WP/20/199

IMF Working Paper

The Fiscal Multiplier of Public Investment: The Role of Corporate Balance Sheet

by Raphael Espinoza, Juliana Gamboa-Arbelaez, and Mouhamadou Sy

INTERNATIONAL MONETARY FUND

 WP/20/199

IMF Working Paper

Fiscal Affairs Department

The Fiscal Multiplier of Public Investment: The Role of Corporate Balance Sheet

Prepared by Raphael Espinoza, Juliana Gamboa-Arbelaez, and Mouhamadou Sy[1]

Authorized for distribution by

Catherine Pattillo and Nikolay Gueorguiev

September 2020

Abstract

This paper explores whether public investment crowds out or crowds in private investment. To this aim, we build a database of about half a million firms from 49 countries. We find that the effect of public investment on corporate investment depends both on leverage and financial constraints. Public investment boosts private investment for firms with low leverage. However, for firms with high leverage, private investment does not react to an increase in public investment, in line with theory (Myers 1977). We also find that the effect of public investment on corporate investment is much weaker for firms that are financially constrained.

JEL Classification Numbers: E22; E62; G31; G39; R42.

Keywords: Public investment; private investment; fiscal multipliers; crowding in; crowding out; corporate balance sheet.

Authors' E-Mail Addresses: REspinoza@imf.org; gambo038@umn.edu ; MSy@imf.org

[1] The authors are grateful for comments and suggestions from N. Gueorguiev, C. Pattillo.

Contents

Figures

I. INTRODUCTION

The global economy is projected to shrink by 4.9 percent in 2020 from a positive growth rate of 2.9 percent recorded in 2019 because of the consequences of the Great Lockdown (IMF, 2020a). In addition, the perspectives for growth in the medium-term are falling. Economic activity has stalled as acute uncertainty on the dynamics of the pandemic is taking a toll on firms' investment plans and private consumption. Private investment (excluding residential investment) in advanced economies decreased by 21.5 percent between 2019Q2 and 2020Q2. Private consumption has also fallen, and households' savings are expected to remain high, driven by worries about rising unemployment and uncertainty on jobs prospects (see Gagnon 2020). As the pandemics recedes and economies reopen, governments will need to consider how to support private spending. Among the possible fiscal instruments, public investment stands out as having both short-term and long-term benefits. In the short-term, public investment has a high fiscal multiplier (IMF, 2020b); in the long run, it increases the productive capacity of the economy.

In addition, public investment could help boost private investment, which would both increase the fiscal multiplier and support long-term productivity growth. However, the effect of public investment on corporate investment might depend on the financing capacity of firms to invest. This could be seriously hampered by the COVID-19 crisis. Indeed, the OECD (2020) estimates that a large share of European firms will face liquidity constraints because of confinement policies (see also IMF, 2020c). Better understanding the role of balance sheet conditions following a fiscal stimulus is important to understand complementarities between policies to support firms and policies to support aggregate demand.

This paper studies how public investment affects firms' investment. Specifically, we analyze the conditions under which public investment can boost firms' investment by focusing on two important questions:

(i) What is the average effect of public investment on corporate investment (how large is the "multiplier", or "crowding-in effect")?

(ii) Do balance sheet conditions matter for the effect of public investment on corporate investment (how sensitive is the multiplier to balance sheet conditions)?

We focus on two important measures of balance sheet strength: leverage, which is measured as the level of debt relative to assets, and financing constraints, which exist when a firm does not have enough internal sources of funds to finance its investment. Hennessy et al. (2007) show both theoretically and empirically that high debt and financial constraints discourage firms' investment. Thus, balance sheet strength could also affect the multiplier, particularly during periods of economic downturns such as the Global Financial Crisis (GFC) or the Great Lockdown.

Since the COVID-19 crisis is having very heterogenous effects across sectors, while at the same time is raising questions of what kind of public investment should be increased, this paper also assesses the effect of different types of public investment and analyses the response of corporate investment differentiating by the sectors in which each firm operates.

This paper seeks to unify two strands of literature. The first is the macroeconomic literature on fiscal multipliers, which studies the effect of government spending on outcomes such as GDP growth. This literature has noted that public investment may be a particularly powerful fiscal tool (e.g. IMF, 2020b). The second is the corporate finance literature that focuses on the effect of balance sheet conditions on corporate investment and find that firm leverage is an obstacle to private investment (e.g. Kalemli-Özcan et al., 2018; see section II.B).

To the best of our knowledge, this paper is the first to provide empirical evidence on the link between public investment, private investment, and the strength of corporate balance sheets. We build a database of about half a million private firms from 49 countries from 1999 to 2017 using the Orbis database. The sample mostly covers advanced and emerging markets (Table 1). We find that the effect of public investment on corporate investment depends both on leverage and financial constraints. Public investment boosts private investment for firms with low leverage. However, a public investment stimulus does not crowd in private investment for firms with high leverage, possibly because of the risks that high corporate debt puts on future profits and the risk of bankruptcy. We also find that the effect of public investment is positive for both financially constrained and less financially constrained firms. However, the public investment's multipliers are much higher for firms that are less financially constrained. At a time when the focus is on how to support the recovery after the Great Lockdown, policymakers need to keep in mind that addressing both high corporate leverage and financial constraints will be necessary to harness the benefits of a public investment fiscal stimulus for private investment.

The remaining of the paper is organized as follow. Section II discusses the literature with a focus on public investment multipliers and private investment and the strength of firms' balance sheet. Section III presents the data from Orbis and the methodology, which is based on local projection method. Section IV discusses the econometric results and policy implications. Section V concludes.

II. Selected Literature Review

A. Public Investment Multipliers

The fiscal multiplier measures the short-term impact of discretionary fiscal policy on output (Battini et al., 2014; see also Ramey, 2019, for a survey of the post-GFC literature). Recent contributions have studied whether multipliers depend on the state of the economy (Auerbach and Gorodnichenko, 2012), on monetary and exchange rate regimes (Ilzetzki et al. 2013), and on the proximity to the zero-lower bound on interest rates (Miyamoto et al. 2018). The size of the fiscal multipliers may also vary by fiscal instrument and depend on the quality of

governance (Miyamoto et al., 2020). Gechert and Rannenberg (2018) conduct a meta-regression analysis of the literature on fiscal multipliers and find that government expenditure on goods and services is significantly higher during downturns than during average economic periods. They confirm the findings by Gechert (2015) that indicates that government spending multipliers tend to be larger than tax multipliers, and this is particularly true for public investment multipliers.

The fiscal multiplier may be higher for public investment because in addition to its effect on aggregate demand, public investment has the potential to expand the productive capacity of the economy, both directly and indirectly by crowding in private investment (IMF, 2014). For instance, An, Kangur and Papageorgiou (2019) find, using a production function approach, that public capital and private capital are imperfect substitutes. Abiad et al. (2016) use investment forecast errors at the macro level to identify the causal effect of government investment and find that increased public investment raises output, both in the short-term and in the long-term, crowds in private investment, and reduces unemployment. In advanced economies, investment multipliers range from 0.4 (in the short-term) to 1.4 (in the medium-term) and are higher than public consumption multipliers, due to the public investment positive supply side effects (IMF, 2014; Coenen et al., 2012). Kraay (2014) uses variation in World Bank financing to estimate a multiplier of around 0.5 in low-income countries. In a later paper Eden and Kraay (2014) estimate the effect of public investment on private investment in a sample of 39 low-income countries. They identify the fluctuations in disbursements on loans from official creditors and used them as proxies of fluctuations in public investment. They find evidence of a "crowd-in" effect: a dollar of government investment raises private investment by about two dollars, and output by 1.5 dollars.

A few papers using subnational data have also found large multipliers for public investment. Acconcia et al. (2014) use Italian provincial level data and an exogenous variation in public investment, driven by the dismissal of local officials because of Mafia-related inquiries, to estimate a multiplier of at least 1.5. Leduc and Wilson (2013) use US state-level funding for highways and estimate a multiplier of public infrastructure of 2 at a 10-year horizon. They also find larger short-term multipliers in recessions.

Finally, the literature on firm-level productivity has contributed to the understanding of the importance of public infrastructure. Nadiri and Manumeas (1993) found that public infrastructure reduces the cost structure of manufacturing firms using data at the two-digit classification for the US. The effects on the cost structure are significant for every industry and generate significant productivity effects on the firms. Fernald (1999) found that US industries that are more vehicle intensive have a disproportionately increase in productivity after the construction of roads (largest component of infrastructure), but on the margin, road investments are not unusually productive. Hence, he concludes that big infrastructure pushes (i.e. the construction of the interstate highway network) offer a onetime increase on firm productivity. Holl (2016) uses micro-level data on manufacturing firms in Spain to estimate the effect of access to highways on firm-level productivity. He concludes that access to

highways increase firm-level productivity directly and the benefits are unevenly distributed across sectors. Using Orbis data as well as input-output data from six Latin American countries, Lanau (2017) identifies the impact of infrastructure on growth by exploiting the variation in the dependence of sectors in the economy on infrastructure. Using a difference-in-difference analysis he finds that improving the quantity or quality of infrastructure increases growth, and the effect is larger for sectors that depend relatively more on infrastructure.

B. Corporate Investment and the Strength of Firms' Balance Sheet

The growth in private sector debt in advanced economies since the mid-1990s and 2000s (Mbaye et al. 2018) has motivated an extensive literature on the effect of high debt on corporate investment. Many papers (Jager, 2003; Goretti and Souto, 2013; Chen and Lu, 2016; Borensztein and Ye, 2018; Kalemli-Özcan et al., 2018 among others) find that high debt is negatively associated with corporate investment. A few mechanisms can explain such findings. High debt induces higher default risks in the event of an economic downturn, and thus more aversion to risk at the firm level. Default risk also increases borrowing costs and reduces the availability of funds to finance new investment. Hennessy (2004) shows that very high debt distorts both the level and composition of corporate investment. High debt induces underinvestment on long-term assets. This effect is particularly acute during periods of financial distress because firms tend to be highly leveraged and have lower capacity to finance investment using internal sources of funds (Gebauer, Setzer, and Westphal, 2018).

The corporate finance literature has also studied the effect of financial constraints on firms' investment. This literature emphasizes the importance of making the distinction between internal finance (especially retained profits) and external finance (e.g. bonds, bank credit, etc.). When capital markets are perfect and complete, internal and external funds are perfect substitutes and the financial structure does not matter. This is the famous Modigliani-Miller theorem (Modigliani and Miller, 1958). But the liability structure of the balance sheet matters when capital markets cannot fully assess firms' investment opportunities (Myers 1984; Serven and Solimano, 1992); hence, the cost of external financing is higher than the cost of internal funds. This is why cash flow—a good proxy of internal funds—is expected to affect investment (Fazzari et al. 1998), although there are competing views on the sensitivity of firms' investment to cash flow (Kaplan and Zingales, 1997); Fazzari, Hubbard, and Petersen, 2000; Moyen, 2004).

III. Data and Methodology

A. Balance Sheet Data

The data on nonfinancial corporate firms comes from Orbis. The Orbis database compiled by the Bureau van Dijk is the primary source for balance sheet data. The database contains information about state-owned and private-owned firms in many countries for up to 20 years,

providing both financial and real sector information (e.g. employment) about the firms. However, the coverage is uneven across countries.[2]

The raw Orbis data, while rich, requires treatment to correct for some data issues. The analysis is based on unconsolidated financial data of nonfinancial private corporate companies in the following sectors: agriculture, electricity and gas, water and sewerage, mining (including oil) and quarrying, manufacturing, communication, transport, and construction. The data cleaning closely follows Kalemi-Ozcan and others (2015) and Baum and others (2019). Observations that have negative assets, negative tangible assets, negative employees, or negative sales were dropped first. Any observation with missing data for total assets, sales, numbers of employees, or total operating revenues was dropped. Last, companies that have four or fewer years of data available were dropped. Observations that are duplicates, do not have an industry classification (either nace2 or nace4), or are missing cost of employees and productivity were also dropped.

Additional adjustments are made to address outliers. While the majority of return on average equity observations lie within plus and minus 20 percent, a significant number of observations have large values (positive and negative), which might indicate either misreporting or equity close to zero. Therefore, a company observation is only included in the sample if the return on average equity is between –50 and 50 percent. Firms that have zero sales, sales above $1.5 million per employee, or zero labor costs per operating revenue are also excluded. As in Gopinath and others (2017) observations below the 0.1 percentile or above the 99.9 percentile of the distribution of each variable (except for return on average equity) are dropped.

The final database consists of about 400,000 firms in 49 countries, of which 26 are advanced economies, 23 are emerging markets and developing economies.

B. Econometric Strategy

Econometric Specification

We conduct two different exercises, the first is to establish the impact of public investment on firm's net investment, and the second to determine whether the elasticity of private investment to public investment changes with the strength of firms' balance sheets. The baseline specification—which closely follows IMF (2014) —is as follows:

$$k_{i,c,s,t+h} - k_{i,c,s,t+h-1} = \alpha_i + \mu_t + \beta_{1,h} G(z_{it}) GIS_{c,t} + \beta_{2,h}\big(1 - G(z_{it})\big) GIS_{c,t} + X_{i,c,s,t+h-1} + \xi_{i,t+h} \quad (1)$$

[2] Total output from the companies reported by Orbis varies widely across countries, see Kalemi-Ozcan and others (2015) for a discussion on nationally representative firm-level data. Even tough in the raw historical dataset more countries are present, the coverage of some countries is not good. This is why after the cleaning process, some countries that are not well covered in Orbis are not included.

with

$$G(z_{it}) = \frac{\exp(-\gamma z_{it})}{1+\exp(-\gamma z_{it})}, \ \gamma > 0 \quad (2)$$

where z is an indicator of the conditions of firms' balance sheet (e.g. leverage) normalized to have zero mean and unit variance. The dependent variable is the net investment rate of firm i, in country c, in sector s at horizon h. The net investment rate is computed as the annual change in real fixed tangible assets scaled by lagged fixed tangible assets[3]. Therefore, k is the logarithm of real capital stock. α_i and μ_t are firm and time fixed effects, respectively. GIS is the public (general government) investment shocks. All explanatory variables (X) are lagged to avoid endogeneity issues but also because investments are executed with lags. We use growth in sales as a control of firms' prospect on investment, earnings before interest, taxes, depreciation, and amortization (EBIDTA) to control for profitability, number of employees as a control of firm size, and GDP growth as the control of the effect of the economic activity on firms' investment[4].

Local Projection Estimation

The methodology for assessing the short-term to medium-term impact of public investment on corporate investment (equation (1)) depending on firms' balance sheet conditions is based on the local projection estimator developed by Jorda (2005). The method allows us to draw the impulse response functions by directly estimating the coefficient at each time horizon. It estimates impulse response functions with a single equation OLS, and provides simple, analytic, joint inference for impulse response coefficients which are more robust to misspecification. The methodology allows for nonlinear specifications that can be adjusted to estimate state dependent models. A drawback from local projections is that the estimates are often less precisely estimated and can be sometimes erratic. Nonetheless, the procedure is more robust than some alternative methods (Jorda, 2005; Ramey, 2016).

We closely follow the methodology in Ramey and Zubairy (2018) where cumulative multipliers (or integral multipliers) are calculated using the local projection estimation method. They argue that the integral multipliers address the relevant policy question because they measure the cumulative gain of investment relative to the cumulative public investment during a given period. Ramey and Zubairy (2018) show that the Blanchard-Perotti method (non-cumulative multipliers) tends to bias the estimates of multipliers upwards.

[3] We use net investment rather than gross investment because it is the first that matters for future productivity. Our measure of net investment rates is standard in the literature. See among others Kalemli-Özcan et al. (2015), Chen and Lu (2016), and Lanau (2017).

[4] Table 2 provides the list of all variables and their definition.

IV. ECONOMETRIC RESULTS

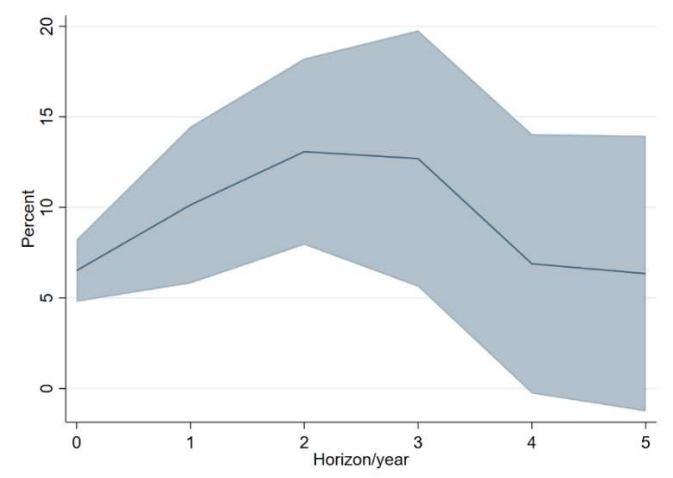
A. First Approach: Public Investment Growth Shock

Our first approach is based on public investment growth shock and we study the effects of public investment on private investment depending on the conditions of the balance sheet.

Level Effect on Public Investment

What is the effect of public investment on corporate investment? The estimation of the linear version of equation (1) shows that a 1 percent of GDP positive shock to public investment is associated to an increase in the net investment rate by 6.5 percent at the impact of the shock. The cumulative effect peaks at 13 percent at year 3 and decreases to 6.3 percent after six years (Figure 1). This result suggests that public investment has a direct and positive effect on firm's investment and could be used to boost total—both public and private—investment and aggregate demand. There is an old literature that studies the complementarity between public and private investment. Blejer and Khan (1984) found that government in public investment boosts private investment. Musalem (1989), Green and Villanueva (1991), and Serven and Solimano (1991) found also that public and private investment are complements. However, Balassa (1988) found the opposite result.

Figure 1. Linear Effect on Public Investment on Private Firms' Net Investment Rates



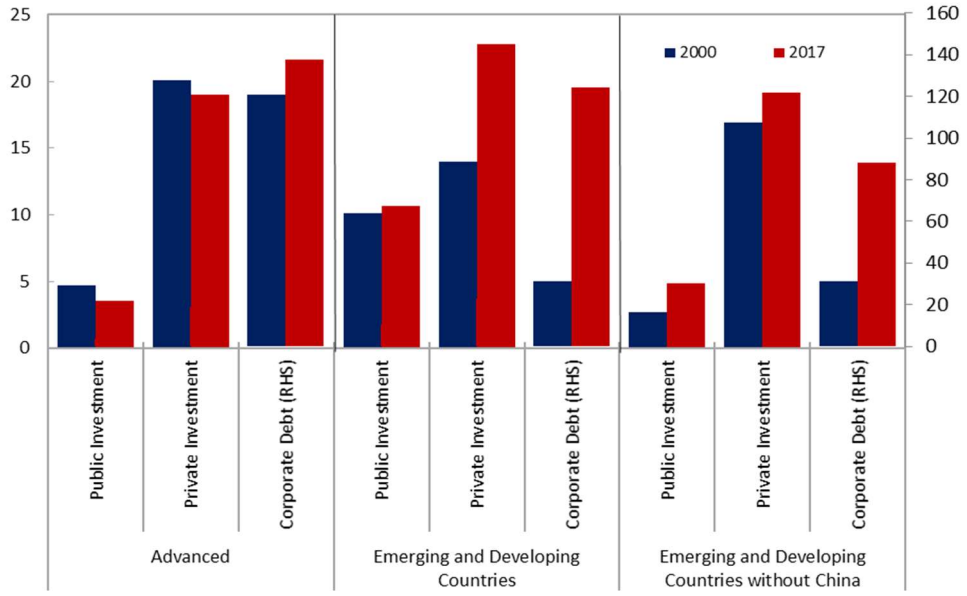
Source: Authors' estimates.
Note: The chart shows the results of the local projections method (Jorda, 2005) of the effect of public investment stimulus on firm's net investment rate. The cumulative multiplier (blue line) over a 6-year horizon is plotted. Net investment rate is defined as the annual change in tangible fixed assets. Confidence intervals are set at 90% (dash lines).

Our result implies that there are some complementarities between public and private investments. However, there is a lot of heterogeneity in our sample in terms of balance sheet conditions. All firms do not have a similar strength. Therefore, effect of public investment on private investment should depend on firms' balance sheet conditions. It is important to understand these conditions to better assess the impact of public investment on corporate investment. This allows to increase the granularity and the relevancy of policy recommendations. Figure 2 shows the evolution of public investment, private investment,[5] and corporate debt. Over the last two decades, both advanced

[5] A better measure should be corporate investment but due to lack of data, we are using private investment.

and emerging markets experienced a large increase in their corporate debt. However, public investment and private investment decreased in advanced economies while increasing in emerging and developing countries during that period. This highlights the difficulty in using macroeconomic data to isolate the effect of public investment on private investment and, therefore, the value of using firm-level data.

Figure 2. Private Investment, Public Investment, and Corporate Debt
(Weighted average by income group, percent of GDP)



Source: Global Debt Database, WEO, and author's calculations.

Fiscal Multiplier and the Balance Sheet: The Role of Corporate Leverage

The effect of public investment on firms' investment could be lower for firms with high debt. High debt levels that put at risk future profits. Myers (1977) proposed an analytical framework that allows to understand the effect of leverage on corporate investment. More specifically, higher debt can discourage firm investment because new investments financed by the new debt could generate future low cash flows. Therefore, firms that are highly leveraged could underinvest even if the net present value of new projects is positive. For firms that are highly leveraged, future profits are likely to benefit debt holders rather than equity holders. In addition, higher interest payments and increasing borrowing costs (because of higher default risks), put a drag on new investment. Borensztein and Ye (2018) tested the idea of Myers (1977) and found that high debt burdens negatively affect firms' investment in a sample of 13 emerging market economies. Other studies[6] found similar results. We extend this literature by examining whether the effect of public investment on private investment depends on the level of corporate debt.

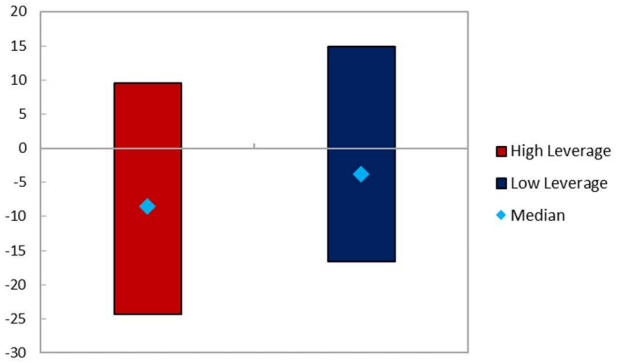
[6] See among other Kalemli-Özcan et al. (2018) and Magud and Sosa (2015).

Figure 3 shows the distribution of net investment rates conditioned on the level of leverage. The figure shows that firms with low leverage have on average higher net investment rates. This stylized fact is in line with the above mentioned theoretical and empirical literature.

Figure 4 and Table 4A are based on the estimation of equation (1). It shows that the effect of public investment on corporate investment is highly nonlinear. Indeed, whether there is crowding-in or crowding-out of private investment depends on the level of corporate debt. Firms with low leverage see an increase in their investment rates following an increase in public investment. In the initial period of the shock, their net investment rates increase by 2.5 percent. The cumulative impact is 10.7 percent after six years. For firms with high leverage, however, the effect of public investment is zero at impact and is negative for the remaining forecast horizon. The cumulative decrease in net investment rates for firms with high leverage is about -5.0 percent after six years.

Figure 3. Net nvestment Rates and Leverage

(Percent)

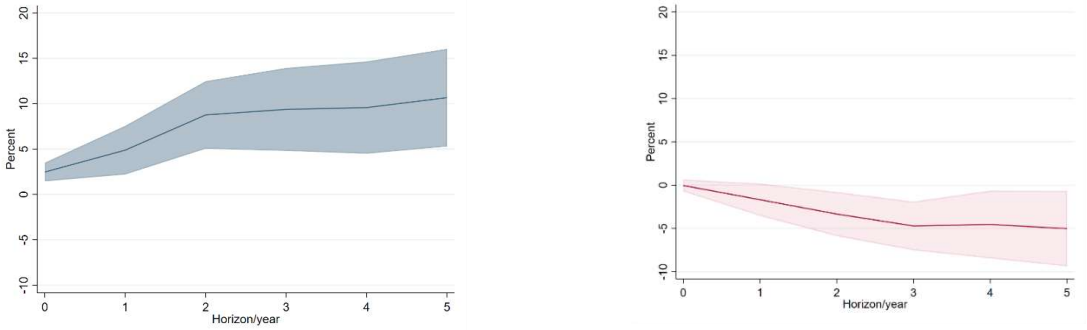


Source: Orbis and author's calculations.

Notes: A company with high leverage is defined as being over the 75 percentiles of the distribution of debt and low leverage is defined as being below the 25 percentile of the distribution of debt.

Figure 4. Non-linear Effect of Leverage on Private Firms' Net Investment Rates

a. Low Leverage **b. High Leverage**



Source: Authors' estimates.

Notes: The charts show the results of the local projections method (Jorda, 2005) of the effect of public investment stimulus on firm's net investment rate depending on the level of leverage of the firm. The cumulative multiplier (blue line) over a 6-year horizon is plotted. Net investment rate is defined as the annual change in tangible fixed assets. Leverage is defined as total debt divided by total assets. Confidence intervals are set at 90% (dash line).

These results are consistent with the analytical framework proposed by Myers (1977). Indeed, when corporate debt is low, a fiscal stimulus can help firms boost their investments and future profits may not be at risk. However, when corporate debt is high, the fiscal stimulus may be not effective. Therefore, the weakness of firms' balance sheets may need to be addressed before a public stimulus, because firms with high leverage devote more cash to pay back their debt

limiting their ability to invest. Put differently, our results indicate that balance sheets should be supported to maximize the fiscal multiplier. These results are also consistent with studies that used macro data to study how the levels of sovereign debt affect the impact of government stimulus. For example, Ilzetzki, Mendoza and Vegh (2013) found that high public debt is associated with negative fiscal multipliers while low public debt is associated with positive fiscal multipliers.

The policy implications for the current crisis is that supporting firms that are highly leveraged will be essential for a stimulus to boost the recovery. Instruments to address solvency risks include transfers and if the situation of the firm is worrisome, equity injections or debt restructuring can help, although the private sector should take the lead on the process (Blanchard, Philippon and Pisani-Ferry, 2020). However, cleaning up private firms are first and foremost the (financial) responsibility of the firms' private shareholders. The state could offer the option of acquiring equity stakes in private companies if they agree. In this case, to minimize the fiscal cost, public support to private firms should be transparent, costed, recorded, targeted, and temporary.

Fiscal Multiplier and the Balance Sheet: The Role of Financial Constraints

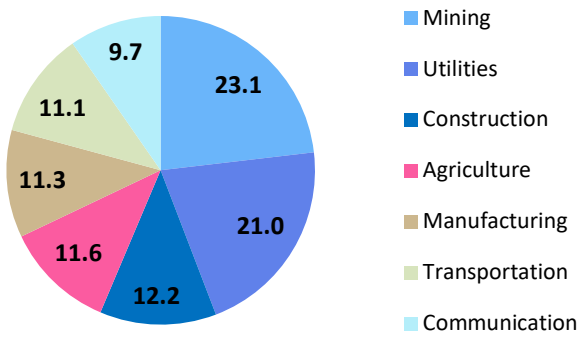
Financial constraints play an important role on firms' investment. If firms are constrained in their ability to raise external funds (e.g. because they are more expensive), internal funds become an important determinant of investment. Therefore, investment should be very sensitive to financial constraints. Fazzari, Hubbard and Petersen (1998) study the dependency of investment to financial constraints across a group of US manufacturing firms and found that cash flow does affect firms' investment spending because of capital market imperfections. Using a sample of UK firms, Carpenter and Guariglia (2008) found that financial constraints play an important role on firms' decision to investment. This is particularly true for small firms. Magud and Sosa (2015) found also similar results based on a sample of 38 emerging market economies.

We contribute to this literature by examining the effect of public investment on firms' investment spending depending on the degree of financial constraints. There is no item in the balance sheet that tells us if a firm is financial constrained or not. We adopt the definition that a firm is financially constrained if there is a wedge between internal and external costs of funds. We rely on a standard proxy—cash flow—to measure financial constraints. A firm is deemed to be financially constrained if it has at least three consecutive years of negative cash flows normalized by real capital stock. Our implicit assumption is that a firm with successive positive cash flows is likely to use internal funds and will be less financially constrained. The cash-flow definition of a financing constraint is rather stringent but allow to provide a proxy of firms' liquidity problems. All sectors are affected by financial constraints (Figure 5). However, it is more acute in the mining and utilities sectors, possibly because these industries are capital intensive.

Figure 6 shows the distribution of net investment rates conditioned on the financial constraints of the firm. The figure shows that firms who are more financial constrained have on average lower net investment rates. This stylized fact is also in line with the above mentioned theoretical and empirical literature.

Figure 5. Financially Constrained Firms by Sector

(Percent)

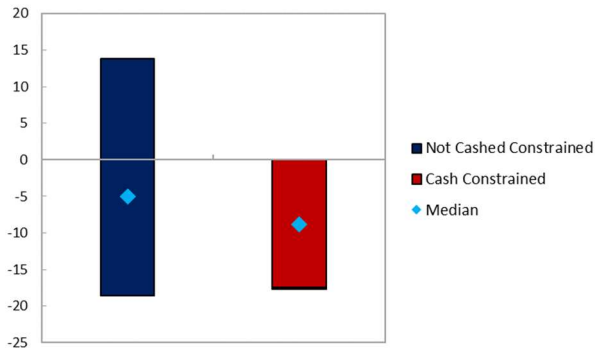


Source: Orbis and author's calculations.
Notes: The figure shows the average percentage of constrained firms by sector for the years 2010 – 2017.

Figure 7 and Table 5A are also based on the estimation of equation (1). The results show that financial constraints matter for the effect on public investment on private investment. Both types of firms see an increase in their net investment rates following an increase in public investment. However, the fiscal multipliers are higher for firms that are less financially constrained. At the impact of the public investment shock, net investment rates of firms that are financially constrained increase by 2.3 percent and its cumulative impact peaks at year 2 with an effect of around 8 percent, although it decreases towards 0 after six years. For firms that are less financially constrained, net investment rates increase by 6.7 percent at the impact and reach a cumulative impact of 12.9 percent at year 3 and then decreases to 6.6 percent after six years. These results highlight the importance of internal funds and financial constraints for the impact of public stimulus on corporate investment.

Figure 6. Net Investment Rates and Financial Constraints

(Percent)



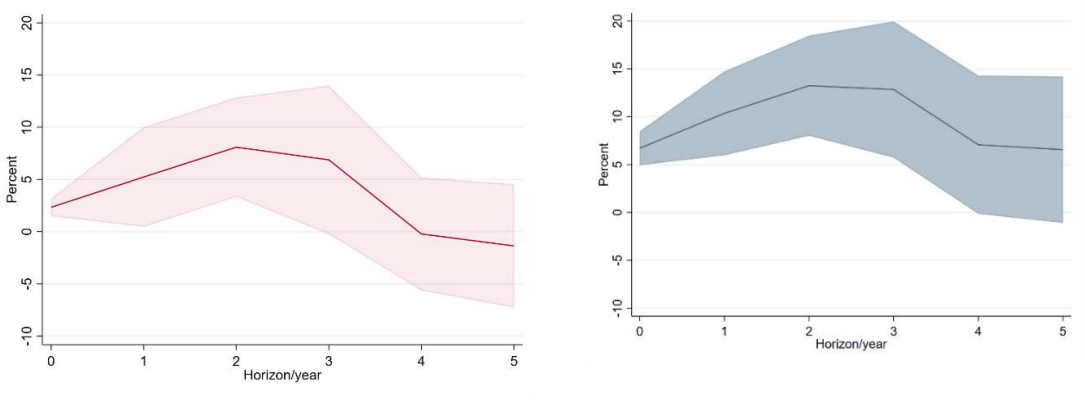
Source: Orbis and author's calculations.
Notes: A financially constraint firm is one that has at least three consecutive years of negative cash flow.

The implication of these results for the current crisis is the necessity to support firms particularly those that are cash constrained. Firms that are financially constrained but viable can be supported thanks to central bank (quasi-fiscal) operations as well as fiscal measures that provide liquidity. These include tax relief (as done in e.g. China, the UK, Indonesia), tax deferral (as done in Germany, Italy, and Korea), and debt service deferrals (see IMF 2020d for a comprehensive coverage of policy measures taken during the Great Lockdown). Expenditure

measures such as wage subsidies or government guaranties can also encourage firms to preserve employment, wages, and investment (Balibek et al., 2020).

Figure 7. Non-linear Effect of Financial Constraints on Corporate' Net Investment Rates

a. Financially Constrained **b. Not Financially Constrained**



Source: Authors' estimates.

Notes: The charts show the results of the local projections method (Jorda, 2005) of the effect of public investment stimulus on firm's net investment rate depending on the degree of financial constraint of the firm. The cumulative multiplier (blue line) over a 6-year horizon is plotted. Net investment rate is defined as the annual change in tangible fixed assets. A financially constraint firm is one that has at least three consecutive years of negative cash flow to capital. Confidence intervals are set at 90% (dash line).

Fiscal Multiplier and the Balance Sheet: A Macroeconomic Perspective

So far, we have presented our results in a form of elasticities but they can be converted to a more traditional fiscal multipliers, under the assumption that only private investment reacts to the fiscal shock.[7] To this aim, we define the multiplier from a macro perspective as the increase of private investment, in percent of GDP, when public investment increases by one percent of GDP (Table 3). The multiplier is consistent with what has been found in the literature. Eden and Kraay (2014) find that the multiplier for low income and developing countries ranges from 1.8 to 2.3, while Abiad et al. 2016 find that the multiplier for advanced economies is around 0.4.

Table 3. Fiscal Multipliers

	Elasticities	Multipliers
Linear estimation	0.07	1.4
Leverage		
Low	0.02	0.5
High	0.00	-0.1
Financial constraints		
Constrained	0.02	0.4
Not constrained	0.07	1.4

Source: Orbis, WEO, and author's calculations.

Fiscal Multiplier and the Balance Sheet: A Sectoral Perspective

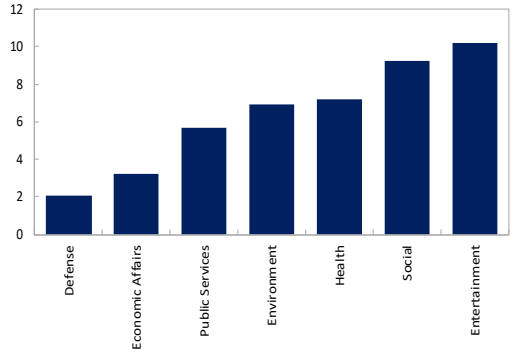
A sectoral decomposition analysis in conducted in efforts to highlight the sectors that could benefit the most from an increase in public investment as well as to highlight what kind of public investment is the most efficient at stimulating private investment. An analysis of the

[7] It is not clear whether this is an upper bound or a lower bound estimate. Although private consumption may increase with public investment because of Keynesian effects, the trade balance may deteriorate. Indeed, Eden and Kraay (2014) find a smaller effect of public investment on output than on private investment.

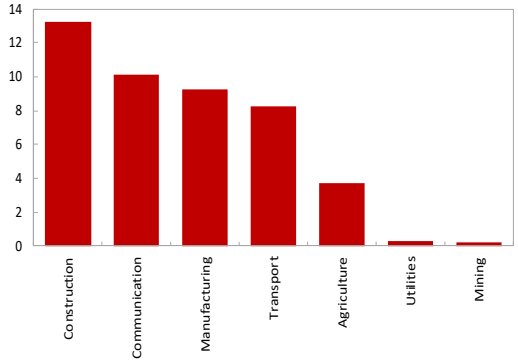
firm-level response to public investment shocks, which separates public investment by type and distinguishes firms by sectors of activity, shows that public investments in entertainment followed by healthcare and other social services are associated with sizable increases in private investment at the one-year horizon (see Figure 8.a). This complements earlier findings that healthcare and social spending has strong Keynesian multipliers because these sectors are labor intensive, and the import leakages are small (Reeves et al., 2013). The analysis also shows that public investment on the environmental sector has substantial increases in private investment at the one-year horizon.

Figure 8. Effect of Public Investment on Private Firms' Net Investment
(in percent)

a. Type of Public Investment



b. Sector of Operation of Firms



Source: Orbis, OECD and authors' estimates.
Notes: The effect of public investment on private investment depends both on the type of public investment (left panel) and on the economic sector in which firms operate (right panel). Defense includes defense and public order and safety, Social covers education and social protection, Entertainment includes recreation, culture and religion, and public services covers general public services and housing and community amenities.

It is also important to consider the impact of public investment on sectors in which private firms operate. Our analysis shows that there is a strong crowded-in in industries that are critical for the resolution of the current COVID-19 health crisis (for example communications and transport). There is also evidence that firms within the sectors that can support the recovery, such as construction and manufacturing firms, have strong and sizable responses to an increase in public investment (see Figure 8.b).

B. Second Approach: Public Investment Forecast Errors Shock

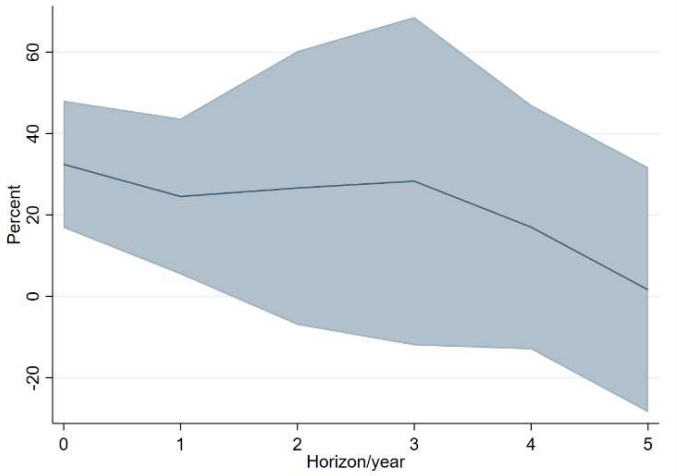
The first approach to identifying shocks was based on growth in public investment. The main shortcoming of this approach is that the effect of public investment is likely correlated with other macroeconomic shocks. Thus, the public investment shock might not be fully exogenous. We therefore use unanticipated shocks to public investment, building on forecasts by IMF country desks published in the IMF World Economic Outlook (WEO). The public investment shock is thus a forecast error (FE), defined as the difference between actual and forecasted

public investment as a share of GDP ($FE_{c,t}$).[8] The forecasted public investment for year *t* is taken from the October vintage of the WEO for the year *t-1*. Equation (1) becomes:

$$k_{i,c,s,t+h} - k_{i,c,s,t+h-1} = \alpha_i + \mu_t + \beta_{1,h} G(z_{it}) FE_{c,t} + \beta_{2,h}(1 - G(z_{it}))FE_{c,t} + X_{i,c,s,t+h-1} + \xi_{i,t+h} \quad (3)$$

This approach helps overcomes endogeneity concerns that alter the causal estimation of the fiscal multipliers. First, it allows to overcome the problem of fiscal foresights (Leeper et al., 2012; Leeper et al., 2013; Zeev and Pappa, 2015; Furceri and Li, 2017). Firms investment strategies are likely to react to new news about public investment (Ramey, 2011) as well as to the realization of public investment. Therefore, it is important to use a refined measure of unanticipated shocks (Auerbach and Gorodnichenko, 2012, 2013). Second, it allows to rely on forecast errors to isolate the true "innovations" contained in public investment. The identification strategy assumes that public investment shocks do not affect the state of the balance sheet at time *t;* this means that the balance sheet conditions remain unaltered at the time of the shock (Abiad et al., 2016). Figure 9 shows that these unanticipated shocks have a positive effect on private firms' net investment rates. Net investment rates increase by 32.5 percent the year when the investment shock is 1 percent (of GDP) and the effect disappears over time.

Figure 9. Linear Effect of Public Investment Shock on Private Firms' Net Investment Rates



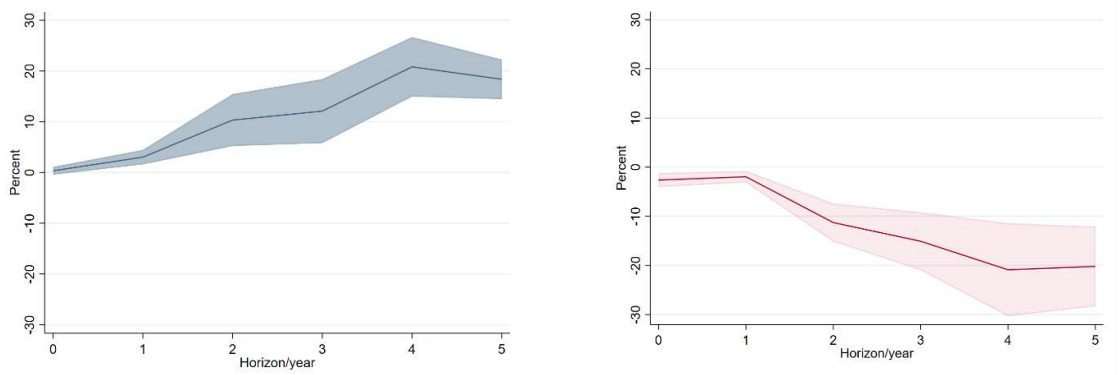
Source: Authors' estimates.
Note: The chart shows the results of the local projections method (Jorda, 2005) of the effect of a public investment forecast errors shock on firm's net investment rate. The cumulative multiplier (blue line) over a 6-year horizon is plotted. Net investment rate is defined as the annual change in tangible fixed assets. Confidence intervals are set at 90% (dash lines).

Figure 10 and Table 4B shows the effect of the unanticipated shocks on firm's net investment rates depending on the firm's levels of debt. The qualitative results are the same than those with the expected shocks. Low leverage is associated with positive multipliers while high leverage is associated with negative multipliers.

[8] Given that the left-hand side is expressed in growth rate, the shock is also expressed in growth rate by dividing the difference between the forecast and the actual public investment with the actual public investment.

Figure 10. Non-linear Effect of Leverage on Private Firms' Net Investment Rates

a. Low Leverage **b. High Leverage**



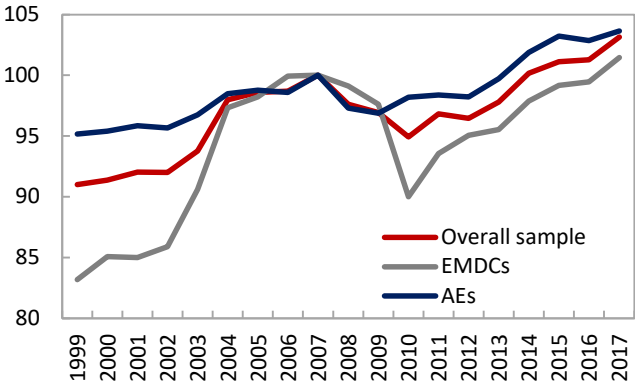
Source: Authors' estimates.

Notes: The charts show the results of the local projections method (Jorda, 2005) of the effect of a public investment forecast errors shock on firm's net investment rate depending on the level of leverage of the firm. The cumulative multiplier (blue line) over a 6-year horizon is plotted. Net investment rate is defined as the annual change in tangible fixed assets. Leverage is defined as total debt divided by total assets. Confidence intervals are set at 90% (dash line).

The main advantages of using cash flow as a proxy of financial constraints are that it is easy to interpret and operationalize, it is firm-specific, and it is time-varying. However, its main weakness is that financial constraints are too complex to be captured by a unidimensional index. For example, even though cash flow is a powerful variable to proxy for financial constraints, some other variables such as the solvency of a firm matter. We therefore follow Musso and Schiavo (2008) and Bellone et al. (2010) and build an index that is multidimensional but that at the same time keeps the advantages of the previous proxy. We exploit information coming from four balance sheet variables: (i) ratio of cash flow to stock of capital, (ii) current ratio to gauge how the firm is liquid, (iii) profitability (return on assets), and (iv) solvency (cash flow to total liability). For each variable, the mean corresponding to the NACE 2-digit classification is calculated. The variables are then de-meaned and we assign a number (1 to 5) that corresponds to the quintile of the distribution in which the observation falls. The information is then collapsed into a single index which is the simple sum of the four numbers.

Figure 11. Financial Constraints Index

(2007 = 100) Lower values mean more financially constrained



Source: Authors' estimates.

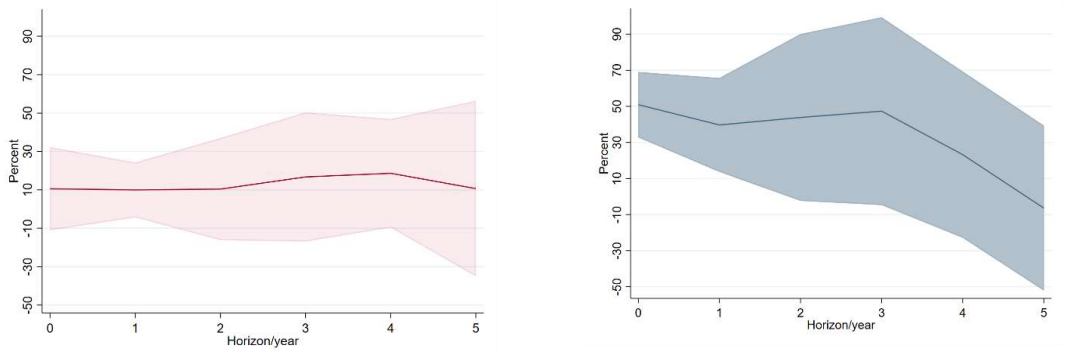
Note: The chart shows the mean of the financial constraint index by year of the overall sample and for the different income groups. The mean is scaled to be 100 for the year 2007. EMDCs: Emerging markets and developing countries; AEs: Advanced economies.

Figure 11 displays the aggregated multidimensional index. The beginning of the global financial crisis is used as the base year to highlight how economic downturns such as the GFC or the great lockdown can affect the financial constraints of firms and in turn their ability to invest to support the recovery. Firms in emerging and developing countries tend to be more financially constrained but all countries were hit by the GFC. The financial constraints become less binding from 2011 onwards.

Figure 12 and Table 5B show the effect of an unexpected public investment shock on private net investment rates based on the multidimensional financial constraint index. We also observe that the net investment rates of firms that are not financially constrained are much higher compared to those that are financially constrained. Overall, the effects of a forecast error shock are higher than the effects of a public investment stimulus on private net investment rates.

Figure 12. Non-linear Effect of Financial Constraints on Corporate' Net Investment Rates

a. Financially Constrained **b. Not Financially Constrained**



Source: Authors' estimates.

Notes: The charts show the results of the local projections method (Jorda, 2005) of the effect of a public investment forecast error shock on firm's net investment rate depending on the degree of financial constraint of the firm. The cumulative multiplier (blue line) over a 6-year horizon is plotted. Net investment rate is defined as the annual change in tangible fixed assets. A financially constraint index is constructed using four different balance sheet variables. A financially constraint firm is one that is in the bottom 25% of the distribution of the financial constraint index, and a not financially constraint firm is one that is in the top 25% of the distribution of the financial constraint index. A dummy is used to separate the firms between those that are financially constraint and those who are not. Confidence intervals are set at 90% (dash line).

V. Conclusion and Policy Implications

In this paper, we have investigated the effect of public investment multipliers on private firm's investment and have analyzed the underlying balance sheet conditions that may affect the size of the multipliers. Using a robust method for estimating state-dependent impulse response functions we provide numerous estimates of the crowding-in effect of public investment, across different specifications.

We find that public investment can help boost private investment, but the strength of corporate balance sheets plays an important role. Government support to financially constrained firms and to highly leverage firms is going to be crucial to maximize the effect of public investment on private investment. The type of supports includes transfers, equity injections, debt

restructuring, etc. and the private sector should take the lead on the process (Blanchard, Philippon, and Pisani-Ferry, 2020).

REFERENCES

Abiad, A., Fuceri, D., and Topalova, D. 2016. "The Macroeconomic Effects of Public Investment: Evidence from Advanced Economies." *Journal of Macroeconomics*. 50(C): 224–40.

Acconcia, A., Corsetti, G., and Simonelli, S. 2014. "Mafia and Public Spending: Evidence on the Fiscal Multiplier from a Quasi-experiment". *American Economic Review*. 104 (7): 2185–2209.

An, Z., Kangur, A., and Papageorgiou, C. 2019. "On the Substitution of Private and Public Capital in Production". *European Economic Review*. 118: 296–311.

Auerbach, A., and Gorodnichenko, Y. 2012. "Measuring the Output Responses to Fiscal Policy." *American Economic Journal: Economic Policy*. 4(2): 1–27.

Auerbach, A., and Gorodnichenko, Y. 2013. "Output Spillovers from Fiscal Policy." *American Economic Review*. 103(3): 141–46.

Balassa, B. 1988. "Public Finance and Economic Development." Working Paper 31. World Bank, Office of the Vice President for Development Economics, Washington, D.C. Processed.

Balibek E., Medas P., Ralyea J. and Saxena S. 2020. "Public Sector Support to Firms''. Fiscal Affairs Department, International Monetary Fund.

Baum, A., Hackney, C., Medas, P., and Sy, M. 2019. "Governance and State-Owned Enterprises: How Costly is Corruption''. International Monetary Fund, Working Paper 19/253.

Batini, N., Eyraud, L., Forni, L., and Weber, A. 2014. "Fiscal Multipliers: Size, Determinants, and Use in Macroeconomics Projections." International Monetary Fund, Technical Notes and Manuals.

Bellone F., Musso P., Nesta L. and Schiavo S. 2010. ''Financial Constraints and Firm Export Behavior'', *The World Economy*, Volume 33, Issue 2.

Blanchard, O., and Perotti, R. 2002. "An Empirical Characterization of the Dynamic Effects of Changes in Government Spending and Taxes on Output." *The Quarterly Journal of Economics*. 117(4): 1329–68.

Blanchard, O., T. Philippon and J. Pisani-Ferry. 2020. "A New Policy Toolkit is Needed as Countries Exit COVID-19 Lockdowns." Peterson Institute for International Economics Policy Brief.

Blejer, M., and Khan, M. 1984. "Government Policy and Private Investment in Developing Countries." *IMF Staff Papers* 31. no. 2: 379–403.

Borensztein, E., and Ye, L.S. 2018. "Corporate Debt Overhang and Investment: Firm-Level Evidence." World Bank Working Paper No 8553.

Carpenter, R., and Guariglia, A. 2008. "Cash Flow, Investment, and Investment Opportunities: New Tests using UK Panel Data." *Journal of Banking and Finance*. 32: 1894–1906.

Chatterjee, S., Lebesmuehlbacher, T., and Narayanan, A. 2020. "How Productive is Public Investment? Evidence from Indian Manufacturing." *Journal of Development Economics*. forthcoming.

Chen, S. and Lu, Y. 2016. "Does Balance Sheet Strength Drive the Investment Cycle? Evidence from Pre-and Post-Crisis Cyprus", International Monetary Fund, Working Paper 16/248.

Eden, M., and Kraay, A. 2014. ""Crowding in" and the Returns to Government Investment in Low-Income Countries". Policy Research Working Papers, World Bank. WPS6781.

Fazzari, S., Hubbard, G., and Petersen, B. 1998. "Financing Constraints and Corporate Investment." Brooking Papers on Economic Activity. 1:1998: 141–95.

Fazzari, S., Hubbard, G., and Petersen, B. 2000. "Investment-Cash Flow Sensitivities are Useful: A Comment on Kaplan and Zingales." *The Quarterly Journal of Economics*. 115(2): 695–705.

Fernald. J.G. 1999. "Roads to Prosperity? Assessing the Link between Public Capital and Productivity". *American Economic Review.* 89 (3): 619–38.

Furceri, D., and Li, G. 2017. "The Macroeconomic (and Distributional) Effects of Public Investment in Developing Economies." International Monetary Fund, Working Paper 17/217.

Gagnon, J. 2020. "The 2020 US private saving boom: An unexpected result of Covid-19'', Realtime Economic Issues Watch, Peterson Institute for International Economics.

Gebauer, S., Setzer, R., and Westphal, A. 2018. "Corporate debt and investment: A firm-level analysis for stressed euro area countries." *Journal of International Money and Finance*. 86: 112–30.

Gechert, S., and Rannenberg, A. 2018. "Which Fiscal Multipliers are Regime-Dependent? A Meta-Regression Analysis." *Journal of Economic Surveys.* 32(4): 1160-–82.

Gechert, S. 2015. "What Fiscal Policy is Most Effective? A Meta-Regression Analysis. *Oxford Economic Papers*. 67(3): 553–80.

Ghosal, V., and Loungani, P. 2000. "The Differential Impact of Uncertainty on Investment in Small and Large Businesses." *Review of Economics and Statistics*. 82(2).

Gopinath, G., S. Kalemli-Ozcan, L. Karabarbounis, and C. Villegas-Sanchez. 2017. "Capital Allocation and Productivity in South Europe.", *Quarterly Journal of Economics,* 132 (4): 1915–67.

Goretti, M., and Souto, M. 2013. "Macro-financial implications of corporate (de-)leveraging in the euro area periphery." International Monetary Fund, Working Paper 13/154.

Guiso, L., and Giuseppe, P. 1999. "Investment and Demand Uncertainty." *Quarterly Journal of Economics*. 114: 185–227.

Hennessy, C.A. 2004. "Tobin's Q, Debt Overhang, and Investment." *The Journal of Finance*. 59 (4): 1717–42.

Hennessy, C.A., Levy, A., and Whited, T.M. 2007. "Testing 'Q' Theory with Financing Frictions." *Journal of Financial Economics*. 83 (3): 691–717.

Holl, A. 2016. "Highways and Productivity in Manufacturing Firms". *Journal of Urban Economics*. 93: 131–51.

Ilzetzki, E., Mendoza, E., and Vegh, C. 2013. "How big (small?) are fiscal multipliers?" *Journal of Monetary Economics*. 60: 239–54.

International Monetary Fund. 2014. "It is Time for an Infrastructure Push? The Macroeconomic Effects of Public Investment." World Economic Outlook, Chapter 3.

———. 2020a. "A Crisis Like No Other, An Uncertain Recovery." *World Economic Outlook*, June Update.

———. 2020b. "Countering Future Recessions in Advanced Economies: Cyclical Policies in an Era of Low Rates and High Debt." *World Economic Outlook*, April, Chapter 2.

———. 2020c. Global Financial Stability Report, October. International Monetary Fund, Washington, D.C.

———. 2020d. ''Investing in a Sustainable, Inclusive, and Green Recovery'', Fiscal Monitor, April. Chapter 2.

Jager, A. 2003. "Corporate balance sheet restructuring and investment in the euro area." International Monetary Fund, Working Paper 03/117.

Jorda, O. 2005. "Estimation and Inference of Impulse Responses by Local Projections." *American Economic Review*. 95(1): 161–82.

Kang, W., Leeb, K., and Rattic., R. 2014. "Economic policy uncertainty and firm-level investment." *Journal of Macroeconomics*. 39: 42–53.

Kalemli-Özcan, S., S. Bent, V-S Carolina, V. Vadym, Y. Sevcan. 2015. ''How to Construct Nationally Representative Firm level data from the ORBIS Global Database" NBER Working Paper 21558.

Kalemli-Özcan, S., Laeven, L., and Moreno, D. 2018. "Debt Overhang, Rollover Risk, and Corporate Investment: Evidence from the European Crisis." CEPR Discussion Paper 12881.

Kaplan, S.N., and Zingales, L. 1997. "Do Investment-Cash Flow Sensitivities Provide Useful Measures of Financing Constraints?" *Quarterly Journal of Economics.* 169–215.

Kraay, A. 2014. "Government Spending Multipliers in Developing Countries: Evidence from Lending by Official Creditors". *American Economic Journal: Macroeconomics*. 6(4): 170–208.

Lanau, S. 2017. "The Growth Return of Infrastructure in Latin America." International Monetary Fund, Working Paper 17/35.

Leduc, S., and Wilson, D. 2012. "Roads to Prosperity or Bridges to Nowhere? Theory and Evidence on the Impact of Public Infrastructure Investment." *NBER Macroeconomics Annual*. 27: 89–142.

Leeper, E.M., Richter, A.W., and Walker, T.B. 2012. "Quantitative Effects of Fiscal Foresight." *American Economic Journal: Economic Policy*, 4 (2): 115–44.

Leeper, E.M., Walker, T.B., and Yang, S. 2013. "Fiscal Foresight and Information Flows." *Econometrica*, 81(3): 1115–45.

Magud, N., and Sosa, S. 2015. "Investment in Emerging Markets: We Are Not in Kansas Anymore...Or Are We?" International Monetary Fund, Working Paper 15/77.

Mbaye, S., Badia, M.M., and Chae, K. 2018. ''Global Debt Database: Methodology and Sources'', International Monetary Fund, WP/18/111.

Miyamoto, H., N. Gueorguiev, J. Honda, A. Baum, and S. Walker. 2020. "Growth Impact of Public Investment and the Role of Infrastructure Governance." In *Well Spent: How Strong Infrastructure Governance Can End Waste in Public Investment*, edited by G. Schwartz, M. Fouad, T. Hansen, and G. Verdier. Washington DC: International Monetary Fund.

Miyamoto W., Nguyen, T.L., and Sergeyev, D. 2018. “Government Spending Multipliers under the Zero Lower Bound: Evidence from Japan”. *American Economic Journal: Macroeconomics*. 10 (3): 247–77.

Modigliani, F. and Miller, M. 1958. ‘’The Cost of Capital, Corporation Finance and the Theory of Investment’’, *The American Economic Review*, 48 (3): 261–97.

Moyen, N. 2004. “Investment-Cash Flow Sensitivities: Constrained versus Unconstrained Firms’’. *The Journal of Finance.* 59(5): 2061–92.

Musalem, A.R. 1989. "Private Investment in Mexico: An Empirical Analysis." Working Paper 183. World Bank, Latin America and the Caribbean Country Department II, Washington, D.C. Processed.

Musso, P. and Schiavo, S. 2008. ‘’The impact of financial constraints on firm survival and Growth’’, *Journal of Evolutionary Economics,* 18(2), 135–49.

Myers, S. 1977. “Determinants of Corporate Borrowing.” *Journal of Financial Economics* 5(2): 147-175.

Myers, S. 1984. “The Capital Structure Puzzle.” *The Journal of Finance*, 39(3): 574–92. OECD. 2020. “Corporate sector vulnerabilities during the Covid-19 outbreak: assessment and policy responses”, *Tackling Coronavirus Series*.

Ramey, V. A. 2011, “Identifying government spending shocks: It’s all in the timing.” *The Quarterly Journal of Economics.* 126(1): 1–50.

———. 2016. “Macroeconomic Shocks and Their Propagation.” Handbook of Macroeconomics, in: J. B. Taylor & Harald Uhlig (ed.), Handbook of Macroeconomics, edition 1, volume 2, chapter 0, pages 71–162.

———. 2019. “Ten Years after the Financial Crisis: What Have We Learned from the Renaissance in Fiscal Research?”. *Journal of Economic Perspectives*. 33 (2): 89–114.

Ramey, V., and Zubairy, S. 2018. “Government Spending Multipliers in Good Times and in Bad: Evidence from U.S. Historical Data.” *Journal of Political Economy*. 126 (2): 850–901.

Serven, L., and Solimano, A. 1992. “Private Investment and Macroeconomic Adjustment: A survey.” *The World Bank Research Observer*. 7(1): 95–114.

Serven, L., and Solimano, A. 1991. *"Economic Adjustment and Investment Performance in Developing Countries: The Experience of the 1980s."* Paper presented at the conference on Private Investment and Macroeconomic Adjustment, March 21–22, Washington, D.C. World Bank, Country Economics Department, Washington, D.C. Processed.

Wolff, E., and Nadiri, M.I. 1993. “Spillover Effects, Linkage Structure, and Research and Development”. *Structural Change and Economic Dynamics.* 4(2): 315–31.

Zeev, N.B., and Pappa, E. 2015. “Chronicle of a War Foretold: The Macroeconomic Effects of Anticipated Defense Spending Shocks.” *The Economic Journal*. 127(603): 1568–97.

VI. APPENDIX

Table 2. Countries in Firm-Level Sample

Advanced Economies	Emerging and Developing Countries
Austria	Argentina
Belgium	Bulgaria
Switzerland	Bosnia and Herzegovina
Czech Republic	Bolivia
Germany	Chile
Denmark	China
Spain	Colombia
Estonia	Croatia
Finland	Hungary
France	India
Greece	Kazakhstan
Iceland	St. Kitts and Nevis
Italy	Kosovo
Japan	Moldova
Korea	Mexico
Lithuania	North Macedonia
Luxembourg	Montenegro
Latvia	Poland
Malta	Paraguay
Netherlands	Romania
Portugal	Russia
Singapore	Serbia
Slovak Republic	Ukraine
Slovenia	
Sweden	
Taiwan	

Table 3. Variable Definition

Variable	Definition
Net Investment Rate	Annual change in tanglible fixed assets
Leverage	Non current liabilities diveded by total assets
Growth of Sales	Annual change in sales
Size 1	Logarithm of total assets
Size 2	Logarithm of number of employees
Return on Assets	Net profits after taxes divided by total assets
Current Ratio	Current assets divided by current liabilities
Cash to Assets	Cash flow divided by tangible fixed assets
Cash Flow	Net income plus depreciation
Solvency	Cash flow divided by total liabilities
GDP growth	Annual change in GDP
Public Investment Forecast Error	Difference between public investment forecast and actual public investment divided by actual public investment

Table 4A. Public Investment and Corporate Investment: The Role of Leverage

Regressions POE Leverage Logistic Public Investment OLS

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
Public Investment Shock High Leverage t=5						-0.0502
						(0.0340)
Public Investment Shock Low Leverage t=5						0.1066
						(0.0419)
Public Investment Shock High Leverage t=4					-0.0454	
					(0.0305)	
Public Investment Shock Low Leverage t=4					0.0957	
					(0.0396)	
Public Investment Shock High Leverage t=3				-0.0472		
				(0.0219)		
Public Investment Shock Low Leverage t=3				0.0937		
				(0.0356)		
Public Investment Shock High Leverage t=2			-0.0334			
			(0.0199)			
Public Investment Shock Low Leverage t=2			0.0876			
			(0.0290)			
Public Investment Shock High Leverage t=1		-0.0168				
		(0.0145)				
Public Investment Shock Low Leverage t=1		0.0488				
		(0.0209)				
Public Investment Shock High Leverage t=0	-0.0004					
	(0.0053)					
Public Investment Shock Low Leverage t=0	0.0247					
	(0.0080)					
Lag Sales growth	0.0838	0.1226	0.1426	0.1486	0.1645	0.1755
	(0.0048)	(0.0050)	(0.0086)	(0.0160)	(0.0227)	(0.0353)
Lag GDP growth	0.5818	0.7688	0.4673	-0.1193	-0.0396	0.6356
	(0.3222)	(0.5631)	(0.6386)	(0.7686)	(0.5639)	(0.3975)
Lag EBITDA to Sales	-0.0000	-0.0000	-0.0000	0.0000	-0.0000	-0.0000
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Lag Log of total employment	-0.0234	-0.0525	-0.0848	-0.1194	-0.1526	-0.1816
	(0.0028)	(0.0057)	(0.0086)	(0.0118)	(0.0146)	(0.0175)
Constant	0.1534	0.5217	0.9206	1.266	1.4304	1.7027
	(0.0291)	(0.0368)	(0.0480)	(0.0755)	(0.1104)	(0.1511)
Observations	1,029,473	768,904	565,693	406,701	288,558	211,271
R-squared	0.0209	0.0307	0.0366	0.0435	0.0568	0.0719

Robust standard errors in parentheses

Table 4B. Public Investment and Corporate Investment: The Role of Leverage

Regressions POE Loverage Forecast Error OLS

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
Forecast Error Shock High Leverage t=5						-20.2035
						(6.3118)
Forecast Error Shock Low Leverage t=5						18.3701
						(3.0463)
Forecast Error Shock High Leverage t=4					-20.8771	
					(7.3891)	
Forecast Error Shock Low Leverage t=4					20.8299	
					(4.5701)	
Forecast Error Shock High Leverage t=3				-15.0788		
				(4.5889)		
Forecast Error Shock Low Leverage t=3				12.1011		
				(4.9151)		
Forecast Error Shock High Leverage t=2			-11.2754			
			(3.0253)			
Forecast Error Shock Low Leverage t=2			10.3292			
			(3.9888)			
Forecast Error Shock High Leverage t=1		-1.9513				
		(0.9042)				
Forecast Error Shock Low Leverage t=1		3.0216				
		(1.1069)				
Forecast Error Shock High Leverage t=0	-2.6366					
	(1.0950)					
Forecast Error Shock Low Leverage t=0	0.3370					
	(0.5969)					
Lag Sales growth	0.0794	0.1203	0.1465	0.1505	0.1668	0.1643
	(0.0055)	(0.0070)	(0.0092)	(0.0171)	(0.0248)	(0.0347)
Lag GDP growth	0.1286	-0.1738	-0.9065	-1.5655	-0.9612	-0.0807
	(0.3712)	(0.6829)	(0.7568)	(0.8701)	(0.7545)	(0.8064)
Lag EBITDA to Sales	0.0000	0.0000	0	0	0	0.0000
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Lag Log of total employment	-0.0257	-0.0562	-0.0942	-0.1349	-0.168	-0.2018
	(0.0032)	(0.0074)	(0.0121)	(0.0158)	(0.0183)	(0.0219)
Constant	0.2	0.5857	1.2669	1.7429	1.9334	2.3146
	(0.0309)	(0.0430)	(0.1631)	(0.2182)	(0.2665)	(0.3411)
Observations	748,377	488,687	304,523	211,122	155,607	111,881
R-squared	0.0277	0.0400	0.0517	0.0645	0.0787	0.0963

Robust standard errors in parentheses

Table 5A. Public Investment and Corporate Investment: The Role of Financial Constraints

Regressions POE Cash Flow to Capital Public Investment OLS

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
Public Investment Shock Constraint t=0	0.0233					
	(0.0066)					
Public Investment Shock No Constraint t=0	0.0671					
	(0.0139)					
Public Investment Shock Constraint t=1		0.0523				
		(0.0373)				
Public Investment Shock No Constraint t=1		0.1035				
		(0.0342)				
Public Investment Shock Constraint t=2			0.0809			
			(0.0372)			
Public Investment Shock No Constraint t=2			0.1325			
			(0.0408)			
Public Investment Shock Constraint t=3				0.0688		
				(0.0556)		
Public Investment Shock No Constraint t=3				0.1285		
				(0.0555)		
Public Investment Shock Constraint t=4					-0.0023	
					(0.0423)	
Public Investment Shock No Constraint t=4					0.0708	
					(0.0563)	
Public Investment Shock Constraint t=5						-0.0137
						(0.0461)
Public Investment Shock No Constraint t=5						0.0656
						(0.0597)
Lag Sales growth	0.0403	0.0368	0.0216	0.0100	0.0075	-0.0048
	(0.0032)	(0.0069)	(0.0104)	(0.0112)	(0.0131)	(0.0208)
Lag GDP growth	0.6053	0.9106	0.7891	0.0563	0.4629	0.9567
	(0.2369)	(0.3827)	(0.4353)	(0.5720)	(0.4011)	(0.3933)
Lag EBITDA to Sales	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Lag Log of total employment	-0.0853	-0.1888	-0.2705	-0.3406	-0.3818	-0.4326
	(0.0089)	(0.0165)	(0.0206)	(0.0237)	(0.0247)	(0.0332)
Constant	0.3482	0.9336	1.4766	1.9617	2.1889	2.5571
	(0.0384)	(0.0528)	(0.0647)	(0.0796)	(0.1184)	(0.1591)
Observations	1,165,450	867,627	635,499	454,823	321,337	233,273
R-squared	0.0211	0.0354	0.0471	0.0584	0.0781	0.1101

Robust standard errors in parentheses

Table 5B. Public Investment and Corporate Investment: The Role of Financial Constraints

Regressions POE Financial Constraint Index Forecast Errors OLS

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
Forecast Error Shock No Constraint t=0	0.509					
	(0.1416)					
Forecast Error Shock Constraint t=0	0.1057					
	(0.1693)					
Forecast Error Shock No Constraint t=1		0.3966				
		(0.2031)				
Forecast Error Shock Constraint t=1		0.0994				
		(0.1115)				
Forecast Error Shock No Constraint t=2			0.4383			
			(0.3609)			
Forecast Error Shock Constraint t=2			0.1039			
			(0.2074)			
Forecast Error Shock No Constraint t=3				0.4731		
				(0.4061)		
Forecast Error Shock Constraint t=3				0.1673		
				(0.2625)		
Forecast Error Shock No Constraint t=4					0.2319	
					(0.3597)	
Forecast Error Shock Constraint t=4					0.1863	
					(0.2206)	
Forecast Error Shock No Constraint t=5						-0.0645
						(0.3571)
Forecast Error Shock Constraint t=5						0.1065
						(0.3569)
Sales growth = L,	0.0352	0.0421	0.0341	0.019	0.0153	-0.0083
	(0.0054)	(0.0078)	(0.0074)	(0.0069)	(0.0126)	(0.0177)
GDP growth = L,	0.1040	-0.1899	-0.6915	-1.1921	-0.2833	0.4957
	(0.2795)	(0.5139)	(0.5660)	(0.6059)	(0.3118)	(0.3700)
EBITDA to Sales = L,	0.0000	0.0000	0.0000	-0.0000	-0.0000	-0.0000
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Log of total employment = L,	-0.0862	-0.1683	-0.2478	-0.3163	-0.3773	-0.4578
	(0.0049)	(0.0091)	(0.0162)	(0.0313)	(0.0421)	(0.0513)
Constant	0.4118	0.9924	1.8743	2.4465	2.7393	3.3334
	(0.0223)	(0.0556)	(0.1182)	(0.1892)	(0.2564)	(0.3093)
Observations	493,800	318,131	195,448	134,550	98,101	69,929
R-squared	0.0229	0.0390	0.0589	0.0835	0.1152	0.1608

Robust standard errors in parentheses