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Fiscal policy response to the COVID-19 pandemic in the euro area

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Abstract

We estimate the macroeconomic impact of fiscal measures adopted in response to the COVID-19 crisis at the euro area level. Given the multitude of shocks occurred simultaneously during the pandemic, the fiscal stimulus is identified together with other supply- and demand-side shocks using a sign and zero restricted Bayesian vector autoregressive (VAR) model. Our results suggest that fiscal policy measures avoided a further collapse of GDP equal to 3.7 percentage points during the two years 2020-2021.

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1. Introduction

The COVID-19 pandemic has affected every aspect of the economic activities. The forced shutdown of a number of productive sectors had important repercussions on aggregate supply, while the lockdown has profoundly changed consumption choices.

To different extents, fiscal policies have been employed by worldwide governments to counterbalance the economic crisis triggered by the pandemic. Given the unprecedent size and importance that fiscal policies had during the crisis, in this paper we focus our attention on the euro area as a whole, seeking to assess the macroeconomic impact of the fiscal measures implemented during the recession.

Our paper is not the first study looking at the role of fiscal measures during the COVID-19 crisis. The economic literature began to show interest in the role of fiscal policies right after the beginning of the pandemic. Chudik et al. (2021) study the effects of fiscal policies in a number of countries adopted to face the COVID-19 pandemic in a threshold-augmented global VAR model. They find that fiscal policies have played a key role in mitigating the effects of the pandemic and countries with larger fiscal support have experienced fewer output contractions.

Faria-e-Castro (2021) simulates the macroeconomic effects of a pandemic and studies the response of different types of fiscal policy instruments in a nonlinear DSGE model calibrated for the US economy. He finds that unemployment benefits are the most effective tool to stabilize income for borrowers, who are the hardest hit during a pandemic, while liquidity assistance programs are the most effective if the policy objective is to stabilize employment in the affected sector. At the national level, Di Bartolomeo and D'Imperio (2022) provide an analysis on the effects of emergency fiscal measures introduced by the Italian government, showing that they avoided an additional fall of the Italian GDP of about 4.4 percentage points (pp thereafter) in 2020, with a significant impact on the dynamics of consumption and investments (see also Haroutunian *et al.*, 2021 for a quantification and a taxonomy of the initial fiscal policy response across euro area).

Against this background, this paper contributes to the literature by assessing the role of fiscal policies at the euro-area level in sustaining the economy during the pandemic using updated quarterly data. The fiscal shocks are identified and isolated from other supply- and demand-side disturbances occurred during the pandemic by means of a VAR model with sign and zero restrictions, with a methodology and an identification strategy that - to the best of our knowledge - has not been used so far to tackle this important issue.

According to our results, fiscal policy measures avoided an even wider collapse of the aggregate euro-area GDP of 3.6 pp in the two years 2020-2021.

The paper is organized as follows. The next section introduces the empirical approach and sets out the structural identification of the shocks, providing a description of the estimation procedures. Section 3 shows and discusses results. Finally, the last section concludes pointing out to possible critical drawbacks and future avenues of research.

2. Empirical strategy

As already outlined, our goal is to quantify the role that fiscal interventions played during the pandemic in avoiding an even wider collapse of the economy. To estimate the impact of fiscal policies, we employ a VAR model estimated with standard Bayesian techniques. We construct a dataset of quarterly data from 2002Q1 to 2021Q4 for the euro area. The vector of endogenous variables includes real gross domestic product (GDP), the harmonised index of consumer prices, government final consumption expenditures and investment and net taxes (i.e., total revenues net of transfers).

We also include the so-called Stringency index as an exogenous variable to capture the pandemic shock (Hale *et al.*, 2021). The index records the strictness of 'lockdown style' policies that primarily limit people and firms' behaviour at the country level. It is calculated using all ordinal containment and closure policy indicators, plus an indicator recording public information campaigns. The index for the euro area is a GDP-weighted average of the national Stringency indices. All macroeconomic series are retrieved from Eurostat, while the Stringency index is developed and provided by the University of Oxford. Nominal variables are deflated and enter the VAR in log-levels. Description and sources of variables are reported in Table 1.

Table 1: Data description and source

Variable	Description	Source
GDP	Gross domestic product at current prices	Eurostat
Prices	Euro-area harmonised index of consumer prices (2015=100)	Eurostat
Government spending	General government final consumption and investment at current prices	Eurostat
Government revenue	Net taxes (total revenues net of transfers) at current prices	Eurostat
Str. index	Covid-19 government Response Tracker	Oxford University

2.1 Structural identification with mixed zero and sign restrictions

Our empirical strategy has the objective of isolating the fiscal policies shocks that occurred during the pandemic and their impact on GDP. As previously described, governments employed a combination of higher expenditures and lower/deferred taxes to deal with the effects of the pandemic on firms and households. Consequently, the fiscal shocks we consider are a government spending shock and a government revenue shock.[1]

[1] We do not evaluate the role of public guarantee schemes issued in response to the COVID-19 pandemic, as their evaluation would requires different empirical and theoretical techniques such as the one proposed in Pfeiffer et al. (2020). Similarly, our methodology is not able to capture other liquidity measures such as government loans.

Economic literature has suggested several methods to identify fiscal shocks into the economy. Following Mountford and Uhlig (2009), we propose an identification strategy based on sign restrictions, exploiting the methodology developed by Arias *et al.* (2021) to disentangle the government spending and the revenue shock from the other disturbances in the economy.

Our first step is to impose a series of sign restrictions able to isolate demand and supply (business cycle) shocks orthogonal to the fiscal stimulus we are interested in.[2] As shown in Table 2, a demand shock is assumed to trigger a positive response of output and prices, while a supply shock would generate an increase of GDP and a contemporaneous decrease of prices. Moreover, we also assume that business cycle shocks have positive effects on government revenues.

A government spending shock is simply assumed to have a positive impact on GDP while we remain agnostic on the contemporaneous impact on other variables. Similarly, a reduction in net tax burden is assumed to have a positive impact on GDP but no contemporaneous impact on government spending. The latter restriction is also imposed on the demand and supply shocks in order to disentangle them from the government expenditure shock. The assumption is that governments do not respond on impact to demand and supply shocks, in line with Blanchard and Perotti (2002) suggesting that fiscal authorities respond with a lag because of lags in the release of GDP and due to the discretionary nature of policies.

Table 2: Zero and sign restrictions

	Demand	Supply	Government spending	Government revenue
GDP	+	+	+	+
Prices	+	-	NA	NA
Government spending	0	0	+	0
Government revenue	+	+	NA	-

Note: The table describes the restrictions used for each variable (in rows) to identified shocks (in columns) in our VAR. *NA* indicates that the response of the variable is left unrestricted.

Finally, it is worth to mention that the supply and demand shocks we identify are compatible with the business cycle shock proposed in Mountford and Uhlig (2009), although they also restrict consumption and investment. Another difference is that they restrict the response of variables for four quarters, while we only impose restrictions on impact. The latter choice rests on the fact that during the pandemic fiscal authorities adopted a number of timely emergency measures, often addressing specific issues with possibly short-lived effects on output. Our identification strategy does not exclude longer lasting impact on GDP but is also able to capture Covid-related measures that would be discarded with alternative and more stringent identification strategies.

[2] See, e.g., Furlanetto *et al.* (2017).

2.2 Estimation

Structural identification of shocks is based on sign and zero restrictions. Defining β as the vector of coefficients to estimate, its prior is assumed to be Normal-Diffuse.[3] The VAR lags are assumed to be equal to five given the quarterly frequency of data. After obtaining the reduced-form coefficients, we retrieve the structural shocks by means of zero-sign restriction as in Arias *et al.* (2018).[4] Here we report the main steps of the Gibbs-Sampling used for the identification with sign restrictions in the case of a simple VAR model with p lags:

$$Y_t = A_1 \cdot Y_{(t-1)} + A_2 \cdot Y_{(t-2)} + \ldots + A_p \cdot Y_{(t-p)} + u_t$$

where Y_t is the vector of endogenous variables and A_i are the p matrices containing the reduced-form coefficients, with p=5 lags. The steps proposed by Arias *et al.* (2018) provide to *(i)* draw the coefficients A_i from the VAR posterior distribution, *(ii)* obtain the (reduced-form) impulse response functions (IRFs) from the moving average matrices; *(iii)* impose the sign restrictions according to theory and check whether the structural IRFs are coherent with them. *(iv)* repeat the sampling steps until the established number of successful iterations is achieved. This setup can be easily extended to our VAR model with five lags and one exogenous variable:

$$Y_t = A_1 \cdot Y_{(t-1)} + A_2 \cdot Y_{(t-2)} + \ldots + A_5 \cdot Y_{(t-5)} + C \cdot X_{(t)} + u_t$$

where $Y_{(t)}$ is the vector containing our four endogenous variables, namely, GDP, Prices, Gov. Spending, Gov. Revenues, and $X_{(t)}$ the vector containing the stringency index (Str. Index) treated as exogenous in the model. Coefficients are contained in the matrix A_i and C.

3. Results

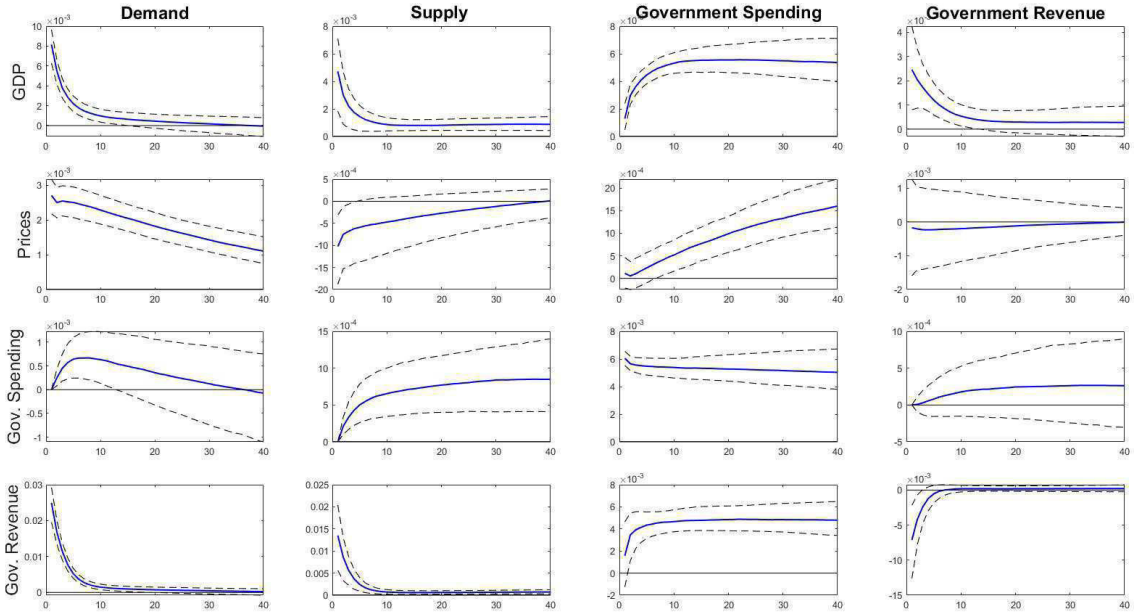
Before moving to the actual assessment of fiscal policies during the pandemic, we briefly comment the VAR's IRFs, conditional to our identification strategy.

The VAR's endogenous variables consistently respond to the imposed shocks. In particular, following a positive demand shock we have an increase in GDP and prices. At the same time, following a positive supply shock we observe an increase in GDP and a decrease in prices. Moving to the fiscal shocks, an increase of total government expenditure has a positive effect on GDP that remains above its steady state during the forty periods under analysis. On the other hand, an expansionary fiscal policy through a reduction in fiscal revenues triggers a positive effect on GDP which converges to its steady state after about ten periods.

[3] See Zellner (1974). This setup was chosen as it avoids the constraints imposed by alternative priors. Results based on Normal-Wishart priors are qualitatively similar.

[4] A detailed description of the algorithm used to find the structural IRFs is contained in their paper.

Figure 1: Impulse response functions



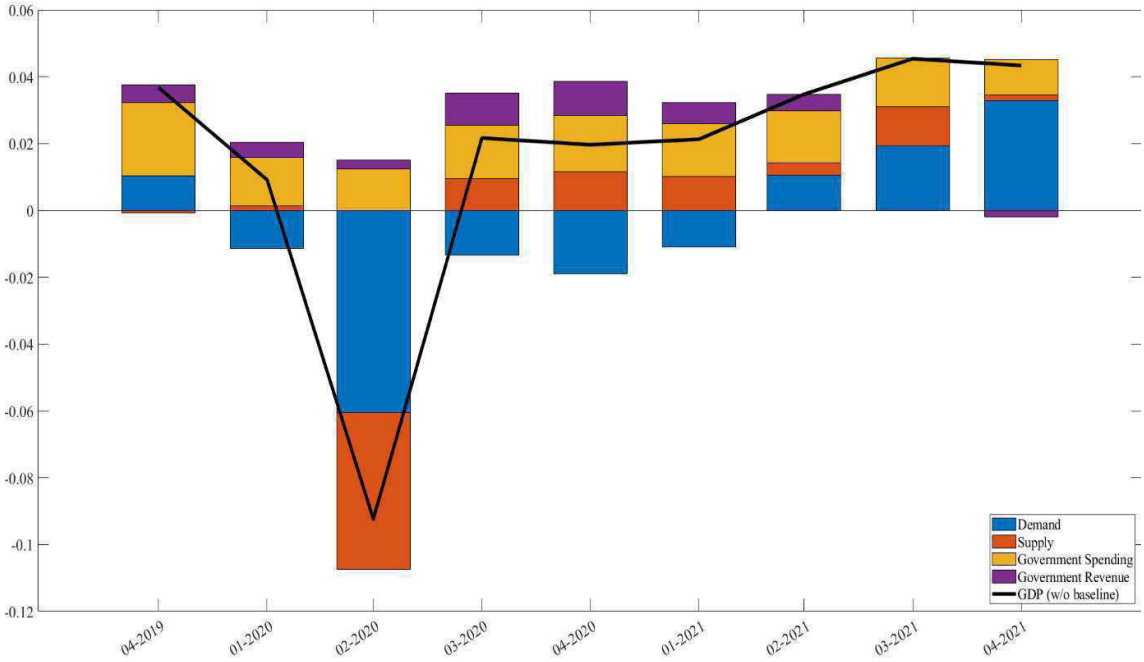
Note: The figure reports the response of endogenous variables in the VAR to Demand, Supply, and Fiscal structural shocks. 68% uncertainty interval. Source: Authors' elaborations from VAR estimates.

The historical shock decomposition of GDP to the identified structural shocks is reported in Figure 2. We focus on the period 2019q4-2021q4, namely from the beginning of the COVID-19 pandemic to the last quarter before the Russian invasion of Ukraine, which triggered disturbances of diverse nature that go beyond the goal of this study. The black-solid line represents the GDP in deviation from its baseline, while the bars describe the quarterly contribution of each shock to this deviation.

The Figure 2 clearly shows that expansionary fiscal policies contributed to mitigating the negative effects of the recession caused by the pandemic crisis. This major contribution occurred from the beginning of the pandemic, in the first quarter of 2020, onward.[5] To quantify the contribution of fiscal measures to GDP growth we consider two scenarios. The first is the observed scenario, where the dynamic of GDP is the product of the four identified shocks, namely demand, supply, government spending and revenues. The second is the counterfactual scenario, where we switch off the last two fiscal policy shocks. By comparing the two scenarios we find that fiscal policy measures avoided an even wider collapse of GDP in the eight quarters 2020q1-2021q4 equal to 3.7 pp, where we take the GDP registered in 2019 as reference. The total contribution of fiscal policies can be decomposed in the two identified components: spending measures avoided a reduction of GDP equal to 2.8 pp, while revenue-side measures contributed for the residual 0.9 pp.

[5] Except for the last quarter of 2021, when government revenues become slightly contractionary.

Figure 2: Historical decomposition, euro-area GDP



Note: The figure reports the contribution of the identified structural shocks to the deviations of GDP from its baseline forecast over the period 2019q4-2021q4. Source: Authors' elaborations from VAR estimates.

The discussed results should be considered as conservative given that our methodology is not able to capture the role of public loan guarantees and other liquidity measures which likely avoided a large number of liquidity issues and defaults across firms (see, e.g., Falagiarda et al. 2020).

4. Conclusions

In this paper, we have evaluated the role of the economic support of the fiscal policies during the COVID-19 pandemic in the euro-area using fresh quarterly data.

In a counterfactual scenario, we find that fiscal policy measures avoided a further collapse of GDP equal to 3.7 pp during the two years 2020-2021. Government spending has produced a more sizeable effect than tax cuts and tax deferral to mitigate the recession caused by the pandemic crisis.

Lastly, the results obtained in this paper may offer interesting insights for future research. Among others, the heterogeneity in the fiscal response across countries and the interactions between monetary and fiscal policy.

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