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The Macroeconomic Effects of Tax Reform: Evidence from the EU

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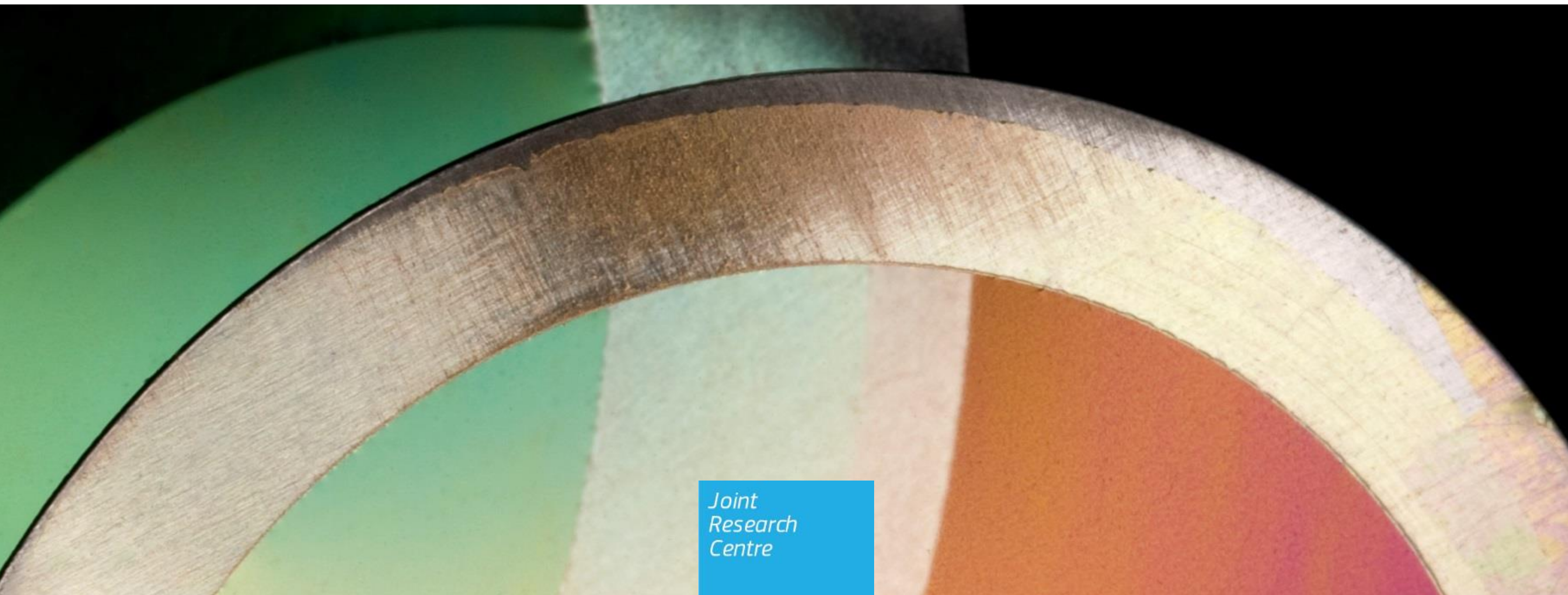

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The Macroeconomic Effects of Tax Reform: Evidence from the EU

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Abstract

This paper examines the macroeconomic effects of tax changes in the EU between 2000 and 2016. The novelty of our approach hinges on the use of real-time estimates of discretionary fiscal adjustments, covering personal income taxes, social insurance contributions, corporate income taxes and value added taxes. In particular, exploiting a unique database covering anticipated and unanticipated tax reforms in the EU, we provide the first narrative estimates of output and employment multipliers for tax reforms in the EU. Our results suggest that medium-term revenue-based output multipliers are in the range of -1.8 for unanticipated and -2.3 for anticipated reforms. Preannounced reforms, moreover, portray larger labour supply responses (by 0.7 percentage points) and temporarily impact economic activity inversely upon announcement. Finally, we find evidence of asymmetry between the effects of revenue increasing and decreasing measures in the EU. On average, revenue-based consolidations resulted in a 1.2 percentage point larger medium-term output multiplier in absolute terms.

Keywords: fiscal multipliers, narrative approach, discretionary tax reform

JEL codes: E62, H30, C32, C33

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1 Introduction

The effects of fiscal policy on economic activity are long-standing debate that resulted in a vast academic literature. In light of the Great recession, the question regained importance and lead the way to new macroeconometric estimates. Despite the ongoing debate, some standard insights have emerged.[1] First, while there is general agreement that fiscal consolidation has a negative effect on GDP in the short-run, the multipliers of tax increases tend to be smaller than for spending cuts. Second, the idea that the impact of the adjustment is conditional on the position within the cycle and the degree of monetary accommodation gained traction.

Identifying the economic impact of fiscal reforms is complicated by various confounding factors, most notably the two-way interaction between fiscal policy and output growth. The empirical literature is typically classified into two strands, based on the resolution of endogeneity problems. Structural models achieve identification by exploiting institutional features of tax and transfer systems (Blanchard and Perotti, 2002) or by introducing sign restrictions derived from economic theory (Mountford and Uhlig, 2009).[2] Alternatively, rather than assuming that shocks are latent variables, narrative approaches identify exogenous sources of variation in fiscal adjustments, i.e. unrelated to macroeconomic conditions, and estimate their effects by regressing observables on those narratively identified policy shocks (e.g. Romer and Romer 2009, 2010).[3]

The objective of this paper is to extend the existing set of estimates with narrative panel vector autoregression (VAR) estimates of discretionary tax reforms in the European Union (EU). In particular, this paper presents the output and employment impact of both anticipated and unanticipated tax reforms. Despite the substantial use of macroeconometric models in the estimation of spending and revenue shocks, following the seminal work of Blanchard and Perotti (2002), studies have mainly documented responses in the US (Romer and Romer, 2010; Favero and Giavazzi, 2007; Auerbach and Gorodnichenko, 2012; Mertens and Ravn, 2012 and 2014) or panels of OECD countries (Guajardo et al., 2014; Kataryniuk and Vallés, 2018; Alesina et al., 2018a and 2018b). Those macro estimates available for the EU

[1]A full review of the recent findings on size of fiscal multipliers is outside the scope of this paper. Moreover, various extensive overviews already exist, including European Commission (2012), Gechert (2015) and Kilponen et al. (2015). Coenen et al. (2012) provide evidence based on structural models.

[2]Imposing a structure may lead the models to be reliable even if there is shock foresight and small sample limitations (Sims, 2012). Nonetheless, structural approaches require assumptions on expectations, e.g. future tax rates, that are often important in shaping the short-run effects.

[3]Mertens and Ravn (2013) employ an estimation strategy that combines both strands using the narrative measure as an instrument for structural identification. See Stock and Watson (2018) for details on the method.

either rely on a structural identification of the fiscal shocks (Burriel et al., 2010), focus on shocks to government spending (Mencinger et al., 2017) or cyclically adjusted budget measures (Carnot and de Castro, 2015; Gechert et al., 2019).[4] Our paper is most closely related to Hondroyiannis and Papaoikonomou (2015), whom apply the narrative shocks constructed by Devries et al. (2011) in a Euro area panel setting.

In contrast to the aforementioned authors, we use a unique database of real-time estimates of the budgetary impact of discretionary tax measures implemented by each EU Member State. Using this real-time database, we construct an indicator variable as common in the narrative identification literature, i.e. we treat comparable, past tax reforms as exogenous shocks. While the number of paper using narrative identification has been growing rapidly (supported by the advances in text mining software, see e.g. Dabla-Norris and Lima, 2018), the lion's share of the literature relies on a limited number of datasets (cf. Devries et al., 2011, Romer and Romer, 2010). Hence, replicating these multipliers using analogous, but different sources is indispensable. In addition, we complement earlier Member State specific, narrative estimates – in particular, Cloyne (2013) for the UK, Gil et al. (2018) for Spain, Hayo and Uhl (2014) for Germany and Pereira and Wemans (2015) for Portugal – with EU-wide macroeconomic responses. Moreover, our database allows us to distinguish between anticipated and unanticipated shocks.

Our results are threefold. First, using a distinctively new dataset, we find fiscal multipliers for EU Member States broadly in line with earlier panel studies for OECD countries, suggesting significant medium-term increases in output as a result of tax cuts. While interesting by itself, confirming earlier, established findings also instils faith in our dataset. Second, further exploiting our unique dataset shows significant differences between unexpected and preannounced fiscal adjustments. Preannounced, but not yet implemented, revenue-based consolidations are found to have a significant, positive impact on output upon announcement. Nonetheless, in combination with their larger negative impact upon implementation, the magnitude of their medium-term output (employment) multipliers is found to be 0.5 (0.7) percentage point larger than for unanticipated reforms. Third, we find evidence of asymmetries between the effects of revenue increasing and decreasing measures in the EU. On average, revenue-based consolidations resulted in a 1.2 percentage point larger medium-term impact on output.

The remainder of this paper is structured as follows. Section 2 presents the macroeconometric specification and data used for identification. Next, Section 3 reports the estimation results. Section 4 concludes.

[4]Arguably, exogenous tax changes are more exogenous than changes in the cyclically-adjusted primary balance previously considered (see e.g. Kataryniuk and Vallés, 2018). For example, the cyclically-adjusted measure likely suffers from measurement error and includes legislated changes in taxes and spending motivated by the business cycle.

2 Data and Methodology

2.1 Methodology

We start by elaborating the dynamic framework commonly used to estimate tax multipliers. The output multiplier follows from a simple regression of changes in output (Δy_t) on changes in tax revenues (ΔT_t) in period t:

$$\Delta y_t = \beta_0 + \beta_1 \Delta y_{t-1} + \beta_2 \Delta T_t + \upsilon_t \tag{1}$$

In equation (1), β_2 can be interpreted as the contemporaneous tax multiplier. Such straightforward interpretation of β_2, nonetheless, is not without problem. The construct ΔT_t is a compound of revenue changes resulting from both endogenous (mainly, non-fiscal policy effects, automatic stabilizers and fiscal policy changes in response to the business cycle) and exogenous, discretionary sources. Even if ΔT_t is measured using the cyclically adjusted revenue adjustments, fiscal policy changes in response to the business cycle pose a problem. The estimates may be clouded due to reversed causality.

Romer and Romer (2010) showed that aforementioned issues can be overcome by estimating

$$\Delta y_t = \beta_0 + \beta_1 \Delta y_{t-1} + \beta_2 x_t + \varepsilon_t \tag{2}$$

instead, where x_t only encompasses the revenue impact of exogenous fiscal reforms.[5]

Two additional adjustments are often considered, either separately or combined. On the one hand, data limitations advocated the use of panel data, typically for a subset of OECD countries. Equation (2), for example, can be estimated in a panel setting as

$$\Delta y_{it} = \beta_1 \Delta y_{t-1} + \beta_2 x_{it} + \varepsilon_{it} \quad \text{with } \varepsilon_{it} = \eta_i + \nu_{it} \tag{3}$$

where η_i represents the country fixed effects and act as an intercept. Time fixed effects, λ_t, may also be introduced. Adding more lags is not unusual and commonly referred to as an autoregressive distributed lag (ADL) model:

$$\Delta y_{it} = \sum_{\tau=1}^{T} \beta_\tau \Delta y_{i\tau-1} + \sum_{\tau=0}^{T} \beta_\tau x_{it-\tau} + \varepsilon_{it} \tag{4}$$
$$\text{with } \varepsilon_{it} = \eta_i + \nu_{it}$$

[5]In other words, to estimate the multiplier of fiscal policy changes as a whole (ΔT_t), the series x_t measures the exogenous component of the shock, such that the constructed series is correlated with the shock of interest but not with other shocks and can be employed as an instrument for the underlying endogenous series of interest (Hebous and Zimmermann, 2018).

On the other hand, researchers are often interested in more elaborate dynamics. Instead of the single-equation (panel) regression from equation (3), systems of equations are considered. The systems simultaneously estimate the interrelation of multiple variables of interest (e.g. revenues, spending and GDP). A reduced form panel VAR model takes the following form:

$$Y_{it} = \sum_{\tau=1}^{T} F_\tau Y_{it-\tau} + G_0 X_{it} + \varepsilon_{it} \tag{5}$$

where Y_{it} is the vector of macroeconomic variables encompassing economy i at time t, $F_{t-\tau}$ is the vector of coefficients for lag τ of the vector of endogenous variables, vector X_{it} contains the exogenous regressors and ε_{it} is the vector of reduced form residuals. As in (4), lags of vector X_{it} can be included to filter out the impact of reforms implemented in earlier periods.

Identifying the fiscal multipliers by incorporating a variable of exogenous, discretionary fiscal measures such as x_{it} in X_{it} is commonly referred to as narrative identification, since it requires going through a variety of legal documents by hand to construct x_{it}. The lion's share of previous narrative multiplier estimations build on the indicators of fiscal adjustment constructed by Romer and Romer (2010) for the US, Cloyne (2013) for the UK and Devries et al. (2011) for a subset of OECD countries. In contrast, for the construction of our series of past tax reforms comparable across time to identify the exogenous fiscal policy shocks, we use a database of real-time estimates of discretionary tax measures implemented by each EU Member State over the period 2000-2016. Following earlier studies, we compute the aggregate revenue impact of past and present tax measures for each year under consideration. For each measure, the database reports the prospected annual revenue impact for K consecutive years, with K varying across tax changes and Member States. Consequently, we compute the aggregate change in tax revenue in year t by adding up the projected changes in tax revenues for year t of all tax measures adopted between t and $t - K$. Thus, our exogenous (x_{it}) tax shock is defined as:

$$x_{it} = x_{it}^{u} + x_{it}^{a} \quad \text{with } x_{it}^{a} = \sum_{k=1}^{K} x_{it}^{a,t-k} \tag{6}$$

where x_{it}^{u} captures unforeseen tax revenue changes implemented in year t, i.e. that were in all likelihood not anticipated or not perceived likely in any period before t. By contrast, x_{it}^{a} is the sum of tax revenue changes anticipated for year t across all tax measures introduced in year $t - k$ expressed as percentage of GDP in $t - 1$, hereafter referred to as anticipated tax measure. In other words, anticipated measures include those fiscal adjustments in year t whose impact was announced (and thus expected) already in $t-1$ or earlier, e.g. announced gradual reduction in the tax rates or smaller measures part of a multi-year adjustment plan.

While the unexpected shocks are by definition only impacting the economy upon their implementation, anticipated shocks may cause changes in the economy before their implementation. The above specifications capture the economy's response upon implementation and filter out the impact of reforms implemented in earlier periods, but should be extended further to capture those effects prior to implementation. In this we follow Mertens and Ravn (2012), who split the Romer and Romer (2010) database based on anticipation of the reforms, and include $x^{a,t}_{it+\tau}$, which measures the sum of all anticipated tax changes known at date t to be implemented at date $t+\tau$. Consequently, we estimate

$$Y_{it} = \sum_{\tau=1}^{T} F_\tau Y_{it-\tau} + \sum_{\tau=0}^{T} G_\tau X_{it-\tau} + \sum_{\tau=1}^{M} h_\tau x^{a,t}_{it+\tau} + \varepsilon_{it} \tag{7}$$

where X_{it} comprises both the implementation of unanticipated (x^u_{it}) and anticipated (x^a_{it}) reforms as separate series and the inclusion of anticipated, future reforms $x^{a,t}_{it+\tau}$ allows us to capture effects from the announcement date onwards. This is appropriate as anticipated reforms, such as medium-term consolidation plans, entail an implementation lag.

Fiscal adjustments typically are part of a larger reform agenda. Among other things, fiscal reforms may aim to initiate labour market adjustments, e.g. affecting work incentives via in-work benefits and tax shifts away from labour towards pollution and capital. The possible impact on employment and wages codetermines the final macroeconomic impact. Therefore, in what follows, vector Y_{it} is composed of primary government spending (GP_{it}), employment (E_{it}), wage compensation (W_{it}), inflation derived using the GDP deflator (P_{it}), and GDP in real terms (GDP_{it}). GP_t is defined as the sum of public consumption (purchases of goods and services plus compensation of civil servants) and public investment, but excluding interest payments on government debt. Fiscal variables refer to the whole general government sector as defined in ESA 2010 and reported by Eurostat. The GDP deflator is employed to obtain the corresponding variables in real terms. All variables enter the model specification in log differences except the employment and inflation rates, which enter in differences.[6] We employ time-demeaning (i.e. subtract the cross-sectional mean from each variable) to correct for the impact of time fixed effects not adequately accounted for by the endogenous variables, e.g. sudden drops in market confidence as a result of the financial and sovereign debt crisis. Panel-specific fixed effects are removed using

[6]Stationarity of the individual series was confirmed using the Phillips-Perron and augmented Dickey-Fuller unit root tests as well as using the less well-known, but more powerful Dickey-Fuller GLS regressions. The panel was tested for unit roots using the Im-Pesaran-Shin test.

a Helmert transformation, in which we subtract the variable mean over the period $t+1$ through T from its observation at time t. This all leaves us with an unbalanced panel covering the period 1999-2017.

2.2 Data

The Output Gap Working Group (OGWG) of the Economic Policy Committee annually collects data on discretionary tax measures (DTM) by the EU Member States; where a DTM is defined as any legislative or administrative change in policy that has an impact on tax revenues, whether it is already finally adopted or only likely to be implemented. In this regard, the OGWG submits a questionnaire to the Member States, consistent with the information that the Member States are required to report in the context of the assessment of their Stability and Convergence Programmes (SCP).

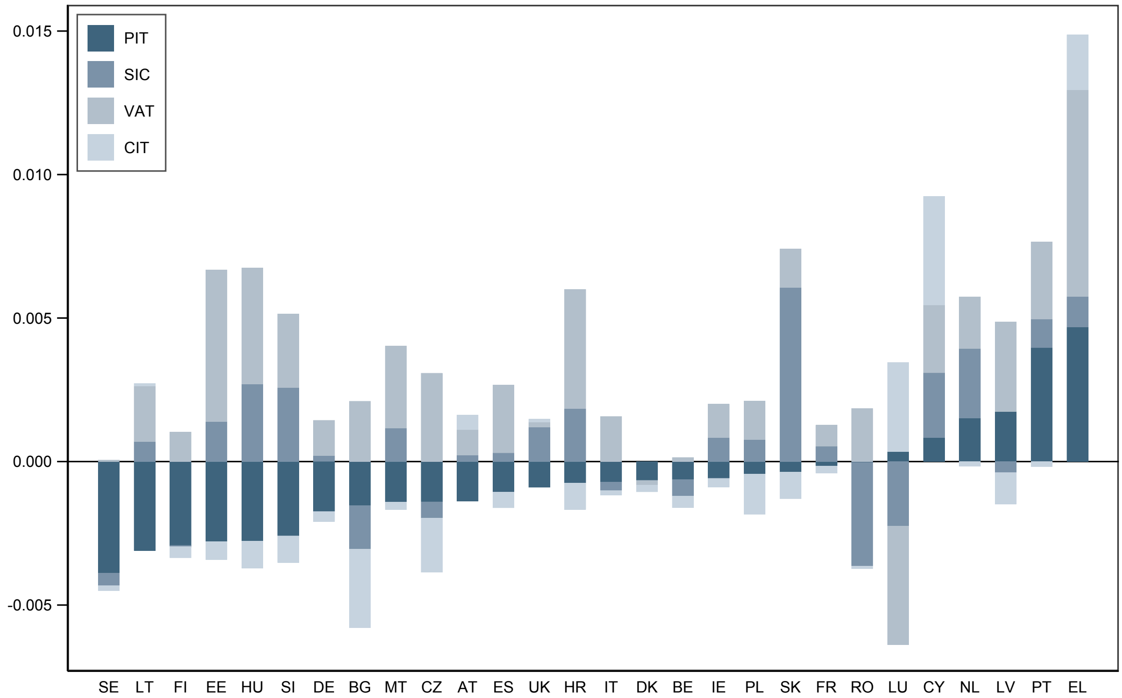
The corresponding database is employed in light of the implementation of the Stability and Growth Pact (SGP). For example, under the preventive arm of the SGP the growth rate of spending net of discretionary revenue measures should not exceed a reference medium-term rate for potential GDP growth. Under the corrective arm, the evaluation of adherence with Council recommendations is based on the budgetary impact of discretionary revenue measures. More generally, interpreting the annual development in the discretionary component of the changes in the budget balance is a key indicator for fiscal surveillance.

The database's original purpose was analytical (see Barrios and Fargnoli, 2010), with a view to sharing a better understanding of DTM patterns over time. For instance, the reported information is more detailed than in the SCPs. DTMs representing at least 0.05 percentage point of GDP in terms of revenue loss or gain are presented as historical time series starting in 2000. Using this database, Barrios and Fargnoli (2010) performed a cross-country comparison of the elasticity of tax revenue with respect to GDP and found evidence of pro-cyclical fiscal policy. More recently, Princen et al. (2013) updated and Mourre and Princen (2019) extended this analysis.

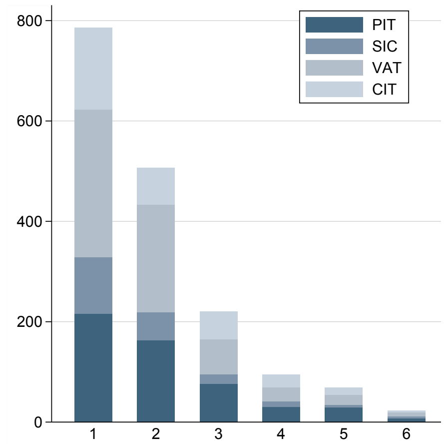
In what follows, we employ the DTM panel data to identify comparable discretionary revenue shocks to be included in the estimation of the macro model. Specifically, we construct a yearly indicator that measures just these reforms. Carnot and de Castro (2015) relied on an earlier vintage of the same database to construct a yearly measure of discretionary fiscal effort to estimate EU-wide multipliers in a limited panel regression set-up. Gechert et al. (2019), in their turn, employ the yearly discretionary fiscal effort aggregates (pooling discretionary revenue measures and spending adjustments) in a two-stage panel regression to gauge the size and persistence of fiscal multipliers in Europe.

It is worth acknowledging that these data are not always readily comparable

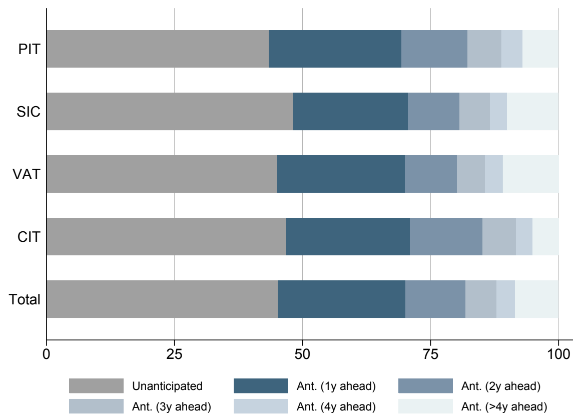
Figure 1: Discretionary revenue measures in 28 EU Member States



(a) Average tax measure as a % of GDP_{t-1} by type and Member State



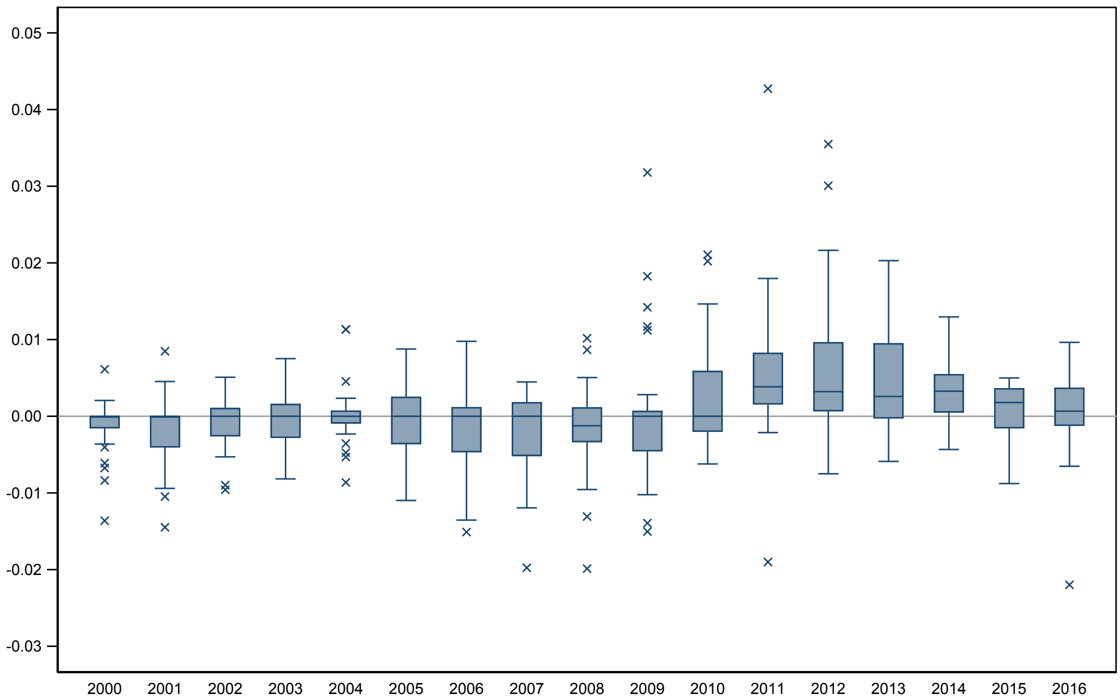
(b) Horizon individual measures



(c) Anticipation horizon of observations

Note: The narrative shocks measure discretionary reforms to personal income taxes, social insurance contributions, corporate income taxes and value added taxes as specified by the Member State, based on the latest available data vintage (2016) at the time of writing.

Figure 2: Aggregate country-year shocks to tax revenues (as a % of GDP_{t-1})



Note: The narrative shocks measure discretionary reforms to personal income taxes, social insurance contributions, corporate income taxes and value added taxes as specified by the Member State, based on the latest available data vintage (2016) at the time of writing.

across countries. While the data comprises the revenue impact expected by the Member States, the approach used to estimate the revenue impact is left unspecified. Therefore, it is a limitation of our data. However, for our estimates we are interested in what member states expect to be the revenue impact of the discretionary reforms. In the end, households and firms are, on average, likely to disregard methodological concerns in their decisions and behaviour and focus on the magnitude reported.

It is important to remark that we are analysing permanent tax shocks, since temporary and permanent fiscal measures may have different effects. For example, in standard New Keynesian models permanent tax hikes are much more contractionary than temporary ones (see e.g. Erceg and Lindé, 2013). Hence, at the outset of our analysis we went through all the detailed disaggregated measures covered by the DTM to exclude those that were reversed or expected to be reversed within the foreseeable future.

We identified 1754 individual permanent tax measures over the period 2000-2016.[7]

[7] See online Appendix A.1 for detailed descriptives of the measures covered by our data.

Aggregating the individual observations by revenue type for each Member State in a specific year results in country and year specific shocks to tax revenues. These aggregate revenue changes are distributed relatively equal over the different revenue types: 331 country and year specific observations for PIT, 213 for SIC, 288 for CIT, and 364 for VAT. The means of these measures by country and type are illustrated in Figure 1 (a). On average, PIT cuts outweighed hikes, while SIC and VAT were predominantly increased.

While a large portion of individual measures (44%) is recorded to only impact revenues once, for a narrow majority the impact is spread over two or more years (e.g. due to phasing of the reforms), as illustrated in panel (b) of Figure 1. Moreover, this trend seems to be comparable across revenue sources when splitting up all observations by horizon of anticipation, see panel (c) of Figure 1.

Next, the type-specific observations can be aggregated further into country-year shocks for total tax revenues.[8] Figure 2 illustrates the distributions of the resulting 486 total discretionary tax changes in all 28 EU Member States over the period 2000-2016.[9] Overall, the discretionary measures (relative to the previous year's GDP) indicate a slightly procyclical trend.[10] More than half (58%) of aggregate tax revenue adjustments in our data are revenue increasing. The median adjustment is 0.07% of GDP and the average is 0.10% of GDP, with a standard deviation of 0.73 pp. The range runs from -2.20% to 4.27% of GDP.

2.3 Predictability

As described in section 2.1, our method of identification relies on exogenous sources of variation. Rather than assuming the shocks are latent variables, we identify fiscal policy shocks in our model by treating comparable, past discretionary tax reforms as exogenous shocks. Hence, the fiscal adjustments identified using our narrative database are assumed to be unrelated to the prevailing macroeconomic conditions. This assumption can be tested straightforwardly by gauging the predictability of the narrative fiscal adjustments.

First, we report the results of an F-test of the joint significance of the macro variables on their association with the legislated tax shocks. Since outcomes depend

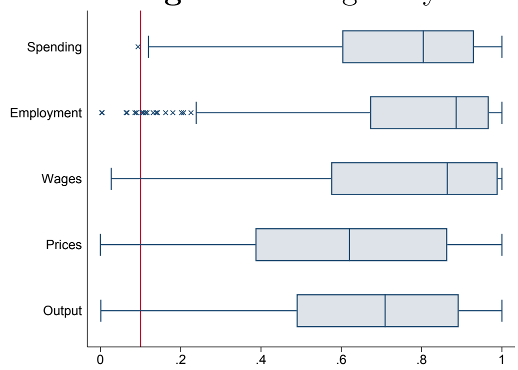
[8] A breakdown of all country-year aggregates by revenue source, sign and subsample can be found in the Online Appendix.

[9] The panel is unbalanced as DTM recordings for Bulgaria, Estonia, Greece, Malta, Slovenia and Slovakia do not cover the full period, and are particularly limited for Cyprus, Croatia, Hungary, Luxembourg and Romania.

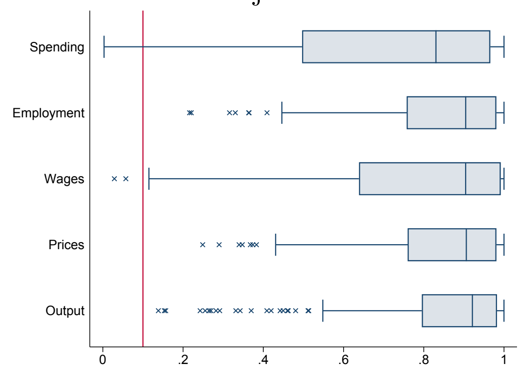
[10] The empirical evidence on the cyclicality of discretionary fiscal policy in the EU remains inconclusive. Findings range from procyclicality (Galí and Perotti, 2013) in run-up to the EMU as well as afterwards (Candelon et al., 2010) to countercyclical (Cimadomo, 2012), especially in good times, when using real-time data.

on the regression specification, rather than reporting one point estimate and corresponding standard error, we report the distribution of the test results over a large number of valid specifications; thereby, ensuring robustness of the conclusions. In particular, varying the regressors, instruments, number of lags and standard errors computation we obtain around three thousand F-statistic and p-value pairs. Their distribution is displayed in Figure 3, with the red vertical line indicating the 10% cut off. The rightward skewedness of the distribution leads us to conclude that the lags of our macro variables do not seem to be correlated with the indicator variable.

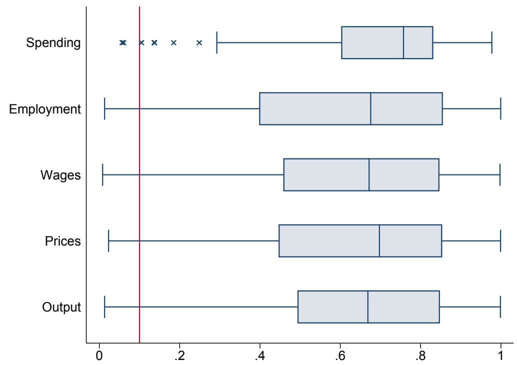
Figure 3: Exogeneity tests of narrative fiscal adjustments



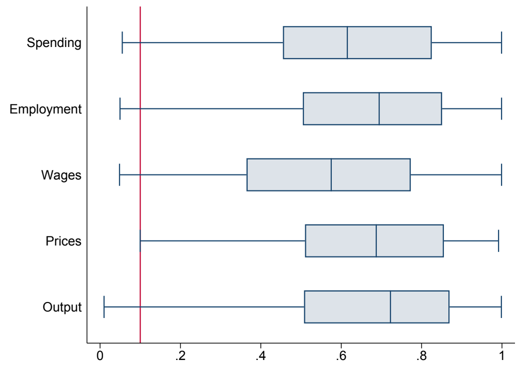
(a) F-test: Anticipated



(b) F-test: Unanticipated



(c) Weak exogeneity: Anticipated



(d) Weak exogeneity: Unanticipated

Note: The figures show the distribution of the p-values across a vast set of possible specifications for the respective tests. For the F-test, the null hypothesis assumes that the coefficients of the distributed lags of each regressor are jointly zero. The dependent variable is the narrative indicator of exogenous tax measures and we include up to four lags of the indicator and the respective macro variables. For the weak exogeneity test, the null hypothesis is that the covariance matrix is diagonal.

Second, as observed by Alesina et al. (2018a), estimation of a dynamic time-series model only requires weak exogeneity, which is different from a lack of the predictability commonly tested. Similarly, Figure 3 displays the weak exogeneity test results for our model, showing it holds in the large majority of specifications for each of the impulse-responses considered.

Third, following Cloyne (2013), we report the Granger causality test results of over five thousand possible VAR specifications, varying the number of lags, endogenous regressors, instruments and type of standard errors. While the median of most tests' p-value remains above the 10% cut off, the test results are skewed towards the lower end of the spectrum. To further understand these findings, we additionally estimate ordered probit regressions to perform Likelihood Ratio tests in the spirit of Mertens and Ravn (2012), i.e. to test the predictability of the sign of the discretionary tax measures. Most importantly, prior macro conditions seem to have some predictive power about the sign of the unexpected tax measures, but little to none for anticipated measures.

In brief, while there is suggestive evidence lessening the exogeneity of (unexpected) fiscal adjustments, no variable in our data consistently predicts the indicator variable over all tests. This finding is in line with Granger causality and probit-based Likelihood Ratio tests performed on comparable datasets. For instance, using the narrative data from Devries et al. (2011), Hernández de Cos and Moral-Benito (2016) argued that tax-based consolidations are unpredictable. Spending cuts, on the other hand, could be predicted.

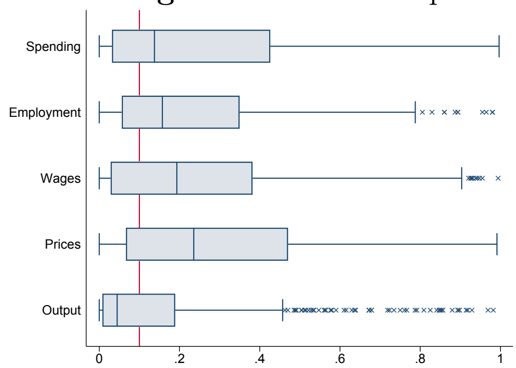
3 Results

3.1 Unanticipated and Anticipated Shocks

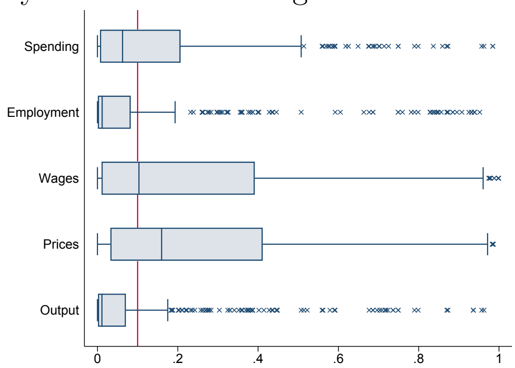
Anticipated shocks can generate fundamentally different responses from unexpected changes in fiscal policy, see e.g. House and Shapiro (2006) and Mertens and Ravn (2012). The reasoning behind this is simple: while unanticipated tax cuts tend to lead to immediate output increases, anticipated cuts can be associated with decreases in economic activity due to firms' and consumers' decisions to postpone investment and consumption until the actual implementation.

Figure 5 summarizes the output effect of an unanticipated 1 per cent of GDP increase to tax revenues in the full panel of EU Member States, using the model specified in (7). The figure shows both the contemporaneous and cumulative impulse-response functions. The cumulative multiplier for a given year is obtained as the ratio of the cumulative response of GDP and the cumulative response of (discretionary) tax revenues. The panel VAR results suggest that a medium-term deterioration of GDP growth by 1.83 percentage points can be expected as Member States increase

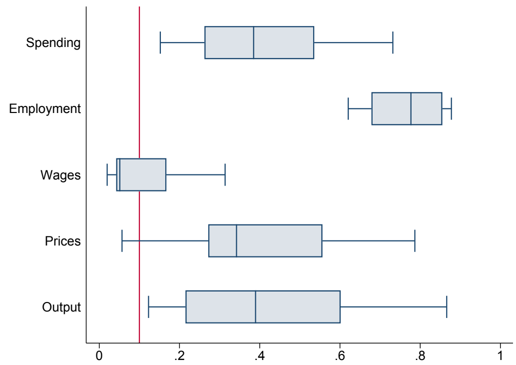
Figure 4: Predictive power by macroeconomic regressor



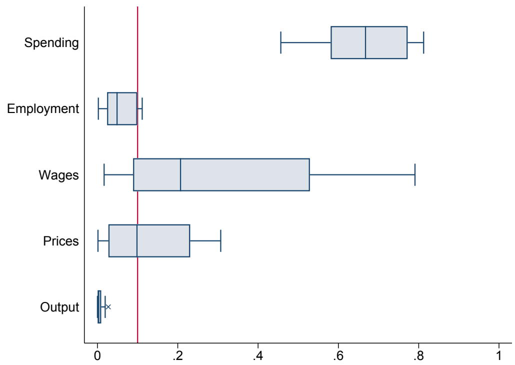
(a) Granger: Anticipated



(b) Granger: Unanticipated



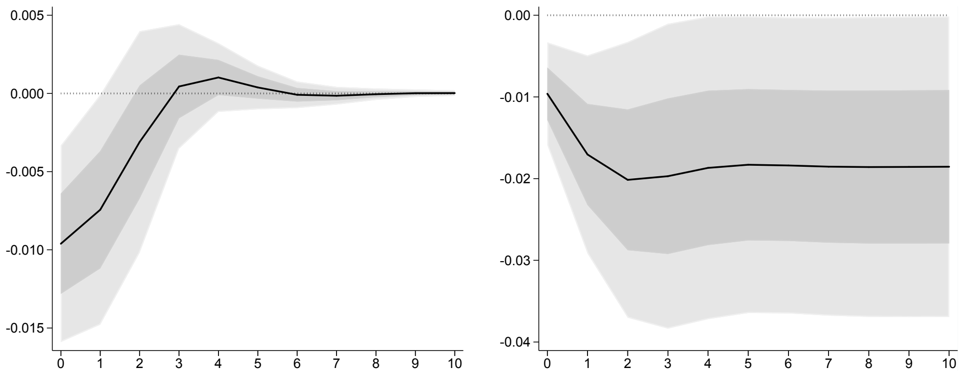
(c) Probit LR Test: Anticipated



(d) Probit LR Test: Unanticipated

Note: The figures show the distribution of the p-values across a vast set of possible specifications for the respective tests. The null hypothesis assumes that the coefficients of the distributed lags of each regressor are jointly zero. The dependent variable is the narrative indicator of exogenous tax measures. Up to four lags of the indicator and the respective macro variables are included.

Figure 5: Output response to an unanticipated 1% of GDP shock to tax receipts



(a) Contemporaneous **(b)** Cumulative

Note: The reported confidence intervals for the cumulative dynamic multiplier functions are the 68% and 95% confidence intervals based on 2,000 Monte Carlo draws using Gaussian approximation.

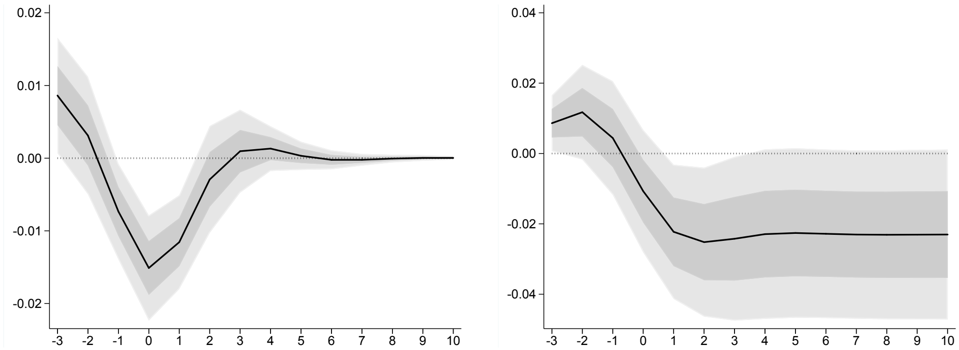
tax receipts by one percent of GDP.[11] Full details are reported in Table 1.

Figure 6, on the other hand, shows the output response to an anticipated 1 per cent of GDP increase to tax revenues in our panel of EU Member States. Again, our results suggest that a medium-term deterioration of GDP growth can be expected as Member States increase tax receipts. Nonetheless, we observe two key differences with respect to unanticipated tax reforms. First, the overall GDP response is found to be larger for anticipated tax increases. For example, for the full sample of EU Member States it cumulates to -2.26 percentage points after five years (see Table 1) and reaches -2.51 when restricting the sample to the EU15. The output multipliers by subsample are reported in Appendix. Second, we observe a significant impact of anticipated tax reforms from the moment of their announcement. Specifically, the announcement of a tax increase tends to boost economic activity temporarily, while the impact upon implementation of the reform remains negative. One possible reasoning behind this is that, agents consume before the permanent tax hike hits or, in case of tax cuts, postpone consumption until taxes decrease. Alternatively, the announcement of consolidation measures may (temporarily) boosts confidence in debt-reliant economies. Beetsma et al. (2015), nonetheless, find evidence that (consumer) confidence falls around the announcement of (revenue-based) consolidation measures.

In keeping with the literature, our results should be interpreted as the average

[11]The cumulative GDP multiplier increases to -2.15 when we exclude countries that benefited from financial assistance programmes during the time horizon covered by our data. This condition excludes Cyprus, Greece, Hungary, Ireland, Latvia, Portugal, Romania and Spain from our sample.

Figure 6: Output response to an anticipated 1% of GDP shock to tax receipts from announcement onwards



(a) Contemporaneous **(b)** Cumulative

Note: The reported confidence intervals for the dynamic multiplier functions are the 68% and 95% confidence intervals based on 2,000 Monte Carlo draws using Gaussian approximation.

effects of exogenous tax changes. The magnitude of our estimates for unexpected reforms is in line with earlier narrative estimates of tax multipliers in high-income countries. For instance, in their seminal work Romer and Romer (2010) find a medium-term multiplier of almost -3 for US taxes.[12] Cloyne (2013), in its turn, finds UK output multipliers to be around -0.6 percent on impact and -2.5 percent over three years. Similarly, Hayo and Uhl (2014) find cumulative output multipliers up to -2.4 in response to a revenue increase in Germany. Finally, Gil et al. (2018) present suggestive evidence that a 1% of GDP increase in tax liabilities affects Spanish output less than is generally found in the narrative literature, with output (per capita) falling by up to 1.3 percent after 1 year.

Our findings moreover confirm earlier panel studies. Using a subset of OECD countries, Guajardo et al. (2014) find a contractionary output impact of about 1.5 percentage points three years after a one percent of GDP tax hike. More recently, Kataryniuk and Vallés (2018) extended this analysis to cover more countries. Using a panel VAR they also find a medium-term multiplier of -1.50 for narrative revenue shocks, which increases further to -2.32 if only large consolidations (i.e. greater than 1% of GDP) are considered. Applying the same database of narrative shocks but limiting the panel to the Euro area, Hondroyiannis and Papaoikonomou (2015) find an output multiplier of -1.59 for revenue increases.[13]

[12] Mountford and Uhlig, 2009 come to a relatively similar conclusion (-2.35) using sign restrictions.

[13] Burriel et al. (2010) apply a structural identification in line with Blanchard and Perotti (2002) to data for the Euro area. They find a multiplier of -0.63 after four quarters and similar, yet insignificant afterwards. Higher and insignificant multipliers for tax-based measures are not uncommon

Similar to the findings of Mertens and Ravn (2012) for the US, we find that pre-announced, but not yet implemented, tax hikes give rise to expansions in output. Upon implementation of the tax hikes, we observe a drop in economic activity for the full panel, leading to negative cumulative multipliers in the medium term. To the best of our knowledge, at the moment of writing there are no comparable narrative estimates for Europe we can compare our results to, especially not where anticipated and unanticipated reforms are considered separately. Closest may be the work by Alesina et al. (2018a) and Alesina et al. (2018b) on medium-term consolidation plans. Using a subset of OECD countries, they find medium-term output multipliers between -0.75 and -1.50 for tax-based consolidation plans.[14]

Our results show that, in the medium term, tax cuts can result in higher output, prices and wages. The tax reforms do not seem to drive medium-term public spending adjustments. The full macroeconomic responses for both unanticipated and anticipated found using our model are summarized in Table 1.

Overall, by increasing the after-tax return from working, saving, and investing, a reduction in income tax rates has two opposing effects on economic activity. It encourages work effort (substitution effect), which increase economic activity, but it also reduces their need to work, save, and invest (income effects). The short, medium and long-term effect on the economy depends on the financing of the personal income tax cut, in terms of possible increases in less distorting taxes, a reduction in government spending or higher government borrowing.[15]

Firstly, in accordance with conventional wisdom, labour supply responses to an anticipated tax change are found to be bigger than the responses to unanticipated changes, since the income effect is expected to shut down in the anticipated case. Secondly, the size of the labour market responses found, is in line with earlier empirical findings. For instance, Mertens and Ravn (2013) included labour market effects – employment and hours worked – in their analysis of personal income tax (PIT) and corporate income tax (CIT) changes in the US. They find that a 1 percentage point cut of the average PIT rate raise employment per capita by 0.3 percentage points on impact, peaking at 0.8 percentage points after five quarters.[16] Woo et al. (2016)

using structural identification, likely because the definition of the shocks markedly differs.

[14] In their application to Spain, Gil et al. (2018) do differentiate between surprise and anticipated tax changes following the specification of Mertens and Ravn (2012). Nonetheless, an increase in anticipated taxes yields no effect on output after being implemented, while an unexpected tax increase triggers a fall in GDP close to their baseline estimates (1.3). Moreover, the contractionary, preimplementation effect on output they find is not robust to changes in the anticipation horizon.

[15] See Gale and Samwick (2017) for a detailed discussion of the channels through which income tax changes affect economic performance.

[16] Together with their results for the limited impact on participation (via hours worked), the result for employment lead Mertens and Ravn (2013) to conclude that a 1 percentage point cut of the average PIT rate decreases unemployment by 0.3 percentage points on impact and reaches a

Table 1: Macroeconomic effects of unanticipated and anticipated tax reforms

		Unanticipated				
		Impact	1y	3y	5y	Cum.
Primary spending		-0.63	-0.09	-0.19	0.02	-1.17
		(0.84)	(0.82)	(0.26)	(0.09)	(1.85)
Employment		-0.29**	-0.23*	0.05	0.04*	-0.33
		(0.15)	(0.15)	(0.08)	(0.04)	(0.37)
Wages		-0.70*	-1.23***	0.05	-0.01	-2.40*
		(0.68)	(0.62)	(0.27)	(0.09)	(1.48)
Prices		-0.13	-0.44*	-0.20	0.05	-1.21*
		(0.38)	(0.40)	(0.22)	(0.08)	(1.00)
Output		-0.96***	-0.74***	0.04	0.04	-1.83***
		(0.32)	(0.37)	(0.20)	(0.07)	(0.93)
		Anticipated				
	Announc.	Impact	1y	3y	5y	Cum.
Primary spending	0.71*	-0.46	-1.55***	-0.36*	0.01	-1.31
	(0.59)	(0.85)	(0.76)	(0.31)	(0.12)	(1.85)
Employment	-0.26*	-0.64***	-0.14	0.11	0.06*	-1.03**
	(0.24)	(0.19)	(0.16)	(0.11)	(0.04)	(0.57)
Wages	1.37***	-0.73*	-2.33***	-0.07	-0.05	-1.63
	(0.65)	(0.66)	(0.63)	(0.32)	(0.12)	(1.66)
Prices	-0.41	-1.06***	-0.47*	-0.34*	0.08	-2.15*
	(0.54)	(0.46)	(0.45)	(0.28)	(0.11)	(1.43)
Output	0.86***	-1.51***	-1.16***	0.10	0.03	-2.26**
	(0.40)	(0.37)	(0.33)	(0.29)	(0.10)	(1.23)

Note: Except the cumulative multipliers after five years reported in the last column, all values are contemporaneous multipliers. Standard errors are noted in parentheses and are based on 2,000 Monte Carlo draws using Gaussian approximation. Asterisks indicate significance of the estimate, referencing 68% (*), 90% (**) and 95% (***) confidence intervals.

present panel data evidence for the OECD that a 1 percent of GDP consolidation increases unemployment by 0.19 percentage points in the same year and 1.5 percentage points cumulative over 5 years. In the same vein, Holden and Sparrman (2018) find that an increase in real government purchases of 1 percent of GDP reduces unemployment by 0.3 percentage points in the same year, conditional on the labour market institutions.

3.2 Tax Hikes and Cuts

Next, we analyse possible asymmetries between tax revenue increases and decreases. In addition to the possibility of structural differences in the type of measures taken, there is suggestive empirical evidence of asymmetries (see Jones et al., 2015 for tax and Barnichon and Matthes, 2016 with regards to spending multipliers). To this purpose, we follow the relatively straightforward differentiation applied by Cover (1992) to monetary policy and extended to fiscal multiplier by Jones et al. (2015). In particular, we create separate time series of the indicator variables based on their sign. We define the variable x_{it}^{u+} as the observed shock to total tax receipts if x_{it}^{u} is positive and zero otherwise. Similarly, we create the variable x_{it}^{u-} as the shock if x_{it}^{u} is negative and zero otherwise. The same procedure is applied for the aggregate indicator of anticipated reforms. Next, both series are included in the model simultaneously to assure unbiased estimates of their effects. Hence, in what follows, we estimate the following system of equations:

$$Y_{it} = \sum_{\tau=1}^{T} F_\tau Y_{it-\tau} + \sum_{\tau=0}^{T} g_\tau^- x_{it-\tau}^- + \sum_{\tau=0}^{T} g_\tau^+ x_{it-\tau}^+ + \sum_{\tau=1}^{M} h_\tau x_{it+\tau}^{a,t} + \varepsilon_{it} \tag{8}$$

capturing the asymmetric responses for the full sample. The results are shown in shown in Figure 7 and Table 2. On average, revenue-based consolidations resulted in a 1.2 percentage point larger medium-term impact on output. Nonetheless, while the results show clear differences in the level of the output responses, the overall dynamics of the response functions are found to be comparable. Notably, the peak impact of a tax cut follows one year after impact instead of upon impact, unlike for tax hikes.

In line with the previous section, we continue by splitting up the responses by their degree of anticipation:

$$Y_{it} = \sum_{\tau=1}^{T} F_\tau Y_{it-\tau} + \sum_{\tau=0}^{T} g_\tau^{u-} x_{it-\tau}^{u-} + \sum_{\tau=0}^{T} g_\tau^{u+} x_{it-\tau}^{u+} + \sum_{\tau=0}^{T} g_\tau^{a} x_{it-\tau}^{a} + \sum_{\tau=1}^{M} h_\tau x_{it+\tau}^{a,t} + \varepsilon_{it} \tag{9}$$

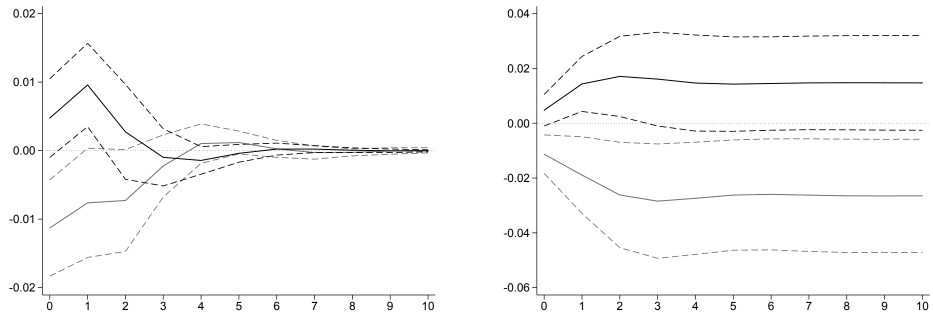
maximum decrease of about 0.5 percentage points in the fifth quarter.

Table 2: Asymmetric macroeconomic effects of discretionary tax reforms

	Impact	1y	3y	5y	Cum.
Tax Decrease					
Primary spending	-0.02	0.26	0.41*	-0.04	0.93
	(0.95)	(0.67)	(0.30)	(0.13)	(1.76)
Employment	-0.16	0.12	-0.07	-0.05*	-0.22
	(0.20)	(0.17)	(0.09)	(0.03)	(0.43)
Wages	0.31	1.22**	-0.07	0.02	1.98*
	(0.92)	(0.72)	(0.33)	(0.11)	(1.68)
Prices	-0.56	0.71*	0.20	-0.06	1.48*
	(0.65)	(0.64)	(0.24)	(0.08)	(1.16)
Output	0.47*	0.96***	-0.10	-0.04	1.43*
	(0.36)	(0.36)	(0.26)	(0.08)	(1.07)
Tax Increase					
	Impact	1y	3y	5y	Cum.
Primary spending	-1.62*	-1.77**	-0.41*	-0.10	-3.63*
	(1.07)	(1.03)	(0.36)	(0.17)	(2.28)
Employment	-0.66***	-0.09	-0.02	0.07*	-0.73*
	(0.21)	(0.19)	(0.09)	(0.05)	(0.46)
Wages	-0.49	-2.29***	-0.22	0.07	-3.99**
	(0.97)	(0.92)	(0.38)	(0.15)	(2.10)
Prices	-0.78*	0.13	-0.52**	0.03	-1.88*
	(0.49)	(0.39)	(0.30)	(0.13)	(1.21)
Output	-1.13***	-0.76*	-0.22	0.12	-2.62***
	(0.42)	(0.50)	(0.27)	(0.12)	(1.24)

Note: Except the cumulative multipliers after five years reported in the last column, all values are contemporaneous multipliers. Standard errors are noted in parentheses and are based on 2,000 Monte Carlo draws using Gaussian approximation. Asterisks indicate significance of the estimate, referencing 68% (*), 90% (**) and 95% (***) confidence intervals.

Figure 7: Output response to a 1% of GDP decrease (black) and increase (grey) in tax receipts



(a) Contemporaneous **(b)** Cumulative

Note: The reported confidence intervals for the dynamic multiplier functions are the 90% confidence intervals based on 2,000 Monte Carlo draws using Gaussian approximation.

$$Y_{it} = \sum_{\tau=1}^{T} F_\tau Y_{it-\tau} + \sum_{\tau=0}^{T} g_\tau^{a-} x_{it-\tau}^{a-} + \sum_{\tau=0}^{T} g_\tau^{a+} x_{it-\tau}^{a+} + \sum_{\tau=0}^{T} g_\tau^{u} x_{it-\tau}^{u} + \sum_{\tau=1}^{M} \sum_{j\in(-,+)} h_\tau^{j} x_{it+\tau}^{aj,t} + \varepsilon_{it} \tag{10}$$

As summarized in Table 3, we observe markedly different results for increases and decreases in tax receipts. We find that surprise decreases in tax revenues boost economic activity by 1 percentage point on impact and up to 2.2 percentage point after 5 years, while their anticipated counterparts are not found to be significant. Anticipated revenue-based consolidations, on the other hand, are found to have a contractionary impact – in fact, almost a percentage point more than the unanticipated cuts boosted output – in the medium-term. We do not find a significant impact of unanticipated hikes. One possible explanation for the differences in magnitude may be the overall design of the reforms covered by both categories.[17]

Interestingly, our results may explain the discrepancies between US and UK tax multipliers found by Jones et al. (2015). They find that in the US tax cuts have large, positive output effects, while tax increases are not found to be significant. For the UK, they find a significant impact from tax increases, but not from tax cuts. Given our findings, this discrepancy may be explained based on the degree of anticipation inherent to the tax reforms implemented in both countries. Particularly, their results for US tax measures seem to be consistent with unanticipated reforms, while their

[17] The differences in results are unlikely to be driven by an over-representation of one type over another in the data, as illustrated by the scatter plots in Appendix.

Table 3: Asymmetric output multipliers for discretionary tax reforms

	Announc.	Impact	1y	3y	5y	Cum.
Revenue decrease:						
Unanticipated		1.03***	1.20***	-0.14	-0.06	2.23*
		(0.47)	(0.47)	(0.32)	(0.11)	(1.39)
Anticipated	0.04	0.22	0.56*	-0.17	-0.00	-0.36
	(0.38)	(0.56)	(0.51)	(0.42)	(0.10)	(2.14)
Revenue increase:						
Unanticipated		-0.71*	-0.27	-0.18	0.02	-1.50
		(0.62)	(0.74)	(0.37)	(0.12)	(2.03)
Anticipated	1.55***	-2.46***	-1.39***	0.15	0.07	-3.08*
	(0.66)	(0.68)	(0.62)	(0.41)	(0.14)	(2.93)

Note: Except the cumulative multipliers after five years reported in the last column, all values are contemporaneous multipliers. Standard errors are noted in parentheses and are based on 2,000 Monte Carlo draws using Gaussian approximation. Asterisks indicate significance of the estimate, referencing 68% (*), 90% (**) and 95% (***) confidence intervals. The complete, corresponding macroeconomic effects for each type of shock are reported in Appendix.

results for the UK tend to suggest a certain degree of anticipation.

4 Conclusion

The budgetary and macroeconomic impact of fiscal policy reforms has become a topic of intense debate in the Euro area. First, fiscal policy remains the key macroeconomic policy lever Member States avail of in order to counter adverse economic shocks and to possibly foster economic growth. Second, EU fiscal policy surveillance has experienced significant reforms in the wake of the global financial crisis including among others the creation of national fiscal councils conducting independent assessments of national fiscal reforms. In this context growing attention has been paid to discretionary tax measures taken by Member States in order to assess fiscal policy stances in an accurate way. However, the ex-ante assessment of discretionary tax measures is notoriously difficult. It must clearly identify the channels through which these might impact the economy, especially so in the case of tax cuts intended to foster economic activity.

In this paper, we contribute to this debate in two important ways. First, by exploiting a rich database including information on discretionary tax measures, we construct a new narrative indicator variable in order to estimate the economy-wide effects of tax reforms in the EU. In particular, we provide the first narrative estimates of output and employment multipliers for revenue-based reforms in the EU; thereby complementing a growing literature of Member State specific, narrative estimates and structurally identified responses to fiscal shocks in the EU and Euro area. Second, we enhance earlier estimates by explicitly accounting for the difference in responses from anticipated and unanticipated changes in fiscal policy.

Our results show that, in the medium term, tax cuts can lead to a more efficient reallocation of resources, resulting in higher output, employment and wages. The magnitude of our multiplier estimates are in line with earlier narrative estimates of tax multipliers in high-income countries, ranging from -1.8 for unanticipated to -2.3 for anticipated reforms. Furthermore, we confirm that preannounced but not yet implemented tax hikes give rise to expansions in output in the EU, in line with earlier findings for the US, and that the labour supply responses to an anticipated tax reform are bigger than for unanticipated changes. Finally, we find evidence of asymmetry between the effects of revenue increasing and decreasing measures in the EU. On average, revenue-based consolidations resulted in a 1.2 percentage point larger medium-term impact on output.

These findings demonstrate some clear policy implications. In particular, our results highlight the importance of the design of the discretionary tax reforms implemented by Member States. Our estimates based on European data for the last two decades seem to suggest that tax cuts and hikes differed in their absolute macroeconomic impact. This also points to a need to look more closely into these reforms to inform ourselves of what design features lay at the heart of their different effects on economic activity. Anticipated and unanticipated tax cuts and hikes seem to have been almost equally common in the EU over the last two decades. Nonetheless, the degree of planning and anticipation seems to have impacted the effectiveness of tax cuts and hikes asymmetrically. One possible direction for further research could be to extend the existing set of narrative multipliers to a more granular level by decomposing the total change in tax receipts by revenue source. Similarly, differences could be explained by distinguishing between tax rate and base changes. Finally, directly modelling for spillover effects among Member States could be imagined.

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A Appendix

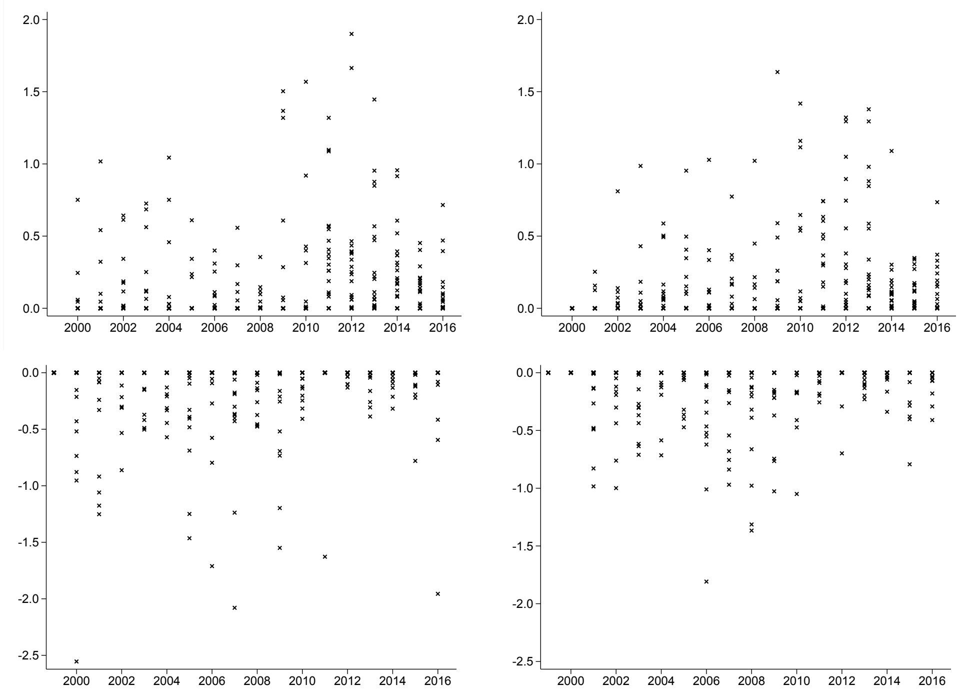
A.1 Database Descriptives

Table 4: Descriptives Discretionay Tax Measures Database

	PIT	**SIC**	**VAT**	**CIT**	**TOTAL**
Individual DTM measures					
Min	-1.29%	-1.51%	-1.63%	-1.20%	-1.63%
Mean	-0.02%	0.02%	0.05%	-0.01%	0.01%
Max	1.27%	2.33%	1.15%	0.82%	2.33%
Standard Deviation	0.18%	0.23%	0.15%	0.15%	0.17%
No. Observations	1257	483	1477	743	3960
No. Measures	539	216	659	340	1754
Country-year aggregates					
Min	-1.71%	-1.51%	-1.75%	-1.36%	-2.20%
Mean	-0.09%	0.04%	0.19%	-0.03%	0.10%
Max	2.20%	2.06%	2.82%	0.82%	4.27%
Standard Deviation	0.40%	0.35%	0.37%	0.24%	0.73%
No. Observations	331	213	364	288	388
of which are: <0	*137*	*133*	*279*	*125*	*224*
>0	*194*	*80*	*85*	*163*	*164*
Country-year aggregates, by type					
Anticipated	253	142	272	207	327
Unanticipated	206	114	245	161	308
Tax cuts	265	114	196	215	343
Tax hikes	224	167	331	173	355

Notes: Variables expressed as a % of lagged GDP. Table constructed excluding zero-valued observations.

Figure 8: Observed tax shocks across the EU by type (as a % of GDP_{t-1})



(a) Unanticipated **(b)** Anticipated

Table 5: Composition of Country-year Aggregates

A. Standalone measures

	Number			Mean		
	All	Hike	Cut	All	Hike	Cut
PIT	8	2	6	-0.11%	0.04%	-0.16%
SIC	4	1	3	-0.15%	0.08%	-0.23%
VAT	23	19	4	0.05%	0.07%	-0.06%
CIT	9	4	5	-0.11%	0.06%	-0.25%
Total	44	26	18	-0.03%	0.07%	-0.18%

B. Packages

B.1 All components

	Number			Mean		
	All	Hike	Cut	All	Hike	Cut
PIT	325	136	189	-0.06%	0.07%	-0.15%
SIC	209	132	77	0.01%	0.11%	-0.15%
VAT	341	260	81	0.06%	0.10%	-0.07%
CIT	280	121	158	-0.04%	0.07%	-0.12%
Total	1155	649	505	-0.01%	0.09%	-0.13%

B.2 Average composition

	EU	EU15	2nd Gen.	Cuts	Balanced	Hikes
PIT	33%	37%	26%	46%	28%	23%
SIC	15%	14%	17%	13%	17%	17%
VAT	33%	28%	41%	19%	33%	43%
CIT	19%	21%	16%	22%	22%	17%
Total	100%	100%	100%	100%	100%	100%

Notes: Packages are defined as country-year aggregates in which measures were implemented for more than one revenue category. Averages are for individual measures (as % of lagged GDP) on a yearly basis. The composition illustrates the average weight of the different tax types in the packages. Packages are considered balanced when their overall impact is between -0.1% and 0.1% of GDP.

A.2 Additional Model Output

Table 6: Output multipliers (by subsample)

			Unanticipated			
		Impact	1y	3y	5y	Cum.
EU		-0.96***	-0.74***	0.04	0.04	-1.83***
		(0.34)	(0.36)	(0.19)	(0.07)	(0.93)
EU, excl. progr.		-1.14***	-1.22***	0.22	0.23*	-2.15***
		(0.40)	(0.52)	(0.36)	(0.20)	(1.00)
EMU		-1.04**	-0.18	0.49*	-0.18	-0.27
		(0.59)	(0.57)	(0.38)	(0.25)	(1.30)
EU15		0.51*	0.12	-0.28	0.22	0.42
		(0.49)	(0.60)	(0.39)	(0.29)	(1.31)
2nd generation		-0.56**	0.11	0.02	0.01	-0.35
		(0.33)	(0.34)	(0.21)	(0.06)	(0.91)
			Anticipated			
	Announc.	Impact	1y	3y	5y	Cum.
EU	0.86***	-1.51***	-1.16***	0.10	-0.02	-2.28***
	(0.41)	(0.36)	(0.30)	(0.28)	(0.06)	(1.12)
EU, excl. progr.	0.27	-0.64*	-0.43*	0.26	-0.06	-1.46*
	(0.42)	(0.46)	(0.38)	(0.27)	(0.10)	(1.08)
EMU	0.66*	-1.15***	-0.76**	0.13	-0.07	-2.36***
	(0.43)	(0.52)	(0.45)	(0.44)	(0.25)	(0.97)
EU15	-0.06	-0.64**	-0.54*	0.05	0.10	-2.51***
	(0.32)	(0.38)	(0.43)	(0.23)	(0.15)	(1.21)
2nd generation	1.93***	-1.80***	-1.05***	0.48*	-0.03	1.16
	(0.48)	(0.45)	(0.46)	(0.33)	(0.10)	(1.70)

Note: Except the cumulative multipliers after five years reported in the last column, all values are contemporaneous multipliers. Standard errors are noted in parentheses and are based on 2,000 Monte Carlo draws using Gaussian approximation. Asterisks indicate significance of the estimate, referencing 68% (*), 90% (**) and 95% (***) confidence intervals. The second generation subsample is the subset of the EU excluding the EU15, i.e. EU Member States that joined from 2004 onwards. In particular, it comprises Bulgaria, Croatia, Cyprus, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Romania, Slovenia and Slovakia.

Table 7: Macroeconomic effects of (un)anticipated tax decreases

	Unanticipated					
		Impact	1y	3y	5y	Cum.
Primary spending		0.40	0.07	0.39	-0.04	1.13
		(1.42)	(0.92)	(0.40)	(0.14)	(2.34)
Employment		0.06	0.42**	-0.08	-0.06*	0.29
		(0.23)	(0.22)	(0.12)	(0.05)	(0.49)
Wages		0.53	0.92*	-0.20	0.00	2.03*
		(1.15)	(0.75)	(0.38)	(0.13)	(1.97)
Prices		-1.15**	1.52***	0.24	-0.08	1.63*
		(0.62)	(0.69)	(0.30)	(0.11)	(1.17)
Output		1.03***	1.20***	-0.14	-0.06	2.23*
		(0.47)	(0.47)	(0.32)	(0.11)	(1.39)
	Anticipated					
	Announc.	Impact	1y	3y	5y	Cum.
Primary spending	-0.25	0.08	-0.30	0.09	-0.06	-0.87
	(0.62)	(0.97)	(0.91)	(0.44)	(0.17)	(2.89)
Employment	0.47*	-0.11	-0.25*	-0.10	-0.02	-0.17
	(0.47)	(0.25)	(0.24)	(0.14)	(0.06)	(0.83)
Wages	-0.21	0.01	1.62*	-0.07	0.06	1.01
	(0.74)	(1.16)	(1.00)	(0.52)	(0.14)	(2.87)
Prices	-0.30	0.61	0.25	-0.02	-0.04	-0.67
	(0.56)	(0.86)	(0.83)	(0.43)	(0.11)	(2.47)
Output	0.04	0.22	0.56*	-0.17	0.00	0.36
	(0.38)	(0.56)	(0.51)	(0.42)	(0.10)	(2.14)

Note: Except the cumulative multipliers after five years reported in the last column, all values are contemporaneous multipliers. Standard errors are noted in parentheses and are based on 2,000 Monte Carlo draws using Gaussian approximation. Asterisks indicate significance of the estimate, referencing 68% (*), 90% (**) and 95% (***) confidence intervals.

Table 8: Macroeconomic effects of (un)anticipated tax increases

		Unanticipated				
		Impact	1y	3y	5y	Cum.
Primary spending		-1.68*	0.65	0.14	-0.02	-2.15
		(1.49)	(1.76)	(0.51)	(0.18)	(3.72)
Employment		-0.48*	0.02	-0.04	0.02	-0.43
		(0.30)	(0.27)	(0.13)	(0.07)	(0.74)
Wages		-0.73	-1.96*	-0.30	0.02	-3.17
		(1.30)	(1.28)	(0.58)	(0.16)	(3.34)
Prices		-0.61	0.75*	-0.13	-0.04	-0.02
		(0.73)	(0.62)	(0.42)	(0.14)	(1.96)
Output		-0.71*	-0.27	-0.18	0.02	-1.50
		(0.62)	(0.74)	(0.37)	(0.12)	(2.03)
		Anticipated				
	Announc.	Impact	1y	3y	5y	Cum.
Primary spending	1.45*	-1.03	-2.59**	-0.54	-0.02	-0.53
	(1.09)	(1.98)	(1.48)	(0.56)	(0.19)	(5.21)
Employment	-0.11	-1.31***	-0.30*	0.13	0.09*	-1.96*
	(0.30)	(0.31)	(0.30)	(0.17)	(0.07)	(1.38)
Wages	1.83*	-1.26*	-3.07***	0.19	-0.05	-1.42
	(1.30)	(1.15)	(1.13)	(0.52)	(0.17)	(4.33)
Prices	-1.05*	-1.56**	-1.06*	-0.50*	0.12	-5.62*
	(0.98)	(0.82)	(0.68)	(0.45)	(0.15)	(3.65)
Output	1.55***	-2.46***	-1.39***	0.15	0.07	-3.08*
	(0.66)	(0.68)	(0.62)	(0.41)	(0.14)	(2.93)

Note: Except the cumulative multipliers after five years reported in the last column, all values are contemporaneous multipliers. Standard errors are noted in parentheses and are based on 2,000 Monte Carlo draws using Gaussian approximation. Asterisks indicate significance of the estimate, referencing 68% (*), 90% (**) and 95% (***) confidence intervals.

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