Asymmetric effects of private debt on income growth[*]

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Abstract

This paper uses a panel vector autoregressive model to study the differential effects of components of private debt on income growth for a large panel of countries. While household debt growth in a given period generally has a positive impact on income, this effect is much stronger for countries with relatively lower levels of income and household debt-to-GDP ratios. On the other hand, the responsiveness of income growth to an increase in corporate debt varies across countries, with a consistently negative impact in richer and/or more heavily indebted countries. A simple extension of our framework suggests the roles of investment and consumption spending in explaining the varying effects of household and corporate debt on growth. We carry out several exercises to illustrate the robustness of our results.

Keywords: Private debt; Debt threshold; Household debt; Panel VAR

JEL classification: H31, H32, H6, C33, O57, O4

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1. Introduction

The impact of private debt, and in particular the household component of private debt, has led many economists to conclude that private debt accumulation signals the onset of an incoming crisis (Bunn and Rostom, 2014; Gomez-Puig and Sosvilla-Rivero, 2018). The subprime mortgage crisis that preceded the financial crisis has entrenched this position, with economists studying the relationship between private debt and growth, an issue that has been the subject of much research in the literature since the seminal contributions by Levine (1993, 1997).

Existing studies have focused on countries worst affected by the financial crisis, and empirical results have been skewed due to the magnitude of the negative shock these economies experienced during the financial crisis (Cecchetti et al., 2011; Cafiso, 2019; Cafiso, 2021; Puente-Ajovin and Sanso-Navarro, 2015). While increasing aggregate savings in the pandemic era may allay these fears for the time being (raising fears of a public debt driven crisis instead), it is worth revisiting this relationship now that more data has accumulated since the financial crisis, allowing for a more nuanced econometric approach using richer and longer datasets.

This paper examines the differential effects of components of private debt on income growth in a large panel of countries over 1990 to 2018 and characterizes the underlying mechanisms for the heterogeneous impact of private debt across various groups of countries. Using a panel vector autoregressive technique (PVAR), we show that although total private debt does not appear to have a significant impact on income growth, the aggregated investigation hides key differences in the effects of various components of debt on income. As opposed to non-financial corporate debt, household debt tends to have a stronger, more significant, and longer-term positive impact on income compared to the one identified by most existing studies.

Our results contrast with key findings obtained in recent literature which find a less favorable impact of disaggregated debt on growth and investment. The most relevant and comprehensive study in this literature is that by Mian et al. (2017). Based on data for a large panel of countries, Mian et al. (2017) show that growth in household debt has a negative impact on income growth three years after the household debt shock. Alter et al. (2018) and Park et al. (2018) also note similar results, i.e., an initial positive response turning subsequently and cumulatively negative. These studies focus largely on advanced economies, and the results may be significantly affected by the financial crisis and European sovereign debt crisis (Cecchetti et al., 2011; Chmelar, 2013). In addition to sampling differences, our analysis emphasizes on quantifying the impact of period-specific shocks, i.e., debt growth in a single period, on annual income growth, as opposed to estimating the effect of a sustained debt accumulation over a period of three to five years. As explained later, since the underlying mechanisms triggering these shocks can be different, it is important to distinguish between the nature of these shocks.

Our empirical study is organized around the following set of predictions. In addition to finding a positive impact of private debt components on growth, we also note a substantial amount of variation in the effects of household and corporate debt on income growth in more as opposed to

less heavily indebted countries. Similar heterogeneity is found in high versus low-income countries. While a household debt buildup usually bears a positive impact on income growth, this effect is more persistent and stronger for countries below the sample median income level, and for countries with relatively lower levels of household debt. On the other hand, the corporate debt component has a consistently negative effect on income growth for countries above the median debt and/or income levels. These results are robust to alternative PVAR specifications and identification assumptions about whether lending rates affect debt, or vice versa, and irrespective of the assumptions about the direction of causality of debt-growth nexus.

In the next step, to identify the underlying sources of our baseline results, we study the channels through which private debt may give rise to diverging results across samples of high- versus low-income and debt countries. A simple extension of our model and the corresponding impulse response functions suggests the roles of investment and consumption spending in explaining the asymmetric effects of household and corporate debt on growth: if a rise in debt levels is associated with larger capital formation, we observe a positive impact of private debt on income. The opposite is true if higher debt gives rise to only an increase in consumption. This effect holds for both types of country categories studied in the paper. Owing to the role of investment in determining the outcome of private debt, and in line with existing literature (for example, Mian et al., 2017), we examine the relevance of credit demand and supply shocks in describing our findings. These channels, therefore, help shed light on the asymmetry we discover in our results, and the PVAR approach used facilitates in identifying the sources of differing outcomes.[1]

The following section summarizes recent literature on the topic. Section 3 explains our econometric methodology. In Section 4, we investigate the relationship between components of private debt and income growth across various income groups and debt profiles, and present a discussion of the underlying mechanisms. Robustness tests are provided in Section 5. Finally, the last section concludes.

2. Literature review

Our paper contributes to the growing strand of literature investigating the impact of household and corporate debt on output growth and other macroeconomic indicators. Levine (2005) provides a summary and critique of the theoretical and empirical research on the association between financial system operations and economic growth, suggesting that financial intermediaries and markets matter for growth. The paper highlights how panel data techniques can be used to tackle a number of statistical problems with pure cross-country investigations. Earlier work also illuminates potential mechanisms through which finance influences economic growth, and identifies the roles of cross-country differences in initial income per capita, financial structure, and the ability to

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[1] Panel vector autoregressive models have been used to examine multivariate time-series for panel data and in the context of a range of macroeconomic analyses. Canova and Ciccarelli (2013) provide a comprehensive overview of PVAR models used in macroeconomics and finance literature.

identify worthy investments. Our investigation of growth channels in explaining the relationship between private debt and income offers useful insights which are largely consistent with those proposed by Levine (1993). For example, per capita output growth is expected to occur only if agents invest enough in projects that augment human capital and stimulate technological innovation.

Recent literature has focused primarily on credit supply as an explanation for debt accumulation, as discussed by Mian et al. (2018), Mian and Sufi (2018), and Mian et al. (2020). They explain that an increase in credit supply (referred to as the *saving glut of the rich* in Mian et al. (2020)), leads initially to excessive dissaving by households, fueling excessive consumption and non-productive investment. This excessive consumption subsequently becomes unsustainable, leading to a drop in aggregate demand as households deleverage. Although finding an initially positive response to a household debt shock, they obtain a subsequently negative response leading to a cumulative negative effect. Cafiso (2021) carries out a more granular analysis of household loans and their impact during the Global Financial Crisis for the United States. Chmelar (2013) and Bunn and Rostom (2014) consider the impact of household debt for the European and British cases, respectively, focusing on the financial crisis of 2008-09 and the European debt crisis of 2010-11.

Lombardi et al. (2017) employ a cross-sectional autoregressive distributed lag model, to explore the impact of household debt on 54 countries, detecting a positive response in the short-run but a long-run negative impact. They note that once a 60 percent debt-to-GDP threshold is breached, the impact of household debt on growth turns negative. However, compared to Mian et al. (2017) and Alter et al. (2018), this study uses a limited number of controls and does not explore the mechanisms through which household debt impacts growth. An earlier study by Cecchetti et al. (2011) found much higher thresholds for disaggregated components of private debt (85 percent for household debt and 90 percent for corporate debt) to have a negative impact on growth. Nevertheless, the analysis was limited to standard growth regressions and correlational analysis, as opposed to more robust approaches utilized in recent studies, including this article.

There has also been some interest in exploring the household debt and growth dynamics from an empirical microeconomic perspective using household debt data. Dynan (2012) uses US household data to show that deleveraging households reduces consumption significantly. Garber et al. (2018) use Brazilian household data to see how an expansion in household debt levels from 2003-2014 preceded the largest economic crisis in Brazil in 2014-2016. They argue for household debt as a potential channel, citing earlier studies for support.

The household debt component of private debt has attracted significant attention. However, some studies do focus on corporate debt. Gomez-Puig and Sosvilla-Rivero (2018) carry out an in-depth analysis of 10 Euro area countries, considering the impact of various forms of non-financial debt, including corporate debt. They find a lower impact of corporate debt on growth as opposed to household debt using country time series regressions, which allows them to find heterogeneous country-specific effects. While the country-specific approach is interesting, this study, like others

in the field, is primarily focused on a set of countries under very specific circumstances. Verner (2019) uses aggregated private debt data for a large set of countries and identifies periods of debt-booms and the after-effects of these periods on different countries. In a recent study, De Vita and Luo (2020) also consider the components of debt, namely, financialization of the financial, non-financial, and household sectors for multiple countries. However, their focus is on determining the impact of financialization (where aggregate indebtedness of the sector plays a role) on inequality. They find that of the three sectors, household financialization has a positive and significant impact on income inequality.

While most studies focus on the negative impact of private debt or its components on growth in the medium to long run, Cafiso (2019) identifies household debt as an important channel through which monetary policy can generate GDP growth. In exploring the impact of household debt on economic growth, it is important to highlight some of the fundamental results and rationalizations discovered in a related strand of literature about productive versus unproductive credit. As pointed out by Dynan (2012), there are types of household debt that are believed to be productive investments. This includes student loans amongst others which are used to make vital human capital investments, and the net return on higher education continues to remain positive for most students. This is contrary to the expectation that only business credit and investment is productive which is directly linked with growing the supply side of any given economy (Levine 1993). Similarly, traditional home mortgages can be considered as commitment devices that encourage households to save more. In general, spending on education and other social programs that have long-term payoffs in terms of higher earnings are considered as productive human capital investments (Hoynes and Schanzenbacch, 2018), and could theoretically be drivers of higher long-term economic growth. Thus, there are potentially sizable benefits of both household and corporate debt that need to be accounted for in any longer-term assessment of the effects of private debt.

3. Methodology

Several studies in applied macroeconomics employ panel vector autoregressive techniques. A fundamental feature of PVAR models is that all variables are treated as endogenous and interdependent, both in a dynamic as well as in a static sense (Canova and Ciccarelli, 2013; Holtz-Eakin et al., 1988). This represents a key advantage over estimation techniques used in the existing analyses of private debt and income growth. Moreover, the current literature examining the effects of household and corporate debt does not fully account for the endogenous interactions amongst factors influencing the growth of private debt. Our approach, on the other hand, permits us to examine the transmission of idiosyncratic shocks to private debt over time, allowing for endogenous interactions between major macroeconomic indicators.

Let Y_{it} represent the vector of endogenous variables, such as, private debt and income per capita, which is observed over time for each i representing the cross-sectional macroeconomic observation unit, i.e., country, in this case. While PVAR offers the possibility to simultaneously account for

interdependencies between endogenous variables within one unit as well as between units, we further assume that Y_{it} also depends on a set of weakly exogenous or predetermined variables, X_{it}, which are independent of contemporaneous or lagged fluctuations in Y_{it}. The panel VAR with exogenous driving forces (PVARX) can be written as:

$$Y_{it} = A(L)Y_{it-1} + B(L)X_{it} + \mu_i + \epsilon_{it}, \tag{1}$$

where both Y_{it} and X_{it} are log-differenced sets of endogenous and exogenous variables, respectively. $A(L)$ is a matrix polynomial for the lag operator, μ_i is a vector of country specific effects, and ϵ_{it} denotes idiosyncratic errors. The above panel VAR is estimated in a generalized method of moments (GMM) framework, similar to Lof and Malinen (2014), using lagged values of regressors as instruments to estimate the coefficients.[2] The PVARX, consequently, is an extension of the basic PVAR which allows for a linear relationship with a set of exogenous covariates (Dees and Güntner, 2014). Similar PVARX models have been used by Cushman and Zha (1997), Ramey and Shapiro (1998), and Kilian and Vega (2011).

In addition to components of private debt and output growth, the vector of dependent variables, Y_{it}, comprises of the growth rate (log-differences) of combinations of the following endogenous variables: gross fixed capital formation, consumption, trade openness, and interest rate spread.[3] The vector of exogenous variables includes government spending and taxation. Nonetheless, as indicated in Section 5, our findings are independent of our assumptions regarding the classification of exogenous variables, as well as to the exclusion of additional endogenous variables used.[4]

The primary objective of controlling for additional endogenous variables in our PVARX framework is to explore the transmission of idiosyncratic shocks to debt, as well as to shed light on the specific channels through which private debt may possibly affect income growth. Furthermore, the existing literature has indicated a possible correlation between private debt growth and several macroeconomic indicators, such as, household consumption and import spending (Mian et al., 2017). Therefore, the exclusion of potentially important variables is expected to yield biased estimates.

We use a recursive structure through applying a Cholesky decomposition to the impulse responses, since the innovations ϵ_{it} are contemporaneously correlated, and a shock in one variable is likely to be accompanied by shocks in other variables (Abrigo and Love, 2016). The recursive structure represents a causal ordering which can be used to isolate the effects of a shock to one variable on another variable, such as, the effect of a shock to household debt on household consumption, keeping all else constant. The corresponding impulse response functions (IRFs) characterize how

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[2] We use forward-mean differencing or orthogonal deviations instead of fixed-effects estimators, and therefore, preserve homoscedasticity without inducing serial correlation (Love and Zicchino, 2006).
[3] An alternative specification replacing interest rate spread (lending rate minus deposit rate) by real interest rates yields similar results but at times resulted in violating the stability conditions of the associated IRFs.
[4] We also estimate a simplified PVAR specification including only debt, income, and interest rate in the set of endogenous variables, instead of PVARX as in Eq. (1). Interestingly, the simplified PVAR yields very similar results compared to our baseline findings (see Table 4).

debt growth affects GDP per capita growth, along with the differential impact of components of debt on income and other variables of interest. We test for the stability conditions of all impulse responses, suggesting that our PVARX is invertible and has an infinite-order vector moving-average representation, providing known interpretation to the estimated impulse-responses (Abrigo and Love, 2016). The confidence intervals for IRFs are estimated using 200 Monte-Carlo simulations.

The ordering of variables in Y_{it} is critical in obtaining the IRFs reported. We assume a recursive structure to identify structural disturbances, but our results are not sensitive to this structure. The baseline estimation places components of debt before income growth and other controls in Y_{it}, excluding interest rates, assuming that debt affects other macroeconomic indicators contemporaneously, whereas income growth influences household or corporate debt only through their lagged values. This assumption is also motivated by the expectation that balance sheets are typically marked-to-market, and therefore, the volume of debt and interest rates are expected to be rather closely tied. Furthermore, these identifying assumptions are consistent with those imposed in earlier literature (see, for instance, Caldara and Kamps (2008), Qureshi and Liaqat (2019), and Liaqat (2019)). Nonetheless, our results are supported by imposing an alternative Cholesky ordering in the estimation of Eq. (1). As discussed later in the paper, our key findings are robust to alternate causal specifications, thereby substantiating our structural interpretation.

It is worth distinguishing the shock process in our specification, ϵ_{it}, from the shock process considered by existing studies. As outlined above, a 'shock' is defined as a standard deviation increase in the growth rate of private debt-to-GDP ratio, or one of its components, in a single period. Thus, ϵ_{it} impacts current period Y_{it} only, and the remaining impact results from the recursive structure estimated through the PVAR. In contrast, most existing studies define the debt shock to be a sustained increase in private debt or its components.[5] Such shocks were a natural avenue for investigation following the credit supply buildup in the wake of financial crisis. However, a complete understanding of the relationship between private debt and income growth also needs to consider single-period shocks that may be prompted by completely exogenous events (such as, lockdowns resulting from a pandemic), or those resulting from exogenous policy and institutional changes (such as, legislations making it easier to borrow). The underlying mechanisms for these shocks can be different and may help explain the distinct results we obtain, in addition to our differing samples.

Data

We employ a comprehensive dataset for a large sample of countries covering a sufficiently long horizon. Our dataset consists of an unbalanced panel data for 76 countries, and spans a relatively

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[5] For example, the regression framework used by Mian et al. (2017) takes a local projections-based econometric approach, and estimates the impact of a three-year debt build-up on three-year output growth, and does not consider the impact of the shock in the interim.

long period, from 1990 to 2018. Nonetheless, data coverage for subsequent estimation varies depending on the availability of private debt, household debt, and corporate debt data, along with the various measures of interest rate spread used.

Our study has an advantage over earlier work due to the consistency of the definition and measurement of private debt as we utilize a standardized database. We use the World Bank's World Development Indicators (WDI) database and the IMF's World Economic Outlook (WEO) as our primary sources. Private debt, which is composed of household debt and corporate debt, is defined as the total stock of loans and debt securities issued by households and non-financial corporations as a share of GDP and is taken from the IMF's Global Debt database. Accordingly, the determination of the number of countries and years used is guided by the availability of data in WDI and WEO datasets. Although the complete sample comprises of a large panel, the baseline estimation with the complete set of controls is based on private debt data for 42 countries. As explained below, the exclusion of several controls as a robustness check considerably increases our sample size.

Other macroeconomic indicators that are treated as controls in the PVARX were also obtained from the WDI data, including interest rate spread, real GDP per capita, capital formation, trade openness, government spending, and taxation.[6] Interest rate spread, measured as the percentage-point difference between lending rate and deposit rate, is defined as the interest rate charged by banks on loans to private sector minus the interest rate paid by commercial or similar banks for deposits, and therefore, measures credit plus liquidity risk.[7, 8] All other variables are expressed as a percentage of GDP.

Table 1 presents summary statistics for the complete sample. The average private debt expressed as a percentage of GDP is roughly 118 percent. In contrast, the mean household and corporate debt levels are 43.5 percent and 75 percent, respectively. Nonetheless, there are a number of outliers with very large levels of household debt. Household debt far exceeds the overall average in many advanced economies, such as, Australia, Canada, Denmark, Norway, and Switzerland, and specifically over the period of 1999 to 2018. Corporate debt, and as a result total private debt, exceeded five hundred percent in Iceland over 2008-09.

As highlighted in the introduction above, our focus is on the consequences of different components of private debt on income growth, and the heterogeneity of these effects and the mechanisms across

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[6] The list of countries is provided in the Appendix. It also reports the income and debt group each country belongs to over the course of the period under consideration.

[7] A related measure used by earlier studies uses risk premium on lending, defined as the interest rate charged by banks on loans to private sector customers minus the 'risk free' treasury bill interest rate at which short-term government securities are issued or traded in the market. As opposed to interest rate spread, the risk premium captures more fundamental risk factors. Unfortunately, data coverage for risk premium is rather limited in the WDI database. Both Mian et al. (2017) and Alter et al. (2018) use this measure.

[8] Since our data set includes middle and low-income countries, we were unable to utilize mortgage spread rates data used by other studies in this literature, such as, Mian et al. (2017), which relies on mortgage spread rates for the US.

country groups. Motivated by existing studies on the effects of government debt on growth (Liaqat, 2019), the consequences of private debt are also expected to differ across countries. Hence, we extend our analysis to examine the divergent implications of household and corporate debt for countries above and below the median income and debt thresholds.[9] For the baseline specification of PVARX, our dataset comprises of 10 countries in the above-median income group, and 32 countries in the below-median income category. The representation of low-and middle-income countries is, consequently, larger compared to other studies cited in this literature (such as, Mian et al. (2017) which uses data for 30 countries) investigating the relationship between private debt and income growth predominantly for advanced or emerging economies. Similarly, there are 17 countries in above-median and 31 countries in below-median debt categories, which enables us to compare the consequences of household and corporate debt in country groups depending on their overall stock of private debt.

4. Estimation Results and Discussion

In this section, we describe the results obtained by estimating a PVAR model explained in the previous section to study the impact of aggregate private debt and its components on income per capita growth. Furthermore, we disaggregate the effects of the components of private debt across country groups classified by the volume of debt, and by income level. The disaggregated analysis shows that the relationship between household and corporate debt and income growth is heterogenous across types of private debt and is conditional on the country classification.

4.1 Private debt and income growth

Figure 1 illustrates the impulse response functions obtained from the system of equations estimated in Eq. (1) for the complete sample of countries. Each graph shows the response, in percentage points, to a standard deviation positive shock to the growth of private debt-to-GDP ratio over a period of eight years. The impact of a positive shock in total private debt is depicted in the top graph, while the following two figures show the effects of household and corporate private debt accumulation on income per capita growth, respectively. We observe that private debt growth appears to have no significant impact on income growth. On the other hand, there is a positive and sustained impact of a shock to household debt growth on income. This effect is stronger and more significant compared to the effect of corporate debt. Income growth jumps on impact and remains significant and positive for at least six years after the shock. A positive shock to household debt growth expands income per capita more sharply in the year following the shock, peaking at approximately one year after the initial shock.

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[9] Unlike most existing studies relying on specific income or debt threshold levels to classify countries (for example, Lombardi et al. (2017) and Cecchetti et al. (2011)), we utilize this approach primarily due to data limitation. Nonetheless, our classification enables us to carry out a meaningful comparison across country groups whilst ensuring a sufficiently large and representative sample for each category.

These results contrast with existing studies (Mian et al., 2017; Alter et al., 2018; Park et al., 2018).[10] Our findings are not sensitive to the choice of endogenous variables or to the recursive structure of the PVARX model. As explained in Section 5, we conduct various robustness checks to substantiate these findings. For example, the empirical framework of our baseline PVARX is modified by excluding some of the endogenous variables, such as, measures of the economy's openness and government spending. A simplified PVAR with the exclusion of exogenous variables and considering only debt, interest rate, and output as endogenous variables also yields similar results. Finally, all baseline estimates are compared with those obtained by assuming alternative recursive structures. The IRFs provided in the Appendix generally mirror the results demonstrated in Figure 1 above.

4.2 Private debt and income thresholds

Next, we investigate if the response of income growth to private debt buildup varies across countries belonging to different debt and income threshold categories. We first group countries in our sample based on their volume of debt expressed as a proportion of GDP. Eq. (1) is estimated separately for countries with a debt level above and below the median household or corporate debt. The impulse response functions generated for the corresponding PVARX are shown in Figure 2. The graphs in the top row indicate the response of income growth to total private, household, and corporate debt growth in countries belonging to the below-median debt category, and the second row presents the corresponding IRFs for the above-median group. As indicated in Table 1, the median total private debt level for the complete sample is approximately 114 percent. The corresponding values for household and corporate debt are 37.6 percent and 66.8 percent, respectively. Table A.1 in the Appendix lists the number of countries in each group.

For countries with a relatively lower private debt-to-GDP ratio, we observe a statistically significant positive response of income growth when there is a shock to either household or corporate debt ratio (Figure 2, top row). On the other hand, economies with relatively higher debt-to-GDP ratios display a persistently negative response of income growth to corporate debt growth that lasts for at least three years (bottom right graph). Although we do observe a rise in income growth in response to household debt growth in the above-median debt group, the immediate impact upon a shock to debt growth is somewhat negligible and appears to become significant only overtime. Moreover, the impact is much higher in magnitude and more persistent (8 years as

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[10] For the sake of comparison with existing studies, we also consider a three-year debt growth shock for our sample of countries, for the basic model including only debt and growth variables, as well as for the complete model with the inclusion of additional controls used in our study. Our estimates are broadly consistent with Mian et al. (2017), with a stronger positive effect of household debt for low-income countries, as explained later in the paper. In line with their key results, we find that the rise in household debt over a three-year period is contemporaneously positively correlated with income growth, but as we examine income growth further into the future, the correlation goes from being positive to negative for both income categories. As far as corporate debt growth is concerned, the rise in debt is negatively correlated with GDP per capita growth but loses predictive power as we extend the horizon. In most cases, we do not obtain a significant association between a sustained corporate debt build-up and income growth for the low-income group. Nonetheless, this analysis is purely correlational and does not take into account endogenous interactions between variables, as the PVARX approach used in this paper does.

opposed to 4 years) for countries with relatively lower volumes of household debt-to-GDP ratio (see second column of Figure 2). The total private debt, in contrast, is associated with having no suggestive impact on income growth for both groups of countries (see Table 2). Our results suggest that countries with lower debt-to-GDP ratios are more likely to benefit from longer-term growth than heavily indebted countries.

The Appendix also reports the income classification for each country based on median income per capita. The median income level is approximately $22079 (see Table 1). We observe that there is often an overlap of countries that are both high income and heavily indebted. This holds true for both components of private debt. For instance, the mean private debt for the high-income group is approximately 172 percent, as opposed to only 65 percent for the below-median income category of countries. There are also stark differences in the volumes of household and corporate debts. Whereas the mean household and corporate debt for low-income group is only 21.1 and 43.7 percent, respectively, the corresponding averages for our high-income sample stand at roughly 65.8 and 106.2 percent.[11]

Nonetheless, in line with the existing literature examining the effects of private debt accumulation in countries belonging to various income categories (Alter et al. (2018) and Park et al. (2018)), Eq. (1) is re-estimated for country groups classified by median income per capita. This step is also motivated by a number of cases whereby a country belongs to either both low-income and high-debt group (such as, Malaysia and Chile), or has a high-income and below-median private debt status (for instance, Germany) during a part of the time frame considered. The corresponding impulse response functions are presented in Figure 3. The top (bottom) row shows the response of income growth to total private, household, and corporate debt growth shocks in countries belonging to the below (above)-median income category.

Table 2 summarizes these findings and shows that a majority of the results are consistent with the estimates obtained for various debt thresholds. There is a positive and significant effect of a rise in household debt on income growth in both groups of countries, even though the effect is stronger in the below-median income group (Figure 3, second column). The response to a positive corporate debt shock varies across countries and is negative initially and cumulatively in high-income countries (Figure 3, last column). For the higher-income countries, such a shock implies an initial decrease of almost 0.4 percentage points in the growth of GDP per capita.

However, there are some key differences compared to when countries are grouped based on debt thresholds. As Table 2 reveals, the shock persistence in this case varies across the two categorizations, and the impact on income growth appears to last for longer under income as opposed to debt categories as a result of corporate debt accumulation (see Figures 2 and 3, last column). Moreover, the statistically significant negative impact of corporate debt on income

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[11] Interestingly, these estimates pertaining to private debt contrast with those for public debt or external debt. It has been reported that the lower-income group has the highest percentages of average total and public external debt, for example, while high-income countries have the largest average private external debt levels (Qureshi and Liaqat, 2019).

growth seems to more than counterbalance the positive effect of household debt buildup for this group, and brings about a negative, albeit short-term, response of income growth to the overall private debt accumulation (see Figure 3, bottom left graph). This disaggregation also suggests that the overall insignificant results for corporate debt for the full sample (shown in Figure 1) are being driven by the contrasting results across income groups, rendering the overall impact of private debt growth on income to become unnoticeable.

Thus, we observe that growth in household debt can spur more persistent output expansion in low-income countries and in countries with a relatively lower debt-to-GDP ratio, but the opposite holds for corporate debt growth in high-income groups and for the heavily indebted countries.[12] The findings obtained in this section help rationalize the results noted by earlier studies that find a negative effect of private debt shock on income (such as, Mian et al. (2017) and Alter et al (2018)). As previously observed, these studies often focus on advanced economies that have seen their debt-to-GDP ratios increase over the 2000s. Our debt threshold results are, accordingly, in line with their findings, while the results for countries with low debt-to-GDP ratios present a novel finding. Consequently, our work reconciles earlier conclusions about the impact of private debt and its components on income growth and various debt-thresholds proposed for differently indebted economies.

4.3 Cross-country divergence in mechanisms

The results underlined in the last section constitute the most important contribution of this study and emphasize on the dissimilarity in the effects of household and corporate debt using data for a relatively large sample of countries. By repeating the PVARX analysis for individual country groups, we show how the significance of our results varies depending on income and debt levels of countries. As underscored above, the panel VAR estimation accounts for the endogeneity of debt-to-GDP growth, an attribute not fully addressed by earlier studies.

An additional advantage of using PVARX is that it permits us to disentangle the mechanisms through which private debt is expected to have an impact on income growth. Therefore, in this section, we study the impact of components of private debt on the growth of total investment, consumption, and trade openness for various country categories described in the previous section, by employing the methodology explained in Section 3. The estimated IRFs are depicted in Figures 4 and 5 for household and corporate debt, respectively. The first set of graphs shown in Figures 4 and 5 (see panels A and B) depicts the response of various channels identified above to a standard deviation growth in the stock of household debt (Figure 4) and corporate debt (Figure 5) observed

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[12] As noted above, the inclusion of interest rate in the baseline specification greatly limits our sample size. Therefore, we also re-estimate Eq. (1) for separate country groups after excluding our proxy for interest rate, and in order to test the robustness of our key findings across a bigger sample of countries. Although there is some variation in the effect of growth of private debt across countries, the positive and significant impact of household debt on income growth in the lower-debt and lower-income categories, and the negative effect of corporate debt noted for the higher-debt and higher-income countries continues to hold for the larger sample.

across debt categories (below-median in top row, and above-median debt group in the second row). The subsequent panels (C and D) repeat the exercise for income classifications. Each panel of graphs presents the impulse response functions for consumption, trade openness, investment, and finally, income growth in columns (1)-(4) of Figures 4 and 5. These results are summarized in Table 3.

The positive and significant response of income growth to household and corporate debt in the below-median debt category of countries is largely attributable to the significant growth in capital formation in these countries (see panels A in Figures 4 and 5). On the other hand, for countries with relatively higher stocks of private debt, an additional positive shock to either household or corporate debt is associated with an insignificant response of investment growth (panel B of both figures), and instead generates growth in consumption (albeit briefly), which is in line with the existing literature. Even though the overall effect of household debt growth on income in these countries turns out to be positive, as discussed above, the effect of corporate debt on income growth in the above-median debt group is invariably and significantly negative (last IRFs in panels B).

Furthermore, there are interesting differences in the response of trade openness and consumption growth, not only across debt categories of countries but also for the two components of private debt. While a higher growth of household debt brings about consumption growth only in the above-median debt group (Figure 4, panels A and B, first column), a positive shock to corporate debt growth boosts consumption in all countries (Figure 5, first column). Growth in investment in the below-median debt group also seems to be reflected in increased volumes of exports and imports, although this effect is not significant in the case of corporate debt accumulation for both groups (see Figures 4 and 5, second column). Thus, our results imply that investment versus consumption channels appear to be the key determinants of how the impact of private debt unfolds in terms of income growth, and that the effect of debt on investment varies substantially across country groups and across debt types.

As revealed in panels C and D of Figures 4 and 5, a similar story emerges if we classify countries based on income levels instead of by debt thresholds. The largest positive impact of private debt on income growth is accompanied by a substantial growth in capital formation (third columns in Figures 4 and 5). It is worthy of note that, in line with the effects observed for the above-median debt group, the response of income growth to a surge in corporate debt in the high-income group is significantly negative, despite a positive yet short-lived rise in consumption (Figure 5, panel D). One possible interpretation of this finding is attributed by Mian et al. (2017) to channels other than household debt expansion under periods of declining interest spreads. If lower spreads result in a misallocation of resources toward unproductive industries, the alternative channels may push output growth in the opposite direction (Gopinath et al. 2017; Borio et al. 2016). This is precisely what we observe in Figure 5 for the categories of high-income and high-debt countries (rows B and D), whereby the growth of consumption is not sufficient to trigger a positive response of income to rising corporate debt.

We also find a positive response of openness to household debt growth for the low-income group, perhaps attributable to a growing volume of trade in these countries arising due to increased capital formation (see Figure 4, panel C, second graph). The upsurge in exports coupled with growing investment leads to a more persistent impact on income growth in these countries. Nonetheless, this result does not apply for corporate debt growth. In contrast to the results reported earlier pertaining to debt thresholds, we do observe a modest growth in trade openness in the above-median income group when there is a positive shock to household debt growth, although the initial impact is negative (Figure 4, second graph in last row). The initial decline in imports due to a rise in household debt-to-GDP is consistent with the recent experience of many advanced countries pointed out in the literature (Mian et al., 2017).

To summarize, a comparison of these responses provides a possible explanation of the findings noted in the last section. We observe that the impact of both types of private debt on income growth across the two sets of countries largely depends on the response of investment versus consumption growth to a shock in debt growth, whereas trade openness appears to be an important channel only for household debt accumulation.

4.4 Does the source of credit expansion matter?

In order to shed further light on the asymmetric consequences of private debt boom across countries, it is critical to examine the sources of household debt or corporate debt buildup in the first place. In particular, we are interested in identifying the causes of a sudden rise in private debt-to-GDP ratio, and why such an increase may be linked with generating boom-bust cycles in real economic activity. One possible approach to address this question is to determine whether debt expansion is due to credit demand shocks or credit supply shocks (Mian and Sufi, 2018). The demand for credit is likely to shift in response to adjustments in household permanent income or beliefs, driven by changes such as technology shocks (Aguiar and Gopinath, 2007). Credit supply shocks, on the other hand, suggest a greater willingness of lenders to provide credit due to, for example, a deregulation of the financial sector.

As explained in Mian et al. (2017) and Mian and Sufi (2018), when the underlying shock is an increase in future productivity or expectations about permanent income, a surge in private debt appears to be associated with subsequent GDP growth. Our findings pertaining to low-debt category of countries can be somewhat reconciled with models based on credit demand shocks that yield a more persistent positive correlation between contemporaneous changes in debt and income growth. A rise in private debt fueled by overoptimism about future productivity or income helps trigger investment. The subsequent impact on growth will eventually depend on the extent, persistence, and nature of new investment spending. While corporate debt rises are almost always associated with an increase in the consumption-to-GDP ratio, this association does not hold in the relatively lower-debt and lower-income category of countries in the case of household debt buildup

(see Table 3). In contrast, the investment-to-GDP ratio increases significantly during household and corporate debt booms in this group (Figures 4 and 5, third columns).

In principle, credit supply expansions could affect the supply side of the economy by improving investment and raising aggregate demand. The recent experience of many advanced countries, on the other hand, reveals that periods of soaring household debt are correlated with an increase in consumption, but no significant change in investment is observed (Mian et al., 2020). Looser borrowing constraints may lead to greater household debt levels and lower income growth owing to a reduction in household savings impeding capital accumulation by firms (Jappelli and Pagano, 1994; Schmitt-Grohe and Uribe, 2016). This prediction is consistent with our findings obtained for higher-income, higher-debt group of countries, whereby corporate debt buildup is not associated with greater investment spending by firms. Additionally, under credit rationing assumptions in financial markets, private debt growth induced by credit supply shocks is expected to be correlated with a rise in credit originations for lower credit quality borrowers (Greenwood and Hanson, 2013), that may lead to misallocation of resources toward unproductive industries.[13]

To differentiate credit supply and credit demand shocks in longer time series data, one may examine interest rates and credit spreads during periods of private debt expansions. For example, Mian et al. (2017) report that large three to four-year increases in household debt in the US were linked with low spreads between mortgage credit and sovereign credit, and that such credit supply driven expansions in household debt predict later economic downturns. In contrast, a rise in household debt motivated by a positive permanent income shock is more likely to bring about an increase in subsequent growth and is often accompanied by an increase in interest rates: a sudden increase in optimism by borrowers while credit supply remains fixed would lead to greater interest rate spreads during the boom (Mian et al., 2017; Justiniano et al., 2019).

Although it may not be feasible to categorize each private debt surge as either a positive credit supply or credit demand shock for a large panel of countries, we compute the average interest rate spreads for various country classifications considered above to test our predictions about the nature of credit shock that is expected to have occurred in each case. For instance, the average interest rate spread for the high-income group is approximately 2.7 percent over the time period considered, whereas the mean spread rate is 8.7 percent for the low-income category. Similarly, the mean risk premium percentage stands at 2.4 as opposed to 7.2 percent for these two groups, respectively. Whilst a given country may have undergone both types of credit shocks at various instances over the period under consideration, a comparison of widely diverging average interest rate spreads across categories of countries, nonetheless, offers valuable insights into the underlying nature of debt expansion.

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[13] The role of variation in financial structures in explaining differing growth rates was also emphasized by Levine (1997).

Figure 6 depicts the inverse relationship between average interest rate spread and mean income per capita for countries included in our sample. As indicated above, the average spread rates are lower for more advanced countries. Interestingly, the subsequent plot (Figure 7) shows that there is also a negative relationship between mean spread rates and the average volume of private debt incurred by countries, consistent with our earlier hypothesis. These disparities also exist for the second categorization of countries based on the existing stock of private debt. The risk premium average for the high-debt group is approximately 2.7 percent; in contrast, the corresponding average for the lower-debt group of countries is 7.6 percent. Similarly, there is an approximately 11-percentage point difference in the mean lending rates in the two sets of countries, with significantly lower rates of interest in countries having relatively larger volumes of household and corporate debt volumes.

In short, the descriptive statistics pertaining to credit rate spreads complement our interpretation of the divergence in estimated responses across countries. When periods of rising debt are associated with having lower interest rates, the source of debt escalation is expected to predominantly be a positive credit supply shock (Mian and Sufi, 2018). The opposite is true in models based on credit demand shocks. Our results highlight the importance of debt-driven consumption versus investment channels depending on the source of credit expansion. As shown above, these sources differ substantially across countries included in our sample, and consequently, may explain the varying responses of income and investment growth to private debt expansion in these sub-samples of countries.

5. Robustness

We carry out extensive robustness checks to test our empirical findings by considering several alternative PVARX specifications and identifying restrictions. As described in Section 3, Eq. (1) is estimated for a simplified model which considers only private debt, interest rate, and income per capita as the set of endogenous variables. Moreover, the initial model is also re-estimated by imposing alternative recursive assumptions.[14] In both cases, the IRFs generated closely resemble those estimated for the complete PVARX model described above. Table 4 summarizes the specifications used and identification assumptions made under various robustness tests.

As a further exercise, we test the sensitivity of our results to alternative orderings imposed within our original PVARX setup. The corresponding IRFs are reported in the Appendix and are similar to our benchmark results. This step is motivated by the expectation that one or more of the endogenous variables may have a contemporaneous effect on private debt, and thus, the outcome may be sensitive to the order of causation applied in our identification scheme. By imposing alternative Cholesky orderings in the estimation of Eq. (1), we show that there are no major changes in the response of income growth to a rise in either aggregate private debt, or a growth in

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[14] The results based on the simplified model are presented in the Online Appendix in Figure A.1.

either of its components. The overall effect of private debt, once again, always turns out to be ambiguous while the significantly positive and persistent effect of household debt continues to hold. Because the IRFs are robust to alternative causal assumptions, the reduced-form errors are unlikely to be correlated and may well have a structural interpretation (Liaqat, 2019).

We report the IRFs verifying the robustness of our findings recognizing the heterogeneity across countries based on debt and income levels (Figures 2 and 3) by imposing alternative recursive structures in our baseline PVARX.[15] The alternate PVARX structures also include removing one or more of the endogenous variables from the baseline characterization of Y_{it}, as well as alternative assumptions regarding the classification of variables as either endogenous or exogenous to the debt-growth nexus. For example, the baseline results continue to hold upon the omission of two exogenous variables specified in the original PVARX. This amounts to estimating a standard PVAR model instead of the PVARX setup assumed in Eq. (1). Likewise, treating consumption, investment, and openness as exogenous to quantifying the impact of private debt on income growth also yields largely similar results. In this final set of results, however, we do observe some variation in the effect of growth of private debt components on income across some country groups. Nonetheless, the positive and significant impact of household debt growth on income in the lower-debt and lower-income level groups, as well as the significantly negative effect of corporate debt observed for the higher-debt and higher-income sample of countries always holds, and is robust across a majority of the specifications outlined above.[16]

In a subsequent set of further checks, we consider alternative measures of one or more of the endogenous variables. For instance, consumption spending is replaced by household final consumption expenditure, which measures the market value of all goods and services, including durable products, purchased by households. Similarly, gross fixed capital formation used in the original specification is replaced by gross capital formation. Gross fixed capital formation includes land improvements, plant and equipment purchases, and the construction of roads, railways, schools, offices, hospitals, and private and industrial buildings. On the other hand, gross capital formation consists of outlays on additions to the fixed assets plus net changes in the level of inventories. Once again, our key findings continue to hold for alternative proxies of investment and consumption.

6. Conclusion

In this article, we use a PVAR approach to show that the response of household debt and corporate debt shocks on income growth and its components is heterogeneous and varies across country groups depending on their underlying characteristics. While recent literature casts doubt on the consequences of private debt accumulation, we find that the impact of a growth in household and

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[15] See Figures A.2 and A.3. The only exception arises in quantifying the impact of total private debt on income growth for the high-debt and high-income groups, whereby in some cases, the result appears to be sensitive to alternative recursive orderings.

[16] For the sake of brevity, the corresponding IRFs are not shown, but can be made available upon request.

corporate debt on income can be positive, particularly for countries with low debt burdens and those with lower income per capita. Compared to the existing literature, our results differ in several important ways, and explain why disaggregation of private debt is necessary as the overall results based on total private debt tend to be inconclusive. Our results are robust to imposing alternative recursive structures.

Despite our differing results, we view this study as complementing earlier research and filling in some important gaps. In contrast to focusing on sustained shocks which have been the subject matter of recent studies, we consider the response of one-period shocks. In conjunction with other studies, the picture that emerges suggests that even though a sustained increase in household and corporate debt may eventually lead to adverse consequences for income growth, one-period shocks may lead to better outcomes, particularly for low-income and less indebted countries. The PVARX methodology allows us to investigate the mechanisms through which these results manifest, and helps shed light on the asymmetric consequences of a private debt boom across countries by examining the sources of debt buildup. As a result, the underlying nature and definition of the shock becomes important. This further differentiates our work from the earlier literature, which largely attributes the negative response of private debt on income to credit supply shocks.

Our article makes an important contribution by highlighting the consequences of private debt shocks on income growth. The policy implications of our findings taken together with existing literature suggests that time limited policy interventions that boost household or corporate debt through the credit demand channels may yield better results for output growth than longer term interventions. For example, time limited stamp duty cuts may lead to a substantial increase in household mortgage debt through the demand channel and could spur further economic activity. Similarly, temporary investment incentives may enable firms to take on more leverage and use the leverage in productive ways rather than to solely fund working capital. Our study also offers useful insights for future theoretical and empirical work to control for factors which could potentially play a crucial role in determining the consequences of private debt on income growth.

References

1. Abrigo, Michael R.M. and Inessa Love. 2016. "Estimation of Panel Vector Autoregression in Stata," *The Stata Journal,* 16(3). 778-804. doi:10.1177/1536867X1601600314

2. Aguiar, Mark and Gita Gopinath. 2007. "Emerging Market Business Cycles: The Cycle is the Trend." *Journal of Political Economy.* 115(1), 69-102. doi:10.1086/511283

3. Alter, Adrian, Alan Xiaochen Feng, and Nico Valckx. 2018. "Understanding the Macro-Financial Effects of Household Debt: A Global Perspective." *IMF Working Paper WP/18/76.* http://dx.doi.org/10.5089/9781484349861.001

4. Borio, Claudio, Enisse Kharroubi, ChristianUpper, and Fabrizio Zampolli. 2016. "Labour Reallocation and Productivity Dynamics: Financial Causes, Real Consequences," *BIS Working Paper.* https://www.bis.org/publ/work534.pdf

5. Bunn, Phillip, and May Rostom. 2014. "Household Debt and spending." *Bank of England Quarterly Bulletin.* 54(3), 304-315.

6. Cafiso, Gianluca. 2019. "GDP Growth through Private Debt: The Effect of Monetary Shocks." *CESifo Economic Studies,* 236-253. Doi:10.1093/cesifo/ify027

7. Cafiso, Gianlcuca. 2021. "Loans to Different Groups and Economic Activity at Times of Crisis and Growth". *Oxford Bulletin of Economics and Statistics.* 1-30. doi: 10.1111/obes.12474

8. Caldara, Dario and Christophe Kamps. 2008. "What are effects of fiscal policy shocks? A VAR-based comparative analysis." *European Central Bank Working Paper No 877.* https://EconPapers.repec.org/RePEc:ecb:ecbwps:2008877.

9. Canova, Fabio, and Ciccarelli, Matteo. 2013. "Panel Vector Autoregressive Models: A Survey" *ECB Working Paper No. 1507,* Available at SSRN: https://ssrn.com/abstract=2201610

10. Cecchetti, Stephen G., Sunil Mohanty, and Fabrizio Zampolli. 2011. "Achieving growth amid fiscal imbalances: the real effects of debt," *Proceedings – Economic Policy Symposium – Jackson Hole,* Federal Reserve Bank of Kansas City, 145-196. doi:10.1.1.297.2259

11. Chmelar, Ales. 2013. "Household Debt and the European Crisis." Paper presented at the ECRI Conference Organized by the European Credit Research Institute (ECRI) and the Centre for European Policy Studies (CEPS) in Brussles. 13. https://ssrn.com/abstract=2307854

12. Cushman, David and Tao Zha. 1997. "Identifying monetary policy in a small open economy under flexible exchange rates," *Journal of Monetary Economics*, 39, 433-448. doi:10.1016/S0304-3932(97)00029-9

13. De Vita, Glauco and Yun Luo. 2021. "Financialization, household debt and income inequality: Empirical Evidence," *International Journal of Finance & Economics,* John Wiley & Sons, Ltd., 26(2), 1917-1937. Doi: 10.1002/ijfe.1886

14. Dees, Stephane and Jochen Guntner. 2014. "Analyzing and Forecasting Price Dynamics Across Euro Area Countries and Sectors: A Panel VAR Approach," *European Central Bank Working Paper Series No. 1724.* https://www.ecb.europa.eu/pub/pdf/scpwps/ecbwp1724.pdf

15. Dynan, Karen. 2012. "Is a Household Debt Overhang Holding Back consumption?" *Brookings Papers on Economic Activity,* 299-362. Doi: http://www.jstor.com/stable/23287219

16. Garber, Gabriel, Atif Mian, Jacopo Ponticelli, and Amir Sufi. 2018. "Household Debt and Recession in Brazil." *NBER Working Paper 25170.* doi:10.3386/w25170

17. Gomez-Puig, Marta and Simon Sosvilla-Rivero. 2018. "Nonfinancial debt and economic growth in euro-area countries," *Journal of International Financial Markets, Institutions & Money.* 56, 17-37. doi:10.1016/j.intfin.2018.03.005

18. Gopinath, Gita, Sebnem Kalemli-Ozcan, Loukas Karabarbounis, and Carolina Villegas-Sanchez. 2017. "Capital Allocation and Productivity in South Europe," *Quarterly Journal of Economics*, 132, 1915-1967. doi:10.1093/qje/qjx024

19. Greenwood, Robin, and Samuel G. Hanson, "Issuer Quality and Corporate Bond Returns," *Review of Financial Studies*, 26 (2013), 1483–1525. doi:10.1093/rfs/hht016

20. Holtz-Eakin, Douglas, Whitney Newey & Harvey S. Rosen. 1988. "Estimating Vector Autoregressions with Panel Data," *Econometrica*, 56(6), 1371-1395. doi:10.2307/1913103

21. Hoynes, W. Hilary, and Diane Whitmore Schanzenbach. 2018. "Safety Net Investments in Children," Brookings Papers on Economic Activity, 2018(1), 89-150. doi:10.3386/w24594

22. International Monetary Fund. 2020. *World Economic Outlook.* Washington, DC: International Monetary Fund. https://www.imf.org/en/Data

23. Jappelli, Tullio, and Marco Pagano. 1994. "Saving, Growth, and Liquidity Constraints," *The Quarterly Journal of Economics*, 109(1), 83-109. doi:10.2307/2118429

24. Justiniano, Alejandro, Giorgio E. Primiceri, and Andrea Tambalotti. 2019. "Credit Supply and the Housing Boom." *Journal of Political Economy.* 127(3), 1317-1350. doi:10.1086/701440

25. Kilian, Lutz, and Clara Vega. 2011. "Do Energy Prices Respond to U.S. Macroeconomic News? A Test of the Hypothesis of Predetermined Energy Prices," *The Review of Economics and Statistics*, Vol. 93, 660-671. https://www.jstor.org/stable/23015961

26. Levine, Ross. 1993. "Financial structures and economic development," *Revista de Analisis Economico,* 8, 113-129. https://www.jstor.org/stable/2729790

27. Levine, Ross. 1997. "Financial development and economic growth: Views and agenda," *Journal of Economic Literature,* 35, 688-726. https://www.jstor.org/stable/2729790

28. Levine, Ross. 2005. "Finance and Growth: Theory and Evidence," In *Handbook of Economic Growth*, Volume 1A, Ed. Philippe Aghion and Steven N. Durlauf, 865-934. doi:10.1016/S1574-0684(05)01012-9

29. Liaqat, Zara 2019. "Does government debt crowd out capital formation? A dynamic approach using panel VAR," *Economics Letters*. doi:10.1016/j.econlet.2019.03.002

30. Liaqat, Zara, and Irfan Qureshi, 2020. "The long-term consequences of external debt: Revisiting the evidence and inspecting the mechanism using panel VARs," *Journal of Macroeconomics*, 63(C). doi:10.1016/j.jmacro.2019.103184

31. Lof, Matthijs, and Tuomas Malinen. 2014. "Does sovereign debt weaken economic growth? A panel VAR analysis." *Economics Letters*. doi:10.1016/j.econlet.2013.12.037

32. Lombardi, Marco, Madhusudan Mohanty, and Ilhyock Shim. 2017. "The real effects of household debt in the short and long run," *BIS Working Paper No. 607.* https://www.bis.org/publ/work607.htm

33. Love, Inessa, and Lea Zicchino. 2006. "Financial development and dynamic investment behavior: evidence from panel var," *Quarterly Review of Economics and Finance*. 46(2), 190-210. doi:10.1016/j.qref.2005.11.007

34. Mian, Atif, Amir Sufi, and Emil Verner. 2017. "Household Debt and Business Cycles Worldwide," *The Quarterly Journal of Economics,* 1755-1817. Doi:10.1093/qje/qjx017

35. Mian, Atif and Amir Sufi. 2018. "Finance and Business Cycles: The Credit-Driven Household Demand Channel," *Journal of Economic Perspectives.* 32(3), 31-58. doi:10.1257/jep.32.3.31

36. Mian, Atif, Ludwig Straub, and Amir Sufi. 2020. "The Saving Glut of the Rich," *NBER Working Paper Series 26941,* 1-69. Doi: 10.3386/w26941

37. Park, Donghyun, Kwanho Shin, and Shu Tian. 2018. "Household Debt, Corporate Debt, and the real economy: some empirical evidence," *ADB Working Paper Series No. 567.* doi:10.2139/ssrn.3339193

38. Puente-Ajovin, Miguel, and Marcos Sanso-Navarro. 2015. "Granger Causality between debt and growth: Evidence from OECD countries," *International Review of Economics and Finance,* 66-77. doi:10.1016/j.iref.2014.09.007

39. Ramey, Valerie, and Matthew D. Shapiro. 1998. "Costly capital reallocation and the effects of government spending," Carnegie-Rochester Conference Series on Public Policy, 48, 145-194. doi:10.1016/S0167-2231(98)00020-7

40. Schmitt-Grohe, Stephanie and Martin Uribe. 2016. "Downward Nominal Wage Rigidity, Currency Pegs, and Involuntary Unemployment." *Journal of Political Economy.* 124(5), 1466-1514. doi: 10.1086/688175

41. Verner, Emil. 2019. "Private Debt Booms and the Real Economy: Do the Benefits Outweigh the Costs?" *INET initiative on Private Debt,* 1-29. doi:10.2139/ssrn.3441608

42. World Bank. *World Development Indicators.* The World Bank Group, 2015. https://data.worldbank.org.

Tables and Figures

Table 1: Descriptive Statistics

	Observations	Median	Mean	Standard deviation	Minimum	Maximum
Private debt, loans and debt securities (%)	1,306	114.18	118.42	79.802	4.344	679.681
Household debt (%)	1,306	37.59	43.46	31.452	0.1058	139.427
Corporate debt (%)	1,306	66.82	74.97	56.212	1.131	569.084
Real GDP per capita	1,306	22079.14	26204.9	21644.16	336.098	111968.4
Gross fixed capital formation (%)	1,306	22.35	22.67	4.413	4.493	45.091
Interest rate spread (%)	545	4.20	6.55	7.712	-1.112	58.36
Consumption (%)	1,306	77.08	76.69	10.350	41.872	138.106
Tax revenue (%)	1,306	18.88	18.83	7.107	0.043	62.859
Government spending (%)	1,306	18.35	17.79	4.801	5.039	40.444
Openness (%)	1,306	69.69	86.78	62.395	13.482	395.667

Notes: Annual data is obtained from World Bank (WDI) and IMF (WEO) databases.

Table 2: The effect of total private, household, and corporate debt on income growth

	Total Private Debt		Household Debt		Corporate Debt	
	Effect	Shock Persistence	Effect	Shock Persistence	Effect	Shock Persistence
Complete sample	Insignificant	-	Positive	6 years	Insignificant	-
Below-median debt	Insignificant	-	Positive	8 years	Positive	5 years
Above-median debt	Insignificant	-	Positive	4 years	Negative	3 years
Below-median income	Insignificant	-	Positive	8 years	Positive	7 years
Above-median income	Negative	1 year	Positive	4 years	Negative	5 years

Notes: Based on the estimation of PVARX (Eq. (1)) and the corresponding impulse response functions of income growth to a shock in debt for income and debt classifications.

Table 3: Private debt, thresholds, and channels of growth

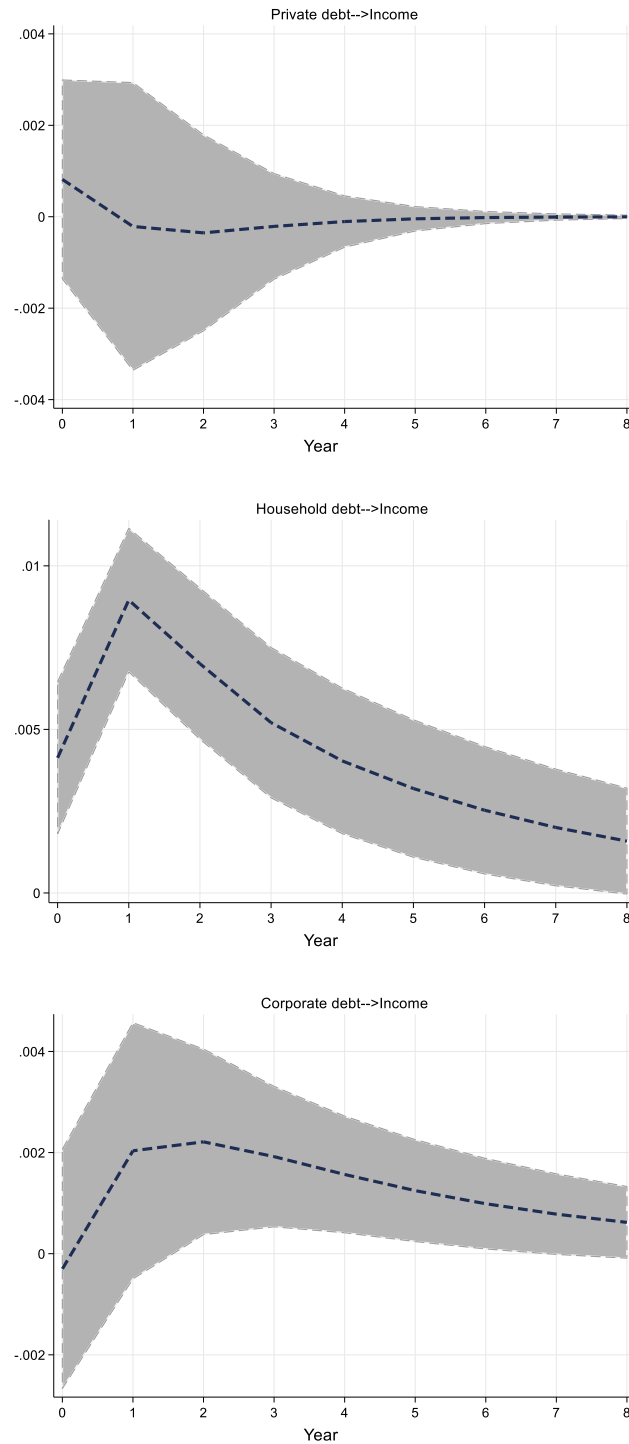| Country group:	Household debt				Corporate debt			
	Consumption	Trade Openness	Investment	Income	Consumption	Trade Openness	Investment	Income
Below-median debt Below-median income	Insignificant	Positive	Positive	Positive	Positive	Insignificant	Positive	Positive
Above-median debt Above-median income	Positive	Negative	Insignificant	Positive	Positive	Insignificant	Insignificant	Negative

Notes: Based on the estimation of PVARX (Eq. (1)) and the corresponding impulse response functions to a shock in debt for income and debt classifications. The table reports the effects of household and corporate debt on income and growth channels for each category of countries.

Table 4: Robustness tests

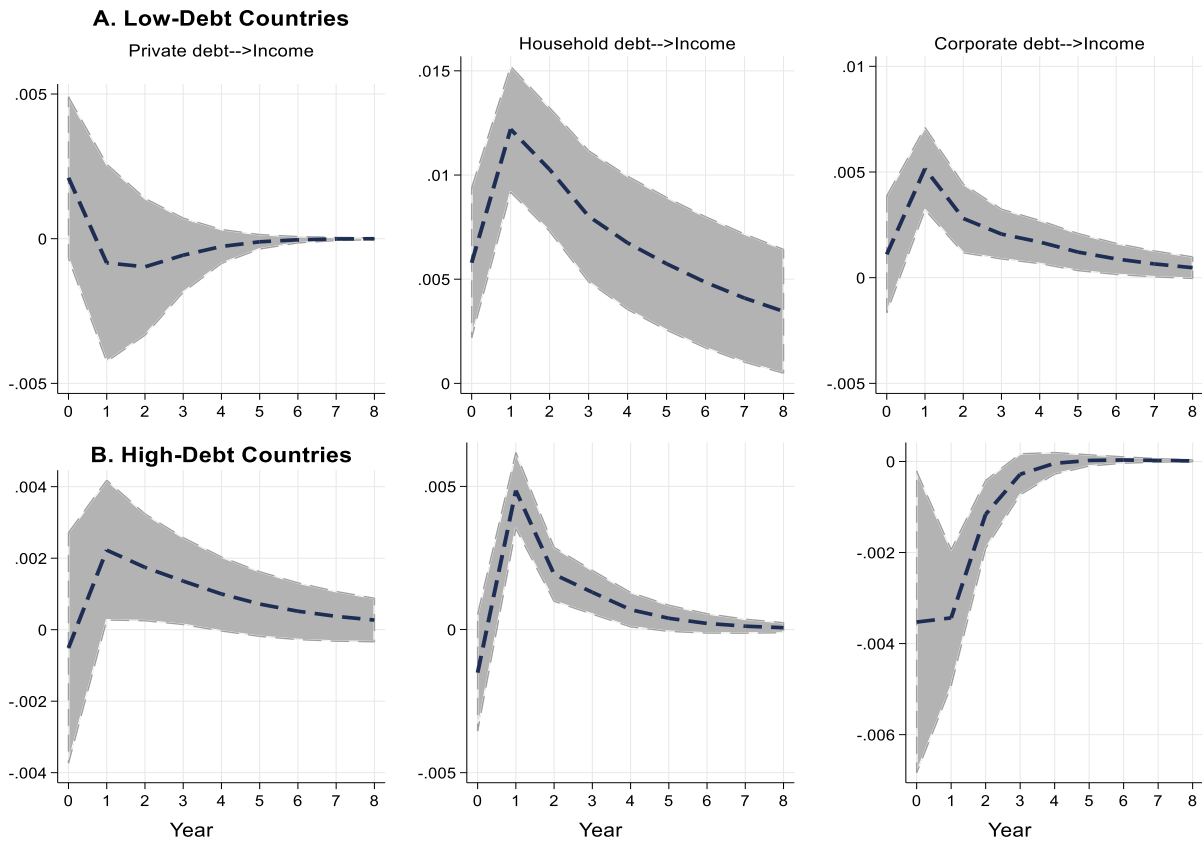|	Specification and Ordering	Recursive assumptions
Baseline PVARX estimation	Y_{it} = {Interest rate, debt, investment, consumption, trade openness, income} X_{it} = {Government spending, tax revenue}	Debt affects other macroeconomic indicators contemporaneously, whereas income growth affects debt with a lag
Alternative ordering	Y_{it} = {Income, debt, investment, interest rate, consumption, trade openness} Y_{it} = {Debt, interest rate, investment, consumption, trade openness, income} X_{it} = {Government spending, tax revenue}	1. Income growth affects debt and other macroeconomic indicators contemporaneously 2. Debt affects interest rate spreads contemporaneously, whereas income growth affects debt with a lag
Trivariate PVAR	Y_{it} = {Income, interest rate, debt} Y_{it} = {Debt, interest rate, income} Y_{it} = {Interest rate, debt, income}	1. Income growth affects debt and interest rate contemporaneously 2. Debt affects interest rate spreads contemporaneously, whereas income growth affects debt with a lag 3. Interest rates affect debt contemporaneously, whereas income growth affects debt with a lag
Basic PVAR model	Y_{it} = {Interest rate, debt, investment, consumption, trade openness, income}	Baseline assumption
Exclude Interest rate	Y_{it} = {Debt, investment, consumption, trade openness, income} X_{it} = {Government spending, tax revenue}	Baseline assumption
Extended specification	Y_{it} = {Interest rate, debt, income} X_{it} = {Investment, consumption, trade openness, government spending, tax revenue, savings}	Baseline assumption

Alternative indicators:
   Consumption
 	
   Investment
	
	 Consumption spending replaced by household final consumption expenditure
	 Gross fixed capital formation replaced by capital formation
		
		 Baseline assumption

Notes: This table reports the robustness checks carried out to test the estimation of PVARX (Eq. (1)) by considering alternative PVAR specifications and identifying restrictions.

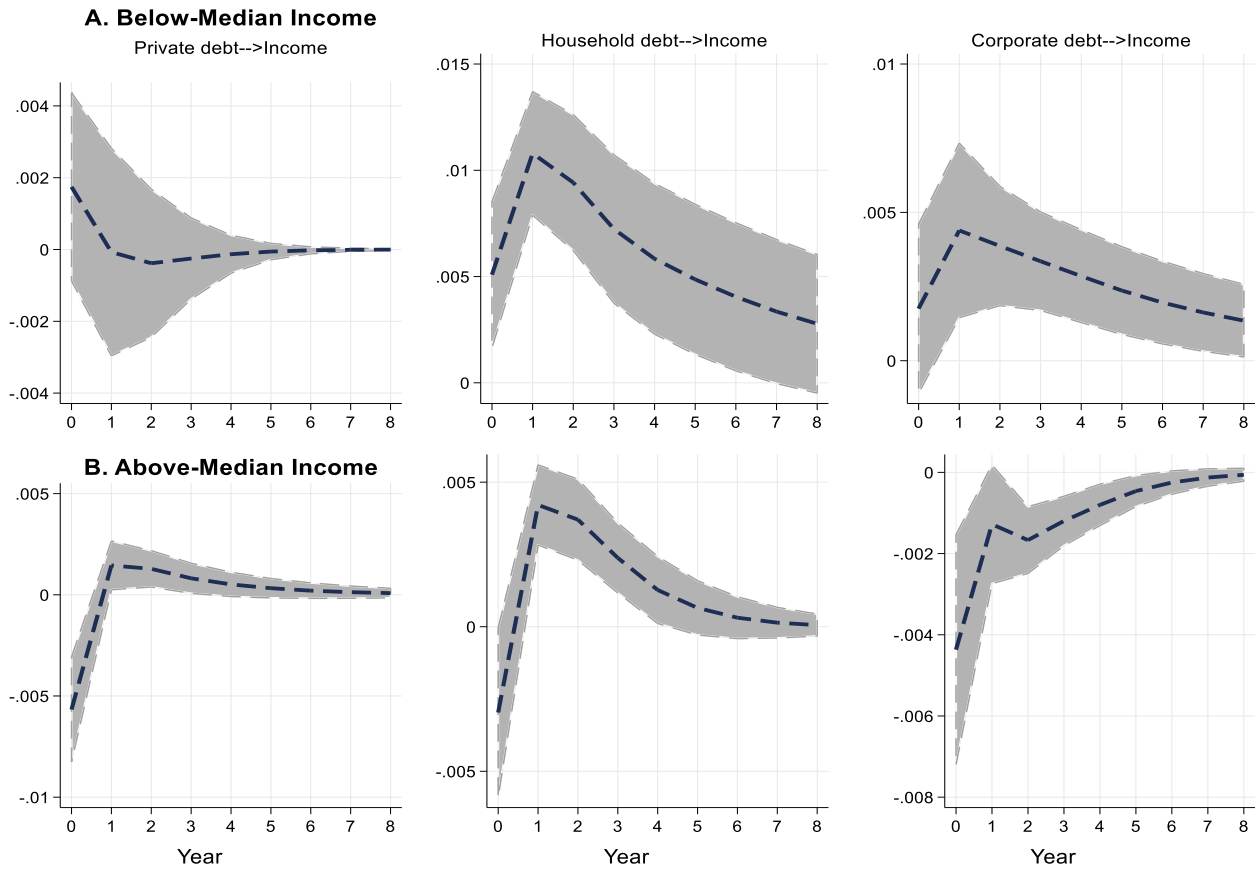Figure 1: The effect of private debt on income growth

Notes: Orthogonalized impulse response functions of income growth to a shock in debt (total private, household, and corporate debt) computed from estimated PVARX (Eq. (1)) for the complete sample of countries. The shaded area represents 95% confidence intervals based on 200 Monte Carlo simulations.

Figure 2: The effect of private debt on income growth by debt categories

A. Low-Debt Countries

Private debt-->Income | Household debt-->Income | Corporate debt-->Income

B. High-Debt Countries

Notes: Orthogonalized impulse response functions of income growth to a shock in debt computed from estimated PVARX (Eq. (1)) for the below-median (top row) and above-median debt (bottom row) sample of countries. The shaded area represents 95% confidence intervals based on 200 Monte Carlo simulations.

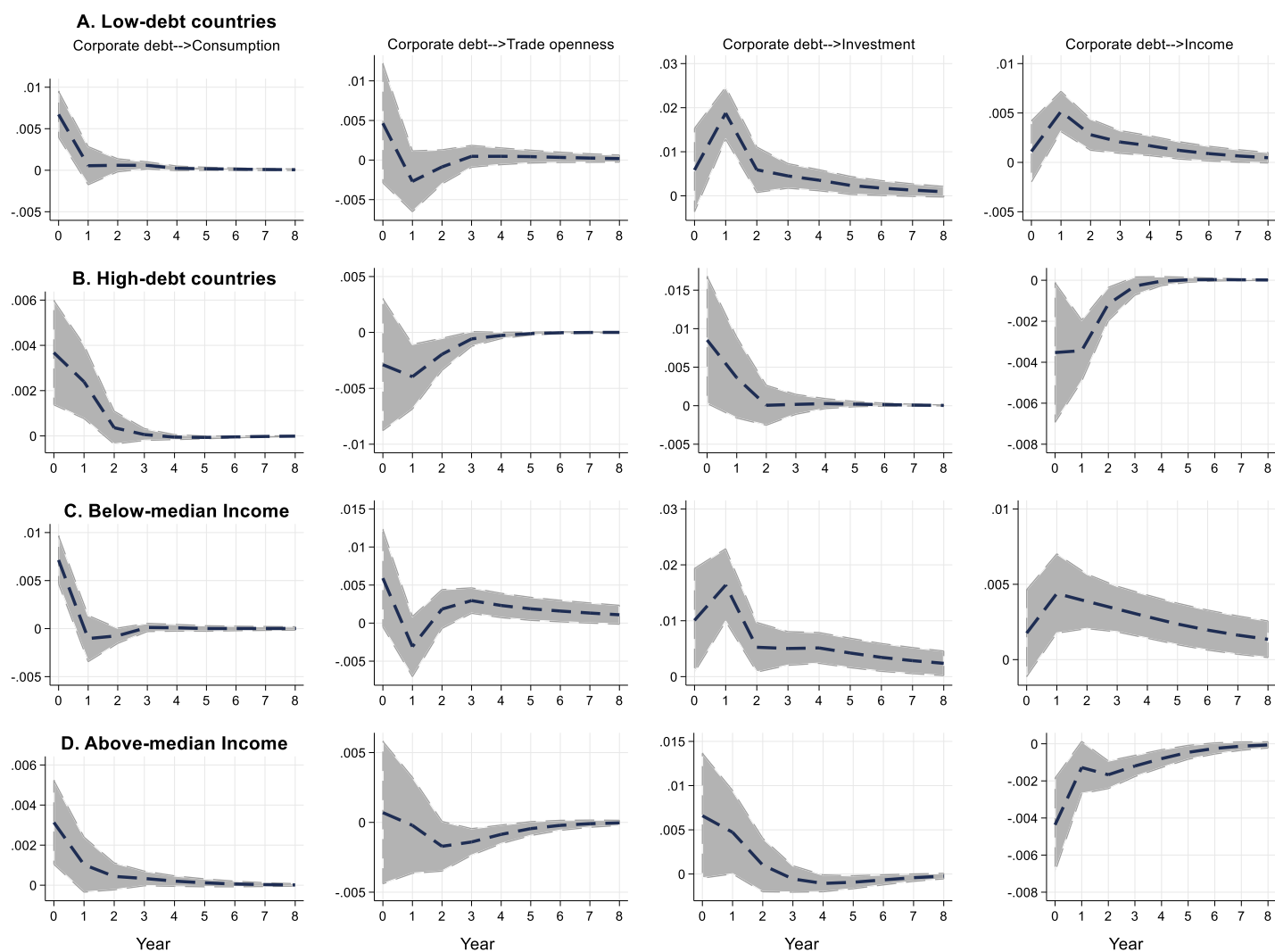Figure 3: The effect of private debt on growth by income groups

Notes: Orthogonalized impulse response functions of income growth to a shock in debt computed from estimated PVARX (Eq. (1)) for the below-median (top row) and above-median GDP p.c. (bottom row) sample of countries. The shaded area represents 95% confidence intervals based on 200 Monte Carlo simulations.

Figure 4: Impact of household debt on other endogenous growth channels
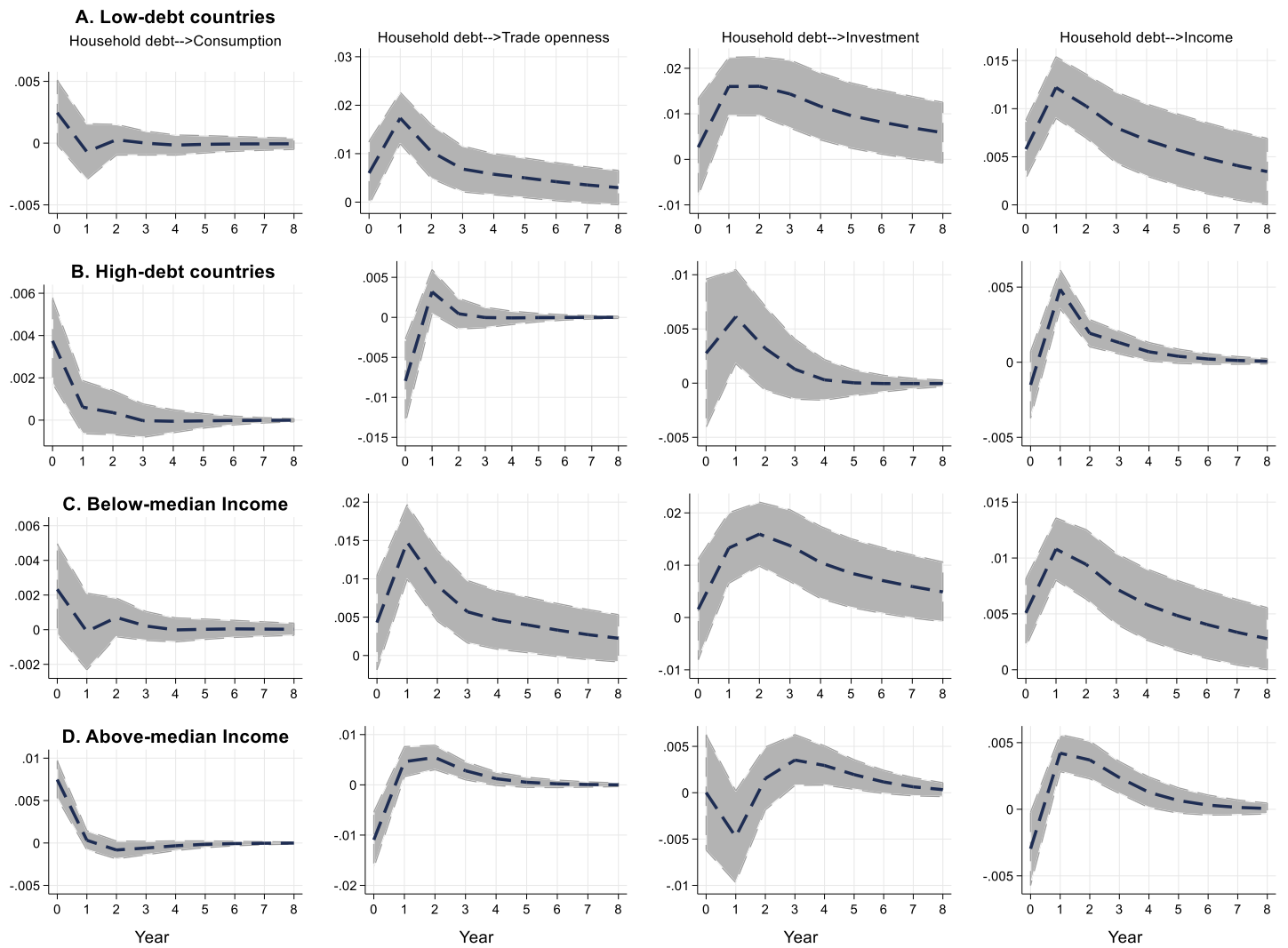
Notes: Orthogonalized impulse response functions for consumption, trade openness, investment, and income growth to a shock in debt computed from PVARX (Eq. (1)) estimated separately for each country category. The shaded area represents 95% confidence intervals based on 200 Monte Carlo simulations.

Figure 5: Impact of corporate debt on other endogenous growth channels


Notes: Orthogonalized impulse response functions for consumption, trade openness, investment, and income growth to a shock in debt computed from PVARX (Eq. (1)) estimated separately for each country category. The shaded area represents 95% confidence intervals based on 200 Monte Carlo simulations.

Figure 6: Average interest rate and GDP per capita
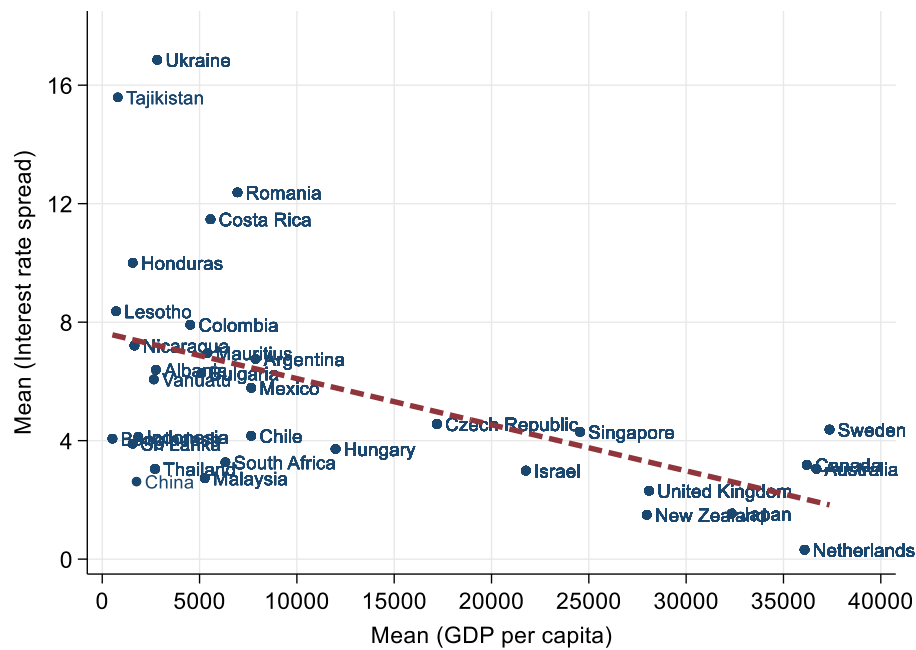
Notes: Based on authors' calculations using annual data obtained from World Bank (WDI) and IMF (WEO) databases. The graph shows the inverse relationship between average interest rate spreads and GDP per capita for countries included in the sample.

Figure 7: Average interest rate and private debt
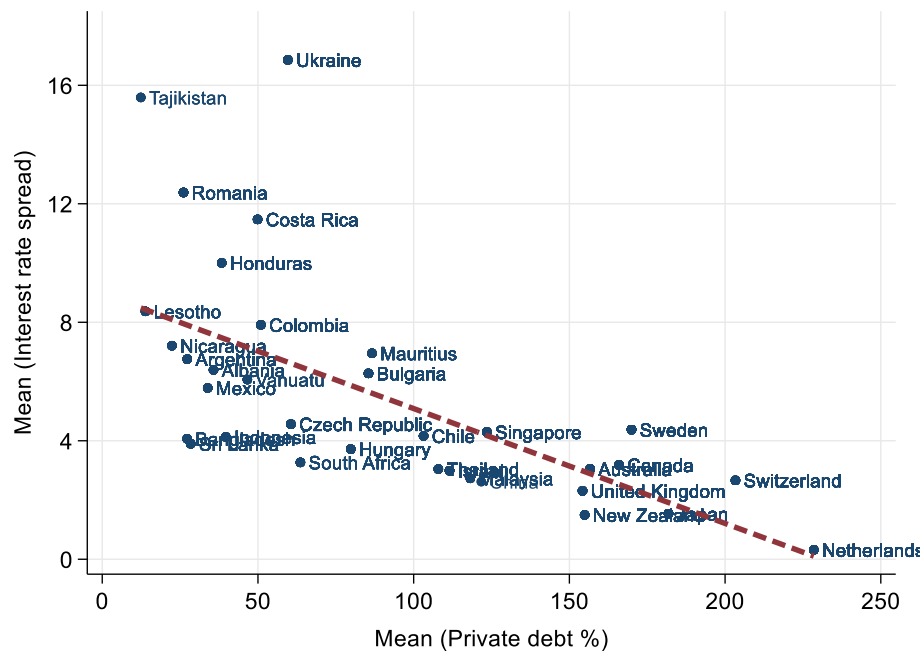
Notes: Based on authors' calculations using annual data obtained from World Bank (WDI) and IMF (WEO) databases. The graph shows the inverse relationship between average interest rate spreads and private debt for countries included in the sample.

Appendix

Table A.1: List of countries

	Household debt		Corporate debt			Household debt		Corporate debt	
	Above median	Below median	Above median	Below median		Above median	Below median	Above median	Below median
A. Above-median income (N=25)									
					Italy	X	X	X	X
Australia	X		X	X	Japan	X		X	
Austria	X		X	X	Luxembourg	X		X	
Belgium	X	X	X	X	Netherlands	X		X	
Canada	X		X		New Zealand	X	X	X	
Cyprus	X		X		Norway	X		X	
Denmark	X		X	X	Singapore	X	X	X	X
Finland	X	X	X		Spain	X	X	X	X
France	X	X	X		Sweden	X		X	
Germany	X			X	Switzerland	X		X	
Iceland	X		X		UAE		X	X	X
Ireland	X		X		UK	X		X	X
Israel	X	X	X	X	USA	X		X	X
B. Below-median income (N=47)									
					Lesotho		X		X
Afghanistan		X		X	Lithuania		X		X
Albania		X		X	Malaysia	X		X	X
Argentina		X		X	Mauritius		X		X
Bangladesh		X		X	Mexico		X		X
Brazil		X		X	Morocco		X		X
Bulgaria		X	X	X	Myanmar		X		X
Cameroon		X		X	Nepal	X	X		X
C. African Republic		X		X	Nicaragua		X		X
Chad		X		X	Pakistan		X		X
Chile	X	X	X	X	Peru		X		X
China	X	X	X		Poland		X		X
Colombia		X		X	Romania		X		X
Costa Rica		X		X	Samoa		X		X
Croatia	X	X	X	X	Saudi Arabia		X		X
Czech Republic		X		X	Sierra Leone		X		X
El Salvador		X		X	S. Islands		X		X
Estonia	X	X	X	X	South Africa	X	X		X
Honduras		X		X	Sri Lanka		X		X
Hungary	X	X	X	X	Tajikistan		X		X
India		X		X	Thailand	X			X
Indonesia		X		X	Turkey		X	X	X
Kazakhstan		X		X	Ukraine		X	X	X
Latvia	X	X	X	X	Vanuatu		X		X
C. Both income groups (N=4)									
Greece	X	X	X	X	Portugal	X	X	X	X
Malta	X	X	X		Slovenia		X	X	X
N=Number of countries	37	58	38	61					

Sources: World Development Indicators (WDI) and IMF databases. Panel C lists countries which are classified as either above- or below-median income countries during a part of the time period considered, and therefore, belong to both income groups over the course of this period.
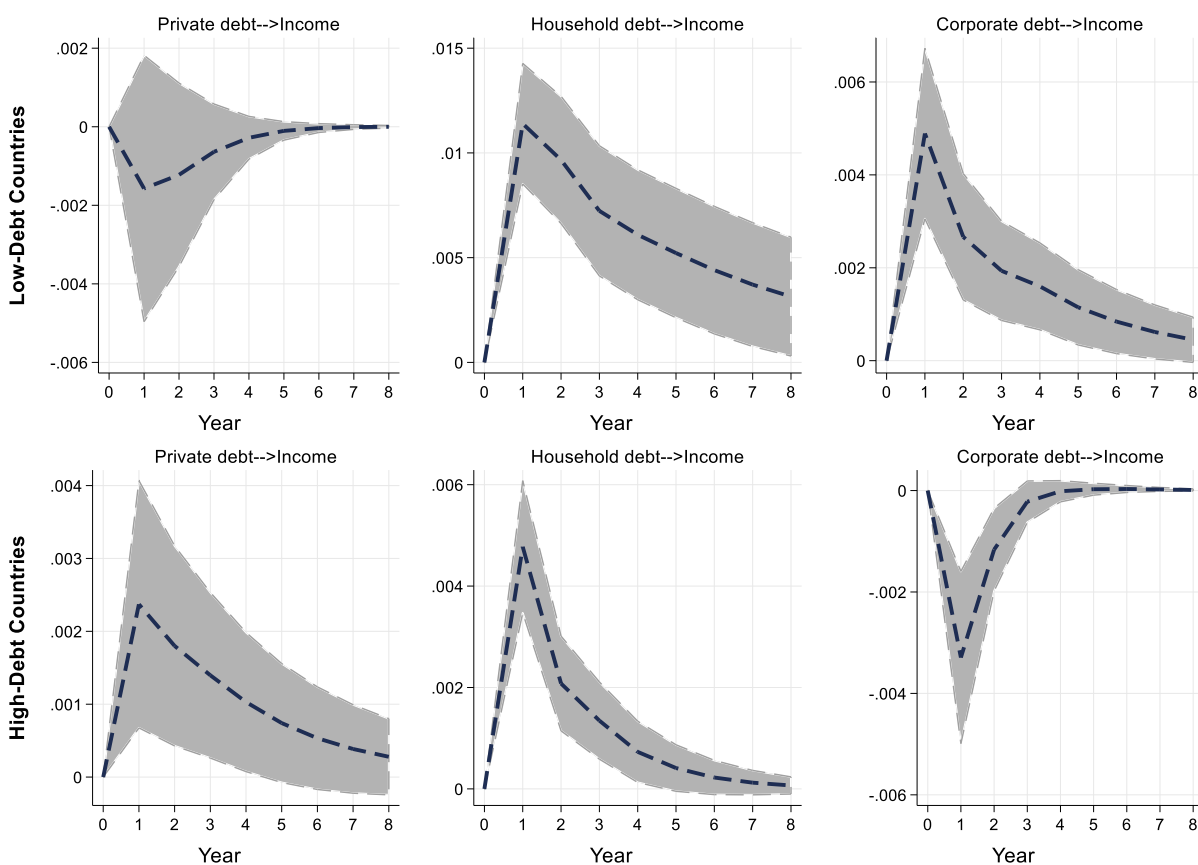
Figure A.1: The effect of private debt on income growth – Robustness tests
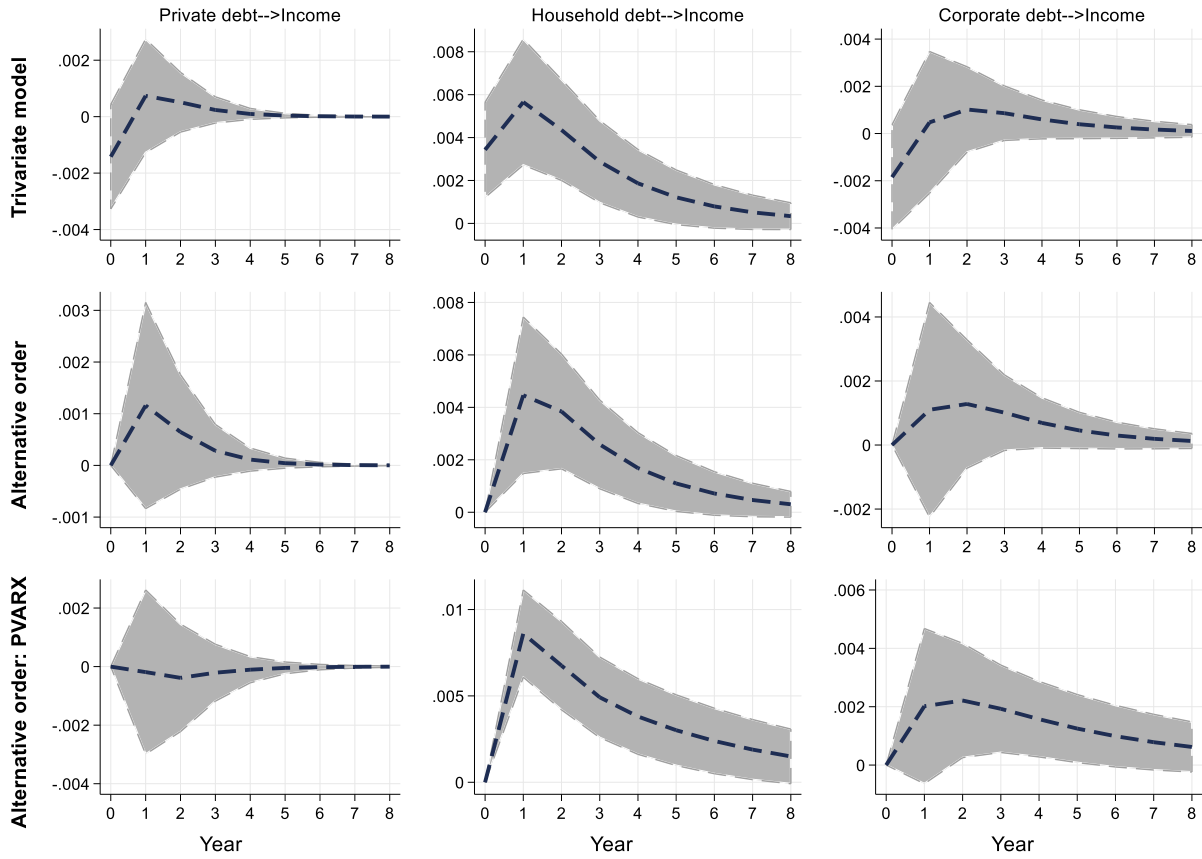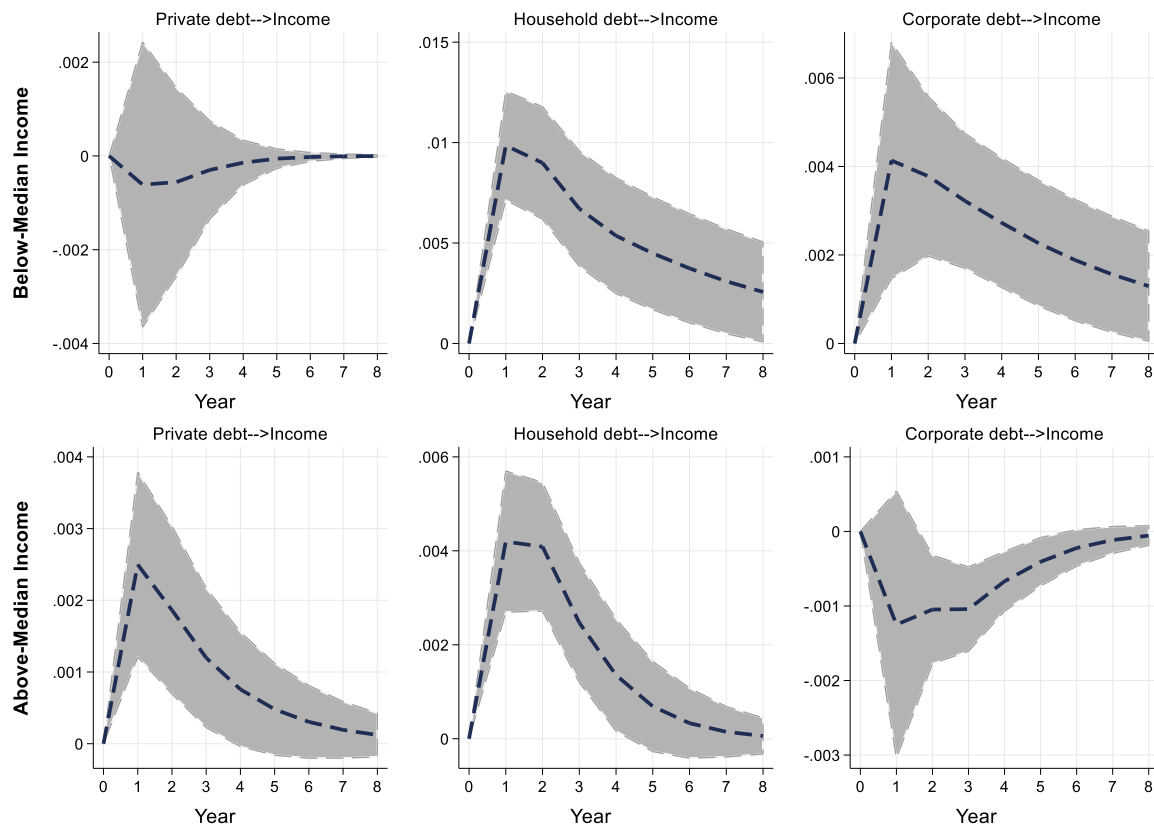

Notes: Orthogonalized impulse response functions of income growth to a shock in debt computed from estimated PVARX (Eq. (1)) for the complete sample of countries. The shaded area represents 95% confidence intervals based on 200 Monte Carlo simulations.

Figure A.2: The effect of private debt on income growth by debt categories – Alternative order

Notes: Orthogonalized impulse response functions of income growth to a shock in debt computed from estimated PVARX (Eq. (1)) for the below-median (top row) and above-median debt (bottom row) sample of countries. The shaded area represents 95% confidence intervals based on 200 Monte Carlo simulations.

Figure A.3: The effect of private debt on income growth by income groups – Alternative order

Notes: Orthogonalized impulse response functions of income growth to a shock in debt computed from estimated PVARX (Eq. (1)) for the below-median (top row) and above-median GDP p.c. (bottom row) sample of countries. The shaded area represents 95% confidence intervals based on 200 Monte Carlo simulations.