IWH
Halle Institute for Economic Research
Member of the Leibniz Association

CompNet
The Competitiveness Research Network

IWH-CompNet Discussion Papers

No. 7
December 2019

Private Debt, Public Debt, and Capital Misallocation

Behzod Alimov

Author

Behzod Alimov
Collegio Carlo Alberto, Università degli Studi di Torino
Tel +39 388 1672311
E-mail: behzod.alimov@gmail.com

IWH-CompNet Discussion Papers are indexed in RePEc-EconPapers and in ECONIS.

Editor

Halle Institute for Economic Research (IWH) – Member of the Leibniz Association

Address: Kleine Maerkerstrasse 8
D-06108 Halle (Saale), Germany
Postal Address: P.O. Box 11 03 61
D-06017 Halle (Saale), Germany

Tel +49 345 7753 60
Fax +49 345 7753 820

www.iwh-halle.de
www.comp-net.org

ISSN 2513-1303

Private Debt, Public Debt, and Capital Misallocation

This Draft: October 31, 2019

Abstract

Does finance facilitate efficient allocation of resources? Our aim in this paper is to find out whether increases in private and public indebtedness affect capital misallocation, which is measured as the dispersion in the return to capital across firms in different industries. For this, we use a novel dataset containing industry-level data for 18 European countries and control for different macroeconomic indicators as potential determinants of capital misallocation. We exploit the within-country variation across industries in such indicators as external finance dependence, technological intensity, credit constraints and competitive structure, and find that private debt accumulation disproportionately increases capital misallocation in industries with higher financial dependence, higher R&D intensity, a larger share of credit-constrained firms and a lower level of competition. On the other hand, we fail to find any significant and robust effect of public debt on capital misallocation within our country-sector pairs. We believe the distortionary effects of private debt found in our analysis needs a deeper theoretical investigation.

Keywords: private debt, public debt, capital misallocation, productivity

JEL Classification: D24, D61, E44, F34, H63, O47

1. Introduction

Finance, and especially debt finance, is an extremely important part of modern economies. On the one hand, it is indisputable that debt allows firms to realize important investment projects and governments to finance necessary expenditures. On the other hand, persistent debt build-ups can make financial markets—and with them the real economy—vulnerable to crises and may lead governments to default on their liabilities. Economists are now well aware that the likelihood and severity of financial crises tend to increase beyond a certain level of indebtedness (see Reinhart and Rogoff, 2009). Considerable research has been conducted on the nonlinear effects of debt on economic growth.

Over the past few decades, extensive research has been carried out on the relationship between private sector debt and economic growth. Earlier studies found positive effects of finance on growth (King and Levine, 1993; Rajan and Zingales, 1998; Levine et al., 2000; Beck et al., 2000). Huang and Lin (2009) find that financial intermediation has much stronger growth-enhancing effects in low-income countries than in high-income countries. More recently, however, several studies have indicated that the effect of finance on growth is unlikely to be strictly positive. Shen and Lee (2006) show that the relationship between bank development and growth has an inverse U-shape in middle-income countries. Rousseau and Wachtel (2011) find that positive finance–growth relationship that was estimated with data from the 1960s to the 1980s has disappeared over the subsequent decades. Law and Singh (2014) estimate a threshold value of around 90-95% of GDP beyond which financial development indicators (i.e., private sector credit and liquid liabilities) affect growth negatively. Arcand et al. (2015) find that financial depth has a negative effect on output growth when private sector credit reaches 100% of GDP. Mian et al. (2017) show that an increase in the household debt to GDP ratio predicts a lower subsequent GDP growth. Other studies document the detrimental effects of private credit growth on financial stability and intensity of subsequent recessions (Mian and Sufi, 2010; Jordà et al., 2011; Schularick and Taylor, 2012; Jordà et al., 2013; Jordà et al., 2015a).

In addition to the growth effects of private sector debt, a number of studies have analyzed the relationship between public debt and economic growth since the publication of Reinhart and Rogoff's (2009) seminal book. Reinhart and Rogoff (2010) find in a sample of both advanced and emerging economies that public debt to GDP ratios as high as 90% and above are associated with significantly lower growth outcomes. These findings are also supported by Cecchetti et al. (2011), whose results suggest that increases in public debt beyond 85 percent of GDP have a negative effect on growth in a sample of 18 OECD countries. Other papers confirming the nonlinear effects of public debt on growth include Checherita-Westphal and Rother (2012), Baum et al. (2013), Woo and Kumar (2015), Karadam (2018), and Yang and Su (2018). Chudik et al. (2017) find significant negative effects of public debt build-up on economic growth in the long run, although they find no evidence for a universally applicable threshold effect of public debt on growth. Panizza and Presbitero (2014), however, fail to find any evidence for a *causal* effect of public debt on growth once corrected for endogeneity.

Another strand of literature—albeit to a limited extent—has focused on the joint dynamics of public and private debt. Reinhart and Rogoff (2011) document numerous episodes where

there are surges in private debt before crises and surges in public debt after crises across advanced and emerging market economies. Reinhart et al. (2012) argue that the interaction between the different types of debt overhang is extremely complex and the lines between public and private debt often become blurred in a crisis. Jordà et al. (2015b), after examining the co-evolution of public and private sector debt in 17 advanced countries over a 140-year period (1870-2011), show that financial stability risks originate primarily in the private sector rather than in the public sector; high public debt only exacerbates the effects of private sector deleveraging after financial crises and hence contributes to deepening of the recessions following a credit bust. Indeed, the earlier research by Reinhart and Rogoff (2009) confirms these findings by showing that, in many crisis episodes over the past century, corporate defaults were precursors to government defaults or reschedulings as governments tended to shoulder private sector debts. It can also be seen in Figure 1 that private debt in 18 EU countries had been rising dramatically for years preceding the 2007-2008 global financial crisis, while public debt has risen following the crisis. In a recent study that uses data from 29 OECD countries over 1995-2014, Caner et al. (2019) find that the interaction between public and private debt stimulates economic growth at low levels of indebtedness but decreases growth when the private-public debt interaction reaches the threshold level of 137%.

Besides the many studies investigating the effects of debt on output growth, more recent research focuses on how debt accumulation impacts on productivity and allocative efficiency. In one of the early papers, Kim and Maksimovic (1990) apply an econometric methodology for estimating agency costs of debt to the air transport industry to show that high debt levels are associated with firm-level inefficiency and the fall in industry-wide productivity growth. Borio et al. (2015) study a sample of 21 OECD countries over 30 years and find that credit booms tend to undermine aggregate productivity growth mainly through labor reallocations towards sectors with lower productivity growth. Cecchetti and Kharroubi (2018) find, in a sample of 20 advanced economies over 25 years, that a country's credit growth is a drag on its productivity growth since credit booms slow down the growth in those industries that have either lower asset tangibility or high R&D intensity, i.e., in what are usually thought of as the engines for growth. Anderson and Raissi (2018) find significant negative effects of persistent corporate debt accumulation on the growth of total factor productivity (TFP) within Italian firms over the period 1999-2015.

It is widely known that TFP growth is the most important determinant of output growth in the long run (Klenow and Rodriguez-Clare, 1997; Hall and Jones, 1999; Caselli, 2005; Hsieh and Klenow, 2010). This suggests that the observed differences in per capita income across countries are primarily due to the differences in their aggregate productivity. One of the key factors in understanding measured TFP differences is input misallocation: an inefficient allocation of resources across firms and sectors. A baseline paper in this area is by Restuccia and Rogerson (2008), who show that policies that distort the prices faced by different producers lead to reallocation of resources across productive units, thus having important effects on aggregate TFP. In another seminal paper, Hsieh and Klenow (2009) use microdata on manufacturing firms to document much higher dispersion of marginal products of capital and labor (i.e., measures of input misallocation) across plants in China and India as compared to the United States. The authors also estimate large gains from reallocation: had the levels of

dispersion of marginal products in China and India been counterfactually equalized to those in the U.S., TFP levels would be increased by 30%–50% in China and by 40%–60% in India.

Figure 1. Time series of private and public debt (as % of GDP), average for 18 EU countries

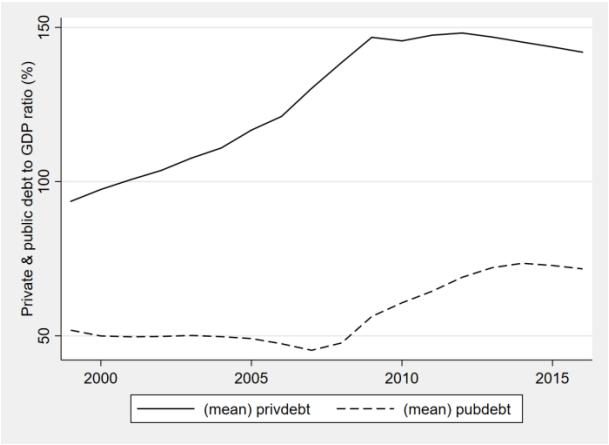
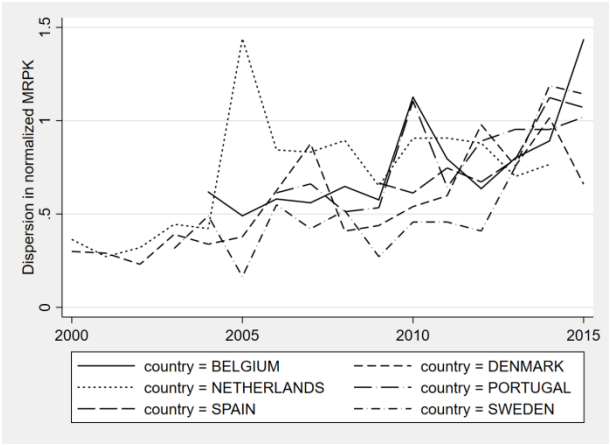


Figure 2a. Capital misallocation for 6 EU countries with high private debt to GDP ratio



Source: Author's calculations based on IMF data.

Figure 2b. Capital misallocation for 6 EU countries with medium private debt to GDP ratio

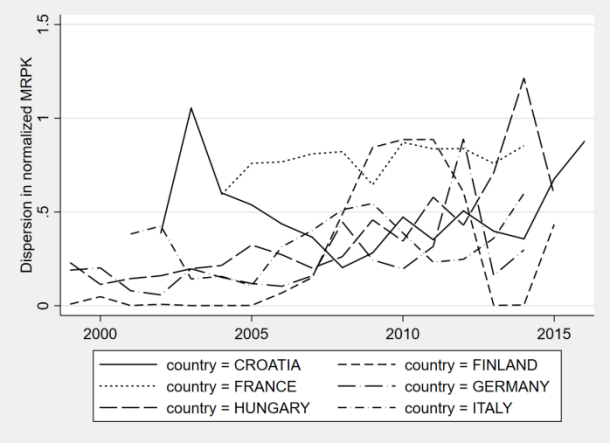
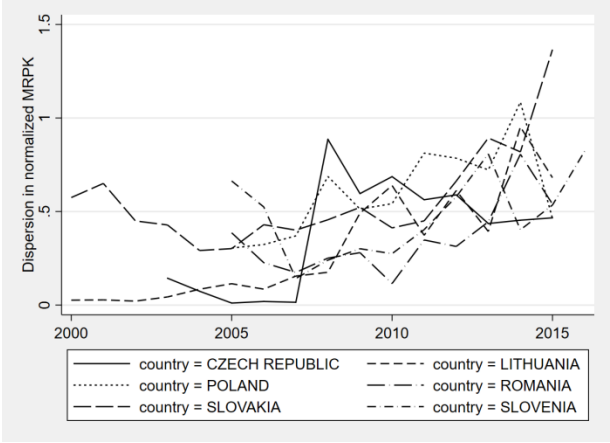


Figure 2c. Capital misallocation for 6 EU countries with low private debt to GDP ratio



Source: Author's calculations based on CompNet data. Values are weighted averages, where the weights are country-specific time-varying sectoral value added shares.

Our goal in this paper is to investigate how private debt and public debt at the aggregate level influence capital misallocation across firms in different industries over time. We use an unbalanced panel of 18 European countries from 1999 to 2015 for our analysis. (Figures 2a-2c show the weighted-average dispersion[1] of marginal revenue product of capital for these 18 countries by splitting them into those with the highest, medium and lowest private debt to GDP ratio over the sample period.) To our knowledge, this is the first paper to study the effects of aggregate leverage on sectoral-level input misallocation. Few recent studies have

[1] These dispersion measures are detrended and normalized by sector-specific standard deviations.

analyzed either the role of financial frictions (Buera et al., 2011; Midrigan and Xu, 2014) or the overall financial development (Marconi and Upper, 2017) in generating capital misallocation, or the impacts of firm-level and aggregate leverage on within-firm productivity (Gomis and Khatiwada, 2017). An interesting finding by Gomis and Khatiwada (2017) is that firm leverage is positively associated with TFP, whereas aggregate leverage (at the country level) has a negative effect on firm-level TFP. Our work differs from these studies in that we are interested in how aggregate leverage of private and public sectors affect capital misallocation across firms in different industries in an economy.

Figure 3a. Scatterplot of private debt and capital misallocation

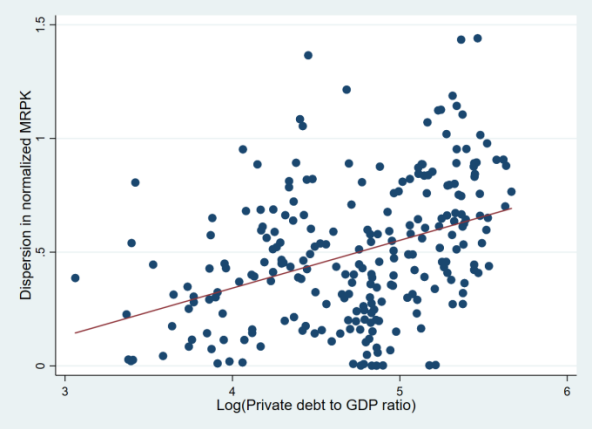
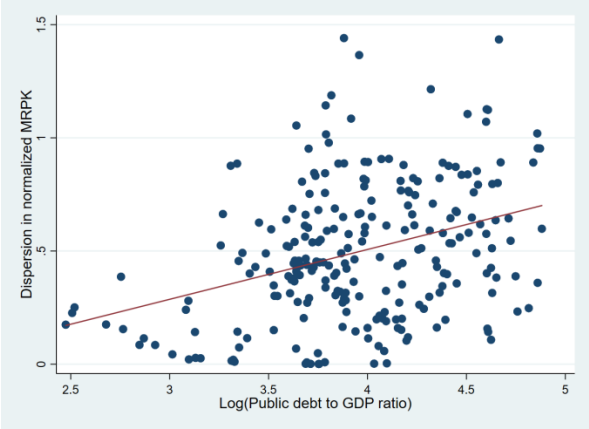


Figure 3b. Scatterplot of public debt and capital misallocation



Source: Author's estimations based on the IMF and CompNet data. The estimations are at the country-year level, and MRPK dispersions are weighted averages, where the weights are country-specific time-varying sectoral value added shares.

The remaining part of this paper proceeds as follows. Section 2 gives a brief theoretical insight into debt, productivity, and capital misallocation. Section 3 discusses data and the empirical methodology. Section 4 presents the results of the empirical analysis regarding the effects of private and public debt on capital misallocation. Finally, Section 5 concludes.

2. Theoretical underpinnings

2.1. Debt and misallocation

There is no generally accepted theory of how increases in private and public debt affect allocative efficiency or aggregate productivity growth. A few existing studies suggest that debt accumulation may influence aggregate productivity either through intra-firm efficiency channel or through inter-firm reallocation channel. Kobayashi and Shirai (2018) construct a theoretical model to show that excessive debt build-up in the private sector can depress economic growth through persistent productive inefficiency of debt-ridden firms. Pannella (2018) shows in a model of rational bubbles in the credit market that the periods of high

credit allow larger but unproductive firms to increase their leverage relative to smaller and productive firms, thus generating a misallocation of capital. Basco et al. (2018), by using matched firm- and bank-level data for Spain, document that housing bubbles generate misallocation of capital within industries and across municipalities by raising the value of the collateral disproportionately more for firms and municipalities that have larger amounts of real estate assets. In a recent paper, Aghion et al. (2019) develop a simple theoretical model to show that there is an inverted-U relationship between credit access and aggregate productivity growth that is generated by two counteracting effects: (i) a positive investment effect of credit access on incumbent firms' productivity growth working through facilitation of innovation, and (ii) a negative *reallocation* effect of credit access working through the exit rate of incumbent firms and its influence on the entry cost for new—potentially more efficient—innovators. Regarding public debt, Kaas (2016) develops a dynamic general equilibrium model with credit market frictions to show that there may exist an unstable "bubble" steady state with a higher interest rate, higher *public debt*, and higher TFP and output coupled with lower levels of credit and private capital stock.

Based on the findings of some recent studies, we can think of at least *two main channels* through which debt accumulation at the aggregate level may affect capital misallocation across firms in a country or an industry. The *first* is the existence of financial frictions associated with pledgeable collateral or borrowing constraints. As argued by Moll (2014) in a general equilibrium framework, with the borrowing constraints resulting from credit market imperfections, the equilibrium allocation implies that the marginal product of capital in highly productive firms exceeds that in less productive firms unless idiosyncratic productivity shocks are persistent. Similarly, Doerr (2018) finds that rising property prices reduce aggregate productivity by reallocating capital and labor towards unproductive real estate owning firms. The *second* channel is bubbles arising from excessive debt accumulation. Miao and Wang (2014) construct a two-sector endogenous growth model with credit-driven stock price bubbles to show that bubbles impact on economic growth by easing access to credit and improving investment efficiency on the one side, and by reallocating capital across sectors on the other side. As mentioned earlier in this section, Basco et al. (2018) and Pannella (2018) also find distortionary effects of bubbles in the housing and the credit markets on capital allocation. So, we hypothesize that an increase in supply of bank credit and other private debt instruments exacerbates capital misallocation by disproportionately benefiting those firms that have better collateral (e.g., in the form of real estate assets) or access to credit, while an increase in public debt *may* alter the allocation of capital by crowding out private credit or subsidizing certain producers at the expense of others. Based on the findings of the studies discussed above, however, we expect the increases in private debt to have a larger and stronger (amplifying) effect on capital misallocation as compared to the increases in public debt. In addition, we also check whether other differences across firms (e.g., technological intensity or exposure to competition) could be the basis for disproportionate effects of debt accumulation leading to increased capital misallocation.

2.2. A theoretical basis for misallocation

To measure capital misallocation, we adopt the framework developed by Hsieh and Klenow (2009). They consider an economy consisting of S sectors characterized by monopolistic competition. Each sector's output is a CES aggregate of M_s differentiated products:

$$Y_s = \left(\sum_{i=1}^{M_s} Y_{si}^{\frac{\sigma-1}{\sigma}} \right)^{\frac{\sigma}{\sigma-1}}, \quad (1)$$

where Y_{si} is the firm *i*'s real value added and σ indicates the elasticity of substitution across varieties of goods.

Each firm's production function is given by a Cobb-Douglas technology of the following form:

$$Y_{si} = A_{si} K_{si}^{\alpha_s} L_{si}^{1-\alpha_s}, \quad (2)$$

where A_{si}, K_{si} and L_{si} are the firm-level TFP, capital input and labor input, respectively, and α_s is the sector-specific share of capital. In addition to the level of TFP, A_{si}, firms also differ in terms of output and input constraints they face. Hsieh and Klenow (2009) define distortions that simultaneously affect both capital and labor—thus increasing the marginal products of these inputs by the same proportion—as an output distortion, denoted by τ_Y, and those that raise the marginal product of capital relative to labor as the capital distortion, denoted by τ_K. Examples given by the authors for output distortions include government restrictions on size and differences in transportation costs, while an example for capital distortions includes differences in access to credit. Firms maximize profits given by:

$$\pi_{si} = (1 - \tau_{Ysi}) P_{si} Y_{si} - w L_{si} - (1 + \tau_{Ksi}) R K_{si}, \quad (3)$$

where $P_{si}Y_{si}$ stands for the nominal value added, w is the cost of labor (wage rate), and R is the cost of capital (rental rate). By solving the firms' profit maximization problem we can get the standard result that the output price of a monopolistically competitive firm is a markup over its marginal cost:

$$P_{si} = \frac{\sigma}{\sigma-1} \left(\frac{R}{\alpha_s} \right)^{\alpha_s} \left(\frac{w}{1-\alpha_s} \right)^{1-\alpha_s} \frac{(1+\tau_{Ksi})^{\alpha_s}}{A_{si}(1-\tau_{Ysi})} \quad (4)$$

The capital-labor ratio is given by:

$$\frac{K_{si}}{L_{si}} = \frac{\alpha_s}{1-\alpha_s} \cdot \frac{w}{R} \cdot \frac{1}{1+\tau_{Ksi}} \quad (5)$$

Given the definition of marginal products of capital and labor (MPK and MPL), we obtain the following results for marginal revenue products of these inputs:

$$MRPK_{si} \equiv MR_{si} \cdot MPK_{si} = \alpha_s \frac{\sigma-1}{\sigma} \frac{P_{si}Y_{si}}{K_{si}} = R \frac{1+\tau_{Ksi}}{1-\tau_{Ysi}} \quad (6)$$

$$MRPL_{si} \equiv MR_{si} \cdot MPL_{si} = (1-\alpha_s)\frac{\sigma-1}{\sigma}\frac{P_{si}Y_{si}}{L_{si}} = w\frac{1}{1-\tau_{Ysi}} \quad (7)$$

where $MR_{si} \equiv \frac{\sigma-1}{\sigma}P_{si}$ is the marginal revenue from selling an additional unit of output.

It can be seen from (6) and (7) that, in the absence of distortions, marginal returns to capital and labor would be equalized across firms in a given sector. When there are firm-specific output and capital distortions, however, marginal revenue products differ across these firms.

The "revenue productivity" of the firm—as opposed to its "physical productivity" given by A_{si}—is defined as follows:[2]

$$TFPR_{si} \equiv P_{si}A_{si} = \frac{P_{si}Y_{si}}{K_{si}^{\alpha_s}L_{si}^{1-\alpha_s}} \quad (8)$$

In the absence of distortions, differences in firms' physical productivity (A_{si}) would lead to the allocation of capital and labor in such a way that all firms within an industry would have the same TFPR, since firms with higher A_{si}—and hence higher output—would charge a correspondingly lower price for their product. Using (6) and (7), a firm's TFPR is given by:

$$TFPR_{si} = \frac{\sigma}{\sigma-1}\left(\frac{MRPK_{si}}{\alpha_s}\right)^{\alpha_s}\left(\frac{MRPL_{si}}{1-\alpha_s}\right)^{1-\alpha_s} = \frac{\sigma}{\sigma-1}\left(\frac{R}{\alpha_s}\right)^{\alpha_s}\left(\frac{w}{1-\alpha_s}\right)^{1-\alpha_s}\frac{(1+\tau_{Ksi})^{\alpha_s}}{1-\tau_{Ysi}} \quad (9)$$

By using simple algebra, the industry TFP can then be expressed as:

$$TFP_s = \left[\sum_{i=1}^{M_s}\left(A_{si}\cdot\frac{\overline{TFPR}_s}{TFPR_{si}}\right)^{\sigma-1}\right]^{\frac{1}{\sigma-1}}, \quad (10)$$

where $\overline{TFPR}_s$ is the weighted average of $TFPR_{si}$ across all firms in the industry. It can be seen from (10) that, given the firm-specific physical productivities (A_{si}), the industry TFP would be maximized if all firms in the industry had identical TFPR, i.e., if there were no dispersion in firm-level revenue productivities. Any heterogeneity in TFPR across firms, as can be seen from (9), is driven by differences in capital and output distortions faced by individual firms.[3]

Thus, the dispersion of marginal revenue products of capital and labor can serve as a measure of input misallocation, which in turn is one of the main determinants of aggregate TFP. Then, our hypothesis about the impact of aggregate debt on capital misallocation would be justified if an increase in debt interacts with financial market frictions (e.g., differences in possession of real estate assets or access to credit) in affecting the dispersion of the marginal revenue product of capital across firms.

[2] This is the productivity that we observe in the data—and not the physical productivity—as we do not observe the prices of individual firms.

[3] An important concern here is that, as shown by Haltiwanger et al. (2018), a significant part of the variation in TFPR may reflect the influence of demand shifts rather than true distortions. In order to account for this issue, we control for sectoral demand proxied by sectoral average real turnover as in Gamberoni et al. (2016).

3. Empirical methodology

3.1. The data

For our measure of capital misallocation we employ the 6th Vintage of the Competitiveness Research Network (CompNet) database, which is compiled by a number of institutions, including inter alia the European Central Bank, the European Bank for Reconstruction and Development, the Halle Institute for Economic Research, and the Tinbergen Institute. CompNet offers a micro-based dataset with a wide range of indicators constructed on firm-level information as described in Lopez-Garcia et al. (2015). The 6th Vintage of CompNet dataset represents an annual unbalanced panel covering 18 EU countries[4] for the period 1999-2015, although actual data availability reduces this time span to 2003-2015 for the majority of these countries. Indicators in the dataset were collected considering two different samples of firms: those with at least one employee (the "full" sample) and those with at least 20 employees (the "20E" sample). In our analysis we use the 20E sample, since it is far more homogenous and comparable across countries than the full sample due to the exclusion rules in some countries such as Poland and Slovakia, where only firms with more than 10 employees and 20 employees, respectively, have to report their accountings. The dataset reports indicators aggregated to macro-sector (1-digit sectors corresponding to NACE Rev.2 sections) and sector (2-digit NACE Rev.2 sectors) levels. For each indicator in the 20E sample, firms are weighted according to their relative presence in the sample, so they are representative of the population of firms in terms of sectoral distribution. We use the macro-sector level data that include nine sectors of the economy at the one-digit industry level: manufacturing, construction, and seven service sectors (wholesale and retail trade; information and communication; transportation and storage; accommodation and food services; professional, scientific and technical services; administrative and support services; real estate services).[5]

The data on private debt and public debt come from the International Monetary Fund's Global Debt Database. Private debt comprises the total stock of loans and debt securities issued by households and nonfinancial corporations (as a share of GDP), and public debt consists of the total stock of debt liabilities issued by the general government (as a share of GDP). We use control variables such as Chinn and Ito (2006) capital account openness index, long-term interest rates[6] (OECD), general government final consumption expenditure (World Bank), taxes on income, profits and capital gains (ICTD Government Revenue Dataset[7]), trade (sum of exports and imports as % of GDP, World Bank), sectoral average real turnover (CompNet), and an index of institutional quality measured as the sum of political risk rating

[4] The countries are: Belgium, Croatia, Czech Republic, Denmark, Finland, France, Germany, Hungary, Italy, Lithuania, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, and Sweden.

[5] The reader must be aware that data collection rules and procedures across countries are different, and out of CompNet's control. Hence, despite all efforts made to improve sample comparability across countries (including the use of population weights), some country samples might still suffer from biases. For a more detailed account of raw data characteristics and sample biases, please refer to the Cross-Country Comparability Report available at https://www.comp-net.org/data/.

[6] The data on long-term interest rates are not available for Croatia and Romania.

[7] ICTD/UNU-WIDER, 'Government Revenue Dataset', 2018, https://www.wider.unu.edu/project/government-revenue-dataset.

indicators such as bureaucracy quality, investment profile, rule of law, and control of corruption (ICRG Researchers Dataset[8]).[9] The choice of our control variables as possible determinants of capital misallocation is based on different studies including Larrain and Stumpner (2017), Gopinath et al. (2017), Monacelli and Sala (2018), Ramey and Shapiro (1998), McNabb (2018), Edmond et al. (2015), Bai et al. (2019), Gamberoni et al. (2016), Durnev (2010), and Hassan et al. (2019). Our explanatory variables are constructed as an interaction term between a time-varying country-level component and a time-invariant sectoral-level component (except for the average real turnover, which is available at the sectoral level from CompNet database). As sector-specific interacting variables we use: (i) an indicator of external finance dependence as in Rajan and Zingales (1998)—based on Compustat data on U.S. listed firms—obtained from Franco (2018); (ii) an indicator of credit constraints (ICC) available from CompNet database (i.e., share of credit constrained firms based on the methodology used in the Survey on Access to Finance of Enterprises, SAFE)[10]; (iii) an indicator of sectoral technological intensity obtained from Eurostat (namely, Eurostat indicators on high-tech industry and knowledge-intensive services)[11].

3.2. Empirical measurement of capital misallocation

CompNet database provides several different measures of sectoral allocative efficiency and input misallocation.[12] As mentioned earlier, we take the Hsieh and Klenow (2009) approach to defining the misallocation of capital as the dispersion of its marginal revenue products. Here we briefly discuss the measurement of this misallocation as explained in the CompNet User Guide.

Taking Eq. (2) in logs gives the empirical version of the firm-level (time-varying) production function:

$$rva_{it} = \theta^k k_{it} + \theta^l l_{it} + a_{it} + \varepsilon_{it}, \qquad (11)$$

where rva_{it} is real value added, k_{it} is the real book value of net capital, l_{it} is total employment, a_{it} is the (Hicks-neutral) TFP indicator, and ε_{it} is an i.i.d. error term. θ^k and θ^l denote the output elasticity of capital and labor, respectively. To control for potential endogeneity issues arising from the firm-observed productivity component, a control function approach as in Olley and Pakes (1996) and Levinsohn and Petrin (2003) is applied. Assuming that TFP evolves according to a Markov process and using the control function for productivity, Eq. (11) can be rewritten as:

---

[8] PRS Group, 'International Country Risk Guide (ICRG) Researchers Dataset', 2018, https://hdl.handle.net/10864/10120.

[9] The variables such as government consumption, taxes on income, profits and capital gains, and trade are in percent of GDP.

[10] We take the average of the indicator for every country-sector over the entire period of available data to make it time-invariant. Note that these data are not available for Hungary and Slovakia.

[11] Calligaris et al. (2018) show that an increase in misallocation is positively correlated to R&D intensity at the sector level, and argue that relative specialization in sectors where technology has been changing faster helps to explain the patterns of misallocation across geographical areas and firm size classes. Cecchetti and Kharroubi (2018) also find negative effects of credit growth on TFP growth in sectors with high R&D intensity.

[12] For details, see CompNet User Guide and Cross-Country Report available at https://www.comp-net.org/data/.

$$rva_{it} = \theta^k k_{it} + \theta^l l_{it} + g_{it-1}(k_{it-1}, l_{it-1}) + \nu_{it} + \varepsilon_{it}, \quad (12)$$

where ν_{it} denotes the innovation in productivity (TFP). The term $g_{it-1}(k_{it-1}, l_{it-1})$ is approximated with a third-order polynomial in all of its variables. Eq. (12) is estimated via GMM following Wooldridge (2009), using lagged values of labor as instruments for its contemporaneous values (since labor and TFP are simultaneously determined, while capital takes time to build), and controlling for a full set of time dummies. In order to obtain consistent estimates with sufficient degrees of freedom, a cut-off of a minimum of 100 observations per sector and year is introduced.

Having estimated the capital output elasticity, θ^k, from the production function, marginal revenue product of capital is computed as:

$$MRPK_{it} = \frac{\theta^k rva_{it}}{k_{it}} \quad (13)$$

The above estimate is then used to calculate the measure of within-sector time-series dispersion of the marginal productivity of capital for each 2-digit industry. In order to control for potential bias driven by sector-specific price dynamics or technology improvements, the marginal productivity of capital at the firm level is detrended and rescaled by the sectoral standard deviation (at the 2-digit level).[13] Then, the macro-sector level of capital misallocation is computed as the median standard deviation of the resulting series across all 2-digit industries in the 1-digit sector. Hence, our measure of capital misallocation for each macro sector can be formulated as:

$$Capital\_Misallocation_t \equiv Median_t \left[STDEV_{st} \left(\frac{MRPK_{sit} - \overline{MRPK_s}}{\sigma_s} \right) \right] \quad (14)$$

where $MRPK_{sit}$ denotes the deviation of $MRPK_{it}$ around the 2-digit industry's long-run growth trend, $\overline{MRPK_s}$ stands for the long-run average level of $MRPK_{sit}$, and σ_s denotes the long-run standard deviation of $MRPK_{sit}$.

3.3. The empirical model

In order to study the effects of private and public debt on capital misallocation, we employ an empirical methodology whereby we interact the aggregate debt-to-GDP ratio variables with different sector-specific[14] indicators in a manner somewhat similar to Rajan and Zingales (1998) and Larrain and Stumpner (2017). The general form of our empirical model looks as follows:

[13] This measure was proposed by Kehrig (2015), and it also accounts for Asker et al.'s (2014) critique that cross-industry variability in MRPK could be (partly) due to "uncertainty" and associated adjustment costs faced by different industries.

[14] Henceforth, we will be referring to the 1-digit NACE Rev.2 sectors whenever we use the terms "sector" or "industry", unless specified otherwise.

$$Capital\_Misallocation_{cjt} = \\ = \beta_0 + \beta_1\left(\ln[PrivateDebt]_{ct-1} \times Z_j\right) + \beta_2\left(\ln[PublicDebt]_{ct-1} \times Z_j\right) \\ + \gamma\left(X_{ct} \times Z_j\right) + \varepsilon_{cjt}$$

where $Capital\_Misallocation_{cjt}$ denotes the level of capital misallocation for macro sector j in country c, X_{ct} is a vector of time-varying country-level controls, and Z_j is a sector-specific (time-invariant) interacting variable.

We estimate our empirical model using the fixed-effects (within) regression, since our explanatory variables of interest may be correlated with country and sector-specific unobserved factors. We cluster standard errors at the country level. Additionally, we use heteroscedasticity- and autocorrelation-consistent (HAC) standard errors as per Driscoll and Kraay (1998). For robustness, we test our model using the generalized method of moments (GMM) estimation as proposed by Arellano and Bover (1995) and Blundell and Bond (1998).

4. Results

4.1. Baseline regressions

In this section we discuss the results of our panel regressions. As explanatory variables, we use the natural logarithms of private debt, public debt, government consumption, taxes on income, profits and capital gains, trade, and sectoral average real turnover across firms; we also control for the long-term interest rate and the indices for capital account openness[15] and the quality of political institutions. We use the *lagged* values of the (logs of) private and public debt in order to account for potential endogeneity concerns, and also the lagged value of the capital account openness index—as in Larrain and Stumpner (2017)—since it is unlikely to have an immediate effect on capital misallocation.

Table 1 reports the results of fixed effects regressions where the explanatory variables are interacted with the sectoral-level indicator of external finance dependence. The results strongly suggest that an increase in private debt exacerbates capital misallocation and more so in sectors with higher financial dependence. In other words, those sectors that depend more on external finance—and are hence more likely to benefit from higher credit availability—experience a larger increase in dispersion of marginal revenue products of capital following a rise in private sector indebtedness. Public debt, on the other hand, does not seem to affect capital misallocation after controlling for other potential determinants. The effect of capital account openness is found to be negative, meaning that financial liberalization reduces capital misallocation, supporting the findings of Larrain and Stumpner (2017). The coefficient on the long-term interest rate also has a negative sign, suggesting that declining interest rates tend to increase the dispersion of returns to capital—a finding that is supported by some recent studies including Cette et al. (2016), Gopinath et al. (2017), and Caggese and

[15] This index is normalized to take values between 0 and 1.

Pérez-Orive (2019). We do not find any significant effect on capital misallocation of other control variables.

Table 2 reports the regression estimates where we interact the explanatory variables with the indicator of average credit constraints. The estimates of the coefficients of private debt are similar in sign to those in Table 1: in sectors with a higher share of credit constrained firms, a rise in private debt increases capital misallocation significantly more as compared to sectors with a lower share of credit constrained firms. Although the coefficient of public debt is significantly positive in several columns that exclude most of the controls, it loses any significance when all controls are included. The long-term interest rate is found to improve capital allocation, as in Table 1, when we use the Driscoll-Kraay standard errors.

Table 3 shows the results of regressions where the explanatory variables are interacted with sectoral R&D intensity. The strong amplification effect of private debt is again confirmed: a rise in private debt increases capital misallocation particularly in sectors that are more technologically intensive. A potential explanation for this is that R&D-intensive sectors are more likely to be credit constrained due to higher informational asymmetries, lower collateral value of firms (because of the higher usage of intangible assets such as human capital and specialized machinery), and highly uncertain and skewed investment returns (Carpenter and Petersen, 2002; Fauceglia, 2015). Public debt, again, does not seem to have any significant capital misallocation effect. While we find the sign of the effect of financial openness to be similar to that in Table 1, meaning that capital account liberalization improves capital allocation (more in highly R&D-intensive sectors), we fail to find any significant effect of interest rates in the current estimation.

We also regress capital misallocation on the two components of private debt separately: non-financial corporations' debt and household debt. The results are given in Table 4. In these regressions, we omit public debt since we find that (i) its effect is insignificant anyway and (ii) it does not add noticeably to the explanatory power of the regression model. We can see from the table that both corporate debt and household debt have significant amplifying effects on capital misallocation, but the effect of corporate debt is much larger than—almost three times as large as—that of household debt. This is both an intuitive and important finding, since (i) capital misallocation is mainly the problem of the corporate sector, and (ii) this suggests that excessive corporate debt could be an important factor in reallocating resources toward unproductive firms, hence negatively affecting countries' TFP and long-run growth, as opposed to medium-run (negative) growth effects of household debt (Mian et al., 2017).

4.2. Robustness tests

As a robustness check of our baseline specification, we estimate our regression model using the system GMM procedure as proposed by Blundell and Bond (1998)—though without the autoregressive term[16]—by instrumenting the explanatory variables with their lags as

[16] Since our baseline specification is static and assumes no autocorrelation in the error term, we do not include the lagged dependent variable in our GMM regressions. The results of the Arellano-Bond tests for AR(1) and AR(2) in first differences (given in Table B1) indeed imply no serial autocorrelation in the error terms.

described in Holtz-Eakin et al. (1988). In order to avoid the overfitting of endogenous variables and the associated bias caused by too many instruments, we collapse the instrument matrix as recommended by Roodman (2009). Since our data are unbalanced and include gaps, instead of first differencing, we employ the forward orthogonal deviations to transform our variables as proposed by Arellano and Bover (1995). Standard errors are clustered at the country level.

Table B1 in the Appendix reports the one-step system GMM estimates using two different instrument sets: all the lags of the explanatory variables dated $t-2$ and earlier, and those dated from $t-2$ to $t-10$. The results strongly support our earlier finding that private debt accumulation increases capital misallocation given our sectoral-level indicators such as financial dependence, average credit constraints, and R&D intensity, albeit the coefficients are not significant at the 1% level in the case of the interaction with average credit constraints. Public debt, on the other hand, is found to have a somewhat negative effect on capital misallocation when our explanatory variables are interacted with financial dependence and technological intensity. We can see that the coefficients on private debt estimated with the GMM are smaller in magnitude than those estimated with the fixed effects estimator when the explanatory variables are interacted with the indicators of financial dependence and credit constraints, while the GMM-estimated coefficients are larger in magnitude when our explanatory variables are interacted with the indicator of technological intensity. All of the private debt coefficients estimated with the GMM, however, lie within the 95% confidence interval of those estimated with the fixed effects estimator. As before, we find negative coefficients for capital account openness and the long-term interest rate (where the coefficients on capital account openness are statistically significant only when we use financial dependence and technological intensity as interacting variables), suggesting that financial openness and higher interest rates tend to improve capital allocation. Moreover, demand conditions (proxied by average real turnover) are found to be positively correlated with capital misallocation in some of the regressions, while the quality of political institutions seems to reduce capital misallocation in all the interactions.

In Table B2 in the Appendix, we present the results of the robustness checks—using both the fixed effects and the GMM estimators—where we exclude four countries: Croatia and Romania due to the lack of data on the long-term interest rate, and Germany and Spain due to the small number of observations for the MRPK dispersion (Germany has 16 observations due to the data availability for the manufacturing sector only, and Spain has 56 observations since the data are available only starting from 2009). In addition, the data on credit constraints are not available for Hungary and Slovak Republic for the regressions using the indicator of credit constraints as an interacting (sectoral-level) variable. The results in Table B2 show that our findings regarding the effect of private debt are robust to excluding certain countries from regressions.

In Table B3 in the Appendix, we use alternative sectoral-level indicators for interaction with our country-level explanatory variables. All of these indicators are available from CompNet database at the sectoral level; we average them over the available time period for each country-sector. In columns (1)-(3), we use the industry standard deviation of credit

constraints (instead of the industry mean as we did earlier) to interact with our country-level variables. Here, we hypothesize that private debt may disproportionately increase capital misallocation in sectors with more heterogeneous credit constraints. In columns (4)-(9), we use as our interacting variable two different measures of sectoral competitive structure: average markups (calculated as per De Loecker and Warzynski, 2012) and the skewness of sectoral TFP distribution.[17] Our conjecture here is that market imperfections such as the lack of competition could be the source of capital misallocation, whereby private debt may exacerbate this misallocation particularly in sectors with a low level of competition (or a high level of concentration). The results in Table B3 strongly support our hypotheses that private debt disproportionately increases capital misallocation in sectors with more heterogeneous credit constraints, higher average markups, and more skewed TFP distribution. Public debt is found to have no significant effect except in one regression, column (5), where it is found to increase capital misallocation when the Driscoll-Kraay standard errors are used. Capital account liberalization is found to have a significantly negative effect on capital misallocation when interacted with the skewness of TFP distribution, and the interest rate is found to have a negative significant effect when interacted with the dispersion of credit constraints.

Overall, our results suggest that excessive private debt accumulation is much more detrimental to the efficiency of capital allocation across firms than public debt, while the latter has no robust capital misallocation effect in our sample of European countries. We find that a rise in private debt disproportionately increases the dispersion of returns to capital in sectors that are, on average, more dependent on external finance, more credit constrained, more technologically intensive, and less competitive. This confirms our intuition that continuous debt build-up in the private sector exacerbates capital misallocation by feeding on financial frictions, market imperfections and existing differences across firms. Our finding that higher long-term interest rates may sometimes reduce capital misallocation—particularly in sectors with higher financial dependence and credit constraints—strengthens this case because excessive debt accumulation goes hand in hand with low interest rates. To a certain extent, we also confirm the earlier finding of Larrain and Stumpner that capital account liberalization improves capital allocation, probably because this allows financially constrained firms to access foreign capital markets, including foreign equity capital. An important message of this paper, however, is that private debt has turned out to be the most significant and robust determinant of capital misallocation among all its potential macroeconomic determinants that we have used as explanatory variables in our panel regressions. Thus we believe that this fact needs further and deeper exploration, since it pertains to real economic effects of the financial sector that has the potential to destabilize entire economies.

Although the aggregate productivity effects of private debt accumulation is beyond the scope of this paper, we take seriously Aghion et al. (2019), who find a two-sided effect of credit access on productivity growth resulting in an inverted-U relationship. Thus we conjecture that private debt may increase aggregate TFP at low levels of debt-to-GDP ratio by enabling firms to invest in new technologies, while high levels of private debt may reduce

[17] Dias et al. (2019) suggest the skewness of an industry TFP distribution as an inverse measure of the sectoral competitive structure.

aggregate TFP growth due to its capital misallocation effect dominating the investment effect. Testing this conjecture, however, is left for future research.

5. Conclusion

The past two decades of research in international macroeconomics has seen a number of studies finding nonlinear effects of private and public debt on economic growth. In addition, findings of some very recent studies have suggested that there might be an inverted-U relationship between debt accumulation and aggregate productivity growth. At the same time, another active strand of research has shown that misallocation of capital and labor across firms is responsible for a significant part of the differences in total factor productivity across countries. These developments have led us to ask the question about the possible role of debt build-up in generating these productivity differences.

In this paper, we aim to find out whether increases in private and public indebtedness affect capital misallocation, which is measured as the dispersion in the return to capital across firms in different industries. For this, we use a novel dataset containing industry-level data for 18 European countries and control for different macroeconomic indicators as potential determinants of capital misallocation. We exploit the within-country variation across industries in such indicators as external finance dependence, credit constraints, technological intensity, and the degree of competition. Our results show that private debt accumulation significantly increases capital misallocation, particularly in industries with high financial dependence, high R&D intensity, a larger share of credit-constrained firms and a lower level of competition among firms. In other words, private debt accumulation seems to act as a factor amplifying the negative impact of financial frictions and market imperfections on macroeconomic outcomes. When considering the two components of private debt, we find that corporate debt has a much larger amplifying effect on capital misallocation as compared to household debt, although the coefficients of both corporate debt and household debt are significant. On the other hand, we fail to find any significant and robust effect of public debt on capital misallocation within industries in our sample.

One of the extensions of our empirical analysis in this paper would be to develop a theoretical model that accounts for the observed amplification effect of private debt on capital misallocation. Another extension would be to quantitatively analyze the implications of the misallocation-aggravating effects of private debt accumulation for the long-run aggregate productivity growth. A further extension still would be to test the relationship between private and public debt and misallocation for a wide range of developing countries, since the structural differences between advanced and developing economies might give rise to a different finance-productivity nexus. We leave these and other extensions of our analysis for future research.

Table 1. Debt to GDP ratios and capital misallocation: fixed effects regressions (interaction with financial dependence)

Dependent variable: *Capital misallocation*	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
$\ln(Private\ Debt) \times Fin.\ Dep.$ (lagged)	0.739*** (0.232)	0.901*** (0.229)	0.856*** (0.211)	0.747*** (0.206)	0.731*** (0.246)	0.608** (0.243)	0.787*** (0.220)	0.668** (0.295)	0.994*** (0.173)	0.994*** (0.262)
$\ln(Public\ Debt) \times Fin.\ Dep.$ (lagged)	0.391** (0.171)	0.294 (0.185)	0.327 (0.250)	0.385** (0.169)	0.285 (0.212)	0.300 (0.189)	0.360* (0.180)	0.303* (0.172)	0.017 (0.306)	0.017 (0.256)
$Capital\ Acc.\ Openness \times Fin.\ Dep.$ (lagged)		-0.878** (0.380)							-1.104** (0.474)	-1.104*** (0.316)
$LT\ Interest\ Rate \times Fin.\ Dep.$			-0.038 (0.026)						-0.054** (0.023)	-0.054*** (0.017)
$\ln(Govt.\ Consump.) \times Fin.\ Dep.$				-0.130 (0.732)					0.076 (0.962)	0.076 (1.177)
$\ln(Taxes\ on\ IPC) \times Fin.\ Dep.$					-0.273 (0.490)				-0.026 (0.386)	-0.026 (0.356)
$\ln(Trade) \times Fin.\ Dep.$						0.573 (0.375)			-0.141 (0.686)	-0.141 (0.587)
$\ln(Avg.\ Real\ Turnover)$							0.158* (0.080)		0.068 (0.088)	0.068 (0.110)
$Institut.\ Quality \times Fin.\ Dep.$								-0.031 (0.053)	-0.034 (0.052)	-0.034 (0.041)
Constant	-1.515*** (0.435)	-1.350*** (0.421)	-1.582*** (0.424)	-1.356 (1.196)	-1.072 (0.901)	-2.209*** (0.584)	-3.000*** (0.796)	-0.946 (1.076)	-1.009 (2.581)	-1.009 (2.684)
Standard errors	Clustered (country)	Clustered (country)	Clustered (country)	Clustered (country)	Clustered (country)	Clustered (country)	Clustered (country)	Clustered (country)	Clustered (country)	HAC (Driscoll-Kraay)
Observations	1,806	1,806	1,600	1,806	1,782	1,806	1,786	1,806	1,596	1,596
R-squared	0.172	0.176	0.190	0.172	0.180	0.173	0.174	0.172	0.196	0.196

Standard errors in parentheses. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

Table 2. Debt to GDP ratios and capital misallocation: fixed effects regressions (interaction with average credit constraints)

Dependent variable: *Capital misallocation*	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
$\ln(Private\ Debt) \times Cred.Constr.$ (lagged)	3.364*** (0.709)	3.310*** (0.733)	3.901*** (0.687)	3.405*** (0.705)	3.478*** (0.709)	2.625*** (0.780)	3.281*** (0.735)	3.428*** (0.674)	3.431*** (1.010)	3.431*** (1.054)
$\ln(Public\ Debt) \times Cred.Constr.$ (lagged)	1.386*** (0.368)	1.148* (0.611)	0.814 (0.465)	1.343*** (0.354)	1.316** (0.515)	0.685 (0.533)	1.430*** (0.375)	1.477** (0.666)	0.472 (1.982)	0.472 (1.030)
$Capital\ Acc.Openness \times Cred.Constr.$ (lagged)		-1.830 (1.822)							-2.010 (5.965)	-2.010 (2.923)
$LT\ Interest\ Rate \times Cred.Constr.$			-0.220** (0.086)						-0.190 (0.116)	-0.190** (0.067)
$\ln(Govt.Consump.) \times Cred.Constr.$				-0.800 (1.901)					1.296 (2.981)	1.296 (3.773)
$\ln(Taxes\ on\ IPC) \times Cred.Constr.$					0.232 (1.183)				0.815 (1.319)	0.815 (0.980)
$\ln(Trade) \times Cred.Constr.$						3.346* (1.850)			1.455 (2.418)	1.455 (1.844)
$\ln(Avg.Real\ Turnover)$							0.153 (0.088)		0.071 (0.097)	0.071 (0.134)
$Institut.Quality \times Cred.Constr.$								0.029 (0.133)	0.004 (0.230)	0.004 (0.135)
Constant	-1.995*** (0.354)	-1.648** (0.618)	-2.010*** (0.347)	-1.709* (0.814)	-2.089*** (0.663)	-3.041*** (0.688)	-3.368*** (0.837)	-2.149** (0.739)	-3.538 (2.981)	-3.538 (2.034)
Standard errors	Clustered (country)	Clustered (country)	Clustered (country)	Clustered (country)	Clustered (country)	Clustered (country)	Clustered (country)	Clustered (country)	Clustered (country)	HAC (Driscoll-Kraay)
Observations	1,482	1,482	1,326	1,482	1,473	1,482	1,473	1,482	1,322	1,322
R-squared	0.178	0.179	0.197	0.179	0.178	0.181	0.181	0.179	0.197	0.197

Standard errors in parentheses. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

Table 3. Debt to GDP ratios and capital misallocation: fixed effects regressions (interaction with technological intensity)

Dependent variable: *Capital misallocation*	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
$\ln(Private\ Debt) \times Tech.\ Intensity$ (lagged)	0.566**	0.639**	0.711***	0.587***	0.533**	0.360**	0.625***	0.553**	0.588**	0.588***
	(0.204)	(0.245)	(0.181)	(0.194)	(0.202)	(0.171)	(0.197)	(0.213)	(0.232)	(0.179)
$\ln(Public\ Debt) \times Tech.\ Intensity$ (lagged)	0.354*	0.311	0.251	0.339*	0.177	0.213	0.328*	0.339	0.094	0.094
	(0.192)	(0.218)	(0.208)	(0.183)	(0.191)	(0.210)	(0.184)	(0.228)	(0.310)	(0.166)
$Capital\ Acc.\ Openness \times Tech.\ Intensity$ (lagged)		-0.390							-0.555*	-0.555***
		(0.247)							(0.307)	(0.172)
$LT\ Interest\ Rate \times Tech.\ Intensity$			-0.025						-0.020	-0.020
			(0.018)						(0.019)	(0.025)
$\ln(Govt.\ Consump.) \times Tech.\ Intensity$				-0.347					0.621	0.621
				(0.526)					(0.518)	(0.731)
$\ln(Taxes\ on\ IPC) \times Tech.\ Intensity$					-0.465				-0.126	-0.126
					(0.343)				(0.287)	(0.272)
$\ln(Trade) \times Tech.\ Intensity$						0.891*			0.734	0.734
						(0.424)			(0.659)	(0.437)
$\ln(Avg.\ Real\ Turnover)$							0.176*		0.106	0.106
							(0.092)		(0.094)	(0.102)
$Institut.\ Quality \times Tech.\ Intensity$								-0.005	0.012	0.012
								(0.038)	(0.037)	(0.014)
Constant	-0.822***	-0.762**	-0.884***	-0.471	-0.167	-1.716***	-2.486***	-0.740	-3.099**	-3.099***
	(0.278)	(0.289)	(0.245)	(0.709)	(0.605)	(0.476)	(0.801)	(0.634)	(1.208)	(0.876)
Standard errors	Clustered (country)	Clustered (country)	Clustered (country)	Clustered (country)	Clustered (country)	Clustered (country)	Clustered (country)	Clustered (country)	Clustered (country)	HAC (Driscoll-Kraay)
Observations	1,806	1,806	1,600	1,806	1,782	1,806	1,786	1,806	1,596	1,596
R-squared	0.164	0.165	0.178	0.164	0.171	0.167	0.166	0.164	0.182	0.182

Standard errors in parentheses. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

Table 4. Private debt to GDP ratios and capital misallocation: fixed effects regressions

Interacting variable	Financial Dependence		Financial Dependence		Avg. Credit Constraints		Avg. Credit Constraints		Technological Intensity		Technological Intensity	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
$\ln(Corporate\ Debt) \times Interaction$ (lagged)	0.996***	0.996***			3.347***	3.347**			0.597**	0.597***		
	(0.275)	(0.295)			(1.012)	(1.320)			(0.228)	(0.195)		
$\ln(Household\ Debt) \times Interaction$ (lagged)			0.359***	0.359**			1.159**	1.159**			0.191**	0.191**
			(0.090)	(0.163)			(0.453)	(0.481)			(0.089)	(0.084)
$Capit.\ Acc.\ Openness \times Interaction$ (lagged)	-0.852**	-0.852***	-1.213*	-1.213***	-2.695	-2.695	-1.297	-1.297	-0.465**	-0.465***	-0.646*	-0.646***
	(0.358)	(0.183)	(0.604)	(0.360)	(3.800)	(2.520)	(3.457)	(2.259)	(0.178)	(0.117)	(0.339)	(0.165)
$LT\ Interest\ Rate \times Interaction$	-0.052**	-0.052**	-0.048*	-0.048**	-0.198*	-0.198**	-0.181*	-0.181**	-0.021	-0.021	-0.019	-0.019
	(0.020)	(0.019)	(0.023)	(0.018)	(0.093)	(0.081)	(0.097)	(0.083)	(0.020)	(0.028)	(0.020)	(0.028)
$\ln(Govt.\ Consump.) \times Interaction$	0.139	0.139	0.884	0.884	0.922	0.922	3.915	3.915	0.624	0.624	1.094**	1.094*
	(0.925)	(1.158)	(1.041)	(1.035)	(2.551)	(3.769)	(3.075)	(3.224)	(0.536)	(0.732)	(0.492)	(0.617)
$\ln(Taxes\ on\ IPC) \times Interaction$	-0.261	-0.261	-0.067	-0.067	-0.072	-0.072	0.251	0.251	-0.298	-0.298	-0.207	-0.207
	(0.391)	(0.261)	(0.426)	(0.372)	(1.929)	(0.998)	(1.430)	(1.191)	(0.247)	(0.199)	(0.279)	(0.183)
$\ln(Trade) \times Interaction$	0.261	0.261	0.008	0.008	2.554	2.554	2.400	2.400	0.961	0.961**	0.879	0.879**
	(0.641)	(0.613)	(0.644)	(0.565)	(2.366)	(1.897)	(2.642)	(1.919)	(0.579)	(0.378)	(0.658)	(0.387)
$\ln(Avg.\ Real\ Turnover)$	0.063	0.063	0.068	0.068	0.077	0.077	0.070	0.070	0.104	0.104	0.095	0.095
	(0.088)	(0.112)	(0.086)	(0.116)	(0.095)	(0.133)	(0.097)	(0.134)	(0.094)	(0.103)	(0.096)	(0.102)
$Institut.\ Quality \times Interaction$	-0.027	-0.027	-0.059	-0.059**	-0.019	-0.019	-0.108	-0.108	0.009	0.009	-0.010	-0.010
	(0.055)	(0.020)	(0.054)	(0.025)	(0.122)	(0.097)	(0.136)	(0.073)	(0.039)	(0.011)	(0.040)	(0.016)
Constant	-1.545	-1.545	-0.560	-0.560	-3.190*	-3.190*	-2.921	-2.921	-3.101**	-3.101***	-2.602	-2.602***
	(2.561)	(1.941)	(2.726)	(2.102)	(1.692)	(1.959)	(2.156)	(2.011)	(1.328)	(0.749)	(1.571)	(0.892)
Standard errors	Clustered (country)	Driscoll-Kraay	Clustered (country)	Driscoll-Kraay	Clustered (country)	Driscoll-Kraay	Clustered (country)	Driscoll-Kraay	Clustered (country)	Driscoll-Kraay	Clustered (country)	Driscoll-Kraay
Observations	1,596	1,596	1,596	1,596	1,322	1,322	1,322	1,322	1,596	1,596	1,596	1,596
R-squared	0.194	0.194	0.192	0.192	0.194	0.194	0.194	0.194	0.182	0.182	0.181	0.181

Standard errors in parentheses. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

References

Aghion, P., A. Bergeaud, G. Cette, R. Lecat and H. Maghin (2019), *Coase Lecture – The Inverted-U Relationship Between Credit Access and Productivity Growth*, Economica, Vol. 86(341), 1-31.

Anderson, G. and M. Raissi (2018), *Corporate Indebtedness and Low Productivity Growth of Italian Firms*, IMF Working Papers 18/33.

Arcand, J.L., E. Berkes and U. Panizza (2015), *Too Much Finance?* Journal of Economic Growth, Vol. 20(2), 105-148.

Arellano, M. and O. Bover (1995), *Another Look at the Instrumental Variable Estimation of Error-Components Models*, Journal of Econometrics, Vol. 68(1), 29-51.

Asker, J., A. Collard-Wexler and J. De Loecker (2014), *Dynamic Inputs and Resource (Mis)Allocation*, Journal of Political Economy, Vol. 122(5), 1013-1063.

Bai, Y., K. Jin and D. Lu (2019), *Misallocation Under Trade Liberalization*, Mimeo.

Basco, S., D. Lopez-Rodriguez and E. Moral-Benito (2018), *Housing Bubbles and Misallocation: Evidence from Spain*, Mimeo.

Baum, A., C. Checherita-Westphal and P. Rother (2013), *Debt and Growth: New Evidence for the Euro Area*, Journal of International Money and Finance, Vol. 32(C), 809-821.

Beck, T., R. Levine and N. Loayza (2000), *Finance and the Sources of Growth*, Journal of Financial Economics, Vol. 58(1-2), 261-300.

Blundell, R. and S. Bond (1998), *Initial Conditions and Moment Restrictions in Dynamic Panel Data Models*, Journal of Econometrics, Vol. 87(1), 115-143.

Borio, C., E. Kharroubi, C. Upper and F. Zampolli (2015), *Labour Reallocation and Productivity Dynamics: Financial Causes, Real Consequences*, BIS Working Papers 534.

Buera, F.J., J.P. Kaboski and Y. Shin (2011), *Finance and Development: A Tale of Two Sectors*, American Economic Review, Vol. 101(5), 1964-2002.

Caggese, A. and A. Pérez-Orive (2019), *Capital Misallocation and Secular Stagnation*, Barcelona GSE Working Papers 1056.

Calligaris, S., M. Del Gatto, F. Hassan, G.I. Ottaviano and F. Schivardi (2018), *The Productivity Puzzle and Misallocation: an Italian Perspective*, Economic Policy, Vol. 33(96), 635-684.

Caner, M., Q. Fan and T. Grennes (2019), *Partners in Debt: An Endogenous Nonlinear Analysis of the Effects of Public and Private Debt on Growth*, SSRN Electronic Journal, Available at https://ssrn.com/abstract=3186077.

Carpenter, R. and B. Petersen (2002), *Capital Market Imperfections, High-Tech Investment, and New Equity Financing*, The Economic Journal, Vol. 112(477), F54-F72.

Caselli, F. (2005), *Accounting for Cross-Country Income Differences*, In: P. Aghion and S. Durlauf (Eds.), Handbook of Economic Growth, Vol. I, 679–741.

Cecchetti, S.G., E. Kharroubi (2018), *Why Does Credit Growth Crowd Out Real Economic Growth?* NBER Working Papers 25079.

Cecchetti, S.G., M.S. Mohanty and F. 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.

Cette, G., J. Fernald and B. Mojon (2016), *The Pre-Great Recession Slowdown in Productivity*, European Economic Review, Vol. 88(C), 3-20.

Checherita-Westphal, C. and P. Rother (2012), *The Impact of High Government Debt on Economic Growth and Its Channels: An Empirical Investigation for the Euro Area*, European Economic Review, Vol. 56(7), 1392-1405.

Chinn, M.D. and H. Ito (2006), *What Matters for Financial Development? Capital Controls, Institutions, and Interactions*, Journal of Development Economics, Vol. 81(1), 163-192.

Chudik, A., K. Mohaddes, M.H. Pesaran and M. Raissi (2017), *Is There a Debt-Threshold Effect on Output Growth?* The Review of Economics and Statistics, Vol. 99(1), 135-150.

De Loecker, J. and F. Warzynski (2012), *Markups and Firm-Level Export Status*, American Economic Review, Vol. 102(6), 2437-2471.

Dias, D.A., C.R. Marques and C. Richmond (2019), *A Tale of Two Sectors: Why is Misallocation Higher in Services than in Manufacturing?* The Review of Income and Wealth, Forthcoming.

Doerr, S. (2018), *Collateral, Reallocation, and Aggregate Productivity: Evidence from the U.S. Housing Boom*, SSRN Electronic Journal, Available at https://ssrn.com/abstract=3184162.

Driscoll, J.C. and A.C. Kraay (1998), *Consistent Covariance Matrix Estimation with Spatially Dependent Panel Data*, The Review of Economics and Statistics, Vol. 80(4), 549-560.

Durnev, A. (2010), *The Real Effects of Political Uncertainty: Elections and Investment Sensitivity to Stock Prices*, SSRN Electronic Journal, Available at https://ssrn.com/abstract=1549714.

Edmond, C., V. Midrigan and D.Y. Xu (2015), *Competition, Markups, and the Gains from International Trade*, American Economic Review, Vol. 105(10), 3183–3221.

Fauceglia, D. (2015), *Credit Constraints, Firm Exports and Financial Development: Evidence from Developing Countries*, The Quarterly Review of Economics and Finance, Vol. 55(C), 53-66.

Franco, G. (2018), *Misallocation and the Credit Cycle: Evidence from Europe*, SSRN Electronic Journal, Available at https://ssrn.com/abstract=3140282.

Gamberoni, E., C. Giordano and P. Lopez-Garcia (2016), *Capital and Labour (Mis)allocation in the Euro Area: Some Stylized Facts and Determinants*, ECB Working Paper Series 1981.

Gomis, R.M. and S. Khatiwada (2017), *Debt and Productivity: Evidence from Firm-Level Data*, The Graduate Institute of International and Development Studies, Working Paper No. HEIDWP04-2017.

Gopinath, G., Ş. Kalemli-Özcan, L. Karabarbounis and C. Villegas-Sanchez (2017), *Capital Allocation and Productivity in South Europe*, The Quarterly Journal of Economics, Vol. 132(4), 1915-1967.

Hall, R.E. and C.I. Jones (1999), *Why do Some Countries Produce So Much More Output Per Worker than Others?* The Quarterly Journal of Economics, Vol. 114(1), 83-116.

Haltiwanger, J., R. Kulick and C. Syverson (2018), *Misallocation Measures: The Distortion That Ate the Residual*, NBER Working Papers 24199.

Hassan, T.A., S. Hollander, L. van Lent and A. Tahoun (2019), *Firm-Level Political Risk: Measurement and Effects*, Mimeo.

Holtz-Eakin, D., W. Newey and H.S. Rosen (1988), *Estimating Vector Autoregressions with Panel Data*, Econometrica, Vol. 56(6), 1371-1395.

Hsieh, C. and P.J. Klenow (2009), *Misallocation and Manufacturing TFP in China and India*, The Quarterly Journal of Economics, Vol. 124(4), 1403-1448.

Hsieh, C. and P.J. Klenow (2010), *Development Accounting*, American Economic Journal: Macroeconomics, Vol. 2(1), 207–223.

Huang, H. and S. Lin (2009), *Non-Linear Finance–Growth Nexus. A Threshold with Instrumental Variable Approach*, Economics of Transition, Vol. 17(3), 439–466.

Jordà, Ò., M. Schularick and A.M. Taylor (2011), *Financial Crises, Credit Booms, and External Imbalances: 140 Years of Lessons*, IMF Economic Review, Vol. 59(2), 340–378.

Jordà, Ò., M. Schularick and A.M. Taylor (2013), *When Credit Bites Back*, Journal of Money, Credit and Banking, Vol. 45(S2), 3-28.

Jordà, Ò., M. Schularick and A.M. Taylor (2015a), *Betting the House*, Journal of International Economics, Vol. 96(S1), 2-18.

Jordà, Ò., M. Schularick and A.M. Taylor (2015b), *Sovereigns versus Banks: Credit, Crises, and Consequences*, Journal of the European Economic Association, Vol. 14(1), 45-79.

Kaas, L. (2016), *Public Debt and Total Factor Productivity*, Economic Theory, Vol. 61(2), 309-333.

Karadam, D.Y. (2018), *An Investigation of Nonlinear Effects of Debt on Growth*, The Journal of Economic Asymmetries, Vol. 18, Article e00097.

Kehrig, M. (2015), *The Cyclical Nature of the Productivity Distribution*, SSRN Electronic Journal, Available at https://ssrn.com/abstract=1854401.

Kim, M. and V. Maksimovic (1990), *Debt and Input Misallocation*, The Journal of Finance, Vol. 45(3), 795-816.

King, R.G. and R. Levine (1993), *Finance and Growth: Schumpeter Might Be Right*, The Quarterly Journal of Economics, Vol. 108(3), 717-737.

Klenow, P. and A. Rodriguez-Clare (1997), *The Neoclassical Revival in Growth Economics: Has It Gone Too Far?* In: NBER Macroeconomics Annual 1997, Vol. 12, 73-114.

Kobayashi, K. and D. Shirai (2018), *Debt-Ridden Borrowers and Economic Slowdown*, The Canon Institute for Global Studies Working Paper Series No. 18-003E.

Larrain, M. and S. Stumpner (2017), *Capital Account Liberalization and Aggregate Productivity: The Role of Firm Capital Allocation*, The Journal of Finance, Vol. 72(4), 1825-1858.

Law, S.H. and N. Singh (2014), *Does Too Much Finance Harm Economic Growth?* Journal of Banking and Finance, Vol. 41(C), 36-44.

León-Ledesma, M.A. and D. Christopoulos (2016), *Misallocation, Access to Finance, and Public Credit: Firm-Level Evidence*, Asian Development Review, Vol. 33(2), 119-143.

Levine, R., N. Loayza and T. Beck (2000), *Financial Intermediation and Growth: Causality and Causes*, Journal of Monetary Economics, Vol. 46(1), 31-77.

Levinsohn, J. and A. Petrin (2003), *Estimating Production Functions Using Inputs to Control for Unobservables*, Review of Economic Studies, Vol. 70(2), 317-341.

Lopez-Garcia, P., F. di Mauro and the CompNet Task Force (2015), *Assessing European Competitiveness: the New CompNet Micro-Based Database*, ECB Working Paper 1764.

Marconi, D. and C. Upper (2017), *Capital Misallocation and Financial Development: A Sector-Level Analysis*, BIS Working Papers 671.

McNabb, K. (2018), *Tax Structures and Economic Growth: New Evidence from the Government Revenue Dataset*, Journal of International Development, Vol. 30(2), 173-205.

Mian, A. and A. Sufi (2010), *Household Leverage and the Recession of 2007–09*, IMF Economic Review, Vol. 58(1), 74–117.

Mian, A., A. Sufi and E. Verner (2017), *Household Debt and Business Cycles Worldwide*, The Quarterly Journal of Economics, Vol. 132(4), 1755–1817.

Miao, J. and P. Wang (2014), *Sectoral Bubbles, Misallocation, and Endogenous Growth*, Journal of Mathematical Economics, Vol. 53(C), 153-163.

Midrigan, V. and D.Y. Xu (2014), *Finance and Misallocation: Evidence from Plant-Level Data*, American Economic Review, Vol. 104(2), 422-458.

Moll, B. (2014), *Productivity Losses from Financial Frictions: Can Self-Financing Undo Capital Misallocation?* American Economic Review, Vol. 104(10), 3186-3221.

Monacelli, T. and L. Sala (2018), *Real Interest Rates and Productivity in Small Open Economies*, CEPR Discussion Papers 12808.

Olley, G.S. and A. Pakes (1996), *The Dynamics of Productivity in the Telecommunications Equipment Industry*, Econometrica, Vol. 64(6), 1263-1297.

Panizza, U. and A.F. Presbitero (2014), *Public Debt and Economic Growth: Is There a Causal Effect?* Journal of Macroeconomics, Vol. 41(C), 21-41.

Pannella, P. (2018), *Credit Bubbles and Misallocation*, Mimeo, São Paulo School of Economics.

Rajan, R.G. and L. Zingales (1998), *Financial Dependence and Growth*, The American Economic Review, Vol. 88(3), 559-586.

Ramey, V.A. and M.D. Shapiro (1998), *Costly Capital Reallocation and the Effects of Government Spending*, Carnegie-Rochester Conference Series on Public Policy, Vol. 48(1), 145-194.

Reinhart, C.M. and K.S. Rogoff (2009), *This Time Is Different. Eight Centuries of Financial Folly*, Princeton University Press.

Reinhart, C.M. and K.S. Rogoff (2010), *Growth in a Time of Debt*, American Economic Review: Papers & Proceedings, Vol. 100, 573–578.

Reinhart, C.M. and K.S. Rogoff (2011), *A Decade of Debt*, Peterson Institute for International Economics, Policy Analyses in International Economics 95.

Reinhart, C.M., V.R. Reinhart and K.S. Rogoff (2012), *Public Debt Overhangs: Advanced-Economy Episodes Since 1800*, Journal of Economic Perspectives, Vol. 26(3), 69–86.

Restuccia, D. and R. Rogerson (2008), *Policy Distortions and Aggregate Productivity with Heterogeneous Establishments*, Review of Economic Dynamics, Vol. 11(4), 707–720.

Roodman, D. (2009), *A Note on the Theme of Too Many Instruments*, Oxford Bulletin of Economics and Statistics, Vol. 71(1), 135-158.

Rousseau, P.L. and P. Wachtel (2011), *What is Happening to the Impact of Financial Deepening on Economic Growth*, Economic Inquiry, Vol. 49(1), 276–288.

Shen, C. and C. Lee (2006), *Same Financial Development yet Different Economic Growth—Why?* Journal of Money, Credit, and Banking, Vol. 38(7), 1907-1944.

Schularick, M. and A.M. Taylor (2012), *Credit Booms Gone Bust: Monetary Policy, Leverage Cycles, and Financial Crises, 1870–2008*, American Economic Review, Vol. 102(2), 1029-1061.

Woo, J. and M.S. Kumar (2015), *Public Debt and Growth*, Economica, Vol. 82(328), 705-739.

Wooldridge, J.M. (2009), *On Estimating Firm-Level Production Functions Using Proxy Variables to Control for Unobservables*, Economics Letters, Vol. 104(3), 112–114.

Yang, L. and J. Su (2018), *Debt and Growth: Is There a Constant Tipping Point?* Journal of International Money and Finance, Vol. 87(C), 133-143.

Appendix A: Summary statistics of variables by country

Belgium	Obs.	Mean	Std. Dev.	Min.	Max.
Dispersion in normalized MRPK	108	0.777	0.493	0.109	2.902
Private debt (% of GDP)	108	188.12	20.98	156.11	214.07
Public debt (% of GDP)	108	98.88	6.30	87.03	107.02
Chinn-Ito capital account openness index	108	1	0	1	1
Long-term interest rate	108	3.31	1.09	0.84	4.42
Government consumption (% of GDP)	108	23.21	1.05	21.59	24.49
Taxes on income, prof. & cap. gains (% of GDP)	108	15.49	0.59	14.37	16.40
Trade (% of GDP)	108	153.21	10.12	136.04	164.71
Average real turnover	108	21597.94	13216.95	4116.01	48124.33
Index of political institutions quality	108	23.38	1.13	21.5	24.5
Indicator of credit constraints	108	0.104	0.024	0.035	0.234

Croatia	Obs.	Mean	Std. Dev.	Min.	Max.
Dispersion in normalized MRPK	135	0.494	0.628	0.019	3.579
Private debt (% of GDP)	135	119.47	23.62	80.85	143.37
Public debt (% of GDP)	135	56.68	19.18	36.60	85.71
Chinn-Ito capital account openness index	135	0.68	0.07	0.42	0.70
Government consumption (% of GDP)	135	19.38	0.85	18.28	20.57
Taxes on income, prof. & cap. gains (% of GDP)	135	5.30	0.42	4.76	6.13
Trade (% of GDP)	135	84.59	5.49	72.67	94.69
Average real turnover	129	9578.41	6383.44	2365.07	34374.34
Index of political institutions quality	135	19.34	0.90	17.58	20.13
Indicator of credit constraints	135	0.055	0.019	0.033	0.147

Czech Republic	Obs.	Mean	Std. Dev.	Min.	Max.
Dispersion in normalized MRPK	104	0.406	0.434	0.002	2.754
Private debt (% of GDP)	117	62.40	9.88	46.91	77.20
Public debt (% of GDP)	117	34.64	6.74	27.46	44.91
Chinn-Ito capital account openness index	117	0.995	0.016	0.940	1
Long-term interest rate	117	3.44	1.27	0.58	4.84
Government consumption (% of GDP)	117	20.30	0.82	19.22	22.26
Taxes on income, prof. & cap. gains (% of GDP)	117	7.59	0.79	6.57	8.74
Trade (% of GDP)	117	131.14	17.74	95.02	158.73
Average real turnover	117	12822.01	8550.6	2827.49	33897.22
Index of political institutions quality	117	21.11	1.52	18.5	22.5
Indicator of credit constraints	117	0.102	0.023	0.082	0.205

Denmark	Obs.	Mean	Std. Dev.	Min.	Max.
Dispersion in normalized MRPK	142	0.572	0.647	0.038	3.838
Private debt (% of GDP)	142	215.75	34.05	155.26	252.71
Public debt (% of GDP)	142	41.87	6.53	27.35	52.35
Chinn-Ito capital account openness index	142	1	0	1	1
Long-term interest rate	142	3.39	1.44	0.69	5.66
Government consumption (% of GDP)	142	25.45	1.14	23.87	27.94
Taxes on income, prof. & cap. gains (% of GDP)	142	28.35	1.10	27.20	31.69
Trade (% of GDP)	142	94.15	8.72	80.88	104.83
Average real turnover	140	13684.37	10802.48	3483.41	59120.53
Index of political institutions quality	142	26.00	1.35	23	27.04
Indicator of credit constraints	142	0.074	0.025	0.043	0.169

Finland	Obs.	Mean	Std. Dev.	Min.	Max.
Dispersion in normalized MRPK	133	0.290	0.637	0.000	3.870
Private debt (% of GDP)	133	149.77	25.21	112.33	193.20
Public debt (% of GDP)	133	45.30	8.58	32.65	63.54
Chinn-Ito capital account openness index	133	1	0	1	1
Long-term interest rate	133	3.49	1.32	0.72	5.48

Finland	Obs.	Mean	Std. Dev.	Min.	Max.
Government consumption (% of GDP)	133	22.32	1.75	19.81	24.74
Taxes on income, prof. & cap. gains (% of GDP)	133	16.05	1.29	14.49	19.75
Trade (% of GDP)	133	75.51	5.59	66.24	86.51
Average real turnover	133	15062.96	10180.06	4699.8	43220.58
Index of political institutions quality	133	27.21	1.00	25.17	28
Indicator of credit constraints	133	0.034	0.011	0.020	0.056

France	Obs.	Mean	Std. Dev.	Min.	Max.
Dispersion in normalized MRPK	99	0.775	0.301	0.262	1.850
Private debt (% of GDP)	99	161.05	13.57	139.32	180.29
Public debt (% of GDP)	99	78.75	11.95	64.54	94.89
Chinn-Ito capital account openness index	99	1	0	1	1
Long-term interest rate	99	3.30	0.82	1.67	4.30
Government consumption (% of GDP)	99	23.44	0.64	22.43	24.13
Taxes on income, prof. & cap. gains (% of GDP)	99	10.12	0.65	8.56	11.07
Trade (% of GDP)	99	56.35	3.17	50.46	60.48
Average real turnover	99	13667.51	7324.34	2808.91	27885.09
Index of political institutions quality	99	22.67	1.84	19.54	24.83
Indicator of credit constraints	99	0.094	0.033	0.041	0.149

Germany	Obs.	Mean	Std. Dev.	Min.	Max.
Dispersion in normalized MRPK	16	0.241	0.206	0.058	0.890
Private debt (% of GDP)	16	119.88	8.20	106.54	131.00
Public debt (% of GDP)	16	68.14	8.03	57.74	80.95
Chinn-Ito capital account openness index	16	1	0	1	1
Long-term interest rate	16	3.47	1.25	1.16	5.26
Government consumption (% of GDP)	16	18.67	0.54	17.50	19.56
Taxes on income, prof. & cap. gains (% of GDP)	16	10.43	0.70	9.26	11.38
Trade (% of GDP)	16	72.66	10.71	53.37	85.87
Average real turnover	16	12810.33	5394.52	5997.89	19980.77
Index of political institutions quality	16	25.09	0.77	23.25	26
Indicator of credit constraints	16	0.218	0	0.218	0.218

Hungary	Obs.	Mean	Std. Dev.	Min.	Max.
Dispersion in normalized MRPK	150	0.416	0.487	0.011	3.934
Private debt (% of GDP)	150	96.57	25.99	51.49	131.24
Public debt (% of GDP)	150	67.04	9.70	51.38	79.91
Chinn-Ito capital account openness index	150	0.90	0.18	0.42	1
Long-term interest rate	150	7.07	1.40	3.43	9.12
Government consumption (% of GDP)	150	21.15	0.91	19.67	22.92
Taxes on income, prof. & cap. gains (% of GDP)	150	8.50	1.26	6.25	10.22
Trade (% of GDP)	150	145.66	19.84	113.73	171.57
Average real turnover	150	10089.5	7825.75	1996	44800.15
Index of political institutions quality	150	20.82	2.03	17.5	25

Italy	Obs.	Mean	Std. Dev.	Min.	Max.
Dispersion in normalized MRPK	125	0.347	0.467	0.007	3.815
Private debt (% of GDP)	125	109.73	16.12	82.37	127.32
Public debt (% of GDP)	125	110.23	10.95	99.79	131.78
Chinn-Ito capital account openness index	125	1	0	1	1
Long-term interest rate	125	4.42	0.69	2.89	5.49
Government consumption (% of GDP)	125	19.41	0.59	18.41	20.63
Taxes on income, prof. & cap. gains (% of GDP)	125	13.49	0.72	12.36	14.54
Trade (% of GDP)	125	51.86	3.75	45.61	56.18
Average real turnover	125	13638.83	8401.96	3213.24	34477.21
Index of political institutions quality	125	19.80	1.75	16.5	22.54
Indicator of credit constraints	125	0.153	0.042	0.103	0.265

Lithuania	Obs.	Mean	Std. Dev.	Min.	Max.
Dispersion in normalized MRPK	142	0.355	0.594	0.002	4.121
Private debt (% of GDP)	142	58.54	19.24	29.32	86.83
Public debt (% of GDP)	142	27.37	9.92	14.56	42.59
Chinn-Ito capital account openness index	142	0.889	0.125	0.699	1
Long-term interest rate	142	5.28	2.77	1.38	14.00
Government consumption (% of GDP)	142	18.96	1.65	16.61	22.40
Taxes on income, prof. & cap. gains (% of GDP)	142	6.95	1.87	4.30	9.52
Trade (% of GDP)	142	124.59	26.32	83.27	166.87
Average real turnover	140	5261.64	3590.16	1070.82	14293.98
Index of political institutions quality	142	18.87	1.06	16	20
Indicator of credit constraints	142	0.116	0.034	0.069	0.297

Netherlands	Obs.	Mean	Std. Dev.	Min.	Max.
Dispersion in normalized MRPK	118	0.727	0.472	0.135	2.969
Private debt (% of GDP)	120	245.97	24.34	216.25	289.12
Public debt (% of GDP)	120	53.82	8.02	41.97	67.10
Chinn-Ito capital account openness index	120	1	0	1	1
Long-term interest rate	120	3.60	1.12	1.45	5.40
Government consumption (% of GDP)	120	23.94	2.04	20.44	26.48
Taxes on income, prof. & cap. gains (% of GDP)	120	9.63	0.43	8.80	10.26
Trade (% of GDP)	120	131.76	13.97	112.65	154.29
Average real turnover	118	18433.11	12158.96	3141.16	48785.33
Index of political institutions quality	120	26.35	1.01	24.08	27.63
Indicator of credit constraints	118	0.118	0.041	0.072	0.211

Poland	Obs.	Mean	Std. Dev.	Min.	Max.
Dispersion in normalized MRPK	99	0.619	0.374	0.120	2.820
Private debt (% of GDP)	99	69.00	12.73	43.31	83.40
Public debt (% of GDP)	99	50.12	3.64	44.16	55.69
Chinn-Ito capital account openness index	99	0.472	0.072	0.449	0.699
Long-term interest rate	99	5.01	1.08	2.70	6.12
Government consumption (% of GDP)	99	18.33	0.34	17.93	19.12
Taxes on income, prof. & cap. gains (% of GDP)	99	6.77	0.61	6.25	8.03
Trade (% of GDP)	99	83.97	7.73	70.27	96.01
Average real turnover	99	12606.06	8421.89	2658.92	44081.69
Index of political institutions quality	99	20.74	0.67	19.5	21.5
Indicator of credit constraints	99	0.100	0.014	0.036	0.129

Portugal	Obs.	Mean	Std. Dev.	Min.	Max.
Dispersion in normalized MRPK	80	0.782	0.420	0.058	3.028
Private debt (% of GDP)	90	210.24	12.86	187.60	231.38
Public debt (% of GDP)	90	100.94	25.68	68.44	130.59
Chinn-Ito capital account openness index	90	1	0	1	1
Long-term interest rate	90	5.57	2.61	2.42	10.55
Government consumption (% of GDP)	90	19.65	1.01	18.12	21.43
Taxes on income, prof. & cap. gains (% of GDP)	90	9.19	1.03	7.98	10.96
Trade (% of GDP)	90	72.51	5.89	61.08	80.22
Average real turnover	90	10581.47	7279.18	2502.71	35129.67
Index of political institutions quality	90	21.11	2.54	18	24
Indicator of credit constraints	90	0.116	0.040	0.076	0.303

Romania	Obs.	Mean	Std. Dev.	Min.	Max.
Dispersion in normalized MRPK	88	0.380	0.451	0.005	2.849
Private debt (% of GDP)	88	35.57	6.87	21.35	43.34
Public debt (% of GDP)	88	26.32	11.09	11.88	39.22
Chinn-Ito capital account openness index	88	0.984	0.037	0.879	1
Government consumption (% of GDP)	88	15.33	1.23	13.74	17.54
Taxes on income, prof. & cap. gains (% of GDP)	64	5.71	0.43	5.03	6.33

Romania	Obs.	Mean	Std. Dev.	Min.	Max.
Trade (% of GDP)	88	74.95	7.24	59.32	82.77
Average real turnover	76	4670.08	2494.13	1187.32	9987.25
Index of political institutions quality	88	15.60	1.02	14	16.5
Indicator of credit constraints	33	0.196	0.049	0.103	0.243

Slovak Republic	Obs.	Mean	Std. Dev.	Min.	Max.
Dispersion in normalized MRPK	142	0.608	0.516	0.006	3.588
Private debt (% of GDP)	142	63.49	13.70	47.54	85.86
Public debt (% of GDP)	142	42.45	8.52	28.46	54.74
Chinn-Ito capital account openness index	142	0.571	0.216	0.166	0.750
Long-term interest rate	134	4.36	1.63	0.89	8.04
Government consumption (% of GDP)	142	18.91	0.82	17.22	20.16
Taxes on income, prof. & cap. gains (% of GDP)	142	6.16	0.54	5.33	7.04
Trade (% of GDP)	142	154.09	23.42	110.70	184.33
Average real turnover	141	14859.03	12263.76	1799.03	52769.78
Index of political institutions quality	142	20.05	1.00	18.5	21.5

Slovenia	Obs.	Mean	Std. Dev.	Min.	Max.
Dispersion in normalized MRPK	106	0.469	0.512	0.000	2.957
Private debt (% of GDP)	106	108.73	15.15	83.67	125.33
Public debt (% of GDP)	106	48.94	22.95	21.80	82.62
Chinn-Ito capital account openness index	106	0.807	0.110	0.699	1
Long-term interest rate	106	3.98	1.38	1.15	5.81
Government consumption (% of GDP)	106	19.08	0.98	17.29	20.43
Taxes on income, prof. & cap. gains (% of GDP)	106	7.39	0.80	6.31	8.65
Trade (% of GDP)	106	135.18	10.36	112.62	146.15
Average real turnover	104	12114.46	8315.7	2844.98	32399.69
Index of political institutions quality	106	20.01	1.52	18.04	21.5
Indicator of credit constraints	106	0.157	0.022	0.122	0.263

Spain	Obs.	Mean	Std. Dev.	Min.	Max.
Dispersion in normalized MRPK	56	0.803	0.355	0.081	2.418
Private debt (% of GDP)	63	201.51	14.81	175.03	215.98
Public debt (% of GDP)	63	80.46	18.34	52.70	100.37
Chinn-Ito capital account openness index	63	1	0	1	1
Long-term interest rate	63	4.08	1.35	1.74	5.85
Government consumption (% of GDP)	63	19.97	0.49	19.34	20.52
Taxes on income, prof. & cap. gains (% of GDP)	63	9.30	0.37	8.77	9.64
Trade (% of GDP)	63	57.81	5.83	46.50	63.61
Average real turnover	63	14619.31	9587	3329.71	39990.55
Index of political institutions quality	63	20.79	1.55	18.71	23.08
Indicator of credit constraints	63	0.199	0.056	0.150	0.316

Sweden	Obs.	Mean	Std. Dev.	Min.	Max.
Dispersion in normalized MRPK	111	0.560	0.597	0.000	2.736
Private debt (% of GDP)	111	184.86	21.47	141.57	210.90
Public debt (% of GDP)	111	42.00	4.17	36.71	48.88
Chinn-Ito capital account openness index	111	1	0	1	1
Long-term interest rate	111	2.98	1.14	0.72	4.64
Government consumption (% of GDP)	111	25.38	0.70	24.07	26.33
Taxes on income, prof. & cap. gains (% of GDP)	111	16.02	1.26	14.50	18.22
Trade (% of GDP)	111	85.71	4.31	76.15	93.36
Average real turnover	111	9849.17	5358.48	3189.28	22889.56
Index of political institutions quality	111	27.18	0.23	27	27.5
Indicator of credit constraints	111	0.068	0.018	0.055	0.141

Appendix B: Robustness checks

Table B1. Debt to GDP ratios and capital misallocation: One-step system GMM regressions

Interacting variable	Financial Dependence		Average Credit Constraints		Technological Intensity	
	(1)	(2)	(3)	(4)	(5)	(6)
$\ln(Private\ Debt) \times Interaction$ (lagged)	0.763***	0.694***	2.156**	1.961*	0.640***	0.642***
	(0.208)	(0.201)	(0.911)	(1.038)	(0.210)	(0.212)
$\ln(Public\ Debt) \times Interaction$ (lagged)	-0.463*	-0.507**	-1.408	-1.422	-0.378*	-0.424*
	(0.234)	(0.235)	(1.030)	(1.042)	(0.208)	(0.242)
$Capit.Acc.Openness \times Interaction$ (lagged)	-1.473**	-1.485**	-5.444	-6.521	-1.021*	-1.169**
	(0.540)	(0.552)	(4.046)	(4.330)	(0.505)	(0.496)
$LT\ Interest\ Rate \times Interaction$	-0.055**	-0.055*	-0.251**	-0.221*	-0.057***	-0.061***
	(0.023)	(0.030)	(0.112)	(0.125)	(0.018)	(0.018)
$\ln(Govt.Consump.) \times Interaction$	0.205	0.559	1.071	2.000	0.092	0.302
	(0.627)	(0.737)	(2.824)	(3.289)	(0.358)	(0.416)
$\ln(Taxes\ on\ IPC) \times Interaction$	0.102	0.044	1.028	1.108	-0.149	-0.149
	(0.322)	(0.338)	(1.326)	(1.462)	(0.251)	(0.242)
$\ln(Trade) \times Interaction$	0.276	0.260	0.831	0.705	0.159	0.135
	(0.245)	(0.236)	(0.990)	(1.079)	(0.185)	(0.194)
$\ln(Avg.Real\ Turnover)$	0.306***	0.290	0.345*	0.364*	0.183	0.151
	(0.102)	(0.180)	(0.165)	(0.202)	(0.160)	(0.157)
$Institut.Quality \times Interaction$	-0.107***	-0.127***	-0.340**	-0.366**	-0.058**	-0.068**
	(0.023)	(0.026)	(0.119)	(0.137)	(0.025)	(0.026)
Constant	-2.212**	-2.029	-2.656	-2.832	-0.997	-0.695
	(0.949)	(1.668)	(1.644)	(2.007)	(1.432)	(1.410)
Observations	1,596	1,596	1,322	1,322	1,596	1,596
Instrument count	*133*	*91*	*128*	*91*	*133*	*91*
AR(1) test p-value	0.000	0.000	0.000	0.000	0.000	0.000
AR(2) test p-value	0.274	0.274	0.415	0.404	0.236	0.230
Hansen test p-value	1.000	1.000	1.000	1.000	1.000	1.000

Standard errors in parentheses. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

Table B2. Debt to GDP ratios and capital misallocation: excluding Croatia, Germany, Romania, and Spain

Interacting variable	Financial Dependence			Average Credit Constraints			Technological Intensity		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Estimation	*FE*	*FE*	*Sys-GMM*	*FE*	*FE*	*Sys-GMM*	*FE*	*FE*	*Sys-GMM*
$\ln(Private\ Debt) \times Interaction$ (lagged)	1.046***	1.046***	0.800***	3.506**	3.506***	2.473**	0.620**	0.620***	0.621**
	(0.178)	(0.266)	(0.191)	(1.189)	(1.173)	(0.857)	(0.250)	(0.195)	(0.208)
$\ln(Public\ Debt) \times Interaction$ (lagged)	-0.085	-0.085	-0.470*	-0.895	-0.895	-1.291	0.016	0.016	-0.335
	(0.305)	(0.280)	(0.219)	(1.968)	(1.487)	(0.856)	(0.310)	(0.160)	(0.201)
$Capit.Acc.Openness \times Interaction$ (lagged)	-1.173**	-1.173***	-1.423**	-5.859	-5.859	-5.994	-0.610*	-0.610***	-0.832*
	(0.464)	(0.347)	(0.509)	(6.088)	(4.315)	(4.786)	(0.304)	(0.191)	(0.407)
$LT\ Interest\ Rate \times Interaction$	-0.053**	-0.053***	-0.049**	-0.208	-0.208***	-0.208*	-0.016	-0.016	-0.045**
	(0.022)	(0.016)	(0.022)	(0.123)	(0.069)	(0.101)	(0.020)	(0.023)	(0.020)
$\ln(Govt.Consump.) \times Interaction$	0.042	0.042	0.330	1.194	1.194	1.468	0.594	0.594	0.190
	(0.960)	(1.196)	(0.556)	(3.302)	(4.207)	(2.630)	(0.526)	(0.743)	(0.259)
$\ln(Taxes\ on\ IPC) \times Interaction$	-0.108	-0.108	0.079	0.475	0.475	1.230	-0.178	-0.178	-0.142
	(0.373)	(0.373)	(0.345)	(1.494)	(0.886)	(1.646)	(0.294)	(0.271)	(0.248)
$\ln(Trade) \times Interaction$	-0.266	-0.266	0.161	0.145	0.145	-0.006	0.640	0.640	0.070
	(0.688)	(0.624)	(0.216)	(3.122)	(2.596)	(0.792)	(0.653)	(0.467)	(0.138)
$\ln(Avg.Real\ Turnover)$	0.075	0.075	0.255***	0.088	0.088	0.201	0.119	0.119	0.170
	(0.094)	(0.123)	(0.082)	(0.100)	(0.158)	(0.123)	(0.101)	(0.114)	(0.140)
$Institut.Quality \times Interaction$	-0.042	-0.042	-0.107***	-0.130	-0.130	-0.314**	0.000	0.000	-0.066**
	(0.053)	(0.046)	(0.022)	(0.272)	(0.200)	(0.120)	(0.037)	(0.016)	(0.027)
Constant	-0.536	-0.536	-1.747**	-1.339	-1.339	-1.343	-2.848**	-2.848***	-0.892
	(2.548)	(2.802)	(0.763)	(3.446)	(2.856)	(1.216)	(1.188)	(0.916)	(1.250)
Standard errors	Clustered (country)	HAC (Driscoll-Kraay)	Clustered (country)	Clustered (country)	HAC (Driscoll-Kraay)	Clustered (country)	Clustered (country)	HAC (Driscoll-Kraay)	Clustered (country)
Observations	1,533	1,533	1,533	1,259	1,259	1,259	1,533	1,533	1,533

Standard errors in parentheses. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

Table B3. Debt to GDP ratios and capital misallocation: interaction with alternative sectoral indicators

Interacting variable	Dispersion of Credit Constraints			De Loecker & Warzynski (2012) Markups			Skewness of TFP distribution		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Estimation	*FE*	*FE*	*Sys-GMM*	*FE*	*FE*	*Sys-GMM*	*FE*	*FE*	*Sys-GMM*
$\ln(Private\ Debt) \times Interaction$ (lagged)	1.534**	1.534***	1.370***	0.268***	0.268***	0.163**	0.063***	0.063***	0.076***
	(0.515)	(0.452)	(0.315)	(0.089)	(0.061)	(0.069)	(0.018)	(0.008)	(0.020)
$\ln(Public\ Debt) \times Interaction$ (lagged)	0.136	0.136	-0.600	0.139	0.139***	0.028	-0.007	-0.007	0.002
	(0.915)	(0.532)	(0.387)	(0.091)	(0.046)	(0.030)	(0.025)	(0.011)	(0.018)
$Capit.Acc.Openness \times Interaction$ (lagged)	-1.680	-1.680	-2.356	-0.217	-0.217*	-0.216	-0.105**	-0.105***	-0.134**
	(2.559)	(1.634)	(1.431)	(0.145)	(0.116)	(0.257)	(0.047)	(0.024)	(0.052)
$LT\ Interest\ Rate \times Interaction$	-0.082*	-0.082**	-0.124**	-0.003	-0.003	-0.014	-0.003	-0.003	-0.004***
	(0.039)	(0.033)	(0.042)	(0.006)	(0.004)	(0.009)	(0.002)	(0.002)	(0.001)
$\ln(Govt.Consump.) \times Interaction$	1.136	1.136	0.251	-0.308	-0.308*	-0.466**	-0.017	-0.017	-0.099**
	(1.731)	(1.816)	(1.048)	(0.267)	(0.172)	(0.194)	(0.077)	(0.061)	(0.035)
$\ln(Taxes\ on\ IPC) \times Interaction$	0.031	0.031	-0.110	-0.088	-0.088	-0.075	-0.033	-0.033**	-0.014
	(0.610)	(0.463)	(0.602)	(0.101)	(0.091)	(0.062)	(0.021)	(0.014)	(0.018)
$\ln(Trade) \times Interaction$	1.004	1.004	0.091	0.137	0.137	0.210**	0.040	0.040	0.010
	(1.234)	(0.917)	(0.381)	(0.186)	(0.118)	(0.085)	(0.031)	(0.024)	(0.017)
$\ln(Avg.Real\ Turnover)$	0.020	0.020	0.196	0.075	0.075	0.565**	0.045	0.045	0.321
	(0.105)	(0.119)	(0.150)	(0.097)	(0.079)	(0.202)	(0.091)	(0.093)	(0.213)
$Institut.Quality \times Interaction$	0.009	0.009	-0.140***	0.006	0.006	0.003	0.001	0.001	0.002
	(0.102)	(0.055)	(0.043)	(0.012)	(0.006)	(0.008)	(0.002)	(0.001)	(0.001)
Constant	-3.965	-3.965	-1.004	-1.780	-1.780	-4.671**	-1.253	-1.253	-2.253
	(3.551)	(2.794)	(1.601)	(2.416)	(1.581)	(1.880)	(1.536)	(1.296)	(1.941)
Standard errors	Clustered (country)	HAC (Driscoll-Kraay)	Clustered (country)	Clustered (country)	HAC (Driscoll-Kraay)	Clustered (country)	Clustered (country)	HAC (Driscoll-Kraay)	Clustered (country)
Observations	1,322	1,322	1,322	1,398	1,398	1,398	1,596	1,596	1,596

Standard errors in parentheses. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

Note: All of the sectoral-level interacting variables are averaged over the available time period for each country-sector to make them time-invariant. We take the natural logarithm of the De Loecker and Warzynski (2012) measure of average markup before interacting it with the country-level variables.

Halle Institute for Economic Research –
Member of the Leibniz Association

Kleine Maerkerstrasse 8
D-06108 Halle (Saale), Germany

Postal Adress: P.O. Box 11 03 61
D-06017 Halle (Saale), Germany

Tel +49 345 7753 60
Fax +49 345 7753 820

www.iwh-halle.de
www.comp-net.org

ISSN 2513-1303

Leibniz
Association