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On The Output Cost of Fiscal Consolidations: An Empirical Investigation on Tax and Spending Multipliers for a Sample of OECD Economies

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ABSTRACT

We estimate the output costs of fiscal contractions and distinguish between tax-based and expenditure-based adjustments, employing narratively identified fiscal measures. While the studies that use narrative fiscal plans in VARs find short-lasting effects of expenditure-based consolidations, this result is not maintained in a recently developed method of including fiscal shocks in Local Projections. We argue that the Impulse Responses from this approach are inconsistent and augment the Local Projections equations with a term capturing the expectation of future fiscal measures, recovering the results of the previous literature and finding that expenditure-based consolidations tend to be less recessive than tax-based consolidations.

Keywords: Macroeconomics; Fiscal Consolidations; Local Projections; Rational Expectations.

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1. Introduction

According to the IMF Fiscal Monitor (IMF, 2023), Debt-to-GDP ratios are expected to increase globally by 1 percentage point yearly between 2023 and 2028, on top of an already elevated level of debt and the large budget deficits that were inherited from the fiscal policy response to the COVID-19 crisis. In a scenario with increasing borrowing costs for governments, as major central banks have been rising interest rates to bring inflation back to their targets, some sovereigns will be eventually forced to change their fiscal stance to maintain public debt in a sustainable path. In such a context, the discussion about the output costs of fiscal adjustments looks of particular relevance.

The main goal of this paper is to analyse the effects of fiscal consolidations on output and investigate which type of adjustment, tax-based (TB) or expenditure based (EB), is less recessionary. Although a large body of literature has delved into these issues, most has been devoted to identifying fiscal shocks and simulating impulse responses through SVARs and calibrated DSGE models, with the latter generally finding that spending multipliers are larger in absolute value than tax multipliers (Ramey 2019). A downside of these techniques is that they usually require the imposition of assumptions to restrict the behaviour of variables.

To avoid this problem, a new literature uses narrative methods to identify exogenous fiscal shocks. Alesina et al. (2015) simulates the effects of narratively identified fiscal adjustment plans on a set of macroeconomic variables, computing impulse responses from a model estimated by Seemingly Unrelated Regressions and finding that TB plans are costlier than EB plans. A series of subsequent studies confirm these results (see Alesina et al. (2020) for a review), estimating a larger and more persistent output loss after TB consolidations, while the economic downturns provoked by EB adjustments usually vanish between 2 and 3 years after they are first implemented.

Applying a similar identification strategy, Carrière-Swallow et al. (2021) proposes a new technique to estimate the effects of narratively identified fiscal shocks using the Local Projections (LP) method (Jordá 2005). When applying their methodology to the same sample as the previous studies, one finds larger multipliers overall and observes persistent effects in both EB and TB consolidations. A limitation of this study is that it does not allow for anticipated future shifts in fiscal variables to affect GDP before implementation, unlike the previous studies that enabled announcements of future fiscal measure to contemporaneously impact GDP. We also argue that their Impulse Response Functions (IRFs) are inconsistent as they do not properly reflect the difference between the conditional expectations of output in a scenario where an impulse on fiscal measures was implemented and a counterfactual where it wasn´t. This is because their coefficient captures the response of output to future fiscal measures that are orthogonal to the fiscal shock that is the initial impulse, as will be explained in more detail in further sections.

To address these limitations, we propose a novel approach that consists of including in the LP regressions a term capturing the expectation of future fiscal consolidation measures, allowing us to estimate the dynamic response of output to a fiscal shock and the endogenous change in expectations it entails, while excluding the part of future fiscal measures that are independent of the currently implemented fiscal consolidation, and thus should not influence the IRF. In doing so, we recover the results presented in Alesina et al. (2020).

This Work Project is structured as follows. Section 2 reviews the literature on the effects of fiscal contractions and the leading methods for identifying and simulating responses to exogenous fiscal measures. Section 3 describes the data, its sources and particularities. Section 4 presents our empirical strategies, while section 5 goes through the estimation procedure, as well as the presentation and discussion of results. Section 6 concludes.

2. Literature Review

2.1 The output effects of fiscal contractions

The interaction between fiscal policy and output has been the object of study of a large and long-lasting literature, even more so after the Great Financial Crisis, when the interest about fiscal stimulus increased massively. Despite of all the effort applied to this topic, there is still no consensus on the size of fiscal multipliers and on whether the effect of tax measures is larger or smaller than of spending measures, which warrants further research. Therefore, before presenting our contributions, we summarize the findings of relevant theoretical and empirical work on this subject.

First of all, in light of the textbook Keynesian model, fiscal contractions are always recessionary, as a result of the interaction between their negative effect on aggregate demand and wage/price rigidities, and expenditure multipliers are larger in absolute value than tax multipliers, as government spending directly impacts aggregate demand in a one-to-one proportion, while taxes reduce the private disposable income, of which consumers only spend a fraction, saving the rest. Modern New Keynesian DSGE models have incorporated features of Keynesian models in a more rigorous framework. In a wide array of these models, contractions are always recessionary and government spending multipliers are larger in absolute terms than tax multipliers (see Ramey (2019) for a survey).

However, evidence from aggregate time series data which employs different methodologies, identification strategies and data sets estimate an average (cumulative, usually between 0 and 20 quarters) multiplier for government spending in the range of 0.6 to 1, while tax multipliers are typically between -2 and -3 (Ramey 2019). Additionally, a branch of literature which specifically studies fiscal consolidations, summarized in Alesina et al. (2020), finds that TB consolidations lead to larger and longer recessionary effects, while EB fiscal adjustment plans have a low and short-lasting recessionary effect on average. To explain the heterogenous response of the economy to EB and TB programs the authors point to expectational effects, as a lower level (or slower growth) of spending reduces the expectations of future levels of taxation, which would increase consumer's permanent income and the return on investments. Conversely, if taxes increase but the dynamics of government spending remains unchanged, agents will expect additional future increases in taxes. Therefore, EB programs would have a lighter effect on aggregate demand given the improvement of expectations of future income and the reduction of uncertainty regarding the government's solvency.

The "non-Keynesian" transmission channels of fiscal policy described above, in which fiscal consolidations can improve expectations of future income, are at the heart of the expansionary fiscal contraction hypothesis, which received attention after cases of consolidations that were followed by significant expansions in the 1980s, such as Ireland in 1987 and Denmark in 1982 (Giavazzi and Pagano 1990, Bergman and Hutchison 2010). This literature focuses on situations where public debt is high and growing in an unsustainable path, causing agents to expect a drastic contraction or a default to materialize at some point. Thus, in these special circumstances, fiscal contractions could be expansionary, either by decreasing spreads and interest rates (Afonso 2007, Esquivel and Samano 2023), or by pushing the economy away from the point where an even more aggressive contraction, which would significantly decrease agent's life-time wealth, becomes necessary (Blanchard 1990, Sutherland 1997, Perotti 1999).

2.2 Isolating exogenous fiscal shocks

Endogeneity is one of the main reasons why estimating the causal effects of fiscal policies on output is so challenging and generates this amount of controversy. Indeed, simply looking at the correlation between spending, taxes and output would lead us to error, given that the direction of causality is unclear, as economic growth increases tax revenues, and periods of expansions reduce the needs for some spending programs such as unemployment benefits. Moreover, it is common for governments to respond to changes in the economic environment, for example increasing expenditures during recessions to try to stimulate the economy. This would lead to a negative association between spending and output growth in the data, but the recession is the cause of the increase in expenditure in this case, not the opposite.

Consequently, researchers developed several methods to try to isolate exogenous changes in taxes and expenditures, those not caused by the business cycle, in order to correctly estimate the impact of a fiscal measure on output. Many studies recurred to Structural Vector Autoregressive (SVAR) models, which impose restrictions on the relation between the variables in the system to identify structural shocks to spending and taxes, that is, changes not predicted by past and current movements of macroeconomic variables, and thus exogenous variations of fiscal variables (Ilzetzki et al. 2013, Mountford and Uhlig 2009). Exemplifying, Blanchard and Perotti (2002) assume fiscal authorities are not able to respond to shocks in the economy within a quarter and impose an externally estimated elasticity of taxes to output, allowing them to isolate the components of taxes and spending that are not caused by changes in GDP. A weakness of the SVAR approach is the sensitivity of the results to the identifying restrictions (Caldara and Kamps 2017). Also, these structural shocks may have been announced before implemented, and hence they could have started to affect other variables in earlier periods than they are allowed in a SVAR, what is known as the “fiscal foresight” problem.

Another common approach is the use of natural experiments. Authors select episodes unrelated to the economic cycle that cause changes in fiscal variables, such as military build-ups, and use them to estimate the causal effect of fiscal shifts on output (Ramey and Shapiro 1998, Barro and Redlick 2011). A limitation of using wars and military spending to estimate multipliers is that many countries outside of the U.S. do not have sufficient variation in defence spending to employ this method or have large output losses associated to the destruction caused by wars that would contaminate the multiplier estimates. There is also a question regarding the external validity of these estimates for different contexts or types of expenditures.

An identification strategy that avoids the fiscal foresight problem and the necessity of imposing restrictions on coefficients, and its validity is not tied to a particular country or type of fiscal measure, is the narrative approach, pioneered in fiscal research by Romer and Romer (2010) and adopted in this Work Project. It consists of recovering exogenous shifts in spending and taxes by assessing the motivation of the implementation of each measure using budget documents, transcripts of congressional debates and speeches, documents produced by international organizations such as the OECD, IMF, the European Commission, etc. This way, the authors can rule out measures that were taken in response to the business cycle. Adopting this approach, Devries et al. (2011) constructed a database with narrative fiscal shocks, composed of unexpected measures (announced and implemented in the same year) and announced measures (announced in years before the implementation). These measures include both spending and taxes and are exclusively consolidations, as the selection criteria was that the motivation of the policy had to be to "reduce an inherited deficit". Several studies employ this database, for example, Guajardo et al. (2014) use the fiscal shocks in a VAR as instruments for changes in the cyclically adjusted primary balance (CAPB), their results suggest contractionary effects of consolidations sized 1% of GDP on output of -1.57% within 2 years.

Alesina et al. (2015) point out that fiscal consolidations are usually implemented through multi-year plans, and not independent individual measures. Hence, they construct an alternative database by adding the unexpected and announced measures described before to announcements of future shifts in fiscal variables (measures that are announced in year t to be implemented in $t + j$), this way explicitly allowing for anticipation effects. They also classify each plan as TB or EB depending on whether its tax hikes or spending cuts that account for a larger share of the plan. Since announcements play an important role in computing expectations of future fiscal consolidations, we use the updated version of this database instead of Devries et al. (2011).

2.3 Simulating responses to narrative shocks

Once exogenous shifts in fiscal variables are identified, it is still necessary to choose a methodology to simulate their effects on the economy. A range of studies utilizing the data on narrative fiscal plans applies VARs with exogenous variables to simulate the effect of plans on output, consumption, investment, confidence, inflation, interest rates and the debt-to-GDP ratio (Alesina et al. 2015, Alesina et. al 2018, Favero and Mei 2019). The main conclusions are that EB fiscal plans are more successful in stabilizing the debt-to-GDP ratio than TB ones and have milder recessionary effects, which are also short-lived as output returns to its previous trend after 2 or 3 years, while in the case of TB large recessions with persistent losses are observed.

Another branch of the literature employs narratively identified fiscal shocks in a LP framework. There are many advantages to this approach. Jordá (2005) argues that since you can directly compute IRFs without specifying and estimating the underlying dynamic multivariate system, this method is more robust to misspecification than VARs, as, for example, it doesn't require the researcher to know whether the data generating process follows a VAR, a VARMA or even some non-linear form. Additionally, LP can very easily be adapted to non-linear specifications which we can use to estimate different multipliers for TB and EB consolidations. For these reasons, our methodology will make use of LP to estimate the IRFs of output to the narratively identified fiscal shocks instead of VAR.

Carriere-Swallow et al. (2021) introduces a specification that directly includes the narrative fiscal shocks from Devries et al. (2011) and David and Leigh (2018) (which utilizes the exact same methodology but for Latin American countries) in a LP context. Given that consolidations are implemented through plans, a possible source of bias arising from this approach is that future fiscal measures within the IRF's horizon will be correlated with the ones used as exogenous shocks. The authors control for this problem by including leads of fiscal shocks up to the estimation horizon of each LP equation. Thus, considering the sum of all measures of fiscal adjustment in this horizon as their variable of interest, they estimate only one coefficient for this cumulative fiscal adjustment measure and this leads to larger multipliers and persistent output losses, independently of the composition of the fiscal adjustment.

We point out that this approach does not take into account the effect of anticipated future fiscal measures, and its IRF includes also the response of GDP to fiscal shocks that are orthogonal to the initial one, and thus could have happened independently of the original fiscal consolidation. Instead, in this WP we include only the future fiscal measures that are expected given currently available information on implemented fiscal measures and announcements of future adjustments. This way, we allow expectations to directly affect output and compute the dynamic effect of the average expected 1% of GDP fiscal plan, excluding the part of future fiscal measures that are orthogonal to our impulse and hence would also be included in the counterfactual scenario.

3. Data

The data set of narratively identified fiscal consolidations used for this Work Project is the one from Alesina et al. (2020), which utilizes an extended and modified version of Devries et al. (2011), containing annual information for 16 OECD countries (Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Great Britain, Ireland, Italy, Japan, Portugal, Spain, Sweden, and U.S.A.) for the period 1978-2014. For the same countries and periods, data for GDP at constant prices was retrieved from the IMF's World Economic Outlook database, while the commodity export value series is the one used in Carrière-Swallow et al. (2021), which is taken from Gruss (2014).

We utilize the same narrative fiscal shocks, $FC_{i,t}$, as Carrière-Swallow et al. (2021), where i is the country and t is the year. These are the sum of unexpected consolidation measures (announced and implemented in year t), $e^{u}_{i,t}$, and measures that were announced before but implemented in year t, $e^{a}_{i,t,0}$, which we will refer to as announced or anticipated measures. So,

$$FC_{i,t} = e^{u}_{i,t} + e^{a}_{i,t,0} \tag{1}$$

Additionally, we compute expectations of future fiscal consolidations using announcements of measures to be implemented in the future, $e^{a}_{i,t,j}$ (announced in year t, to be implemented in year $t+j$), as defined in Alesina et al. (2015). Importantly, in case a fiscal plan is carried out in the manner that it was announced, we will observe that announcements made in period t to be implemented in $t+j$ will equal announced measures in period $t+j$, so that:

$$e^{a}_{i,t,j} = e^{a}_{i,t+j,0} \tag{2}$$

Considering that fiscal consolidations are usually executed in a multi-year process of announcements and implementation of deficit reduction policies, we can estimate a correlation between $e^{u}_{i,t}$ and $e^{a}_{i,t,j}$ for each horizon j:

$$e^{a}_{i,t,j} = \varphi^{j} e^{u}_{i,t} + v^{j}_{i,t} \tag{3}$$

In case φ^{j} indicates that unexpected measures tend to be accompanied by announcements, one should not simulate the effect of $e^{u}_{i,t}$ assuming there will be no $e^{a}_{i,t,t+j}$, as if those variables were orthogonal. Also, with this information we can see that there is an inter-temporal correlation between future announced, $e^{a}_{i,t+j,0}$, and current unexpected, $e^{u}_{i,t}$, fiscal shifts. This causes $FC_{i,t}$ to be correlated with its future values, as can be easily shown (this demonstration is adapted from Alesina et al. (2015)):

$$cov\left(FC_{i,t+j}, FC_{i,t}\right) = cov\left(\left(e^{u}_{i,t+j} + e^{a}_{i,t+j,0}\right), \left(e^{u}_{i,t} + e^{a}_{i,t,0}\right)\right)$$

We know that $e^a_{i,t,j} = e^a_{i,t+j,0}$ and $e^a_{i,t,j} = \varphi^j e^u_{i,t} + v^j_{i,t}$, as stated in (2) and (3), respectively.

$$= cov\left(\left(e^u_{i,t+j} + e^a_{i,t,j}\right), \left(e^u_{i,t} + e^a_{i,t,0}\right)\right) = cov\left(\left(e^u_{i,t+j} + \varphi^j e^u_{i,t} + v^j_{i,t}\right), \left(e^u_{i,t} + e^a_{i,t,0}\right)\right) =$$

$$= E\left[\varphi^j \left(e^u_{i,t}\right)^2\right] = \varphi^j Var(e^u_{i,t})$$

Here, we obtained a correlation between $FC_{i,t}$ and $FC_{i,t+j}$, even when assuming that $e^u_{i,t+j}$ is uncorrelated with past fiscal adjustments. This is not necessarily true, as there also could be an auto-regressive behaviour of unexpected measures.

Given the correlation between $FC_{i,t}$ and its future values, computing the IRF with Local Projections having $FC_{i,t}$ as the exogenous variable leads to an omitted variable bias problem. To observe this, let's consider this model with $s = 0,1$ and 2:

$$y_{i,t+s} - y_{i,t-1} = \alpha^s_i + \gamma^s_t + \beta^s FC_{i,t} + \delta^s X_{i,t} + \epsilon_{i,t+s} \qquad (4)$$

It's reasonable to expect that $FC_{i,t+1}$ will impact $y_{i,t+1}$ and $y_{i,t+2}$ and $FC_{i,t+2}$ will at least impact $y_{i,t+2}$. Thus, we can write $\epsilon_{i,t+s}$ for $s = 1,2$ as:

$$\epsilon_{i,t+1} = \theta^1_1 FC_{i,t+1} + u_{i,t+1} \qquad (5)$$

$$\epsilon_{i,t+2} = \theta^2_1 FC_{i,t+1} + \phi^2_2 FC_{i,t+2} + u_{i,t+2} \qquad (6)$$

As we have seen in the previous section, $FC_{i,t+1}$ and $FC_{i,t+2}$ are correlated with $FC_{i,t}$. This way, we know that $E\left[\epsilon_{i,t+s} \mid FC_{i,t}\right] \neq E\left[\epsilon_{i,t+s}\right] = 0$ for $s > 0$, hence the estimates for β^1 and β^2 will be biased.

Carrière-Swallow et al. (2021) avoid this problem by including, in each regression equation, all $FC_{i,t+s}$ up to the period to which they are computing the impulse response:

$$y_{i,t+s} - y_{i,t-1} = \alpha^s_i + \gamma^s_t + \beta^s \sum_{j=0}^{s} FC_{i,t+s} + \delta^s X_{i,t} + \epsilon_{i,t+s} \qquad (7)$$

This way, the authors control for the future adjustments that may correlate with FC_t by directly including the future consolidations. However, instead of estimating the response of output to a fiscal adjustment plan adopted at t, at each point s in the IRF, they are estimating the response of output to all the deficit reduction measures implemented between t and s, regardless of whether they were part of the same plan or unrelated.

It is necessary to highlight that a few limitations arise from this approach. Firstly, announcements are not allowed to affect GDP until they are implemented. This lack of anticipation effects seems very unplausible unless there was no credibility in legislated future fiscal changes or all agents in the economy were liquidity constrained. Thus, it is likely that the effects of announcements will be captured by β^h, so instead of this coefficient indicating the response of GDP to a 1% of GDP implemented adjustment over h years, it will capture the response of GDP to 1% of GDP of implemented measures and some unknown percentage of GDP in expectations of future fiscal measures, driven by announcements and current implemented measures, which are not specified in the model. This not very informative on what is the magnitude of the impact of a fiscal consolidation on the economy, as a consolidation that is sized 1% of GDP on impact and is expected to decrease the deficit in, for example, 5% throughout 3 years and a once and for all 1% of GDP correction of the deficit will most likely have different effects which this approach fails to capture.

Furthermore, their coefficients will also include the impact on GDP of the part of the future fiscal consolidation measures that is orthogonal to $FC_{i,t}$, and hence measures that occurred independently of this fiscal shock. This is inconsistent with the notion of an IRF, as it should only display the difference between the conditional expectations of a dependent variable in a scenario where an impulse occurred and the counterfactual:

$$IRF_s = E(Y_{t+s}|d = 1, \Omega_t) - E(Y_{t+s}|d = 0, \Omega_t) \tag{8}$$

Where Y is the dependent variable, s the horizon of the IRF, d is the impulse and Ω_t is the information set in period t. Clearly, if a future fiscal measure is orthogonal to the impulse, it will not alter the difference between the two terms on the right-hand side of equation (8) and its effect on the dependent variable should be excluded from the IRF. Therefore, the only consistent form of interpreting their IRF is knowing that it does not show the dynamic response of output to an original impulse, it rather displays, at each horizon, the response of output to different impulses. For example, at horizon 1, the impulse is a 1% increase in $\sum_{j=0}^{1} FC_{i,t+s}$ while in horizon 2 is a 1% increase in $\sum_{j=0}^{2} FC_{i,t+s}$. This deviates from the usual interpretation of IRFs and is less informative, as we are not necessarily looking at the same scenario over time, but rather possibly different scenarios of fiscal consolidations at different horizons.

Besides, when looking at the heterogenous effects of tax based (TB) and expenditure based (EB) plans, overlooking announcements will lead to a different classification of TB and EB years relative to the rest of the literature, as the Alesina fiscal plans are classified as TB (EB) if the sum of all tax measures in that year, including announcements, is higher (lower) than the sum of all expenditure measures in the same year.

4. Methodology

4.1 Construction of the expectations term

This Work Project proposes a novel solution to the problems described in the previous section. It consists of creating a variable that gives us the agent's rational expectations of future fiscal consolidation measures with the information available on the current period. Rational expectations is a common modelling technique, frequently used in situations where the beliefs of agents about the future affect economic outcomes. The hypothesis of rationality implies that, as people repeatedly forecast a variable, they update their forecasting techniques to prevent errors that can be predicted with the current available information, which means forecasting errors exist, but they do not happen systematically. In other words, the agent's forecast error should be orthogonal to the agent's information set. Thus, our rational expectations variable is simply the expected value of future fiscal adjustments given current information.

Consider our period of analysis $h = 3$. To compute our "expectations variable", we first run regressions of future adjustments on current information, namely, fiscal consolidation measures implemented at time t, announcements and other controls that help predict future values of $FC_{i,t}$:

$$FC_{i,t+1} = \alpha_i + \gamma_t + \beta_1 FC_{i,t} + \beta_2 e^a_{t,1} + \beta_3 e^a_{t,2} + \beta_4 e^a_{t,3} + \delta X_{i,t} + v_{i,t+1} \tag{9}$$

$$FC_{i,t+2} = \alpha_i + \gamma_t + \beta_1 FC_{i,t} + \beta_2 e^a_{t,1} + \beta_3 e^a_{t,2} + \beta_4 e^a_{t,3} + \delta X_{i,t} + v_{i,t+2} \tag{10}$$

$$FC_{i,t+3} = \alpha_i + \gamma_t + \beta_1 FC_{i,t} + \beta_2 e^a_{t,1} + \beta_3 e^a_{t,2} + \beta_4 e^a_{t,3} + \delta X_{i,t} + v_{i,t+3} \tag{11}$$

Then, we take the fitted values of these regressions, $\widehat{FC}_{i,t+j}$, to capture the expected future fiscal adjustment conditional on present available information. To avoid multicollinearity and increase degrees of freedom, we sum our three expectations terms instead of including them directly in the regression. The limitation of this solution is that it gives the same weight to consolidations independently of how far in the future they are. We experimented applying the method Burnside and Dollar (2000) used to create an index which weights each variable by their impact on growth, however, the results did not change significantly (appendix 1), and it implied increased complexity and loss of efficiency. For this reason, we proceeded using the sum of expectations, obtaining:

$$\widehat{FC}_{i,t+1} + \widehat{FC}_{i,t+2} + \widehat{FC}_{i,t+3} = \sum_{j=1}^{3} E\left[FC_{i,t+j} | \Omega_t\right] \tag{12}$$

This way, the expectations term will capture the effects of all the predictable share of future adjustments, leaving only the unexpected, uncorrelated with current implemented measures, portion of FC_{t+j} on the error term, thus, recovering the orthogonality between FC_t and $\epsilon_{i,t+s}$. Moreover, we also allow the expected part of the fiscal adjustment to contemporaneously affect agent's behaviour and have an impact on GDP through this anticipation effect.

4.2 Specification of the local projections regressions

The LP regressions for the baseline model then become:

$$y_{i,t+s} - y_{i,t-1} = \alpha_i^s + \gamma_t^s + \beta_F^s FC_{i,t} + \beta_E^s \sum_{j=1}^{3} E\left[FC_{i,t+j} \mid \Omega_t\right] + \delta^s X_{i,t} + \epsilon_{i,t+s} \qquad (13)$$

Where $y_{i,t}$ is the log of GDP at constant prices, s denotes the time horizons considered, which are 0,1,2 and 3, α_i^s and γ_t^s are the country and time fixed effects, respectively, and X_t is a vector of control variables, which is the same used in Carrière-Swallow et al. (2021), including two lags of real GDP growth, two lags of the narrative fiscal consolidations, as well as the growth rate of commodity export value and its two lags.

As mentioned before, we also aim to investigate the heterogeneous effects of TB and EB fiscal consolidations. For this purpose, we use the interaction of the narrative fiscal consolidations and the expectations term with dummies $EB_{i,t}$ and $TB_{i,t}$. The variable $EB_{i,t}$ ($TB_{i,t}$) is defined as 1 if the sum of all narratively identified expenditure-side fiscal consolidation measures are larger (smaller) than the sum of all narratively identified tax-side consolidation measures. The LP regressions become:

$$\begin{aligned} y_{i,t+s} - y_{i,t-1} = \alpha_i^s + \gamma_t^s + EB_{i,t}\left(\beta_{EB,F}^s FC_{i,t} + \beta_{EB;E}^s \sum_{j=1}^{3} E\left[FC_{i,t+j} \mid \Omega_t\right]\right) \\ + TB_{i,t}\left(\beta_{TB,F}^s FC_{i,t} + \beta_{TB;E}^s \sum_{j=1}^{3} E\left[FC_{i,t+j} \mid \Omega_t\right]\right) + \delta^s X_{i,t} + \epsilon_{i,t+s} \qquad (14) \end{aligned}$$

4.3 Simulation

After estimating these equations, we proceed to compute the impulse response functions of output to a fiscal consolidation. A challenge arising from our specification is that we cannot just use the estimated β_F^s for each horizon s as the response of output to a fiscal consolidation, as the expectations term moves endogenously with FC_t and it also has an impact on output. Hence, a solution is to capture the sample average of the response of expectations of future fiscal adjustments to current implemented measures. For this purpose, we estimate the following regression:

$$\sum_{j=1}^{3} E\left[FC_{i,t+j} \mid \Omega_t\right] = \alpha_i + \gamma_t + \lambda FC_{i,t} + \epsilon_{i,t} \tag{15}$$

The estimated lambda λ represents both the direct effect of $FC_{i,t}$ on expectations as well as the indirect effect through announcements, which are also correlated with FC_t as discussed in previous sections, hence also capturing the intertemporal correlations of fiscal consolidation measures. Next, we compute the IRFs assuming that a unit change in $FC_{i,t}$ leads to a change in the expectations term of λ. To obtain the IRF to a total expected fiscal consolidation sized 1% of GDP, we use the following normalization:

$$\Delta FC_{i,t} + \Delta \sum_{j=1}^{3} E\left[FC_{i,t+j} | \Omega_t\right] = 1 \tag{16}$$

$$\Delta FC_{i,t} + \lambda \Delta FC_{i,t} = 1 \tag{17}$$

$$\Delta FC_{i,t} = \frac{1}{1+\lambda} \wedge \Delta \sum_{j=1}^{3} E\left[FC_{i,t+j} | \Omega_t\right] = \frac{\lambda}{1+\lambda} \tag{18}$$

Finally, the IRF will take, at each horizon s, the value of the following linear combination of coefficients:

$$IRF_s = (\beta_F^s + \lambda \beta_E^s) \times \frac{1}{1+\lambda} \tag{19}$$

This technique is based on the method used by Alesina et al. (2015) (and all the following related papers from the same authors) to simulate the response of output to a fiscal plan where unexpected measures and announcements are correlated. However, instead of directly including announcements, we use the expectation of future consolidation policies. We apply the same procedure, albeit with minor adjustments, to the specification where we estimate the heterogeneous effects of TB and EB plans.

5. Results

5.1. Regression Diagnostics and Estimation of Expectations

Firstly, models (9), (10), (11) and (13) are estimated twice, using fixed and random effects estimators. Then, a Hausman test is conducted to determine which estimator is more appropriate, and it leads to the rejection of the null hypothesis that the random effects estimator is consistent and efficient (with a p-value of 0.000) in all cases. Next, we run heteroskedasticity and autocorrelation tests and reject the nulls of homoskedasticity and no autocorrelation (again with p-values of 0.000). Thus, for the remainder of this section, we use fixed effects estimators and Driscoll-Kray standard errors, the same used in Carrière-Swallow et al. (2021), that are robust to heteroskedasticity and autocorrelation.

Then, we run regressions (9), (10) and (11). After testing multiple specifications, including as control variables announcements, other macroeconomic variables, such as debt-to-GDP ratios, and their lags, the only predictors of future fiscal consolidations that remained significant and were thus maintained in our final specification are the ones presented in Table l. These are the contemporaneous fiscal shocks and announcements of future measures.

These results suggest that the implementation of fiscal consolidation measures help predict further adjustments in the future, even when controlling for announcements. According to this finding, the implementation of deficit correcting policies should lend credibility to future measures in a fiscal consolidation plan. Additionally, in the regressions of fiscal shocks in each period $t + j$, announcements made in period t of measures to be implemented j periods ahead always present positive and significant coefficients, highlighting the credibility of announcements in our sample of advanced economies. The fact that future fiscal measures can be foreseen through announcements and current measures supports the idea that anticipation effects will be relevant and further justifies the inclusion of the expectations term on our LP regressions.

Table 1- Estimation of expectations of future fiscal consolidation measures (regressions (9), (10) and (11)):

Estimation Method	Fixed effects estimator	Fixed effects estimator	Fixed effects estimator
VARIABLES	(9) Fiscal Shock at t+1	(10) Fiscal Shock at t+2	(11) Fiscal Shock at t+3
Fiscal Shock	0.420***	0.305***	0.128*
	(0.083)	(0.093)	(0.066)
Announcements for t+1	0.681***		
	(0.119)		
Lag of announcements for t+2	-0.293**		
	(0.135)		
Announcements for t+2		0.932***	
		(0.161)	
Announcements for t+3		-0.723***	0.481*
		(0.252)	(0.251)
Observations	575	560	544
Number of Countries	16	16	16
Within R^2	0.535	0.322	0.225
F-Statistic	2105	19.64	129.7

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

5.2. Baseline model

Now, the baseline model is estimated to obtain β_F^s and β_E^s. We immediately notice that our expectations variable bears some relevance, given that it is significant at the 10% level for horizons $s = 0$ and $s = 2$, and significant at the 1% level at $s = 1$, although there should be caution in analysing coefficients from these regressions individually due to the existence of some degree of multicollinearity between the variables, instead we should focus on the IRF. Then, we run regression (15) and estimate λ. This way, we use a linear combination of these coefficients to compute the IRFs of output to a 1% of GDP total expected fiscal consolidation. For comparative purposes, we also display the estimates using the methodology of Carrière-Swallow et al. (2021) (equation (7)), which will be referred to as CS2021.In the following figures, our methodology will be shown on the left panels, labelled as "Rational Expectations", while the CS2021 approach will appear on the right panels. The shaded areas represent 90% confidence intervals.

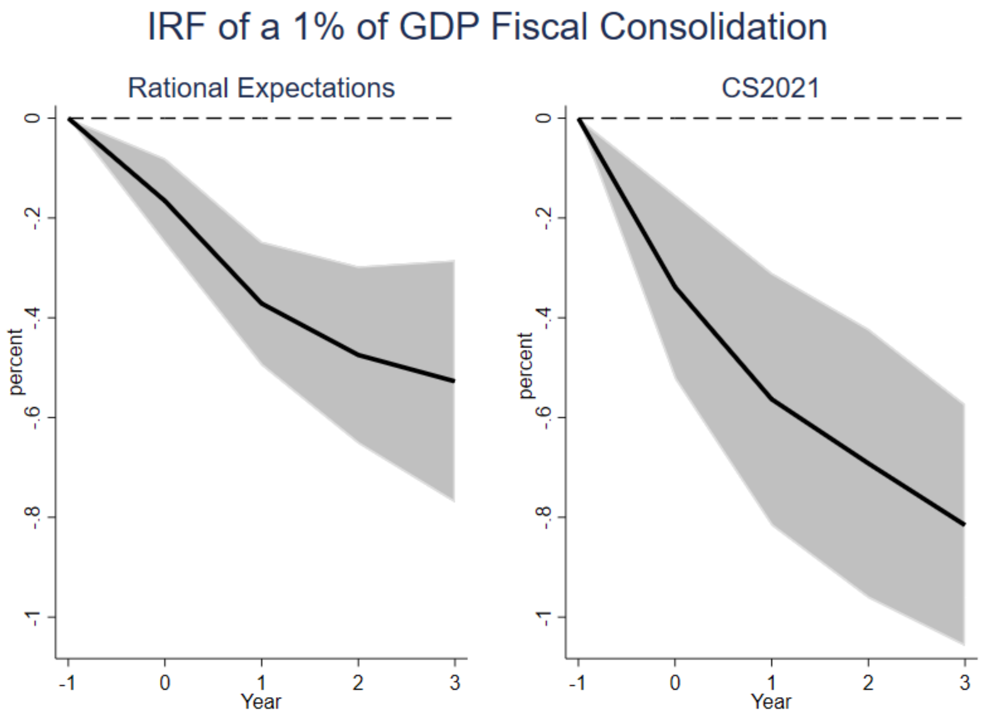

Figure 1 – The cumulative response of real GDP to a 1% of GDP fiscal consolidation. Source: Own calculations based on regressions (1), and (7), respectively, and using data from Alesina et al. (2020).

The results in Figure 1 indicate, for our methodology, that a fiscal consolidation with expected total size of 1% of GDP, decreases real GDP by approximately 0.2% on impact and 0.53% after a 3-year period, results that are statistically significant at the 1% significance level. The presented 90% confidence interval shows the effect ranges between -0.3% and -0.8%, approximately. Alternatively, the CS2021 estimation results in a larger multiplier, reaching a 3-year cumulative loss of 0.8% of GDP, whereas the confidence interval suggests the loss is approximately between 0.6% and 1.1%.

To assess the quality of our estimates, we perform an analysis of the residuals from the regression where $s = 3$ in our baseline model. Figure 2 shows a residual plot, filtered so that it only displays outliers, in this case residuals with an absolute value larger than 0.04 in countries and years where there was a consolidation, meaning that the model over/underestimated growth by at least 4 p.p.

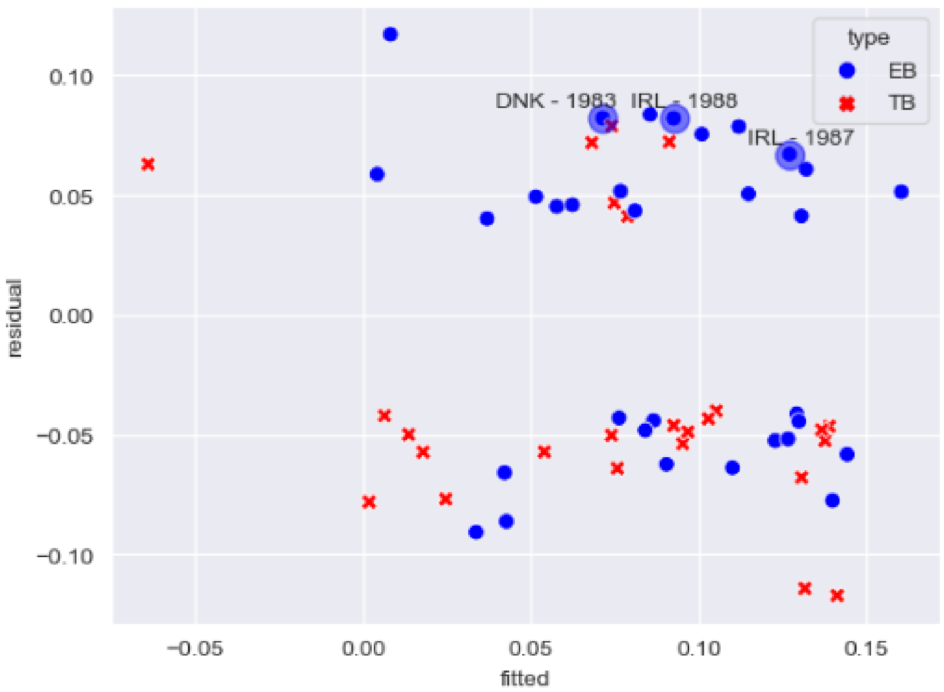

Figure 2 – Residuals plotted against fitted values, both from the regression where s= 3 of model (13), divided between observations where the fiscal consolidation was EB or TB. We only show the more extreme values of residuals (>0.04) for years when a fiscal consolidation happened.

We obtain two key takeaways. First, by labelling each observation as EB or TB, it becomes apparent that the model is more likely to significantly underestimate growth when the adjustment is EB, while the majority of times that growth is highly overestimated occurs during TB programs. This reiterates the necessity of estimating a model such as (14) that allows for different coefficients for EB and TB consolidations, motivating the next subsection.

Second, episodes of expansionary fiscal contractions identified in the literature (Giavazzi and Pagano 1990) indeed show large positive residuals. For example, Denmark's residuals in 1983 were 0.082 and Ireland's residuals in 1987 and 1988 were 0.067 and 0.082, respectively. This raises the question of whether the sign of the multiplier can actually be reversed under special circumstances. Unfortunately, the annual frequency of our data generates too small of a sample to analyse episodes of individual countries. However, this evidence suggests that future research might benefit from adapting our methodology to estimate state-dependent multipliers, allowing the coefficients to change in case the economy is under fiscal stress, and thus prone to benefit from these unusual expansionary effects of consolidations.

5.3. Tax-based and Expenditure-based

Next, we repeat the procedure from section 5.2, now to compute the IRFs for model (14) and assess the heterogenous effects of fiscal consolidations with different compositions. In the case of TB consolidations, as Figure 3 displays, our methodology finds an effect on GDP of -0.22% on impact and a cumulative loss of approximately 1.4% after 3 years, coefficients that are significant at the 1% significance level. The 90% confidence interval for the cumulative multiplier ranges from -0.84% to -1.9%. As for CS2021, the impact multiplier is approximately -0.52%, whereas the cumulative effect in the third year of the consolidation is close to -2.1%.

Figure 4 refers to EB consolidations. As one can observe, the Rational Expectations approach finds a contemporaneous effect on output of the expected 1% of GDP fiscal adjustment of -0.1%, and the recessionary effects reach their peak after 1 year, when output falls 0.22% relative to a counterfactual with no consolidation, with both results being significant at the 10% level.

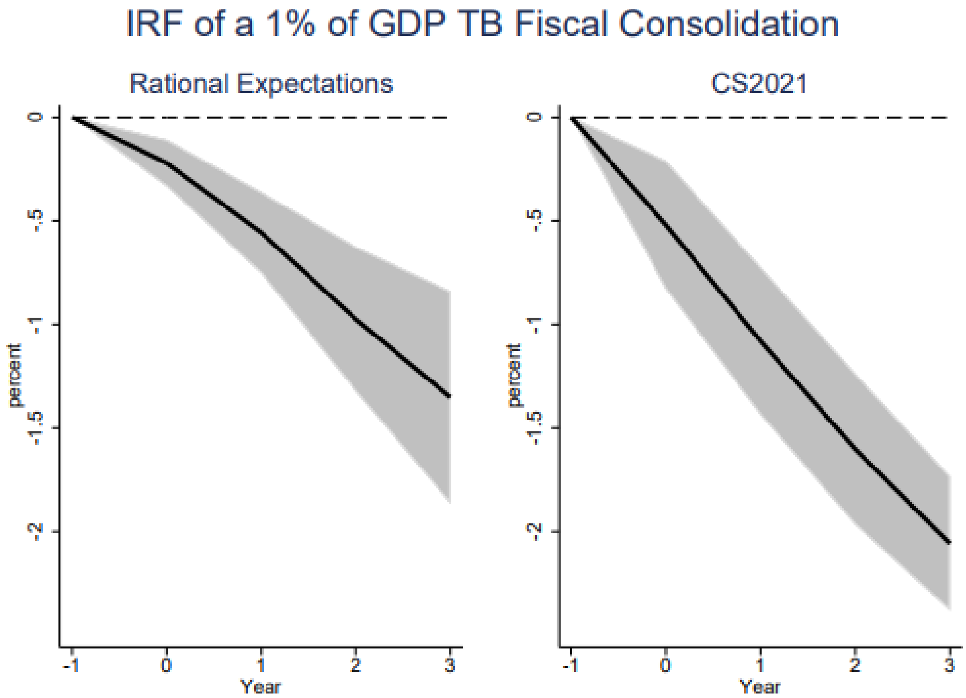

Figure 3 - The cumulative response of real GDP to a 1% of GDP TB fiscal Source: Own calculations based on regressions (14) and (7), respectively, and using data from Alesina et al. (2020).

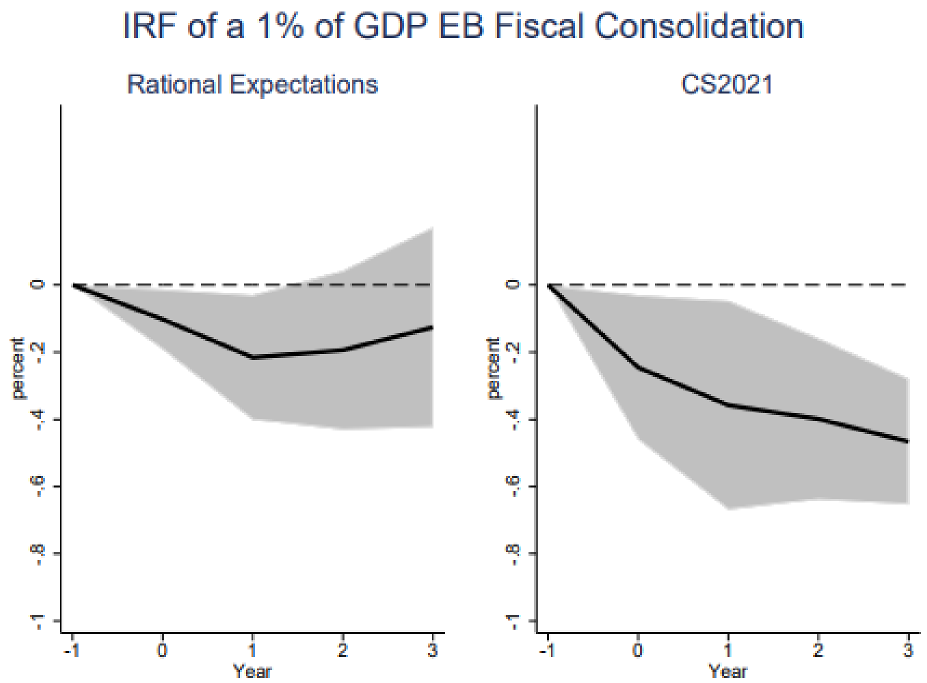

Figure 4 - The cumulative response of real GDP to a 1% of GDP EB fiscal consolidation Source: Own calculations based on regressions (14) and (7), respectively, and using data from Alesina et al. (2020).

The cumulative 3-year effect is not statistically different from zero at any conventional significance level, suggesting that 3 years after an EB consolidation, output returns to the level it was expected to be in case no fiscal adjustment was adopted, given its previous trend. Differently, CS2021 estimates an effect on impact close to -0.25% and the contractionary effects remain relevant after a 3-year period, showing a cumulative loss of approximately 0.5%, which is statistically significant at any conventional significance level.

5.4 Discussion

A few important messages can be highlighted from these results. Firstly, our estimates of the effects of fiscal adjustments on output are always smaller than the ones from CS2021. One possible explanation for this discrepancy is that their estimates capture the effect of 1% of GDP in implemented measures and an unknown % of GDP of expected future fiscal measures that are foreseen through announcements and current fiscal shifts, which means the total size of the fiscal plan being simulated is larger than 1%, causing multipliers to be overestimated, appearing larger than they actually are. Furthermore, differently from CS2021, in the case of EB consolidations, the Rational Expectations approach finds a short-lasting recessionary effect that disappears after 3 years, meaning that real GDP returns to its previous trend and there is no output loss in the long run. This lack of hysteresis provides a less pessimistic picture for economies in need of correcting deficits, although for TB adjustments both methods find evidence of persistent contractionary effects.

Above all, by allowing for anticipation effects, approximating our treatment of expectations to the one used in the literature that inserted narratively identified fiscal consolidation plans in VARs, and applying a more consistent approach to compute IRFs, we recover the results of Alesina et al. (2020), as even the shape and size of the IRFs are remarkably similar, considering the very different methodologies adopted. These results are consistent with the view that expectations regarding the government's solvency and future levels of taxation play a large role in determining the impact of fiscal policy on output, and that fiscal adjustments with different compositions have heterogeneous effects on these expectations.

Last but not least, we find that, in our sample of advanced economies, TB consolidations have a larger cost in terms of output than EB ones. Thus, the results of this Work Project suggest that, at least when it comes to fiscal consolidations, spending multipliers are in fact smaller, in absolute value, than tax multipliers.

6. Conclusion

In this Work Project, we compute the dynamic response of output to fiscal consolidations, using the Alesina et al. (2020) dataset of narratively identified exogenous fiscal measures. Our results for the baseline model indicate cumulative 3-year fiscal multipliers in the range between -0.3 and -0.8 at the 90% confidence level. When computing different coefficients for EB and TB consolidations, we find the 90% confidence interval for the 3-year cumulative effect on output of a 1% of GDP EB consolidation is between -0.42% and 0.17% (not statistically significant at any conventional significance level), and between -1.86% and -0.84% for TB consolidations. This evidence strongly suggests that EB adjustments are less contractionary than TB ones, contradicting the standard view that spending multipliers are always larger than tax multipliers.

Our main contribution lies on our new method of computing IRFs by augmenting LP regressions with a variable that captures the rational expectations of future deficit correction policies. Besides showing the relevance of implemented measures and announcements in predicting future fiscal consolidations, we compare our approach with the one from Carrière-Swallow et al. (2021) and argue that the omission of expected future consolidations from their model and the inconsistencies arising from the use of the sum of implemented fiscal measures in each horizon as their impulse leads to an overestimation of multipliers and thus suggest an excessively pessimistic scenario for economies seeking to stabilize their debt levels. Furthermore, in contrast with CS2021, we find no evidence of a persistent output loss in the case of EB consolidations, as there is a full recovery of GDP relative to the counterfactual scenario in which no consolidation took place. In fact, our results corroborate the previous set of studies that computed IRFs through VARs and allowed announcements to contemporaneously affect output, finding small and temporary effects of EB consolidations as opposed to large and long-lasting recessionary consequences of TB adjustments (Alesina et al. 2015, Alesina et al. 2018, Favero and Mei 2019).

Finally, our estimates suggest that stabilizing debt through deficit correction policies generally entails some degree of losses in output, however, these losses can be smaller and vanish more swiftly if the program is EB instead of TB. An important caveat is that these results were obtained from a sample of advanced OECD economies. Therefore, a valuable extension of our research would be to apply our technique to emerging market economies, as fiscal policy could have different implications in their macroeconomic environment. To that end, it would be necessary to extend the David and Leigh (2018) dataset to include announcements, thus enabling the creation of an expectations variable.

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Appendix 1

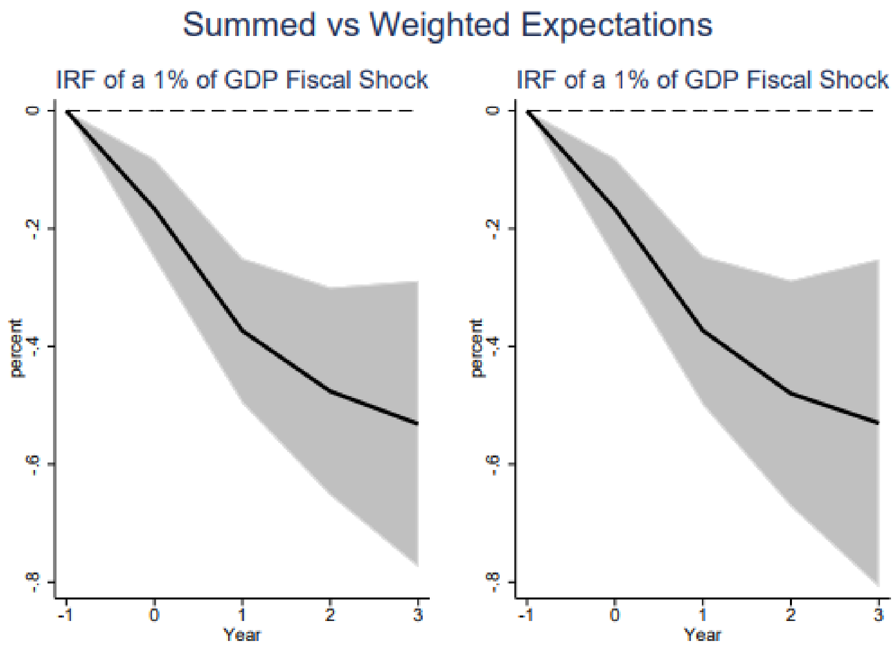

Figure A – The cumulative response of real GDP to a 1% of GDP fiscal consolidation employing the Rational expectations approach, however on the left panel we use the simple sum of expectations and on the right panel we weight them using the Burnside and Dollar (2000) method.

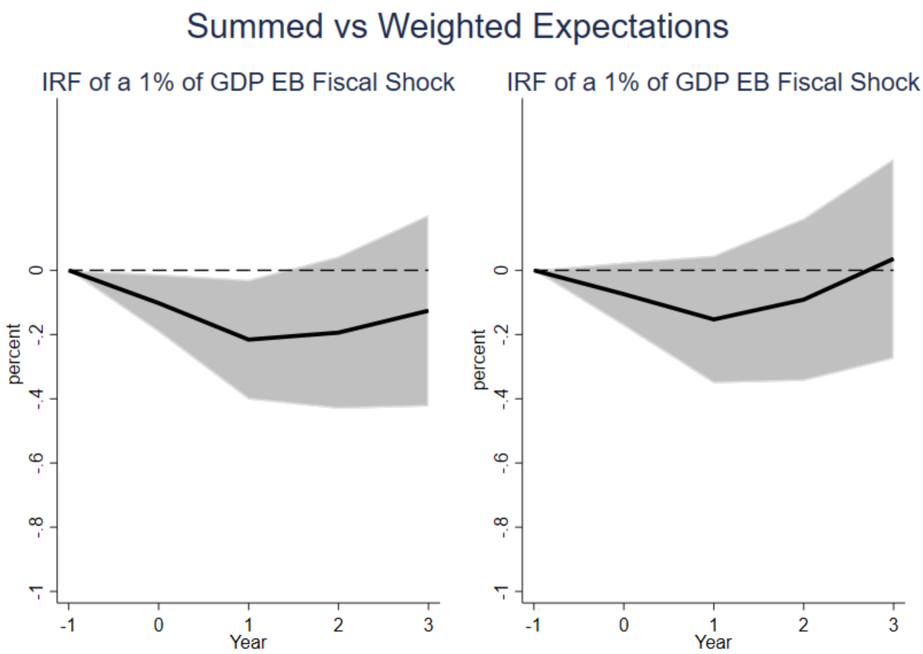

Figure B – The cumulative response of real GDP to a 1% of GDP EB fiscal consolidation employing the Rational expectations approach, however on the left panel we use the simple sum of expectations and on the right panel we weight them using the Burnside and Dollar (2000) method.

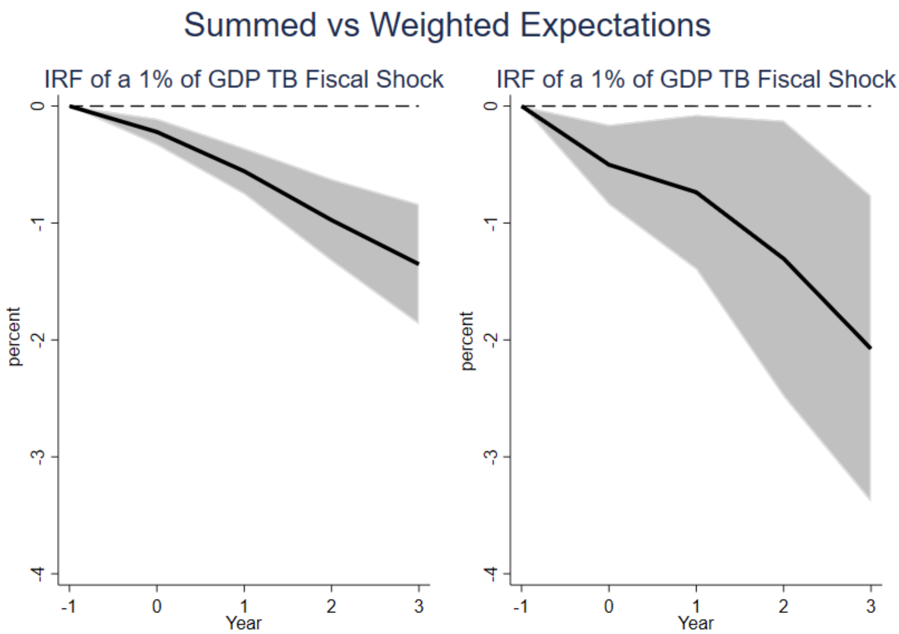

Figure C – The cumulative response of real GDP to a 1% of GDP TB fiscal consolidation employing the Rational expectations approach, however on the left panel we use the simple sum of expectations and on the right panel we weight them using the Burnside and Dollar (2000) method.

Appendix 2

Table 2A – Estimation of expectations of future fiscal consolidation measures (regressions (9), (10) and (11)). First alternative specification.

VARIABLES	(9) Fiscal Shock at t+1	(10) Fiscal Shock at t+2	(11) Fiscal Shock at t+3
Fiscal Shock	0.415***	0.305***	0.128*
	(0.081)	(0.094)	(0.066)
Announcements for t+1	0.623***		
	(0.111)		
Announcements for t+2		0.735***	
		(0.168)	
Announcements for t+3			0.481*
			(0.251)
Observations	576	560	544
Number of Countries	16	16	16
Within R^2	0.532	0.316	0.225
F-Statistic	19.69	14.55	129.7

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 2B – Estimation of expectations of future fiscal consolidation measures (regressions (9), (10) and (11)). Second alternative specification.

VARIABLES	(9) Fiscal Shock at t+1	(10) Fiscal Shock at t+2	(11) Fiscal Shock at t+3
Fiscal Shock	0.409***	0.302***	0.135**
	(0.083)	(0.098)	(0.064)
Announcements for t+1	0.622***		
	(0.111)		
Debt-to-GDP ratio	0.001	0.001	-0.001
	(0.001)	(0.002)	(0.002)
Announcements for t+2		0.738***	
		(0.171)	
Announcements for t+3			0.471*
			(0.247)
Observations	576	560	544
Number of Countries	16	16	16
Within R^2	0.533	0.317	0.226
F-Statistic	15.05	27.35	16.30

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 2C – Estimation of expectations of future fiscal consolidation measures (regressions (9), (10) and (11)). Third alternative specification.

VARIABLES	(9) Fiscal Shock at t+1	(10) Fiscal Shock at t+2	(11) Fiscal Shock at t+3
Fiscal Shock	0.392***	0.315***	0.116
	(0.082)	(0.114)	(0.072)
Announcements for t+1	0.698***		
	(0.115)		
Lag of Fiscal Shock	0.088	-0.034	-0.014
	(0.100)	(0.071)	(0.051)
Lag(2) of Fiscal Shock	-0.057	0.000	0.090
	(0.076)	(0.059)	(0.096)
Lag of announcements for t+2	-0.450**		
	(0.167)		
Lag(2) of announcements for t+3	0.265		
	(0.245)		
Announcements for t+2		0.858***	
		(0.205)	
Lag of announcements for t+3		-0.482	
		(0.311)	
Announcements for t+3			0.445
			(0.280)
Observations	544	528	512
Number of Countries	16	16	16
Within R^2	0.537	0.317	0.238
F-Statistic	36.97	25.60	6.903

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 2D – Estimation of expectations of future fiscal consolidation measures (regressions (9), (10) and (11)). Fourth alternative specification.

VARIABLES	(9) Fiscal Shock at t+1	(10) Fiscal Shock at t+2	(11) Fiscal Shock at t+3
Fiscal Shock	0.420***	0.271***	0.099
	(0.082)	(0.091)	(0.066)
Announcements for t+1	0.678***	0.202	0.298
	(0.122)	(0.136)	(0.206)
Announcements for t+2	0.086	0.745***	-0.348
	(0.117)	(0.170)	(0.285)
Announcements for t+3	-0.222*	-0.731***	0.508**
	(0.131)	(0.238)	(0.203)
Lag of announcements for t+2	-0.296**		
	(0.129)		
Observations	575	560	544
Number of Countries	16	16	16
Within R^2	0.535	0.330	0.239
F-Statistic	1491	30.85	79.96

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1