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On the Output Effect of Fiscal Consolidation Plans: A Causal Analysis

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Abstract

Using data from 16 OECD countries over the period 1981-2011, this paper studies how different policy announcements affect economic growth in situations of fiscal consolidation. We focus on government announcements regarding reductions in expenditure and increases in taxation. We use a mediation analysis to uncover the direct and indirect effects elicited by such announcements. We find that during debt consolidation periods, announcements related to consolidation plans have no direct impact on GDP growth. However, spending cuts announcements have substantial negative indirect effects, resulting in overall negative total effects, while tax increases have negligible indirect and overall impacts. Our findings propose a new interpretation of the results of Alesina et al. (2015b): in terms of announcements, once accounting for indirect effects, spending cuts are more harmful to growth than tax hikes.

Keywords: fiscal adjustment, economic growth, causal mechanisms, mediation analysis.

JEL codes: E60, H60, H63.

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1 Introduction

This is an empirical paper that examines the cause-and-effect relationship between government announcements (specifically, those related to fiscal consolidation plans) and macroeconomic performance.

Several factors play a role in determining the effectiveness of an economic policy and its long-term impact on the macroeconomy. Recently, some authors have started to explicitly incorporate the role of information into studies that measure the effects of changes in fiscal policy, using the so-called "narrative approach".[1] In fact, the ability of the private sector to anticipate the impact of a policy is essential in determining both the timing and the realization of the objective targeted by the government. The narrative approach helps address this issue because it relies on official documents that national governments release about their long-term economic plans. Since these documents are available to the public, they can influence individual economic decisions through their effect on agents' expectations. In general, governments are unable to firmly commit to the policy mix they intend to use to achieve their targets over time. However, it is possible to categorize the announced interventions based on the chosen resource sources. These could either arise from increased taxes, reduced expenditure, or a combination of both.

Policy announcements are typically hard to anticipate both in their *nature*, that is whether they are spending- or tax-based, and in their *size*.[2] This unpredictability makes such announcements similar to an exogenous treatment, which is suitable for conducting a causal analysis.[3]

Using the dataset of Alesina et al. (2015b), we estimate the total effect of a fiscal consolidation plan announcement on GDP growth, decomposing it into direct and indirect effects (via the debt-to-GDP ratio). Specifically, we posit that, if effective,

[1] See, e.g., Favero and Giavazzi (2012), Alesina et al. (2015b) and Rojas et al. (2022) and Nakamura and Steinsson (2018) for a survey. Melosi et al. (2022) highlights that fiscal announcements have the potential to influence macroeconomic stabilization. This is because such announcements communicate the government's perspective on the economic forecast to the private sector.

[2] The literature, see, e.g., Mertens and Ravn (2011) and Mertens and Ravn (2012), distinguishes between *anticipated* and *unanticipated* fiscal shocks. To maintain a realistic perspective, we assume that agents are unable to predict whether a consolidation plan relies on increasing taxes or reducing expenditures nor its size.

[3] It must be noticed that just because a government declares a policy aimed at a specific objective, it doesn't necessarily mean that this goal will be achieved solely through the effect of that announcement on the actions of economic agents or through the tools implemented by the government. For example, in the case of debt consolidation plans, the total level of debt is influenced by whatever policies are ultimately implemented, not just those contained in the announced plan itself. This is a well know problem in causal inference. We tackle this issue in Section 4.4.

fiscal policy should primarily affect the debt-to-GDP ratio, as it is this ratio that directly impacts the real GDP growth and other macroeconomic variables.[4] Since we aim to understand which among a tax-based and an expenditure-based consolidation plan is less harmful to the economy, we create two treatment variables. These variables indicate whether a plan belongs to the former category or the latter.[5] In periods of consolidation plans, a spending-based policy has to be interpreted as a decrease in the level of government spending while a tax-based policy as an increase in the level of taxation.

We employ *mediation analysis*, which helps us delineating the mediating mechanisms underlying observed relationships. Through this method, we are able to elucidate causal pathways and disentangle direct and indirect effects of policy announcements. This disentanglement enables us to identify specific channels through which announcements exert their impact, thereby clarifying the results of Alesina et al. (2015b). In our implementation, standard errors are adjusted for the heterogeneity bias (i.e., we assume that, due to country specific unobserved characteristics, the effectiveness of fiscal policy can vary from country to country). We decompose the total effect of fiscal consolidation plans announcements into direct and indirect effects. Our econometric design allows to explore different causal processes by studying the roles of intermediary variables or *mediators* that exist in the causal pathways connecting the treatment, i.e. the policy announcement, and macroeconomic outcome variables, once country-specific unobserved heterogeneity is taken into account.[6]

Our estimates suggest that policy announcements pertaining to both tax hikes and reductions in government spending are associated with adverse effects on the economic expansion as measured by GDP growth. Logically, both an increase in taxes and a decrease in spending would lead to a diminished government contribution to the GDP's dynamics. Concerning plans based on spending cuts, our analysis reveals a direct effect which is not statistically significant. This is consistent with the findings of Alesina et al. (2015a) and Alesina et al. (2015b). Nonetheless, the indirect effects are negative and significant. Therefore, the overall impact of this policy is negative and statistically significant. We observe this consistency across various models that we evaluate. As for plan based on tax increases, our analysis indicates that both the

[4]See Reinhart and Rogoff (2010). In our baseline regression the response variable is the real GDP growth rate. In the appendix, we run the same analysis, using the growth rate of real per capita consumption, the growth rate of the gross fixed capital formation, consumer and business confidence indicators and the spread between long-term and short-term interest rates.

[5]As we will show below, these variables differ slightly from those of Alesina et al. (2015b), which do not consider the scale of the announced policy (in terms of percentage of GDP).

[6]See, e.g., Li et al. (2007) and Celli (2022). As we point out in Section 4, the findings are sensitive to the selection of mediators.

direct and indirect effects are negative. However, neither of these effects is statistically significant.

Related literature This paper is related with two branches of the literature. The first looks at how debt, in both absolute level and as a percentage of GDP, affects economic growth. The second, which has seen substantial growth in the past two decades, following the Great Recession and the COVID-19 pandemic, delves into the role of economic policy in managing severe macroeconomic disturbances. The latter . Interestingly, there is no unanimous agreement regarding the impacts of consolidation plans. In fact, the projected implications vary based on the empirical specifications, statistical methodologies, and available data.

The need for consolidation plans arises since it is generally agreed upon that excessive public debt negatively impacts the macroeconomic performance. Indeed, both the exogenous growth model, as seen in Diamond (1965), and the endogenous growth model, as seen in Saint-Paul (1992), indicate that government debt can be detrimental to GDP growth. However, as observed by Panizza and Presbitero (2014), the crowding out effect appears to not be too intense in quantitative terms. If public debt influences the productivity of public expenditures, as in Teles and Mussolini (2014), increases uncertainty or creates expectations of future financial repression, as in Cochrane (2011), it could have a more substantial negative impact on economic outcomes. Codogno et al. (2003) provides evidence that the rising sovereign risk leads to higher real interest rates, thereby reducing private investment. Specifically, they document that "the impact of international risk on yield differentials in Austria, Italy and Spain, is explained by their debt-to-GDP ratios relative to Germany". Conversely, DeLong et al. (2012) shows that expansionary fiscal policies that result in debt accumulation but prevent prolonged recessions could potentially have a positive effect on both short- and long-term growth.

According to empirical studies, it is also broadly acknowledged that the impact of debt on growth is dependent on its starting level. A change in the level of debt has varying effects depending on initial conditions. This feature naturally suggests the idea that non-linear aspects drive the process, and these non-linearities could possibly be defined by thresholds, as suggested in studies like Reinhart and Rogoff (2010), Baum et al. (2013), and Égert (2015).

The study by Reinhart and Rogoff (2010) groups countries based on their debt-to-GDP ratio, using data from 44 countries over roughly 200 years, up until 2009. The findings suggest that both in advanced and emerging economies, high debt-to-GDP ratios (greater than 90%) are linked with significantly lower growth. No noticeable differences are observed for the other clusters. Almost identical thresholds are found

by Caner et al. (2010) and Cecchetti et al. (2011).

In line with this, Baum et al. (2013) looks at 12 European countries over the period from 1990 to 2010. Using a dynamic threshold panel methodology, they observe a positive short-term effect. However, similar to the findings in Reinhart and Rogoff (2010), when the debt ratios are high (above 95%), the influence of additional debt on economic activity is negative. On the contrary, Égert (2015) uses non-linear threshold models, finding only limited evidence supporting a negative relationship between debt and growth for the period from 1946 to 2009. According to this study, the threshold can be lower than 90%, and the non-linearity can vary across different datasets and specifications. Eberhardt and Presbitero (2015) finds systematic differences in the debt–growth relationship across countries, with lower long-run debt coefficients in countries with higher average public debt burdens, but no evidence for non-linearities. Similarly, Chudik et al. (2017) does not find a threshold effect that is universally applicable once global factors are taken into account, but rather in the case of countries with rising debt-to-GDP ratios. Kourtellos et al. (2013) argues that the quality of a country's institutions mitigates the impact of public debt on growth, suggesting that low-quality countries are negatively impacted by higher levels of debt while debt is neutral to growth for high-quality countries.

In relation to the literature that discusses policy effects in severe economic conditions, papers close to ours are those that employ the narrative approach developed by Romer and Romer (2010). Among these, Alesina et al. (2015a), Alesina et al. (2015b), Alesina et al. (2018), Alesina et al. (2019), and Beetsma et al. (2021) argue for the non-detrimental effects of spending reductions on economic growth, in contrast to the harmful effects of tax increases. These studies propose a methodology to analyze such policies over time, also considering the role of information. Riera-Crichton et al. (2016) supports the use of narrative analysis comparable to Romer and Romer (2010), but endorses the application of tax policies in contrast to measures based on spending. In a similar vein, focusing on emerging economies, Carrière-Swallow et al. (2021) finds that spending cuts have a negative impact that is several times larger than tax increases. Using the narrative approach, Jordà and Taylor (2016) finds that austerity consistently hampers economic growth, with its effects being particularly severe in struggling economies. Specifically, a fiscal consolidation equivalent to 1% of GDP results in a 3.5% reduction in real GDP over the span of five years if enacted during a downturn, as opposed to a lesser impact of only 1.8% if carried out during a period of economic expansion. Along this line, House et al. (2020) reveal a notable overall adverse impact of curtailing public expenditure amid crises. This effect is attributable to the extent of austerity's contractionary nature, which is so pronounced that it paradoxically leads to an increase in the debt-to-GDP ratio. Gunter et al. (2021) focuses

on the role of the initial level of taxation (when new policies are implemented), finding non-linear effects. A comprehensive review of spending and tax multipliers is provided by Ramey (2019). Hommes et al. (2018) and D'Acunto et al. (2022) analyze the effects of heterogeneity in expectations concerning the effectiveness of fiscal policies. Particularly, Hommes et al. (2018) finds that spending policies endure for extended periods and result in more profound economic downturns when individuals exhibit bounded rationality.

Lastly, our paper aligns with the literature on causal inference that relies on mediation. Mediation is a statistical technique that enables the direct modeling of the causal mechanisms underlying a process. Our specification draws from Li et al. (2007), which controls for potential estimation biases due to confounding variables in the mediation framework. For a broader understanding of the theory that underpins our approach, see, e.g., Selig and Preacher (2009), Emsley et al. (2010), Fiedler et al. (2011) and VanderWeele (2016). Additionally, for examples of how this approach is utilized in economic studies, refer to Swamy and Dharani (2018), Celli (2022) and Guo et al. (2024).

Outline The paper is structured as follows. In Section 2, we present the methodology for identifying the causal mechanisms. In Section 3, we describe the data. In Section 4, we present our results. Section 5 is a conclusion.

2 Model and methodology

In line with Alesina et al. (2015a) and Alesina et al. (2015b), our goal is to quantify the impact of announcements about tax hikes, denoted as $\widetilde{TB}$, and reductions in government expenditure, denoted as $\widetilde{EB}$, on GDP growth, within the context of debt consolidation plans. We concentrate on the chain mechanism set off by information shocks. The method we use to derive $\widetilde{EB}$ and $\widetilde{TB}$ aligns with that used in Alesina et al. (2015b) and will be detailed below.

The baseline regression equation is

$$\Delta y_{it} = \beta_0 + \beta_1 \widetilde{EB}_{it} + \beta_2 \widetilde{TB}_{it} + \beta_3 \Delta d_{it} + \mu_i + \chi_t, \tag{1}$$

where μ_i is a country-specific random effect and χ_t accounts for year-specific dummies, Δy is the real GDP per capita growth rate while β_1 and β_2 captures the effects of spending- and tax-based announcements weighted by the respective announced GDP variation. Lastly, Δd is the growth rate of the debt-to-GDP ratio, which is included as a covariate since the policies under discussion are intended to directly affect this variable.

The causal model A mediation model proposes that, once controlling for a vector of independent variables, X, the treatment, T, influences the mediator variable, M, which in turn affects the dependent variable, Y, i.e. $Y = f(X, T, M(T))$. In our baseline model, T is the announced consolidation plan, which can be centered on tax increases ($\widetilde{TB}$) or expenditure cuts ($\widetilde{EB}$), the mediator M is the growth rate of the debt-to-GDP ratio (Δd) while Y is the real GDP growth rate (Δy).[7] In the Appendix, we run the same model with other response variables.

We define (i) the causal mediation effect as $\delta(t) = Y(t, M(1)) - Y(t, M(0))$, (ii) the direct effect as $\zeta(t) = Y(1, M(t)) - Y(0, M(t))$ and (iii) the total treatment effect as $\tau = Y(1, M(1)) - Y(0, M(0))$.

Our interests lie primarily on the average direct effect (ADE), denoted by $\overline{\zeta}$, and on the average causal mediation effect (ACME), denoted by $\overline{\delta}$, which we interpret as informational shocks about fiscal policy. Consequently, the mediation equation is given by

$$\Delta d_{it} = \lambda_0 + \lambda_{Ann} Ann_{it} + \lambda_i + \lambda_t. \tag{2}$$

where λ_i and λ_t are country-specific random effect and year-specific dummies, respectively. Using (1) and (2), we get

$$\overline{\delta}_{Ann} = \lambda_{Ann}\beta_3, \tag{3}$$

$$\overline{\zeta}_{Ann} = \beta_{Ann}, \tag{4}$$

and

$$\tau_{Ann} = \lambda_{Ann}\beta_3 + \beta_{Ann}, \tag{5}$$

with $Ann = \widetilde{EB}, \widetilde{TB}$.

The choice to rely on linear equations is driven by two factors. First, it enables a more direct comparison between our results with those of Alesina et al. (2015a). Second, linear specifications provide clarity on the theoretical effects of potential confounding factors. Li et al. (2007) also recommends considering limited, if any, confounders, demonstrating that adjusting for their presence could lead to biased estimates under certain conditions.[8]

[7] Our mediation analysis is similar to that present in Riera-Crichton et al. (2016).

[8] Indeed, a confounder can impact X, M and Y either individually or jointly. Li et al. (2007) argues that the right estimation strategy relies on the specific causal pattern, highlighting the common misconception according to which unbiased estimates are only obtained when accounting for potential confounders in all regressions.

3 Data and summary statistics

Our data consists of 487 observations for 16 OECD countries over the period 1981-2011.[9]

We merge data from different sources. Leigh et al. (2011) provides data on the structure and size of each announced plan; Alesina et al. (2015b) creates dummy variables for each announcement and use several macro variables; finally, we retrieve data on Total Factor Productivity (TFP) and human capital from the Penn World Table (PWT version 10.01).

Constructing announcements To ensure that our results are comparable with existing literature, we construct our announcement variables in a manner that mirrors the approach used in Alesina et al. (2015b). Their approach consists in summing all the announced effects over a period of 3 years and then defining the policy type based on the largest announced effects. That is, for TB, which is a dummy variable that takes the value 1 if the consolidation plan is based on tax hikes, we have

$$\tau_{it}^{u} + \sum_{j=0}^{3} \tau_{it+j}^{a} > g_{it}^{u} + \sum_{j=0}^{3} g_{it+j}^{a} \Rightarrow TB_{it} = 1, \tag{6}$$

where τ_{it+j}^{a} and g_{it+j}^{a} are the announced effects of, respectively, the tax and spending policies announced at time t to be implemented in $t+j$, conversely τ_{it}^{u} and g_{it}^{u} are unexpected components. Analogously, for EB, which is a dummy variable that takes the value 1 if the consolidation plan is based on government expenditure reductions we have

$$g_{it}^{u} + \sum_{j=0}^{3} g_{it+j}^{a} > \tau_{it}^{u} + \sum_{j=0}^{3} \tau_{it+j}^{a} \Rightarrow EB_{it} = 1. \tag{7}$$

Notice that policy announcements are only documented when the intention behind fiscal change is debt reduction. Consequently, it does not necessarily hold that $TB + EB = 1$. Indeed, there are many instances where both TB and EB equal 0, signifying the absence of a debt consolidation policy.

This method for classifying plans has some drawbacks. First, all announcements, despite occurring at different periods, are summed without discounting. However, while this might theoretically pose an issue, the brevity of the time span under consideration (3 years) and the typical discounting factor being close to 1 means that this approximation doesn't significantly skew the results. Second, and of greater importance, this approach converts a continuous variable (that is, the total value of announced policies)

[9]The countries included in our dataset are: Australia, Austria, Belgium, Canada, Germany, Denmark, Spain, Finland, France, Great Britain, Ireland, Italy, Japan, Portugal, Sweden and the United States.

into a binary one. The consequence of this procedure is the loss of the size characteristics of the plan, a factor that is crucial to consider when performing a mediation analysis.[10] To tackle this issue, we define the following variables, which are designed to capture not only the nature of a policy but also its magnitude:

$$\widetilde{TB}_{it} = TB_{it} \times \left(\tau^u_{it} + \sum_{j=0}^{3} \tau^a_{it+j} - g^u_{it} - \sum_{j=0}^{3} g^a_{it+j} \right) \tag{8}$$

and

$$\widetilde{EB}_{it} = EB_{it} \times \left(g^u_{it} + \sum_{j=0}^{3} g^a_{it+j} - \tau^u_{it} - \sum_{j=0}^{3} \tau^a_{it+j} \right). \tag{9}$$

Notice that equations (8) and (9) are always weakly positive and at least one of them, in each period, is equal to zero. It is worth noting that announced policies of any type are not inevitably implemented in the following periods, i.e. governments can exhibit inconsistency over time.

Descriptive statistics Table 1 presents the summary statistics of our key variables. Notice that policies based on spending cuts carry 2-3 times more weight than those on tax hikes.

The GDP growth, on average, stands at 2%, with considerable fluctuations reaching up to 12%, indicative of periods of exceptional booms and crises. As expected, for most countries in our dataset, the lowest points correlate with the year 2009, while the peaks are predominantly seen around the mid-1990s. Similarly, when considering the growth of the debt-to-GDP ratio, we notice a pattern that can be divided into three distinct phases. From 1980 to 1995, the average growth is slightly positive, yet remains stable. Between 1996 and 2007, a pattern of debt reduction is observed across all the countries in our dataset. However, post-2008, the aftermath of the Great Recession, characterized by a lower GDP and higher debt, caused the ratio to surge dramatically. Regarding the growth of TFP, the trajectory is stable and positive, with the lowest points occurring around 2009.

The correlation matrix, presented in Table 2, does not show excessive levels of comovements between variables, with a few exceptions. The correlation between $\widetilde{TB}$

[10] In Alesina et al. (2015b) the use of EB and TB is not problematic. This is due to their approach based on Seemingly Unrelated Regressions (SUR), in which they incorporate the actual sizes of the plans into the regression model by interacting it with the dummy variables EB and TB. However, this particular feature is not applicable to our mediation framework since we can only evaluate the mediation through one variable. We then construct appropriate variables, $\widetilde{EB}$ and $\widetilde{TB}$, which allow to jointly consider the size and the type of the plan.

Table 1: Summary Statistics.

Variable	Obs.	Mean	St. Dev.	Min	Max
Δy	487	2.349	3.381	−11.841	12.497
$\widetilde{TB}$	487	0.078	0.275	0.000	2.645
$\widetilde{EB}$	487	0.208	0.537	0.000	4.718
Δd	487	1.639	4.937	−10.744	24.623
ΔTFP	487	0.458	1.417	−7.170	5.224

and $\widetilde{EB}$ is negative, reflecting that the alternation of policies over time is usually preferred and that, by construction, both policies cannot be positive at the same time. On the other hand, Δy and Δd show a negative correlation, a relationship we will further explore in this paper. Lastly, the impact of the change in productivity (ΔTFP) is evident, as it is linked with higher GDP growth and a reduction in the growth of the debt-to-GDP ratio.

Table 2: Correlation matrix for key variables.

	Δy	$\widetilde{TB}$	$\widetilde{EB}$	Δd	ΔTFP
Δy	-	-	-	-	-
$\widetilde{TB}$	−0.095	-	-	-	-
$\widetilde{EB}$	0.031	−0.110	-	-	-
Δd	−0.475	0.108	0.222	-	-
ΔTFP	0.498	0.010	0.094	−0.263	-

Table 3 shows the cumulated plans of each country (as a percentage of GDP). We consider the cumulated fiscal consolidation as the sum of policies that were actually implemented ($\sum_{t=1981}^{2011} g_{it}^u + g_{it}^a + \tau_{it}^u + \tau_{it}^a$), independently of their announcement and type, while the cumulated announced fiscal consolidation as the sum of policies that were known to be implemented ($\sum_{t=1981}^{2011} g_{it}^a + \tau_{it}^a$), independently of the type. The table also reports the cumulated spending cuts as the sum spending-based policies that were actually implemented ($\sum_{t=1981}^{2011} g_{it}^u + g_{it}^a$).[11]

[11]For the sake of brevity, Table 3 does not report the cumulated figures related to tax hikes. However,

Our dataset indicates a pattern among most countries, with a preference for implementing policies focused on reductions in spending as opposed to increasing taxes. There is a significant heterogeneity in the total levels of fiscal consolidation, with figures ranging from just under 4% to over 24%. Interestingly, the announced counterpart suggests that many countries often opt not to disclose such policies before their implementation. A case in point is Italy, which, despite having a negative level of announced consolidation, holds the highest level of cumulative consolidation. This highlights the significance of differentiating between anticipated and unanticipated policies as governments can easily reverse or significantly alter their plans. Lastly, in terms of scale, spending policies constitute the largest portion of total consolidation.

Table 3: Summary Statistics of Fiscal Plans.

Country	$\#EB$	$\#TB$	Cumulated Fiscal Consolidation	Cumulated Announced Fiscal Consolidation	Cumulated Spending Cuts
AUS	6	5	4.39	2.32	2.89
AUT	5	2	10.85	2.74	5.89
BEL	9	3	14.06	5.15	8.59
CAN	12	5	9.90	7.24	5.75
DEU	11	7	12.33	2.65	7.02
DNK	6	3	7.72	4.15	5.48
ESP	8	5	13.98	0.40	9.03
FIN	6	2	12.13	3.20	11.25
FRA	11	2	3.74	0.37	2.35
GBR	2	9	5.94	2.95	1.59
IRL	5	6	22.62	2.12	11.03
ITA	11	4	24.61	−5.38	13.86
JPN	5	5	6.04	1.15	3.05
PRT	5	3	13.51	5.50	6.93
SWE	7	0	10.82	5.78	7.11
USA	10	7	6.05	5.39	3.21

these can be calculated by subtracting the cumulated values of spending cuts from the cumulated values of fiscal consolidations. Similarly, we do not report the cumulated figures for unanticipated policies can be obtained by subtracting the cumulated values of announced fiscal consolidations from the cumulated values of fiscal consolidations.

4 Results

In this section, we outline estimates on the impacts of policy announcements under various specifications. Initially, we show a simple Seemingly Unrelated Regression (SUR) estimate, which is subsequently augmented using a Random Effects (RE) model and a Fixed Effects (FE) model, in line with the methodology outlined by Alesina et al. (2015b). Subsequently, we detail the estimates derived from the linear mixed mediation model, incorporating country-specific random effects and year-specific dummies, using the growth rate of the debt-to-GDP ratio as the mediator.

4.1 SUR, RE and FE

Table 4 provides a comparison between our estimates, column (I), and those of Alesina et al. (2015b), column (II).[12] Notice that in Alesina et al. (2015b) each announcement is interacted with the time-specific announced size, distinguishing between anticipated and unanticipated policies.[13] Since our treatment variables, $\widetilde{EB}$ and $\widetilde{TB}$, inherently include the size of the plan, we do not carry out any interaction.

Despite such differences, columns (I) and (II) in Table 4 yield similar results. We find that, according to our announcement variables, spending cuts are less detrimental to growth than tax hikes. These results persist both considering the aggregated-announcement variables, $\widetilde{EB}$ and $\widetilde{TB}$, and interacting announcement dummies with their sizes.

In Table 5 we display the results from the Random Effects (RE) regressions. In columns (II) and (IV), the TFP growth is included as a covariate while in columns (III) and (IV) $\widetilde{EB}$ and $\widetilde{TB}$ are replaced by EB and TB, respectively. Regardless of the variable used to identify them, parameter estimates for policy announcements are consistently found to be non-significant. The impact of the growth rate of the debt-to-GDP ratio is negative and stable across specifications, around -0.2. Likewise, no coefficient associated with announced policies is statistically significant. Interestingly, the inclusion of the change in debt (Δd) accounts for a substantial amount of the variation. The coefficient related to the change in productivity (ΔTFP) is stable and close to 0.75, implying that technological advancement plays a crucial role in driving growth.

Table 6 shows the estimates obtained using Fixed Effects estimator (FE). Again, we note that the majority of the coefficients associated with announced policies are

[12] The estimates presented in column (II) are taken from Alesina et al. (2015b) (Table 5, p. s28), where leads and lags of the fiscal variables are also taken into account. For the sake of space, we have omitted the parameter estimates for the lagged values of $\widetilde{EB}$ and $\widetilde{TB}$, as they are typically found to be non-significant.

[13] We define the unexpected size as $e^u_{it} = g^u_{it} + \tau^u_{it}$, and the announced one as $e^a_{it} = g^a_{it} + \tau^a_{it}$.

Table 4: SUR.

	GDP growth, Δy	
	(I)	(II)
$\widetilde{EB}$	-0.49^{**}	
	(0.22)	
$\widetilde{TB}$	-0.75^{*}	
	(0.43)	
$e_t^u \times EB$		-0.115
		(0.075)
$e_t^u \times TB$		-0.880^{***}
		(0.114)
$e_t^a \times EB$		-0.345^{*}
		(0.180)
$e_t^a \times TB$		-0.485^{*}
		(0.117)
Year FE	Yes	Yes
Country FE	Yes	Yes
Obs.	487	
R^2	0.55	
Adj. R^2	0.50	

$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$

Table 5: RE.

	GDP growth, Δy			
	(I)	(II)	(III)	(IV)
$\widetilde{EB}$	0.029	−0.082		
	(0.217)	(0.201)		
$\widetilde{TB}$	−0.324	−0.401		
	(0.397)	(0.367)		
EB			−0.345	−0.270
			(0.281)	(0.260)
TB			−0.116	−0.089
			(0.327)	(0.302)
Δd	−0.222***	−0.192***	−0.214***	−0.190***
	(0.028)	(0.026)	(0.028)	(0.026)
ΔTFP		0.745***		0.739***
		(0.084)		(0.084)
Constant	−0.011	−0.182	−0.044	−0.223
	(0.624)	(0.578)	(0.623)	(0.577)
Year FE	Yes	Yes	Yes	Yes
Country RE	Yes	Yes	Yes	Yes
Obs.	487	487	487	487
Log Likelihood	−1,065.374	−1,030.480	−1,064.975	−1,030.544
Akaike Inf. Crit.	2,202.747	2,134.959	2,201.951	2,135.088
Bayesian Inf. Crit.	2,353.525	2,289.925	2,352.728	2,290.054

$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$

negative, even though none of them show statistical significance. A marginal increase in the change in debt (Δd) results in a decrease in economic growth equivalent to 0.2%.

Importantly, none of the models presented in this section support the existence of the so-called *expansionary austerity*, which states that reducing government spending leads to increased economic activity through the reduction of frictions and crowding-out effects that result from public sector activity.

Lastly, it is important to note that, apart from $\widetilde{EB}$ and EB in the SUR analysis, the lack of statistical significance for policy announcements aligns with the results of Alesina et al. (2015b), where most of the coefficients associated with the interacted announcements and sizes are not statistically significant. Our findings are consistent with Carrière-Swallow et al. (2021), which also indicates that expenditure-based policies tend to have a more significant negative impact compared to those that are tax-based.

Table 6: FE.

	GDP growth, Δy			
	(I)	(II)	(III)	(IV)
$\widetilde{EB}$	0.043	−0.074		
	(0.220)	(0.203)		
$\widetilde{TB}$	−0.410	−0.459		
	(0.401)	(0.370)		
EB			−0.254	−0.199
			(0.285)	(0.264)
TB			−0.084	−0.055
			(0.330)	(0.305)
Δd	−0.230***	−0.199***	−0.224***	−0.199***
	(0.029)	(0.027)	(0.028)	(0.026)
ΔTFP		0.750***		0.746***
		(0.085)		(0.085)
Year FE	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes
Obs.	487	487	487	487
R^2	0.139	0.268	0.139	0.267
Adj. R^2	0.045	0.186	0.044	0.185

$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$

4.2 Mediation

We run different specifications using a linear mixed model which accounts for both fixed and country-specific random effects, as well as year-specific effects. Table 7 shows the results of each regression stage. Due to the estimating procedure, we distinguish between first- and second-stage estimates.

The first-stage estimates are reported in columns (I) and (II). In the case of spending cuts, we find that the effect of $\widetilde{EB}$ on Δd is positive and strongly significant. The impact of a governmental announcement regarding its plan to curtail debt through expenditure reductions results in a diminished forecast of production (and possibly overall consumption, as shown in the Appendix), subsequently impacting the actual GDP. Hence, even if the debt level remains constant, the debt-to-GDP ratio increases.

Table 7: Mediation, GDP growth.
Mediator: Debt-to-GDP ratio growth rate.

	Debt-to-GDP ratio growth rate, Δd		GDP growth, Δy	
	(I)	(II)	(III)	(IV)
$\widetilde{EB}$	2.133***		0.029	−0.082
	(0.340)		(0.217)	(0.201)
$\widetilde{TB}$		0.861	−0.324	−0.401
		(0.675)	(0.397)	(0.367)
Δd			−0.222***	−0.192***
			(0.028)	(0.026)
ΔTFP				0.745***
				(0.084)
Constant	3.254***	3.235***	−0.011	−0.182
	(1.036)	(1.075)	(0.624)	(0.578)
Year FE	Yes	Yes	Yes	Yes
Country RE	Yes	Yes	Yes	Yes
Obs.	487	487	487	487
Log Likelihood	−1,295.310	−1,312.538	−1,065.374	−1,030.480
Akaike Inf. Crit.	2,658.621	2,693.075	2,202.747	2,134.959
Bayesian Inf. Crit.	2,801.022	2,835.476	2,353.525	2,289.925

$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$

We document the negative effect of $\widetilde{EB}$ on consumption in Table 25a.

The second-stage estimates are reported in columns (III) and (IV). As in Alesina et al. (2015b), the coefficients of spending policies hover close to zero, regardless of whether the changes in productivity (ΔTFP) are controlled for or not. However, the impact of Δd is negative (-0.222), and strongly significant.

Turning our attention to the causal chain triggered by tax announcements, we find no significant effect of $\widetilde{TB}$ on Δd neither at the first-stage nor at the second-stage.

Ultimately, the direct influence of a tax-based consolidation plan announcement (-0.324 and -0.401) is consistently more substantial (i.e., more harmful to growth) compared to the announcement of an expenditure-based plan (0.029 and -0.082), although none of them hold statistical significance. Nonetheless, upon conducting a mediation analysis, we find that while announcements don't exert any significant direct influence on growth, there are certain indirect impacts that indeed become apparent. Table 8a and Table 9a provide the estimates of each effect triggered by an expenditure-based announcement, while Figure 1a and Figure 2a provide their graphical representation. In the same way, Table 8b and Table 9b show the effects of a tax-based announcement, plotted in Figure 1b and Figure 2b.

In terms of indirect effects, an announced reduction in public spending exerts a positive impact on the change in debt (Δd), which subsequently produces a negative influence on growth. As both effects are significant, their combined impact results in a strongly negative indirect effect. This outcome persists even when we account for change in productivity (ΔTFP), albeit the effect size is reduced. However, the same cannot be said for announcements on tax-based consolidation plans. In this case, irrespective of whether we control for ΔTFP, the strong significance of Δd is entirely counterbalanced by the high variance of the first-stage estimator. The overall estimate is negative in magnitude but statistically non-significant.

Lastly, when considering total effects, it is the indirect effects that dictate the significance. We find that all estimates are virtually identical, fluctuating between -0.45 and -0.57. However, only the estimates associated with spending cuts hold statistical significance.

As shown in the Appendix, similar results are obtained when we apply our setup to estimate the causal effects of spending-based and tax-based plans announcements on the change of other relevant macroeconomic variables, such as consumption and gross fixed capital formation.

Table 8: Mediation effects, GDP growth, without ΔTFP.
Mediator: Debt-to-GDP ratio growth rate.

	Estimate	p-value
$\overline{\delta}_{\widetilde{EB}}$	-0.476^{***}	$< 2e-16$
$\overline{\zeta}_{\widetilde{EB}}$	0.027	0.904
$\tau_{\widetilde{EB}}$	-0.449^{**}	0.042

(a) Spending cut.

	Estimate	p-value
$\overline{\delta}_{\widetilde{TB}}$	-0.189	0.21
$\overline{\zeta}_{\widetilde{TB}}$	-0.304	0.44
$\tau_{\widetilde{TB}}$	-0.492	0.25

(b) Tax hike.

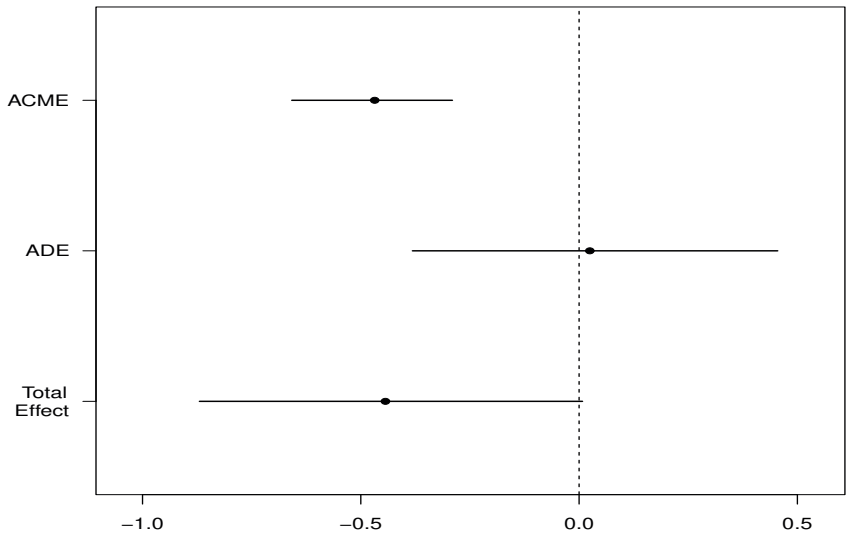
Table 9: Mediation effects, GDP growth, with ΔTFP.
Mediator: Debt-to-GDP ratio growth rate.

	Estimate	p-value
$\overline{\delta}_{\widetilde{EB}}$	-0.406^{***}	$< 2e-16$
$\overline{\zeta}_{\widetilde{EB}}$	-0.086	0.674
$\tau_{\widetilde{EB}}$	-0.492^{**}	0.018

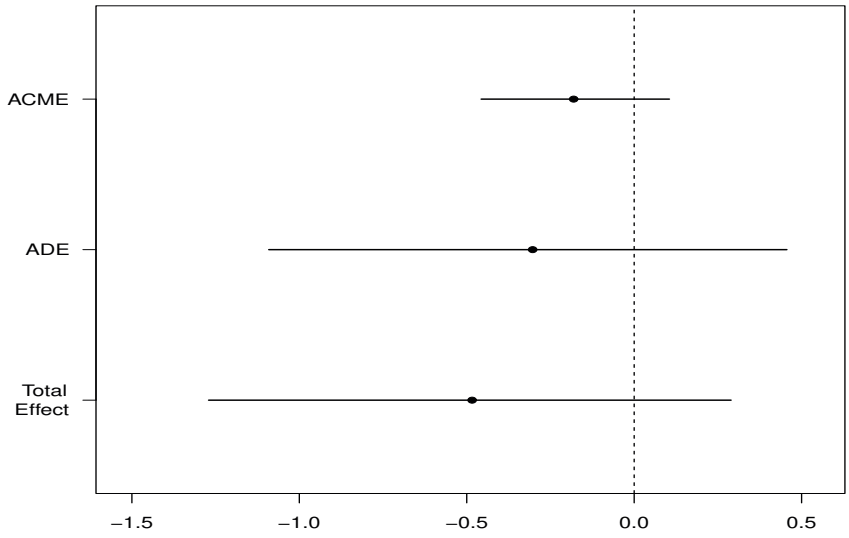
(a) Spending cut.

	Estimate	p-value
$\overline{\delta}_{\widetilde{TB}}$	-0.172	0.17
$\overline{\zeta}_{\widetilde{TB}}$	-0.401	0.25
$\tau_{\widetilde{TB}}$	-0.572	0.16

(b) Tax hike.

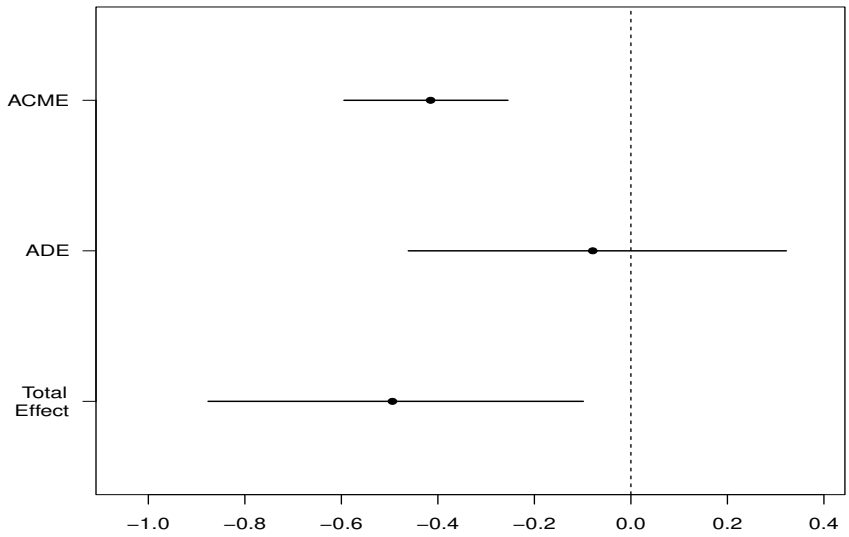


(a) Spending cut.

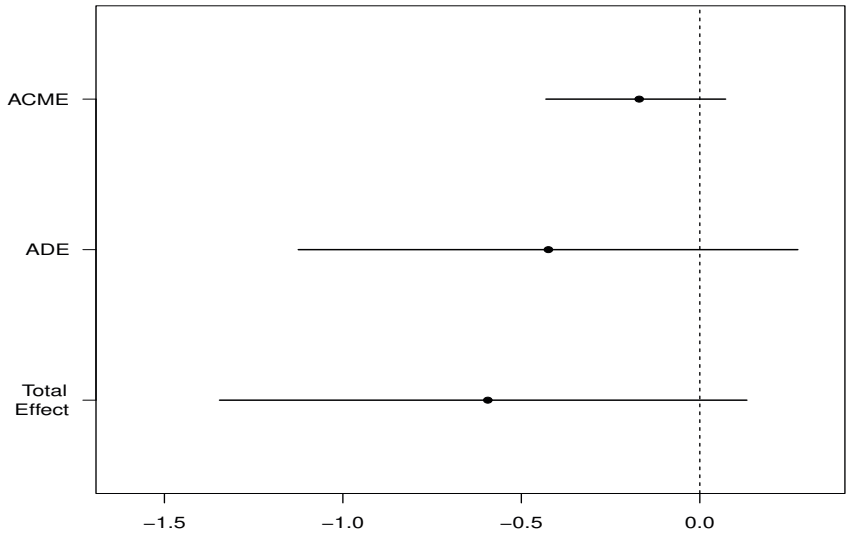


(b) Tax hike.

Figure 1: Mediation, GDP growth, without ΔTFP.
Mediator: Debt-to-GDP ratio growth rate.



(a) Spending cut.



(b) Tax hike.

Figure 2: Mediation, GDP growth, with ΔTFP.
Mediator: Debt-to-GDP ratio growth rate.

4.3 State-contingent mediation

As part of our extended analysis, we adopt the methodology outlined in Jordà and Taylor (2016) to replicate mediation estimates within a framework that considers different economic states.[14] For each country included in our dataset, we employ the HP-filter, as described in Hodrick and Prescott (1997), to extract the cyclical component of real GDP per capita.[15]

In defining economic states, we categorize an economy as being in a *boom* if the cyclical component of real GDP per capita in the previous period is positive, and as being in a *slump* if it is negative. To accommodate the timing of data availability, we utilize lagged cycles since the cyclical component of GDP is only observable at the end of period t.

Table 10: Summary Statistics, booms and slumps.

	Variable	Obs.	Mean	St. Dev.	Min	Max
Boom						
	Δy	254	1.356	3.488	-11.841	9.763
	$\widetilde{TB}$	254	0.092	0.322	0.000	2.645
	$\widetilde{EB}$	254	0.080	0.315	0.000	3.036
	Δd	254	1.598	5.111	-10.723	19.334
Slump						
	Δy	233	3.431	2.903	-5.152	12.497
	$\widetilde{TB}$	233	0.063	0.212	0.000	1.559
	$\widetilde{EB}$	233	0.348	0.678	0.000	4.718
	Δd	233	1.684	4.750	-10.744	24.623

Table 10 offers a comparative analysis of policy announcement strategies during various economic conditions, such as during a *boom* or a *slump*. During periods of economic expansion, policy announcements tend to avoid large-scale interventions, whether they are related to tax increases or spending cuts. However, in times of recession, policy announcements are primarily concerned with spending cuts, the scale of which is six times larger than that of tax-related measures. The total number of announcements

[14]For a related work, see Delle Monache et al. (2023).

[15]We set the penalty parameter of the HP-filter to 100, a common practice for annual data.

also reflects these patterns. In expansionary periods, there were 74 announcements, equally distributed with 36 for spending cuts and 38 for tax increases. During economic downturns, instead, policies based on spending were announced 83 times, while those based on taxation were announced just 30 times.

Our findings corroborate the importance of macroeconomic conditions when quantifying the impact of policy announcements. This is in line with Jordà and Taylor (2016). In a *boom*, neither tax increases nor spending cuts have significant total effects on the economy, as summarized in Table 12 and Figure 3. Specifically, referring to Table 11, despite the significant effect observed in the initial stage for spending cuts, and the lack of significant effect for tax hikes throughout the entire causal chain, the total effects of both policies are not significant. This suggests that, notwithstanding the differing magnitudes of their initial impacts, neither spending cuts nor tax hikes exert statistically significant overall effects during expansionary phases. Conversely, during a *slump*, the impact of tax hikes remains statistically non-significant, as detailed in Table 14b and Figure 4b. However, spending cuts during this phase are notably more harmful to economic growth. Our analysis reveals that spending cuts in a recessionary phase can decrease growth by approximately -0.6, a 50% increase in negative impact compared to the baseline estimate derived from the full dataset. During economic downturns, as depicted in Table 13, tax hikes still fail to propagate in the causal chain. Nonetheless, spending cuts exhibit significant first stage estimates, which offset the fact that their direct effects are not statistically significant.

Table 11: Boom. Mediation, GDP growth.
Mediator: Debt-to-GDP ratio growth rate.

	Debt-to-GDP ratio growth rate, Δd		GDP growth, Δy
	(I)	(II)	(III)
$\widetilde{EB}$	2.777***		−0.114
	(0.758)		(0.506)
$\widetilde{TB}$		0.574	−0.239
		(0.794)	(0.503)
Δd			−0.256***
			(0.043)
Constant	3.277***	3.282***	0.059
	(0.953)	(0.988)	(0.653)
Year FE	Yes	Yes	Yes
Country RE	Yes	Yes	Yes
Obs.	254	254	254
Log Likelihood	−629.734	−635.977	−534.338
Akaike Inf. Crit.	1,323.469	1,335.953	1,136.676
Bayesian Inf. Crit.	1,436.664	1,449.148	1,256.946

$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$

Table 12: Boom. Mediation effects, GDP growth, without ΔTFP.
Mediator: Debt-to-GDP ratio growth rate.

	Estimate	p-value
$\overline{\delta}_{\widetilde{EB}}$	−0.711***	$< 2e-16$
$\overline{\zeta}_{\widetilde{EB}}$	−0.111	0.82
$\tau_{\widetilde{EB}}$	−0.822	0.14

(a) Spending cut.

	Estimate	p-value
$\overline{\delta}_{\widetilde{TB}}$	−0.141	0.47
$\overline{\zeta}_{\widetilde{TB}}$	−0.235	0.63
$\tau_{\widetilde{TB}}$	−0.376	0.50

(b) Tax hike.

Table 13: Slump. Mediation, GDP growth.
Mediator: Debt-to-GDP ratio growth rate.

	Debt-to-GDP ratio growth rate, Δd		GDP growth, Δy
	(I)	(II)	(III)
$\widetilde{EB}$	2.206^{***}		-0.181
	(0.425)		(0.246)
$\widetilde{TB}$		0.787	0.044
		(1.466)	(0.754)
Δd			-0.190^{***}
			(0.037)
Constant	6.874^{***}	6.674^{***}	2.124^{*}
	(2.315)	(2.474)	(1.249)
Year FE	Yes	Yes	Yes
Country RE	Yes	Yes	Yes
Obs.	233	233	233
Log Likelihood	-601.005	-612.012	-470.851
Akaike Inf. Crit.	1,264.011	1,286.023	1,007.703
Bayesian Inf. Crit.	1,370.993	1,393.005	1,121.587

$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$

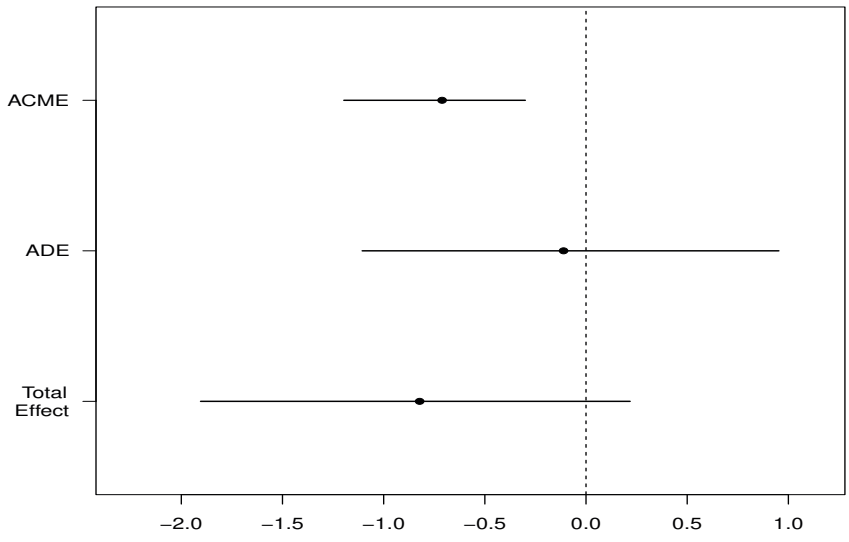
Table 14: Slump. Mediation effects, GDP growth, without ΔTFP.
Mediator: Debt-to-GDP ratio growth rate.

	Estimate	p-value
$\overline{\delta}_{\widetilde{EB}}$	-0.415^{***}	$< 2e-16$
$\overline{\zeta}_{\widetilde{EB}}$	-0.185	0.45
$\tau_{\widetilde{EB}}$	-0.599^{**}	0.02

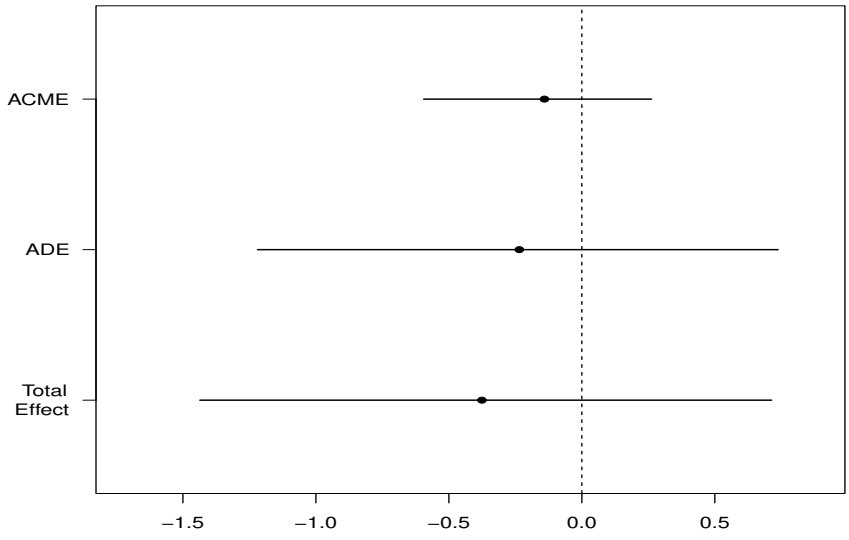
(a) Spending cut.

	Estimate	p-value
$\overline{\delta}_{\widetilde{TB}}$	-0.157	0.58
$\overline{\zeta}_{\widetilde{TB}}$	0.038	0.96
$\tau_{\widetilde{TB}}$	-0.119	0.91

(b) Tax hike.

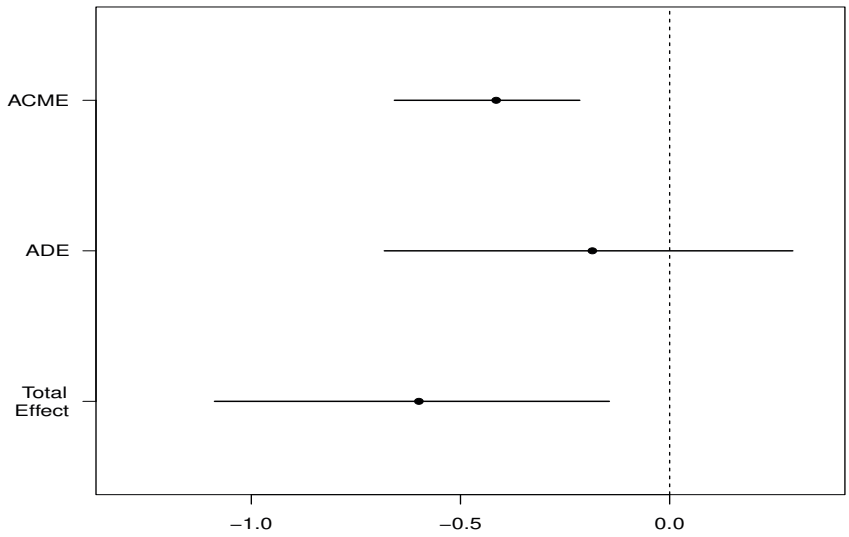


(a) Spending cut.

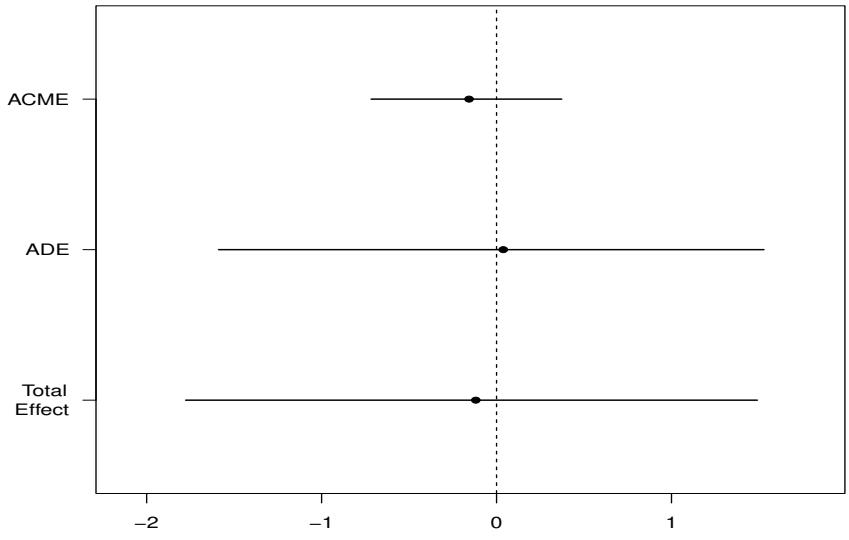


(b) Tax hike.

Figure 3: Boom. Mediation, GDP growth, without ΔTFP. Mediator: Debt-to-GDP ratio growth rate.



(a) Spending cut.



(b) Tax hike.

Figure 4: Slump. Mediation, GDP growth, without ΔTFP. Mediator: Debt-to-GDP ratio growth rate.

4.4 Sensitivity

To check the robustness of our findings, we run two different analyses. First, we modify the mediator by using the level of the debt-to-GDP ratio, d, rather than its growth rate. Second, we expand our set of controls to make our results comparable with those from the standard empirical growth literature based on Mankiw et al. (1992) and, then, to include global crises data as in Reinhart and Rogoff (2009).

Table 15: Summary Statistics for sensitivity.

Variable	Obs.	Mean	St. Dev.	Min	Max
d	487	63.526	32.597	9.683	231.629
y_0	487	9.965	0.245	9.360	10.369
$\ln(INV/GDP)$	487	3.123	0.148	2.750	3.571
$\ln(HC)$	487	1.106	0.149	0.519	1.311
$\ln(n+g+\delta)$	487	1.611	0.117	1.221	2.002
$BankCr$	453	0.210	0.408	0	1
$SystCr$	453	0.062	0.241	0	1
$InflCr$	453	0.007	0.081	0	1

Mediator Table 16 shows the estimates obtained in the two stages, for each treatment. We notice that the effect of d on Δy is negative and significant, similar to the effect of Δd in Table 7. The coefficient associated with $\widetilde{TB}$ in the second stage, column (III), is negative but not statistically significant. Conversely, $\widetilde{EB}$ has a negative and significant direct effect. Columns (I) and (II) show the effect of each treatment on the mediator d. As in Table 7, announcements associated with spending-based consolidation plans have a significant and positively large effect. Announcements based on tax-based consolidation plans also show a positive impact, but it is largely non-significant. Table 17a and Table 17b display the impacts within the causal chains initiated by announcements on spending-based and tax-based plans, respectively. These effects are plotted in Figure 5a for spending-based plans and in Figure 5b for tax-based plans. Our findings indicate that announcements of spending cuts have negative impacts across the entire causal chain. The total effect is strongly negative and significant, primarily driven by the low variance of the mediated effect. Conversely, none of the effects triggered by a tax increase are significant.

Table 16: Mediation, GDP growth – Robustness I.
Mediator: Debt-to-GDP ratio.

	Debt-to-GDP ratio, d		GDP growth, Δy
	(I)	(II)	(III)
$\widetilde{EB}$	7.106***		−0.384*
	(1.663)		(0.222)
$\widetilde{TB}$		1.044	−0.624
		(3.226)	(0.418)
d			−0.012**
			(0.005)
Constant	41.397***	41.660***	−0.203
	(8.189)	(8.242)	(0.680)
Year FE	Yes	Yes	Yes
Country RE	Yes	Yes	Yes
Obs.	487	487	487
Log Likelihood	−2,034.644	−2,042.893	−1,092.870
Akaike Inf. Crit.	4,137.288	4,153.787	2,257.740
Bayesian Inf. Crit.	4,279.689	4,296.188	2,408.517

$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$

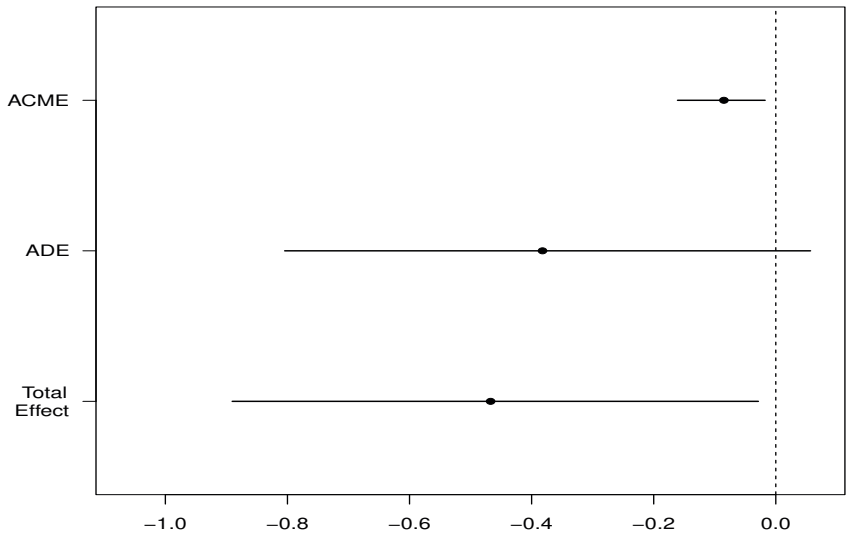
Table 17: Mediation effects, GDP growth – Robustness I.
Mediator: Debt-to-GDP ratio.

	Estimate	p-value
$\overline{\delta}_{\widetilde{EB}}$	−0.082**	0.012
$\overline{\zeta}_{\widetilde{EB}}$	−0.388*	0.086
$\tau_{\widetilde{EB}}$	−0.470**	0.036

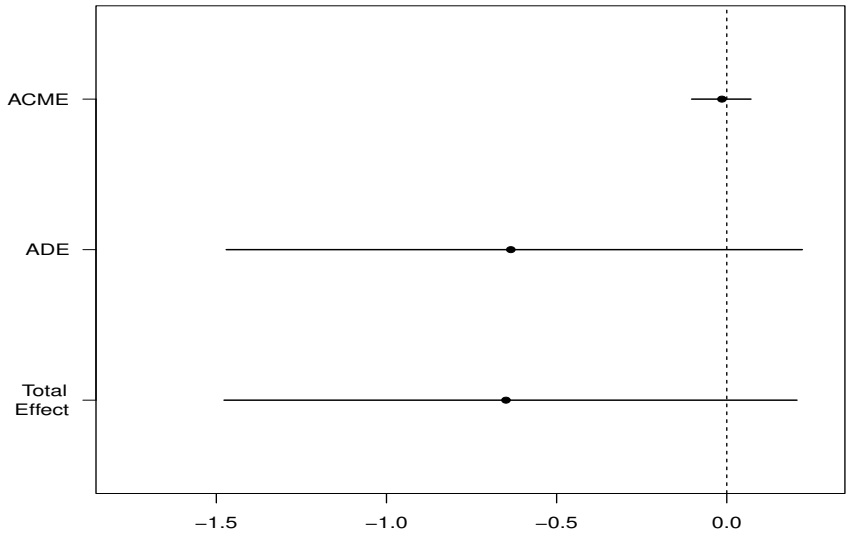
(a) Spending cut.

	Estimate	p-value
$\overline{\delta}_{\widetilde{TB}}$	−0.010	0.76
$\overline{\zeta}_{\widetilde{TB}}$	−0.602	0.14
$\tau_{\widetilde{TB}}$	−0.612	0.14

(b) Tax hike.



(a) Spending cut.



(b) Tax hike.

Figure 5: Mediation, GDP growth – Robustness I. Mediator: Debt-to-GDP ratio.

Controls We expand the controls in the second-stage equation by including those growth determinants that are suggested by the augmented Solow growth model, i.e. investment share, human capital, population growth and the initial level of GDP, as in Mankiw et al. (1992).[16] The investment share, INV/GDP, is taken from the World Bank, while the population growth rate, n, the depreciation rate, δ, and the human capital Index, HC, that proxies the rate of human capital accumulation, are taken the Penn World Table.[17] Moreover, we control for initial conditions, using the logarithm of the real GDP in 1981, y_0. As shown in Table 18, the two announcements have no direct effect on output growth. We observe in column (III) that an increase in INV/GDP corresponds to a rise in output growth, while a boost in HC results in a decrease in production. However, both effects are not statistically significant. The impact of Δd is virtually identical to what is presented in Table 7. Regarding the first-stages presented in columns (I) and (II), they are exactly the same of Table 7. Table 20a and Table 20b demonstrate each effect along the path, depicted in Figure 6a and Figure 6b. The indirect effect triggered by a reduction in spending is negative and highly significant. The resultant overall effect is negative and statistically significant, being very close, in terms of size, to the estimates displayed in Table 8a. On the contrary, in this instance as well, no effect activated by an increase in tax is significant

Finally, we incorporate the global crises variables provided by Reinhart and Rogoff (2009) in both first- and second-stage equations, as shown in Table 19. We take into account dummies for bank crises ($BankCr$), systemic crises ($SystCr$), and inflation crises ($InflCr$). The results of the first-stage remain unaltered in relation to $\widetilde{EB}$ and $\widetilde{TB}$, with the former showing a significant positive correlation while the latter shows no significant correlation. We note that the crisis dummies exert a positive influence on the growth of the debt-to-GDP ratio and a negative influence on output growth, which aligns with expectations. However, the estimates for the second-stage related to announcements are found to be non-significant. As a result, the indirect effects stimulated by spending announcements are negative and notably significant, but these effects are entirely counterbalanced by the low significance (i.e., high variance) of first-stage estimates, implying non-significant overall effects (see Table 21a and Figure 7a). Regarding tax announcements, we find no significance in the causal chain in this instance as well, as shown in Table 21b and Figure 7b.

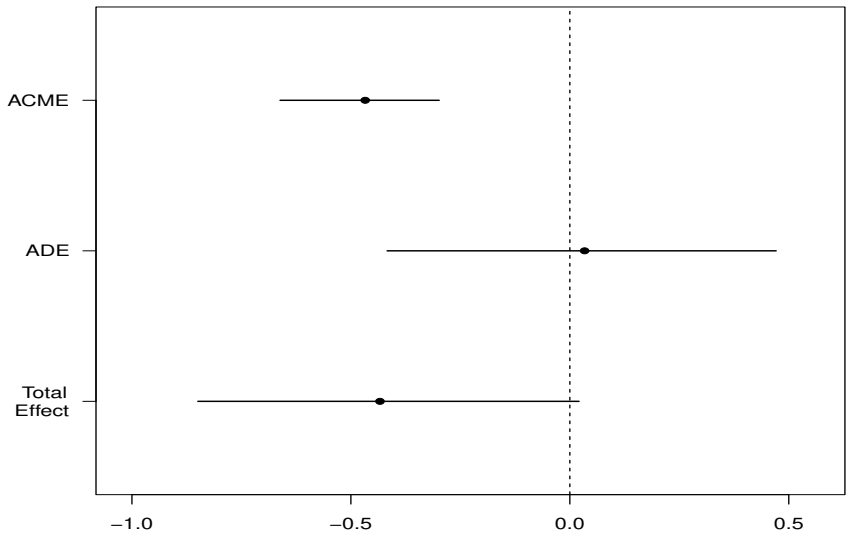
[16] See, e.g., Omerovic et al. (2022), Acquah et al. (2023), and Alfò et al. (2023) for recent applications.

[17] Differently from Mankiw et al. (1992), that considers $g + \delta = 5\%$, we use actual values for both δ and n, assuming $g = 1\%$.

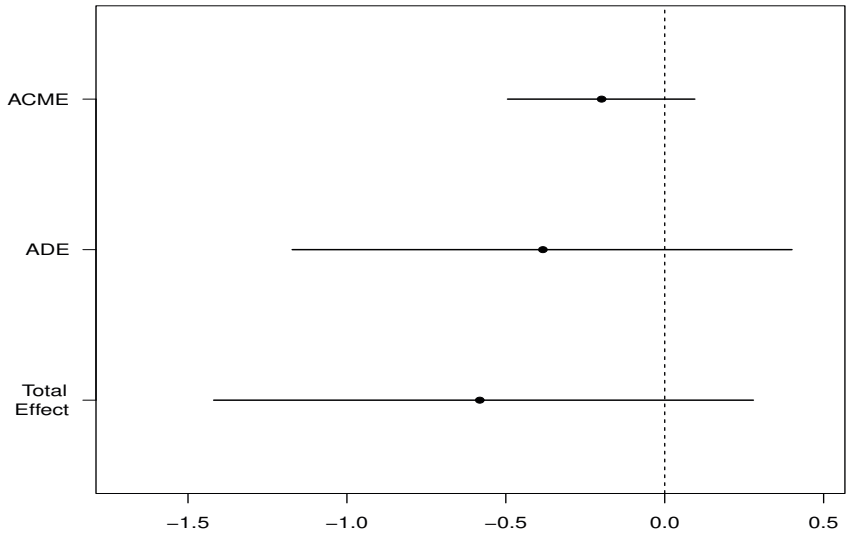
Table 18: Mediation, GDP growth – Robustness II.
Mediator: Debt-to-GDP ratio growth rate.

	Debt-to-GDP ratio growth rate, Δd		GDP growth, Δy
	(I)	(II)	(III)
$\widetilde{EB}$	2.133^{***}		0.029
	(0.329)		(0.217)
$\widetilde{TB}$		0.861	-0.395
		(0.675)	(0.398)
Δd			-0.221^{***}
			(0.027)
y_0			-3.558^{***}
			(0.693)
$\ln(INV/GDP)$			0.142
			(0.793)
$\ln(HC)$			2.915^{***}
			(1.245)
$\ln(n+g+\delta)$			0.501
			(1.123)
Constant	3.254^{***}	3.235^{***}	31.264^{***}
	(1.001)	(1.075)	(7.013)
Year FE	Yes	Yes	Yes
Country RE	Yes	Yes	Yes
Obs.	487	487	487
Log Likelihood	$-1,321.592$	$-1,312.538$	$-1,052.283$
Akaike Inf. Crit.	2,711.185	2,693.075	2,184.567
Bayesian Inf. Crit.	2,853.586	2,835.476	2,352.097

$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$



(a) Spending cut.



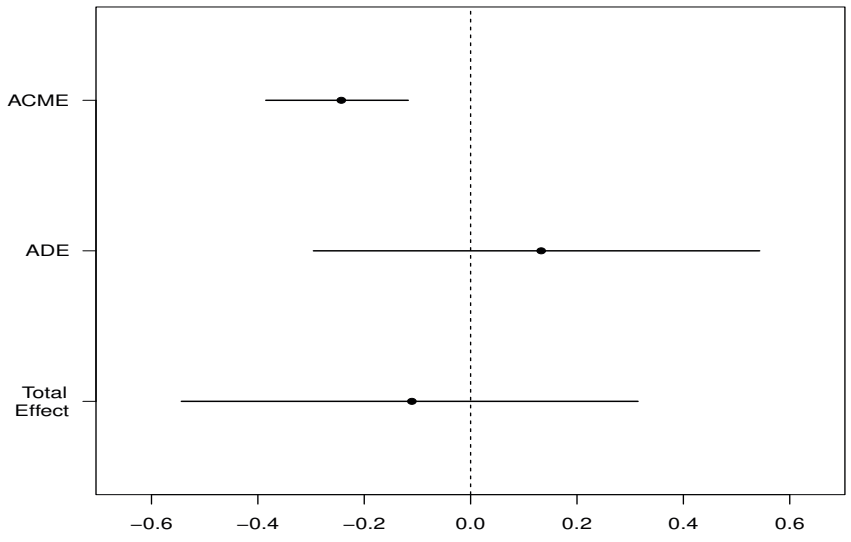
(b) Tax hike.

Figure 6: Mediation, GDP growth – Robustness II. Mediator: Debt-to-GDP ratio growth rate.

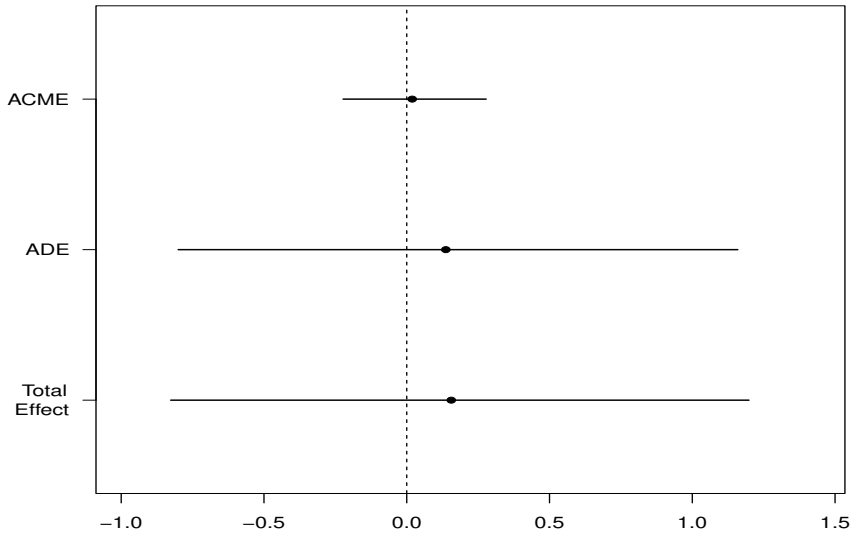
Table 19: Mediation, GDP growth – Robustness III.
Mediator: Debt-to-GDP ratio growth rate.

	Debt-to-GDP ratio growth rate, Δd		GDP growth, Δy
	(I)	(II)	(III)
$\widetilde{EB}$	1.399***		0.132
	(0.310)		(0.215)
$\widetilde{TB}$		−0.149	0.140
		(0.742)	(0.495)
Δd			−0.170***
			(0.032)
$BankCr$	1.937***	2.091***	−0.791**
	(0.497)	(0.509)	(0.335)
$SystCr$	1.765**	1.846**	−0.548
	(0.749)	(0.767)	(0.497)
$InflCr$	−0.121	−0.371	−3.059**
	(1.972)	(2.020)	(1.305)
Constant	2.971***	3.075***	−0.263
	(0.938)	(0.963)	(0.615)
Year FE	Yes	Yes	Yes
Country RE	Yes	Yes	Yes
Obs.	453	453	453
Log Likelihood	−1,133.920	−1,142.948	−963.377
Akaike Inf. Crit.	2,341.841	2,359.896	2,004.754
Bayesian Inf. Crit.	2,494.129	2,512.184	2,165.273

$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$



(a) Spending cut.



(b) Tax hike.

Figure 7: Mediation, GDP growth – Robustness III. Mediator: Debt-to-GDP ratio growth rate.

Table 20: Mediation effects, GDP growth – Robustness II.
Mediator: Debt-to-GDP ratio growth rate.

	Estimate	p-value
$\overline{\delta}_{\widetilde{EB}}$	-0.467^{***}	$< 2e-16$
$\overline{\zeta}_{\widetilde{EB}}$	0.034	0.874
$\tau_{\widetilde{EB}}$	-0.434^{*}	0.072

(a) Spending cut.

	Estimate	p-value
$\overline{\delta}_{\widetilde{TB}}$	-0.199	0.17
$\overline{\zeta}_{\widetilde{TB}}$	-0.383	0.35
$\tau_{\widetilde{TB}}$	-0.582	0.17

(b) Tax hike.

Table 21: Mediation effects, GDP growth – Robustness III.
Mediator: Debt-to-GDP ratio growth rate.

	Estimate	p-value
$\overline{\delta}_{\widetilde{EB}}$	-0.236^{***}	$< 2e-16$
$\overline{\zeta}_{\widetilde{EB}}$	0.136	0.51
$\tau_{\widetilde{EB}}$	-0.010	0.67

(a) Spending cut.

	Estimate	p-value
$\overline{\delta}_{\widetilde{TB}}$	0.0286	0.82
$\overline{\zeta}_{\widetilde{TB}}$	0.1378	0.78
$\tau_{\widetilde{TB}}$	0.1664	0.75

(b) Tax hike.

5 Conclusion

Acknowledging that the aggregate effects of fiscal consolidation plans is a matter for empirical analysis, this paper adds to the current body of research by examining the potential impact that policy announcements may have on macroeconomic outcomes. During periods of debt consolidation, the way in which policies are announced can play a pivotal role in determining their effectiveness.

Policy announcements affect macroeconomic outcomes both directly and indirectly. Taking into account these indirect effects, our paper complements the analyses put forth by Alesina et al. (2015a) and Alesina et al. (2015b), which concentrate solely on direct effects.

We develop our argument as follows. First, we conduct a Seemingly Unrelated Regression (SUR) to compare, within the same empirical framework, our announcement variables with those of Alesina et al. (2015b). We find that spending cuts produce negative and significant effects. However, these results lack robustness when we implement Random Effects (RE) and Fixed Effects (FE) regressions, controlling for the growth rate of the debt-to-GDP ratio. In these estimates, the impact of each announcement is not significant, but the effect of the growth rate of the debt-to-GDP ratio is negative and highly significant.

This finding prompts us to examine the causal chains initiated by spending cuts and tax hikes announcements, taking into account how these effects are propagated via the growth of the debt-to-GDP ratio. We model each stage as a linear mixed model and find no effect of tax-based consolidation plans announcements on debt. Conversely, spending cuts announcements lead to a significant increase in the debt-to-GDP ratio.

Our results suggest that, particularly during periods of high debt and sluggish economic growth, announcements of spending-based plans tend to have a more adverse effect on growth than those related to tax-based plans. These findings remain consistent through several robustness checks and also persist when we shift our focus to the causal effects on the changes in other relevant macroeconomic variables, such as consumption and gross fixed capital formation.

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Appendix

Following Alesina et al. (2015b), we look for further mediation effects. Keeping the mediator of our baseline specification, i.e., the growth rate of the Debt-to-GDP ratio Δd, we estimate the heterogeneous impacts of spending- and tax-based announcements on the vector $\Delta z_{it} = [\Delta fce_{it}, \Delta gcf_{it}, lcc_{it}, lbc_{it}, s_{it}]'$. Concerning the entries of Δz_{it}, Δfce_{it} is the growth rate of the final real consumption expenditure per capita, Δgcf_{it} is the growth rate of the gross fixed capital formation per capita, lcc_{it} and lbc_{it} are, respectively, consumer and business confidence indicators, while s_{it} is the spread between long-term and short-term interest rates.[18]

Table 22: Mediation, Δz.
Mediator: Debt-to-GDP ratio growth rate.

	Δd		Δfce	Δgcf	lcc	lbc	s
	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)
$\widetilde{EB}$	1.486***		−0.003**	−0.009**	−0.003**	0.001	0.338***
	(0.325)		(0.002)	(0.004)	(0.001)	(0.001)	(0.125)
$\widetilde{TB}$		0.932	0.003	−0.018*	−0.002	−0.001	0.513
		(0.875)	(0.004)	(0.011)	(0.003)	(0.002)	(0.322)
Δd			−0.002***	−0.005***	−0.001***	−0.001***	0.024
			(0.0002)	(0.001)	(0.0002)	(0.0001)	(0.019)
Constant	0.014	−0.277	0.011*	0.009	4.599***	4.593***	−0.329
	(1.446)	(1.507)	(0.006)	(0.017)	(0.004)	(0.004)	(0.525)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country RE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	397	397	397	397	397	397	397
Log Likelihood	−978.385	−987.026	993.344	626.703	1,130.382	1,177.357	−610.674
Akaike Inf. Crit.	2,024.770	2,042.053	−1,914.689	−1,181.405	−2,188.763	−2,282.714	1,293.347
Bayesian Inf. Crit.	2,160.224	2,177.507	−1,771.267	−1,037.983	−2,045.341	−2,139.292	1,436.769

$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$

When we compare the initial two columns of Table 7 with those of Table 22, it is apparent that the outcomes remain relatively unchanged. The effect of announcements related to spending-based plans on the growth of the debt-to-GDP ratio is positive and statistically significant, whereas the impact of tax-based plans announcements is less effective and statistically non-significant.

[18]Specifically, s_{it} is the difference between the long-term government bond (ten-year) and the short-term (three-month).

With respect to Δfce, we find that an increase in the debt-to-GDP ratio leads to a decrease in real consumption. A similar effect, both in magnitude and significance, is observed for $\widetilde{EB}$, as shown in Table 23a and Figure 8a. This implies a total effect of -0.006 which is statistically significant. Interestingly, when $\widetilde{TB}$ is considered, none of the effects - be it direct, indirect, or total - approach significance, as shown in Table 23b and Figure 8b.

When considering the growth rate of gross fixed capital formation, Δgcf, we see similar total effects occurring through different mechanisms. The mediated (indirect) effect initiated by a tax announcement has no influence, as outlined in Table 24b and Figure 9b. Conversely, the effect attributable to $\widetilde{EB}$ is negative and highly significant, coming in at -0.07. Both direct effects are negative and significant. This is also the case for the total effects, which are comparable in magnitude.

When we consider confidence indicators, it is worth mentioning that regardless of the indicator we examine, no significant effect of any kind influences *lcc* (as seen in Table 25b and Figure 10b) or *lbc* (as demonstrated in Table 26b and Figure 11b) when the trigger is $\widetilde{TB}$.

However, the effect of $\widetilde{EB}$ is distinctly different. Regarding *lcc*, it impacts both the direct and indirect channels, resulting in a total negative effect of -0.005, which is strongly significant (refer to Table 25a and Figure 10a).

In contrast, for *lbc*, the effect is significant only in the first-stage, but it becomes completely absorbed and loses its statistical significance when evaluating the total effect (as shown in Table 26a and Figure 11a).

Finally, dealing with the interest rate spread, s, we observe some interesting facts. First, the estimates of the direct effects imply a higher effect of tax-based policy announcement rather than spending ones. However, this result is also associated with the non-significance of the former (Table 27b and Figure 12b). An announcement indicating a contraction in government spending seems to amplify the spread between long-term and short-term interest rates (as shown in Table 27a and Figure 12a). Notice that an increase in the s could be attributed to a reduction in short-term rates, rather than an escalation in long-term ones. This could be due to a heightened level of trust following the announced debt-reducing policy.

Table 23: Mediation effects, consumption growth.
Mediator: Debt-to-GDP ratio growth rate.

	Estimate	p-value
$\overline{\delta}_{\widetilde{EB}}$	-0.002^{***}	$< 2e-16$
$\overline{\zeta}_{\widetilde{EB}}$	-0.003^{**}	0.026
$\tau_{\widetilde{EB}}$	-0.006^{***}	0.002

(a) Spending cut.

	Estimate	p-value
$\overline{\delta}_{\widetilde{TB}}$	-0.001	0.24
$\overline{\zeta}_{\widetilde{TB}}$	0.003	0.44
$\tau_{\widetilde{TB}}$	0.002	0.71

(b) Tax hike.

Table 24: Mediation effects, capital formation growth.
Mediator: Debt-to-GDP ratio growth rate.

	Estimate	p-value
$\overline{\delta}_{\widetilde{EB}}$	-0.007^{***}	$< 2e-16$
$\overline{\zeta}_{\widetilde{EB}}$	-0.009^{**}	0.03
$\tau_{\widetilde{EB}}$	-0.015^{***}	$< 2e-16$

(a) Spending cut.

	Estimate	p-value
$\overline{\delta}_{\widetilde{TB}}$	-0.004	0.322
$\overline{\zeta}_{\widetilde{TB}}$	-0.018^{*}	0.088
$\tau_{\widetilde{TB}}$	-0.022^{*}	0.060

(b) Tax hike.

Table 27: Mediation effects, interest rate spread.
Mediator: Debt-to-GDP ratio growth rate.

	Estimate	p-value
$\overline{\delta}_{\widetilde{EB}}$	0.035	0.232
$\overline{\zeta}_{\widetilde{EB}}$	0.338^{***}	0.004
$\tau_{\widetilde{EB}}$	0.373^{***}	0.002

(a) Spending cut.

	Estimate	p-value
$\overline{\delta}_{\widetilde{TB}}$	0.022	0.428
$\overline{\zeta}_{\widetilde{TB}}$	0.523	0.108
$\tau_{\widetilde{TB}}$	0.545^{*}	0.098

(b) Tax hike.

Table 25: Mediation effects, consumer confidence.
Mediator: Debt-to-GDP ratio growth rate.

	Estimate	p-value
$\overline{\delta}_{\widetilde{EB}}$	-0.002^{***}	$< 2e-16$
$\overline{\zeta}_{\widetilde{EB}}$	-0.003^{**}	0.016
$\tau_{\widetilde{EB}}$	-0.005^{***}	$< 2e-16$

(a) Spending cut.

	Estimate	p-value
$\overline{\delta}_{\widetilde{TB}}$	0.001	0.26
$\overline{\zeta}_{\widetilde{TB}}$	0.002	0.48
$\tau_{\widetilde{TB}}$	0.003	0.27

(b) Tax hike.

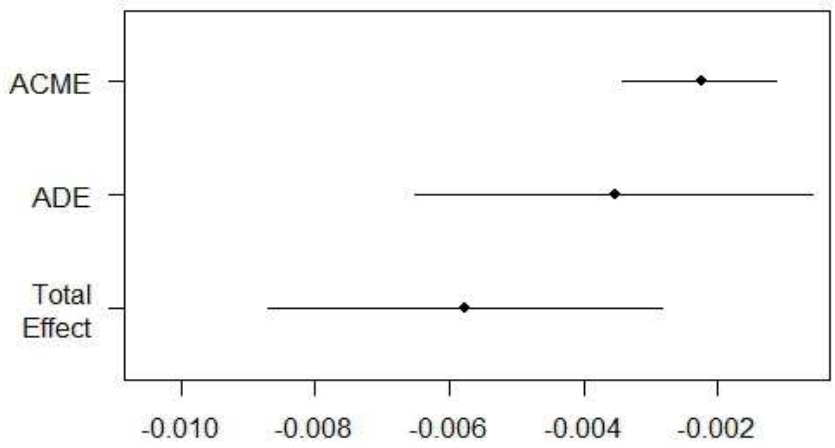
Table 26: Mediation effects, business confidence.
Mediator: Debt-to-GDP ratio growth rate.

	Estimate	p-value
$\overline{\delta}_{\widetilde{EB}}$	$-1.07e-03^{***}$	$< 2e-16$
$\overline{\zeta}_{\widetilde{EB}}$	$7.89e-04$	0.38
$\tau_{\widetilde{EB}}$	$-2.81e-04$	0.75

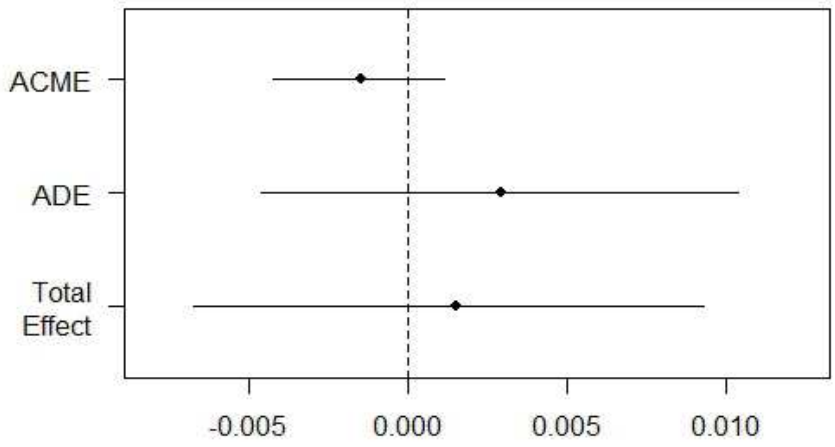
(a) Spending cut.

	Estimate	p-value
$\overline{\delta}_{\widetilde{TB}}$	-0.001	0.28
$\overline{\zeta}_{\widetilde{TB}}$	-0.001	0.58
$\tau_{\widetilde{TB}}$	-0.002	0.44

(b) Tax hike.

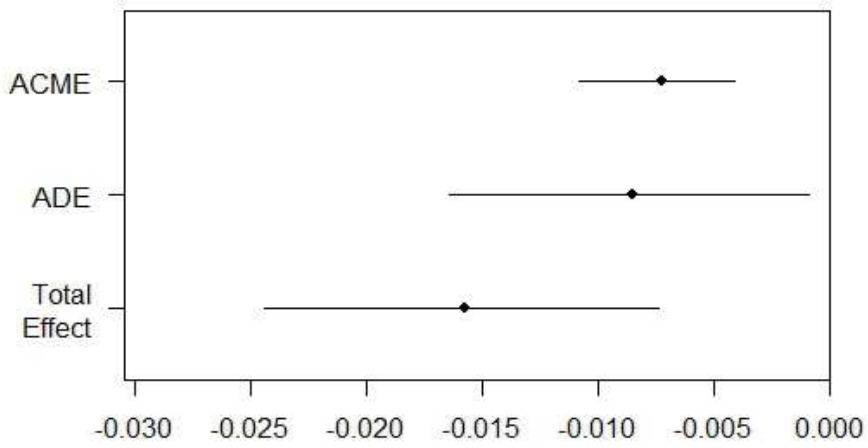


(a) Spending cut.

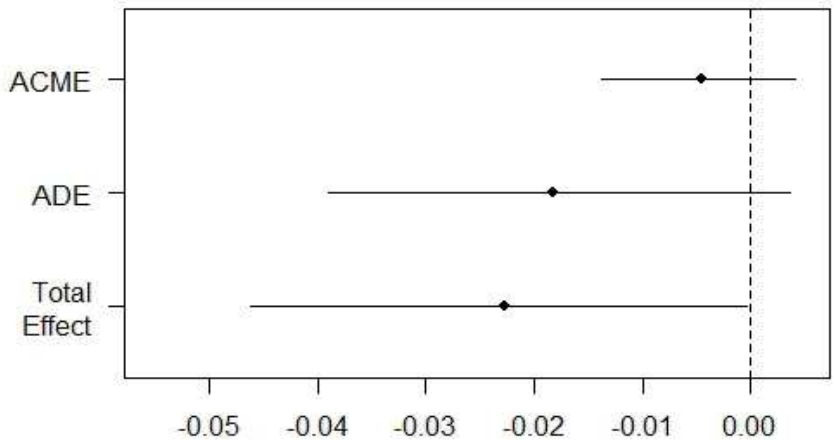


(b) Tax hike.

Figure 8: Mediation, consumption growth.
Mediator: Debt-to-GDP ratio growth rate.

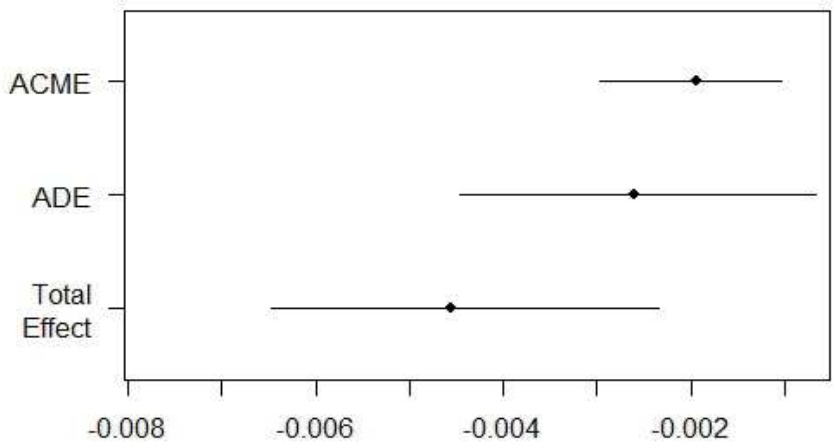


(a) Spending cut.

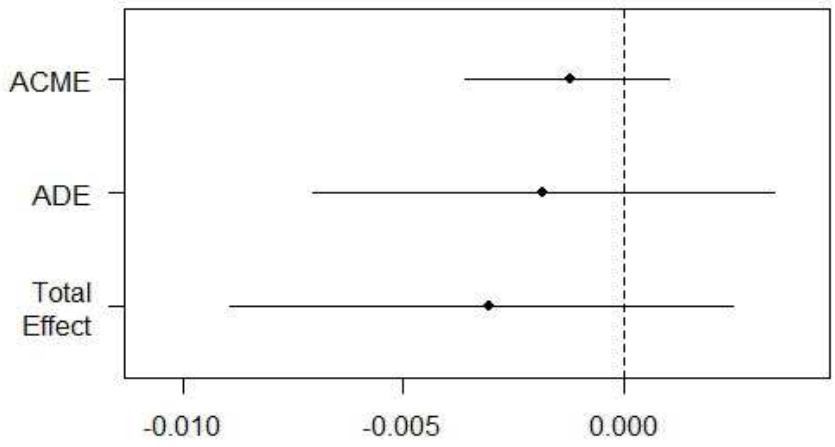


(b) Tax hike.

Figure 9: Mediation, capital formation growth.
Mediator: Debt-to-GDP ratio growth rate.

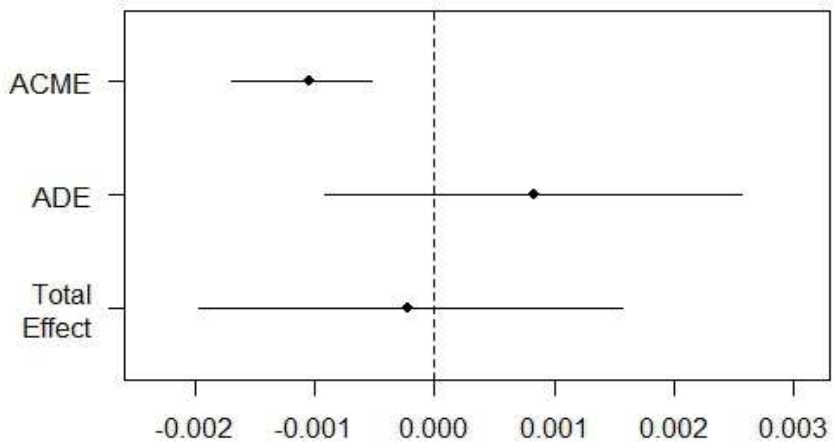


(a) Spending cut.

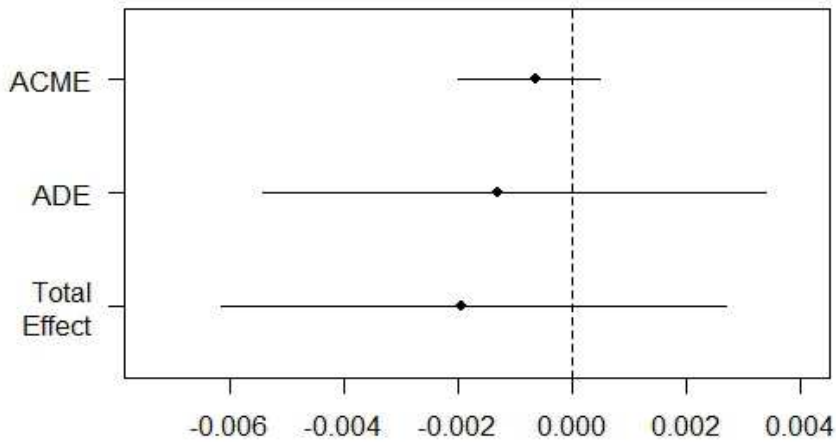


(b) Tax hike.

Figure 10: Mediation, consumer confidence.
Mediator: Debt-to-GDP ratio growth rate.

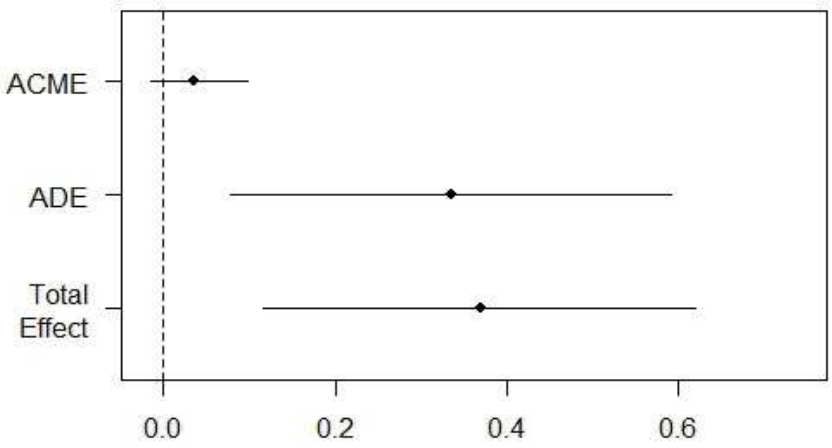


(a) Spending cut.

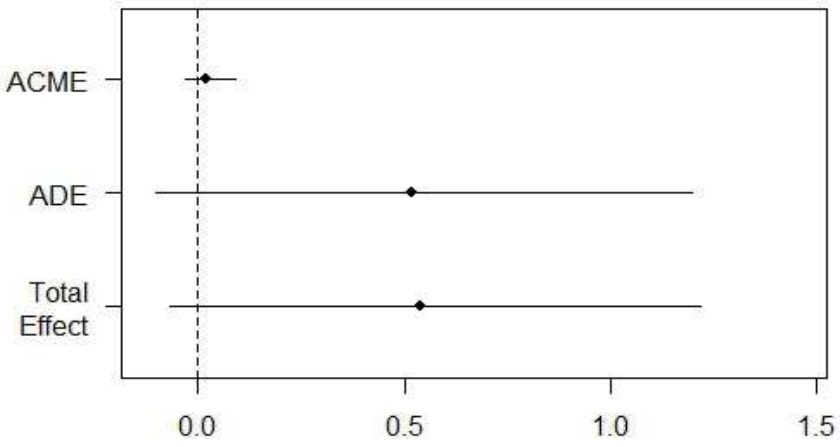


(b) Tax hike.

Figure 11: Mediation, business confidence.
Mediator: Debt-to-GDP ratio growth rate.



(a) Spending cut.



(b) Tax hike.

Figure 12: Mediation, interest rate spread.
Mediator: Debt-to-GDP ratio growth rate.

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