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ARTICLE

Government investment fiscal multipliers: evidence from Euro-area countries

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Abstract

This paper aims to estimate the government investment fiscal multipliers in select European countries for the period 1970–2016. To do this, we combine Structural Vector Autoregression (SVAR) modeling with the Local Projections (LP) approach. We estimate models by also controlling for fiscal foresight, excluding the postcrisis period and distinguishing between Northern and Southern countries. Our findings suggest that an increase in government investment generates a "Keynesian effect" by engendering positive and permanent effects on the GDP level, even when government expenditure expectations are considered. Fiscal multipliers are close to 1 on impact and increase in the years after the implementation of a discretionary fiscal policy.

Keywords: Fiscal multipliers, government investment, local projections, Euro area

JEL Codes: H50, H54, E60, E62

1. Introduction

After the 2008 Great Recession and the sovereign debt crisis of 2010–2011, Southern European countries (e.g. Italy, Greece, Spain, and Portugal) implemented austerity policies. Austerity—mainly based on a reduction in government spending—was supposed to foster economic growth by increasing private consumption and investment [Alesina et al. (2015)]. However, GDP growth was not boosted, the debt-to-GDP ratio increased, and unemployment rates remained high.

Recently, several international institutions have questioned the foundations of austerity policies. For instance, the International Monetary Fund (IMF), which has historically been one of the greatest proponents of austerity policies, affirmed through its chief economist that austerity failed because the fiscal multiplier was higher than economists assumed [Blanchard and Leigh (2013)]. Contextually, the IMF and the European Commission (EC) have acknowledged that government investment plays a strategic role in supporting economic growth both in the short and long run, especially during phases characterized by interest rates close to zero. Indeed, according to the IMF (2014), government should carry out a public investment push to boost economic activity and private investment. Similarly, the European Commission [EC (2014)] designed a public investment plan to emerge from the economic stagnation by highlighting that public investment—especially in infrastructure—is one of the main policy levers for supporting economic growth. On the other hand, this urge for public investment plans is strongly advocated nowadays by the EC and other international institutions like once more the IMF (2020) in order to face the global recession after the coronavirus pandemic. Moreover, such a dispute on the effectiveness of fiscal policies is nowadays relevant also in light of the current debate on the possible permanent effects of fiscal consolidation policies on potential output through a mechanism defined as hysteresis [Fatás and Summers (2018)].

In line with this background, the international debate among academic scholars has gained momentum on the magnitude assumed by fiscal multipliers in advanced countries. Even though there is little consensus on the size of multipliers [Gechert (2015)], government spending is generally found to produce positive effects on the GDP level, thus confirming that fiscal multipliers are positive. The existing literature primarily focuses, however, on the effects of total public expenditure on GDP and does not distinguish between its components. Few contributions deal with this last issue, for instance, by evaluating the effect of government investment and consumption [see, among others, Perotti (2004*b*), Pappa (2009), Auerbach and Gorodnichenko (2012), Boehm (2020) Bonam et al. (2020)], but without providing univocal results. Indeed, while Perotti (2004*b*), Pappa (2009), and Boehm (2020) show that government investment is no more effective than other government expenditure, Burriel et al. (2010) and Auerbach and Gorodnichenko (2012) estimate a fiscal multiplier of government investment that is larger than the one obtained for government consumption, thus affirming that government investment is more effective in boosting the GDP than government consumption. These findings are in line with the empirical literature that recognizes the superiority of government investment in boosting economic growth [Burriel et al. (2010), Bénétrix and Lane (2010), Tenhofen et al. (2010), Auerbach and Gorodnichenko (2012), Gechert (2015), Boitani and Perdichizzi (2018)], which typically produces permanent effects on GDP [Abiad et al. (2016), Deleidi et al. (2020)]. These studies support the view that government investment can produce a twofold effect on the output level. An increase in government investment boosts aggregate demand through the multiplier effect in the same way as other government spending components. However, government investment has an additional effect: it creates positive externalities for the private sector [Baxter and King (1993), Skidelsky (2001), Ramey (2020)].

Based on these premises, the aim of this paper is to provide an estimation of fiscal multipliers associated with government investment expenditure for a panel of 11 Euro-area countries during the period 1970–2016 and assess whether public investment generates permanent effects on the level of output. To do this, the paper implements a recent empirical strategy, which combines the advantages of the identification strategy of Structural Vector Autoregression (hereinafter, SVAR) modeling with the Local Projections (hereinafter, LP) approach [Leduc and Wilson (2013), Ramey (2016), Auerbach and Gorodnichenko (2017), Ramey and Zubairy (2018)].

The paper presents several key elements. First, we assess whether the effectiveness of fiscal policies changes when removing the period subsequent to the Great Recession. Second, we analyze whether government investment spending has a different multiplier effect among different groups of countries, namely Northern and Southern ones. Third, fiscal multipliers are estimated by considering the fiscal foresight which allows us to evaluate the effect of an unanticipated fiscal policy shock on GDP [Auerbach and Gorodnichenko (2012)]. Our findings suggest that an increase in government investment generates a Keynesian effect by engendering positive and permanent effects on the GDP level. These results are confirmed even when the postcrisis period is omitted, notwithstanding the fact that estimated fiscal multipliers are slightly lower. Finally, by introducing fiscal foresight, our findings continue to support the idea that government investment can be considered as one of the main levers for supporting economic growth, which is confirmed also by a comparison with some preliminary estimates of government consumption multipliers (Appendix C). Generally, government investment fiscal multipliers are close to 1 on impact and increase in the years following the shock.

The paper is structured as follows. Section 2 provides a review of the existing literature. Section 3 shows data and methods, Section 4 presents findings while Section 5 extends them by including fiscal expectations. Section 6 concludes by highlighting the policy implications of our findings and the further research needed.

2. Literature review

In order to study the effects of public expenditures on output, the macroeconomic literature estimates the so-called fiscal multipliers mainly using two alternative methods. The first is the model-based approach, which is based on simulations built within Dynamic Stochastic General Equilibrium (hereinafter, DSGE) models, while the second one employs econometric techniques grounded on SVAR models and the LP approach.

The model-based approach is built on Real Business Cycle (RBC) and New Keynesian (NK) DSGE models. Both measure the effect of discretionary fiscal policies by considering neoclassical wealth and substitution effects that are direct consequences of the hypotheses included in those models. Therefore, according to alternative assumptions on the behavior of the private sector, these models determine different wealth and substitution effects, which in turn determine a wide range of estimations that can be considered as model dependent. It follows that by assuming rigidities—such as monopolistic competition and price stickiness that typically not considered in RBC models—NK-DSGE models allow for possible demand-side short-run effects that in turn produce larger fiscal multipliers than those obtained through RBC models. Moreover, fiscal multipliers are estimated to be larger than 1 when additional hypotheses regarding household preferences [Galí et al. (2007), Hall (2009), Furceri and Mourougane (2010)],[1] the reaction function of monetary policy and the presence of a zero lower bound for the nominal policy interest rate are introduced [Eggertsson (2011), Leeper et al. (2010), Christiano et al. (2011), Woodford (2011), Farhi and Werning (2016), Bouakez et al. (2017)]. For an in-depth review of the fiscal multiplier estimate through DSGE models, see, among others, Spilimbergo et al. (2009); Batini et al. (2014); Leeper et al. (2017); and Deleidi et al. (2020).

When we look at the empirical class of models, the major part of the literature employs vector autoregressive (VAR) models, which allow exogenous fiscal policy shocks to be isolated through the imposition of suitable identification strategies [see, among others, Blanchard and Perotti (2002), Perotti (2004*a*,b, 2007), Auerbach and Gorodnichenko (2012)]. VAR studies have developed four main alternative identifications to isolate innovation in fiscal stance [Caldara and Kamps (2008)]. Three of these make use of SVAR models to identify fiscal policy shocks by means of sign and zero restrictions, while the last one uses the so-called Narrative Approach (hereinafter, NA), which determines innovation in fiscal stance through qualitative information derived from fiscal policy news.

More precisely, the first strategy is the recursive approach that applies a standard Cholesky decomposition where government spending is usually ordered first since it is assumed that government expenditure is independent of the macroeconomic conditions and other variables included in the VAR. This assumption is justified by the idea that implementation and decision lags do not allow the contemporaneous reaction of fiscal policy to macroeconomic conditions. These motivations imply that government spending decisions take more than one period to respond to business cycle fluctuations [Fatás and Mihov (2001), Beetsma et al. (2009)]. The second identification strategy is the so-called Blanchard and Perotti approach, which shares with the recursive approach the idea that government spending is not contemporaneously affected by GDP dynamics [Blanchard and Perotti (2002)]. However, unlike traditional recursive ordering, the Blanchard and Perotti approach (2002) imposes the coefficient describing the contemporaneous elasticity of revenues to GDP using external information, namely it imposes an elasticity equal to 2.08. The third identification strategy is the sign restriction approach. Unlike the abovementioned methods which impose zero restrictions or specific values, this approach identifies fiscal shocks by imposing restrictions only on the sign of the response function [Pappa (2009)]. For instance, a basic government spending shock is defined as a shock where government spending is increased for a defined period after the shock [Mountford and Uhlig (2009), Laumer (2020)][2] Finally, the NA presupposes the construction of a series of fiscal episodes induced by political events, which are considered to be uncorrelated with the business cycle. For instance, Ramey and Shapiro (1998) identify policy shocks and in particular defense news—such as the Korean War, the

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Vietnam War, and the Carter and Reagan buildup—using Business Week articles and policy news, whereas Ramey (2011b) creates a "better measure of news" [Ramey (2011b), p. 24] using newspaper sources. Other examples of the use of narrative method can be found in Romer and Romer (2010) who estimate the effects of tax shocks by constructing a narrative series of tax changes based on legislative documents.[3]

More recently, however, fiscal multipliers have been estimated using the LP approach, a method proposed by Jordà (2005) to compute impulse response functions (IRFs). As affirmed by Auerbach and Gorodnichenko (2017), the LP approach is a natural alternative to SVAR models for obtaining IRFs. According to Jordà (2005), LPs have multiple advantages compared to other approaches since they: (i) can be estimated by single regression techniques, (ii) are robust to misspecifications, (iii) easily accommodate highly nonlinear and flexible specifications, and (iv) allow for the introduction of additional control variables because of a number of estimated parameters that is lower than the ones calculated in the SVAR model. Equation (1)

$$y_{t+h} = \alpha_h + \Psi_h\,(L)\,X_t + \beta_h D_t + \varepsilon_{t+h} \tag{1}$$

describes how the LP method works, where y is the variable of interest considered at each horizon $h = 1, \ldots H$, X is a vector of control variables and Ψ_{h} (L) is a lag polynomial. $\mathrm{D_t}$ is the selected exogenous fiscal variable whose effects at each horizon $t + h$ are given by the coefficient β_{h}. Technically, this approach computes IRFs directly from the estimation of the coefficients β_h obtained by carrying out single regressions in which the variable of interest is considered in each time $t + h$ following the initial shock ($\mathrm{D_t}$).

Finally, in recent years, empirical works have combined SVAR modeling with the LP approach by identifying exogenous fiscal shocks through one of the abovementioned strategies in VAR models and then using identified shocks in the LP equation ($\mathrm{D_t}$) [see, among others, Auerbach and Gorodnichenko (2017), Ramey (2016), Ramey and Zubairy (2018)]. The combination of these two approaches allows practitioners to use the advantages associated with the LP method by also exploiting exogenous shocks derived from SVAR models. For example, Auerbach and Gorodnichenko (2017) identify the fiscal variable $\mathrm{D_t}$ by applying the Blanchard and Perotti strategy, whereas Owyang et al. (2013) use the narrative military news shocks. Ramey (2016) and Ramey and Zubairy (2018) use both methods.

By applying all the aforementioned methods, most contributions conclude that real GDP increases in response to a government spending shock, following a hump-shaped pattern [Blanchard and Perotti (2002), Fatás and Mihov (2001), Bilbiie et al. (2008), Pappa (2009), Burriel et al. (2010)]. Notwithstanding, the magnitude of fiscal multipliers assumes different values among studies by therefore providing a mixed range of estimations. The estimated average value is equal to 1 and estimates tend to be characterized by a high standard deviation [Gechert (2015)]. A summary of main estimations differentiated by the applied methodology (i.e. VAR model and LP approach) are illustrated in Tables 1 and 2. Although providing only a partial classification, the fiscal multipliers range from negative values [Perotti (2004*b*)] to positive ones, reaching a peak effect larger than 3.5 [Edelberg et al. (1999)]. Moreover, the recursive and the Blanchard and Perotti identifications tend to produce larger fiscal multipliers, whereas the lowest values are determined when the sign restriction identification strategy is applied. It also emerges that the existing literature has mainly focused on the effects of total public expenditure on output. Few exceptions are represented by Perotti (2004*b*), Pappa (2009), and Boehm (2020) who distinguish between public investment and consumption expenditures by showing that public investment is no more effective than government consumption in boosting GDP.[4] The same distinction has been also made by Burriel et al. (2010), Auerbach and Gorodnichenko (2012), Deleidi (2021), and Deleidi et al. (2021) who reach the opposite conclusion by showing that the effect of public investment is stronger than government consumption expenditures. Other works only distinguish between defense and nondefense spending. For example, Auerbach and Gorodnichenko (2012) estimate a different dynamic of GDP by applying this distinction, although they estimate a similar

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Table 1. Summary of government spending multiplier—VAR models

Authors	Period, country, spending typology	Output multiplier				
		Impact	Peak	4	8	12
Blanchard and Perotti identification						
Auerbach and Gorodnichenko (2012)	1947:1-2009:2, US – G		1			
	1947:1-2009:2, US – Def		1.16			
	1947:1-2009:2, US – No-Def		1.17			
	1947:1-2009:2, US – C		1.21			
	1947:1-2009:2, US – Inv		2.12			
Blanchard and Perotti (2002)	1960:1-1997:4, US – G	0.84	1.29	0.45	0.54	1.13
Burriel et al. (2010)	1981:1-2007:4, US – G	0.76		0.91	0.67	0.46
	1981:1-2007:4, US – C	0.49		0.73	0.55	0.37
	1981:1-2007:4, US – Inv	2.00		1.96	0.90	0.17
	1981:1-2007:4, EU – G	0.75		0.87	0.85	0.61
	1981:1-2007:4, EU – C	0.86		1.14	1.26	1.16
	1981:1-2007:4, EU – Inv	1.56		1.61	1.59	0.92
Caldara and Kamps (2017)	1950:1-2006:4, US – G			1–1.3		
Perotti (2004*a*)	1980:1-2001:2, AUS – G			0.21		0.77
	1980:1-2001:4, CAN – G			−0.28		−2.25
	1975:1-1989:4, GER – G			0.40		−1.38
	1980:1-2001:2, UK – G			−0.22		−1.23
	1980:1-2001:4, US – G			0.31		0.10
Perotti (2004*b*)	1960:1-2001-2, AUS – C		0.89	0.56	0.86	0.88
	1961:1-2001:4, CAN – C		1.11	0.55	0.74	0.93
	1960:1-1989:4, GER – C		1.23	0.77	0.83	0.91
	1963:1-2001:2, UK – C		1.01	0.64	0.94	0.99
	1960:1-2001:4, US – C		2.32	1.37	1.91	2.16
	1960:1-2001-2, AUS – Inv		1.07	−0.29	0.02	0.5
	1961:1-2001:4, CAN – Inv		0.74	0.38	−0.24	−0.73
	1960:1-1989:4, GER – Inv		5.46	5.07	4.38	3.84
	1963:1-2001:2, UK – Inv		0.16	0.01	−0.08	−0.06
	1960:1-2001:4, US – Inv		1.68	1.17	0.52	0.21
Perotti (2007)	1959:3-2006:2, AUS – G				1.26	
	1961:1-2006:3, CAN – G				−0.46	
	1963:1-2006:2, UK – G				0.66	
	1947:1-2003:4, US – G				0.73	
Cimadomo and Bénassy-Quéré (2012)	1970:1-2009:4, GER – G	0.46			0.08	
	1970:1-2009:4, UK – G	0.28			−0.11	
	1970:1-2009:4, US – G	1.30			−0.73	
Recursive						
Galí et al. (2007)	1948:1 2003:4, US – G	0.51		0.31	0.28	
	1954:1 2003:4, US – G	0.74		0.75	1.22	
	1960:1 2003:4, US – G	0.91		1.05	1.32	
Bilbiie et al. (2008)	1957:1-1979:2, US – G			1.71		4.50
	1983:1-2004:4, US – G			0.94		2.38
Beetsma et al. (2008)	1970-2004, EU – G	1.17	1.50	1.50	1.19	

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Table 1. Continued

Authors	Period, country, spending typology	Output multiplier				
		Impact	Peak	4	8	12
Bachmann and Sims (2012)	1960:1-2011:1, US – G	0.84	0.84			
Ellahie and Ricco (2017)	1959:1-2012:1, US – G	0.72		0.36	0.28	
	1959:1-2012:1, US – Def C	0.89		0.35	−0.61	
	1959:1-2012:1, US – Def Inv	0.68		−3.88	−3.50	
	1959:1-2012:1, US – No-Def C	−0.25		0.03	−0.12	
	1959:1-2012:1, US – No-Def Inv	5.76		7.52	4.38	
Sign restrictions						
Mountford and Uhlig (2009)	1955:1-2000:4, US – G	0.65	0.65	0.46	0.12	−0.22
Pappa (2009)	1970:1-2007:4, CAN – C	0.18	1.02	0.43		1.02
	1970:1-2007:4, JAP – C	0.13	0.38	0.26		0.38
	1970:1-2007:4, US – C	0.74	2.52	1.46		2.52
	1970:1-2007:4, UK – C	0.13	0.39	0.39		0.07
	1991:1-2007:4, EU – C	0.16	0.38	0.38		0.33
	1970:1-2007:4, CAN – Inv	0.05	0.61	0.36		0.61
	1970:1-2007:4, JAP – Inv	0.16	1.93	0.83		1.93
	1970:1-2007:4, US – Inv	0.07	0.23	0.17		0.23
	1970:1-2007:4, UK – Inv	0.03	0.09	0.08		0.09
	1991:1-2007:4, EU – Inv	0.06	0.22	0.22		0.07
Narrative approach						
Ben Zeev and Pappa (2017)	1947:1-2007:4, US – G				2.14	
Eichenbaum and Fisher (2004)	1947:1-2001:2, US – G			0.61	0.28	0.21
Ramey and Shapiro (1998)	1947:1-1996:4, US – G	+				
Edelberg et al. (1999)	1948:1-1996:1, US – G	1.1	3.5			
Cavallo (2005)	1948:1-2000:4, US – G	+				
Ramey (2011a)	1939:1-2008:4, US – G		0.6–1.2			
Ramey (2011b)	1939:1-2008:4, US – G		0.8–1.5			

G = total government spending; Def= defense government spending; No-Def = nondefense government spending; C = government consumption; Inv = government investment spending.

peak multiplier for defense and nondefense spending. Ramey (2016) and Ramey and Zubairy (2018) also find that the multiplier associated with defense spending has a larger effect on the GDP level than the one associated with nondefense expenditure. Finally, the heterogeneity of the dynamic responses of GDP to different components of spending is also studied by Ellahie and Ricco (2017). Considering the consumption component of government spending, they estimate a positive impact multiplier for federal defense consumption, while a federal nondefense consumption spending shock reduces the GDP. On the contrary, they find that government investment spending in defense has a negative effect on output, whereas nondefense investment provides a strong economic stimulus.[5]

3. Data and methodology

3.1 Data

In order to estimate the fiscal multiplier associated with government investment, we use data from the OECD's Economic Outlook database. Our analysis is based on advanced panel techniques on a sample of 11 Euro-area countries: Austria, Belgium, Finland, France, Germany, Ireland, Italy,

Table 2. Summary of government spending multiplier—Local Projection models

Authors	Period, country, spending typology, identification strategy	Output multiplier				
		Impact	Peak	4	8	12
Auerbach and Gorodnichenko (2017)	1980–2017, panel 25 OECD countries – G – BP	1.047				
	1980–2017, panel 25 OECD countries – G – FE	0.663				
	1980–2017, panel 25 OECD countries – Na	0.632				
	1980–2017 semiannual data, panel 25 OECD countries – G – BP	0.655				
	1980–2017 semiannual data, panel 25 OECD countries – G – FE	0.228				
Riera-Crichton et al. (2015)	1986–2008 semiannual data, panel 29 OECD countries – G – FE	0.31		0.40		
Abiad et al. (2016)	1985:2013, panel 17 OECD countries – Inv – FE	0.40				1.4
Owyang et al. (2013)	1890:1-2010:4, US – Def – FE		0.87		0.72	
	1921:1-2011:4, CAN – Def – FE		0.57		0.67	
Ramey and Zubairy (2018)	1889:1-2015:4, US – Def – FE				0.66	
	1889:1-2015:4, US –G – BP				0.38	
Ramey (2016)	1947:1-2015:5, US – Def- FE			1.37	0.80	0.77
	1947:1-2015:5, US – G –BP			0.37	0.39	0.39
Boehm (2020)	2003:1-2016:4, panel OECD countries – C – BP			0.76	0.85	
	2003:1-2016:4, panel OECD countries – Inv – BP			−0.08	−0.06	
Leduc and Wilson (2013)	1990-2010, US – Inv – FE	3.4	7.8			

G = total government spending; Def = defense government spending; No-Def = nondefense government spending; C = government consumption; Inv = government investment spending; BP = Blanchard and Perotti identification strategy; FE = forecast error of the rate of growth of government spending; Na = narrative approach.

Luxemburg, the Netherlands, Portugal, and Spain. The analysis is conducted using yearly macroeconomic data for the period 1970–2016.[6] The considered macroeconomic variables are: real GDP (y); government investment (I_g); public expenditure (g) measured as government current disbursements plus government fixed capital formation net of interest payments;[7] the real effective exchange rate ($REER$), and the long-term interest rate (r). All selected variables are converted into real terms using the GDP deflator (DEF). Details on sources and definitions of the variables used are provided in Appendix A, Table A1.

3.2 Methodology

To estimate the fiscal multiplier associated with government investment spending, we apply the method aimed at merging the LP approach with the SVAR modeling. To do this, we follow two steps: (i) we identify government investment shocks by applying a recursive identification strategy in an SVAR model where government investment is first ordered and (ii) we use identified shocks to estimate the IRFs through the LP equation. The estimated model is formalized as in equation (2)

$$\Delta y_{i,t+h} = \alpha_i^h + \delta_t^h + \beta^h D_{,i,t} + \psi_j^h \mathbf{X}_{i,t+h} + \sum_{j=1}^{p} \phi_j^h \Delta y_{i,t-j} + \sum_{j=1}^{p} \varphi_j^h \Delta g_{i,t-j} + \varepsilon_{t+h} \qquad (2)$$

where i and t index countries and time, respectively; α_i^{h} is the country fixed effects and δ_i^h is the time fixed effects.[8] $\Delta y_{i,t+h}$ represents the rate of growth of output between $t-1$ and $t+h$, $D_{i,t}$ is the government investment shocks, and the associated coefficient β_{h} describes the effect of $D_{i,t}$ on the variable of interest at horizon $t+h$. Following Riera-Crichton et al. (2015) and Owyang et al. (2013), the lagged rates of growth of GDP ($\Delta y_{i,t-1}$) and government spending ($\Delta g_{i,t-1}$) are

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introduced as control variables.[9] Additionally, the first differences of the long-term interest rate and REER are included in the **X** vector to control for the feasible effects of the stance of monetary policy [Auerbach and Gorodnichenko (2017)] and the trade performances [David (2017)] on economic growth.[10]

As a first step in our analysis, we identify the government investment shocks ($D_{i,t}$) by applying a recursive identification strategy to a VAR model where the public investment rate of growth ($\triangle I_{g,i,t}$) is ordered first, whereas the GDP rate of growth ($\triangle y_{i,t}$) is the second variable.[11] As shown in equation (3), the structural shocks $D_{i,t}$ are given by the residuals ($e_{i,t}^{I_g}$) of the first equation of a VAR model:

$$\triangle I_{g,i,t} = a\triangle I_{g,i,t-1} + b\triangle y_{i,t-1} + e_{i,t}^{I_g} \tag{3}$$

where the current rate of change in public investment $\triangle I_{g,i,t}$is regressed on its 1-year lagged value ($\triangle I_{g,i,t-1}$) and on lagged value of the GDP rate of growth ($\triangle y_{i,t-1}$). Once structural shocks $e_{i,t}^{I_g}$ are identified, they are substituted in the LP equation (2) where $D_{i,t} = e_{i,t}^{I_g}$.[12]

To estimate fiscal multipliers, the coefficient β^h, namely the output elasticities to public investment, needs to be multiplied by an *ex post* transformation factor equal to the average value of the GDP government investment ratio (Y/I). Additionally, following Spilimbergo et al. (2009) and Ramey (2016), we estimate the cumulative fiscal investment multiplier rather than simply by converting elasticities into "dynamic multipliers". The IRFs, namely the estimates of β from t to $t+h$, are calculated by considering a public spending shock equal to 1 Euro on impact, which is usually accompanied by a persistent dynamic, implying that an initial government spending shock may build up over time, stabilizing on a value greater than one. Hence, the estimation of cumulative fiscal multiplier is the more appropriate measure for representing the multiplier per unit government investment spending [Ramey (2016)], or in other words, the Euro change in GDP due to a 1 Euro increase in public investment. Furthermore, cumulative multipliers can be used to evaluate whether a permanent increase in the level of government expenditure produces permanent and long-lasting effects on the GDP level. The cumulative multiplier is computed as the cumulative (or integral) response of GDP relative to the cumulative (or integral) government investment change that occurred during the observed period. The cumulative government investment fiscal multiplier is estimated in three steps [Ramey and Zubairy (2018)]. First, the cumulative change of GDP is estimated between t and $t+h$ in equation (2). Similarly, as a second step, the cumulative change of government investment between $t$and $t+h$ is calculated by regressing the same equation (2) with the government investment rate of growth in the considered period ($\triangle I_{i,t+h}$) as the dependent variable, instead of $\triangle y_{i,t+h}$.[13] Finally, the cumulative investment multiplier is computed as the ratio between the coefficients β^h estimated in steps one and two multiplied by the average value of Y/I.[14][15]

With regard to the models described in equation (2), we consider three different specifications characterized by different control variables. First, we include only time and country fixed effects and the lag of GDP growth rate (Model 1). The second specification incorporates the lag of the government spending growth rate (Model 2). Finally, in the last specification (Model 3), additional control variables, such as the real effective exchange rate (*REER*) and the long-term interest rate (r), are considered.[16]

4. Empirical findings

This section shows our findings by displaying both the estimated IRFs and the cumulative fiscal multiplier. In all figures reported below, we have displayed both the dynamics of government investment spending (I_g) as well as the corresponding responses of the GDP (y). In all considered models, public investment has been normalized in order to obtain a 1% point increase at time t.

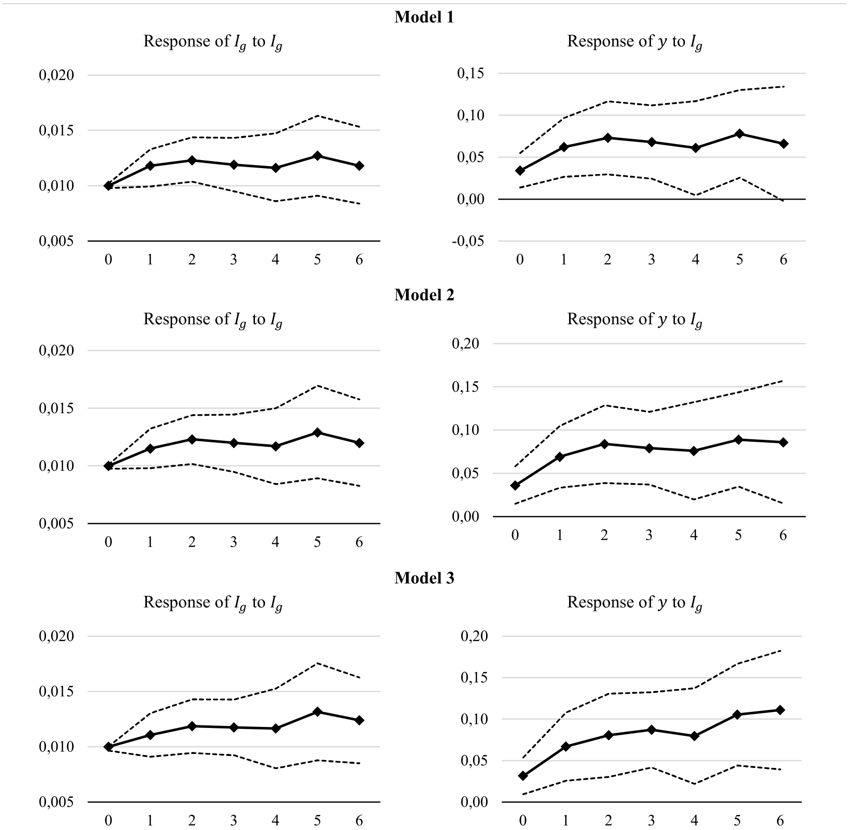

Figure 1. Impulse response functions of output to government investment shocks.
Years on x-axis. Dotted lines denote 95% confidence bands.

Table 3. Cumulative government investment fiscal multiplier

	(1) Year 0	(2) Year 1	(3) Year 2	(4) Year 3	(5) Year 4	(6) Year 5	(7) Year 6
Model 1	1.06***	1.64***	1.85***	1.78***	1.64***	1.91***	1.74*
Model 2	1.12***	1.87***	2.13***	2.06***	2.03***	2.15***	2.23***
Model 3	0.99***	1.89***	2.12***	2.31***	2.13***	2.50***	2.80***

***$p<0.01$, **$p<0.05$, *$p<0.1$, $^{+}p<0.32$.

Figure 1 plots the IRFs of Models 1, 2, and 3, whereas the corresponding cumulative fiscal multipliers are reported in Table 3. IRFs show that the government investment shocks are equal to 1% on impact whereas its dynamic changes throughout the selected period by assuming values other than 1%. For all considered model specifications, the estimated IRFs are all positive reflecting a high persistence both in the shocks and the GDP responses. This suggests that government investment generates permanent effects on the level of economic activity and the effect on GDP is statistically significant even 6 years after the initial shock. When we look at the cumulative multipliers in Table 3, estimates are close to 1 on impact and tend to grow in the subsequent years. Looking at Model 1 in Table 3, the impact multiplier is equal to 1.06 and reaches a peak of 1.91 after 5 years. After 6 years, the multiplier is still larger than 1 and equal to 1.74. Model 2, which also includes the lagged rate of growth of government spending, provides multipliers that are higher than those obtained in Model 1. Indeed, in this case, we estimate an impact multiplier of 1.12 that

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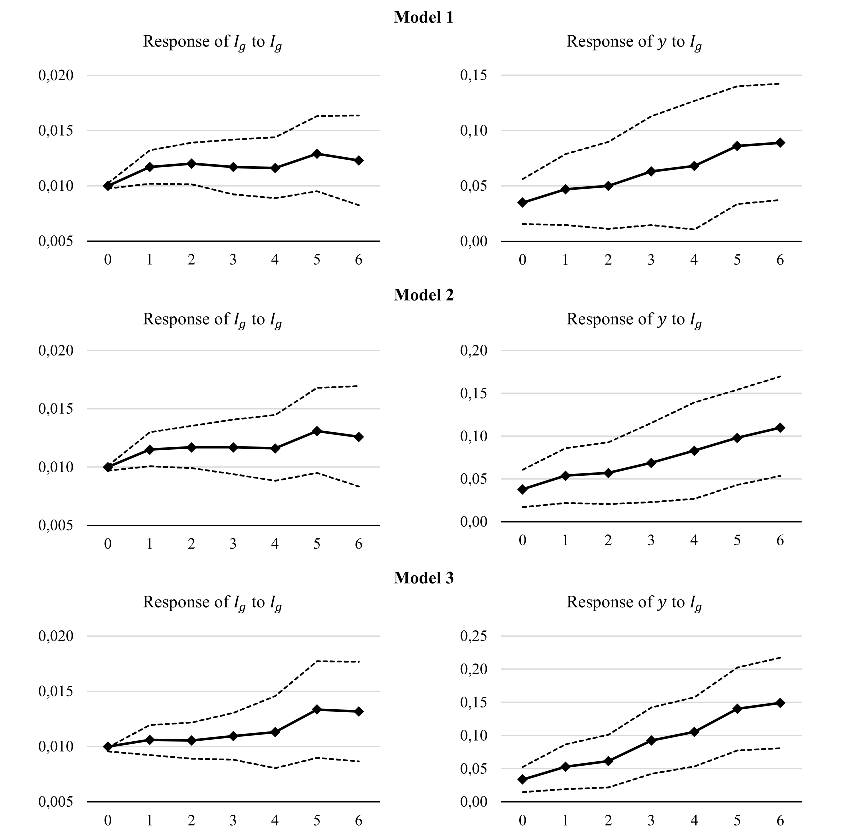

Figure 2. Elasticities of output to government investment shocks in pre-crisis years (1970–2007). Years on x-axis. Dashed lines denote 95% confidence bands.

reaches a peak of 2.23 6 years after the shock. Finally, Model 3, which includes the real effective exchange rate and the long-term interest rate, provides an impact government investment multiplier that is lower than those obtained in Models 1 and 2 and equal to 0.99 (Table 3, Model 3). However, the peak multiplier reaches the largest estimated effect of 2.80 after 6 years. All findings reported in this section show that public investment multipliers assume values that are close to 1 on impact and are higher than one in the following years. Furthermore, the estimated models clearly show that public investment shocks produce positive and permanent effects on the GDP level, in line with the Keynesian tradition.

To measure the sensitivity of our results, two robustness checks are performed. Specifically, we assess whether: (i) the effectiveness of fiscal policies changes when the period subsequent to the Great Recession is removed and whether (ii) government investment assumes a different multiplier when considering different groups of countries, namely Northern and Southern ones.

To assess whether the Great Recession and the postcrisis period have impacted the size of the fiscal multiplier, all considered models are estimated over the period 1970–2007.[17] Findings are consistent with those obtained when the entire timespan is considered. All specifications present the same qualitative properties and produce similar results in terms of sign and persistence of the effects. All IRFs show a high persistence both in the estimated shocks and the GDP responses, even 6 years after the implementation of discretionary fiscal policy. Looking at the IRFs shown in Figure 2, government investment shocks determine positive and long-lasting effects on economic activity. In Model 1, the elasticity of output to government investment is 3.5% on impact and reaches a peak of 8.9% 6 years after the shock. When Model 2 is considered, elasticities of 3.8% on

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Table 4. Cumulative government investment fiscal multipliers in pre-crisis years (1970–2007)

	(1) Year 0	(2) Year 1	(3) Year 2	(4) Year 3	(5) Year 4	(6) Year 5	(7) Year 6
Model 1	1.07***	1.22***	1.26***	1.63***	1.78***	2***	2.2***
Model 2	1.15***	1.42***	1.48***	1.79***	2.17***	2.27***	2.65***
Model 3	1.02***	1.52***	1.77***	2.57***	2.83***	3.19***	3.45***

***$p<0.01$, **$p<0.05$, *$p<0.1$, +$p<0.32$.

Table 5. Government investment fiscal multipliers in Northern and Southern countries

Northern European countries							
	(1) Year 0	(2) Year 1	(3) Year 2	(4) Year 3	(5) Year 4	(6) Year 5	(7) Year 6
Model 1	1.09***	1.07*	1.36**	1.62**	2.03**	2.09**	1.60**
Model 2	1.29**	1.42*	1.74**	1.86**	2.80**	2.44**	2.56**
Model 3	1.04**	1.37*	1.40**	2.23***	2.57**	2.62**	3.07***
Southern European countries							
	(1) Year 0	(2) Year 1	(3) Year 2	(4) Year 3	(5) Year 4	(6) Year 5	(7) Year 6
Model 1	0.78	1.96*	2.24*	2.58*	2.94*	3.08**	2.38+
Model 2	0.77	1.96*	2.24*	2.59*	2.93**	3.00**	2.36+
Model 3	0.23	1.38+	2.21+	2.52*	2.56*	3.16**	2.91+

***$p<0.01$, **$p<0.05$, *$p<0.1$, +$p<0.32$.

impact and 11% 6 years after the shock are estimated, compared with those obtained for Model 1. Finally, in Model 3, although the impact effect on GDP is less than the one estimated for Models 1 and 2, we obtain a greater elasticity of 14.9% 6 years after the shock. When elasticities are converted into cumulative multipliers (Table 4), a 1 Euro increase in public investment creates a multiplier effect on output close to 1 on impact in all the three model specifications. The peak multiplier is obtained for all specifications 6 years after the shock and it assumes values of 2.2, 2.45, and 3.45 in Models 1, 2, and 3, respectively. When these findings are compared with those obtained in the baseline models, the main results are confirmed. Indeed, estimated fiscal multipliers are close to 1 on impact and tend to grow in the subsequent periods. Notwithstanding, estimates of fiscal multipliers are slightly lower than the one obtained when the full sample period is considered. This allows us to conclude that the years of the Great Recession and the postcrisis period have positively influenced the value of the fiscal multiplier.

With regard to the second robustness check, we follow Deleidi et al. (2020) by analyzing the potential heterogeneity of government investment fiscal multipliers across two different groups of countries. Specifically, in the first groups, we incorporate Southern European countries, also known as PIIGS or periphery countries, namely Portugal, Ireland, Italy, and Spain, whereas the second one consists of the remaining seven Northern European countries, namely Austria, Belgium, Finland, France, Germany, Luxemburg, and the Netherlands, also called as core countries. The estimated cumulative government investment multipliers are shown in Table 5. They are consistent with the findings obtained by Deleidi et al. (2020) and suggest that the magnitude of the government investment multiplier is larger in Southern countries than in Northern ones. These results may reflect the fact that Southern countries are characterized by a lower GDP per capita than Northern ones and therefore a higher marginal propensity to consume.

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5. The role of fiscal foresight

Although we do not consider expectations when assessing the magnitude of the investment fiscal multiplier in the baseline formulation of the empirical model, the recent literature has highlighted the important role played by fiscal foresight [Blanchard and Perotti (2002), Ramey (2011b), Leeper et al. (2012 and 2013), Auerbach and Gorodnichenko (2012, 2013, 2017)]. To consider this issue, in this section we provide estimations of fiscal multipliers by introducing fiscal expenditure expectations in Models 1, 2, and 3 (equation 2, Section 3.2).

It is widely recognized that legislative and implementation lags of fiscal policy involve a substantial amount of time between the moment in which fiscal policy news is announced and when they actually take place. This implies that the private sector receives information on future changes in fiscal expenditure, which could, in turn, alter private consumption and investment decisions by leading private agents to anticipate the effect of actual government spending [Blanchard and Perotti (2002)]. As a consequence, erroneous conclusions could be drawn in conventional empirical analysis when only changes in actual public spending are incorporated in models since the additional relevant information arising from policymakers' announcements is not considered. Technically, if variables capturing fiscal foresight—for instance, represented by government expenditure forecasts—are not included in the model, errors can arise because relevant variables are omitted and the identified fiscal policy shocks may not be truly unexpected. From an empirical point of view, the crucial role of the timing of fiscal policy, namely the importance of including fiscal foresight in the econometric analysis, has been confirmed by Ramey (2011b) who employs a Granger causality test to assess the unpredictability of SVAR shocks in models not augmented by expectations. For instance, Ramey (2011b) carried out this procedure by showing that SVAR shocks are Granger caused—and thus predicted—by the professional forecasts of government spending.[18][19] This in turn implies that only lagged values of the variables included in SVAR models may not capture all future changes in fiscal variables and allows us to conclude that SVAR shocks should not be considered truly unexpected. These government spending shocks, therefore, comprise a predictable and an unpredictable component [Ben Zeev and Pappa (2017)] and one should be interested in using only unanticipated government spending shocks [Auerbach and Gorodnichenko (2012)]. In this regard, the simplest way is to augment the SVAR model with the forecasts of government spending as a proxy of the predictable changes of government spending [Auerbach and Gorodnichenko (2012)]. Indeed, the introduction of this variable allows econometricians to distinguish between predictable and unpredictable fiscal shocks, and therefore assess the effect of the unexpected fiscal policy shock on GDP. In so doing, the effect of fiscal foresight is adequately taken into account and therefore, while shocks associated with the effective government expenditures can be considered as an unexpected shock, the ones corresponding to the fiscal foresight are expected shocks.

To consider this issue, we follow the empirical strategies carried out by Ramey (2011b) and Auerbach and Gorodnichenko (2012). As a first step, following Ramey (2011b), we assess whether the structural shocks identified in the model, not including expectations ($e^{I_g}_{i,t}$ in equation 3, Section 3.2) are foreseen by our fiscal forecasts ($\triangle G^{F}{}_{i,t|t-1}$).[20] To do this, we perform the recent Pairwise Dumitrescu–Hurlin Panel Causality Tests [Dumitrescu and Hurlin (2012)]. Findings, estimated with one and two lags, are reported in Table 6 and show that government investment spending shocks ($e^{I_g}_{i,t}$) are foreseen by fiscal policy forecasts ($\triangle G^{F}{}_{i,t|t-1}$). This implies that shocks include both an anticipated (expected) and unanticipated (unexpected) component [Ben Zeev and Pappa (2017)].

As a second step, to identify pure unanticipated government investment shocks, we follow Auerbach and Gorodnichenko (2012) by augmenting our SVAR model with the government spending forecasts ($\triangle G^{F}{}_{i,t|t-1}$). Technically, we apply a recursive identification strategy to a VAR model where government spending forecasts ($\triangle G^{F}{}_{i,t|t-1}$) are ordered first, whereas the public investment ($\triangle I_{g,i,t}$) and the GDP ($\triangle y_{i,t}$) rates of growth are the second and the third ordered

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Table 6. Pairwise Dumitrescu–Hurlin Panel causality tests between $\triangle G^F{}_{i,t|t-1}$ and $e^{I_g}_{i,t}$

Null hypothesis	Lag	W-Statistics	Zbar-Statistics	Probability
$\triangle G^F{}_{i,t|t-1}$ does not cause $e^{I_g}_{i,t}$	Lag 1	2.11	2.04	0.04
$e^{I_g}_{i,t}$ does not cause $\triangle G^F{}_{i,t|t-1}$	Lag 1	0.91	−0.36	0.72
$\triangle G^F{}_{i,t|t-1}$ does not cause $e^{I_g}_{i,t}$	Lag 2	4.12	2.61	0.01
$e^{I_g}_{i,t}$ does not cause $\triangle G^F{}_{i,t|t-1}$	Lag 2	2.93	0.98	0.33

variable, respectively. The used identification strategy can be summarized by the following recursive factorization: $[\triangle G^F{}_{i,t|t-1};\ \triangle I_{g,i,t};\ \triangle y_{i,t}]$. The unanticipated fiscal shocks are the residuals $(e^{I_g\_unex}_{i,t})$ derived from the following equation (4), namely, the second equation of the SVAR model augmented by expectations:

$$\triangle I_{g,i,t} = a\triangle I_{g,i,t-1} + b\triangle y_{i,t-1} + \delta\triangle G^F{}_{i,t|t-1} + \gamma\triangle G^F{}_{i,t-1|t-2} + e^{I_g\_unex}_{i,t} \tag{4}$$

Unlike the baseline model (equation 3), the rate of growth of government investment $\triangle I_{g,i,t}$ is also regressed on the contemporaneous and lagged value of the government investment forecast $(\triangle G^F{}_{i,t|t-1},\ \triangle G^F{}_{i,t-1|t-2})$. In this way, the estimated shocks $e^{I_g\_unex}_{i,t}$ can be considered as unpredictable and the effect of predictable components are captured by the coefficients γ and δ. Following the procedure carried out for the baseline model, the unexpected fiscal shocks $e_{i,t}$ estimated in equation (4) are included in the LP equation as our measure of discretionary fiscal policy $(D_{i,t})$. Additionally, in this case, the anticipated shocks $(\triangle G^F{}_{i,t|t-1})$ are also incorporated in the LPs equation in order to control for their effect on the level of economic activity [Boehm (2020)]. The estimated LP equation can be formalized as follows in equation (5)

$$\triangle y_{i,t+h} = \alpha^h_i + \delta^h_t + \beta^h D_{,i,t} + \gamma^h\triangle G^F{}_{i,t|t-1} + \psi^h_j \mathbf{X}_{i,t+h} + \sum_{j=1}^{p}\phi^h_j\triangle y_{i,t-j} + \sum_{j=1}^{p}\varphi^h_j\triangle g_{i,t-j} + \varepsilon_{t+h} \tag{5}$$

where the coefficient β^h captures the effect of unanticipated fiscal shocks.

The IRFs as well as the corresponding cumulative government investment multipliers associated with an unexpected shock are shown in Figure 3 and Table 7. In models augmented by expectations, all IRFs are also highly persistent both in the estimated shocks and the GDP responses. As shown in Figure 3, the impact elasticity of GDP determined by normalized unanticipated government investment shocks is approximately 3% in all three model specifications (Models 1, 2, and 3). It increases in the subsequent periods by achieving a peak between 7% and 8% in the second year after the shock for all model specifications.

When looking at the corresponding cumulative multipliers in Table 7, an additional Euro in government investment spending at time t determines a contemporaneous increase in GDP approximately equal to 1 Euro in all three models. In the periods following the shock, the effect on GDP grows assuming the greatest magnitude after 2 years equal to 2.37, 2.27, and 2.21 in Models 1, 2, and 3, respectively. When these findings are compared with the ones obtained in the model without expectation (Section 4), although there is a lower significance of estimates, an important difference is the timing with which the maximum value is reached. Indeed, when expectations are introduced in the model, the peak multiplier is reached in the second year after implementation of the fiscal policy stance, whereas it requires 5 or 6 years when fiscal foresight is omitted. Despite these differences, our findings continue to support the idea that government investment can be considered as one of the main levers for supporting economic growth. Indeed, the effect on GDP is positive and permanent and fiscal multipliers are close to 1 on impact and increase in the period following implementation of an unexpected discretionary fiscal policy.[21]

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Table 7. Cumulative government investment fiscal multipliers of unanticipated fiscal shocks

	(1) Year 0	(2) Year 1	(3) Year 2	(4) Year 3	(5) Year 4	(6) Year 5	(7) Year 6
Model 1	0.98**	1.73*	2.37*	1.73+	1.80	1.98	1.79
Model 2	0.98**	1.69*	2.27*	1.64	1.6	2.01	1.77
Model 3	0.93**	1.75*	2.31*	1.93+	1.44	1.69	0.84

***$p<0.01$, **$p<0.05$, *$p<0.1$, +$p<0.32$.

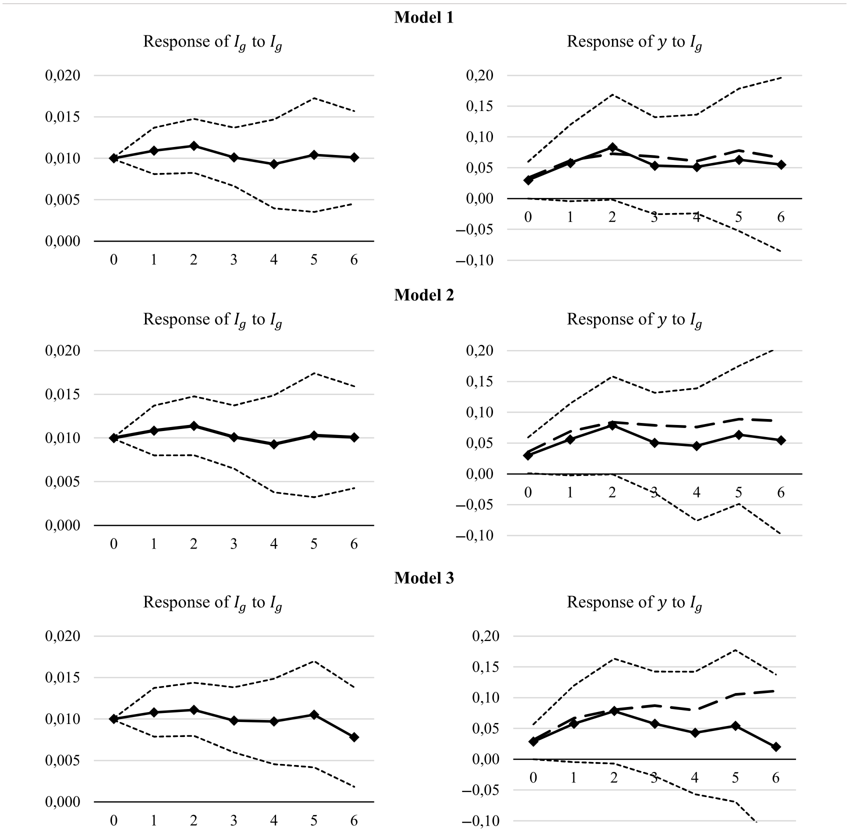

Figure 3. Elasticities of output to unanticipated government investment shocks
Years on x-axis. Dashed lines denote 95% confidence bands and black dashed lines denote the estimated elasticities.

6. Conclusion

In recent years, the importance of a government investment push to foster GDP growth has been recognized by international institutions and the relevance of this policy tool to foster both short and long-run economic growth will become even more apparent after the global recession determined by the coronavirus pandemic. Our paper contributes to the economic literature and policy debates by assessing the macroeconomic effects of government investments in select Euro-area countries for the period 1970–2016. By following the recent works by Ramey (2016) and Auerbach and Gorodnichenko (2017), we apply an innovative econometric technique that are aimed at combining standard SVAR modeling with the LP approach. This methodology allows us to determine

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the magnitude of fiscal multipliers by constructing IRFs and quantifying the dynamic effect of public investment shocks on GDP. Specifically, we identify government investment shocks by applying a Blanchard and Perotti identification strategy and then introducing them in the LP equation. The same identification is used to assess whether the Great Recession influences the size of fiscal multipliers and introduce the role played by fiscal foresight.

Our main findings show that government investment engenders positive effects on economic growth both in the short and in the long run. Indeed, the estimated government investment fiscal multipliers are positive by assuming values close to 1 on the impact that tend to be greater in the years following the implementation of a discretionary fiscal policy. This implies that public investment generates long-lasting, permanent effects on the GDP level. In the baseline model, government investment spending generates impact cumulative multipliers approximately equal to 1 that reaches peak effects of 1.91, 2.23, and 2.8, according to the different models' specification. When fiscal foresight is considered, fiscal multipliers are in line with those obtained in models not including expectations. Indeed, the impact multipliers are about 1 and reach peak values of 2.37, 2.27, and 2.31 in Models 1, 2, and 3, respectively. These results are corroborated even when the post-2008 period is omitted although the size of multipliers is lower than the one estimated in the baseline models. This allows us to conclude that the inclusion of the years after the Great Recession increases the value assumed by fiscal multipliers. Furthermore, when countries are divided into two different groups, we find that the fiscal multiplier effect is asymmetric and larger in Southern European countries than in the Northern ones. Since our estimates have been carried out using linear models, future developments of this work will assess the size of nonlinear fiscal multipliers by considering their magnitude during economic recession and expansions.

Our findings suggest that governments should launch investment plans in order to emerge from the current economic stagnation, as well as be able to face the global recession that will probably follow the coronavirus pandemic. An investment plan would engender a Keynesian effect by generating positive and permanent effects on the GDP level. This implies investing in infrastructures and in the reinforcement of the public health system, both of which are currently experiencing a critical situation.

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Author contribution. Matteo Deleidi: Conceptualization, Methodology, Investigation, Formal analysis, Writing - original draft, Writing - review & editing, Supervision. Francesca Iafrate: Conceptualization, Methodology, Investigation, Formal analysis, Data curation, Software, Writing - original draft, Writing - review & editing. Enrico Sergio Levrero: Conceptualization, Investigation, Funding acquisition, Writing - original draft, Writing - review & editing, Supervision, Project administration.

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Notes

1 To be more precise, the additional hypotheses on household preferences are the introduction of a separable utility function [Christiano et al. (2011), Quaghebeur (2019)] and a share of non-Ricardian (rule of thumb) consumers who consume all their disposable income [Galí et al. (2007)], namely the hypotheses that allow possible positive co-movement between private consumption and government expenditure.

2 For additional information on the sign restriction approach, see, among others, Uhlig (2005) and Kilian and Lütkepohl (2017).

3 Additional information on the identification strategies employed in VAR models are also provided by Ramey (2016).

4 In Perotti (2004*b*), this conclusion is not validated for Germany since the response of GDP to public investment is larger than the one associated with government consumption.
5 The empirical literature specified in Section 2 refers to fiscal multipliers estimated by linear models. Nowadays, the empirical literature is also employed to address the counter cyclicality of fiscal spending multipliers. In this regard, a large part of the literature claims that fiscal spending multipliers tend to be larger in the period of slack because the crowding out of private consumption and investment is weaker [Castelnuovo and Lim (2019)]. On empirical grounds, these findings are obtained by using alternative empirical methods and samples, as well as considering extreme recessions versus strong expansionary periods and the zero lower bound [see, among others, Caggiano et al. (2015), Fazzari et al. (2015), Riera-Crichton et al. (2015), Miyamoto et al. (2018), Fernández-Villaverde et al. (2019), Ghassibe and Zanetti (2019)]. Different findings are obtained by Owyang et al. (2013) and Ramey and Zubairy (2018) who find no evidence of higher fiscal multipliers in bad times. For an in-depth review of the literature on this topic, see Gechert and Rannenberg (2018); and Ramey (2020), among others.
6 High-quality detailed quarterly fiscal data are not available for many European countries. Therefore, in line with Auerbach and Gorodnichenko (2017) and Beetsma and Giuliodori (2011), we use yearly data.
7 Following Riera-Crichton et al. (2015), the total public expenditure is used only as a control variable in all regressions because the main aim of the analysis is to estimate the government investment multiplier.
8 The time effects, with the so-called year dummies, are introduced to control for the presence of factors that could have simultaneously affected all countries.
9 In all specifications, a lag equal to 1 for both rates of growth is considered. We estimate the model by introducing different lags (from 1 to 4) for the rate of growth of GDP and government expenditures and we find that the model reporting the lowest value in AIC and BIC criteria is the one with a lag equal to 1.
10 In all our regression, we apply Driscoll and Kraay (1998) standard errors to correct for heteroscedasticity, autocorrelation, and cross-sectional correlation. The presence of heteroscedasticity, autocorrelation, and cross-sectional correlation is tested by applying the modified Wald test, the Wooldridge test, and the Pesaran's CADF test, respectively. Results are available upon request.
11 As mentioned in Section 2, both these identification strategies consider government expenditure to be the most exogenous variable. Additionally, in our case, these approaches can be considered equal to each other because we are not considering taxes when estimating the public investment shocks. Following Auerbach and Gorodnichenko (2017), Ilzetzki et al. (2013) and Ramey and Zubairy (2018), taxes are not included in the model since these do not alter the estimates of fiscal multipliers. This implies that the exclusion of taxes does not lead to an omission of relevant variable and therefore the estimated models are not misspecified.
12 Following Ramey and Zubairy (2018), we test whether the instruments obtained through the recursive identification are relevant both in the short- and medium/long run. To do this, we make use of the Olea and Pflueger effective F-statistics and thresholds [Olea and Pflueger (2013)] and we find that our shocks have high relevance both over very short- and medium/long horizons. Findings are not reported in the paper and are available upon request.
13 In the second step for estimating the cumulative fiscal multipliers, the independent variable, namely the government investment rate of growth between t-1 and t+h, is defined as $\triangle I_{i,t+h} = \log\left(I_{t+h}\right) - \log(I_{t-1})$.
14 The cumulative multiplier at a horizon N can be formalised as in the following equation (Spilimbergo et al. (2009): $\sum_{h=0}^{N} \Delta Y(t+j)/\sum_{h=0}^{N} \Delta G(t+j)$.
15 For the sake of comparability with other empirical works, the non-cumulated fiscal multipliers—namely the fiscal multiplier at some horizon $t+h$ (Spilimbergo et al. (2009)—are reported in Appendix B. Such values are obtained by directly multiplying the IRFs and the coefficient β^h by the ex-post conversion factor.
16 Since the debate on the effects of different government spending component is relevant to contemporaneous literature, we have also explored whether the composition of government spending matters when assessing the effect of fiscal stimulus. We have investigated this issue by re-estimating the three different model specifications (Model 1, Model 2, and Model 3) using government consumption (C_g). However, since the main focus of the paper is an analysis of multipliers associated with government investments, we have reported the estimates of government consumption multipliers in Appendix C. Our findings show that government investment multipliers are larger than those estimated for government consumption.
17 Here, we assume that the recent Great Recession began in the first quarter of 2008 according to the Euro Area Business Cycle Dating Committee of the Centre for Economic Policy Research (CEPR). This conclusion is in line with the recession indicator proposed by the FRED, implemented considering the Composite Leading Indicators (CLI) provided by the OECD.
18 In addition to the professional forecasts, Ramey (2011b) also found that the "war dates" of the narrative approach foresee the structural residuals estimated in the SVAR not including expectations.
19 A similar conclusion on the predictability of fiscal policy shocks is also reached by Auerbach and Gorodnichenko (2012).
20 $\triangle G^{F}{}_{i,t|t-1}$ is the rate of growth of government investment spending at time t forecasted at time t-1. The government investment spending forecasters are released by the OECD Economic Outlook database and for the group of selected countries in our analysis, they are available from 1987. Therefore, this part of the empirical analysis is affected for the period 1987–2016.
21 It is also worth noting that when considering fiscal expectations, the multipliers associated with government consumption are still lower than those associated with government investments (see Appendix C, Table C2).

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