# Public Debt and Firm Performance: A Love-Hate Relationship?

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**Abstract**

To show how public debt impacts performance for a sample of 79,746 formal private firms located across 72 developing economies, we impose a heteroscedastic covariance restriction and construct internal instruments following Lewbel (2012). In contrast to conventional wisdom, we find that, on average, a 10-percent increase in the debt-to-GDP ratio raises the firm average annual growth rate of sales by around 0.23 percentage points. This effect becomes even larger—reaching around 0.45–0.46 percentage points and statistically significant—when internal instruments are combined with a conventional external instrument based on valuation effects. By contrast, when the external instrument is used alone, the coefficient remains positive but loses statistical significance. We then explore the heterogeneity of this effect in a two-step process. First, we test whether public debt benefits more (or less) firms facing particular constraints—such as finance, infrastructure deficiencies or institutional barriers. To assess the relative importance of these constraints, we combine opinion-based survey questions with hard-data, assuming that objective measures can help mitigate potential biases inherent in subjective perceptions. Second, we explore how firms are impacted by debt based on the structural characteristics of their particular industry. To this end, we construct exogenous sector-specific input intensities using the U.S. input-output matrix (2000–2014).

**Keywords:** Firm Growth · Public Capital · Debt Management · Developing Economies · Institutions
**JEL classification:** D22 · H54 · H63 · O10 · O17.

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# 1 Introduction

Public debt levels are on the rise following the short-lived reduction in 2021-2022, mainly driven by unexpected inflation, and this is part of an upward drift that has been ongoing for more than ten years. The forecast upward trend reflects fiscal deficits, slowing growth, rising debt service, and it is likely that challenges related to climate adaptation, the green transition, and demographic changes will imply additional large-scale spending pressures. Furthermore, past shocks such as the Global Financial Crisis and Covid-19 have shown that debt can rise rapidly, and on a large scale. Indeed, the recent pandemic led to a dramatic escalation, pushing the global average ratio to nearly 100% in 2020–a 15 percentage-point increase from the previous year. In emerging market economies (EMEs) and low-income developing countries (LIDCs), public debt has respectively gone up by close to 10 percentage points and 5 percent of GDP in the space of one year (Moreno Badia et al. (2023)). Yet, the understanding of the risks associated with rising public-debt-to-GDP ratios remains quite low. Applying meta-regression tools, Heimberger (2023) argues that the unweighted mean of the results reported in the literature, which suggests that a 10 percentage-points increase in public-debt-to-GDP is associated with a decline in annual growth rates by 0.14 percentage points, is unlikely to represent a causal effect. He shows that, after correcting for a substantial publication bias in favor of negative growth effects, one cannot reject a zero average effect. Of course, these findings refer to the average effect of higher public-debt-to-GDP ratios on economic growth. There may be country cases with positive or negative growth effects of higher public debt levels. Nevertheless, it underscores the need to remain open-minded regarding the potential direction and magnitude of public debt's impact on economic growth, and calls for further empirical investigation.

In this paper, we focus on a particular dimension of economic growth and seek to answer the following question: does public debt accumulation undermine firm performance in developing economies? More specifically, we examine how increases in public-debt-to-GDP ratios affect the sales growth rates for a sample of 79,746 formal private firms, located in 72 countries and taken from the September 2024 World Bank Enterprise Surveys (WBES) repeated cross-sectional dataset.[1]. Our econometric model controls for part of the time-invariant heterogeneity with country fixed effects, and includes a large set of firm-level and country-level variables as well as industry x year dummies to account for time-varying heterogeneity. However, as we cannot include firm fixed effects, it does not control for time-invariant heterogeneity at the firm-level. Endogeneity could also stem from reverse causality and time-varying unobservable heterogeneity, which may be correlated with both firm performance and the public-debt-to-GDP ratio. Therefore, we construct an external instrument inspired by Panizza and Presbitero (2014), which exploits the fact that, when a portion of public debt is denominated in U.S. dollars, fluctuations in the bilateral exchange rate affect a country's public-debt-to-GDP ratio via the valuation effect channel. Then, we implement the methodology proposed by Lewbel (2012), and impose a heteroskedastic covariance restriction to construct internal instrumental variables.

Our results suggest that, on average, public debt accumulation has a positive impact on firm performance. Using our baseline specification and Ordinary Least Squares (OLS), we find that a one percentage point increase in the public-debt-to-GDP ratio is associated with a 0.19 percentage point increase in firm sales growth. Interestingly, the coefficient is slightly larger and reaches approximately

[1]World Bank Enterprise Surveys, www.enterprisesurveys.org. We thank the Enterprise Analysis Unit of the Development Economics Global Indicators Department of the World Bank for the data.

0.23–0.24 percentage points when public debt is instrumented following Lewbel (2012). This is consistent with the idea that tackling endogeneity issues reduces the downward bias running from firm growth to public-debt-to-GDP ratios, thus leading to less adverse estimates. When using a conventional external instrument based on valuation effects, however, the coefficient remains positive but loses statistical significance. In contrast, when we combine internal instruments with the external instrument, the coefficient becomes even larger—reaching around 0.45–0.46 percentage points—and is statistically significant. Finally, a series of robustness checks suggests that our findings—based on both OLS and Lewbel IV estimates—are not driven by a specific country or by sample selection bias.

We then investigate the channels through which public debt accumulation affects firm growth, following a two-step approach. First, we examine the heterogeneity of the effect of public debt across firms with different characteristics. Specifically, we build on the theoretical literature and test whether public debt benefits more (or less) firms facing particular constraints—such as finance, infrastructure deficiencies or institutional barriers. To assess the relative importance of these constraints, we combine opinion-based survey questions with hard-data, assuming that objective measures can help mitigate potential biases inherent in subjective perceptions. Second, we explore how firms are impacted by debt based on the structural characteristics of their particular industry. Therefore, we follow an empirical strategy similar to Rajan and Zingales (1998) and interact the debt variable with exogenous sector-specific input intensities that are meant to capture the channels through which debt may affect firm growth. These intensities are constructed following Levchenko (2007) and Nunn (2007), using the U.S. input-output matrix (2000–2014) from the World Input-Output Database (WIOD) (Timmer et al. (2015)).

So far, the literature on public debt and economic growth has produced contradictory findings. However, the absence of conclusive evidence should not be interpreted as suggesting that any level of public debt is sustainable. What remains clear is that endogeneity poses a major challenge in understanding the relationship between public debt and growth-related outcomes. In this context, our study contributes to the literature by illustrating how heteroscedasticity-based instruments can provide a valuable alternative when conventional instrumental variables are either unavailable or fail to convince. Furthermore, it tries to provide firm-level evidence on the channels through which public debt may affect growth, in line with recent calls for more granular analysis (Heimberger (2023)).

The article is structured as follows. Section 2 reviews the existing literature. Section 3 describes the model and the data. The baseline results are presented in Section 4. Section 5 discusses the channels through which public debt affects firm growth and Section 6 concludes.

## 2 Literature Review

### 2.1 The relationship between public debt and economic growth

Theoretical studies lead to two major implications that have been widely investigated empirically. First, the relationship between public debt and economic growth is linear and negative, and can be interpreted as causal. Second, there is a threshold in the public-debt-to-GDP ratio beyond which growth falls significantly. However, a careful reading of the empirical literature suggests that the relationship between public debt and economic growth is less clear-cut and more nuanced than these main arguments suggest.

In an influential paper, Kumar and Woo (2010) start from the stylized fact that an increase in the

lagged public-debt-to-GDP ratio is, on average, associated with a 0.25 percentage points decrease in the subsequent real GDP per capita growth. However, they rightly note that this correlation may be biased by endogeneity issues. Public debt and growth could be jointly determined by omitted factors, and slumps in economic activity may be largely responsible for increases in the public-debt-to-GDP ratio. To address these concerns, they use lagged levels of public debt and a GMM estimation approach with suitable instrumental variables, and report results that are still consistent with a negative effect of public debt on growth. Yet, as argued by Panizza and Presbitero (2014), the literature that has used lagged values of public-debt-to-GDP (Cecchetti et al. (2011)), internal instruments via GMM estimation (Kumar and Woo (2010)), or average debt-to-GDP ratios in other countries Checherita-Westphal and Rother (2012) has failed to convincingly address endogeneity. Therefore, to obtain identification, they propose an external instrument based on bilateral exchange rates fluctuations, which affect the value of foreign-denominated public debt. Using this strategy, they find that the negative association between debt and growth disappears, providing no evidence of a causal negative relationship. Ash et al. (2017) further challenge the consensus by drawing on multiple datasets from prominent studies in the literature, and find no consistent causal relationship between public debt and economic growth.

Turning to potential non-linearities, several empirical studies support the influential finding by Reinhart and Rogoff (2010) of a threshold—close to 90% of GDP—beyond which countries tend to experience lower growth rates. Using OLS estimations and including a quadratic term in their specification, Cecchetti et al. (2011) identify a threshold of 85% for a sample of 18 advanced economies over the period 1980–2010. Similarly, Checherita-Westphal and Rother (2012) find that public debt begins to hinder long-term growth at levels between 90% and 100% of GDP, based on a sample of 12 euro area countries between 1970 and 2008. They rely on both annual data and multiyear averages, and instrument the debt ratio using lagged values or the average debt levels of peer countries. Further evidence of threshold effects is provided by Caner et al. (2010), who use a larger sample of 101 advanced and developing economies between 1980 and 2008, and identify a 77% threshold. On the other hand, several authors have examined the original dataset used by Reinhart and Rogoff (2010), or constructed new ones to test the debt-growth relationship. For example, Herndon et al. (2014) criticize the analysis of Reinhart and Rogoff for data exclusions, coding errors, and unconventional weighting decisions. After correcting these issues, they find no consistent evidence that debt-to-GDP ratios above 90% systematically reduce growth. Applying non-linear threshold models to the same dataset, Égert (2015b) concludes that "90% is not a magic number". Using a median regression framework, Lee et al. (2017) locate the threshold much lower, around 30%. More broadly, a number of studies argue that there is no compelling evidence for a universal debt threshold that consistently impairs economic growth (Ash et al. (2017), Bentour (2021), Chudik et al. (2017), Eberhardt (2019), Eberhardt and Presbitero (2015), Égert (2015a), Pescatori et al. (2014), Proaño et al. (2014), Yang and Su (2018)).

In sum, the literature has so far produced contradictory findings. However, the absence of conclusive evidence should not be interpreted as suggesting that any level of public debt is sustainable. What remains clear is that endogeneity poses a major challenge in understanding the relationship between public debt and growth-related outcomes. In this context, our study contributes to the literature by illustrating how heteroscedasticity-based instruments can provide a valuable alternative when conventional instrumental variables are either unavailable or fail to convince. Furthermore, by directly investigating the channels through which higher public debt levels impact growth, this article responds to recent calls for more granular analyzes (Heimberger (2023)). In particular, our focus on firm

performance is connected to the assumption that shocks to large firms can have significant effects on aggregate GDP growth (Gabaix (2011); Di Giovanni et al. (2014)).

### 2.2 The relationship between public debt and firm growth

Theory suggests two major channels through which public debt accumulation may impact firm performance: demand, and supply. In the short term, the demand-side mechanism refers to the idea that a debt-financed fiscal expansion may increase the disposable income of households, thereby boosting consumption and overall demand for goods and services (Elmendorf and Mankiw (1999)). The resulting surge in demand may foster firm growth, provided that firms are able to scale up their production accordingly. In the longer run, however, this positive effect may be offset. Relaxing the assumption of myopic individuals, the Ricardian equivalence suggests that rational economic agents may anticipate future tax increases and save more in response to a debt-financed fiscal expansion. On the supply side, debt accumulation may affect the productive capacity of firms by influencing access to credit, and the provision of public infrastructure and services that complement private sector activities. Private investment may be crowded out if fiscal expansions drive up interest rates. Furthermore, as public debt accumulation raises concerns among lenders and increases borrowing costs, an ever-larger share of public revenues may be absorbed by debt service, thereby reducing the fiscal space available for essential development spending—a phenomenon known as the "real debt burden," first discussed by Krugman (1988).

While these mechanisms are not meant to be exhaustive, we argue that they are the most relevant in the context of developing economies. In particular, the supply-side channels directly relate to two of the three main kinds of constraints identified in the literature on firm performance. Indeed, the financing constraint is by far the most documented. Harrison et al. (2014) and Beck et al. (2005) show that individual financing obstacles such as credit access, collateral requirements, and bank bureaucracies constrain firm growth. Weak access to finance also reduces the probability that firms will enter the export market (Berman and Héricourt (2010)), and prevents them from importing the required capital goods (Bas and Berthou (2012)). Beyond finance, infrastructure emerges as another major constraint. The critical role of infrastructure provision for economic development has been evidenced across various dimensions—transport, energy, telecommunications, and water (see among others Calderón and Servén (2010), Jedwab and Moradi (2016), Limao and Venables (2001), Rud (2012), and Straub (2008)). At a more disaggregated level, several studies have also found that a lack of infrastructure significantly undermines firm growth (Dollar et al. (2005), Harrison et al. (2014)). Lastly, the broader macro-institutional environment plays a critical role in shaping firms' ability to grow. In particular, Fisman and Svensson (2007) and Chong and Gradstein (2009) respectively show that corruption and the volatility of economic policies tend to reduce firm growth.

In this context, our study builds on the existing literature by providing empirical evidence on the channels through which public debt accumulation may affect firm growth. We rely on the World Bank Enterprise Surveys (WBES), which offer rich firm-level data covering both performance indicators and various dimensions of the business environment, such as access to finance, infrastructure, corruption, and regulation. From a methodological perspective, the WBES allow us to use a sales-based measure of firm performance—unlike most existing studies that rely on alternative proxies such as employment growth, due to the difficulty of obtaining reliable financial data for firms in developing economies (Nichter and Goldmark (2009)). In addition, we exploit the U.S. input-output matrix (2000–2014)

from the World Input-Output Database (WIOD) and, building on the approach of Rajan and Zingales (1998), construct exogenous industry-level structural characteristics that proxy for firms' exposure to supply-side mechanisms.

# 3 Model and data

We investigate the impact of public debt on firm performance using the following general specification:

$$Growth_{i,k,j,(t,t-2)} = \alpha + \beta X_{i,k,j,(t)} + \gamma Y_{j,(t-3,t-5)} + \tau_{k,(t)} + \mu_j + \epsilon_{i,k,j,(t)} \quad (1)$$

where $Growth_{i,k,j,(t,t-2)}$ is the average annual growth rate of the sales of firm $i$, in industry $k$, and country $j$. It is computed over three years, between $(t)$ and $(t-2)$. $X_{i,k,j,t}$ is a set of time-varying firm-level characteristics, while $Y_{j,(t-3,t-5)}$ is a set of country-level variables including the public-debt-to-GDP ratio, $Debt_{j,(t-3,t-5)}$, lagged one period and measured on average over three years between $(t-3)$ and $(t-5)$. We finally include country fixed effects to control for part of the unobservable heterogeneity, $\mu_j$, as well as industry x year dummies, $\tau_{k,t}$, which capture industry-level business cycles. $\epsilon_{i,k,j,t}$ is the idiosyncratic disturbance term. Regarding our variable of interest, we rely on the gross debt definition, which encompasses all liabilities that require the payment of interest and/or principal by the debtor to the creditor in the future. This includes liabilities in the form of Special Drawing Rights (SDRs), currency and deposits, debt securities, loans, insurance, pensions and standardized guarantee schemes, and other accounts payable. As defined by the GFSM 2001 system, all liabilities are considered debt except for equity, investment fund shares, financial derivatives, and employee stock options.[2]

In this framework, the debt variable is measured at the country level, whereas the outcome, sales growth, is measured at the firm level. However, as underlined by Moulton (1990), estimating the effect of aggregate policy variables on micro units may introduce a statistical bias.[3] Consequently, we cluster the standard errors at the country-year level, which corresponds to the level of aggregation of our variable of interest, $Debt_{j,(t-3,t-5)}$. Our empirical setting also implies that, within a given country and year, several firm-level growth observations are matched to a single debt observation. As a result, the error term of the estimation might be large since it is difficult to fit all the outcome points at the same time, inducing a more conservative estimate of the effect of public debt. Lastly, we apply sampling probability weights, as each Enterprise Survey is stratified by industry, establishment size, and region. These base weights, defined as the inverse of the probability of selection, correct for the varying selection probabilities across strata.

## 3.1 Firm-level data from the World Bank Enterprise Surveys (WBES)

The dataset contains information on 79,746 firms, located in 72 developing economies (see Table A.2 for details). Within each country, the surveys follow a repeated cross-section design–that is, firms

[2]The GFSM 2001 refers to the *Government Finance Statistics Manual 2001*, published by the International Monetary Fund (IMF), which provides an internationally recognized framework for defining and classifying government debt and other fiscal statistics. It is aligned with the System of National Accounts (SNA) to ensure consistency and comparability across countries.

[3]Random disturbances in the regression correlated within the groupings that are used to merge aggregate with micro data can cause the standard errors from ordinary least squares to be biased downwards (Moulton (1990)).

interviewed in one wave are not necessarily the same as those interviewed in the next. The surveys were conducted in various years between 2006 and 2023, resulting in a varying number of firms and countries covered each year, depending on the survey schedule in each country. Taking into account the lag structure, the effective coverage period for our analysis spans from 2003 to 2020. We did not consider firms when the responses to questions regarding opinions, perceptions, and numbers, were deemed to be untruthful, arbitrary, or unreliable.[4] Surveys for Angola (2006, 2010) and the Democratic Republic of Congo (2006) were also excluded, since these two countries experienced violent events and benefited from higher than normal growth rates, driving our results on the effect of public debt on growth artificially upwards and adding noise to the estimations. The sample includes 13 Latin American countries (accounting for 19.79% of the firms), 25 Sub-Saharan African countries (18.99%), 6 Middle Eastern and North African countries (12.27%), 14 countries from Europe and Central Asia (16%), 9 from East Asia (10.93%), and 5 from South Asia (22.02%).

The World Bank Enterprise Surveys (WBES) cover a representative sample of an economy's private sector. The universe of inference includes all formal private sector businesses ($> 1\%$ private ownership) with more than five employees. In terms of sectoral criteria, all manufacturing businesses are eligible, and a subset of services businesses are included.[5] The unit of analysis is the establishment—a business entity associated with a physical location with its own set of financial statements, including a balance sheet and income statement. For multi-establishment firms, each establishment may be a separate unit of analysis, provided its separate financial statements are identified. Firms with multiple locations but only consolidated financial statements are considered a consolidated unit of analysis. Enterprise Surveys collect data through a standardized questionnaire, administered during face-to-face interviews with business owners and senior managers, on firm characteristics and performance, and on a broad range of business environment topics including access to finance, corruption, infrastructure, crime, regulations, and competition.

The data produced is comparable across time and countries, through a uniform methodology applied globally. It includes a stratified random sampling strategy where the three strata are size, sector, and sub-national location. Stratification by firm size divides the population of firms into 3 strata: small firms (between 5 and 19 employees), medium-size firms (20-99 employees), and large firms (100 or more employees). In very large economies, a fourth size stratum is added–that is, the top 1% of firms by size. Geographical stratification is defined to reflect the distribution of the non-agricultural economic activity, which in most cases implies covering the main urban centers of the country.[6] Stratification by sector of activity depends on the size of the economy as measured by the Gross National Income (GNI). Very small economies (below $20 billion GNI of 2016) are stratified into 2 groups: manufacturing and services, with 75 interviews allocated to each group. For small economies (GNI between $20 billion and $30 billion), the universe is stratified into manufacturing, retail, and the rest services. Medium-size economies (GNI between $30 and 100 billion) single-out the 2 most important manufacturing industries and the remaining ones are grouped together into a residual stratum, "rest of manufacturing". Retail and "rest of services" provide the final two strata. For large and very large

[4]Interview quality is proxied using responses to variables a16 and a17, which reflect the interviewer's assessment of the reliability and consistency of the respondent's answers.

[5]Only those corresponding to the ISIC Rev. 4 codes 41-43, 45-47, 49-53, 55-56, 58, 61-62, 69-75, 79, and 95 are included.

[6]Around the world, most of the non-agricultural, non-mining economic activity, is clustered around the main centers of population.

economies, further manufacturing and services sub-sectors are singled-out for stratification, preserving the residual categories to ensure full coverage of the universe of inference. For comparability purposes, the preferred service sectors to be singled out is retail. Additional services sector are typically hotels or construction. In the case of manufacturing, priority sectors for comparability have typically been the food manufacturing sector and garments manufacturing. Additional industries are chosen depending on the characteristics of the economy as based on contribution to value added, contribution to employment, and number of establishments.

Overall, sample sizes are defined for each degree of stratification to ensure that statistical estimates achieve a precision of 7.5% within 90% confidence intervals, both for population proportions and for the mean of log-transformed sales.[7] The required sample size to reach this target tends toward 120 observations per stratum and may be increased in larger economies to account for potential non-response. A 25% non-response rate requires a sample size of 160 per group in order to end up with 120 usable observations. Evidence shows that the degree of non-response varies by type of firm. While most approaches to correcting for non-response rely on assumptions about how non-respondents relate to respondents, the Enterprise Surveys adopt a specific substitution strategy by cell of stratification. Establishments that refuse the interview are replaced by others belonging to the same combination of sector, size, and region. The underlying assumption is that firms operating within the same stratum face similar business environments and behave in comparable ways. This approach ensures that the original sample design is preserved.[8]

[7] Although 5% precision would be desirable, a precision of 7.5% is more in line with budget constraints.

[8] For transparency, non-response statistics are published along with the dataset in the Implementation Report of each survey.

**Table 1**

Summary statistics.

| Variables | N | Mean | S.D. | Min. | Q1 | Q2 | Q3 | Max. |
|---|---|---|---|---|---|---|---|---|
| **Firm characteristics** | | | | | | | | |
| $\text{Growth}_{i,k,j,(t,t-2)}$ | 79,746 | 4.833 | 46.763 | -74.045 | -14.200 | -3.369 | 9.983 | 533.472 |
| $\text{Sales}_{i,k,j,(t-2)}$ | 79,746 | 7.960 | 7.161 | -7.161 | 6.274 | 7.865 | 9.545 | 21.937 |
| $\text{State}_{i,k,j,(t)}$ | 79,746 | 0.012 | 0.108 | 0.000 | 0.000 | 0.000 | 0.000 | 1.000 |
| $\text{Foreign}_{i,k,j,(t)}$ | 79,746 | 0.096 | 0.295 | 0.000 | 0.000 | 0.000 | 0.000 | 1.000 |
| $\text{Export}_{i,k,j,(t)}$ | 79,746 | 0.225 | 0.418 | 0.000 | 0.000 | 0.000 | 0.000 | 1.000 |
| $\text{Size}_{i,k,j,(t)}$ | 79,746 | 2.545 | 0.751 | 1.000 | 2.000 | 3.000 | 3.000 | 3.000 |
| $\text{Firm age}_{i,k,j,(t)}$ | 79,746 | 19.272 | 14.861 | 0.000 | 9.000 | 16.000 | 25.000 | 210.000 |
| $\text{Managerial experience}_{i,k,j,(t)}$ | 79,746 | 18.727 | 11.123 | 0.000 | 10.000 | 17.000 | 25.000 | 72.000 |
| **Country variables** | | | | | | | | |
| $\text{Debt}_{j,(t-3,t-5)}$ | 79,746 | 50.205 | 24.162 | 0.000 | 33.956 | 49.031 | 69.668 | 183.315 |
| $\text{GDP growth}_{j,(t-3,t-5)}$ | 79,746 | 12.664 | 6.200 | 0.906 | 8.493 | 11.532 | 15.739 | 34.228 |
| $\text{Primary balance}_{j,(t-3,t-5)}$ | 79,746 | -3.536 | 3.811 | -40.553 | -5.832 | -2.884 | -1.267 | 8.463 |
| $\text{Income}_{j,(t-3,t-5)}$ | 79,746 | 6.411 | 2.404 | 1.384 | 4.649 | 6.133 | 7.563 | 12.248 |
| $\text{Inflation}_{j,(t-3,t-5)}$ | 79,746 | 7.170 | 5.357 | -0.100 | 3.772 | 5.083 | 10.407 | 31.884 |
| $\text{Population}_{j,(t-3,t-5)}$ | 79,746 | 17.616 | 1.967 | 12.144 | 16.168 | 17.484 | 18.680 | 21.026 |
| $\text{Corruption control}_{j,(t-3,t-5)}$ | 79,746 | -0.539 | 0.444 | -1.482 | -0.859 | -0.553 | -0.286 | 1.397 |
| $\text{Government effectiveness}_{j,(t-3,t-5)}$ | 79,746 | -0.342 | 0.493 | -1.676 | -0.685 | -0.321 | 0.029 | 1.019 |
| $\text{Rule of law}_{j,(t-3,t-5)}$ | 79,746 | -0.463 | 0.471 | -1.775 | -0.788 | -0.504 | -0.029 | 1.252 |
| $\text{Regulatory quality}_{j,(t-3,t-5)}$ | 79,746 | -0.300 | 0.464 | -1.517 | -0.597 | -0.265 | -0.051 | 1.037 |
| $\text{Political stability}_{j,(t-3,t-5)}$ | 79,746 | -0.778 | 0.746 | -2.762 | -1.257 | -0.855 | -0.252 | 1.171 |

## 3.2 Firm-level control variables

At the firm level, we build on the work of Chauvet and Ehrhart (2018), who examine the impact of foreign aid on firm growth. We control for the lagged value of sales, $Sales_{i,k,j,(t-2)}$, in logarithm. We also control for the characteristics of firm ownership using two variables, $State_{i,k,j,(t)}$ and $Foreign_{i,k,j,(t)}$.[9] $State_{i,k,j,(t)}$ is a dummy variable equal to one when part of the firm is owned by the state.[10] $Foreign_{i,k,j,(t)}$ is a dummy variable equal to one when part of the firm is owned by a foreign individual or company. Firm-level controls also include information on whether the firm is

[9]The firm-level characteristics are measured in $(t)$ since we do not have their pre-determined value at year $(t-2)$. Using contemporaneous firm characteristics may be a source of bias in the estimations.

[10]It is worth recalling that the WBES universe of inference excludes firms with over 99% state ownership.

outward-looking using $Export_{i,k,j,(t)}$, which is a dummy variable equal to one when the firm exports part of (or all) its sales, either directly or indirectly (as a supplier to exporting firms). The size of the firm is also included using $Size_{i,k,j,(t)}$, which takes the value of one for firms with fewer than 20 employees, the value two for firms with between 20 and 100 employees, and three for firms with more than 100 employees[11]. Drawing on insights from Nichter and Goldmark (2009), we enrich our specification with additional firm-level variables likely to influence sales growth in the context of developing economies.[12] More specifically, we control for firm age and the experience of the top manager, using $Firm\ age_{i,k,j,(t)}$ and $Managerial\ Experience_{i,k,j,(t)}$ respectively. In the case of owner gender, information was missing for a large share of firms located in Sub-Saharan African countries.[13] As for access to finance, it lies on the causal pathway between public debt and firm performance; controlling for it would introduce over-control bias by blocking part of the effect we seek to estimate Cinelli et al. (2024).

Table 1 presents summary statistics and shows that the sample is mostly composed of firms with more than 100 employees (70.33%). The remaining 29.57% is split almost equally between small firms (fewer than 20 employees) and medium-sized firms (20 to 100 employees). Around 1.2% of firms are partly state-owned, 9.6% are owned or partly owned by a foreign entity, and 22.5% are outward-looking. The average firm in the sample is just over 19 years old, with a median age of 16 years, indicating a relatively mature population. Top managers have, on average, 18.7 years of experience, with a median of 17 years. Together, these figures suggest that most firms in the dataset are not only large but also well-rooted and managed by experienced individuals. The average annual growth rate of firm sales is 4.83%, but displays substantial variation across firms with values ranging from –74.05% to 533.47%.

### 3.3 Country-level control variables

Unfortunately, there is no straightforward accounting identity that allows for a clean additive decomposition of changes in the debt ratio, which could have informed the choice of country-level control variables. However, the equation introduced by Escolano (2010) comes close. It shows that the evolution of the debt ratio depends only on the real interest rate, real growth, and fiscal adjustment. Hence, it shows that inflation has an impact on the debt ratio only to the extent that it lowers the real interest rate paid by the government. Otherwise, the higher nominal interest rates associated with higher inflation will fully offset the erosion in the real value of the debt due to inflation. Building on these insights, we control for the real GDP growth rate, the primary balance, and inflation, using $GDP\ growth_{j,(t-3,t-5)}$, $Primary\ Balance_{j,(t-3,t-5)}$, and $Inflation_{j,(t-3,t-5)}$ respectively. All three variables are averaged over three years, between $(t-3)$ and $(t-5)$. Information on real interest rates is not included, due to limited data availability across countries for the period considered. Then, we follow Beck et al. (2005) and Harrison et al. (2014), and control for the level of development using the logarithm of income per capita, $Income_{j,(t-3,t-5)}$[14]. We also control for the

[11]This variable enables more firms to be included in the sample, since the exact number of employees was missing for some firms.

[12]Through a systematic methodology, this study builds on a comprehensive review of the literature on small firm growth and offers a synthesis of the key factors associated with the expansion of micro and small enterprises (MSEs). MSEs are defined as firms with up to 50 employees, engaging in non-primary activities and selling at least half of their output.

[13]Owner gender could have been proxied using the following question in WBES: "Among the owners of the firm, are there any females?"

[14]We use GDP per capita in current local currency - World Development Indicators - and deflate it using the same deflator as for the firm-level variables $Growth_{i,k,j,(t,t-2)}$ and $Sales_{i,k,j,(t-2)}$ (base year = 2005).

size of the country using the logarithm of the population, $Population_{j,(t-3,t-5)}$, averaged over three years between $(t-3)$ and $(t-5)$. Finally, following Cooray et al. (2017) and Nichter and Goldmark (2009), we extend the set of country-level controls to include institutional quality measures drawn from the Worldwide Governance Indicators Kaufmann et al. (2011).[15] Specifically, we control for five dimensions: $Corruption\ control_{j,(t-3,t-5)}$, $Government\ effectiveness_{j,(t-3,t-5)}$, $Rule\ of\ law_{j,(t-3,t-5)}$, $Regulatory\ quality_{j,(t-3,t-5)}$, and $Political\ stability_{j,(t-3,t-5)}$. These indicators serve as proxies for broad perceptions of governance quality across countries and over time. Each variable is averaged over three years between $(t-3)$ to $(t-5)$, and expressed in standard normal units ranging from approximately -2.5 to 2.5. Higher values indicate better outcomes.

As shown in Table 1, $Debt_{j,(t-3,t-5)}$ averages 50.2% of GDP, but varies substantially across countries. Values range from 0% in Timor-Leste (2009, 2015), to 183.3% in Zambia (2007). Average debt levels also differ by income group: 40.8% for low-income countries (LICs), 57.5% for lower-middle-income countries (LMICs), and 48.6% for upper-middle-income countries (UMICs).[16] Real GDP growth averages 12.66% per year, but exhibits considerable dispersion, with values ranging from 0.91% to 34.23%. The average primary balance is –3.54% of GDP, suggesting that many countries in the sample run fiscal deficits, although some record surpluses of up to 8.46%. Inflation averages 7.17%, with some countries experiencing rates exceeding 30%. Lastly, the means of the five governance indicators—control of corruption, government effectiveness, rule of law, regulatory quality, and political stability—are all negative, reflecting that a large share of the sample consists of fragile states.

### 3.4 Identification strategy

Our econometric model controls for part of the time-invariant heterogeneity with country fixed effects, and includes a large set of firm-level and country-level variables as well as industry x year dummies to account for time-varying heterogeneity. However, as we cannot include firm fixed effects, it does not control for time-invariant heterogeneity at the firm-level. Endogeneity could also stem from time-varying unobservable heterogeneity, potentially correlated with both firm performance and public debt, as well as from reverse causality, since slumps in firm growth may be responsible for increases in the public-debt-to-GDP ratio (thereby biasing the estimated effect downward).

#### 3.4.1 Conventional instrumental variable

To account for these endogeneity channels, we construct an external instrument inspired by Panizza and Presbitero (2014), which exploits the fact that, when a portion of public debt is denominated in U.S. dollars, fluctuations in the bilateral exchange rate affect a country's public-debt-to-GDP ratio via the valuation effect channel. Formally, let $Foreign\ Debt_{j,(t-3,t-5)}$ denote the average share of public debt issued by country $j$ and denominated in U.S. dollars over the three-year period from $(t-5)$ to $(t-3)$. Let $Exchange\ Rate_{j,(t-4,t-6)}$ denote the variation in the bilateral exchange rate (in logarithm) over the period from $(t-6)$ to $(t-4)$. We then propose the following instrument for the public-debt-to-GDP ratio of country $j$ over the period $(t-3, t-5)$:

$$VE_{j,(t-3,t-5)} = Foreign\ Debt_{j,(t-3,t-5)} \times Exchange\ Rate_{(t-4,t-6)} \tag{2}$$

[15] Worldwide Governance Indicators, 2024 Update, World Bank (www.govindicators.org), accessed on 10/30/2024.
[16] Income groups follow the World Bank country classification for 2024-2025.

To be a good instrument, $VE_{j,(t-3,t-5}$ needs to satisfy two restrictions. First, it needs to be relevant–that is, correlated with the public-debt-to-GDP ratio. Second, it needs to be exogenous: to affect firm growth only through its effect on the public-debt-to-GDP ratio. In other words, the instrumental variable needs to have a direct effect on the public-debt-to-GDP ratio, but no direct (or indirect, except for the one going through public debt) effect on firm growth.

Relevance is supported by the mechanical relationship between $VE_{j,(t-3,t-5)}$ and the public-debt-to-GDP ratio (Escolano (2010)). However, the instrument would be uninformative in countries that have no U.S. dollar-denominated debt or exhibit very stable exchange rates, as $VE_{j,(t-3,t-5)}$ would then be mechanically equal to zero. This is not a concern in our sample, which focuses on developing economies that typically carry substantial U.S. dollar-denominated debt and experience significant exchange rate volatility (Hausmann et al. (2006)). Regarding the exclusion restriction, we must assume that valuation effects are uncorrelated with the error term in Equation (1). Violations could arise if $VE_{j,(t-3,t-5)}$ is correlated with omitted variables that also influence firm growth. Additionally, one might worry that exchange rate fluctuations have a direct effect on firm performance through other channels, such as trade competitiveness or input prices.

### 3.4.2 Heteroscedasticity-based instruments

To address these concerns, we follow Lewbel (2012), who provides a method of identifying structural parameters in settings whether other sources of identification, such as instrumental variables, are not available, or could be complemented to enhance estimation efficiency. The identification comes from having regressors uncorrelated with the product of heteroscedastic errors, which is shown to be a feature of many models in which error correlations are due to an unobserved common factor or measurement errors.[17] Notably, the method can still provide informative bounds on the parameters of interest even if the main identifying assumption does not hold.

Let $Y_1$ and $Y_2$ be observed endogenous variables (measures of firm growth and public debt in our case), and $X$ a vector of observed exogenous regressors. Consider a system of structural models, in which the errors $\epsilon_1$ and $\epsilon_2$ may be correlated with each other:

$$Y_1 = X'\beta_1 + Y_2\gamma_1 + \epsilon_1 \tag{3}$$

$$Y_2 = X'\beta_2 + Y_1\gamma_2 + \epsilon_2 \tag{4}$$

This system of equations is triangular when $\gamma_2 = 0$. Otherwise, it is fully simultaneous (if it is know that $\gamma_1 = 0$, then renumber the equations to set $\gamma_2 = 0$).

Assume $E(\epsilon X) = 0$, which is the standard minimal regression assumption for the exogenous regressors. This permits identification of the reduced form, but is of course not sufficient to identify the structural model coefficients. Typically, identification is obtained by imposing equality constraints on some coefficients, such as assuming that some elements of $\beta_1$ or $\beta_2$ are zero, which is equivalent to assuming the availability of instruments.

Lewbel (2012) instead obtains identification by restricting correlations of $\epsilon\epsilon'$ with $X$. However, this does not automatically provide identification. In particular, the structural model parameters remain unidentified under the standard homoscedasticity assumption that $E(\epsilon\epsilon'|X)$ is constant, and

[17] The idea of using heteroscedasticity in some way to help estimation appears in Wright (1928) and so is virtually as old as the method of instrumental variables itself.

more generally, are not identified when $\epsilon$ and X are independent. In a fully simultaneous system, two assumptions are therefore required: that $cov(X, \epsilon_j^2) \neq 0$ for both $j = 1$ and $j = 2$, and that $cov(Z, \epsilon_1\epsilon_2) = 0$ for an observed $Z$, where $Z$ can be a subset of $X$. Identification of the structural model parameters can then be achieved using an ordinary linear two-stage least squares regression of $Y_1$ on $X$ and $Y_2$, using $X$ and $[Z - \overline{Z}]\epsilon_2$ as instruments, where $\overline{Z}$ is the sample mean of $Z$.[18]

# 4 The impact of public debt on firm growth

## 4.1 Baseline results

Before presenting our core Two-Stage Least Squares (TSLS) results, we first examine the correlation between public debt and firm growth estimated using Ordinary Least Squares (OLS). Column (1) reports the coefficient on the public-debt-to-GDP ratio from a baseline specification without any control variables or fixed effects. In columns (2) to (8), we progressively enrich the specification by sequentially adding firm- and country-level controls, as well as fixed effects. Column (8) presents the final OLS estimation of Equation 1, which includes the full set of firm- and country-level covariates, along with country and industry x year dummies. WBES sampling probability weights are applied, and standard errors are clustered at the country x year level. Across all specifications, the sample remains constant, including 79,746 firms.

In these estimations, the coefficient on $Sales_{i,k,j,(t-2)}$ points to a catching-up effect: firms with lower initial sales in $(t-2)$ tend to have higher subsequent growth rates in $(t)$ than firms that already had high sales levels. The coefficient on $State_{i,k,j,(t)}$ is consistently positive and significant, and suggests that being partly owned by the state boosts firm performance. Still regarding ownership structure, $Foreign_{i,k,j,(t)}$ displays a positive coefficient across all OLS estimations but only becomes statistically significant from Column (6) onwards, indicating that foreign-owned firms tend to grow faster. $Export_{i,k,j,(t)}$ and $Size_{i,k,j,(t)}$ are both positively and significantly associated with firm growth across all estimations, suggesting that outward-oriented and larger firms experience higher growth rates. As suggested by Nichter and Goldmark (2009), the coefficient on $Firm\ age_{i,k,j,(t)}$ is consistently negative and significant. This implies that, on average, younger firms grow more rapidly than older ones. Conversely, $Managerial\ experience_{i,k,j,(t)}$ does not show any significant influence on firm growth in our sample, despite theoretical expectations of a positive contribution. Indeed, it could help in two ways: directly, by enhancing firm capabilities via accumulated skills and knowledge; and indirectly, by expanding entrepreneurs' social and professional networks.

Regarding the relationship between public debt and firm growth, Column (1) initially reports a negative but statistically non-significant coefficient for $Debt_{j,(t-3,t-5)}$. From Column (2) onwards, the coefficient turns positive and significant, and remains so as controls and fixed effects are progressively included. In the most complete OLS estimation, we find that a one percentage point increase in the public-debt-to-GDP ratio is associated with a 0.19 percentage point increase in firm sales growth. Interestingly, the coefficient is slightly higher and reaches approximately 0.23–0.24 percentage points in Column (9), when public debt is instrumented following Lewbel (2012). The sign and significance

[18]The identification here is based on higher moments and so is likely to give noisier, less reliable estimates than identification based on standard exclusion restrictions. However, it may be useful in applications where traditional instruments are not available. As of today, a literature review shows similarly satisfactory empirical results obtained by other researchers using this methodology.

of the other coefficients also remain broadly stable. This is consistent with the idea that tackling endogeneity issues reduces the downward bias running from firm growth to public-debt-to-GDP ratios, thus leading to less adverse estimates.[19]

Column (10) presents results using the conventional external instrument based on valuation effects. In this case, the coefficient remains positive but is no longer statistically significant, raising concerns about the strength of this instrument when used on its own. However, the instrument itself is relevant: in the first-stage regressions, the coefficient associated with valuation effects remains positive and statistically significant, as expected. This indicates that an appreciation of the U.S. dollar, through valuation effects, leads to an increase in public-debt-to-GDP ratios. In contrast, when we combine internal and external instruments in a two-stage least squares (TSLS) estimation (Column (11)), the coefficient increases further—reaching approximately 0.45–0.46 percentage points—and becomes statistically significant.

It should nonetheless be emphasized that these findings refer to the average effect of public debt levels on firm growth. Given the considerable variance, we cannot totally rule out potential country cases where higher public debt levels are associated with either positive or negative firm growth outcomes. Furthermore, it is well-known that both data and econometric specification choices can significantly influence the magnitude and significance of estimated effects.

[19] Slumps in firm growth may fuel increases in public-debt-to-GDP (downward bias).

**Table 2**

Baseline estimations.

| Dep. var.: Growth$_{i,k,j,(t,t-2)}$ | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | OLS | | | | | | | | TSLS | | |
| Debt$_{j,(t-3,t-5)}$ | -0.119 | 0.363** | 0.340** | 0.573*** | 0.146 | 0.179* | 0.217** | 0.185** | 0.231** | 0.127 | 0.464** |
| | (0.090) | (0.145) | (0.141) | (0.124) | (0.091) | (0.095) | (0.098) | (0.091) | (0.099) | (0.304) | (0.149) |
| **Firm var.:** | | | | | | | | | | | |
| Sales$_{i,k,j,(t-2)}$ | | | -4.378*** | -4.682*** | | -4.106*** | -4.502*** | -4.722*** | -4.721*** | -4.568*** | -4.551*** |
| | | | (0.747) | (0.829) | | (0.612) | (0.696) | (0.835) | (0.835) | (0.817) | (0.813) |
| State$_{i,k,j,(t)}$ | | | 10.058** | 9.774** | | 8.643** | 8.243** | 8.518** | 8.509** | 8.689** | 8.612** |
| | | | (4.338) | (3.930) | | (3.856) | (3.947) | (4.131) | (4.132) | (4.233) | (4.240) |
| Foreign$_{i,k,j,(t)}$ | | | 2.528 | 2.866 | | 4.475** | 3.830** | 3.565* | 3.564* | 3.435* | 3.424* |
| | | | (1.728) | (1.833) | | (1.937) | (1.833) | (1.827) | (1.827) | (1.837) | (1.830) |
| Export$_{i,k,j,(t)}$ | | | 6.425*** | 6.609*** | | 7.897*** | 7.156*** | 6.861*** | 6.863*** | 7.832*** | 7.840*** |
| | | | (1.388) | (1.241) | | (1.352) | (1.314) | (1.260) | (1.260) | (0.829) | (0.830) |
| Size$_{i,k,j,(t)}$ | | | 5.840** | 7.128** | | 9.757*** | 10.181*** | 11.051*** | 11.034*** | 10.512*** | 10.450*** |
| | | | (2.696) | (2.996) | | (2.114) | (2.083) | (2.011) | (2.010) | (1.907) | (1.907) |
| Firm age$_{i,k,j,(t)}$ | | | -0.079*** | -0.082*** | | -0.089*** | -0.086*** | -0.077** | -0.077** | -0.076** | -0.077** |
| | | | (0.028) | (0.030) | | (0.028) | (0.029) | (0.031) | (0.031) | (0.030) | (0.031) |
| Managerial experience$_{i,k,j,(t)}$ | | | 0.055 | 0.067 | | 0.078 | 0.079 | 0.068 | 0.068 | 0.049 | 0.049 |
| | | | (0.070) | (0.064) | | (0.060) | (0.062) | (0.067) | (0.066) | (0.072) | (0.072) |
| **Country var.:** | | | | | | | | | | | |
| GDP growth$_{j,(t-3,t-5)}$ | | | | 1.043 | | | -0.025 | -1.454** | -1.375* | -1.529* | -0.999 |
| | | | | (0.847) | | | (0.529) | (0.699) | (0.719) | (0.807) | (0.696) |
| Primary balance$_{j,(t-3,t-5)}$ | | | | -0.364 | | | -0.171 | -0.140 | -0.129 | -0.300 | -0.001 |
| | | | | (0.824) | | | (0.686) | (0.628) | (0.630) | (0.794) | (0.704) |
| Income$_{j,(t-3,t-5)}$ | | | | -13.698 | | | -1.122** | 0.092 | 2.516 | 4.163 | 22.090 |
| | | | | (14.746) | | | (0.533) | (16.942) | (16.936) | (26.476) | (19.400) |
| Inflation$_{j,(t-3,t-5)}$ | | | | -1.563* | | | -0.630 | 0.835 | 0.743 | 0.887 | 0.314 |
| | | | | (0.797) | | | (0.463) | (0.597) | (0.624) | (0.784) | (0.631) |
| Population$_{j,(t-3,t-5)}$ | | | | 30.721 | | | -2.620** | 12.322 | 16.182 | 4.683 | 34.270 |
| | | | | (27.910) | | | (1.195) | (30.714) | (30.818) | (39.465) | (32.900) |
| Corruption control$_{j,(t-3,t-5)}$ | | | | -3.383 | | | 4.277 | 7.383 | 6.950 | 4.142 | 3.526 |
| | | | | (10.375) | | | (7.310) | (9.201) | (9.271) | (8.423) | (8.390) |
| Government effectiveness$_{j,(t-3,t-5)}$ | | | | -18.777 | | | 7.504 | -17.495** | -17.389** | -15.188* | -16.830 |
| | | | | (14.744) | | | (6.819) | (8.403) | (8.385) | (9.253) | (8.680) |
| Rule of law$_{j,(t-3,t-5)}$ | | | | -20.221 | | | -19.324** | -25.644** | -26.036** | -21.750** | -23.900 |
| | | | | (12.697) | | | (8.850) | (10.222) | (10.139) | (10.525) | (10.600) |
| Regulatory quality$_{j,(t-3,t-5)}$ | | | | 16.122 | | | 7.354 | 4.567 | 4.717 | 3.287 | 3.741 |
| | | | | (17.318) | | | (6.538) | (9.630) | (9.633) | (9.904) | (9.910) |
| Political stability$_{j,(t-3,t-5)}$ | | | | -20.221* | | | 2.421 | 7.959* | 7.990* | 6.102 | 6.748 |
| | | | | (12.697) | | | (2.420) | (4.507) | (4.498) | (4.843) | (4.960) |
| First-step results: | | | | | | | | | | | |
| VE$_{j,(t-3,t-5)}$ | - | - | - | - | - | - | - | - | - | 0.252*** | 0.125*** |
| | - | - | - | - | - | - | - | - | - | (0.062) | (0.043) |
| Country FE | No | Yes | Yes | Yes | No | No | No | Yes | Yes | Yes | Yes |
| Ind. x Year FE | No | No | No | No | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Level of se clustering | Cntr-Year | Cntr-Year | Cntr-Year | Cntr-Year | Cntr-Year | Cntr-Year | Cntr-Year | Cntr-Year | Cntr-Year | Cntr-Year | Cntr-Year |
| # | 79746 | 79746 | 79746 | 79746 | 79746 | 79746 | 79746 | 79746 | 79746 | 79746 | 79746 |
| R-squared | 0.004 | 0.065 | 0.113 | 0.125 | 0.077 | 0.121 | 0.137 | 0.158 | 0.158 | 0.158 | 0.161 |
| Kleibergen-Paap LM stat (p-value) | - | - | - | - | - | - | - | - | - | 0.013 | 0.001 |
| Kleibergen-Paap F-stat | - | - | - | - | - | - | - | - | - | 16.741 | 15.291 |
| Stock-Yogo critical value | - | - | - | - | - | - | - | - | - | 16.38 | 11.46 |

Note: Columns (1) to (8) display OLS estimates. Columns (9) to (11) display TSLS estimates, using heteroskedasticity-based instruments, conventional instruments, and both at the time respectively. Robust standard-errors clustered at the country × year level are shown in parentheses. WBES sampling probability weights are used for estimation. The under-identification stems from the Kleibergen-Paap LM statistic. The weak identification test stems from the Kleibergen-Paap Wald F-statistic. The Stock-Yogo weak identification test critical value at 10%. Constant term not reported in order to save space. ***, ** and * denote significance at 1%, 5% and 10% levels."

## 4.2 Robustness checks

### 4.2.1 Sample dependence

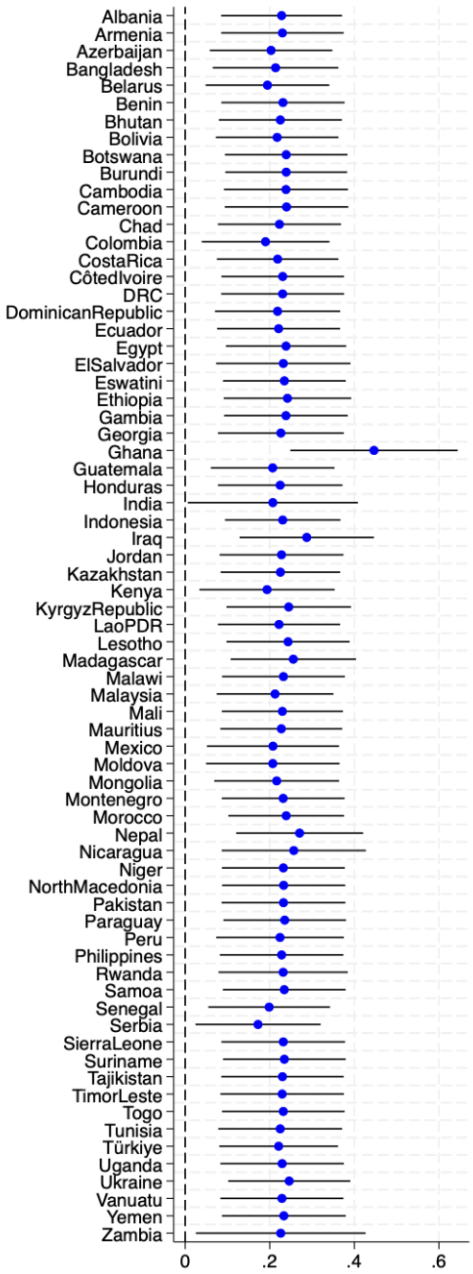


Figure 1: Leave-one-out test (TSLS estimates using heteroscedasticity-based instruments).

Given that the effect of public debt on firm growth may vary across countries, we implement two sets of robustness checks to assess the sensitivity of our results to sample composition.

First, we test whether our baseline estimates are driven by any single country. Figure 1 displays the results from re-estimating our Lewbel IV specification (Column (9) of Table (2)), leaving out one country at a time. The estimated coefficients remain broadly stable, suggesting that no individual country unduly drives the results.

**Table 3**

Random draw of firms.

| Dep. var.: Growth$_{i,k,j,(t,t-2)}$ | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| | OLS | | TSLS | |
| Number of firms randomly drawn | 150 | 250 | 150 | 250 |
| Debt$_{j,(t-3,t-5)}$, 500 replications | 0.212 | 0.218 | 0.228 | 0.213 |
| Standard deviation | (0.034) | (0.026) | (0.096) | (0.098) |
| Percent not significant | 5.6 | 0.8 | 4.2 | 1.9 |
| # | | | | |

Note: Columns (1) and (2) display OLS estimates. Columns (3) and (4) display TSLS estimates, using heteroskedasticity-based instruments. All regressions include country- and firm-level control variables, as well as country and industry × year fixed effects. Robust standard-errors clustered at the country × year level are shown in parentheses. WBES sampling probability weights are used for estimation. ***, ** and * denote significance at 1%, 5% and 10% levels."

Second, we give each country-year combination the same weight by randomly drawing an equal number of firms from each survey.[20] Columns (1) and (2) of Table 3 report OLS estimates based on the specification from Column (8) of Table (2), using random sub-samples of 150 and 250 firms per country-year, respectively. Each random draw is replicated 500 times, and we report the average estimated coefficient for public debt, its standard deviation, and the percentage of replications in which the coefficient is not significantly different from zero. The resulting average coefficients, 0.212 and 0.218, are very close to the original estimate. Moreover, the percentage of replications where the coefficient is not significant remains low, at 5.6% and 0.8%, respectively.

Columns (3) and (4) of Table (3) present the same exercise for the TSLS Lewbel IV estimates based from Column (9) of Table (2). The estimated average coefficients are 0.228 and 0.213, with standard deviations of 0.096 and 0.098, respectively. The share of non-significant replications remains low, between 1.9% and 4.2%. These results suggest that the baseline findings are not driven by sampling imbalance across countries, and are robust to equalizing country weights in the estimation.

### 4.2.2 The choice of Z

In Lewbel's methodology, the choice of $Z$ refers to the set of control variables used to construct the internal instruments. Since this choice is difficult to justify on theoretical grounds, it is important to assess whether the results are sensitive to alternative specifications. To do so, we re-estimate the specification presented in Column (9) of Table 2 by sequentially modifying the composition of the vector $Z$. First, we exclude the micro-level controls and construct the internal instruments using only

[20] As shown in Table A.2, different samples of firms were surveyed in each country. Since debt is measured at the country level, this implies that countries with a larger number of surveyed firms are over-weighted in the estimation.

macro-level variables. The resulting coefficient is 0.241** (0.100), which is very close to the baseline estimate. Then, we reverse the exercise and exclude the macro-level controls, keeping only firm-level variables in the construction of $Z$. In this case, the coefficient is 0.227** (0.095), again consistent in magnitude and significance. These results suggest that the main conclusion—namely, that the IV estimate of the average effect of public-debt-to-GDP ratios on firm growth is positive and slightly higher than the OLS estimate—holds across reasonable variations in the definition of $Z$.

# 5 Mechanisms

So far, our results suggest that public debt has, on average, a positive effect on firm performance. Given the timing structure of our econometric specification, we believe that demand-side mechanisms are partly driving this outcome. As mentioned before, a debt-financed fiscal expansion may, in the short term, increase the overall demand for goods and services, thereby fostering firm growth provided that firms are able to scale up production accordingly (Elmendorf and Mankiw (1999)). Over the longer term, however, this positive effect may be offset. Economic agents may anticipate future tax increases and save more in response to a debt-financed fiscal expansion. On the supply-side, debt accumulation may also affect the productive capacity of firms by influencing access to credit, and the provision of public infrastructure and services that complement private sector activities. Private investment may be crowded out if fiscal expansions drive up interest rates. Furthermore, as public debt accumulation raises concerns among lenders and increases borrowing costs, an even-larger share of public revenues may be absorbed by debt service, thereby reducing the fiscal space available for essential development spending (Krugman (1988)).

When exploring the channels through which public debt accumulation may impact firm performance, we do not rule out these negative effects *a priori*. Therefore, we first test whether public debt benefits more (or less) firms facing particular constraints–such as finance, infrastructure deficiencies or institutional barriers. To assess the relative importance of these constraints, we combine opinion-based survey questions with hard-data, assuming that objective measures can help mitigate potential biases inherent in subjective perceptions. Then, we examine how firms are impacted by debt based on the structural characteristics of their particular industry. To this end, we follow an empirical strategy similar to Rajan and Zingales (1998) and interact the debt variable with exogenous sector-specific input intensities that are meant to capture the channels through which debt may affect firm growth. These intensities are constructed following Levchenko (2007) and Nunn (2007), using the U.S. input-output matrix (2000–2014) from the World Input-Output Database (WIOD) (Timmer et al. (2015)).

## 5.1 Do some firms benefit more from public debt than others?

A natural question arising from the literature is whether the influence of public debt on firm performance depends on the specific constraints firms face in their business operations. One way to explore this heterogeneity is to re-estimate the baseline specification, augmented with an interaction between the debt variable and a set of binary indicators identifying the binding constraints:

$$\begin{aligned} Growth_{i,k,j,(t,t-2)} = \alpha + \beta Debt_{j,(t-3,t-5)} + \gamma Debt_{j,(t-3,t-5)} * X_{i,k,j,(t)} \\ + \delta X_{i,k,j,(t)} + Y_{j,(t-3,t-5)} + \tau_{k,(t)} + \mu_j + \epsilon_{i,k,j,(t)} \end{aligned} \tag{5}$$

To assess whether a constraint is binding, we first rely on opinion-based survey questions. Specifically, we construct a set of binary variables that take the value of one whenever business owners or senior managers report a moderate, major, or very severe obstacle to business operations. This approach offers at least two main advantages. First, it ensures consistency in the definition of binary variables across different potential constraints. Second, it preserves a large number of observations, as information is rarely missing for opinion-based survey questions in the repeated cross-sectional World Bank Enterprise Surveys dataset. That being said, relying on business owners' and senior managers' perceptions also entails an important limitation. Indeed, such subjective assessments may introduce bias into the analysis. In particular, respondents may have strategic incentives to overstate certain constraints if they believe that doing so could attract external support in the future. We believe this is credible given the significant share of infrastructure development projects financed by the World Bank. Furthermore, subjective responses are not immune to unintentional biases. Differences in individual experiences, expectations, or levels of information may lead respondents to perceive the same objective constraint differently. As a result, the constructed set of binary variables may capture not only actual business conditions but also psychological, cultural, or informational factors, thereby further complicating the interpretation of the results.

**Table 4**

Impact of public debt for different kinds of firms.

| Dep. var.: Growth$_{i,k,j,(t,t-2)}$ | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
|---|---|---|---|---|---|---|---|---|---|---|
| Var.$_{i,k,j,(t)}$ = 1 | Electricity | Telecom-munications | Transport | Informal sector | Courts | Tax rates | Political instability | Corruption | Finance | Education |
| | | | | | OLS | | | | | |
| Debt$_{j,(t-3,t-5)}$ | 0.243** | 0.162* | 0.210** | 0.224** | 0.181* | 0.219** | 0.194** | 0.195** | 0.207** | 0.202** |
| | (0.097) | (0.098) | (0.094) | (0.097) | (0.092) | (0.094) | (0.093) | (0.095) | (0.094) | (0.094) |
| Variable$_{j,(t-3,t-5)}$ | 5.861** | -2.044 | 2.364 | 1.548 | -1.835 | 1.774 | -0.425 | -0.214 | 1.294 | 1.799 |
| | (2.741) | (3.615) | (2.130) | (2.744) | (1.968) | (2.063) | (2.225) | (2.231) | (1.896) | (2.351) |
| Debt$_{j,(t-3,t-5)}$ x Variable$_{j,(t-3,t-5)}$ | -0.104** | 0.038 | -0.064 | -0.077 | -0.014 | -0.058* | -0.024 | -0.024 | -0.050 | -0.042 |
| | (0.044) | (0.058) | (0.041) | (0.053) | (0.048) | (0.031) | (0.033) | (0.036) | (0.039) | (0.041) |
| # | 79746 | 79746 | 79746 | 79746 | 79746 | 79746 | 79746 | 79746 | 79746 | 79746 |

Note: Columns (1) to (10) display OLS estimates. All regressions include country- and firm-level control variables, as well as country and industry × year fixed effects. Robust standard-errors clustered at the country × year level are shown in parentheses. WBES sampling probability weights are used for estimation. ***, ** and * denote significance at 1%, 5% and 10% levels."

Table (4) presents the results when Equation 6 is estimated on the full sample of firms. In column (1), we investigate whether firms benefit more (or less) from public debt accumulation when they face an electricity constraint. In line with theoretical considerations, public debt seems less effective in spurring firm growth for firms facing electricity-related challenges. This is suggested by the negative and statistically significant coefficient associated with the interaction between $Debt_{j,(t-3,t-5)}$ and $Electricity_{i,k,j,(t)}$. By contrast, and contrary to expectations, the coefficient on $Electricity_{i,k,j,(t)}$ is positive and statistically significant, suggesting that electricity-constrained firms grow, on average, 5.9 percentage points faster. Given the subjective nature of the information used to characterize a constraint as binding, this finding can be interpreted as likely reflecting biases in subjective responses rather than a true growth-enhancing effect of electrical constraints. Alternatively, it is possible that, in contexts characterized by widespread infrastructure deficiencies, our indicator captures better access to electricity rather than the severity of the constraint itself. We consider this plausible, as 49% of firms in the sample report being electricity-constrained.

We now turn to Column (6), where we examine whether public debt benefits firms more (or less) when they face a tax-rate constraint. Here too, the negative and statistically significant coefficient associated with the interaction between $Debt_{j,(t-3,t-5)}$ and $Tax\ rates_{i,k,j,(t)}$ is consistent with theoretical considerations. Public debt accumulation appears less effective in promoting firm performance among those facing tax-related challenges. Notably, this could reflect either a demand-side or a supply-side mechanism. In fact, rational consumers may anticipate future tax hikes and save more in response to a debt-financed fiscal expansion, thereby reducing firms' sales. In the same way, business owners may choose to reduce or delay investment. We believe this is particularly likely in environments already characterized by high tax rates. Additionally, high-tax environments may lack fiscal space for essential development spending, thereby undermining investment in public infrastructure and services that are critical to productive activities.

**Table 5**

Impact of public debt for different kinds of firms.

| Dep. var.: $\text{Growth}_{i,k,j,(t,t-2)}$ | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
|---|---|---|---|---|---|---|---|---|---|---|
| $\text{Var.}_{i,k,j,(t)} = 1$ | Electricity | Water | Transport | Telecom-munications | Corruption | Public contracts | Tax admin-istrations | Courts | Credit | High school |
| | | | | | OLS | | | | | |
| $\text{Debt}_{j,(t-3,t-5)}$ | 0.094** | 0.143** | 0.107** | 0.061* | 0.193** | 0.236** | 0.200** | 0.210** | 0.119* | 0.136** |
| | (0.039) | (0.068) | (0.050) | (0.029) | (0.092) | (0.105) | (0.094) | (0.101) | (0.068) | (0.060) |
| $\text{Variable}_{j,(t-3,t-5)}$ | -4.101** | 0.023 | -4.406* | 2.827 | -1.609 | 8.648*** | 2.146 | -6.237** | 0.641 | 6.070* |
| | (1.952) | (3.695) | (2.239) | (3.307) | (2.963) | (2.933) | (2.452) | (2.613) | (5.935) | (3.340) |
| $\text{Debt}_{j,(t-3,t-5)}$ x $\text{Variable}_{j,(t-3,t-5)}$ | 0.046 | 0.001 | 0.100** | 0.139** | 0.003 | -0.143** | 0.002 | 0.086** | 0.029 | -0.087* |
| | (0.036) | (0.057) | (0.039) | (0.058) | (0.043) | (0.063) | (0.035) | (0.040) | (0.080) | (0.050) |
| # | 75776 | 37832 | 79746 | 53363 | 79746 | 72594 | 79303 | 63577 | 68430 | 41727 |

Note: Columns (1) to (10) display OLS estimates. All regressions include country- and firm-level control variables, as well as country and industry × year fixed effects. Robust standard-errors clustered at the country × year level are shown in parentheses. WBES sampling probability weights are used for estimation. ***, ** and * denote significance at 1%, 5% and 10% levels."

Using hard data is one way to construct objective measures and thereby mitigate the potential biases inherent in subjective perceptions. Therefore, we redefine the set of binary indicators identifying the binding constraints. In doing so, we adhere to a guiding principle: making the best possible use of the available information while maintaining a concern for objectivity.

Table (5) presents the results of the estimation of Equation 6 on the available sample of firms, which varies depending on the specific binary variable considered. In column (1), we investigate whether firms benefit more (or less) from public debt accumulation when they experienced power outages during the last fiscal year, without owing or sharing a generator. This time, we do not find evidence of significant heterogeneity. However, the coefficient associated with $Electricity_{i,k,j,(t)}$ has turned negative and remains significant, which may suggest that our objective measure better captures firms' exposure to electricity constraints. In other words, the growth-enhancing effect of electrical constraints has disappeared.

In Column (3), we assess whether the effects of public debt accumulation vary for firms that depend on well-functioning transport infrastructure. This dependency is proxied by a binary variable equal to one if the firm exported part or all of its sales—either directly or indirectly (as a supplier to exporting firms)—or if some of its material inputs and supplies were not of domestic origin during the last fiscal year. The negative and statistically significant coefficient on the $Transport_{i,k,j,(t)}$ variable indicates that firms not reliant on transport infrastructure tend to grow faster. Conversely, the positive and

significant coefficient on the interaction between $Debt_{j,(t-3,t-5)}$ and $Transport_{i,k,j,(t)}$ suggests that debt accumulation helps relieve constraints for firms that do depend on such infrastructure.

In Column (4), we turn to the role of telecommunication infrastructure in shaping firms' responses to public debt accumulation. Telecommunication dependency is captured by a binary variable equal to one for firms that use email to communicate with clients or suppliers, or that rely on internet services to place orders, deliver services, conduct research, or develop new products. The interaction between $Debt_{j,(t-3,t-5)}$ and $Telecommunications_{i,k,j,(t)}$ yields a positive and statistically significant coefficient, implying that firms reliant on telecommunications benefit more from debt accumulation. In contrast, the coefficient on $Telecommunications_{i,k,j,(t)}$ is positive but not statistically significant, suggesting that using telecommunication tools alone is not systematically associated with higher growth.

In Column (6), we consider whether access to public procurement influences the relationship between public debt and firm performance. The positive and statistically significant coefficient on $Public\ contracts_{i,k,j,(t)}$ implies that firms having secured a government contract within the past twelve months—or at any point over the past three years—tend to experience faster growth. This effect is economically meaningful: holding a government contract is associated with an 8.6 percentage point increase in subsequent firm growth. However, the negative and significant coefficient on the interaction between $Debt_{j,(t-3,t-5)}$ and $Public\ contracts_{i,k,j,(t)}$ indicates that these firms benefit less from public debt accumulation, potentially due to reduced availability of contracts as fiscal space tightens.

In Column (8), we investigate whether perceptions of legal institutions condition the effect of public debt on firm growth. The negative and statistically significant coefficient on the $Courts_{i,k,j,(t)}$ variable shows that stronger, more trustworthy legal systems are associated with improved firm performance. When legal institutions are weak, firms face higher uncertainty in enforcing contracts and protecting their rights, which can discourage investment and innovation—particularly in sectors where formal legal mechanisms are essential. The interaction between $Debt_{j,(t-3,t-5)}$ and $Courts_{i,k,j,(t)}$ yields a positive and significant coefficient, suggesting that debt accumulation helps mitigate the institutional constraints faced by firms in such environments.

Finally, in Column (10), we analyze whether public debt accumulation has a differentiated impact on firms that employ only full-time workers with a high school education. The positive and statistically significant coefficient on $High\ school_{i,k,j,(t)}$ indicates that employing a more educated workforce is associated with faster firm growth. Yet, the interaction term between $Debt_{j,(t-3,t-5)}$ and $High\ school_{i,k,j,(t)}$ is negative and statistically significant, indicating that firms employing more educated workers gain less from public debt accumulation.

### 5.2 Through which channels does debt affect firm growth?

To take the analysis a step further, we examine how firms are affected by public debt depending on the structural characteristics of their industry. To this end, we follow an empirical strategy similar to Rajan and Zingales (1998), interacting the debt variable with exogenous sector-specific input intensities. This leads to the following general specification:

$$Growth_{i,k,j,(t,t-2)} = \alpha + \beta X_{i,k,j,(t)} + \delta Debt_{j,(t-3,t-5)} * Intensity_k + \tau_{k,(t)} + \gamma_{j,(t)} + \epsilon_{i,k,j,(t)} \quad (6)$$

where we replace the country-level control variables from Equation 1 with country x year fixed effects, $\gamma_{j,(t)}$, and include an interaction term between $Debt_{j,(t-3,t-5)}$ and $Intensity_k$.

We focus on three potential mechanisms: infrastructure deficiencies, financial dependence, and institutional barriers. The exposure of the industries to these mechanisms is supposed to be captured by the different intensities, which reflect the structural dependence on electricity and water provision, transport and telecommunications infrastructure, education and health services, public administration, finance, and institutions. To construct these intensities, we follow Levchenko (2007) and Nunn (2007) and use the U.S. input-output matrix (2000–2014) from the World Input-Output Dataset (WIOD) (Timmer et al. (2015)).[21] First, we calculate for each industry the average share of a set of specific inputs in total intermediate consumption over the period 2000–2014. Then, we define a set of binary variables that take the value of one when the corresponding share exceeds the 75th percentile across industries. For finance- and institutions-related intensities, the approach is different. For finance, we rely on the external finance indicator developed by Kroszner et al. (2007) for U.S. industries over the period 1980–1999, which measures the share of capital expenditures not financed through internal cash flow.[22] As before, we define a binary variable equal to one if the indicator exceeds the 75th percentile across industries. For institutions, we build on Levchenko (2007) and use a measure of product complexity, as there is no well-accepted industry-level index of institutional dependence.[23] In particular, we use the Herfindhal index of intermediate input use, computed from the U.S. input-output matrix (2000–2014). The rationale for using it rather than simply the number of intermediates employed in production is the following. If intermediate input use is dominated by one or two inputs (high concentration) and all the other intermediates are used very little, than what really matters is to the final good producer is the relationship it has with the largest one or two suppliers. The scope for and importance of expropriation by suppliers of minor inputs is probably much smaller than by important suppliers. Thus, simply taking the number of intermediates may give excessive weight to insignificant input suppliers and overestimate the effective reliance on institutions. Because the Herfindhal index increases with concentration, we multiply it by minus one in order to have a measure that increases in institutional intensity.

**Table 6**

Impact of public debt for different kinds of industries.

| Dep. var.: Growth$_{i,k,j,(t,t-2)}$ | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
|---|---|---|---|---|---|---|---|---|---|
| Intensity$_k$ = 1 | Electricity | Water | Transport | Telecomm-unications | Education | Health | Public admin-istrations | External dependence | Institutions |
| | | | | | OLS | | | | |
| Debt$_{j,(t-3,t-5)}$ | 0.686*** | 0.688*** | 0.706*** | 0.688*** | 0.692*** | 0.690*** | 0.696*** | 1.947*** | 0.687*** |
| | (0.074) | (0.074) | (0.077) | (0.073) | (0.074) | (0.073) | (0.074) | (0.053) | (0.074) |
| Intensity$_k$ | 0.093 | -2.690 | 1.584 | 5.658* | 4.418 | 7.207* | 11.158** | 5.298 | 2.523 |
| | (5.631) | (7.071) | (2.365) | (3.175) | (3.274) | (3.721) | (4.766) | (5.386) | (3.125) |
| Debt$_{j,(t-3,t-5)}$ x Intensity$_k$ | -0.044 | -0.036 | -0.004 | -0.087* | -0.054 | -0.130** | -0.200*** | -0.064 | -0.039 |
| | (0.064) | (0.080) | (0.034) | (0.050) | (0.050) | (0.055) | (0.070) | (0.079) | (0.047) |
| # | 79746 | 79746 | 79746 | 79746 | 79746 | 79746 | 79746 | 40,968 | 79746 |

Note: Columns (1) to (10) display OLS estimates. All regressions include country- and firm-level control variables, as well as country and industry × year fixed effects. Robust standard-errors clustered at the country × year level are shown in parentheses. WBES sampling probability weights are used for estimation. ***, ** and * denote significance at 1%, 5% and 10% levels."

[21] That means we consider the U.S. economy as a frictionless benchmark.

[22] Cash flow from operations is defined as in Rajan and Zingales (1998).

[23] The Herfindhal index has been used to measure product complexity and proxy for institutional dependence in the literature (Blanchard and Kremer (1997), Cowan and Neut (2007)).

Table (6) presents the results when Equation **??** is estimated on the available sample of firms, which varies depending on the intensities considered.

We begin with Column (1), which assesses whether the effect of public debt on firm growth differs across industries with high reliance on electricity. Electricity dependence is captured by a binary variable, $Electricity_k$, equal to one for industries whose average share of electricity in total intermediate consumption lies above the 75th percentile. The coefficient on $Electricity_k$ is not statistically significant, nor is the coefficient on its interaction with $Debt_{j,(t-3,t-5)}$, suggesting that firms in electricity-intensive industries are not differentially affected by public debt accumulation. This finding contrasts with earlier results based on a combination of survey-based perceptions and hard-data indicators.

Columns (2) and (3) consider dependence on water and transport infrastructure, respectively. In both cases, the coefficients on $Water_k$ and $Transport_k$ are not statistically significant, and the interaction terms with $Debt_{j,(t-3,t-5)}$ also yield no significant results. These findings suggest that public debt accumulation does not have a differentiated effect based on reliance on these types of infrastructure. Regarding transportation, this is not consistent with the evidence presented in Column (3) of Table (5), where debt accumulation appear to alleviate transport-related constraints.

Column (4) reveals a different pattern. Firms in telecommunication-dependent industries exhibit higher sales growth, as indicated by a positive and statistically significant coefficient on $Telecommunications_k$. However, the interaction between $Debt_{j,(t-3,t-5)}$ and $Telecommunications_k$ is negative and significant, implying that such firms benefit less from public debt accumulation. Again, this diverges from the findings in Table (4) and (5), making the interpretation difficult.

Columns (5) and (6) examine industries dependent on health and public administration infrastructures. In both cases, the interaction terms with public debt are negative and statistically significant, indicating that firms in sectors highly reliant on these services benefit less from debt accumulation. At the same time, the coefficients on $Health_k$ and $Public\ administration_k$ are positive and significant, suggesting that, on average, firms operating in industries intensive in these services experience higher growth.

Finally, Columns (7) and (8) test whether external dependence or institutional reliance shapes the impact of public debt. Neither the main effects nor the interaction terms are statistically significant, suggesting that public debt accumulation does not interact meaningfully with these dimensions of dependence.

# 6 Conclusion

This paper has examined how public debt accumulation affects firm performance across 79,746 formal private firms located in 72 developing economies, using data from the 2024 World Bank Enterprise Surveys. To tackle endogeneity, we constructed internal instruments by imposing a heteroscedastic covariance restriction following Lewbel (2012). In contrast to conventional wisdom, we found that, on average, a 10-percent increase in the debt-to-GDP ratio raises the firm average annual growth rate of sales by around 0.23 percentage points. This effect becomes even larger—reaching around 0.45–0.46 percentage points and statistically significant—when internal instruments are combined with a conventional external instrument based on valuation effects. By contrast, when the external instrument is used alone, the coefficient remains positive but loses statistical significance. We also investigated the channels through which public debt affects firm growth, following a two-step approach.

First, we examined whether the effect of public debt varies across firms facing different types of constraints—such as limited access to finance, infrastructure deficiencies, or institutional barriers—by combining opinion-based survey questions with objective hard-data. Second, we assessed how firms are impacted based on the structural characteristics of their industries, by interacting the debt variable with exogenous sector-specific input intensities constructed from the U.S. input-output matrix (2000–2014), following the methodology of Levchenko (2007) and Nunn (2007).

Several limitations should be acknowledged. First, while our combined use of internal and external instruments yields a statistically significant effect, the coefficient loses significance when the external instrument is used on its own, which raises concerns about the strength and reliability of this instrument in isolation. Second, our analysis relies on repeated cross-sectional data, which prevents us from accounting for unobserved time-invariant firm-level characteristics. Third, our measures of firm-level constraints and sectoral characteristics are based on proxies constructed from survey data and U.S. input-output tables. Although these measures are widely used in the literature, they may not fully capture the actual constraints faced by firms in developing countries. Furthermore, these measures neither allow us to test in a conclusive way the mechanisms highlighted in the theoretical literature.

We still believe this study to be worthy of interest, despite the limitations discussed above. So far, the literature on public debt and economic growth has produced contradictory findings. However, the absence of conclusive evidence should not be interpreted as suggesting that any level of public debt is sustainable. What remains clear is that endogeneity poses a major challenge in understanding the relationship between public debt and growth-related outcomes. In this context, our study contributes to the literature by illustrating how heteroscedasticity-based instruments can provide a valuable alternative when conventional instrumental variables are either unavailable or fail to convince. Furthermore, it attempts to explore firm-level channels through which public debt may affect performance, in line with recent calls for more granular and testable hypotheses on the mechanisms linking fiscal policy to growth-related outcomes Heimberger (2023). Future research could usefully explore cross-country heterogeneity in the structure of contracted debts, as this may shape the sustainability of public borrowing. This perspective also echoes questions raised in the literature on debt restructurings, where the nature of the debt and the identity of the creditors are increasingly seen as relevant factors.

# Appendix

**Table A.1**

Industry intensities.

| $Intensity_{k,US,(2000,2014)}$ | Industry code (ISIC Rev. 4) | Electricity | Water | Transport | Telecommunications | Education | Health | Public administrations | External dependence | Institutions |
|---|---|---|---|---|---|---|---|---|---|---|
| **Agriculture, forestry, and fishing** | | | | | | | | | | |
| Crop and animal production, hunting and related service activities | A01 | 0.001 | 0.000 | 0.001 | 0.011 | 0.052 | 0.039 | 0.244 | - | -0.413 |
| Forestry and loggings | A02 | 0.005 | 0.000 | 0.003 | 0.003 | 0.112 | 0.410 | 2.726 | - | -0.166 |
| Fishing and aquaculture | A03 | 0.005 | 0.000 | 0.003 | 0.003 | 0.109 | 0.399 | 2.663 | - | -0.162 |
| **Mining and quarrying** | B | 9.480 | 0.231 | 1.144 | 0.035 | 0.027 | 0.133 | 3.640 | - | -0.276 |
| **Manufacturing** | | | | | | | | | | |
| Food products, beverages and tobacco products | C10-C12 | 0.009 | 0.000 | 0.037 | 0.012 | 1.022 | 1.864 | 4.510 | -0.420 | -0.396 |
| Textiles, wearing apparel and leather products | C13-C15 | 0.030 | 0.001 | 0.199 | 0.294 | 0.078 | 2.537 | 4.647 | -0.388 | -0.198 |
| Wood, products of wood and cork, except furniture; articles of straw and plaiting materials | C16 | 0.008 | 0.000 | 1.260 | 0.461 | 0.080 | 1.081 | 3.563 | 0.050 | -0.162 |
| Paper and paper products | C17 | 0.059 | 0.002 | 0.288 | 0.234 | 0.190 | 3.279 | 6.741 | -0.305 | -0.098 |
| Printing and reproduction of recorded media | C18 | 0.283 | 0.007 | 0.645 | 1.007 | 1.030 | 5.563 | 14.857 | 0.493 | -0.061 |
| Coke and refined petroleum products | C19 | 3.124 | 0.078 | 13.072 | 0.081 | 0.130 | 1.261 | 18.047 | - | -0.178 |
| Chemical products | C20 | 0.303 | 0.008 | 0.245 | 0.264 | 0.124 | 6.720 | 3.670 | 0.055 | -0.176 |
| Basic pharmaceutical products and pharmaceutical preparations | C21 | 0.388 | 0.010 | 0.266 | 0.306 | 0.158 | 9.205 | 4.854 | - | -0.097 |
| Rubber and plastic products | C22 | 0.051 | 0.001 | 0.849 | 0.920 | 0.384 | 4.584 | 4.984 | -0.020 | -0.058 |
| Other non-metallic mineral products | C23 | 0.176 | 0.004 | 0.099 | 0.737 | 0.153 | 2.631 | 2.921 | - | -0.190 |
| Basic metals | C24 | 0.013 | 0.000 | 0.429 | 0.111 | 0.049 | 0.212 | 0.586 | -0.223 | -0.147 |
| Fabricated metal products, except machinery and equipment | C25 | 0.117 | 0.003 | 1.667 | 1.806 | 0.128 | 0.672 | 3.920 | -0.035 | -0.076 |
| Computer, electronic and optical products | C26 | 0.154 | 0.004 | 0.219 | 4.364 | 0.284 | 1.339 | 6.395 | 0.720 | -0.132 |
| Electrical equipment | C27 | 0.053 | 0.001 | 0.362 | 1.497 | 0.366 | 0.634 | 3.650 | 0.083 | -0.126 |
| Machinery and equipment n.e.c. | C28 | 0.382 | 0.010 | 0.281 | 0.264 | 0.477 | 0.438 | 1.798 | 0.470 | -0.299 |
| Motor vehicles, trailers and semi-trailers | C29 | 0.034 | 0.001 | 1.387 | 0.142 | 0.106 | 0.322 | 2.183 | 0.120 | -0.239 |
| Other transport equipment | C30 | 0.143 | 0.003 | 1.604 | 0.347 | 0.071 | 0.589 | 10.958 | - | -0.269 |
| Furniture; other manufacturing | C31-32 | 0.052 | 0.001 | 0.104 | 0.203 | 0.222 | 12.117 | 3.263 | 0.280 | -0.201 |
| Repair and installation of machinery and equipment | C33 | 0.208 | 0.005 | 0.294 | 0.702 | 0.350 | 2.899 | 4.173 | - | -0.513 |
| **Electricity, gas, steam and air conditioning supply** | D35 | 0.607 | 0.016 | 0.545 | 0.598 | 2.338 | 2.221 | 6.013 | - | -0.238 |
| **Water supply; sewerage, waste management and remediation activities** | | | | | | | | | | |
| Water collection, treatment and supply | E36 | 0.606 | 0.016 | 0.544 | 0.598 | 2.335 | 2.219 | 6.006 | - | -0.239 |
| Sewerage; waste collection, treatment and disposal activities; materials recovery | E37-E39 | 0.931 | 0.024 | 4.421 | 0.380 | 0.963 | 4.404 | 23.039 | - | -2.812 |
| **Construction** | F | 0.392 | 0.011 | 0.207 | 0.203 | 0.038 | 0.148 | 4.529 | - | -0.709 |
| **Wholesale and retail trade; repair of motor vehicles and motorcycles** | | | | | | | | | | |
| Wholesale and retail trade and repair of motor vehicles and motorcycles | G45 | 0.147 | 0.004 | 0.543 | 0.628 | 0.209 | 1.610 | 2.386 | - | -0.577 |
| Wholesale trade, except of motor vehicles and motorcycles | G46 | 0.480 | 0.012 | 1.795 | 0.576 | 0.263 | 2.777 | 3.707 | - | -0.158 |
| Retail trade, except of motor vehicles and motorcycles | G47 | 0.085 | 0.002 | 0.330 | 0.054 | 0.057 | 0.253 | 0.331 | - | -0.729 |
| **Transportation and storage** | | | | | | | | | | |
| Land transport and transport via pipelines | H49 | 3.289 | 0.083 | 2.642 | 0.325 | 0.260 | 1.641 | 7.649 | - | -0.112 |
| Water transport | H50 | 0.665 | 0.017 | 1.502 | 0.082 | 0.376 | 0.712 | 11.727 | - | -0.294 |
| Air transport | H51 | 0.573 | .014 | 0.908 | 0.459 | 0.548 | 1.830 | 8.421 | - | -0.381 |
| Warehousing and support activities for transportation | H52 | 1.802 | 0.046 | 15.767 | 0.208 | 0.216 | 2.660 | 4.248 | - | -0.089 |
| Postal and courier activities | H53 | 2.612 | 0.069 | 25.351 | 0.119 | 0.310 | 3.333 | 2.141 | - | -0.079 |
| **Accommodation and food service activities** | I | 0.491 | 0.012 | 0.672 | 0.298 | 0.255 | 2.114 | 2.678 | - | -0.596 |
| **Information and communication** | | | | | | | | | | |
| Publishing activities | J58 | 0.388 | 0.009 | 0.306 | 0.795 | 0.341 | 1.984 | 6.312 | - | -0.208 |
| Motion picture, video, television; sound recording, music publishing; programming, broadcasting | J59-J60 | 0.103 | 0.003 | 0.340 | 17.932 | 0.490 | 1.602 | 3.924 | - | -0.190 |
| Telecommunications | J61 | 0.209 | 0.005 | 0.674 | 13.533 | 0.347 | 2.440 | 6.512 | - | -0.204 |
| Computer programming, consultancy and related activities; information service activities | J62-J63 | 0.683 | 0.016 | 0.493 | 0.933 | 0.507 | 2.272 | 14.869 | - | -0.231 |
| **Financial and insurance activities** | | | | | | | | | | |
| Financial service activities, except insurance and pension funding | K64 | 2.035 | 0.049 | 1.649 | 0.586 | 0.441 | 2.456 | 4.021 | - | -0.145 |
| Insurance, reinsurance and pension funding, except compulsory social securityg | K65 | 0.074 | 0.002 | 0.010 | 0.109 | 0.113 | 5.774 | 0.859 | - | -0.314 |
| Activities auxiliary to financial services and insurance activities | K66 | 0.489 | 0.012 | 1.122 | 0.127 | 0.164 | 3.243 | 5.368 | - | -0.173 |
| **Real estate activities** | L68 | 0.185 | 0.004 | 0.342 | 0.472 | 1.044 | 4.501 | 2.150 | - | -0.428 |
| **Professional, scientific, and technical activities** | | | | | | | | | | |
| Legal and accounting activities; activities of head offices; management consultancy activities | M69-M70 | 0.976 | 0.023 | 1.097 | 1.205 | 0.318 | 5.456 | 3.881 | - | -0.047 |
| Architectural and engineering activities; technical testing and analysis | M71 | 1.006 | 0.024 | 0.843 | 2.651 | 0.436 | 3.950 | 7.812 | - | -0.119 |
| Scientific research and development | M72 | 1.021 | 0.025 | 0.857 | 2.696 | 0.444 | 4.021 | 7.946 | - | -0.119 |
| Advertising and market research | M73 | 1.021 | 0.025 | 0.857 | 2.696 | 0.444 | 4.021 | 7.946 | - | -0.119 |
| Other professional, scientific and technical activities; veterinary activities | M74-M75 | 1.012 | 0.025 | 0.848 | 2.669 | 0.439 | 3.978 | 7.865 | - | -0.119 |
| **Administrative and support service activities** | N | 0.954 | 0.024 | 4.447 | 2.204 | 0.694 | 6.529 | 8.434 | - | -0.055 |
| **Public administration and defence; compulsory social security** | O84 | 0.118 | 0.003 | 0.465 | 0.137 | 0.165 | 0.617 | 1.151 | - | -0.586 |
| **Education** | P85 | 0.192 | 0.005 | 0.139 | 0.301 | 0.635 | 0.542 | 3.668 | - | -0.690 |
| **Human health and social work activities** | Q | 0.007 | 0.000 | 0.016 | 0.013 | 0.004 | 1.257 | 0.679 | - | -0.948 |
| **Arts, entertainment, recreation - Other service activities** | R-S | 0.186 | 0.005 | 0.284 | 1.898 | 0.334 | 2.119 | 3.397 | - | -0.515 |
| **Activities of households as employers; undifferentiated producing activities for own use** | T | 0.207 | 0.005 | 0.292 | 0.698 | 0.348 | 2.882 | 4.149 | - | -0.515 |

**Table A.2**

Survey details.

| Latin America and the Caribbean | | | Sub-Saharan Africa | | | Middle East and North Africa | | | Europe and Central Asia | | | East Asia and Pacific | | | South Asia Region | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Country | Years | N | Country | Years | N | Country | Years | N | Country | Years | N | Country | Years | N | Country | Years | N |
| Bolivia | (2006, 2010, 2017) | 575 | Benin | (2009, 2016) | 207 | Egypt | (2013, 2016, 2020) | 5,663 | Albania | (2007, 2013, 2019) | 503 | Cambodia | (2016, 2023) | 633 | Bangladesh | (2013, 2022) | 1,871 |
| Colombia | (2006, 2010, 2017, 2023) | 2,881 | Botswana | (2006, 2010, 2023) | 705 | Iraq | (2011, 2022) | 1,021 | Armenia | (2013, 2020) | 514 | Indonesia | (2009, 2015, 2023) | 2,275 | Bhutan | (2009, 2015) | 422 |
| Costa Rica | (2010, 2023) | 501 | Burundi | (2006, 2014) | 221 | Jordan | (2013, 2019) | 503 | Azerbaijan | (2009, 2013, 2019) | 463 | Lao PDR | (2009, 2012, 2016, 2018) | 1,022 | India | (2014, 2022) | 12,681 |
| Dominican Republic | (2010, 2016) | 438 | Cameroon | (2009, 2016) | 554 | Morocco | (2013, 2019, 2023) | 1,270 | Belarus | (2013, 2018) | 681 | Malaysia | (2015, 2019) | 1,542 | Nepal | (2009, 2013, 2023) | 1,198 |
| Ecuador | (2010, 2017) | 622 | Chad | (2009, 2018, 2023) | 368 | Tunisia | (2013, 2020) | 921 | Georgia | (2008, 2013, 2019, 2023) | 1,124 | Mongolia | (2013, 2019) | 565 | Pakistan | (2013, 2022) | 1,377 |
| El Salvador | (2006, 2010, 2016, 2023) | 1,639 | Côte d'Ivoire | (2009, 2016, 2023) | 950 | Yemen | (2010, 2013) | 379 | Kazakhstan | (2009, 2013, 2019) | 1,326 | Philippines | (2009, 2015, 2023) | 2,012 | | | |
| Guatemala | (2006, 2010, 2017) | 960 | DRC | (2010, 2016) | 412 | | | | Kyrgyz Republic | (2013, 2019, 2023) | 827 | Samoa | (2009, 2023) | 158 | | | |
| Honduras | (2006, 2010, 2016) | 682 | Eswatini | (2006, 2016) | 137 | | | | Moldova | (2009, 2013, 2019) | 812 | Timor-Leste | (2009, 2015, 2021) | 349 | | | |
| Mexico | (2006, 2010, 2023) | 2,704 | Ethiopia | (2011, 2015) | 744 | | | | Montenegro | (2013, 2019) | 191 | Vanuatu | (2009, 2023) | 123 | | | |
| Nicaragua | (2006, 2010, 2016) | 855 | Gambia | (2006, 2018, 2023) | 280 | | | | North Macedonia | (2009, 2013, 2019, 2023) | 1,102 | | | | | | |
| Paraguay | (2006, 2010, 2017, 2023) | 983 | Ghana | (2007, 2013, 2023) | 1,156 | | | | Serbia | (2009, 2013, 2019) | 810 | | | | | | |
| Peru | (2006, 2010, 2017, 2023) | 2,582 | Kenya | (2007, 2013, 2018) | 1,674 | | | | Tajikistan | (2008, 2013, 2019) | 502 | | | | | | |
| Suriname | (2010, 2018) | 312 | Lesotho | (2016, 2023) | 225 | | | | Türkiye | (2008, 2013, 2019) | 2,224 | | | | | | |
| | | | Madagascar | (2009, 2013, 2022) | 734 | | | | Ukraine | (2013, 2019) | 1,589 | | | | | | |
| | | | Malawi | (2009, 2014) | 349 | | | | | | | | | | | | |
| | | | Mali | (2007, 2010, 2016) | 434 | | | | | | | | | | | | |
| | | | Mauritius | (2009, 2023) | 473 | | | | | | | | | | | | |
| | | | Niger | (2009, 2017) | 140 | | | | | | | | | | | | |
| | | | Nigeria | (2007, 2018) | 1,832 | | | | | | | | | | | | |
| | | | Rwanda | (2006, 2011, 2019, 2023) | 714 | | | | | | | | | | | | |
| | | | Senegal | (2007, 2014) | 563 | | | | | | | | | | | | |
| | | | Sierra Leone | (2017, 2023) | 276 | | | | | | | | | | | | |
| | | | Togo | (2016, 2023) | 232 | | | | | | | | | | | | |
| | | | Uganda | (2006, 2013) | 574 | | | | | | | | | | | | |
| | | | Zambia | (2007, 2013, 2019) | 1,094 | | | | | | | | | | | | |
| | | 15,784 (19.79%) | | | 15,140 (18.99%) | | | 9,785 (12.27%) | | | 12,760 (16.00%) | | | 8,715 (10.93%) | | | 17,562 (22.02%) |

Note: N refers to the number of observations in the cross-sectional sample.

**Table A.3**

Variable descriptions

| Constructed variables | Source variables | Data source | Description |
|---|---|---|---|
| **Firm var.:** | | | |
| $\text{Growth}_{i,k,j,(t,t-2)}$ | d2, n3 | WBES | Average annual growth rate of the sales |
| $\text{Sales}_{i,k,j,(t-2)}$ | n3 | WBES | Lagged value of the sales, in logarithm |
| $\text{State}_{i,k,j,(t)}$ | b2c | WBES | Dummy equal to one if part of the firm is owned by the state |
| $\text{Foreign}_{i,k,j,(t)}$ | b2b | WBES | Dummy equal to one if part of (or all) the firm is owned by a foreign individual, organization or firm |
| $\text{Export}_{i,k,j,(t)}$ | d3a | WBES | Dummy equal to one if the firm exports part of (or all) its sales, either directly or indirectly (as a supplier to exporting firms) |
| $\text{Size}_{i,k,j,(t)}$ | size | WBES | Takes the value one for firms with fewer than 20 employees, the value two for firms with between 20 and 100 employees, and three for firms with more than 100 employees |
| Firm $\text{age}_{i,k,j,(t)}$ | year, b5 | WBES | Firm age, calculated as the difference between year ($t$) and the year operations began |
| Managerial $\text{experience}_{i,k,j,(t)}$ | b7 | WBES | Reported number of years the top manager has worked in the sector |
| $\text{Electricity}^a{}_{i,k,j,(t)}$ | c30a | WBES | Dummy equal to one if electricity is considered a moderate, major, or very severe obstacle to the firm's operations |
| $\text{Electricity}^b{}_{i,k,j,(t)}$ | c6, c10 | WBES | Dummy equal to one if the firm experienced power outages during the last fiscal year and did not own or share a generator |
| $\text{Telecommunications}^a{}_{i,k,j,(t)}$ | c30b | WBES | Dummy equal to one if telecommunications are considered a moderate, major, or very severe obstacle to the firm's operations |
| $\text{Telecommunications}^b{}_{i,k,j,(t)}$ | c22a, c24b, c24c, c24d | WBES | Dummy equal to one if the firm communicates with clients and suppliers by email, or uses internet connection to place orders, deliver services, conduct research, or develop new products and services |
| $\text{Transport}^a{}_{i,k,j,(t)}$ | d30a | WBES | Dummy equal to one if transport is considered a moderate, major, or very severe obstacle to the firm's operations |
| $\text{Transport}^b{}_{i,k,j,(t)}$ | d3a, dtwelvea | WBES | Dummy equal to one if the firm exported part or all of its sales—either directly or indirectly (as a supplier to exporting firms)—or if some of its material inputs and supplies were not of domestic origin during the last fiscal year |
| Informal $\text{sector}_{i,k,j,(t)}$ | e30 | WBES | Dummy equal to one if the practices of informal sector competitors are considered a moderate, major, or very severe obstacle to the firm's operations |
| $\text{Courts}^a{}_{i,k,j,(t)}$ | h30 | WBES | Dummy equal to one if courts are considered a moderate, major, or very severe obstacle to the firm's operations |
| $\text{Courts}^b{}_{i,k,j,(t)}$ | h7a | WBES | Dummy equal to one if the court system is not considered fair, impartial and uncorrupted |
| Tax $\text{rates}_{i,k,j,(t)}$ | j30a | WBES | Dummy equal to one if tax rates are considered a moderate, major, or very severe obstacle to the firm's operations |
| Political $\text{instability}_{i,k,j,(t)}$ | j30e | WBES | Dummy equal to one if political instability is considered a moderate, major, or very severe obstacle to the firm's operations |
| $\text{Corruption}^a{}_{i,k,j,(t)}$ | j30f | WBES | Dummy equal to one if corruption is considered a moderate, major, or very severe obstacle to the firm's operations |
| $\text{Corruption}^b{}_{i,k,j,(t)}$ | j7a | WBES | Dummy equal to one if the percentage of total annual sales paid in informal payments is strictly greater than zero |
| $\text{Finance}_{i,k,j,(t)}$ | k30 | WBES | Dummy equal to one if access to finance is considered a moderate, major, or very severe obstacle to the firm's operations |
| $\text{Education}_{i,k,j,(t)}$ | l30b | WBES | Dummy equal to one if education is considered a moderate, major, or very severe obstacle to the firm's operations |
| $\text{Water}_{i,k,j,(t)}$ | c15 | WBES | Dummy equal to one if the firm experienced insufficient water supply during last fiscal year |
| Public $\text{contracts}_{i,k,j,(t)}$ | j6a, j42 | WBES | Dummy equal to one if the firm secured or attempted to secure a government contract in the past twelve months, or held one at any point in the last three years |
| Tax $\text{administrations}_{i,k,j,(t)}$ | j30b | WBES | Dummy equal to one if the firm was inspected by tax officials in the past twelve months |
| $\text{Credit}_{i,k,j,(t)}$ | k3bc, k3f, k3hd | WBES | Dummy equal to one if the firm reported no bank financing for its working capital, but reported some credit or advances from suppliers or customers, and/or from other sources (such as money lenders, friends, or relatives) |
| High $\text{school}_{i,k,j,(t)}$ | l9b | WBES | Dummy equal to one if all full-time employees have completed high school education |
| **Industry var.:** | | | |
| $\text{Electricity}_k$ | c24 | WIOD | Dummy variable equal to one if the sector belongs to the top quartile in terms of its average share of electricity in total intermediate input consumption |
| $\text{Water}_k$ | c25 | WIOD | Dummy variable equal to one if the sector belongs to the top quartile in terms of its average share of water in total intermediate input consumption |
| $\text{Transport}_k$ | c31, c32, c33 | WIOD | Dummy variable equal to one if the sector belongs to the top quartile in terms of its average share of transport in total intermediate input consumption |
| $\text{Telecommunications}_k$ | c39 | WIOD | Dummy variable equal to one if the sector belongs to the top quartile in terms of its average share of telecommunications in total intermediate input consumption |
| $\text{Education}_k$ | c52 | WIOD | Dummy variable equal to one if the sector belongs to the top quartile in terms of its average share of education in total intermediate input consumption |
| $\text{Health}_k$ | c53 | WIOD | Dummy variable equal to one if the sector belongs to the top quartile in terms of its average share of human health in total intermediate input consumption |
| Public $\text{administrations}_k$ | c51 | WIOD | Dummy variable equal to one if the sector belongs to the top quartile in terms of its average share of public administrations and defense in total intermediate input consumption |
| External $\text{dependence}_k$ | External dependence (1980-1999) | Kroszner et al. (2007) | Dummy variable equal to one if the sector belongs to the top quartile in terms of its average share of capital expenditures not financed with cash flow from operations |
| $\text{Institutions}_k$ | c1-c56 | WIOD | Dummy variable equal to one if the sector belongs to the top quartile in terms of its Herfindahl index of intermediate input use |
| **Country var.:** | | | |
| $\text{Debt}_{j,(t-3,t-5)}$ | GGXWDG | WEO | General government gross debt (Percent of GDP) |
| GDP $\text{growth}_{j,(t-3,t-5)}$ | NY.GDP.MKTP.KD.ZG | WDIs | GDP growth (annual %) |
| Primary $\text{balance}_{j,(t-3,t-5)}$ | GGX_NGDP, GGR_NGDP | WEO | General government revenue minus expenditure (Percent of GDP) |
| $\text{Income}_{j,(t-3,t-5)}$ | NY.GDP.PCAP.CN | WDIs | GDP per capita (current LCU) |
| $\text{Inflation}_{j,(t-3,t-5)}$ | FP.CPI.TOTL.ZG | WDIs | Inflation, consumer prices (annual %) |
| $\text{Population}_{j,(t-3,t-5)}$ | SP.POP.TOTL | WDIs | Population, total |
| Corruption $\text{control}_{j,(t-3,t-5)}$ | cc | WGIs | Control of corruption (standard normal units) |
| Government $\text{effectiveness}_{j,(t-3,t-5)}$ | ge | WGIs | Government effectiveness (standard normal units) |
| Rule of $\text{law}_{j,(t-3,t-5)}$ | rl | WGIs | Rule of law (standard normal units) |
| Regulatory $\text{quality}_{j,(t-3,t-5)}$ | rq | WGIs | Regulatory quality (standard normal units) |
| Political $\text{stability}_{j,(t-3,t-5)}$ | pv | WGIs | Political stability (standard normal units) |

*Note:* Firm-level variables are from the World Bank Enterprise Surveys (WBES). Industry-level variables are based on the WIOD input–output tables for the U.S. (2000–2014). Country-level indicators are drawn from the World Economic Outlook database (WEO), World Development Indicators (WDIs), and Worldwide Governance Indicators (WGIs). Superscripts $^a$ and $^b$ refer to the perceived and objective measures used in Table 4 and Table 5, respectively.

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