

# 1 Introduction

The aftermath of the 2008 financial crisis witnessed an unprecedented increase in the level of debt-to-GDP all around the world.<sup>1</sup> Several countries had to reduce government debt through fiscal consolidation. While there is widespread agreement that reducing the ratio of debt-to-GDP to sustainable levels would yield long-term benefits, empirical studies on the short-run and medium-run macroeconomic impacts of fiscal consolidation have produced conflicting results. Some authors (e.g., [Giavazzi and Pagano \(1990, 1995\)](#), [Alesina and Roberti \(1995, 1997\)](#) and [Alesina and Ardagna \(1998, 2010\)](#)) find that fiscal consolidation is expansionary even in the short run, while others (e.g., [Guajardo et al. \(2014\)](#), [Jordà and Taylor \(2016\)](#)) find that it leads to a short-run output contraction. The difference in the empirical findings is largely attributable to the use of different indicators of fiscal consolidation. These measures, known to suffer several endogeneity issues, include indicators of a change in primary deficit and changes in debt-to-GDP ratio in a particular period as a result of specific fiscal actions taken by the government. In recent times, however, there has been a convergence to a consensus view that fiscal consolidation indicators based on the narrative approach (pioneered by [Romer and Romer \(2010\)](#)) are more likely to eliminate the endogeneity issues.<sup>2</sup>

In this paper, we combine data on fiscal consolidation episodes in 12 OECD countries (compiled by [Alesina et al. \(2017\)](#) using the narrative approach) with firm-level data to answer an important question: what is the effect of fiscal consolidation on firm-level total factor productivity? The existence of widespread productivity differences across countries and firms within countries underpins the importance of studying the role of macroeconomic policies in explaining productivity dispersion. In the past several decades, various countries have resorted to fiscal consolidations to help reduce government debt. Rising debt levels in recent time imply that fiscal consolidations in several countries in the near future are inevitable. Thus, we focus on the role of fiscal consolidation in determining long run growth through its effect on firm level productivity in this paper. There are several channels through which changes in taxation and government spending may impact firm-level productivity. For example, discretionary spending cuts may involve a reduction in the maintenance expenditure for (and/or investment in) infrastructure, which is an important public intermediate input in firms' production function (see [Clarida and Findlay \(1992\)](#) for a theoretical formulation and [Yeaple and Golub \(2007\)](#) for an empirical study of effects of

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<sup>1</sup>See, for instance, [Mbaye et al. \(2018\)](#) for details on historical profiles of sovereign debts throughout the world.

<sup>2</sup>[Romer and Romer \(2010\)](#) and [Alesina et al. \(2017\)](#) identify fiscal policy shocks using the narrative approach which involves reviewing several budget statements, documents and government communications to identify exogenous shifts in government tax and spending policies. We provide a more detailed explanation of this approach in section 3.

infrastructure on sector-level TFPs in a sample of OECD and developing countries).

On the taxation side, tax increases can induce firms to cut R&D expenditures, especially during recession periods, via their effects on firms' cash flows. Indeed, a large body of empirical research has found that investment depends strongly on cash flow and overall economic conditions ([Abel et al. \(1986\)](#); [Fazzari et al. \(1988\)](#); [Oliner et al. \(1995\)](#)). In particular, [Fazzari et al. \(1988\)](#) argued that due to asymmetric information, firms that are small and not well known are more likely to face financing constraints. For these firms, investment may be sensitive to the average tax burden as well as to the marginal tax rates. [Fazzari et al. \(1988\)](#) provided evidence that during periods of tight credit, small and medium-sized firms are often denied loans. Increases in taxes may reduce these firms' cash flows, thus distorting their investment decisions.

Firm-level productivity may also be impacted by changes in their workers' performance. To the extent that an individual's performance at work depends on their well-being and their perception of inequality, fiscal consolidation that affects these variables will have an impact on their productivity. Recent research by [Eklou et al. \(2020\)](#) revealed a negative relationship between austerity measures and subjective well-being. Implications of fiscal consolidation for inequality have also been studied by [Wolff and Zacharias \(2007\)](#) and [Agnello and Sousa \(2014\)](#).<sup>3</sup>

Our main empirical finding is that periods of fiscal consolidation negatively impact firm-level productivity. Moreover, we find that both discretionary spending cuts and tax increases result in a reduction in firm-level productivity. We also find that tax based fiscal consolidation has a more detrimental effect on firm level productivity compared to spending based fiscal consolidation. This is consistent with evidence provided by [Giavazzi and Pagano \(1990\)](#), [Alesina and Ardagna \(2010\)](#) and [Alesina and Ardagna \(2013\)](#) suggesting that tax based adjustments cause deeper and long lasting recessions. Since the fiscal consolidation episodes provided by [Alesina et al. \(2017\)](#) were compiled based on the narrative approach advocated by [Romer and Romer \(2010\)](#), we are confident that our approach largely avoids the endogeneity issue.<sup>4</sup> A further scrutiny of the granular data reveals heterogeneous effects of various tax policies

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<sup>3</sup>[Wolff and Zacharias \(2007\)](#) assesses the effects of government expenditure and taxation on household economic well-being in the U.S. in 1989 and 2000. They find that inequality in their income measure is considerably reduced by net government expenditures primarily as a result of increases in expenditures. [Eklou et al. \(2020\)](#) measure the effects of spending cuts and tax increases on social well-being. They find that fiscal consolidations reduce well-being in the short run, especially when they are based on spending cuts.

<sup>4</sup>Several authors including [Devries et al. \(2011\)](#) and [Cloyne \(2013\)](#) have found that constructing fiscal policy shocks using the narrative approach results in broadly exogenous fiscal policy shocks. [De Cos and Moral-Benito \(2016\)](#) however questions the exogenous properties of these measures finding, in particular, that spending based adjustments can be predictable whereas tax based adjustments are less predictable.

on firm level productivity. Our findings on the impacts of fiscal consolidation on firm-level productivity thus identify another channel through which fiscal contractions may negatively affect long-run output, consumption, and welfare.

Our results are also consistent with the findings of [Schwarz Müller and Wolters \(2014\)](#) who used a dynamic general equilibrium to probe into the effects of various fiscal instruments. Cuts in public investment reduce the public capital stock (which is a public intermediate input in the private production functions) and lower the productivity of private factors of production. Increases in the tax on labor or capital reduce firms' incentive to invest. These policy measures lead to a very persistent output reduction.

The rest of the paper is organized as follows. In Section 2, we review the literature. Section 3 describes the data and our empirical strategy used to investigate the relationship between fiscal consolidation and firm-level total factor productivity. Results are reported in Section 4. We offer some concluding remarks in Section 5.

## 2 Literature Review

This paper is related to two streams of literature: (i) the literature on the short-run and medium-run macroeconomic effects of fiscal consolidation, and (ii) the determinants of firm-level productivity.

### 2.1 Macroeconomic effects of fiscal consolidation

The effect of fiscal consolidation on the macroeconomy has been studied for a considerably long time. [Hellwig and Neumann \(1987\)](#), for instance, points out that fiscal consolidation can generate two effects that work in opposite directions. Research by [Giavazzi and Pagano \(1990, 1995\)](#), [Alesina and Roberti \(1995, 1997\)](#) and [Alesina and Ardagna \(2010\)](#) supplied some evidence that the short-run fiscal multiplier can be negative.

Using OECD data for the period 1970-2007, [Alesina and Ardagna \(2010\)](#) focus on the analysis of historical episodes of large stances of fiscal policy (including both fiscal stimuli episodes and fiscal consolidation ones). However, as pointed out by [Romer and Romer \(2010\)](#), conventional measures of tax changes contain many observations that are endogenous changes. [Romer and Romer \(2010\)](#) advocated the narrative approach, which studies historical policy documents to identify policy changes

that were motivated by the objective of reducing budget deficit to ensure long-term public financial sustainability. [Guajardo et al. \(2014\)](#) adopted this approach to explore whether the fiscal multiplier is negative or positive. Their findings suggest that, depending on the methods used to measure fiscal adjustments, empirical estimates can yield strikingly contrasting results.

A recent paper by [Alesina et al. \(2017\)](#) marks a significant convergence in economic thought about what constitutes a reasonably cogent measure of fiscal stance. Indeed, [Alesina et al. \(2017\)](#) build on the narrative approach pioneered by [Romer and Romer \(2010\)](#), and extend the data set of [Devries et al. \(2011\)](#) to include all fiscal plans for 16 OECD countries over the period 1978-2014, which include consolidation episodes that occurred between 2009 and 2014. They estimate multipliers for taxes, government consumption and investment, and transfers and find that fiscal consolidations that rely mainly on raising taxes tend to be associated with larger output losses since tax hikes have distortionary effects and tend to increase persistence.

Other important studies that tackle the effect of fiscal consolidation on the different aspects of the economy and different regions include: [Ball et al. \(2013\)](#), [Chen et al. \(2019\)](#), [Carriere-Swallow et al. \(2018\)](#), [Diniz \(2018\)](#), [Leigh et al. \(2010\)](#) and [Forni et al. \(2010\)](#).

## **2.2 Firm-level productivity**

Empirical researchers in various fields of economics have documented large and persistent productivity differences across firms. [Syverson \(2004b\)](#) reports the relationship between firm level productivity and output in the U.S. manufacturing sector. Productivity differences across firms have been linked to features in technology, organizational form, demand, market structure, and so on. These include the size of sunk costs ([Collard-Wexler \(2013\)](#); [Long and Miao \(2020\)](#)), the interaction between market rivalry and technology spillovers ([Bloom and Van Reenen \(2007\)](#)), the degree of competition ([Syverson \(2004a\)](#); [Schmitz Jr \(2005\)](#)), workers' human capital ([Fox and Smeets \(2011\)](#)), incentive pay schemes ([Lazear \(2000\)](#)), managerial talent ([Bloom and Van Reenen \(2010\)](#)), social interaction among co-workers ([Bandiera et al. \(2009\)](#)). In the field of international economics, heterogeneity in productivity has been theoretically modelled (e.g., [Eaton and Kortum \(2002\)](#); [Melitz \(2003\)](#)) and empirically investigated (e.g., [Bernard et al. \(2006\)](#); [Melitz and Trefler \(2012\)](#)). The incentives for firms to carry out R&D investment in the wake of trade liberalization and the stochastic nature of R&D outcomes have also been modeled in the context of oligopoly [Long et al. \(2011\)](#) or monopolistic competition ([Dhingra](#)

(2013); [Nakanishi and Long \(2020\)](#)).

Several studies have found a positive correlation between firms' R&D expenditures and their TFP levels ([Aw et al. \(2008\)](#); [Doraszelki and Jaumandreu \(2008\)](#)). Therefore, as long as fiscal consolidation affect firm cash flow and R&D expenditure, productivity could be affect.

Firm-level TFP and industry-level TFP also depend on the quality of public infrastructure that functions as an intermediate input in firms' production function. This idea is formalized by [Clarida and Findlay \(1992\)](#). They argue that governments play an essential role in the economy, performing essential tasks that provide the framework for the efficient operation of private markets. These include maintaining law and order, supporting the physical and social infrastructure, and enforcing the contracts that private agents enter into (See also [Tawada \(1982\)](#)). In a recent empirical study, [Yeaple and Golub \(2007\)](#) find that infrastructure investments have positive and significant effect on productivity and comparative advantage. [Mamatzakis \(2007\)](#) documented how EU infrastructure investment affected productivity in Greek manufacturing industry; similarly, [Mitra et al. \(2012\)](#) estimated the impact of infrastructure on productivity and efficiency of Indian manufacturing.

### 3 Data and Estimation Strategy

In order to assess the impact of fiscal consolidation on firm level productivity, we use data from 12 European countries over the period 1995-2015 for our empirical analysis. We combine both firm level data and macroeconomic variables for the analysis. Concentrating on only European countries is advantageous because of the comparability of data and the similarity of macroeconomic context. Our choice of variables is informed by several strands of literature that examine the determinants of productivity at the firm level.<sup>5</sup> In the sub-sections below we provide a description of the main variables of interest used in the analysis.

#### 3.1 Firm level data

Our main firm level variable of interest is total factor productivity. We are interested in whether fiscal consolidation has an effect on firm level productivity or not. We use data from Orbis database, provided by Bureau van Dijk, to calculate a measure of firm level total factor productivity (TFP). We obtain TFP estimates directly from [Diez et al. \(2019\)](#). For completeness we summarize the methodology used to

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<sup>5</sup>[Syverson \(2011\)](#) has an excellent survey of the determinants of productivity across firms.

estimate TFP in [Diez et al. \(2019\)](#). To estimate firm level TFP, assume the following industry specific Cobb-Douglas production function:<sup>6</sup>

$$q_{it} = \beta_{\nu}\nu_{it} + \beta_k k_{it} + \omega_{it} + \xi_{it} \quad (1)$$

where  $q_{it}$  represents the log of real sales,  $\nu_{it}$  is the log of any flexible input (in real terms),  $k_{it}$  refers to the log of the real capital stock,  $\omega_{it}$  stands for firm productivity and  $\xi_{it}$  is the error term including unanticipated productivity shocks and measurement error. Our main interest in the production function is the measure of total factor productivity. There are several methodological and data issues related to the estimation of production functions as documented by [Wooldridge \(2009\)](#) especially issues related to simultaneity bias and missing data. [Diez et al. \(2019\)](#) follow the control function approach literature pioneered by [Olley and Pakes \(1996\)](#) and [Levinsohn and Petrin \(2003\)](#) and recently updated by [Akerberg et al. \(2015\)](#) which together, are able to deal with, in varying degree, some of the challenges associated with estimating TFP. The general assumption of this methodology is that, productivity follows a first-order Markov process and is a function of the firm's flexible inputs and capital i.e.  $\omega_{it} = h(\nu_{it}, k_{it})$ . The estimation then involves two steps. First, estimate expected output that removes measurement errors and unanticipated shocks as follows:

$$q_{it} = \phi_t(\nu_{it}, k_{it}) + \xi_{it} \quad (2)$$

To estimate the production function, a second order approximation of the function  $\phi$ , is assumed and this is given by the following equation:

$$\phi_{it} = \beta_{\nu}\nu_{it} + \beta_k k_{it} + \beta_{\nu\nu}\nu_{it}^2 + \beta_{kk}k_{it}^2 + \beta_{\nu k}\nu_{it}k_{it} + h(\nu_{it}, k_{it}) \quad (3)$$

In the second stage, total factor productivity is assumed to follow the law of motion which is given by:  $\omega_{it} = g(\omega_{i,t-1}) + \epsilon_{it}$ , where  $\epsilon_{it}$  are independent and identically distributed innovations to TFP. Estimates of TFP are then obtained by projecting productivity on its lagged value. In the baseline regression we used TFP calculated using multiple variable inputs. We achieve this by using a composite variable input in the production function i.e. we use the cost of goods sold which comprises of the operations cost of labour and materials. For robustness we extend this by using TFP calculated by using only the cost of

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<sup>6</sup>Several variations of the Cobb-Douglas functions are assumed. In the first instance, one flexible input is assumed following [De Loecker et al. \(2020\)](#) and this is later relaxed to a translog production function with multiple inputs to estimate different variations of TFP.

materials as the variable input in the production function and estimating equation (3).

Apart from TFP we use several firm level characteristics that have been shown to exert significant influence on firm level productivity as controls in our estimation (see for instance [Alfaro et al. \(2009\)](#); [Dabla-Norris et al. \(2012\)](#); [Guillaumont Jeanneney et al. \(2006\)](#)). Some of the firm-level characteristics used include labor, capital stock of the firm and the real assets of the firm. The productivity of different firms are influenced by these variables in varying degrees and therefore are controlled for in our regression analysis.

## 3.2 Macro Data

### 3.2.1 Fiscal policy shocks

The main macroeconomic variable of interest for our analysis is a measure of fiscal consolidation. We use the size of fiscal consolidation as our main independent variable in the analysis. Our database comes from [Alesina et al. \(2017\)](#) and spans a variety of fiscal policies. It was based on the narrative approach, following [Devries et al. \(2011\)](#), to construct the measure of fiscal consolidation (see also [Geerolf and Grjebine \(2018\)](#) for more discussion on this approach). This approach is used because it is an attempt at solving the endogeneity problems inherent in identifying fiscal policy shocks.

The variables on fiscal policy shocks are constructed by directly reviewing relevant budgetary documents from government and mapping out fiscal policy innovations that were not initially part of planned spending or taxation policies. [Alesina et al. \(2017\)](#) gather information on each policy prescription and classify each measure using the following categories: personal income direct taxes, corporate direct taxes, individual property taxes, corporate property taxes, taxes on goods and services, government consumption, public investments, public employees salaries, firm subsidies, R&D policies, corporate tax credits and deductions, individual tax credits and deductions, family and children policies, pension-related expenditure, unemployment benefits, health-related expenditures and other social security expenditures. In order to be able to take into account inter-temporal dimension of fiscal policy and therefore be able to reconstruct fiscal “plans” they distinguish measures that were unanticipated from announcements of future measures up to a five year horizon. The richness of the data sources enables them to identify the size and exogeneity of each fiscal policy.

Shifts in fiscal policy are measured relative to the baseline and, following the methodology of [Devries et al. \(2011\)](#) and [Romer and Romer \(2010\)](#), only contemporaneous documents are reviewed. The iden-

tified fiscal shocks are then scaled as a percentage of the GDP in the year before the change in policy is announced, thus avoiding the contemporaneous effect issue as a result of the fiscal policy affecting both fiscal instruments and GDP. Therefore, by using these measures which are deemed exogenous fiscal policy shocks, we are able to identify the direct impact of fiscal consolidation on firm-level productivity.

### 3.2.2 Other macro variables

Several macroeconomic variables affect firm-level productivity. In order to account for the influence of the macroeconomic environment on firm-level productivity, we include some macroeconomic variables to control for confounding factors. The argument is that fiscal consolidation can have an effect on total factor productivity through its effect on the macroeconomic environment such as GDP growth and inflation.

A stable macroeconomic environment is important for businesses to thrive. We control for this by including the GDP growth rate and inflation rate at the country level, using data taken from the World Development Indicators (WDI) database. We argue that a positive macroeconomic environment, indicated by positive GDP growth rate and moderate levels of inflation, would have a positive and significant effect on firm level productivity. We also control for the level of international trade and financial sector development in the country.<sup>7</sup>

The regulatory environment, as well as the institutional environment, also play a significant role in firm level productivity. Therefore, we include measures of the regulatory quality and rule of law within the economy as additional control variables. We obtain these variables from the database of the World Governance Indicators.<sup>8</sup> Table 1 shows the summary statistics for the variables used in our main regression analysis.

## 3.3 Estimating strategy

Similar to several studies that examine the micro and macro determinants of firm-level productivity, we start by investigating the effect of fiscal consolidation on TFP. Our empirical analysis is based on the

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<sup>7</sup>Alcalá and Ciccone (2004) and Keller and Yeaple (2005) show a positive relationship between international trade and firm level productivity while Dabla-Norris et al. (2012), Alfaro et al. (2009) and Ghirmay (2011) provide evidence of a positive and significant effect of financial sector development on productivity.

<sup>8</sup>Dollar and Kraay (2002) show evidence of a positive relationship between institutions, trade and growth while Nicoletti and Scarpetta (2003) show, in the context of the UK utilities sector that, improvement in regulatory quality leads to efficiency gains. Database for regulatory quality and institutions is provided by Kauffmann et al. (2010) and can be downloaded directly from [www.govindicators.org](http://www.govindicators.org)

assumption that fiscal policy shocks may prompt firms to reallocate resources which may lead to sub-optimal reallocation and introduce distortions that are detrimental to firm-level productivity. Following several similar studies, we specify and estimate the following equation:

$$Y_{ict} = \beta_1 \text{Fiscal\_con}_{ct} + \beta_2' X_{ct} + \beta_3' X_{ict} + \delta_c + \text{trend}_c + \varphi_{ict} \quad (4)$$

where  $Y_{ict}$  is our measure of total factor productivity of firm  $i$  in country  $c$  at time  $t$ ;  $\text{Fiscal\_con}_{ct}$  is the size of fiscal consolidation in country  $c$  at time  $t$ ;  $X_{ct}$  refers to our vector of country level macroeconomic control variables while  $X_{ict}$  is our vector of firm-level control variables;  $\delta_c$  represents country's fixed effect;  $\text{trend}_c$  is a country-specific linear trend effect and  $\varphi_{ict}$  is the error term.

Our main estimate of interest is the size and sign of the coefficient on  $\text{Fiscal\_con}_{ct}$  i.e.,  $\beta_1$  which captures the effect of fiscal consolidation on TFP. Usually, getting an unbiased and consistent estimate of  $\beta_1$  is always a difficult task and depends on, among other things, the exogeneity of the independent variable. In our case however, the fiscal policy shocks identified in [Alesina et al. \(2017\)](#) using the narrative approach, which we use in our analysis, have been shown by several studies to be exogenous thus enabling us to estimate the precise effect of fiscal consolidation on firm-level productivity.<sup>9</sup> Concerns about reverse causality between fiscal consolidation and firm-level productivity are also allayed since no one firm has any significant influence on government policies.

To ensure our estimates are not biased, we control for the macroeconomic environment that may cause both fiscal policy shocks and introduce distortions at the firm level concurrently. Thus, we include inflation, GDP growth rate, and financial sector development as control variables. We also include individual firm-level characteristics that have an effect on TFP to control for firm idiosyncratic factors that affect productivity. In the estimation, we include country fixed effects, i.e.,  $\delta_c$ , to control for country time invariant unobservable effects while also controlling for all time-varying unobserved heterogeneity at country level by adding a country trend variable, i.e.,  $\text{trend}_c$ .

We expect that after controlling for firm level variables, the macroeconomic environment and time and country fixed effects, our estimate of  $\beta_1$  is unbiased. Though [Giavazzi and Pagano \(1990, 1995\)](#) and [Alesina and Roberti \(1997\)](#) suggest that there could be expansionary austerity, we expect to find a negative relationship between firm-level productivity and fiscal consolidation. This is because of at least

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<sup>9</sup>See for instance, [Brinca et al. \(2019\)](#) and [Alesina et al. \(2018\)](#). They use the fiscal policy shocks identified using the narrative approach in their study and reference the exogeneity of this measure.

two reasons. First, fiscal consolidation through tax hikes introduces distortion in the optimization and use of production inputs which leads to misallocation and this would cause firm-level productivity to be negatively impacted (Schwellnus and Arnold (2008), Fatica et al. (2013), Liu (2011), Hsieh and Klenow (2009) and Restuccia and Rogerson (2008)).<sup>10</sup> Secondly, fiscal consolidation through spending cuts have the potential to impact public services and the provision of infrastructure. As pointed out in empirical studies by Mitra et al. (2012) and Mamatzakis (2007) infrastructure is a key determinant of firm level productivity.<sup>11</sup> Therefore, as long as fiscal consolidation leads to cuts in infrastructure investment, firms that are particularly dependent on them would experience a reduction in TFP. We argue that these effects in combination (or in isolation), termed fiscal consolidation, would have an unambiguously negative effect on firm-level productivity, i.e., we expect fiscal consolidation to have a negative effect on TFP.

## 4 Estimation Results

In this section, we provide evidence on the relationship between fiscal consolidation and firm level productivity. The goal is to identify the causal effect of fiscal consolidation on firm-level productivity by using the exogenous shocks of fiscal policy in our identification.

### 4.1 Baseline results

Our baseline results are obtained by estimating equation 4. The results are presented in tables 2, 3 and 4. In table 2 we obtain the results by simple OLS and focus on total fiscal consolidation in columns (1) to (3), tax hikes in columns (4) to (6) and spending cuts from columns (7) to (8). The results suggest that total fiscal consolidation has a negative and significant effect on firm-level productivity. We include country fixed effects and country-time trend effect to control for country-level idiosyncratic effects and time trend in table 2 and additional firm fixed effects in table 3. In columns (2) and (3) we introduce GDP growth and inflation to control for the macroeconomic environment and find that the introduction of these variables has no impact on our estimated co-efficient i.e. we still record a negative and significant effect of total consolidation on TFP. Overall, a 1 percent increase in fiscal consolidation is associated with a reduction of firm level productivity of between 0.2 and 0.5 percentage points.

The effect of tax hikes on TFP is found to be negative even after controlling for GDP growth and

<sup>10</sup>See Restuccia and Rogerson (2013) for a discussion of misallocation and productivity and the role played by taxes.

<sup>11</sup>Theoretical growth models and production models augmented with infrastructure find that infrastructure plays a significant role in growth and investment. See for instance Duggal et al. (1999) and Agénor (2010).

inflation. However, in this baseline estimation, the effect of spending cut on TFP is only negative and significant when we control for GDP growth and inflation as seen in column (9). The results in Table 2 suggest that the effect of fiscal consolidation on TFP is mainly driven by tax hikes. This is not completely surprising given that an important factor that businesses consider before making investment decision is the level of tax it faces and the degree of uncertainty when it comes to taxation. As already pointed out earlier, uncertainty with business taxes introduces distortion in the optimal use of inputs and leads to misallocation thus reducing firm level productivity (Fatica et al. (2013), Liu (2011) and Hsieh and Klenow (2009)).

The size of the effect of spending cuts on TFP is also found to be smaller than the effect of tax hikes on TFP. Since our sample comprises of advanced economies that, arguably, have very good infrastructure development, the effect of spending cuts, if directed at a reduction in public infrastructural investment, is likely to have a less profound impact on firms especially those that are not very dependent on public infrastructure.

In our second baseline estimation results reported in Table 4, additional controls have been included. At the firm level, we include the firm's capital expenditure, its total assets and the amount of labor used in the production process. Apart from the GDP growth and inflation used as macroeconomic variable controls in Table 2 we also include a number of additional macroeconomic variables that have been shown to exert significant influence on the business environment. These include: financial credit to the private sector (as a percentage of GDP), the level of international trade (measured as the ratio of imports and exports to GDP), regulatory quality from the world governance indicators (it captures perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development and is measured on a scale of -2.4 to 2.5 with higher values indicating better regulatory environment.) and the share of GDP spent in each economy on research and development. After including these additional controls the results are qualitatively similar to those in table 2 suggesting that our results are not sensitive to adding firm-level variables and additional macroeconomic variables. The control variables are broadly inline with expectation. For instance, inflation is found to be positively related to firm level productivity indicating that some level of price growth is important for production decisions (see for example Weber (2012)). We also find that GDP growth is positively related to firm level productivity also indicating that growth may spur aggregate demand and result in positive firm level productivity effects.

## 4.2 Heterogeneity and the role of macroeconomic policies

In this section, we explore the heterogeneous effect of different macroeconomic environments, given a fiscal policy shock, and their impacts on firm-level productivity. Though our sample appears homogeneous in terms of development, different variables interact with fiscal shocks differently depending on the macroeconomic environment as a whole. For instance, before several of our sample countries joined the Euro area and started using the Euro, they had different exchange rate policies and stability levels. The nature of these exchange rate regimes may interact differently with fiscal policy shocks and therefore have a heterogeneous effect on firm-level productivity. For this reason, we interact the exchange rate with fiscal policy shocks to see if the effect of fiscal consolidation on TFP is dependent on the exchange rate.<sup>12</sup> Other interactions are the governance structure in the economy proxied by a measure of the rule of law, the level of financial development in the economy and the infrastructure development level within the economy.

We report the results of these interactions in Table 5. Column (1) of Table 5 suggests that the existence of rule of law in a particular country is important for promoting firm level productivity. This reflects studies such as [Gani \(2007\)](#) that suggest that rule of law is important for promoting investment. We see that a better rule of law environment increases firm level productivity (0.075\*\*\*). Moreover, our estimate of the coefficient of the interactive term (0.005\*\*\* in Column 1), indicates that the negative effect of fiscal consolidation on firm-level TFP is dampened in countries where the rule of law is strong.

In column (2) of Table 5 we report the results on the interaction between exchange rate and fiscal consolidation. We find that when fiscal consolidation is accompanied by an appreciation of the local currency, its negative effect on TFP is reinforced. A possible explanation is that, since an exchange rate appreciation already puts a strain on firms participating in the export market, with fiscal consolidation which introduces distortions, firms would be even more reluctant to undertake investments, hence the negative impact of fiscal consolidation on TFP is magnified.

We report the rest of the results in column (3) of Table 5. We find in column (3) that even though a more developed financial sector, proxied by credit to the private sector as a percentage of GDP, is good for firm level productivity, the interaction between financial level development and fiscal consolidation has

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<sup>12</sup>Here, an increase in the exchange rate represents an appreciation of the local currency. Research on the effect of exchange rate on firm level productivity is inconclusive. While [Choi and Pyun \(2018\)](#) and [Tomlin \(2014\)](#) find a positive relation between exchange depreciation and firm-level productivity, [Tang \(2015\)](#) suggests that exchange rate appreciation may have a positive effect on productivity through the adoption of new technologies. Our focus is on how the exchange rate interacts with fiscal policy shocks.

no impact on TFP.

### 4.3 The role of financial development and globalization

Firms do not operate in a vacuum. The impact of fiscal consolidation on firm level productivity can be compounded by the environment in which a firm operates. In order to account for some of these factors, we investigate the role that globalization and the financial sector development as a whole play in the relationship between fiscal consolidation and firm level productivity. There is a large stream of literature documenting the effects of financial development and globalization on firm-level productivity in both developed and developing countries. A financially developed economy is capable of easing financial constraints of firms which is a major impediment to firm-level growth and productivity ([Héricourt and Poncet \(2015\)](#)) ; and a more globalized economy provides firms with access to foreign know-how and to a wider variety of intermediate inputs, thus improving their productivity ([Melitz and Trefler \(2012\)](#); [Halpern et al. \(2015\)](#); [Bresnahan et al. \(2016\)](#); [Olper et al. \(2017\)](#); [Brandt et al. \(2017\)](#)). Some contrary evidence, however, has been reported, see e.g. [Mann \(1998\)](#) and [Kueng et al. \(2016\)](#)).<sup>13</sup>To explore this mechanism we modify equation 4 and estimate the following regression.

$$Y_{ict} = \beta_1 \text{Fiscal\_con}_{ct} + \gamma_1 \text{Fiscal\_con}_{ct} \times \text{Fin}_{ct} + \gamma_2 \text{Fin}_{ct} + \beta_2' X_{ct} + \beta_3' X_{ict} + \delta_c + \text{trend}_c + \varphi_{ict} \quad (5)$$

where  $\text{Fin}_{ct}$  is our measure of either financial development or globalization. Our interest is on the size and sign of the interaction term between fiscal consolidation and our interaction variable given by  $\gamma_1$ . A positive value of  $\gamma_1$  implies that firms located in a more financially developed economy in which there is a fiscal policy shock are better able to weather the storm of the shock compared to those located in a less financially developed economy.

To measure financial development, we use the aggregate financial development index from [Svirydzenka \(2016\)](#). This index is an aggregation of the two sub-indexes of financial institutions development and financial markets development (with higher values of the index representing higher levels of financial development). This is a more comprehensive measure of financial development unlike the credit to private sector as a percentage of GDP that only measures the availability of credit by financial institutions. With this measure, a financial system is developed if it has a more efficient, accessible and deeper depth in both its financial institutions and financial markets. The idea is that a financial system with these char-

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<sup>13</sup>For a review of relevant literature in this area see [Shu and Steinwender \(2019\)](#).

acteristics present more opportunities for access to financial instruments at lower cost which firms can access to ease financial constraints, leading to more efficient investment and thus greater productivity. The aggregate financial development index is used as an independent variable and also appears as an interaction term in equation 5.

The results of this exercise are reported in Table 10. The positive estimate of the interactive term indicates that a higher level of financial development provides greater mitigation against the detrimental effect of fiscal consolidation. As mentioned earlier, a more financially developed economy presents more opportunities through which a firm can access credit, lessening the negative impact originating from fiscal consolidation.<sup>14</sup> We extend the results by using the sub-indexes of financial institutions development and financial markets development. We report the results in Tables 11 and 12 respectively and find qualitatively similar results to those in Table 10. This indicates that fiscal consolidation in more financially developed economies is unlikely to greatly negatively impact firm-level productivity compared to those done in less financially developed economies.

Next, we explore the interaction between fiscal consolidation and globalization in relation to the impact on firm level productivity. We posit that because globalization expands the range of firm possibilities, a firm operating in a more globalized country has the potential to mitigate the risks to productivity emanating from fiscal consolidation in the economy. We use the KOF globalization index, recently extended in [Gygli et al. \(2019\)](#), which is a composite index measuring globalization along economic, social and political dimensions as our measure of globalization. This index is measured on a scale of 0-100 with higher values representing high levels of global integration of the country.

We present the results of the effect of globalization on firm level productivity in Table 13. We find that in our sample of 12 OECD countries, firms located in economies that are relatively more integrated with the global economy have lower productivity. On the other hand, we find that in a more globalized economy experiencing fiscal consolidation, firm-level productivity is less harmed by fiscal consolidation as can be seen in columns (1) and (5) of Table 13. The reason is that firms located in more globalized economies have a wide array of avenues to diversify possible risks emanating from fiscal consolidation. For instance, slack in domestic demand as a result of fiscal consolidation can be partly moderated by an uptake in demand in foreign markets thus damping the effect on firms. Not only that, the impact on firm-level productivity of fiscal consolidation in the form of tax hikes and spending cuts are also moderated

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<sup>14</sup>Given that our sample comprises developed countries with more developed financial systems our results on the role of financial development here is likely capturing the lower bounds.

in a more globalized economy compared to a less globalized one. We extend this analysis to the *de jure* and *de facto* measures of globalization (as defined in [Gygli et al. \(2019\)](#)) and find qualitatively similar results which are reported in Tables 14 and 15.<sup>15</sup>

#### 4.4 Unpacking the nature of fiscal consolidation

The implementation of fiscal consolidation differs across countries and over time. Some consolidation episodes rely mainly on tax hikes, while others involve deep expenditure cuts. In this section, we explore whether these different dimensions of fiscal consolidation have heterogeneous effects on firm-level productivity. Do very intense fiscal consolidation episodes have stronger negative impacts on firm level productivity compared to mild episodes of fiscal consolidation? Is the strength of the impacts of fiscal consolidation on firm-level productivity dependent on whether it is achieved mainly through tax hikes or through expenditure cuts?

To answer the first question we introduce a dummy variable which takes the value 1 if and only if the magnitude of fiscal consolidation in a particular country is greater than the mean magnitude (for the same economy) of fiscal consolidations over the sample period. For low episodes of fiscal consolidation in a particular country (characterized by fiscal consolidation levels below the mean level) the dummy variable takes the value 0. We are interested in this because more aggressive forms of fiscal consolidation do not afford firms enough time to adjust and therefore may have greater negative impact than a less aggressive fiscal consolidation that gives firms enough time to adjust, realign production and diversify the production process.

We show the results of the effect of both high and low levels of fiscal consolidation on firm level productivity in Tables 16 and 17 respectively. Table 16 shows that very high episodes of fiscal consolidation are very detrimental to firm level productivity as shown in column (1) and (5). We also find that high fiscal consolidation done partly through spending cuts has a significant negative effect on firm-level productivity. In Table 17 we show that if fiscal consolidation is done less aggressively firm-level productivity will not be negatively impacted. In other words, when consolidation is done moderately either through small increases in taxes or a small cut in government expenditure, firms are able to adjust to these less aggressive policies better than if these same fiscal policies are more aggressive. This is consistent with the call by most multinational institutions for governments to pay attention to rising debt levels in order

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<sup>15</sup>[Gygli et al. \(2019\)](#) contain several variations and sub-indexes of the globalization index. Further details on the construction and interpretation are provided in that paper.

not to have to pursue very aggressive fiscal consolidation measures to bring down debt in the future since those policies can be more devastating.

Next, we answer the second question by using a dummy variable that takes the value 1 if and only if a particular episode of fiscal consolidation in a country was achieved mainly through tax hikes (and zero otherwise). An episode is defined as tax-based fiscal consolidation if the ratio of tax hikes to GDP in that period is greater than the ratio of spending cuts to GDP in that period. Since fiscal consolidation is often achieved through a combination of both factors we are interested in the one that is relatively heavily relied on for fiscal consolidation. Spending-based fiscal consolidation is similarly defined.

The results of the effect of tax-based fiscal consolidation are reported in Table 18. We find that tax-based fiscal consolidation is negatively related to firm-level productivity which is consistent with [Alesina et al. \(2017\)](#). Tax hikes and spending cuts in a period of tax-based fiscal consolidation are detrimental to firm-level productivity as can be seen in columns (2)-(4) and (6)-(8) of Table 18. However, Table 19 shows that even though fiscal consolidation, in general, is detrimental to firm-level productivity, if the consolidation is spending-based, the harm to firm-level productivity is lessened. This is understandable because in our context, developed countries already have a robust public infrastructure for instance, which implies that spending cuts in that area may not necessarily pose severe constraints to a firm's production capacity and therefore the negative impact is negligible.

#### **4.5 Dynamic response to fiscal consolidation**

Next, we try to establish how firm level productivity responds to fiscal consolidation over time. The goal is to estimate the medium term impact of fiscal consolidation on firm level productivity. To accomplish this, we use [Jordà \(2005\)](#) local projection method and trace the impulse response of firm level productivity to fiscal consolidation. The results of the dynamic impact of fiscal consolidation on firm level productivity are presented in figure 2.

We see that the impact of fiscal consolidation on firm level productivity upon impact is negative. However, over the medium term productivity quickly recovers. This suggests that there is some form of reallocation that takes place within the firm after fiscal consolidation that eventually makes the firm recover from the initial shock. Another possible explanation is that since our fiscal consolidation measures in the sample are assumed exogenous, firms production plans are made in the preceding year only to be surprised by either a government tax hike or spending cuts thus necessitating a sub-optimal input com-

bination. Using tax hikes and spending cuts as our measures of fiscal consolidation we obtain similar results and these are reported in figure 3.

#### 4.6 Effects of granular fiscal consolidation instruments

So far we have established that fiscal policy shocks have an impact on firm level productivity. Most importantly, fiscal policy shocks in the form of tax hikes have a far more detrimental impact on firm level productivity compared to spending cuts. Since both tax hikes and spending cuts can and are achieved through hikes in specific taxes and cuts in specific expenditure, we are interested in exploring which specific tax hikes and spending cuts are significantly related to firm level productivity. Fortunately, the data on fiscal policy shocks contain information on specific tax hikes and spending cuts that are used to achieve the level of total fiscal consolidation in any particular year.

To establish this, we estimate equation 4 by using different categories of tax hikes and spending cuts as our independent variables. To limit our analysis and make our results tractable, we use four categories of tax hikes and spending cuts in our analysis namely: direct taxes, indirect taxes, “not-classified-yet” (or NYC for short) taxes, “other taxes”, public investment, transfers, “not-classified-yet” (NYC) spending and “other spending”.<sup>16</sup> This is an attempt at looking at the more granular shocks and their impact on firm level productivity.

We present the results of this analysis in Table 6. From columns (1) and (2) of table 6 it can be seen that both direct and indirect tax hikes have a negative and significant effect on firm level productivity. Taxes, in general, introduce distortions in the production process and result in an inefficient combination of the different factors of production which is detrimental to firm-level productivity (See for instance [Liu \(2011\)](#) and [Hsieh and Klenow \(2009\)](#)). Direct taxes may impact profit incentives while indirect taxes may distort final pricing and affect the optimal use of productive resources thus resulting in a negative impact on firm-level productivity.<sup>17</sup>

In terms of fiscal policy shocks resulting from spending cuts, columns (5) and (8) indicate that government consumption and public investment cuts and “other spending” cuts have a negative and significant impact on firm-level productivity. Investment in public infrastructure, for instance, increases the production capacity of a country as a whole therefore, if there are significant cuts to investment in this area,

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<sup>16</sup>For details on the various classification on tax hikes and spending cuts see [Alesina et al. \(2017\)](#).

<sup>17</sup>We include other forms of tax hikes called “not-yet-classified” taxes and spending cuts called “not-yet-classified” spending. However, we do not discuss this in the results because they are possibly a combination of non-homogeneous items and their impact on firm level productivity will be difficult to explain.

it may affect the ease with which firms are able to conduct production business and this may negatively impact productivity at the firm level. Infrastructure such as roads, railway, telecommunication are important national assets helping in easing and promoting the production process. Spending cuts that involve reducing expenditure in these areas are likely to have detrimental effects on firm level productivity.

#### **4.7 Robustness checks**

We have shown so far that fiscal policy shocks have a significant negative effect on firm-level productivity. In order to assuage our empirical findings from any substantial bias, we employ a battery of robustness checks to ensure that our results are not spurious or driven by a few underlying factors. We address possible concerns mainly on four different fronts. First, we modify our estimation technique by including time fixed effects in our specification of equation 4. Secondly, we use a different measure of firm-level productivity calculated by using multiple variable inputs in the production function as our measure of firm-level total factor productivity third, using labor productivity of the firm as a dependent variable to explore a possible mechanism through which fiscal shocks can have an impact on firm-level productivity through its impact on labor productivity and lastly, we explore whether the size of the firm plays any important role in the relationship between firm level productivity and fiscal consolidation.

In Table 7, we present results from our analysis of equation 4 that includes time fixed effects. The reason we include time fixed effects in the regression is to allay fears of omitted time varying variables that may impact and possibly distort the relationship between fiscal policy shocks and firm-level productivity. By including time fixed effects we are essentially controlling for those unobserved time varying variables not included in the baseline regression model. Table 7 reports the results from the analysis. Column (1) and (5) report the effects of the total size of fiscal consolidation on firm-level productivity. The results suggest that an increase in the size of fiscal consolidation is negatively related to firm-level productivity. This is qualitatively similar to the results obtained in Table 4 which indicates that including the time fixed effects in the regression that accounts for time varying variables does not result in any qualitatively significant change in the impact of fiscal policy shocks on firm productivity. Similarly, columns (2), (4), (6) and (8) indicate that fiscal consolidation in the form of tax hikes are negatively related to firm-level productivity even after controlling for time varying factors. Spending cuts are also shown to have a negative and significant relationship with firm level productivity as can be seen in columns (3), (4), (7) and (8) of Table 7 after controlling for time varying variables in the regression. In a nutshell, by controlling for time varying variables in the regression we get qualitatively similar results and can rule

out the influence of omitted time varying variables in our baseline regression results.

In the baseline regression, we used TFP calculated using one composite variable input in the production function i.e. we use the cost of goods sold which comprises of the operations cost of labour and materials. We extend this by using TFP calculated by using only the cost of materials as the variable input in the production function and estimating equation (3). This is important to allay fears that our results are mainly dependent on the type of TFP used in the analysis. We estimate equation 4 using this measure of TFP and report the results in Table 8. The results from Table 8 show that the total size of fiscal consolidation is negative related to firm level productivity using this measure of total factor productivity. It also shows that, tax hikes and spending cuts are negatively related to this measure of firm level productivity. This thus indicates that our results are not crucially dependent on the measure of TFP used in the analysis.

Labor productivity at the firm level, defined as output per labor is an important determinant of total factor productivity at the firm level.<sup>18</sup> Since labor productivity is an important determinant of total factor productivity, we explore the possible impact of fiscal consolidation on total factor productivity through its impact on labor productivity. Therefore we estimate equation 4 using labor productivity as our dependent variable. The results of this exercise is reported in Table 9. In column (1) which controls for only macro variables in the regression, we see that total fiscal consolidation is negatively related to labor productivity. Also, after controlling for firm specific variables in column (5), we find a significant negative relationship between fiscal consolidation and labor productivity. However, even though fiscal consolidation as a whole is negatively related to labor productivity, surprisingly, only fiscal consolidation in the form of spending cuts are negatively related to labor productivity while tax hikes are positively related to labor productivity. We posit that tax burdens may not be directly passed on to employees, at least not in the short term, but require firms to adjust in other dimensions which are beneficial only to labour output.

An important part of heterogeneity exists amongst firms in different countries. One ubiquitous quality of firms is that they are different in terms of their sizes. Therefore it is relevant to determine whether firms are impacted differently by fiscal consolidation depending on their size. It is reasonable to assume that larger firms have more resources and the flexibility to adjust more to adverse shocks compared to smaller firms. We test this hypothesis by interacting firm size (measured as the amount of labour

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<sup>18</sup>See [Sargent and Rodriguez \(2001\)](#) for an interesting note on how total factor productivity is derived from labor productivity in a neoclassical growth framework.

employed by the firm) with our fiscal consolidation in the estimation process. We report the results from this estimation in table 20. We see that, in general, fiscal consolidation is negatively related with firm level productivity, however the interaction between fiscal consolidation and firm size is positive and significant thus implying that larger firms are able to quickly adjust to fiscal policy shocks. In fact, the overall impact of fiscal policy shocks on firm level productivity for firms with employment level below the 65th percentile is found to be negative indicating a detrimental effect of fiscal policy shocks for small firms compared to much larger firms.

Several other robustness exercises are explored but we do not report the results for brevity. For instance, we include firm fixed effects in our baseline equation and estimate the baseline regressions. This is done primarily to allay fears of systematic bias by omitted firm specific characteristics. We find results qualitatively similar to the baseline results even after controlling for firm fixed effects. Next, we control for country debt levels in the baseline regressions. This is to ensure that our results are not driven by a select few countries that have high debt and are persistently undergoing fiscal consolidation. The results from this exercise provide results that are consistent with our baseline results. We also explore the asymmetric effects on firm level productivity for fiscal consolidation throughout the business cycle by distinguishing between periods of recession and periods of boom using the output gap. We find that fiscal consolidation during recessions are particularly detrimental to firm level productivity compared to periods of boom.

## **5 Conclusion**

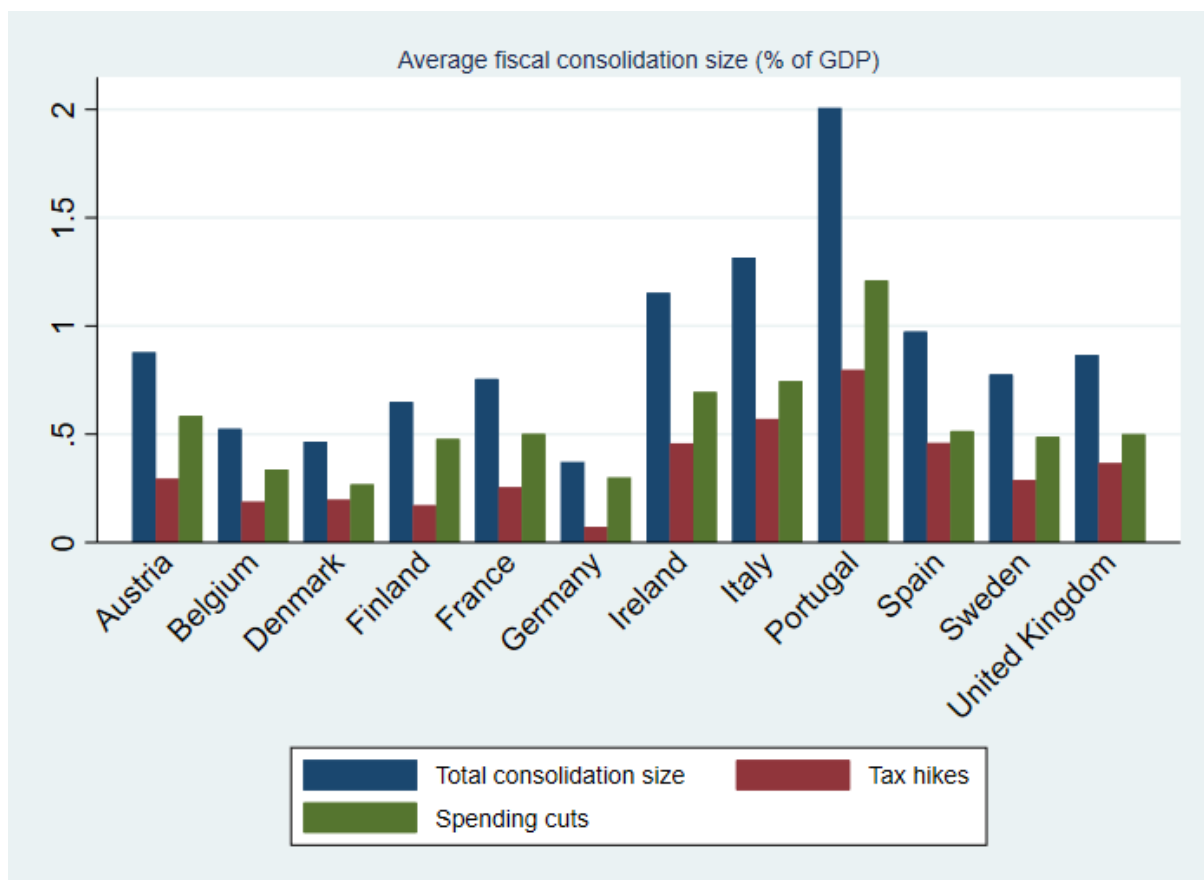
Productivity dispersion across countries has led to several studies on the determinants of firm level productivity and the role of macro economic policies in determining productivity. In this paper, we contribute to the discussion by exploring the relationship between fiscal consolidation and firm level productivity using data from 12 advanced economies. The premise for this analysis is as follows: fiscal consolidation often involves tax hikes or government expenditure cuts or in most cases a combination of both which suggest that a government that is undertaking significant fiscal consolidation may be forced to reduce the provision of necessary government incentives such as subsidies and grants that firms may be dependent on in their production process. Fiscal consolidation through tax hikes may also impose significant distortion in the use of factors of production by firms. Therefore, fiscal consolidation is likely to negatively impact firm-level productivity.

Using fiscal consolidation data combined with firm-level data for 12 advanced economies in Europe over the period 1995-2014, we find that fiscal consolidation has a significant negative effect on firm-level productivity. This is particularly true for consolidation episodes that rely mainly on tax hikes. We posit that tax hikes may introduce distortions into the input choices of firms, resulting in sub-optimal use of factors of production leading to inefficiency and negatively impacting firm level productivity. We also find that high levels of fiscal consolidation are particularly harmful to firm level productivity compared to lower levels of fiscal consolidation.

The findings in this paper are useful for policy purposes. For instance, a country that is saddled with high government debt and a declining productive sector should employ a more focused policy mix in its fiscal consolidation efforts. In particular, it would be important to carefully assess, not just what is feasible in terms of spending cuts and tax hikes but also the fiscal policy measure that preserves or has the potential to increase the productive capacity of the country. Accordingly, it will be useful to shy away from taxes that distort the efficient use of factors of production, and target a reduction in non-priority government expenditure. Very aggressive tax hikes as a means of fiscal consolidation is particularly harmful to firm-level productivity and growth. Thus, instead of countries waiting to implement huge consolidation efforts to reduce debts levels a phased approach over the medium to long term may be more beneficial for firms to adjust and reduce the negative impact.

## 6 Appendix

Figure 1: Average fiscal consolidation across countries 1995-2014 [% of GDP]



*This figure shows the average level of fiscal consolidation of each country in our sample. It also shows the average amount of tax hikes and expenditure cuts that are employed during the fiscal consolidation year for each of our sample countries.*

Table 1: **Summary Statistics**

Variables	Obs	Mean	Std. Dev	Min	Max
Fiscal consolidation size	240	0.894	1.602	-0.291	9.748
Tax hikes	240	0.343	0.739	-0.751	3.871
Spending cuts	240	0.552	1.005	-0.360	6.244
GDP growth	240	2.028	2.617	-8.075	10.904
Inflation	240	1.956	1.205	-4.478	5.591
Private credit	240	100.808	37.852	30.346	201.259
Research exp	240	2.002	0.831	0.55	3.914
Trade	240	82.063	36.077	42.879	201.99
Regulatory quality	240	1.430	.336	0.63	2.05
Rule of law	240	1.541	0.389	0.38	2.1
Direct tax hikes	240	0.183	0.520	-1.137	3.246
Indirect tax hikes	240	0.115	0.253	-0.379	1.3445
NYC tax hikes	240	0.0261	0.111	-0.500	0.582
Other tax hikes	240	0.0188	0.163	-0.553	1.622
Consumption investment cuts	240	0.266	0.537	-0.087	3.852
Transfers cuts	240	0.209	0.432	-0.522	3.022
NYC spending cuts	240	0.0146	0.080	-0.103	0.777
Other spending cuts	240	0.062	0.208	-0.347	2.186

This table presents fairly standard summary statistics for the main variables used in the paper. Fiscal policy shock variables are taken from [Alesina et al. \(2017\)](#) and explained in section 3.2.1. GDP growth, Inflation, Trade, Private credit and country level Research expenditure variables are taken from the World Development Indicators while the Rule of Law and Regulatory quality variables are from the World Governance Indicators database.

Table 2: **Baseline Regression Results**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Total fiscal consolidation	-0.002*** (0.000)	-0.002*** (0.000)	-0.005*** (0.000)						
Tax hikes				-0.005*** (0.001)	-0.005*** (0.001)	-0.010*** (0.001)			
Spending cuts							-0.000 (0.001)	-0.000 (0.001)	-0.003*** (0.001)
GDP growth		0.003*** (0.000)	0.003*** (0.000)		0.003*** (0.000)	0.002*** (0.000)		0.003*** (0.000)	0.003*** (0.000)
Inflation			0.005*** (0.000)			0.006*** (0.000)			0.004*** (0.000)
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country-Time Trend	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs	6982380	6982380	6982380	6982380	6982380	6982380	6982380	6982380	6982380
$R^2$	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22

The dependent variable in the regression is the log of total factor productivity. Robust standard errors in parentheses. \* Indicates 10% significance, \*\* 5% significance, \*\*\* 1%.

Table 3: **Baseline Regression Results**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Total fiscal consolidation	-0.002*** (0.000)	-0.003*** (0.000)	-0.006*** (0.000)						
Tax hikes				-0.004*** (0.000)	-0.004*** (0.000)	-0.008*** (0.000)			
Spending cuts							-0.004*** (0.000)	-0.004*** (0.000)	-0.007*** (0.000)
GDP growth		0.004*** (0.000)	0.004*** (0.000)		0.004*** (0.000)	0.004*** (0.000)		0.004*** (0.000)	0.004*** (0.000)
Inflation			0.004*** (0.000)			0.004*** (0.000)			0.004*** (0.000)
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country-Time Trend	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs	6982380	6982380	6982380	6982380	6982380	6982380	6982380	6982380	6982380
$R^2$	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93

The dependent variable in the regression is the log of total factor productivity. Robust standard errors in parentheses. \* Indicates 10% significance, \*\* 5% significance, \*\*\* 1%.

Table 4: **Baseline Regression Results**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Total fiscal consolidation	-0.005*** (0.000)				-0.003*** (0.000)			
Tax hikes		-0.007*** (0.000)		-0.005*** (0.000)		-0.005*** (0.000)		-0.004*** (0.000)
Spending cuts			-0.006*** (0.000)	-0.004*** (0.000)			-0.004*** (0.000)	-0.002*** (0.000)
GDP growth	0.003*** (0.000)	0.003*** (0.000)	0.003*** (0.000)	0.003*** (0.000)	0.002*** (0.000)	0.002*** (0.000)	0.002*** (0.000)	0.002*** (0.000)
Inflation	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)	0.001*** (0.000)	0.000*** (0.000)	0.001*** (0.000)	0.000*** (0.000)	0.001*** (0.000)
Trade	0.001*** (0.000)	0.002*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)
Incap					-0.005*** (0.000)	-0.005*** (0.000)	-0.005*** (0.000)	-0.005*** (0.000)
Inassets					0.066*** (0.000)	0.066*** (0.000)	0.066*** (0.000)	0.066*** (0.000)
Inlab					-0.031*** (0.000)	-0.031*** (0.000)	-0.031*** (0.000)	-0.031*** (0.000)
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country-Time Trend	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Additional macro variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs	6982380	6982380	6982380	6982380	6925313	6925313	6925313	6925313
R <sup>2</sup>	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93

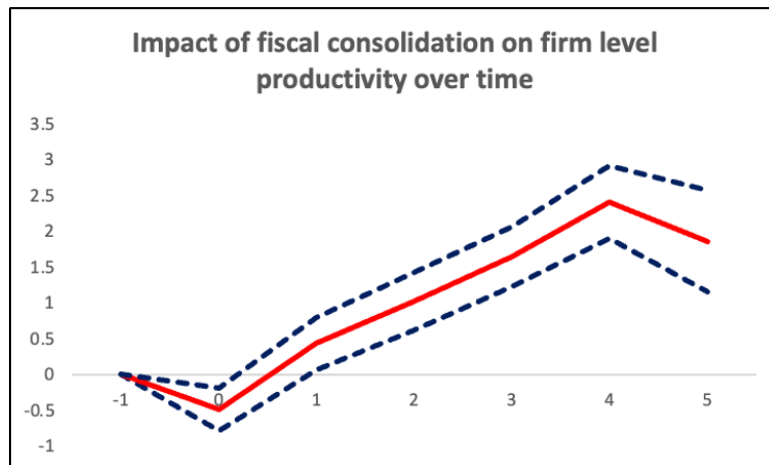
Additional macro variables included in the regressions are: private credit, regulatory quality and research expenditure. The dependent variable in the regression is the log of total factor productivity. Incap is the log of firm capital, Inassets is the log of firm assets and Inlab is the log of firm labour employed. Robust standard errors in parentheses. \* Indicates 10% significance, \*\* 5% significance, \*\*\* 1%.

Table 5: **Heterogeneity: Interaction with macroeconomic variables**

	(1)	(2)	(3)
Total fiscal consolidation	-0.016*** (0.002)	-0.001 (0.004)	-0.016*** (0.002)
Total fiscal consolidation × Rule of law	0.005*** (0.001)		
Rule of law	0.075*** (0.003)		
Total fiscal consolidation × Exchange_rate		-0.011*** (0.003)	
Exchange_rate		-0.056*** (0.005)	
Total fiscal consolidation × Private credit			0.000 (0.000)
Private credit	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)
Capital	-0.014*** (0.000)	-0.014*** (0.000)	-0.014*** (0.000)
Total Assets	0.060*** (0.000)	0.060*** (0.000)	0.060*** (0.000)
Labour	-0.073*** (0.000)	-0.073*** (0.000)	-0.073*** (0.000)
GDP growth	0.004*** (0.000)	0.004*** (0.000)	0.004*** (0.000)
Inflation	0.005*** (0.001)	0.007*** (0.001)	0.007*** (0.001)
Country Fixed Effects	Yes	Yes	Yes
Country-Time Trend	Yes	Yes	Yes
Additional macro variables	Yes	Yes	Yes
Obs	6925313	6925313	6925313
$R^2$	0.23	0.23	0.23

Additional macro variables included in the regressions are: trade, regulatory quality and research expenditure. Robust standard errors in parentheses.. \* Indicates 10% significance, \*\* 5% significance, \*\*\* 1%.

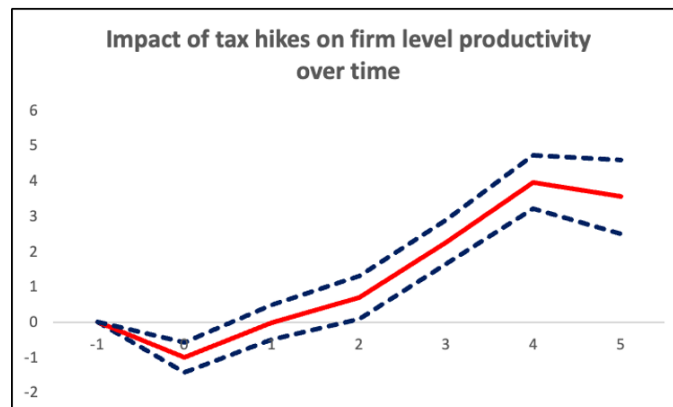
Figure 2: Effect of fiscal consolidation on firm level productivity over time



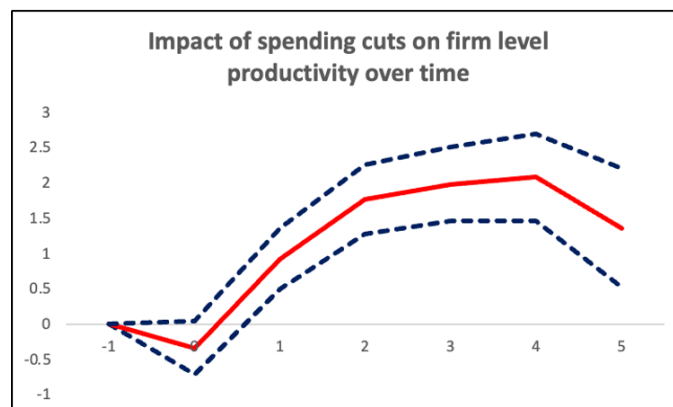
The solid line represents coefficients at the horizon with the dashed line representing 95% confidence intervals (adjusted to make them more visible)

Figure 3: The impact of tax hikes and spending cuts on firm level productivity over time

(a) Tax hikes



(b) Spending cuts



The solid line represents coefficients at the horizon with the dashed line representing 95% confidence intervals (adjusted to make them more visible)

Table 6: **Granular Fiscal Policy Shocks and Total Factor Productivity**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Direct tax hikes	-0.005*** (0.001)							
Indirect tax hikes		-0.002*** (0.000)						
lnnyctax			0.002*** (0.001)					
lnothertax				0.001 (0.001)				
lnconsinv					-0.009*** (0.001)			
lntransfer						0.001** (0.001)		
lnnycspend							0.001 (0.006)	
lnotherspend								-0.014*** (0.001)
lncap	-0.011*** (0.000)	-0.012*** (0.000)	-0.014*** (0.000)	-0.015*** (0.000)	-0.012*** (0.000)	-0.013*** (0.000)	-0.010*** (0.001)	-0.012*** (0.000)
lnassets	0.027*** (0.000)	0.037*** (0.000)	0.030*** (0.000)	0.048*** (0.001)	0.040*** (0.000)	0.034*** (0.000)	0.050*** (0.001)	0.028*** (0.000)
lnlab	-0.038*** (0.000)	-0.052*** (0.000)	-0.046*** (0.000)	-0.057*** (0.001)	-0.054*** (0.000)	-0.049*** (0.000)	-0.067*** (0.001)	-0.048*** (0.000)
GDP growth	0.005*** (0.000)	0.002*** (0.000)	0.003*** (0.000)	0.002*** (0.001)	0.003*** (0.000)	0.003*** (0.000)	0.007*** (0.002)	0.002*** (0.000)
Inflation	0.007*** (0.001)	0.003*** (0.001)	0.002* (0.001)	-0.002 (0.002)	0.006*** (0.001)	0.005*** (0.001)	0.004** (0.002)	0.016*** (0.001)
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country-Time Trend	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Additional macro variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs	2837499	3159107	2105562	1312669	3366838	3051678	663592	2094222
R <sup>2</sup>	0.14	0.16	0.09	0.13	0.18	0.15	0.11	0.13

Additional macro variables included in the regressions are: private credit, trade, regulatory quality and research expenditure. The dependent variable in the regression is the log of total factor productivity. Incap is the log of firm capital, lnassets is the log of firm assets and lnlab is the log of firm labour employed. Robust standard errors in parentheses. \* Indicates 10% significance, \*\* 5% significance, \*\*\* 1%.

Table 7: **Robustness: Baseline Regressions with Time Fixed Effects**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Intotal.con	-0.019*** (0.001)				-0.015*** (0.001)			
Intax		-0.019*** (0.001)		-0.021*** (0.001)		-0.013*** (0.001)		-0.015*** (0.001)
lnspend			-0.010*** (0.001)	-0.013*** (0.001)			-0.007*** (0.001)	-0.010*** (0.001)
GDP growth	0.005*** (0.000)	0.005*** (0.000)	0.006*** (0.000)	0.004*** (0.000)	0.004*** (0.000)	0.004*** (0.000)	0.005*** (0.000)	0.004*** (0.000)
Inflation	0.009*** (0.001)	0.007*** (0.001)	0.008*** (0.001)	0.008*** (0.001)	0.007*** (0.001)	0.006*** (0.001)	0.007*** (0.001)	0.007*** (0.001)
Trade	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)
lnacap					-0.014*** (0.000)	-0.014*** (0.000)	-0.014*** (0.000)	-0.014*** (0.000)
lnassets					0.060*** (0.000)	0.060*** (0.000)	0.060*** (0.000)	0.060*** (0.000)
lnlab					-0.073*** (0.000)	-0.073*** (0.000)	-0.073*** (0.000)	-0.073*** (0.000)
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country-Time Trend	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Additional macro variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs	6982380	6982380	6982380	6982380	6925313	6925313	6925313	6925313
R <sup>2</sup>	0.22	0.22	0.22	0.22	0.23	0.23	0.23	0.23

Additional macro variables included in the regressions are: private credit, regulatory quality and research expenditure. The dependent variable in the regression is the log of total factor productivity. Incap is the log of firm capital, lnassets is the log of firm assets and lnlab is the log of firm labour employed. Robust standard errors in parentheses. \* Indicates 10% significance, \*\* 5% significance, \*\*\* 1%.

Table 8: **Robustness: using a different measure of TFP**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Intotal_con	-0.002*** (0.000)				-0.002*** (0.000)			
Intax		-0.004*** (0.001)		-0.004*** (0.001)		-0.003*** (0.001)		-0.003*** (0.001)
Inspend			-0.002*** (0.001)	-0.000 (0.001)			-0.001** (0.001)	-0.000 (0.001)
GDP growth	-0.001*** (0.000)	-0.001*** (0.000)	-0.001*** (0.000)	-0.001*** (0.000)	-0.001*** (0.000)	-0.001*** (0.000)	-0.001*** (0.000)	-0.001*** (0.000)
Inflation	-0.001*** (0.000)	-0.000 (0.000)	-0.001*** (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)
Trade	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)
Incap					-0.004*** (0.000)	-0.004*** (0.000)	-0.004*** (0.000)	-0.004*** (0.000)
Inassets					0.045*** (0.000)	0.045*** (0.000)	0.045*** (0.000)	0.045*** (0.000)
Inlab					-0.065*** (0.000)	-0.065*** (0.000)	-0.065*** (0.000)	-0.065*** (0.000)
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country-Time Trend	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Additional macro variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs	6418472	6418472	6418472	6418472	6408863	6408863	6408863	6408863
R <sup>2</sup>	0.18	0.18	0.18	0.18	0.20	0.20	0.20	0.20

Additional macro variables included in the regressions are: private credit, regulatory quality and research expenditure. The dependent variable in the regression is the log of total factor productivity.TFP calculated by using only the cost of materials as the variable input in the production function and estimating equation (3) instead of a composite index of labour and material cost. Incap is the log of firm capital, Inassets is the log of firm assets and Inlab is the log of firm labour employed. Robust standard errors in parentheses. \* Indicates 10% significance, \*\* 5% significance, \*\*\* 1%.

Table 9: **Robustness: using labor productivity**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Intotal_con	-0.004*** (0.001)				-0.009*** (0.001)			
Intax		0.067*** (0.001)		0.087*** (0.001)		0.012*** (0.001)		0.012*** (0.001)
Inspend			-0.005*** (0.001)	-0.044*** (0.001)			0.005*** (0.001)	-0.000 (0.001)
GDP growth	-0.009*** (0.000)	-0.008*** (0.000)	-0.009*** (0.000)	-0.008*** (0.000)	-0.004*** (0.000)	-0.004*** (0.000)	-0.004*** (0.000)	-0.004*** (0.000)
Inflation	0.015*** (0.001)	0.001*** (0.001)	0.015*** (0.001)	0.007*** (0.001)	0.004*** (0.000)	-0.001 (0.000)	0.001* (0.000)	-0.001 (0.000)
Trade	-0.006*** (0.000)	-0.005*** (0.000)	-0.006*** (0.000)	-0.006*** (0.000)	-0.000*** (0.000)	-0.000 (0.000)	0.000 (0.000)	-0.000 (0.000)
lncap					0.009*** (0.000)	0.009*** (0.000)	0.009*** (0.000)	0.009*** (0.000)
lnassets					-0.676*** (0.000)	-0.676*** (0.000)	-0.676*** (0.000)	-0.676*** (0.000)
lnlab					0.680*** (0.000)	0.680*** (0.000)	0.680*** (0.000)	0.680*** (0.000)
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country-Time Trend	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Additional macro variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs	6980882	6980882	6980882	6980882	6925313	6925313	6925313	6925313
R <sup>2</sup>	0.16	0.16	0.16	0.16	0.64	0.64	0.64	0.64

Additional macro variables included in the regressions are: private credit, regulatory quality and research expenditure. The dependent variable in the regression is the log of labour productivity lncap is the log of firm capital, lnassets is the log of firm assets and lnlab is the log of firm labour employed. Robust standard errors in parentheses. \* Indicates 10% significance, \*\* 5% significance, \*\*\* 1%.

Table 10: The role of financial development

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Intotal_con	-0.080*** (0.005)				-0.081*** (0.005)			
FD	-0.077*** (0.007)	-0.030*** (0.006)	-0.078*** (0.008)	-0.071*** (0.008)	-0.092*** (0.007)	-0.049*** (0.006)	-0.098*** (0.008)	-0.090*** (0.008)
Intotal_con × FD	0.096*** (0.007)				0.100*** (0.007)			
Intax		-0.096*** (0.008)		-0.015 (0.012)		-0.102*** (0.008)		-0.021* (0.012)
Intax × FD		0.112*** (0.010)		0.004 (0.016)		0.124*** (0.010)		0.017 (0.016)
lnspend			-0.112*** (0.007)	-0.094*** (0.010)			-0.115*** (0.007)	-0.095*** (0.010)
lnspend × FD			0.141*** (0.009)	0.124*** (0.013)			0.147*** (0.009)	0.125*** (0.013)
GDP growth	0.001*** (0.000)	0.000*** (0.000)	0.000* (0.000)	0.000 (0.000)	0.000** (0.000)	0.000** (0.000)	0.000 (0.000)	0.000 (0.000)
Inflation	0.002*** (0.000)	0.002*** (0.000)	0.001*** (0.000)	0.002*** (0.000)	0.001*** (0.000)	0.002*** (0.000)	0.001*** (0.000)	0.002*** (0.000)
Trade	0.002*** (0.000)	0.002*** (0.000)	0.002*** (0.000)	0.002*** (0.000)	0.002*** (0.000)	0.002*** (0.000)	0.002*** (0.000)	0.002*** (0.000)
lnacap					-0.015*** (0.000)	-0.015*** (0.000)	-0.015*** (0.000)	-0.015*** (0.000)
lnassets					0.061*** (0.000)	0.061*** (0.000)	0.061*** (0.000)	0.061*** (0.000)
lnlab					-0.073*** (0.000)	-0.073*** (0.000)	-0.073*** (0.000)	-0.073*** (0.000)
Constant	-0.691** (0.333)	-0.408 (0.288)	0.456 (0.333)	0.031 (0.334)	-0.094 (0.338)	0.065 (0.292)	0.828** (0.337)	0.524 (0.339)
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country-Time Trend	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Additional macro variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs	6982380	6982380	6982380	6982380	6925313	6925313	6925313	6925313
R <sup>2</sup>	0.22	0.22	0.22	0.22	0.23	0.23	0.23	0.23

Additional macro variables included in the regressions are: private credit, regulatory quality and research expenditure. The dependent variable in the regression is the log of total factor productivity. Incap is the log of firm capital, lnassets is the log of firm assets and lnlab is the log of firm labour employed. Robust standard errors in parentheses. \* Indicates 10% significance, \*\* 5% significance, \*\*\* 1%.

Table 11: **The role of financial institutions development**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Intotal_con	-0.029*** (0.005)				0.009* (0.005)			
FI	-0.003 (0.009)	0.014* (0.008)	-0.008 (0.009)	-0.003 (0.009)	-0.029*** (0.009)	-0.026*** (0.008)	-0.036*** (0.009)	-0.031*** (0.009)
Intotal_con × FI	0.028*** (0.007)				-0.016** (0.007)			
Intax		-0.013* (0.007)		0.014 (0.009)		0.027*** (0.007)		0.034*** (0.009)
Intax × FI		0.001 (0.009)		-0.031*** (0.010)		-0.045*** (0.009)		-0.054*** (0.010)
lnspend			-0.056*** (0.007)	-0.050*** (0.009)			-0.006 (0.007)	-0.014 (0.009)
lnspend × FI			0.064*** (0.009)	0.063*** (0.010)			0.005 (0.009)	0.019* (0.010)
GDP growth	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)
Inflation	0.001*** (0.000)	0.002*** (0.000)	0.001 (0.000)	0.002*** (0.000)	0.001*** (0.000)	0.002*** (0.000)	0.000 (0.000)	0.001*** (0.000)
Trade	0.002*** (0.000)	0.002*** (0.000)	0.002*** (0.000)	0.002*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)
lnacap					-0.015*** (0.000)	-0.015*** (0.000)	-0.015*** (0.000)	-0.015*** (0.000)
lnassets					0.061*** (0.000)	0.061*** (0.000)	0.061*** (0.000)	0.061*** (0.000)
lnlab					-0.073*** (0.000)	-0.073*** (0.000)	-0.073*** (0.000)	-0.073*** (0.000)
Constant	-0.471 (0.334)	-0.267 (0.308)	0.490 (0.331)	0.199 (0.338)	-0.360 (0.339)	-0.134 (0.313)	0.321 (0.337)	0.230 (0.343)
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country-Time Trend	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Additional macro variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs	6982380	6982380	6982380	6982380	6925313	6925313	6925313	6925313
R <sup>2</sup>	0.22	0.22	0.22	0.22	0.23	0.23	0.23	0.23

Additional macro variables included in the regressions are: private credit, regulatory quality and research expenditure. The dependent variable in the regression is the log of total factor productivity. Incap is the log of firm capital, lnassets is the log of firm assets and lnlab is the log of firm labour employed. Robust standard errors in parentheses. \* Indicates 10% significance, \*\* 5% significance, \*\*\* 1%.

Table 12: **The role of financial markets development**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Intotal_con	-0.037*** (0.002)				-0.045*** (0.003)			
FM	-0.054*** (0.004)	-0.027*** (0.004)	-0.049*** (0.005)	-0.044*** (0.005)	-0.058*** (0.004)	-0.030*** (0.004)	-0.055*** (0.005)	-0.046*** (0.005)
Intotal_con × FM	0.042*** (0.004)				0.060*** (0.004)			
Intax		-0.046*** (0.003)		-0.017*** (0.006)		-0.060*** (0.003)		-0.032*** (0.006)
Intax × FM		0.050*** (0.005)		0.006 (0.009)		0.078*** (0.005)		0.035*** (0.009)
lnspend			-0.044*** (0.003)	-0.033*** (0.005)			-0.054*** (0.003)	-0.032*** (0.005)
lnspend × FM			0.056*** (0.005)	0.049*** (0.008)			0.075*** (0.005)	0.048*** (0.008)
GDP growth	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.000** (0.000)	0.000*** (0.000)	0.000** (0.000)
Inflation	0.002*** (0.000)	0.002*** (0.000)	0.001*** (0.000)	0.002*** (0.000)	0.002*** (0.000)	0.002*** (0.000)	0.001*** (0.000)	0.002*** (0.000)
Trade	0.002*** (0.000)	0.002*** (0.000)	0.002*** (0.000)	0.002*** (0.000)	0.002*** (0.000)	0.002*** (0.000)	0.002*** (0.000)	0.002*** (0.000)
lnacap					-0.015*** (0.000)	-0.015*** (0.000)	-0.015*** (0.000)	-0.015*** (0.000)
lnassets					0.061*** (0.000)	0.061*** (0.000)	0.061*** (0.000)	0.061*** (0.000)
lnlab					-0.073*** (0.000)	-0.073*** (0.000)	-0.073*** (0.000)	-0.073*** (0.000)
Constant	-0.836*** (0.319)	-0.180 (0.284)	0.139 (0.319)	-0.224 (0.320)	0.273 (0.324)	0.671** (0.288)	1.017*** (0.323)	0.805** (0.325)
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country-Time Trend	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Additional macro variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs	6982380	6982380	6982380	6982380	6925313	6925313	6925313	6925313
R <sup>2</sup>	0.22	0.22	0.22	0.22	0.23	0.23	0.23	0.23

Additional macro variables included in the regressions are: private credit, regulatory quality and research expenditure. The dependent variable in the regression is the log of total factor productivity. Incap is the log of firm capital, lnassets is the log of firm assets and lnlab is the log of firm labour employed. Robust standard errors in parentheses. \* Indicates 10% significance, \*\* 5% significance, \*\*\* 1%.

Table 13: **The role of globalization**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Intotal_con	-0.348*** (0.012)				-0.251*** (0.012)			
KOFGI	-0.007*** (0.000)	-0.004*** (0.000)	-0.007*** (0.000)	-0.005*** (0.000)	-0.008*** (0.000)	-0.005*** (0.000)	-0.007*** (0.000)	-0.005*** (0.000)
Intotal_con × KOFGI	0.004*** (0.000)				0.003*** (0.000)			
Intax		-0.463*** (0.017)		-0.393*** (0.021)		-0.362*** (0.017)		-0.346*** (0.021)
Intax × KOFGI		0.005*** (0.000)		0.005*** (0.000)		0.004*** (0.000)		0.004*** (0.000)
lnspend			-0.388*** (0.015)	-0.145*** (0.019)			-0.264*** (0.015)	-0.054*** (0.019)
lnspend × KOFGI			0.005*** (0.000)	0.002*** (0.000)			0.003*** (0.000)	0.001*** (0.000)
GDP growth	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)
Inflation	0.002*** (0.000)	0.003*** (0.000)	0.002*** (0.000)	0.003*** (0.000)	0.002*** (0.000)	0.003*** (0.000)	0.002*** (0.000)	0.002*** (0.000)
Trade	0.002*** (0.000)	0.002*** (0.000)	0.002*** (0.000)	0.002*** (0.000)	0.002*** (0.000)	0.002*** (0.000)	0.002*** (0.000)	0.002*** (0.000)
lncap					-0.014*** (0.000)	-0.014*** (0.000)	-0.015*** (0.000)	-0.014*** (0.000)
lnassets					0.060*** (0.000)	0.060*** (0.000)	0.060*** (0.000)	0.060*** (0.000)
lnlab					-0.073*** (0.000)	-0.073*** (0.000)	-0.073*** (0.000)	-0.073*** (0.000)
Constant	-2.689*** (0.366)	-2.529*** (0.317)	-2.051*** (0.366)	-1.816*** (0.370)	-2.497*** (0.372)	-2.305*** (0.321)	-1.909*** (0.371)	-1.675*** (0.376)
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country-Time Trend	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Additional macro variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs	6982380	6982380	6982380	6982380	6925313	6925313	6925313	6925313
R <sup>2</sup>	0.22	0.22	0.22	0.22	0.23	0.23	0.23	0.23

Additional macro variables included in the regressions are: private credit, regulatory quality and research expenditure. The dependent variable in the regression is the log of total factor productivity. Incap is the log of firm capital, lnassets is the log of firm assets and lnlab is the log of firm labour employed. Robust standard errors in parentheses. \* Indicates 10% significance, \*\* 5% significance, \*\*\* 1%.

Table 14: **The role of globalization: de jure measure**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Intotal_con	-0.441*** (0.014)				-0.354*** (0.014)			
KOFGIdj	-0.001*** (0.000)	0.000 (0.000)	-0.000 (0.000)	0.000 (0.000)	-0.002*** (0.000)	-0.001*** (0.000)	-0.001*** (0.000)	-0.001*** (0.000)
Intotal_con × KOFGIdj	0.005*** (0.000)				0.004*** (0.000)			
Intax		-0.526*** (0.018)		-0.465*** (0.023)		-0.455*** (0.018)		-0.461*** (0.023)
Intax × KOFGIdj		0.006*** (0.000)		0.005*** (0.000)		0.005*** (0.000)		0.005*** (0.000)
lnspend			-0.488*** (0.017)	-0.199*** (0.022)			-0.367*** (0.017)	-0.087*** (0.023)
lnspend × KOFGIdj			0.006*** (0.000)	0.002*** (0.000)			0.004*** (0.000)	0.001*** (0.000)
GDP growth	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	-0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
Inflation	0.002*** (0.000)	0.003*** (0.000)	0.002*** (0.000)	0.002*** (0.000)	0.002*** (0.000)	0.002*** (0.000)	0.001*** (0.000)	0.001*** (0.000)
Trade	0.002*** (0.000)	0.002*** (0.000)	0.002*** (0.000)	0.002*** (0.000)	0.002*** (0.000)	0.002*** (0.000)	0.001*** (0.000)	0.002*** (0.000)
lncap					-0.014*** (0.000)	-0.014*** (0.000)	-0.014*** (0.000)	-0.014*** (0.000)
lnassets					0.060*** (0.000)	0.060*** (0.000)	0.060*** (0.000)	0.060*** (0.000)
lnlab					-0.073*** (0.000)	-0.073*** (0.000)	-0.073*** (0.000)	-0.073*** (0.000)
Constant	1.364*** (0.313)	-0.557** (0.280)	1.644*** (0.310)	1.360*** (0.314)	1.671*** (0.319)	0.006 (0.285)	1.866*** (0.315)	1.642*** (0.319)
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country-Time Trend	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Additional macro variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs	6982380	6982380	6982380	6982380	6925313	6925313	6925313	6925313
R <sup>2</sup>	0.22	0.22	0.22	0.22	0.23	0.23	0.23	0.23

Additional macro variables included in the regressions are: private credit, regulatory quality and research expenditure. The dependent variable in the regression is the log of total factor productivity. Incap is the log of firm capital, lnassets is the log of firm assets and lnlab is the log of firm labour employed. Robust standard errors in parentheses. \* Indicates 10% significance, \*\* 5% significance, \*\*\* 1%.

Table 15: The role of globalization: de facto measure

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Intotal_con	-0.159*** (0.009)				-0.084*** (0.009)			
KOFGIdf	-0.007*** (0.000)	-0.006*** (0.000)	-0.008*** (0.000)	-0.006*** (0.000)	-0.007*** (0.000)	-0.006*** (0.000)	-0.007*** (0.000)	-0.006*** (0.000)
Intotal_con × KOFGIdf	0.002*** (0.000)				0.001*** (0.000)			
Intax		-0.299*** (0.014)		-0.260*** (0.018)		-0.199*** (0.015)		-0.208*** (0.018)
Intax × KOFGIdf		0.004*** (0.000)		0.003*** (0.000)		0.002*** (0.000)		0.002*** (0.000)
lnspend			-0.169*** (0.010)	-0.044*** (0.013)			-0.079*** (0.010)	0.019 (0.013)
lnspend × KOFGIdf			0.002*** (0.000)	0.001*** (0.000)			0.001*** (0.000)	-0.000* (0.000)
GDP growth	0.002*** (0.000)	0.002*** (0.000)	0.002*** (0.000)	0.002*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)
Inflation	0.003*** (0.000)	0.004*** (0.000)	0.003*** (0.000)	0.004*** (0.000)	0.003*** (0.000)	0.003*** (0.000)	0.003*** (0.000)	0.003*** (0.000)
Trade	0.002*** (0.000)	0.002*** (0.000)	0.002*** (0.000)	0.002*** (0.000)	0.002*** (0.000)	0.002*** (0.000)	0.002*** (0.000)	0.002*** (0.000)
lnacap					-0.014*** (0.000)	-0.014*** (0.000)	-0.015*** (0.000)	-0.014*** (0.000)
lnassets					0.060*** (0.000)	0.060*** (0.000)	0.060*** (0.000)	0.060*** (0.000)
lnlab					-0.073*** (0.000)	-0.073*** (0.000)	-0.073*** (0.000)	-0.073*** (0.000)
Constant	-6.502*** (0.404)	-5.557*** (0.356)	-6.436*** (0.417)	-6.010*** (0.419)	-5.598*** (0.409)	-4.782*** (0.359)	-5.502*** (0.421)	-5.177*** (0.423)
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country-Time Trend	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Additional macro variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs	6982380	6982380	6982380	6982380	6925313	6925313	6925313	6925313
R <sup>2</sup>	0.22	0.22	0.22	0.22	0.23	0.23	0.23	0.23

Additional macro variables included in the regressions are: private credit, regulatory quality and research expenditure. The dependent variable in the regression is the log of total factor productivity. Incap is the log of firm capital, lnassets is the log of firm assets and lnlab is the log of firm labour employed. Robust standard errors in parentheses. \* Indicates 10% significance, \*\* 5% significance, \*\*\* 1%.

Table 16: The role of high fiscal consolidations

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Intotal_con	-0.002** (0.001)				0.001 (0.001)			
high_con × Intotal_con	-0.005*** (0.001)				-0.006*** (0.001)			
Intax		-0.011*** (0.001)		-0.015*** (0.001)		-0.007*** (0.001)		-0.012*** (0.001)
high_con × Intax		-0.001 (0.001)		0.006*** (0.002)		-0.002 (0.001)		0.007*** (0.002)
lnspend			0.005*** (0.001)	0.008*** (0.001)			0.008*** (0.001)	0.010*** (0.001)
high_con × lnspend			-0.012*** (0.001)	-0.010*** (0.001)			-0.013*** (0.001)	-0.013*** (0.001)
GDP growth	0.001*** (0.000)	0.001*** (0.000)	0.000 (0.000)	0.001*** (0.000)	0.000 (0.000)	0.000*** (0.000)	-0.000 (0.000)	0.000 (0.000)
Inflation	0.002*** (0.000)	0.002*** (0.000)	0.001*** (0.000)	0.002*** (0.000)	0.001*** (0.000)	0.002*** (0.000)	0.001*** (0.000)	0.002*** (0.000)
Trade	0.002*** (0.000)	0.002*** (0.000)	0.002*** (0.000)	0.002*** (0.000)	0.002*** (0.000)	0.002*** (0.000)	0.002*** (0.000)	0.002*** (0.000)
lnacap					-0.015*** (0.000)	-0.015*** (0.000)	-0.015*** (0.000)	-0.015*** (0.000)
lnassets					0.061*** (0.000)	0.060*** (0.000)	0.061*** (0.000)	0.060*** (0.000)
lnlab					-0.073*** (0.000)	-0.073*** (0.000)	-0.073*** (0.000)	-0.073*** (0.000)
Constant	-0.439 (0.307)	-0.437 (0.281)	0.388 (0.306)	-0.194 (0.311)	0.448 (0.313)	0.203 (0.286)	1.095*** (0.311)	0.609* (0.316)
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country-Time Trend	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Additional macro variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs	6982380	6982380	6982380	6982380	6925313	6925313	6925313	6925313
R <sup>2</sup>	0.22	0.22	0.22	0.22	0.23	0.23	0.23	0.23

Additional macro variables included in the regressions are: private credit, regulatory quality and research expenditure. The dependent variable in the regression is the log of total factor productivity. Incap is the log of firm capital, lnassets is the log of firm assets and lnlab is the log of firm labour employed. Robust standard errors in parentheses. \* Indicates 10% significance, \*\* 5% significance, \*\*\* 1%.

Table 17: **The role of low fiscal consolidation**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Intotal_con	-0.007*** (0.001)				-0.005*** (0.001)			
low_con × Intotal_con	0.005*** (0.001)				0.006*** (0.001)			
Intax		-0.013*** (0.001)		-0.010*** (0.001)		-0.009*** (0.001)		-0.006*** (0.001)
low_con × Intax		0.001 (0.001)		-0.006*** (0.002)		0.002 (0.001)		-0.007*** (0.002)
lnspend			-0.007*** (0.001)	-0.002** (0.001)			-0.005*** (0.001)	-0.003*** (0.001)
low_con × lnspend			0.012*** (0.001)	0.010*** (0.001)			0.013*** (0.001)	0.013*** (0.001)
GDP growth	0.001*** (0.000)	0.001*** (0.000)	0.000 (0.000)	0.001*** (0.000)	0.000 (0.000)	0.000*** (0.000)	-0.000 (0.000)	0.000 (0.000)
Inflation	0.002*** (0.000)	0.002*** (0.000)	0.001*** (0.000)	0.002*** (0.000)	0.001*** (0.000)	0.002*** (0.000)	0.001*** (0.000)	0.002*** (0.000)
Trade	0.002*** (0.000)	0.002*** (0.000)	0.002*** (0.000)	0.002*** (0.000)	0.002*** (0.000)	0.002*** (0.000)	0.002*** (0.000)	0.002*** (0.000)
lnacap					-0.015*** (0.000)	-0.015*** (0.000)	-0.015*** (0.000)	-0.015*** (0.000)
lnassets					0.061*** (0.000)	0.060*** (0.000)	0.061*** (0.000)	0.060*** (0.000)
lnlab					-0.073*** (0.000)	-0.073*** (0.000)	-0.073*** (0.000)	-0.073*** (0.000)
Constant	-0.439 (0.307)	-0.437 (0.281)	0.388 (0.306)	-0.194 (0.311)	0.448 (0.313)	0.203 (0.286)	1.095*** (0.311)	0.609* (0.316)
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country-Time Trend	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Additional macro variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs	6982380	6982380	6982380	6982380	6925313	6925313	6925313	6925313
R <sup>2</sup>	0.22	0.22	0.22	0.22	0.23	0.23	0.23	0.23

Additional macro variables included in the regressions are: private credit, regulatory quality and research expenditure. The dependent variable in the regression is the log of total factor productivity. Incap is the log of firm capital, lnassets is the log of firm assets and lnlab is the log of firm labour employed. Robust standard errors in parentheses. \* Indicates 10% significance, \*\* 5% significance, \*\*\* 1%.

Table 18: **The effect of tax based fiscal consolidation**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Intotal_con	-0.004*** (0.001)				-0.003*** (0.001)			
tb × Intotal_con	-0.005*** (0.001)				-0.003*** (0.001)			
Intax		-0.011*** (0.001)		-0.012*** (0.001)		-0.008*** (0.001)		-0.009*** (0.001)
tb × Intax		-0.003*** (0.001)		-0.001 (0.002)		-0.001* (0.001)		-0.003 (0.002)
lnspend			-0.003*** (0.001)	0.001* (0.001)			-0.001 (0.001)	0.002** (0.001)
tb × lnspend			-0.007*** (0.001)	-0.002 (0.002)			-0.004*** (0.001)	0.002 (0.002)
GDP growth	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)
Inflation	0.002*** (0.000)	0.002*** (0.000)	0.001*** (0.000)	0.002*** (0.000)	0.001*** (0.000)	0.002*** (0.000)	0.001* (0.000)	0.001*** (0.000)
Trade	0.002*** (0.000)	0.002*** (0.000)	0.002*** (0.000)	0.002*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.002*** (0.000)
lnacap					-0.015*** (0.000)	-0.015*** (0.000)	-0.015*** (0.000)	-0.015*** (0.000)
lnassets					0.060*** (0.000)	0.060*** (0.000)	0.061*** (0.000)	0.060*** (0.000)
lnlab					-0.073*** (0.000)	-0.073*** (0.000)	-0.073*** (0.000)	-0.073*** (0.000)
Constant	-0.671** (0.306)	-0.468* (0.280)	-0.189 (0.308)	-0.337 (0.308)	0.200 (0.311)	0.157 (0.284)	0.667** (0.313)	0.548* (0.314)
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country-Time Trend	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Additional macro variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs	6982380	6982380	6982380	6982380	6925313	6925313	6925313	6925313
R <sup>2</sup>	0.22	0.22	0.22	0.22	0.23	0.23	0.23	0.23

Additional macro variables included in the regressions are: private credit, regulatory quality and research expenditure. The dependent variable in the regression is the log of total factor productivity. Incap is the log of firm capital, lnassets is the log of firm assets and lnlab is the log of firm labour employed. Robust standard errors in parentheses. \* Indicates 10% significance, \*\* 5% significance, \*\*\* 1%.

Table 19: The effect of spending based consolidation

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Intotal_con	-0.009*** (0.001)				-0.006*** (0.001)			
sb × Intotal_con	0.005*** (0.001)				0.003*** (0.001)			
Intax		-0.014*** (0.001)		-0.013*** (0.001)		-0.009*** (0.001)		-0.011*** (0.001)
sb × Intax		0.003*** (0.001)		0.001 (0.002)		0.001* (0.001)		0.003 (0.002)
lnspend			-0.010*** (0.001)	-0.001 (0.002)			-0.005*** (0.001)	0.004** (0.002)
sb × lnspend			0.007*** (0.001)	0.002 (0.002)			0.004*** (0.001)	-0.002 (0.002)
GDP growth	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)
Inflation	0.002*** (0.000)	0.002*** (0.000)	0.001*** (0.000)	0.002*** (0.000)	0.001*** (0.000)	0.002*** (0.000)	0.001* (0.000)	0.001*** (0.000)
Trade	0.002*** (0.000)	0.002*** (0.000)	0.002*** (0.000)	0.002*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.002*** (0.000)
lnacap					-0.015*** (0.000)	-0.015*** (0.000)	-0.015*** (0.000)	-0.015*** (0.000)
lnassets					0.060*** (0.000)	0.060*** (0.000)	0.061*** (0.000)	0.060*** (0.000)
lnlab					-0.073*** (0.000)	-0.073*** (0.000)	-0.073*** (0.000)	-0.073*** (0.000)
Constant	-0.671** (0.306)	-0.468* (0.280)	-0.189 (0.308)	-0.337 (0.308)	0.200 (0.311)	0.157 (0.284)	0.667** (0.313)	0.548* (0.314)
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country-Time Trend	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Additional macro variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs	6982380	6982380	6982380	6982380	6925313	6925313	6925313	6925313
R <sup>2</sup>	0.22	0.22	0.22	0.22	0.23	0.23	0.23	0.23

Additional macro variables included in the regressions are: private credit, regulatory quality and research expenditure. The dependent variable in the regression is the log of total factor productivity. Incap is the log of firm capital, lnassets is the log of firm assets and lnlab is the log of firm labour employed. Robust standard errors in parentheses. \* Indicates 10% significance, \*\* 5% significance, \*\*\* 1%.

Table 20: **The role of firm size**

	(1)	(2)	(3)	(4)
Intotal_con	-0.014*** (0.001)			
Intotal_con × firm size	0.005*** (0.000)			
Intax		-0.024*** (0.001)		-0.024*** (0.002)
Intax × firm size		0.007*** (0.000)		0.007*** (0.001)
Inspond			-0.014*** (0.001)	0.001 (0.001)
Inspond × firm size			0.005*** (0.000)	0.001 (0.001)
Incap	-0.014*** (0.000)	-0.014*** (0.000)	-0.014*** (0.000)	-0.014*** (0.000)
Inassets	0.060*** (0.000)	0.060*** (0.000)	0.060*** (0.000)	0.060*** (0.000)
firm size	-0.076*** (0.000)	-0.076*** (0.000)	-0.075*** (0.000)	-0.076*** (0.000)
GDP growth	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)
Inflation	0.001*** (0.000)	0.002*** (0.000)	0.001* (0.000)	0.002*** (0.000)
Trade	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)
Constant	0.144 (0.291)	-0.052 (0.282)	0.810*** (0.294)	0.423 (0.294)
Country Fixed Effects	Yes	Yes	Yes	Yes
Country-Time Trend	Yes	Yes	Yes	Yes
Additional macro variables	Yes	Yes	Yes	Yes
Obs	6923458	6923458	6923458	6923458
R <sup>2</sup>	0.23	0.23	0.23	0.23

Additional macro variables included in the regressions are: private credit, regulatory quality and research expenditure. The dependent variable in the regression is the log of total factor productivity. Incap is the log of firm capital, Inassets is the log of firm assets and firm size is the log of firm labour employed (labeled lnlab in the other tables). Robust standard errors in parentheses.. \* Indicates 10% significance, \*\* 5% significance, \*\*\*1%.

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## PUBLICATIONS

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