Output effects of fiscal consolidations: does spending composition matter?*

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Abstract

This paper studies whether changes in the composition of public spending affect the macroeconomic consequences of fiscal consolidations. Based on a sample of 52 developing countries and 18 advanced economies during 1980-2019, results show that while fiscal consolidations tend to be on average, contractionary, the size of the output fall depends on the behavior of public investment vis-a-vis public consumption during the fiscal adjustment, with heterogeneous responses growing over time. When public investment is penalized relative to public consumption and thus, its share in public expenditures decreases, a 1 percent of GDP consolidation reduces output by 0.7 percent within three years of the fiscal shock. In contrast, fiscal consolidations can even be expansionary in countries that protect public investment vis-a-vis public consumption the most: a similar-sized consolidation leads to an increase in output of about 0.9 percent within the same time frame. The component of GDP that mostly drives the heterogeneity between both types of adjustments is private investment. The results hold up to a number of robustness tests, including alternative identification strategies of fiscal shocks. The findings have policy implications for the design fiscal adjustment strategies to protect economic growth as countries recover from the coronavirus pandemic.

JEL Codes: H50, H54, O40

Keywords: Fiscal consolidations, public investment, public consumption, fiscal multiplier.

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1 Introduction

Policy responses during and after the global financial crisis have brought about renewed interest in the macroeconomic effects of fiscal policy. In particular, spurred by the sequence of fiscal adjustments in the aftermath of the Great Recession, the literature has focused on the effects of fiscal consolidations on economic activity. One question of interest is whether fiscal austerity is expansionary or contractionary. Some early contributions support the expansionary fiscal contraction hypothesis (Giavazzi and Pagano, 1990; Alesina et al., 2002), but more recent work provides evidence of contractionary effects of fiscal adjustments (Guajardo et al., 2014; Jordà and Taylor, 2016). At the same time, several studies analyze whether the composition of fiscal consolidation affects output. For example, Alesina et al. (2019) show that government spending cuts are much less harmful to GDP growth than tax hikes. Similar results are found in Beetsma et al. (2021), Diniz (2018), Guajardo et al. (2014), and Yang et al. (2015), among others.

However, beyond the distinction between tax versus spending-based fiscal adjustments, there is still limited evidence about the specific combination of fiscal policies contributing to the overall fiscal adjustment and how different policy mixes affect output. In particular, previous studies do not usually separate between two key expenditure categories: government consumption and public investment. However, when countries are confronted with the need to slash budget deficits, they generally tend to cut public investment relatively more than government consumption (Easterly and Servén, 2003; Serven, 2007; Bamba et al., 2020), as capital expenditure cuts tend to be more politically palatable than cutting sensitive items such as public wages (Ardanaz and Izquierdo, 2021). The lack of empirical evidence on the potential differential effects of adjusting one versus the other spending component during fiscal consolidations is noteworthy because a number of studies have found variation in the size of fiscal multipliers when disentangling across these expenditure categories or studying them in isolation (Ilzetzki et al., 2013; Leduc and Wilson, 2017; Izquierdo et al., 2019; Boehm, 2019). In particular, to the extent that the multiplier of capital expenditure is larger than that of current expenditure, it may be beneficial to protect or expand public investment during fiscal adjustments and sustain aggregate demand, especially under circumstances that are common in developing countries (Ilzetzki et al., 2013; Izquierdo et al., 2019). Thus, understanding the role of public spending composition during fiscal adjustments is relevant from a policy perspective to uncover potential heterogeneous responses of output to fiscal policy changes.

This paper studies whether changes in the composition of public spending affect the macroeconomic consequences of fiscal adjustments on a sample of 18 advanced and 52 developing

economies during 1980-2019. Consistent with estimates in the extant literature, a fiscal consolidation of 1 percent of GDP reduces real GDP by 0.4 percent on impact. However, results show these contractionary effects of fiscal austerity can be either exacerbated or attenuated depending on the behavior of public investment vis-a-vis public consumption, with such differences growing over time. When public investment is penalized relative to public consumption and thus, its share in public expenditures is reduced, a 1 percent of GDP consolidation reduces output by 0.7 percent within three years of the fiscal shock. In contrast, fiscal consolidations can be *expansionary* in countries that protect public investment vis-a-vis public consumption the most: a similar-sized consolidation leads to an increase in output of about 0.9 percent within three years. The component of GDP that mostly drives the heterogeneity between both types of adjustments is private investment, which experiences a strong recovery when the public investment share in total spending increases, but remains subdued when public investment looses ground relative to public consumption.

By studying the relationship between fiscal adjustments, changes in public spending composition, and economic activity, this paper contributes to two interrelated strands of the literature. First, the literature on the output effects of fiscal adjustments has made progress on theoretical and empirical grounds in recent years (see Ramey (2019) for a review). However, previous studies have typically reduced the heterogeneity of fiscal adjustment plans to a single dimension: the comparison between tax-based and spending-based consolidations, thus neglecting important variation in the specific policy instruments used to implement fiscal adjustment. To overcome this limitation, this paper disentangles the contributions of public investment vs. consumption during fiscal adjustments to study whether the economic effects of austerity vary with changes in public spending composition. We also draw on insights from previous studies showing that the size of the spending multiplier varies by expenditure component. Ilzetzki et al. (2013), for example, show that fiscal multipliers of public investment are larger than those of current expenditure specially in developing countries. In fact, an extensive body of economic literature has shown that public investment can be particularly useful to propel economic growth specially during economic downturns (Abiad et al., 2016); when investment efficiency is high (Furceri and Li, 2017), and when the initial stock of public capital is low (Izquierdo et al., 2019; Ramey, 2020). This paper considers whether the differences between public spending components studied in the fiscal multiplier literature in isolation can explain variation in the economic costs of fiscal adjustments when combined under alternative policy mixes.

The remainder of the paper is organized as follows: section 2 links the paper to relevant strands in the literature; section 3 presents the data, variable definitions, and describes the empirical strategy; section 4 reports the main results, robustness tests, and extensions. Section 5

provides insights on the transmission mechanisms driving the results. Section 6 concludes.

2 Related Literature

This paper is related to two strands of the literature on the macroeconomic effects of fiscal policy. A first strand consists of contributions analyzing the macroeconomic effects of fiscal consolidations. This literature has made important empirical progress in the identification of fiscal adjustment shocks since 2010 (Ramey, 2019). While earlier studies typically relied on conventional variables such as the improvement in the cyclically adjusted fiscal balance to define a fiscal adjustment period (Alesina and Ardagna, 2013, 2010), more recent work draws on the narrative approach pioneered by Romer and Romer (2010) in the context of tax policy to identify changes in the fiscal stance that are not motivated by the state of the economy (Carrière-Swallow et al., 2021; Alesina et al., 2019; Guajardo et al., 2014). A robust result across identification strategies is that tax-based consolidations are more harmful for output than expenditure-based consolidations (Beetsma et al., 2021; Alesina et al., 2019; Diniz, 2018; Guajardo et al., 2014; Ardagna, 2004).

Demand and supply side mechanisms have been proposed to explain the heterogeneous results in the literature. On the demand side, fiscal adjustments associated with the removal of uncertainty about the future costs of stabilization influence private sector confidence, thus stimulating consumption and investment (Blanchard, 1990; Giavazzi and Pagano, 1990). Such confidence effects could manifest themselves through changes in the interest rates and sovereign spreads (Born et al., 2020; David et al., 2019; Beetsma et al., 2015). On the supply side, the labor market view stresses the impact of fiscal policy changes on the labor costs of private firms (Ardagna, 2004; Alesina et al., 2002). Under both perspectives, the choice of fiscal instruments, and in particular, the composition of public spending, is key to the results. For example, confidence effects are more likely to accrue when fiscal policy changes are perceived as permanent (Corsetti et al., 2012). Spending-based fiscal plans are more likely to be perceived as permanent, because increases in taxes do not stop spending growth (Beetsma et al., 2021; Alesina et al., 2019). Yet the degree of persistence varies with instruments: for example, changes to consumption spending (such as public wages) or transfer payments (such as unemployment benefits) tend to be more permanent than one-off adjustments of public investment. In labor markets, the expenditure choice for consolidations has implications in terms of employment levels and private sector wage dynamics (Ardagna, 2004).

Another strand comprises studies on the public spending multiplier, whose sign and mag-

nitude vary along different dimensions, such as the state of the economy (Auerbach and Gorodnichenko, 2012; Blanchard and Leigh, 2013; Riera-Crichton et al., 2015; Berge et al., 2021), accompanying monetary policies (Christiano et al., 2011; Coenen et al., 2013; Ramey and Zubairy, 2018; Amendola et al., 2020), exchange rate regimes (Ilzetzki et al., 2013; Born et al., 2013), or underlying fiscal positions (Ilzetzki et al., 2013; Aloui and Eyquem, 2019; Huidrom et al., 2020). Specifically, the type of public spending has been shown to affect the size of the multiplier, with the public investment multiplier typically found to be larger than its public consumption counterpart, especially over the medium term (Bachmann and Sims, 2012; Ilzetzki et al., 2013; Izquierdo et al., 2019). For example, Izquierdo et al. (2019) show that: (i) effects of total spending on output are small, with a multiplier lower than one; (ii) consumption spending has also small effects while capital spending has more expansionary effects, with multipliers well above one, due to complementarities between public and private investment.

Despite the relevance of public spending composition along the aforementioned dimensions, empirical work on the effects of fiscal consolidations that differentiate between public consumption and investment is scant. In fact, the two expenditure components usually tend to be lumped together in empirical applications(Alesina et al., 2019, 2017) with the potential implication of introducing bias in the estimation of fiscal multipliers. We take the insight about the importance of addressing the composition of public spending to the empirical analysis to assess whether changes in the behavior of public investment vis-a-vis public consumption matter for understanding the effects of fiscal adjustments on economic activity.

3 Data and Estimation

3.1 Data and definitions

Given the interest on the composition of public spending from an economic classification point of view (public investment vs. consumption), the main source of data is World Economic Outlook (WEO) dataset.[1] The data covers 70 countries, spanning different regions and levels of economic development over the period 1980–2019. In particular, the sample in this paper includes 18 industrial and 52 developing countries for which complete information on spending composition is

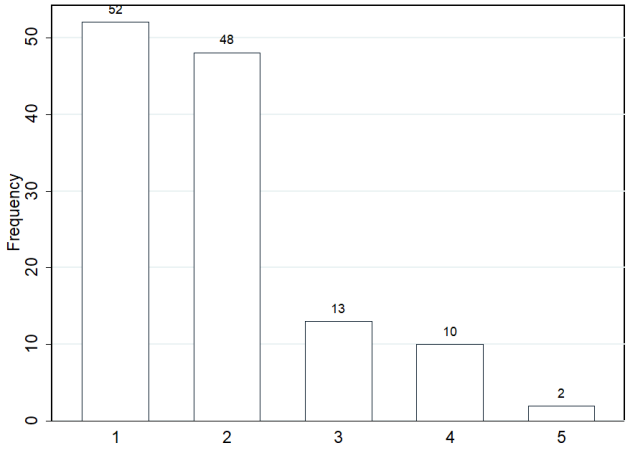
[1]WEO is the most comprehensive cross-country dataset on public finances both across time and space including an economic classification of public expenditures. While Government of Finance Statistics (GFS) is another widely used database with rich information on the functional classification of spending, its data coverage is lower than WEO when considering the key fiscal variables used in this study.

available over time.[2]. Public investment is the gross fixed capital formation of the general government (i.e., central plus subnational governments).[3] Public consumption incurred by the general government is the sum of: i) compensation of employees, and ii) use of goods and services.

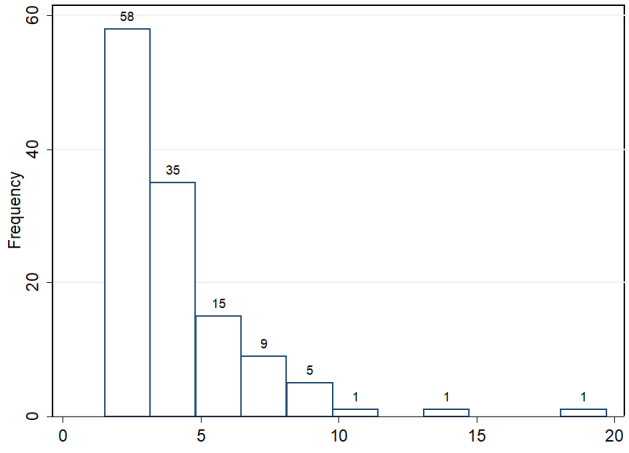
Fiscal consolidations. Fiscal consolidation (FC) episodes are defined based on changes in the cyclically adjusted primary balance (CAPB). Drawing on Alesina and Ardagna (1998), a fiscal adjustment materializes on a specific year if either: (i) the change in the CAPB-to-GDP ratio is greater or equal to 2 percentage points; or (ii) there is a 2-year consecutive improvement in CAPB of at least 1.5 points per year. In order to increase the number of observations, the two thresholds are lowered to 1.5 and 1.25 respectively (alternative definitions are employed in the robustness section). Under the baseline definition, 125 FC episodes are identified in the sample. Figure 1 presents the duration (in years), and the intensity (in points of GDP) of the episodes. The typical episode presents a duration of approximately 2 years. During this period the CAPB improves by about 3.5 percentage points of GDP on average.

Figure 1: Duration and Intensity of Fiscal Consolidation Episodes

Panel A. Duration (in years)



Panel B. Intensity (in % of GDP)



Source: Authors' elaboration based on WEO-IMF.

Changes in public spending composition. Changes in public spending composition during fiscal adjustment episodes are captured through the variation in the two main public expenditure items: public consumption (PC) and public investment (PI). The percentage change in the ratio between PI to total spending (i.e., $PI/(PI + PC)$) is used to approximate the degree of

[2]See the Appendix for the list of countries included in the analysis

[3]Gross public fixed capital formation is measured by the total value of acquisition less disposals of fixed assets plus certain specified expenditure on services that adds to the value of non-produced assets.

protection (alternatively, *penalization*) of public investment vis a vis public consumption during a fiscal adjustment year. Specifically, PI is defined to be protected when the share of PI in total spending increases after the consolidation episode ended, compared to before it began. Alternatively, when the ratio $PI/(PI + PC)$ decreases, then PI is defined as being penalized. To fix ideas, consider the fiscal adjustments in Italy (1995-1997) and Chile (2010-2011). During these adjustments, the public investment share increased by 25 percent in the former and decreased by 11 percent in the latter, thus they represent two different types of adjustments along the dimension of protection/penalization of public investment relative to public consumption.

Based on the definitions reported above, Table 1 presents stylized characteristics of fiscal adjustment episodes distinguishing between those when PI was penalized, versus those when PI was protected. The table also includes information for all episodes in the sample. Cyclically adjusted primary balances increase by about 4 p.p. across all episodes on average, without significant differences in means between episodes when PI was penalized vs. episodes when PI was protected. In a typical fiscal adjustment, the average improvement in the observed primary balance is about 3.5 percent of GDP, which is a combination of revenue increases (1.3 percent of GDP) and public expenditure cuts (2.2 of percent GDP). The results are roughly the same across PI penalized vs. PI protected episodes, with the exception of expenditures which fall about 0.8 p.p. less on average for PI protected episodes. With respect to the expenditure components, both public consumption and public investment experience reductions in a typical adjustment. Note, however, that average PI (PC) levels are 16.1 (4.2) percent of GDP. Thus, the contribution of public investment cuts is about 10 percent relative to average public investment, while the contribution of public consumption is only about 4 percent, on average. As a result, the $PI/(PI+PC)$ ratio falls 4.1 percent during fiscal adjustments, which is a stylized fact that has already been documented in the literature (Ardanaz et al., 2021; Bamba et al., 2020). The novel results is that there is considerable variation in the behavior of this ratio across adjustment episodes. While a majority (74) of fiscal adjustments are characterized by a deterioration in the public investment share, over 40 percent of total episodes exhibit positive changes in the $PI/(PI + PC)$ ratio: across these episodes, the public investment share increases by approximately 10 percent on average. Moreover, countries that protect public investment during fiscal adjustments experiment higher growth rates in the aftermath, especially over the medium term. The empirical analysis that follows probes deeper into whether changes in the composition of public spending affect the macroeconomic consequences of fiscal adjustments.

Table 1: Fiscal adjustments and the behavior of public investment vs. public consumption

	[1]	[2]	[3]	[4]
Variables	**All episodes**	**PI penalized**	**PI protected**	**Diff [2] vs. [3]**
Cyclically adjusted primary balance (p.p.)	3.97	4.08	3.81	0.27
Observed primary balance (p.p.)	3.49	3.63	3.29	0.35
Revenues (p.p.)	1.31	1.15	1.55	-0.41
Expenditure (p.p.)	-2.15	-2.46	-1.65	-0.81*
Public consumption (p.p.)	-0.62	-0.56	-0.69	0.13
Public investment (p.p.)	-0.43	-0.94	0.33	-1.27***
Ratio PI/(PC+PI) (%)	-4.12	-13.69	9.77	-23.45***
Real GDP growth after 1 year (%)	3.74	3.57	3.99	-0.42
Real GDP growth after 2 years (%)	3.02	2.96	3.11	-0.16
Real GDP growth after 3 years (%)	2.89	2.48	3.51	-1.04**
Real GDP growth after 4 years (%)	3.06	2.72	3.58	-0.86*
Number of episodes	**125**	**74**	**51**	

Source: Authors' elaboration based on WEO-IMF. *Notes*: Mean values. Significance level * p < 0.10, ** p < 0.05, *** p < 0.01, respectively. % denotes percentage changes, and p.p. denotes percentage points of GDP changes.

3.2 Estimation

The impact of FC on GDP is estimated using the single-equation approach of Jordà (2005) and Stock and Watson (2007). The specification includes an interaction term to asses how changes in public spending composition during FC episodes affect posterior output growth. Specifically, the non-linear effects of fiscal adjustments are estimated using the following specification:

$$y_{i,t+h} - y_{i,t-1} = \alpha_i^h + \gamma_i^h + \beta_1^h \sum_{s=t}^{t+h} FC_{i,s} + \beta_2^h \sum_{s=t}^{t+h} PIP_{i,s} + \beta_3^h \sum_{s=t}^{t+h} FC_{i,s} * PIP_{i,s} + \rho X_{i,t} + \epsilon_{i,t+h} \quad (1)$$

where i and t index country and years respectively, and time horizons are denoted by h. The dependent variable, y, denotes the log of real GDP; FC denotes the change in the CAPB during a FC episode; and the degree of public investment protection, PIP, is measured as the percent change in the PI share in public spending (i.e., $PI/(PI+PC)$). $X_{i,t}$ is a vector of control variables, including two lags of real GDP growth, FC, PIP, and the interaction term, respectively. α_i are country fixed effects; and γ_i are time fixed effects.

The coefficient β_1^h is the estimated effect a 1 percent of GDP fiscal consolidation on the level of real GDP from over h years, or the so called unconditional multiplier of fiscal adjustments (Alesina et al., 2019; Guajardo et al., 2014). This paper is focused on evaluating whether such effect varies with changes in public spending composition, proxied by the PI share in total (consumption plus investment) spending, that is, $\beta_1^h + \beta_3^h * PIP$. As standard in the literature, fiscal multipliers

are defined as the response of the level of real GDP to the cumulative fiscal consolidation shock over h years; in this paper, multipliers are further conditioned on the PIP ratio. In the baseline estimate, the conditional multiplier is computed by evaluating cases of PI *protection* (where PIP is set at a given high percentile of the distribution of the changes) and cases of PI *penalization* (where PIP is set at a given low percentile of the distribution of the changes). As in Carrière-Swallow et al. (2021) the equations are estimated by ordinary least squares; the impulse response functions, which take into account the interaction term, is obtained through the delta method.

4 Results

4.1 Baseline Results

As a first step, we compute the linear or unconditional cumulative fiscal multiplier, that is, without taking into account spending composition issues, as illustrated in Figure 2. A FC equal to 1 percent of GDP typically reduces output by 0.38 percent on impact and by 0.43 percent after two years. The 90 percent confidence interval of the estimated effect after two years is -0.02 percent to -0.83 percent.[4] These estimates are broadly consistent with previous results obtained in the literature and provide a benchmark to examine whether spending composition affects macroeconomic responses.[5]

Fiscal multipliers conditional on the behavior of public spending composition, based on Equation 1, are shown in Figure 3. The three Panels of Figure 3 show the effects of a 1 percent fiscal adjustment on GDP over time, calibrated at different cutoff points in the distribution of the PIP variable that are used to characterize episodes of public investment protection and penalization. The results show that the difference between protecting and penalizing public investment vis a vis public consumption during fiscal adjustments is significant at alternative cutoff points. Panel A shows the baseline result, in which the conditional multiplier is calibrated at the 5th and 95th percentiles of PIP distribution, equivalent to a 17 percent reduction and 15 increase in the share of public investment in total spending, respectively. Fiscal adjustments that penalize public investment tend to magnify the negative effects of consolidations on economic activity: 1 percent of GDP fiscal adjustment reduces output by 0.48 on impact, and within three years of the

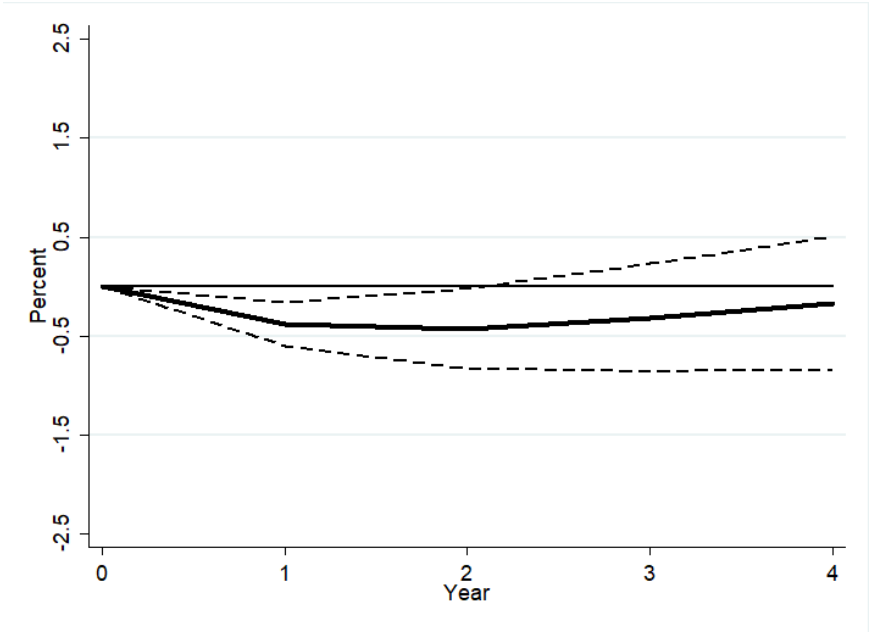
[4]See Supplementary Material for the Regression Tables of each Figure.

[5]Among advanced economies, the multiplier has been estimated in about 0.5 after two years (IMF, 2010). In a sample of Latin American countries, the multiplier was estimated in the range of 0.7 to 0.9 within two years (Carrière-Swallow et al., 2021).

shock, the accumulated output loss is 0.7 percent. In contrast, fiscal consolidations characterized by the protection of public investment vis-a-vis public consumption can not only attenuate the recessionary effects of austerity in the short run, but may also result in expansionary effects over the medium term: output increases by 0.9 percent within three years of the fiscal shock. Such heterogeneity in macroeconomic responses is robust to alternative calibration choices, as shown in Panels B and C.

Figure 4 presents output responses in an alternative format. It shows the estimated fiscal multipliers conditional on the behaviour of public spending composition at the entire distribution of changes in the PIP ratio, for different time horizons. In the background, Figure 4 also presents the frequency distribution of changes in PIP, showing that there is a mass of episodes that fall within the different points of the distribution. There are several noteworthy results that emerge from this Figure. First, note that the slope of the lines showing the central estimates remains positive at different time horizons. This in turn suggests that as we move horizontally across the figures in the direction of more protection of public investment, the estimated fiscal multipliers increase. In other words, the recessionary impacts of FC is reduced as changes in PIP move from negative to positive. Second, the lines showing central estimates get steeper as the time horizon increases from 1 year (Panel A) to 4 years (Panel D). This implies that the accumulated effects of protecting public investment grow over time. Third, across the four Panels, the recessionary effects of adjustments kick in for relatively small changes in the PIP ratio. For example, in Panel B the multiplier is about -0.3 percent when the PI share is reduced by 4.8 percent (25th percentile). In contrast, it takes larger changes in the PIP ratio to experiment expansionary effects. For example, in Panel B, the PI share needs to be increased by at least 14.8 percent (95th percentile) to obtain a positive and statistically significant multiplier.

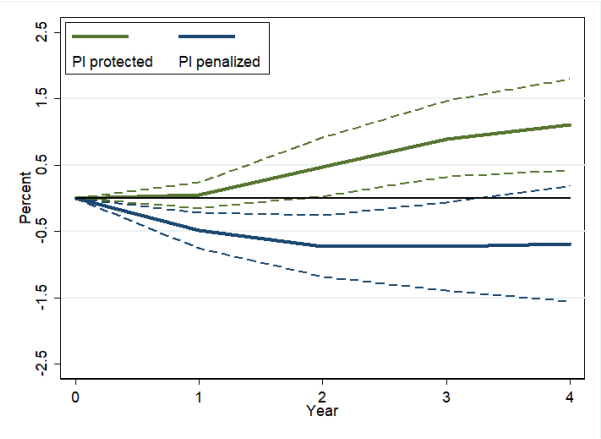
Figure 2: Unconditional Baseline Results. Impact of a 1 Percent of GDP Fiscal Consolidation on GDP



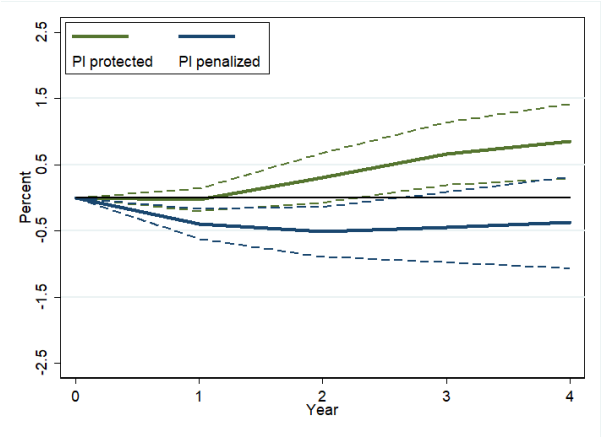
Source: Authors' elaboration based on WEO-IMF. *Note:*: Year = 1 denotes the year of consolidation. Dotted lines indicate 90 percent confidence interval.

Figure 3: Conditional Baseline Results. Impact of a 1 Percent of GDP Fiscal Consolidation on GDP

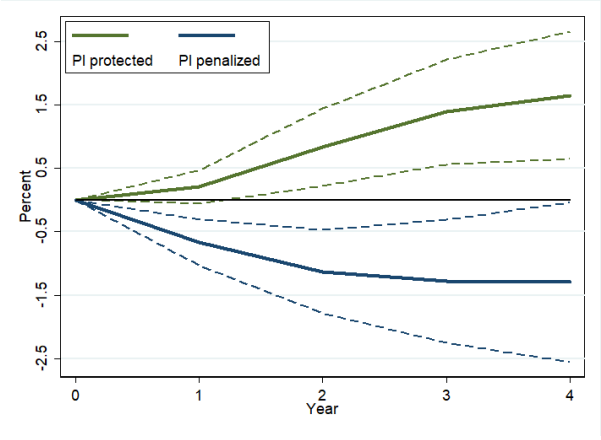
Panel A. At 5th and 95th percentile of PIP.



Panel B. At 10th and 90th percentile of PIP.



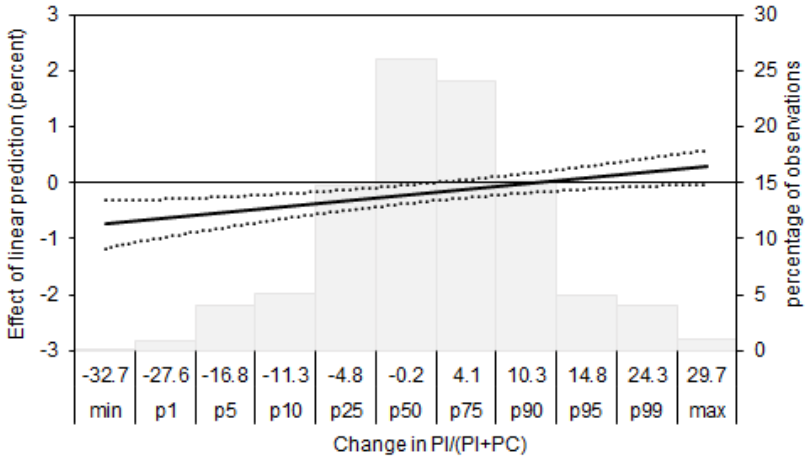
Panel C. At 1st and 99th percentile of PIP.



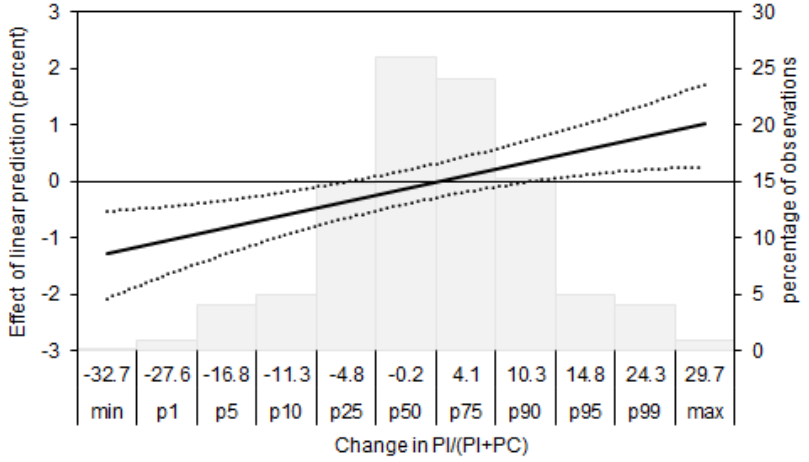
Source: Authors' elaboration based on WEO-IMF. *Note:*: Year = 1 denotes the year of consolidation. (Not) Penalize PI is the IRF calibrated at the percentiles of the distribution of the % change in the PI / (PC+PI) ratio during FC episodes. Dotted lines indicate 90 percent confidence interval.

Figure 4: Conditional Baseline Results. Impact of a 1 Percent of GDP Fiscal Consolidation on GDP

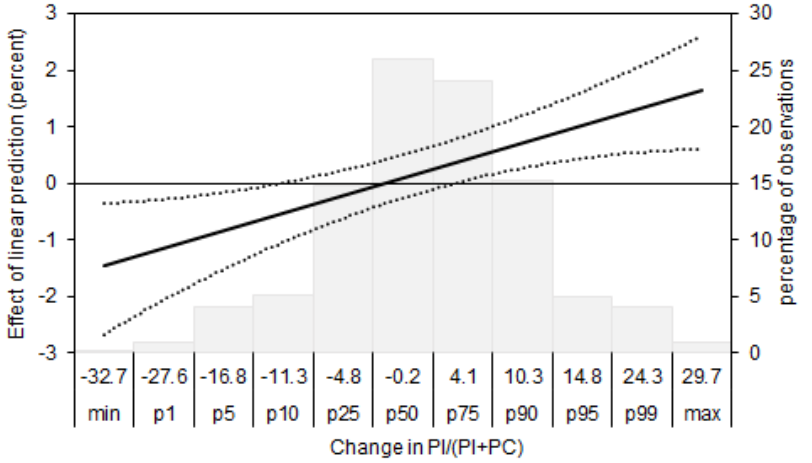
Panel A. 1 Year.



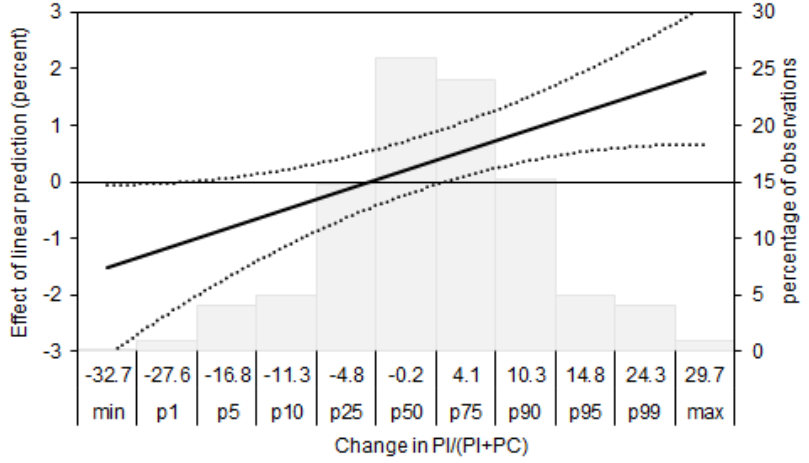
Panel B. 2 Year.



Panel C. 3 Year.



Panel D. 4 Year.



Source: Authors' elaboration based on WEO-IMF. *Note*:: Dotted lines indicate 90 percent confidence interval.

4.2 Robustness Tests

We test the sensitivity of the baseline results to a series of robustness checks: (i) introducing additional control variables, (ii) using an alternative definition of FC, (iii) using an alternative identification strategy of fiscal shocks, and (iv) changing the definition of the PIP ratio. Robustness results are presented in the format of Figure 3 by calibrating the changes in the PIP ratio at the 5th and 95th percentiles of the distribution. Figure 5 shows results from this robusteness exercise.

First, Panel A considers additional control variables that affect output and may be correlated with fiscal consolidation. As in Guajardo et al. (2014) we consider the omitted variables that could plausibly bias the analysis toward overstating the negative effects of FC on GDP. A large initial stock of government debt could raise borrowing costs and reduce growth, and also prompt governments to undertake FC. We therefore control for the country's debt-to-GDP ratio. In addition, demographic controls (i.e., the change in the old-age dependency ratio) are also included because an increase in the fraction of the population that is older might decrease labor supply growth and hence output growth, increase transfer payments and decrease tax revenues, and prompt the government to introduce FC measures. Under this specification, when PI is penalized (protected), a 1 percent of GDP FC leads output to contract (expand) by -0.7 (0.9) within three years. Additionally, in alternative unreported specifications, growth lags were removed and also different lag lengths (up to four) were introduced, as in IMF (2010). In all these checks, the baseline results remain unchanged.[6]

Second, Panel B changes the fiscal balance improvement threshold and time horizon to identify a FC episode. In particular, we follow Alesina and Ardagna (2013) in defining a FC as: (i) a two-year period in which the CAPB improves in each year and the cumulative improvement is at least two percentage points of GDP; or (ii) a three-year or more period in which the CAPB improves in each year and the cumulative improvement is at least three percentage points of GDP.[7] Under this new definition, multipliers become larger than baseline estimates: when PI is penalized (protected), a 1 percent of GDP FC leads to a fall (increase) in output of -1.0 (1.1) percent within three years of the adjustment.

[6]To control for reversion to potential output trend, we also estimate Equation 1 including the output gap in the right hand side, as in Jordà and Taylor (2016). Again, the baseline results remain unchanged.

[7]Under this definition we identify 65 episodes. Among them, 43 (22) penalized (protected) public investment. We also considered definitions considering the change in CAPB relative to the standard deviation considering the whole sample and the within-country standard deviation, as in Diniz (2018). Results are consistent with baseline findings.

Third, since FC episodes as defined in the baseline specification might raise concerns about possible measurement error and endogeneity, Panel C draws on the narrative approach to identify fiscal shocks. The data on narrative fiscal adjustments draws on Devries et al. (2011) and updated by Alesina et al. (2019) for 17 OECD counties (1978–2014), and from David and Leigh (2018) for 14 Latin America and the Caribbean countries (1989–2016). In particular, the change in the CAPB is observed only during years in which the narrative method identifies a fiscal adjustment.[8] Based on these episodes, we find that when public investment is penalized, 1 percent of GDP FC reduces real GDP by 0.4 percent within three years, whereas the same shock is associated with a GDP expansion of 1.7 percent within the same period.

Finally, Panel D changes the definition of the PIP variable by expressing it as the public investment to consumption ratio (i.e., PI/PC) as in Bamba et al. (2020); while this alternative specification has the problem that it is not possible to identify which policy changes are driving the movements in the ratio, it is nonetheless observed that, like in the baseline, when PI/PC ratio increases, the estimated multiplier is significantly larger (1 percent) than when PI/PC declines (-0.8 percent) within three years of the fiscal shock.

4.3 Extensions

We extend the baseline results by asking whether macroeconomic responses differ along several relevant features, such as i) cross-country levels of economic development, ii) variation in public capital stocks, and iii) the type or composition of fiscal adjustment.

Figure 6 shows that the contrast between protecting and penalizing public investment is present in both industrial and developing countries. The output costs of penalizing public investment are substantially similar across these economies during fiscal adjustments (a multiplier of -1.1 in industrial and -0.9 in developing countries within three years), and while the benefits of protecting capital expenditures seem somewhat larger in developing countries, the differences are not statistically significant: in developing countries, the cumulative multiplier is 1.3 with a 90 percent confidence interval of the estimated effect within three years of 0.6 percent to 1.9 percent, whereas in advanced countries, the corresponding multiplier is 0.5, with a -0.1 percent to 0.9 percent confidence interval.

[8] An adjustment identified in the narrative approach is a strong predictor of an improvement in the cyclically adjusted primary balance or CAPB. A 1 percent of GDP fiscal shock increases the CAPB by 0.3 percentage points (t-stat= 3.3). See Figure A1 for details.

Another source of heterogeneity concerns the level of public capital stock in each of the economies that undergo FC. In particular, the estimated fiscal multipliers have been shown to be larger among countries with lower initial capital stocks, probably because the marginal product of an additional unit of public investment in these contexts is larger (Izquierdo et al., 2019; Ramey, 2020). To capture the possible heterogeneous effects, in Figure 7 we compute the different fiscal multipliers for countries with high public capital stocks (Panel A) versus countries with low public capital stocks (Panel B).[9] The results show that the heterogeneous impacts of FC on output responses are larger for countries with low initial capital stocks than for countries with high initial stocks. Notwithstanding the quantitative differences, the direction of the results is the same: in both cases, the estimated multipliers are larger when public investment is protected vis-a-vis the cases when public investment is penalized.

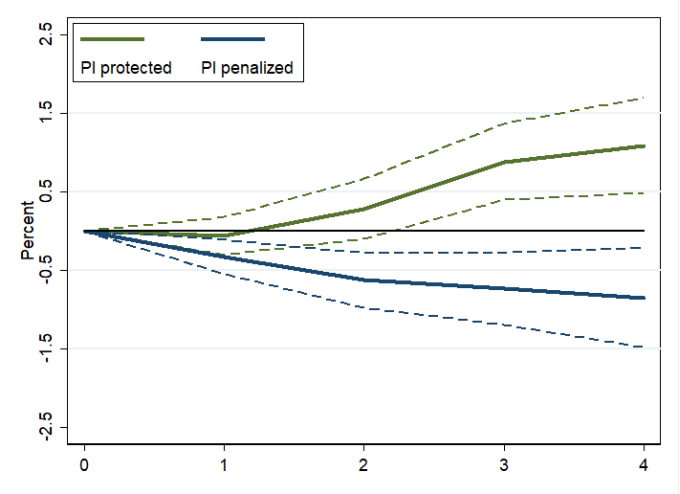
Finally, Figure 8 presents results across different *types* of fiscal adjustments. Following the literature, we define episodes as "tax-based" versus "spending-based" if the change in revenues or spending, respectively, is greater than half the total adjustment.[10] Regardless of the type of adjustment, public investment protection or penalization changes the estimated multipliers. In particular, the cumulative multiplier associated with protecting public investment within three years is 1.6 (1.2) percent in expenditure (tax) driven fiscal adjustments, whereas the GDP *loss* associated with the penalization of public investment is -0.2 (-1.6) percent in expenditure (tax) based consolidations.

[9] We use General Government per capita capital stock, in billions of constant 2011 international dollars, from International Monetary Fund (see IMF). We define public capital stock levels as low (high) when they are below (above) median values in our sample. Results are robust to the use of alternative data sources on the public capital stock such as Penn World Table.

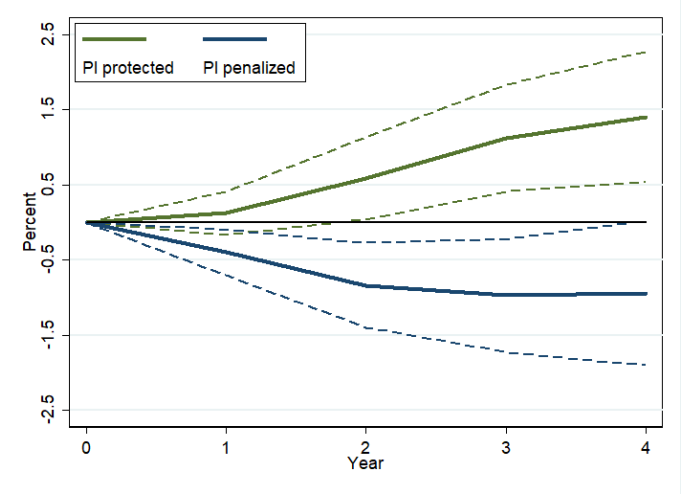
[10] As in Guajardo et al. (2014), to include both types of adjustments in the specification, we split the FC variable into two variables: the first equals the change in the CAPB if the episode is tax based and zero otherwise; and the second equals the change in the CAPB if the episode is spending based and zero otherwise.

Figure 5: Robustness of Conditional Baseline Results. Impact of a 1 Percent of GDP Fiscal Consolidation on GDP

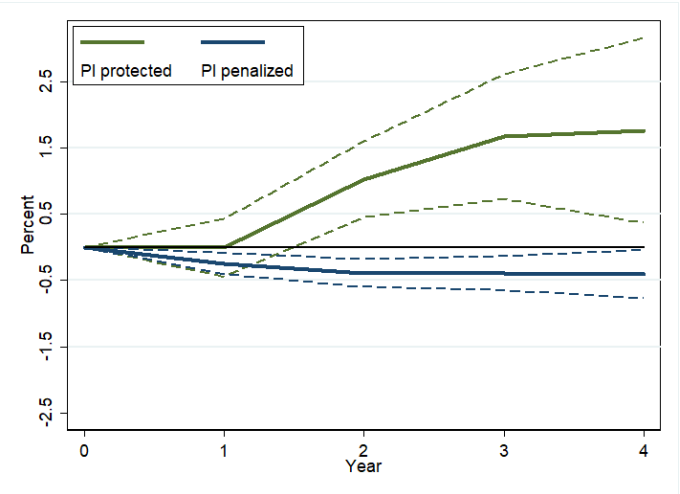
Panel A. Additional Control Variables.



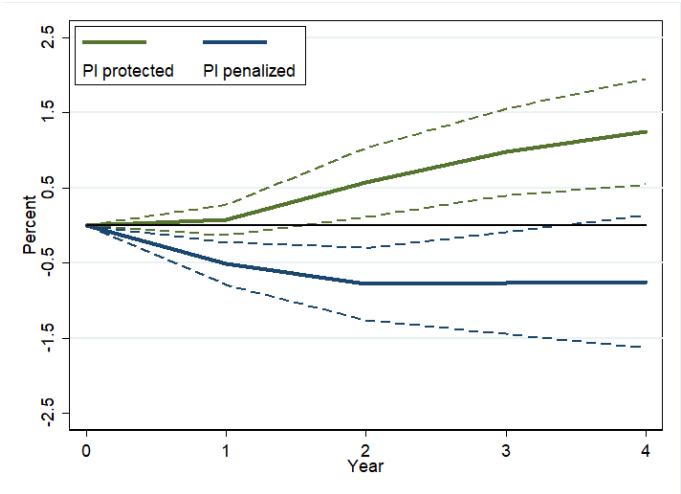
Panel B. Alternative Definition of FC.



Panel C. Narrative episodes.



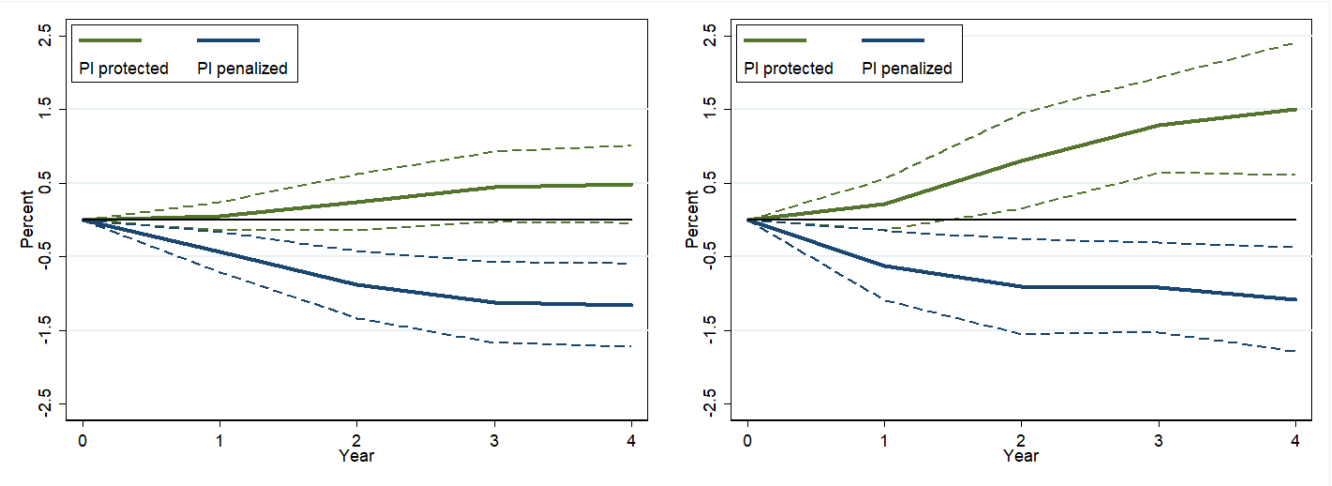
Panel D. Alternative Definition of PIP.



Source: Authors' elaboration based on WEO-IMF. *Note:*: Year = 1 denotes the year of consolidation. For Panels A, B and C (Not) Penalize PI is the IRF calibrated at the percentile (5) 95 of the distribution of the % change in the PI / (PC+PI) ratio during FC episodes. Dotted lines indicate 90 percent confidence interval.

Figure 6: Conditional effects of public investment protection in promoting economic growth on the level of development

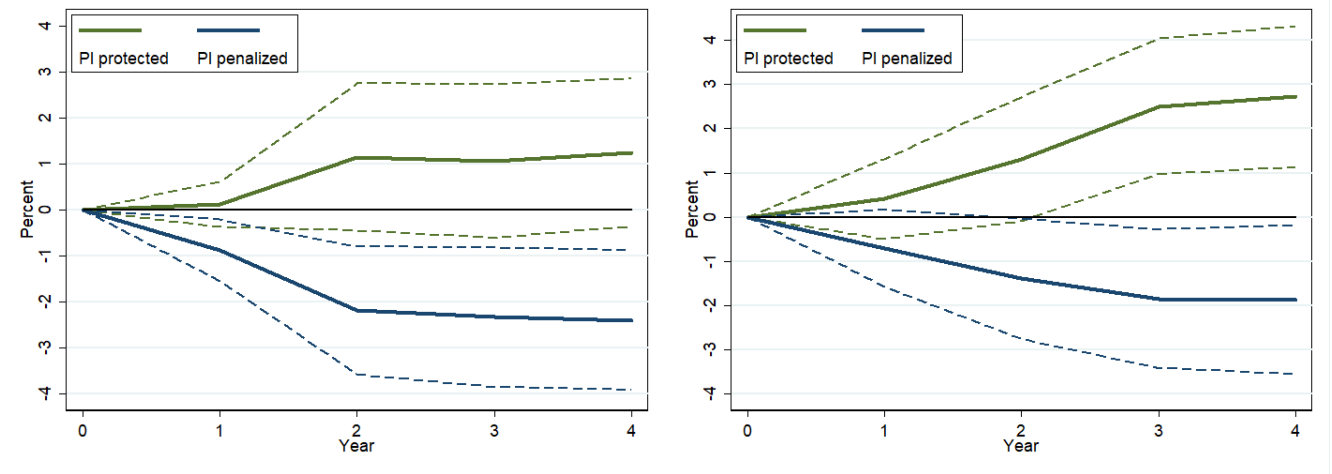
Panel A. Industrial. Panel B. Developing.



Source: Authors' elaboration based on WEO-IMF. *Note:*: Year = 1 denotes the year of consolidation. (Not) Penalize PI is the IRF calibrated at the percentile (5) 95 of the distribution of the % change in the PI / (PC+PI) ratio during FC episodes. Dotted lines indicate 90 percent confidence interval.

Figure 7: Conditional effects of public investment protection in promoting economic growth on the initial stock of public capital

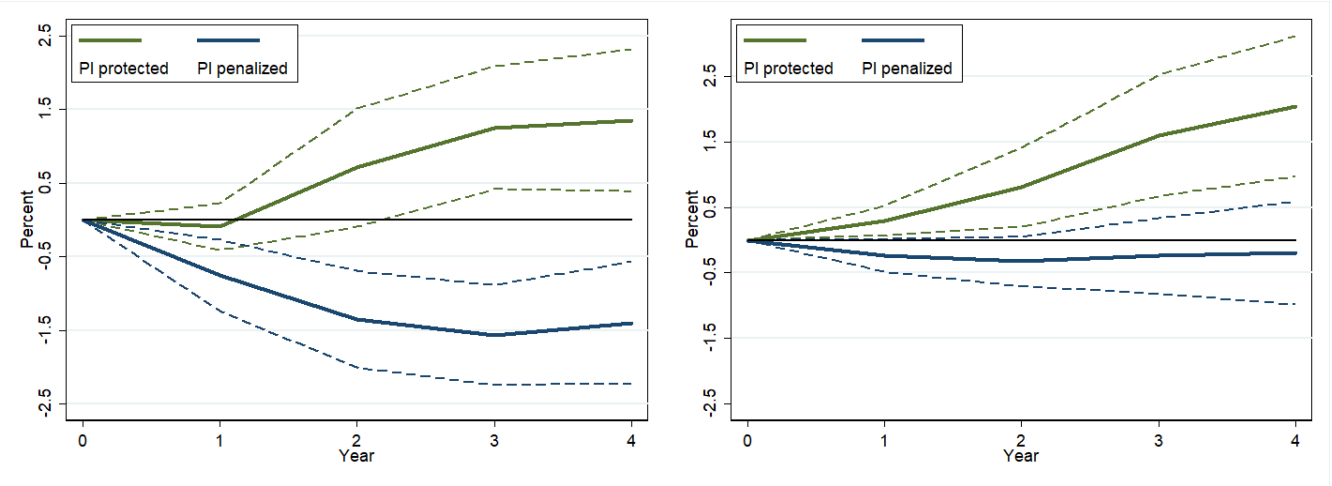
Panel A. High Stock. Panel B. Low Stock.



Source: Authors' elaboration based on WEO-IMF. *Note:*: Year = 1 denotes the year of consolidation. (Not) Penalize PI is the IRF calibrated at the percentile (5) 95 of the distribution of the % change in the PI / (PC+PI) ratio during FC episodes. Dotted lines indicate 90 percent confidence interval.

Figure 8: Conditional effects of public investment protection in promoting economic growth on the type of fiscal consolidation

Panel A. Tax-based consolidation. Panel B. Spending-based consolidation.



Source: Authors' elaboration based on WEO-IMF. *Note:*: Year = 1 denotes the year of consolidation. (Not) Penalize PI is the IRF calibrated at the percentile (5) 95 of the distribution of the % change in the PI / (PC+PI) ratio during FC episodes. Dotted lines indicate 90 percent confidence interval.

5 Mechanisms

To shed light on how FC affects economic activity under different adjustment strategies, we evaluate the response of the aggregate components of GDP, the unemployment rate, and the long-term interest rates.

First, Equation 1 is estimated using the log of private investment and private consumption as dependent variables. Figure 9 (Panel A) presents the results for private investment. When PI is protected (penalized), a FC of 1 percent of GDP leads to an increase (fall) in private investment of 3.6 (-1.8) percent within three years. In the case of private consumption (Panel B), a FC of 1 percent of GDP is associated with a reduction in consumption of 1.1 percent within three years when the PI share falls; instead when the PI share increases, the estimated effect is positive but it is not statistically different from zero.

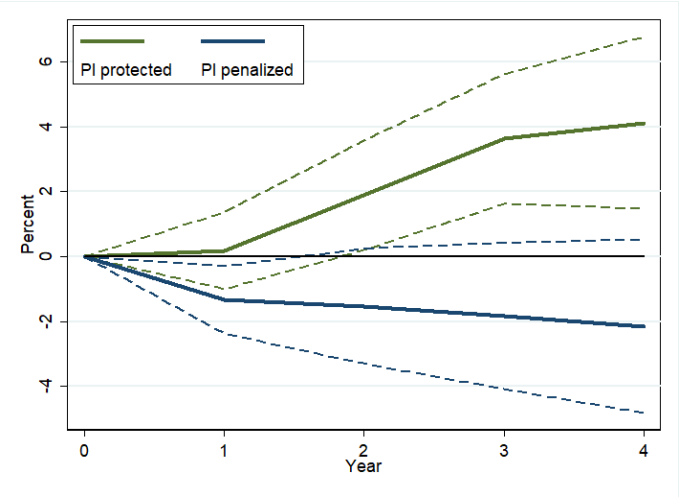
Second, Equation 1 is estimated using the unemployment rate on the left hand side. As shown by Panel C, when PI is protected (penalized), a fiscal consolidation of 1 percent of GDP leads to a reduction (increase) in the unemployment rate of 0.4 (0.5) percentage points within three years of the consolidation. Thus, protecting the PI share in public spending composition has positive effects on employment levels.

Finally, Panel D shows the behavior of the long-term public debt interest rate following different types of fiscal adjustments. There is a significant fall (increase) in the long term interest rate when the PIP increases (decreases) after three years: long term interests are reduced by 0.8 percentage points as the PI share is protected, and they increase by 0.6 percentage points when the PI share is penalized. This suggests that financial markets are reacting differently to fiscal adjustment plans based on their spending composition.

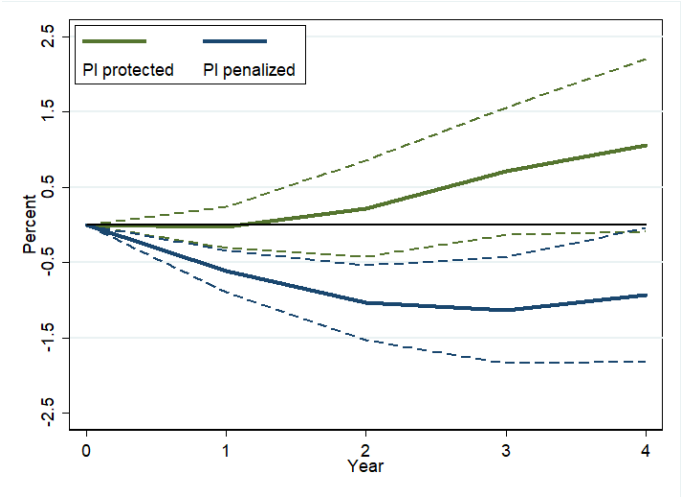
These results are consistent with existing explanations in the literature. First, protecting public investment during FC creates incentives for expanding private investment (Izquierdo et al., 2019). In particular, public investment directly improves the productive capacity of the economy by increasing the marginal product of private capital and labor, generating a crowding-in effect on private investment, as put forward in Baxter and King (1993) seminal work. In our data, these effects are mostly reflected over the medium term, within 3 or 4 years of the fiscal shock. In addition, to the extent that the increase in the share of public investment reflects a relatively larger contribution of public consumption items to total adjustment, then the credibility of the fiscal adjustments might be greater,and that translates in higher private investment levels, and positive reactions in financial markets (Born et al., 2020; David et al., 2019; Beetsma et al., 2015). In particular, by cutting politically sensitive consumption spending (e.g. public wages) rather than productive investment, governments can signal a credible commitment to long-term deficit reduction, and that positive effect can even offset the negative "Keynesian" impacts of the adjustment on aggregate demand. The evidence shown above on the differential behavior of long-term interest rates under alternative composition of FC provides credence to this type of explanation.

Figure 9: Mechanisms of Conditional Baseline Results. Impact of a 1 Percent of GDP Fiscal Consolidation on Private Investment, Private Consumption, Unemployment Rate, and Long-term Public Debt Interest Rate

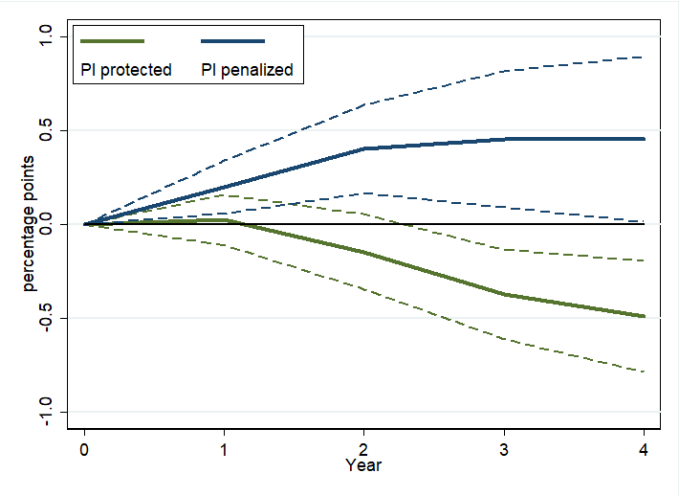
Panel A. Private Investment.



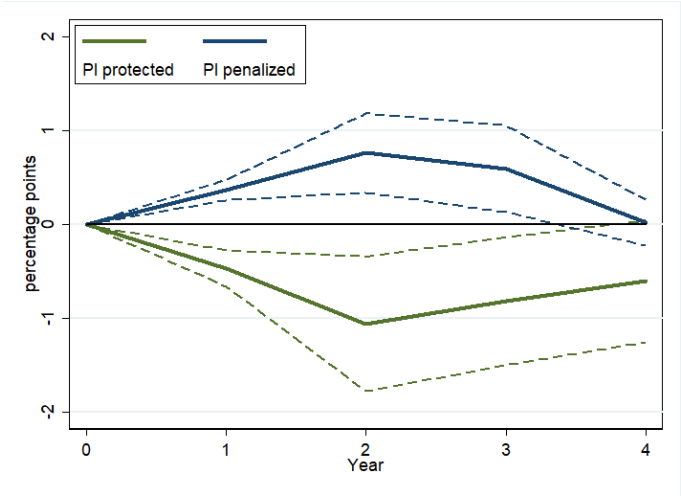
Panel B. Private Consumption.



Panel C. Unemployment Rate.



Panel D. Long Term Interest Rate.



Source: Authors' elaboration based on WEO-IMF. *Note*:: Year = 1 denotes the year of consolidation. (Not) Penalize PI is the IRF calibrated at the percentile (5) 95 of the distribution of the % change in the PI / (PC+PI) ratio during FC episodes. Dotted lines indicate 90 percent confidence interval.

6 Conclusions

This paper shows that the composition of public spending affects the macroeconomic consequences of fiscal austerity. Fiscal consolidations that are designed and implemented in ways that protect public investment can mitigate contractionary impacts. Instead, fiscal consolidations in which public investment ends up carrying the burden of the adjustment are associated with larger drops in real GDP both on impact, and over the medium term.

These findings have relevant policy implications particularly for the post pandemic context. Even before the coronavirus pandemic, there was already a growing concern in policy and academic circles about the secular decline in public investment shares across industrial and developing countries. The pandemic has resulted in a marked deterioration of fiscal accounts around the world as countries responded to the unprecedented challenges imposed by the pandemic with expansionary policies. As the pandemic recedes, many countries will have to design fiscal consolidation plans to restore debt sustainability. While fiscal adjustments may be inevitable, the results in this paper show that expenditure policy can dampen the negative economic effects of consolidation plans. In terms of the available options for policymakers, previous literature has focused on whether the adjustments should be tax or spending based. This paper adds another relevant dimension for policymakers to consider, which is the choice of specific expenditure items to be protected and/or penalized during consolidations. In the end, all the available fiscal policy instruments must be combined to place public finances back on a sustainable path, while protecting economic growth and ensuring a healthy recovery.

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Appendix

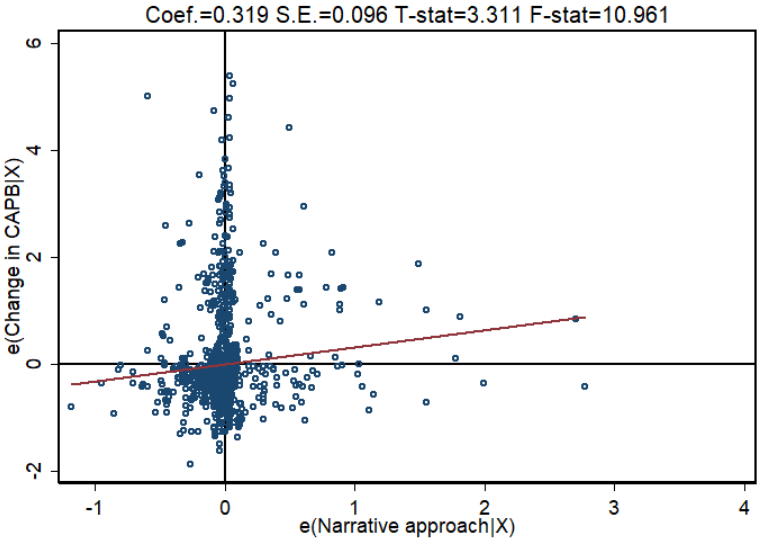
List of Countries. Industrial: Australia, Austria, Belgium, Canada, Finland, France, Germany, Greece, Ireland, Italy, Japan, Luxembourg, Netherlands, New Zealand, Portugal, Switzerland, United Kingdom, United States. **Developing**: Argentina, Barbados, Bosnia Herzegovina, Brazil, Bulgaria, Chile, China,P.R.: Mainland, China,P.R.:Hong Kong, Colombia, Costa Rica, Croatia, Czech Republic, Dominican Republic, Ecuador, Egypt, El Salvador, Estonia, Georgia, Guatemala, Guyana, India, Indonesia, Israel, Jordan, Kazakhstan, Kenya, Korea, Latvia, Lebanon, Lithuania, Malaysia, Mauritius, Mexico, Morocco, Panama, Paraguay, Peru, Philippines, Poland, Romania, Russia, Senegal, Serbia, Republic of, Slovak Republic, South Africa, Suriname, Thailand, Tunisia, Turkey, Ukraine, Uruguay, Vietnam.

Table A1: Descriptive Statistics

	Mean	S.d	min	p10	p50	p90	max	N
GDP Growth Rate (%)	3.20	3.08	-16.03	0.23	3.09	6.68	25.91	1329
Change in CAPB-to-GDP (p.p)	0.36	0.94	0.00	0.00	0.00	1.66	6.54	1329
Change in Ratio PI/(PI+PC) (%)	-0.46	9.16	-32.71	-11.33	-0.16	10.35	29.67	1329
Output Gap (Units Percent)	-0.17	2.48	-18.54	-2.51	-0.11	2.30	13.93	1240
Debt-to-GDP (p.p.)	0.57	0.37	0.00	0.19	0.49	1.03	2.38	1326
Total Net Growth Commodity Exports (%)	0.05	0.07	-0.27	-0.02	0.05	0.13	0.62	1296
Old Age Dependency Ratio (p.p)	0.19	0.15	-0.24	0.02	0.16	0.40	0.75	1260
Change in CAPB-to-GDP (Narrative Approach) (p.p)	0.09	0.40	-0.90	0.00	0.00	0.04	4.74	1329
Private Investment Growth Rate (%)	3.20	11.40	-74.64	-7.96	3.59	14.70	56.15	1323
Private Consumption Growth Rate (%)	3.22	3.28	-18.66	0.14	3.09	7.18	17.70	1279
Unemployment Rate Growth Rate (p.p.)	-0.12	1.13	-5.61	-1.20	-0.12	0.84	9.83	1222
Long Term Interest Rate Growth Rate (p.p.)	-0.23	1.57	-21.63	-1.32	-0.11	0.80	10.36	827

Source: Authors' elaboration.

Figure A1: Size of Fiscal Consolidation: Action-Based Approach versus Standard Approach (Percent of GDP).



Source: Authors' elaboration based on WEO-IMF and Devries et al. (2011); Alesina et al. (2019); David and Leigh (2018). *Notes*: Each variable is controlled for country and time fixed effect. That is, a regression of each variable in country an year fixed effects is estimated. The residuals of each regression are cross-plotted. Coef. is the associated coefficient of regressing both residuals. The S.E., the T- statistic of that coefficient, and the F-statistic of the regression are also reported.

Supplementary Material

Table SM1: Baseline panel regressions: Unconditional Results. Impact of a 1 Percent of GDP Fiscal Consolidation on GDP. Figure 2 in the main text.

	Dependent Variable: $y_{t+h} - y_t$ (dlog $\times$ 100)			
	$h = 1$	$h = 2$	$h = 3$	$h = 4$
Episode, continuous ("1% shock")	-0.382***	-0.428*	-0.315	-0.172
	(0.134)	(0.246)	(0.331)	(0.410)
Observations	1,329	1,260	1,191	1,126
R-squared	0.410	0.332	0.272	0.254
Number of Countries	70	70	70	70

Source: Authors' elaboration based on WEO-IMF. *Notes*: Robust cluster standard errors in brackets. Significance level * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$, respectively. Intercepts are included but not reported for briefness.

Table SM2: Baseline panel regressions: Conditional Results. Impact of a 1 Percent of GDP Fiscal Consolidation on GDP. Figure 3 in the main text.

	Dependent Variable: $y_{t+h} - y_t$ (dlog × 100)			
	$h = 1$	$h = 2$	$h = 3$	$h = 4$
FC ("1% shock")	-0.204**	-0.0865	0.137	0.269
	(0.100)	(0.180)	(0.224)	(0.279)
Change in PIP	0.0434***	0.0528***	0.0557**	0.0407*
	(0.00822)	(0.0161)	(0.0219)	(0.0239)
Interaction (FC * Change in PIP)	0.0169***	0.0377***	0.0514***	0.0567**
	(0.00626)	(0.0131)	(0.0192)	(0.0243)
Marginal Effects				
At 5th and 95th percentile of PIP (Panel A at Figure 3)				
PI protected	0.0460	0.473*	0.899***	1.110***
	(0.117)	(0.269)	(0.349)	(0.419)
PI penalized	-0.487***	-0.721***	-0.727*	-0.684
	(0.163)	(0.280)	(0.405)	(0.529)
At 10th and 90th percentile of PIP (Panel B at Figure 3)				
PI protected	-0.0295	0.304	0.669**	0.856**
	(0.104)	(0.229)	(0.288)	(0.344)
PI penalized	-0.395***	-0.514**	-0.445	-0.374
	(0.137)	(0.229)	(0.323)	(0.421)
At 1st and 99th percentile of PIP (Panel C at Figure 3)				
PI protected	0.205	0.830**	1.385***	1.647***
	(0.158)	(0.370)	(0.501)	(0.611)
PI penalized	-0.669***	-1.127***	-1.281**	-1.296*
	(0.221)	(0.398)	(0.589)	(0.764)
Observations	1,329	1,260	1,191	1,126
R-squared	0.452	0.377	0.313	0.281
Number of Countries	70	70	70	70

Source: Authors' elaboration based on WEO-IMF. *Notes*: Robust cluster standard errors in brackets. Significance level * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$, respectively. Intercepts are included but not reported for briefness.

Table SM3: Robustness test for baseline panel regressions: additional control variables. Panel A in Figure 5 in the main text.

	Dependent Variable: $y_{t+h} - y_t$ (dlog × 100)			
	$h = 1$	$h = 2$	$h = 3$	$h = 4$
FC ("1% shock")	-0.186*	-0.144	0.125	0.181
	(0.109)	(0.174)	(0.207)	(0.235)
Change in PIP	0.0326***	0.0416***	0.0374**	0.0171
	(0.00784)	(0.0132)	(0.0175)	(0.0188)
Interaction (FC * Change in PIP)	0.00845	0.0288***	0.0512***	0.0614***
	(0.00556)	(0.00882)	(0.0126)	(0.0186)
Debt -to- GDP	-13.50***	-23.18***	-25.57***	-24.43***
	(3.435)	(5.975)	(6.997)	(8.274)
Old Age Ratio	-0.786	-3.265	-4.819	-8.266*
	(1.404)	(2.222)	(3.060)	(4.309)
Marginal Effects at 5th and 95th percentile of PIP				
PI protected	-0.0607	0.283	0.883***	1.091***
	(0.146)	(0.233)	(0.295)	(0.370)
PI penalized	-0.328**	-0.628***	-0.735***	-0.851**
	(0.133)	(0.212)	(0.278)	(0.384)
Observations	1,154	1,154	1,090	1,030
R-squared	0.603	0.540	0.482	0.440
Number of Countries	64	64	64	64

Source: Authors' elaboration based on WEO-IMF. *Notes*: Robust cluster standard errors in brackets. Significance level * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$, respectively. Intercepts are included but not reported for briefness.

Table SM4: Robustness test for baseline panel regressions: alternative definition of FC (based on Alesina and Ardagna (2013)). Panel B in Figure 5 in the main text.

	Dependent Variable: $y_{t+h} - y_t$ (dlog $\times$ 100)			
	$h = 1$	$h = 2$	$h = 3$	$h = 4$
FC: AA2013	-0.123	-0.0773	0.140	0.307
	(0.128)	(0.219)	(0.272)	(0.342)
Change in PIP	0.0435***	0.0505***	0.0499**	0.0355
	(0.00785)	(0.0150)	(0.0203)	(0.0229)
Interaction with AA2013	0.0166**	0.0451***	0.0664***	0.0743***
	(0.00808)	(0.0162)	(0.0222)	(0.0277)
Marginal Effects at 5th and 95th percentile of PIP				
PI protected	0.123	0.591*	1.124***	1.409***
	(0.176)	(0.333)	(0.432)	(0.527)
PI penalized	-0.402**	-0.836**	-0.975**	-0.943
	(0.186)	(0.342)	(0.456)	(0.586)
Observations	1,309	1,241	1,173	1,109
R-squared	0.448	0.386	0.332	0.304
Number of Countries	69	69	69	69

Source: Authors' elaboration based on WEO-IMF. *Notes*: Robust cluster standard errors in brackets. Significance level * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$, respectively. Intercepts are included but not reported for briefness.

Table SM5: Robustness test for baseline panel regressions: narrative definition of FC. Panel C in Figure 5 in the main text.

	Dependent Variable: $y_{t+h} - y_t$ (dlog $\times$ 100)			
	$h = 1$	$h = 2$	$h = 3$	$h = 4$
FC: narrative	-0.119	0.361*	0.703*	0.746
	(0.169)	(0.216)	(0.353)	(0.522)
Change in PIP	0.0582***	0.0779***	0.0881***	0.0747**
	(0.0104)	(0.0194)	(0.0262)	(0.0304)
Interaction with narrative FC	0.00749	0.0448***	0.0652***	0.0684***
	(0.00719)	(0.0102)	(0.0156)	(0.0231)
Marginal Effects at 5th and 95th percentile of PIP				
PI protected	-0.00843	1.025***	1.670***	1.760**
	(0.265)	(0.349)	(0.572)	(0.848)
PI penalized	-0.245**	-0.391***	-0.394**	-0.404*
	(0.0956)	(0.126)	(0.156)	(0.220)
Observations	1,214	1,149	1,084	1,023
R-squared	0.437	0.358	0.295	0.264
Number of Countries	66	66	66	66

Source: Authors' elaboration based on WEO-IMF. *Notes*: Robust cluster standard errors in brackets. Significance level * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$, respectively. Intercepts are included but not reported for briefness.

Table SM6: Robustness test for baseline panel regressions: alternative definition of public spending composition. Panel D in Figure 5 in the main text.

	Dependent Variable: $y_{t+h} - y_t$ (dlog × 100)			
	$h = 1$	$h = 2$	$h = 3$	$h = 4$
FC ("1% shock")	-0.201**	-0.0655	0.154	0.308
	(0.101)	(0.182)	(0.233)	(0.286)
Change in PI/PC	0.0322***	0.0354***	0.0396**	0.0290
	(0.00673)	(0.0128)	(0.0169)	(0.0186)
Interaction (FC * Change in PI/PC)	0.0143**	0.0333***	0.0430***	0.0492**
	(0.00543)	(0.0109)	(0.0149)	(0.0192)
Marginal Effects at 5th and 95th percentile of PIP				
PI protected	0.0726	0.573**	0.977***	1.250***
	(0.125)	(0.280)	(0.350)	(0.428)
PI penalized	-0.508***	-0.781***	-0.768*	-0.747
	(0.173)	(0.292)	(0.413)	(0.538)
Observations	1,317	1,248	1,179	1,114
R-squared	0.451	0.372	0.310	0.280
Number of Countries	70	70	70	70

Source: Authors' elaboration based on WEO-IMF. *Notes*: Robust cluster standard errors in brackets. Significance level * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$, respectively. Intercepts are included but not reported for briefness.

Table SM7: Conditional effects of public investment protection in promoting economic growth on the level of development. Figure 6 in the main text.

	Dependent Variable: $y_{t+h} - y_t$ (dlog × 100)							
	Industrial				Developing			
	$h=1$	$h=2$	$h=3$	$h=4$	$h=1$	$h=2$	$h=3$	$h=4$
FC ("1% shock")	-0.148	-0.210	-0.187	-0.184	-0.188	-0.0209	0.226	0.263
	(0.104)	(0.223)	(0.282)	(0.290)	(0.141)	(0.239)	(0.259)	(0.309)
Change in PIP	0.00878	0.000958	-0.00611	0.0125	0.0455***	0.0480**	0.0504**	0.0254
	(0.00609)	(0.0247)	(0.0459)	(0.0665)	(0.00966)	(0.0182)	(0.0240)	(0.0278)
Interaction (FC * Change in PIP)	0.0227**	0.0527***	0.0737***	0.0770***	0.0244*	0.0503***	0.0649***	0.0759***
	(0.00886)	(0.0109)	(0.0119)	(0.0151)	(0.0122)	(0.0183)	(0.0165)	(0.0227)
Marginal Effects at 5th and 95th percentile of PIP								
PI protected	0.0486	0.246	0.451	0.482	0.213	0.805**	1.291***	1.510***
	(0.118)	(0.231)	(0.291)	(0.321)	(0.210)	(0.393)	(0.393)	(0.549)
PI penalized	-0.436***	-0.879***	-1.122***	-1.162***	-0.619**	-0.909**	-0.920**	-1.078**
	(0.167)	(0.277)	(0.333)	(0.344)	(0.288)	(0.392)	(0.370)	(0.430)
Observations	416	400	384	368	793	746	699	655
R-squared	0.731	0.687	0.647	0.598	0.410	0.343	0.283	0.266
Number of Countries	16	16	16	16	48	48	48	48

Source: Authors' elaboration based on WEO-IMF. *Notes*: Robust cluster standard errors in brackets. Significance level * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$, respectively. Intercepts are included but not reported for briefness.

Table SM8: Conditional effects of public investment protection in promoting economic growth on the initial stock of public capital. Figure 7 in the main text.

	Dependent Variable: $y_{t+h} - y_t$ (dlog × 100)							
	Low Stock				High Stock			
	$h=1$	$h=2$	$h=3$	$h=4$	$h=1$	$h=2$	$h=3$	$h=4$
FC ("1% shock")	-0.115	0.0453	0.467	0.572*	-0.347**	-0.412	-0.529	-0.459
	(0.191)	(0.293)	(0.291)	(0.321)	(0.136)	(0.341)	(0.485)	(0.587)
Change in PIP	0.0476***	0.0625***	0.0644***	0.0430**	0.0512***	0.0685***	0.0785***	0.0644**
	(0.00769)	(0.0144)	(0.0185)	(0.0214)	(0.00998)	(0.0186)	(0.0229)	(0.0256)
Interaction (FC * Change in PIP)	0.0353	0.0858*	0.138**	0.145**	0.0316	0.106*	0.107**	0.116**
	(0.0321)	(0.0500)	(0.0569)	(0.0597)	(0.0207)	(0.0539)	(0.0533)	(0.0475)
Marginal Effects at 5th and 95th percentile of PIP								
PI protected	0.409	1.317	2.507***	2.728***	0.121	1.154	1.064	1.253
	(0.550)	(0.852)	(0.935)	(0.970)	(0.300)	(0.974)	(1.014)	(0.977)
PI penalized	-0.709	-1.397*	-1.847*	-1.873*	-0.877**	-2.188***	-2.336**	-2.400***
	(0.530)	(0.828)	(0.955)	(1.023)	(0.405)	(0.847)	(0.922)	(0.923)
Observations	1,257	1,191	1,125	1,063	1,282	1,215	1,148	1,085
R-squared	0.440	0.378	0.321	0.287	0.452	0.383	0.324	0.289
Number of Countries	66	66	66	66	67	67	67	67

Source: Authors' elaboration based on WEO-IMF. *Notes*: Robust cluster standard errors in brackets. Significance level * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$, respectively. Intercepts are included but not reported for briefness.

Table SM9: Conditional effects of public investment protection in promoting economic growth on the type of fiscal consolidation. Figure 8 in the main text.

	Dependent Variable: $y_{t+h} - y_t$ (dlog × 100)							
	Spending-based				Tax-based			
	$h=1$	$h=2$	$h=3$	$h=4$	$h=1$	$h=2$	$h=3$	$h=4$
FC ("1% shock")	0.0497	0.278	0.737**	0.998***	-0.403**	-0.255	-0.0670	0.0660
	(0.106)	(0.194)	(0.279)	(0.372)	(0.193)	(0.325)	(0.307)	(0.348)
Change in PIP	0.0482***	0.0625***	0.0677***	0.0523**	0.0493***	0.0621***	0.0688***	0.0565**
	(0.00895)	(0.0170)	(0.0228)	(0.0250)	(0.00895)	(0.0181)	(0.0229)	(0.0263)
Interaction (FC * Change in PIP)	0.0168***	0.0359**	0.0582**	0.0709**	0.0209**	0.0651***	0.0892***	0.0871***
	(0.00618)	(0.0155)	(0.0244)	(0.0280)	(0.00966)	(0.0196)	(0.0222)	(0.0270)
Marginal Effects at 5th and 95th percentile of PIP								
PI protected	0.299**	0.811**	1.600***	2.049***	-0.0930	0.710	1.255**	1.356**
	(0.137)	(0.370)	(0.564)	(0.651)	(0.193)	(0.488)	(0.508)	(0.588)
PI penalized	-0.233	-0.325	-0.241	-0.193	-0.754**	-1.351***	-1.567***	-1.397***
	(0.151)	(0.229)	(0.350)	(0.480)	(0.295)	(0.400)	(0.414)	(0.504)
Observations	1,306	1,237	1,169	1,105	1,251	1,185	1,120	1,058
R-squared	0.428	0.363	0.306	0.275	0.429	0.360	0.299	0.261
Number of Countries	70	70	70	70	67	67	67	67

Source: Authors' elaboration based on WEO-IMF. *Notes*: Robust cluster standard errors in brackets. Significance level * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$, respectively. Intercepts are included but not reported for briefness.

Table SM10: Mechanisms of Conditional Baseline Results. Impact of a 1 Percent of GDP Fiscal Consolidation on Private Investment, and Private Consumption. Panels A and B in Figure 9 in the main text.

	Public Investment (PI)				Public Consumption (PC)			
	Dependent Variable: $PI_{t+h} - PI_t$ (dlog × 100)				Dependent Variable: $PC_{t+h} - PC_t$ (dlog × 100)			
	$h=1$	$h=2$	$h=3$	$h=4$	$h=1$	$h=2$	$h=3$	$h=4$
FC ("1% shock")	-0.527	0.292	1.069	1.185	-0.306**	-0.369	-0.152	0.125
	(0.528)	(0.799)	(0.912)	(1.157)	(0.139)	(0.265)	(0.357)	(0.461)
Change in PIP	-0.00909	0.133*	0.0576	-0.0280	0.0228**	0.0276	0.0321	0.0141
	(0.0438)	(0.0691)	(0.0850)	(0.0873)	(0.0112)	(0.0227)	(0.0294)	(0.0315)
Interaction (FC * Change in PIP)	0.0481*	0.108**	0.172***	0.198***	0.0186***	0.0397***	0.0584***	0.0629**
	(0.0269)	(0.0432)	(0.0576)	(0.0714)	(0.00593)	(0.0146)	(0.0200)	(0.0272)
Marginal Effects at 5th and 95th percentile of PIP								
PI protected	0.186	1.891*	3.624***	4.117**	-0.0305	0.219	0.714	1.058
	(0.718)	(1.026)	(1.214)	(1.608)	(0.166)	(0.389)	(0.515)	(0.700)
PI penalized	-1.336**	-1.521	-1.829	-2.141	-0.618***	-1.036***	-1.134***	-0.933*
	(0.629)	(1.076)	(1.365)	(1.623)	(0.169)	(0.302)	(0.430)	(0.541)
Observations	1,303	1,236	1,169	1,105	1,257	1,192	1,127	1,065
R-squared	0.310	0.312	0.296	0.283	0.340	0.260	0.233	0.216
Number of Countries	68	68	68	68	66	66	66	66

Source: Authors' elaboration based on WEO-IMF. *Notes*: Robust cluster standard errors in brackets. Significance level * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$, respectively. Intercepts are included but not reported for briefness.

Table SM11: Mechanisms of Conditional Baseline Results. Impact of a 1 Percent of GDP Fiscal Consolidation on Unemployment Rate, and Long-term Public Debt Interest Rate. Panels C and D in Figure 9 in the main text.

	Unemployment Rate (UR)				Interest Rata (i)			
	Dependent Variable: $UR_{t+h} - UR_t$ ($\times$ 100)				Dependent Variable: $i_{t+h} - i_t$ ($\times$ 100)			
	$h=1$	$h=2$	$h=3$	$h=4$	$h=1$	$h=2$	$h=3$	$h=4$
FC ("1% shock")	0.107*	0.111	0.0151	-0.0471	-0.0769	-0.208	-0.156	-0.313
	(0.0616)	(0.103)	(0.109)	(0.119)	(0.0764)	(0.150)	(0.133)	(0.195)
Change in PIP	-0.0129***	-0.0166**	-0.0116	-0.00339	0.0234**	0.0357**	0.00995	0.0330
	(0.00333)	(0.00732)	(0.00904)	(0.0101)	(0.00882)	(0.0143)	(0.0209)	(0.0295)
Interaction (FC * Change in PIP)	-0.00553	-0.0173***	-0.0261***	-0.0299**	-0.0264***	-0.0576***	-0.0446**	-0.0198
	(0.00361)	(0.00518)	(0.00941)	(0.0122)	(0.00374)	(0.0210)	(0.0210)	(0.0149)
Marginal Effects at 5th and 95th percentile of PIP								
PI protected	0.0246	-0.145	-0.372**	-0.490***	-0.468***	-1.062**	-0.817**	-0.607
	(0.0820)	(0.121)	(0.145)	(0.180)	(0.117)	(0.437)	(0.414)	(0.395)
PI penalized	0.200**	0.402***	0.455**	0.455*	0.367***	0.761***	0.594**	0.0198
	(0.0860)	(0.143)	(0.221)	(0.268)	(0.0667)	(0.257)	(0.281)	(0.148)
Observations	1,147	1,087	1,027	970	766	728	690	653
R-squared	0.401	0.338	0.303	0.289	0.370	0.415	0.430	0.236
Number of Countries	60	60	60	60	38	38	38	38

Source: Authors' elaboration based on WEO-IMF. *Notes*: Robust cluster standard errors in brackets. Significance level * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$, respectively. Intercepts are included but not reported for briefness.