistic			3.27	5.81	1.10
	N	2146	162	162	162	162

+, *, and ** denote statistical significance at the 10 percent, 5 percent and 1 percent level, respectively. Standard errors are in parentheses.

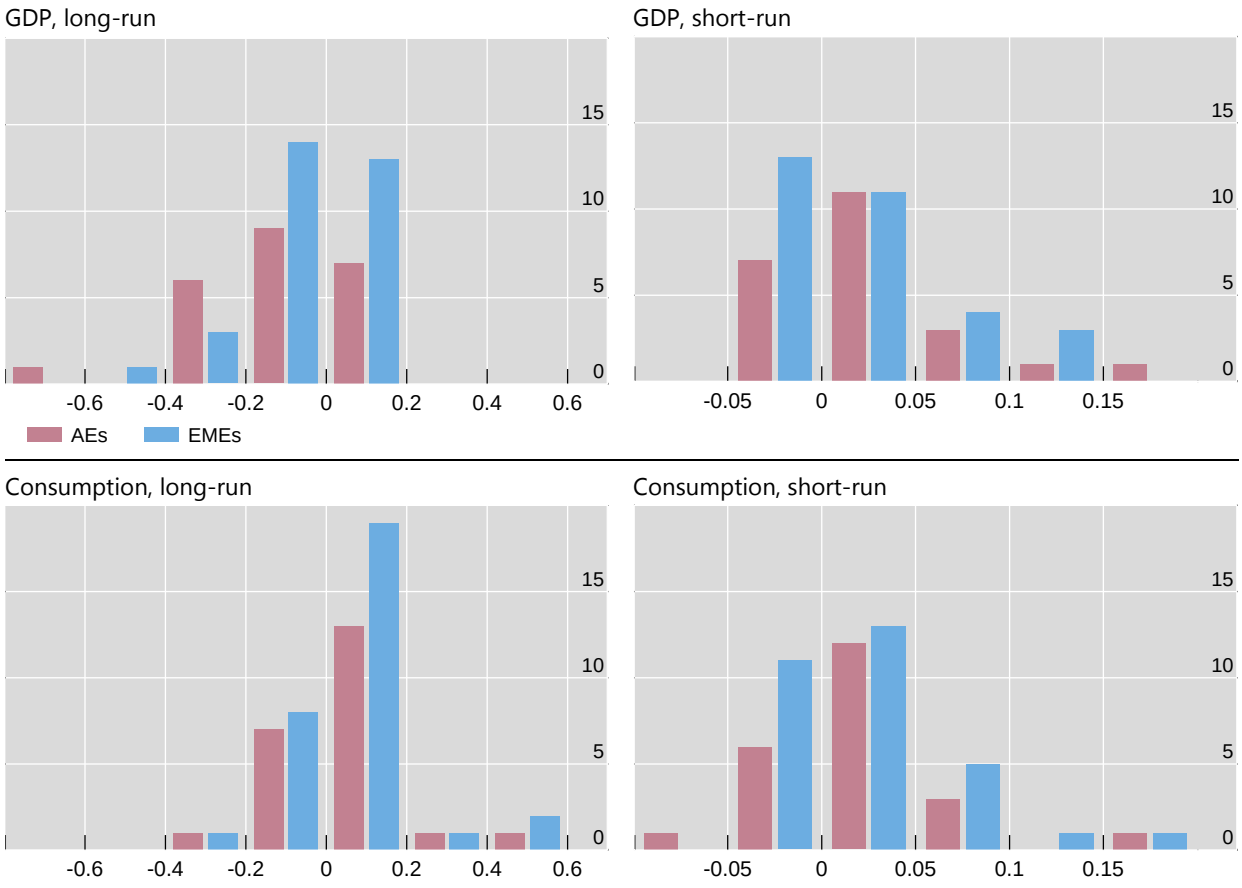
Finally, we explore whether EMEs have specifically different thresholds by excluding AEs from the sample. Table 6 shows that the points made above remain broadly valid. In particular, the 20% level dummy threshold is not significant when cross-sectional dependence is allowed, but the dummy for the slope is significant in the case of consumption. The 60% threshold, which represents a high level of

indebtedness for EMEs, has negative sign and is statistically significant.[14] In all cases, the *t*- and *F*-statistics have larger values for the 60% threshold.

6. Determinants of cross-country variations

One interesting feature of the panel ARDL approach is that it provides country-specific estimates of the coefficients. In this section, we examine such country-specific results in more detail, and try to explain cross-country differences in the impact of household indebtedness on growth, by looking at a set of possible explanatory variables.

Distribution of country-specific coefficients — Graph 4



The vertical axis shows the number of economies whose coefficient values fall into each range. The sample consists of 23 advanced economies and 31 emerging market economies. The list of economies are provided in Table A1.1 in Appendix 1.

Sources: national sources; authors' calculations.

The upper-left panel of Graph 4 reports the distribution of the country-specific estimate of the long-run coefficient. The majority of the coefficients are negative, in line with the aggregate estimates reported in Table 1. But some are also positive which would point to a positive long-run relationship between indebtedness and

[14] In the sample, there is no EME which has ever reached 80% threshold during the sample period.

growth, although their magnitude is smaller. There does not seem to be a clear country pattern: many EMEs, such as Hong Kong SAR and Singapore, have negative coefficients of a comparable magnitude to major AEs. The upper-right panel of Graph 4 reports the short-run coefficients for GDP growth: most of them are positive, but also in this case there is no clear pattern across country groups.

To investigate the drivers of such cross-country differences, we try to pin down possible explanatory factors in a cross-country regression framework. Specifically, we regress the estimated long-run and short-run country-specific coefficients on a set of covariates.[15] We account for the following three possible drivers of the cross-country differences: (1) an index of overall financial developments in Svirydzenka (2016)[16]; (2) a bloc of variables from the growth literature that relate to overall economic development and long-run growth prospects including per-capita income, the saving rate, population growth, schooling, the dependency ratio, a measure of trade openness and inflation[17]; and (3) a set of variables on the quality of the institutional system provided by the World Bank and used, among others, by Jappelli, Pagano and di Maggio (2008), including the degree of legal protection of creditors (a higher value meaning better protection), the depth of the credit information available, time to resolve insolvencies, the tax rate on profits, and the reliance on US dollar borrowing.

Table 7 reports the results from the regression of the country-specific long-run coefficient on three blocs of explanatory variables. We use each bloc one at a time in the first three columns, while the last column reports the result using all explanatory variables at the same time. Financial development enters with a negative sign, meaning that higher development magnifies the drag on growth exerted by household debt. It is statistically significant when used alone, but significance disappears when combined with other variables, although the sign stays negative. The bloc of growth determinants does not seem to be significant. Among the institutional factors, the degree of legal protection is significant at the 5% level, and also remains significant (though at the 10% level) when all variables are included in the regression.

Table 8 shows the same results by restricting our attention to EMEs. The role of financial development appears more nuanced in that no coefficient is significant, and in some case they turn out to be positive. By contrast, the degree of legal protection remains significant at the 10% level.

We repeat the exercise for the short-run coefficient of EMEs. The results are provided in Table 9. Here an interesting finding is that the coefficient on the financial development variable is positive and significant when combined with the growth determinants.[18] This suggests that higher indebtedness may actually lead to higher growth in the short run for better financially developed EMEs. The other institutional variables instead do not seem to play any role.

[15] We are aware that, since we work with generated regressors, the standard errors reported would be largely underestimated.

[16] The index covers a broad number of qualitative and quantitative aspects of financial developments. Admittedly, the credit-to-GDP ratio is among the aspects considered, which is potentially a problem for our regression. However, we stress that it is only one out of the 20 variables on which the overall index is based, so potential endogeneity should be a relatively minor problem.

[17] The same variables are used by Cecchetti, Mohanty and Zampolli (2012) in their study of public debt.

[18] Instead the same results for advanced economies (not reported for the sake of space) point to a negative coefficient.

What explains cross-country difference in the long-run coefficient? Table 7

	Financial development	Growth determinants	Institutional variables	All variables
Financial development	–0.230*	–0.167	–0.214	–0.188
	(*0.103*)	(*0.188*)	(*0.137*)	(*0.204*)
Per-capita income		–0.001		–0.002
		(*0.002*)		(*0.002*)
Saving rate		–0.001		–0.000
		(*0.004*)		(*0.004*)
Population growth		0.141		0.123
		(*0.178*)		(*0.185*)
Schooling		–0.015		–0.003
		(*0.015*)		(*0.017*)
Dependency ratio		–0.002		–0.001
		(*0.006*)		(*0.006*)
Trade openness		–0.000		–0.000
		(*0.000*)		(*0.000*)
Inflation		–0.001		0.001
		(*0.008*)		(*0.009*)
Legal protection			–0.021*	–0.019+
			(*0.009*)	(*0.011*)
Depth of credit information			0.019	0.017
			(*0.014*)	(*0.016*)
Time to resolve insolvency			0.014	–0.004
			(*0.027*)	(*0.034*)
Tax rate			–0.001	–0.001
			(*0.001*)	(*0.002*)
Reliance on USD borrowing			–0.001	0.030
			(*0.063*)	(*0.081*)
Constant	0.054	0.323	0.108	0.229
	(*0.063*)	(*0.450*)	(*0.163*)	(*0.505*)
N	54	54	54	54

+, *, and ** denote statistical significance at the 10 percent, 5 percent and 1 percent level, respectively. Standard errors are in parentheses.

What explains cross-country difference in the long-run coefficient for EMEs? Table 8

	Financial development	Growth determinants	Institutional variables	All variables
Financial development	–0.062	0.150	–0.057	0.089
	(*0.144*)	(*0.249*)	(*0.156*)	(*0.272*)
Per-capita income		–0.006		–0.007
		(*0.006*)		(*0.006*)
Saving rate		–0.001		0.000
		(*0.004*)		(*0.004*)
Population growth		–0.029		–0.034
		(*0.238*)		(*0.252*)
Schooling		–0.006		0.002
		(*0.019*)		(*0.020*)
Dependency ratio		0.003		0.003
		(*0.007*)		(*0.007*)
Trade openness		0.000		0.000
		(*0.001*)		(*0.001*)
Inflation		–0.003		–0.002
		(*0.008*)		(*0.009*)
Legal protection			–0.019[+]	–0.015
			(*0.010*)	(*0.013*)
Depth of credit information			0.018	0.016
			(*0.014*)	(*0.016*)
Time to resolve insolvency			0.001	-0.015
			(*0.028*)	(*0.035*)
Tax rate			0.000	0.000
			(*0.001*)	(*0.002*)
Reliance on USD borrowing			0.126	0.213
			(*0.214*)	(*0.279*)
Constant	–0.024	–0.147	–0.009	–0.176
	(*0.070*)	(*0.469*)	(*0.167*)	(*0.528*)
N	31	31	31	31

[+], *, and ** denote statistical significance at the 10 percent, 5 percent and 1 percent level, respectively. Standard errors are in parentheses.

What explains cross-country difference in the short-run coefficient for EMEs? Table 9

	Financial development	Growth determinants	Institutional variables	All variables
Financial development	0.061	0.253+	0.042	0.179
	(*0.085*)	(*0.143*)	(*0.103*)	(*0.150*)
Per–capita income		–0.001		–0.002
		(*0.003*)		(*0.003*)
Saving rate		–0.002		–0.003
		(*0.002*)		(*0.002*)
Population growth		–0.091		–0.048
		(*0.137*)		(*0.139*)
Schooling		–0.010		–0.011
		(*0.011*)		(*0.011*)
Dependency ratio		0.001		–0.000
		(*0.004*)		(*0.004*)
Trade openness		–0.000		–0.000
		(*0.000*)		(*0.000*)
Inflation		0.002		0.005
		(*0.005*)		(*0.005*)
Legal protection			–0.006	–0.000
			(*0.007*)	(*0.007*)
Depth of credit information			0.000	–0.003
			(*0.009*)	(*0.009*)
Time to resolve insolvency			–0.006	–0.039+
			(*0.018*)	(*0.019*)
Tax rate			–0.000	–0.001
			(*0.001*)	(*0.001*)
Reliance on USD borrowing			–0.026	0.073
			(*0.142*)	(*0.154*)
Constant	–0.063	–0.033	0.021	0.226
	(*0.042*)	(*0.269*)	(*0.111*)	(*0.291*)
N	31	31	31	31

+, *, and ** denote statistical significance at the 10 percent, 5 percent and 1 percent level, respectively. Standard errors are in parentheses.

7. Concluding remarks

This paper investigates the short-run and long-run effects of a rise in household indebtedness on output and consumption growth, using the CS-ARDL model proposed by Pesaran and Smith (1995) and Chudik et al (2016). It uses data on 54 AEs and EMEs over the period of 1990–2015, and shows that an increase in the household debt-to-GDP ratio boosts consumption and GDP growth in the short run, but tends to lower GDP growth in the long run. The negative long-run effects on consumption tend to intensify as the household debt-to-GDP ratio exceeds 60%. The estimated threshold is somewhat larger for GDP growth, with the negative debt effects becoming stronger and much larger as the household debt-to-GDP ratio surpasses 80%.

We also find that the impact of household indebtedness on growth varies across countries depending on their key characteristics such as the degree of legal

protection for creditors. One possible interpretation of this result is that the degree of development of national bankruptcy codes have an important role to play in limiting defaults and therefore the long-run adverse effects of debt on growth that may be explicitly related to banks' ability to intermediate credit. This suggests that households in countries with better creditor protection standards are less likely to be credit-constrained following an adverse shock than those with weaker creditors' rights.

Our results are related to the larger debate about the role of debt in the economy. The real and financial effects of high levels of household debt as well as its rapid growth have become a key concern for policymakers since the financial crisis of 2007–08. At the centre of this debate is the question as to whether the rapid increases in household debt in a country are a reflection of the financial deepening process or the build-up of financial imbalances. Our results do not provide much direct evidence on the former, besides suggesting that growth performance is not significantly weaker in countries with a very low levels of household debt (less than 20% of GDP) than those with moderate levels of debt. That said, our cross-country exercise sheds some light on the institutional factors that may help to enhance "debt tolerance" of countries.

An important question, on which this paper is largely silent, is the role of various factors in the accumulation of household debt.[19] One key issue in the context of the risk-taking channel of monetary policy (eg Borio and Zhu (2012)) is the extent to which low short- and long-term rates over the past eight years may have played a role in the recent rapid rise in household debt in many countries and even constrained the central banks in raising rates. Even though such a question remains beyond the purview of this paper, any assessment must consider the various short-run and long-run effects associated with the strategy to stimulate the economy through ever larger increases in the levels of debt.

[19] A recent review can be found in Cecchetti et al (2012).

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Appendix 1. Data sources on household debt

We use quarterly data on household debt, GDP and other macroeconomic variables, financial variables, institutional variables for 54 economies over the sample 1990Q1 (or earliest time data are available) to 2015Q1. The 54 economies include 23 advanced economies (AEs) and 31 emerging market economies (EMEs). Table A1.1 shows the list of 54 economies.

Sample economies — Table A1.1

Region (number)	Economy
Asia-Pacific (12)	Australia, China, Hong Kong SAR, India, Indonesia, Japan, Korea, Malaysia, New Zealand, Philippines, Singapore, Thailand
Central and eastern Europe (15)	Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Russia, Serbia, Slovakia, Slovenia, Turkey, Ukraine
Latin America (5)	Argentina, Brazil, Colombia, Mexico, Peru
Middle East & Africa (2)	Israel, South Africa
Western Europe (18)	Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Spain, Sweden, United Kingdom
North America (2)	Canada, United States

Household debt data were collected from various national sources. In particular, we collected data on the total amount of loans extended by banks to households, but the exact definition of household debt differs across economies. Table A1.2 provides the exact definitions and data sources as well as the period of data available.

In Table A2.5, we use total credit to households and non-profit institutions serving households (NPISHs) from BIS database on total credit to the non-financial sector for 39 economies out of the 54 economies.

In the empirical analysis, we use the ratio of household debt to GDP as a proxy for household indebtedness. Here we use GDP instead of household disposable income due to data availability.

To measure economic growth, we collected data on GDP, consumption and investment from the IMF World Economic Outlook database. The annual data from the database are interpolated to a quarterly frequency. For ten central and eastern European economies, we have missing data sometime in early 1990s. Graphs A1.1 and A1.2 show the patterns of GDP and consumption growth in comparison with the household debt growth for AEs and EMEs, respectively. We find a loose negative connection between household indebtedness and GDP/consumption growth (Graphs A1.3 and A1.4).

When we consider the cross-country distribution of the household debt-to-GDP ratio and the growth rates of GDP and consumption, we find that the degree of dispersion of the household debt-to-GDP ratio for the AEs in the sample is similar to that for the EMEs in the sample, but the degree of dispersion of GDP and consumption growth for the EMEs is larger than that for the AEs (Graph A1.5). Finally, Graph A1.6 shows that the household debt to GDP ratio for all economies in the sample fluctuated in sync with GDP and consumption growth in the 1990s, but that the household debt to GDP ratio has steadily increased since early 2000s.

Definitions and data sources of household credit by banks

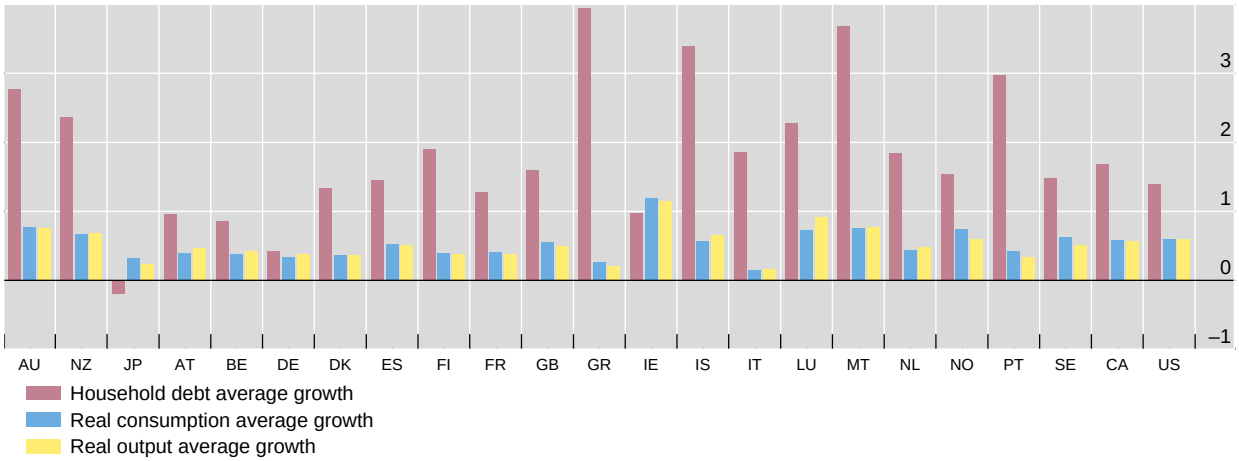
Table A1.2

Economy	Definition	Source
Argentina	Credit institutions: credit (=loans) to households: total, M-end NSA	BIS databank
Australia	Bank assets: loans to households: total, M-end NSA	BIS databank
Austria	Households & NPISHs: liabilities: total (Esa95), NSA	BIS databank
Belgium	Credit institutions: loans to households (including NPISHs): M-end NSA	BIS databank
Brazil	Financial system: credit (=loans) to households: market and non-market conditions: M-end NSA	BIS databank
Bulgaria	Banks (MFIs): credit (=loans) to households and NPISHs: M-end NSA	BIS databank
Canada	Households liabilities: residential mortgage credit and consumer credit: NSA	BIS databank
China	Consumer loan: local and foreign currency	CEIC
Croatia	Banks (MFIs): credit (=loans) to households: total, M-end, Q-end NSA	BIS databank
Colombia	Credit institutions: consumer credit	Datastream
Czech Republic	Bank (MFI) assets: credit to households: total (Esa95), M-end NSA	BIS databank
Denmark	Monetary financial institution lending: households etc: total	Datastream
Estonia	Depository corporation excluding central bank: assets: loans to households: NSA	BIS databank
Finland	Depository corporation excluding central bank: assets: loans to households: NSA	BIS databank
France	Credit institutions: credit (=loans) to households: total, M-end NSA	BIS databank
Germany	Banks (MFIs): credit (=loans) to households: total, NSA	BIS databank
Greece	Credit institutions and central bank: credit to households: Total, NSA	BIS databank
Hong Kong SAR	Bank assets: credit to the household sector: Q-end NSA	BIS databank
Hungary	Households & NPISHs: liabilities: loans	BIS databank
Iceland	Deposit money banks: loans to households, backdated with total lending to households	National data, Datastream
India	Scheduled commercial banks: credit outstanding: personal loans	CEIC
Indonesia	Commercial banks outstanding credits to individuals	Datastream
Ireland	Credit institutions: assets: loans to households: M-end NSA	BIS databank
Italy	MFIs excluding central bank: credit (=loans) to households: total, M-end NSA	BIS databank
Israel	Credit: debt outstanding: households	Datastream
Japan	Flow of funds: liabilities: households: loans	BIS databank
Korea	Loans of commercial and specialised banks: household	CEIC
Latvia	Banks (MFIs): credit (=loans) to households: Total, M-end NSA	BIS databank
Lithuania	Other MFI loans to residents: households	Datastream
Luxembourg	Bank loans: households and NPISHs	Datastream
Malaysia	Loans: banking system: by type: including Cagamas and excluding Danaharta: term: Personal loans and housing loans	CEIC
Malta	Deposit money banks: loans and advances: Personal	Datastream
Mexico	Banks: credit (=loans) to households: total, Q-end NSA	BIS databank
Netherlands	Depository corporation excluding central bank: loans to households: NSA	BIS databank
New Zealand	Deposit-taking corporation and other fin. Institutions: credit to households: M-end SA	BIS databank
Norway	Banks: assets: credit to households: total, M-end NSA	BIS databank
Peru	Credit to the private sector: consumer credit and mortgage loan	National data
Philippines	Philippine banking system: consumer loans	CEIC
Poland	Monetary financial institution loans and other claims on the non-financial sector: households: total	Datastream
Portugal	Depository corporation excluding central bank: assets: credit to households and NPISHs: M-end NSA	BIS databank
Romania	Credit: households: total	Datastream
Russia	Credit institutions: credit to households: Total, NSA	BIS databank
Serbia	Assets: domestic credit: credit to non-government sectors: households	Datastream
Singapore	Domestic banking units: loans and advances: consumer loans	CEIC
Slovakia	Monetary financial institutions: balance sheet: assets: loans to households	Datastream
Slovenia	Other monetary financial institutions domestic ASS (households and NPISHs)	Datastream
South Africa	Credit extended to the domestic private sector: loans and advances: Households	Datastream
Spain	MFIs excluding central bank: credit (=loans) to households: total, M-end NSA	BIS databank
Sweden	Credit institutions: loans to households: total, M-end NSA, backdated with monetary financial institutions: lending to households excluding NPISHs: total	BIS databank, Datastream
Thailand	Banks: assets: loans to individuals: NSA	BIS databank
Turkey	Credit institutions: loans: households (including NPISHs): M-end NSA	BIS databank
Ukraine	Loans: banks: households	Datastream
United Kingdom	Net lending to individuals: total (amounts outstanding): SA	Datastream
United States	Flow of funds balance sheet: household and NPISH: liabilities: credit market instruments total	Datastream

Household debt, consumption and output (advanced economies)

1990–2015 average, in percent

Graph A1.1

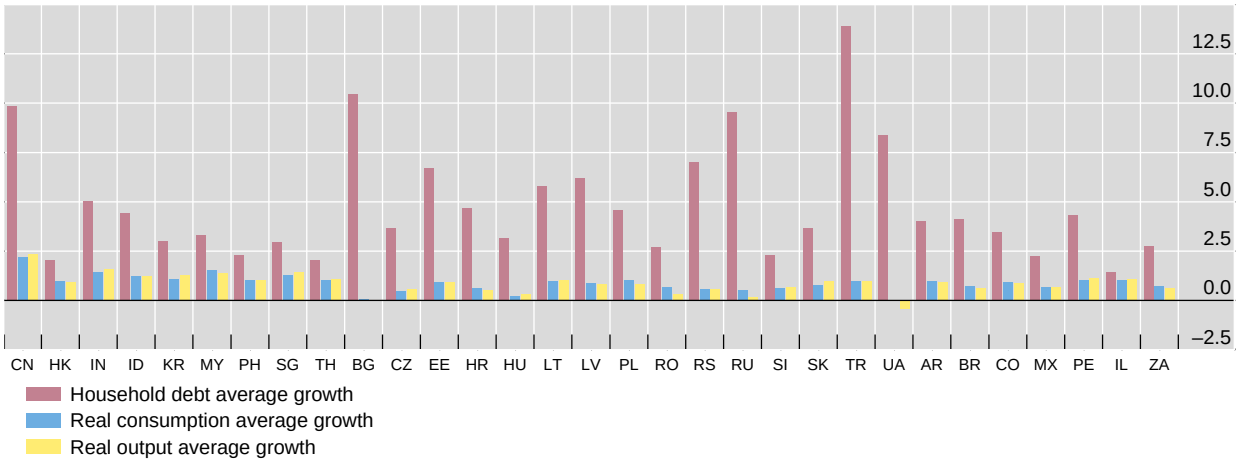


Sources: IMF, *World Economic Outlook*; BIS; authors' calculations.

Household debt, consumption and output (emerging market economies)

1990–2015 average, in percent

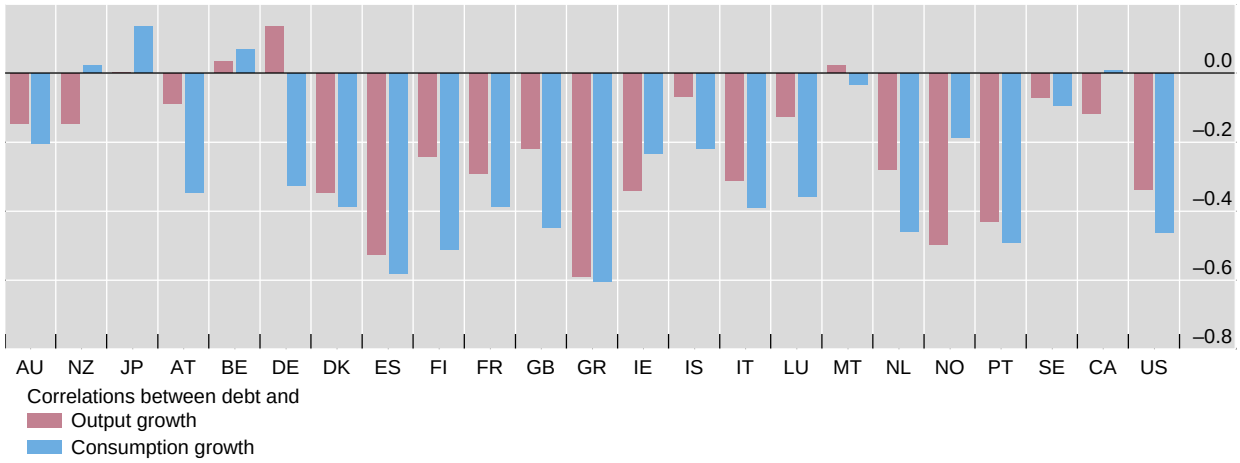
Graph A1.2



Sources: IMF, *World Economic Outlook*; BIS; authors' calculations.

Correlations between household debt and change in output and consumption (advanced economies)

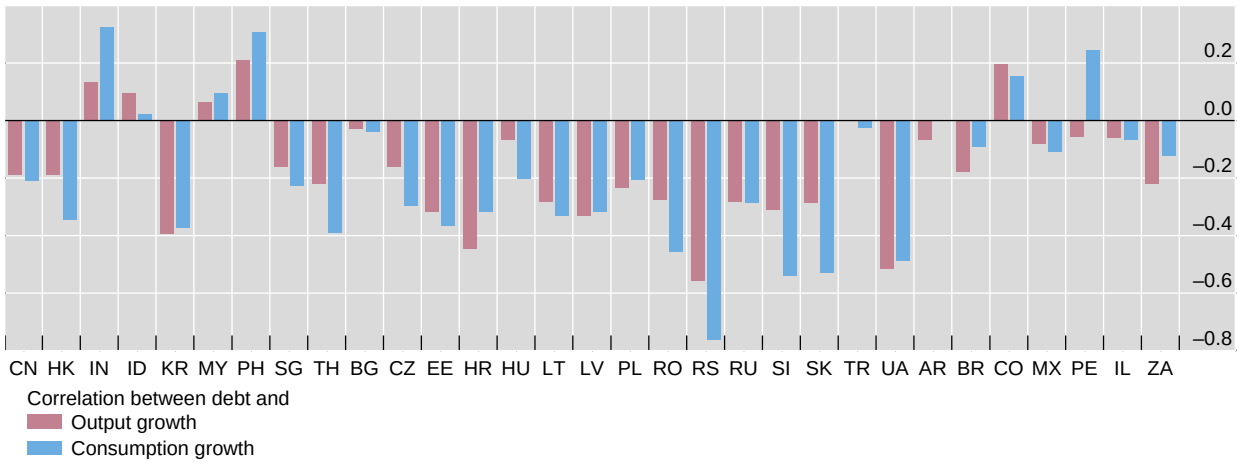
Graph A1.3



Sources: IMF, *World Economic Outlook*; BIS; authors' calculations.

Correlations between household debt and change in output and consumption (emerging market economies)

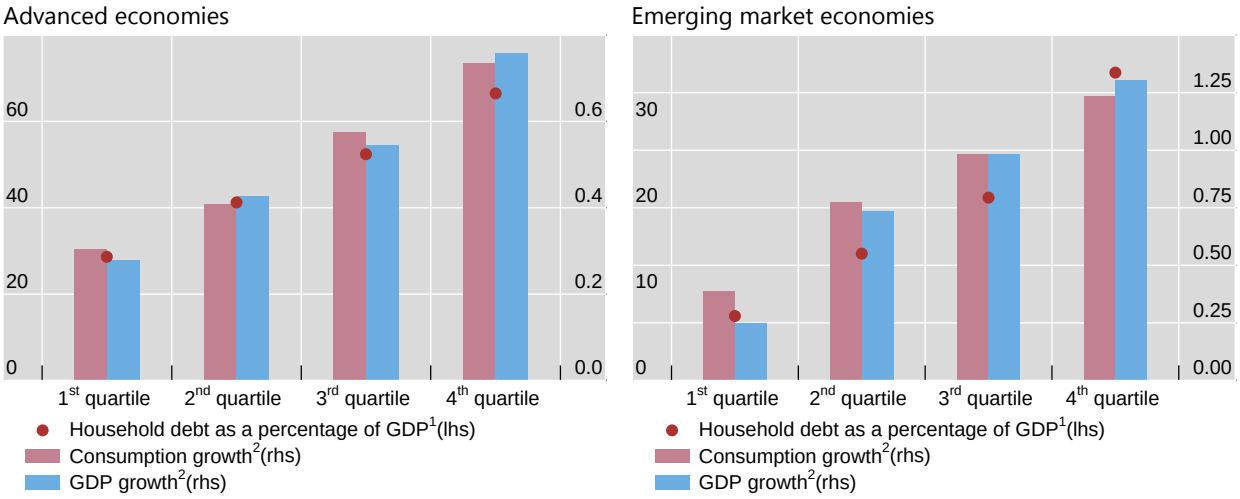
Graph A1.4



Sources: IMF, *World Economic Outlook*; BIS; authors' calculations.

Distribution of debt, output and consumption

Graph A1.5

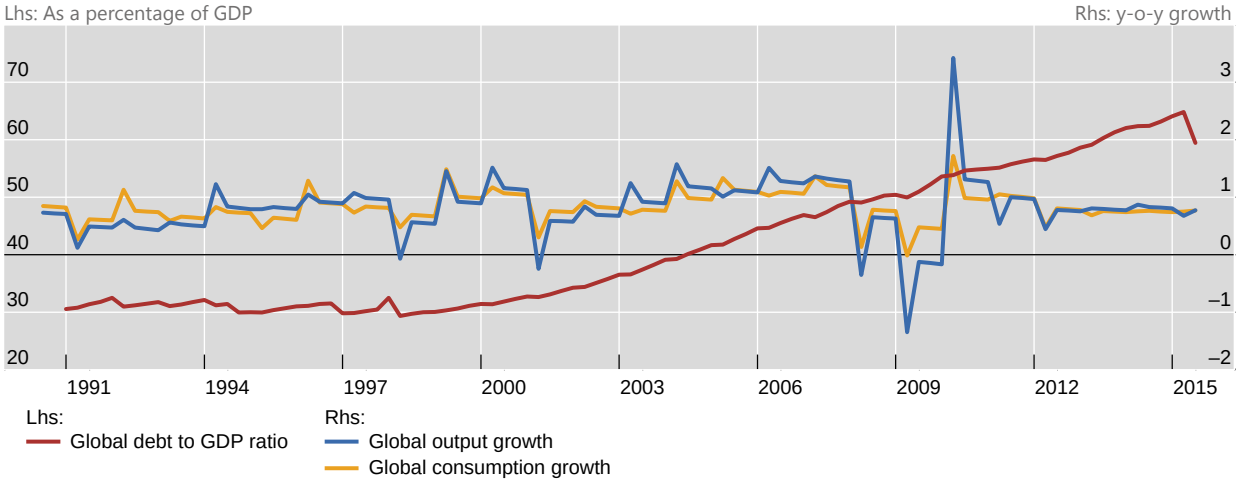


[1] The average within the quantiles. [2] The average growth within the quartiles.

Sources: IMF, *World Economic Outlook*; BIS; authors' calculations.

Global[1] household debt to GDP ratio and global GDP and consumption growth

Graph A1.6



[1] Weighted averages for 54 economies based on rolling GDP and PPP exchange rates.

Sources: IMF, *World Economic Outlook*; BIS; authors' calculations.

Appendix 2. Further robustness checks

To check the robustness of our results, we repeated the exercise on the alternative models employed in Table 3. For the sake of brevity, we only report the results from the first two models corrected for cross-sectional dependence in Table 5. In all cases, the dummy coefficient for GDP growth remains statistically significant (Table A2.1). This means that even controlling for additional long-run drivers of indebtedness does not alter its negative effect on growth. For consumption, the results are less clear-cut, and some specifications produce non-significant results, although the signs are almost always negative.

We also tried to control for banking, financial and currency crises, including dummies based on the dates provided by Laeven and Valencia (2013). The results remain virtually unchanged in terms of statistical significance (Table A2.2). Table A2.3 replicates the results of Table A2.2 for EMEs only by including the financial crisis dummies of Laeven and Valenica (2013). The results remain virtually unchanged.

As an additional robustness check, we also considered different breakdowns of debt and consumption, and tried to associate them with a relevant debt component. More specifically, we looked at consumption of durables and non-durables (which we try to relate to consumer loans) and at residential investment (which we relate to housing loans).

The results are reported in Table A2.4. It is important to stress that, due to data availability, the cross-sectional dimension drops substantially, which is likely to heavily affect the statistical significance of the results. The economic significance, however, is unaltered: the coefficients are all positive and of the same order of magnitude as those in Table 2.

Finally, we also looked at a broader definition of household debt, ie, the BIS definition of total credit to households and NPISHs (Dembiermont et al (2013)). We do not use these data for the baseline regressions, since the cross-sectional coverage is smaller, but the results reported in Table A2.5 are in line with those in Table 2. The only difference is that cross-sectional averages do not seem to mop up completely the cross-sectional dependence.

Results from threshold regressions with additional explanatory variables Table A2.1

		GDP growth					
Threshold		Baseline	Inflation	House price	LT rate	ToT	DSR
20%	Level	–0.107⁺	–0.172*	–0.062*	–0.178**	–0.103⁺	–0.112⁺
		(0.055)	*(0.071)*	*(0.030)*	*(0.063)*	*(0.055)*	*(0.059)*
	Level	–0.140⁺	–0.211*	–0.146*	–0.220*	–0.147⁺	–0.133+
		(0.081)	*(0.09)*	*(0.073)*	*(0.097)*	*(0.082)*	*(0.076)*
	Interaction	0.028	0.055+	0.168**	0.034	0.037	0.099**
		(0.029)	*(0.031)*	*(0.064)*	*(0.029)*	*(0.030)*	*(0.038)*
	N	2997	2997	2060	2655	2997	1533
60%	Level	–0.384**	–0.392**	–0.351*	–0.430**	–0.332*	–0.064
		(0.139)	*(0.151)*	*(0.148)*	*(0.110)*	*(0.153)*	*(0.108)*
	Level	–0.250*	–0.248*	–0.002	–0.275*	–0.202⁺	–0.132
		(0.098)	*(0.113)*	*(0.141)*	*(0.107)*	*(0.118)*	*(0.100)*
	Interaction	–0.118	–0.106	–0.123	–0.105	–0.109	0.062⁺
		(0.126)	*(0.136)*	*(0.137)*	*(0.120)*	*(0.124)*	*(0.033)*
	N	1124	1124	842	1123	1124	590
80%	Level	–0.363**	–0.407**	–0.244**	–0.418**	–0.391**	–0.21
		(0.127)	*(0.077)*	*(0.078)*	*(0.113)*	*(0.082)*	*(0.145)*
	Level	–0.285**	–0.396**	–0.170*	–0.396**	–0.289**	–0.173
		(0.098)	*(0.092)*	*(0.075)*	*(0.117)*	*(0.084)*	*(0.130)*
	Interaction	–0.066	0.004	–0.090⁺	0.004	–0.093⁺	–0.009
		(0.056)	*(0.055)*	*(0.051)*	*(0.058)*	*(0.054)*	*(0.077)*
	N	491	491	399	491	491	285
		Consumption growth					
20%	Level	–0.176**	–0.123*	–0.003	–0.176**	–0.056	–0.100*
		(0.046)	*(0.057)*	*(0.045)*	*(0.063)*	*(0.066)*	*(0.051)*
	Level	–0.174*	–0.234**	–0.154⁺	–0.360**	–0.267**	–0.140⁺
		(0.080)	*(0.090)*	*(0.093)*	*(0.105)*	*(0.094)*	*(0.078)*
	Interaction	0.084*	0.072⁺	0.233*	0.065⁺	0.080*	0.103*
		(0.034)	*(0.038)*	*(0.104)*	*(0.035)*	*(0.035)*	*(0.044)*
	N	2997	2997	2060	2655	2997	1533
60%	Level	–0.576**	–0.516**	–0.475**	–0.589**	–0.469*	–0.279**
		(0.191)	*(0.171)*	*(0.175)*	*(0.154)*	*(0.198)*	*(0.101)*
	Level	–0.467**	–0.392*	–0.046	–0.386**	–0.311**	–0.241**
		(0.117)	*(0.161)*	*(0.199)*	*(0.144)*	*(0.085)*	*(0.081)*
	Interaction	–0.095	–0.119	–0.124	–0.115	–0.107	0.044
		(0.135)	*(0.130)*	*(0.172)*	*(0.128)*	*(0.147)*	*(0.046)*
	N	1124	1124	842	1123	1124	590
80%	Level	–0.163	–0.330⁺	–0.124	–0.206⁺	–0.357**	–0.032
		(0.105)	*(0.176)*	*(0.078)*	*(0.116)*	*(0.063)*	*(0.157)*
	Level	–0.076	–0.419*	–0.071	–0.272	–0.345**	0.029
		(0.098)	*(0.175)*	*(0.150)*	*(0.187)*	*(0.105)*	*(0.168)*
	Interaction	–0.037	0.047	–0.111	0.001	–0.069	0.003
		(0.057)	*(0.123)*	*(0.114)*	*(0.084)*	*(0.063)*	*(0.095)*
	N	491	491	399	491	491	285

⁺, *, and ** denote statistical significance at the 10 percent, 5 percent and 1 percent level, respectively. Standard errors are in parentheses.

Threshold regressions with crisis dummies

Table A2.2

		GDP growth				
Threshold		Pooled	Mean group	Cross-section (CS)		
20%	Level	–0.470**	–0.244**	–0.07	–0.107	
		(0.044)	*(0.073)*	*(0.047)*	*(0.078)*	
	Interaction				0.027	0.004
					(0.030)	*(0.028)*
	N	3811	3086	2997	2997	2997
60%	Level	–0.398**	–0.311**	–0.228*	–0.119	
		(0.044)	*(0.072)*	*(0.097)*	*(0.105)*	
	Interaction				–0.092	–0.269
					(0.115)	*(0.175)*
	N	3811	1136	1124	1124	1124
80%	Level	–0.355**	–0.572**	–0.391**	–0.320**	
		(0.070)	*(0.214)*	*(0.111)*	*(0.113)*	
	Interaction				–0.063	–0.173**
					(0.061)	*(0.057)*
	N	3811	499	491	491	491
		Consumption growth				
20%	Level	–0.463**	–0.260**	–0.045	–0.131+	
		(0.048)	*(0.083)*	*(0.048)*	*(0.079)*	
	Interaction				0.081*	0.053+
					(0.032)	*(0.030)*
	N	3811	3086	2997	2997	2997
60%	Level	–0.355**	–0.483**	–0.513**	–0.402**	
		(0.041)	*(0.158)*	*(0.162)*	*(0.139)*	
	Interaction				–0.085	–0.455
					(0.132)	*(0.287)*
	N	3811	1136	1124	1124	1124
80%	Level	–0.249**	–0.521+	–0.361	–0.305	
		(0.057)	*(0.284)*	*(0.234)*	*(0.220)*	
	Interaction				–0.046	–0.127
					(0.063)	*(0.116)*
	N	3811	499	491	491	491

+, *, and ** denote statistical significance at the 10 percent, 5 percent and 1 percent level, respectively. Standard errors are in parentheses.

Threshold regressions for EMEs with crisis dummies

Table A2.3

		GDP growth				
Threshold		Pooled	Mean group	Cross-section (CS)		
20%	Level	–0.394**	–0.432**	–0.081	–0.141	
		(0.070)	*(0.128)*	*(0.089)*	*(0.154)*	
	Interaction				0.008	–0.024
					(0.037)	*(0.028)*
	N	2146	1502	1449	1449	1449
60%	Level	–0.145	–0.314+	–0.470*	–0.569**	
		(0.107)	*(0.181)*	*(0.211)*	*(0.111)*	
	Interaction				0.167	–1.12
					(0.167)	*(1.228)*
	N	2146	162	162	162	162
		Consumption growth				
20%	Level	–0.382**	–0.415**	–0.001	–0.136	
		(0.070)	*(0.140)*	*(0.089)*	*(0.146)*	
	Interaction				0.085+	0.051
					(0.050)	*(0.044)*
	N	2146	1502	1449	1449	1449
60%	Level	–0.186	–1.079+	–0.838*	–0.900**	
		(0.194)	*(0.629)*	*(0.372)*	*(0.309)*	
	Interaction				0.105	–2.126
					(0.105)	*(2.045)*
	N	2146	162	162	162	162

+, *, and ** denote statistical significance at the 10 percent, 5 percent and 1 percent level, respectively. Standard errors are in parentheses.

Results using granular data

Table A2.4

	Durables		Non–durables		Residential investment	
	CS–ARDL	CS–DL	CS–ARDL	CS–DL	CS–ARDL	CS–DL
			1 lag			
Theta	–0.01	–0.038	0.004	0.020	0.097	0.117+
	(0.048)	*(0.056)*	*(0.013)*	*(0.016)*	*(0.072)*	*(0.068)*
N	1711	1717	1711	1717	2509	2518
CSD test	–1.63	–1.76+	–1.73+	–1.73+	–1.55	–2.10*
			2 lags			
Theta	0.013	–0.038	0.007	0.016	0.065	0.103
	(0.052)	*(0.068)*	*(0.019)*	*(0.016)*	*(0.090)*	*(0.070)*
N	1685	1696	1685	1696	2491	2509
CSD test	–2.15*	–1.95+	–1.23	–1.55	–1.70+	–2.46*
			3 lags			
Theta	0.018	–0.050	0.024	0.021	0.003	0.069
	(0.077)	*(0.089)*	*(0.021)*	*(0.015)*	*(0.097)*	*(0.074)*
N	1659	1675	1659	1675	2473	2500
CSD test	–1.59	–1.94+	–1.06	–1.72+	–1.58	–2.27*

CS–ARDL stands for cross–section augmented autoregressive distributed lag, and CS–DL for cross–section augmented distributed lag. +, *, and ** denote statistical significance at the 10 percent, 5 percent and 1 percent level, respectively. Standard errors are in parentheses.

Results using total credit to households and NPISHs Table A2.5

	GDP growth			Consumption growth	
	ARDL	CS–ARDL	CS–DL	CS–ARDL	CS–DL
			1 lag		
Theta	–0.142**	–0.085**	–0.064**	0.073**	0.087**
	(0.038)	*(0.025)*	*(0.024)*	*(0.030)*	*(0.029)*
N	2677	2677	2677	2677	2677
CSD test	82.23**	11.94**	11.28**	5.03**	5.68
			2 lags		
Theta	–0.104**	–0.116**	–0.060**	0.066+	0.087**
	(0.035)	*(0.026)*	*(0.019)*	*(0.034)*	*(0.030)*
N	2662	2662	2662	2662	2662
CSD test	80.27**	12.01**	11.75**	4.97**	6.15
			3 lags		
Theta	–0.152**	–0.106**	–0.062**	0.061	0.084**
	(0.041)	*(0.028)*	*(0.028)*	*(0.038)*	*(0.033)*
N	2647	2647	2647	2647	2647
CSD test	75.81**	12.56**	12.77**	4.99**	6.70

ARDL stands for autoregressive distributed lag, CS–ARDL for cross–section augmented ARDL, and CS–DL for cross–section augmented distributed lag. +, *, and ** denote statistical significance at the 10 percent, 5 percent and 1 percent level, respectively. Standard errors are in parentheses.