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Fiscal policy and public debt: Government investment is most effective to promote sustainability

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Abstract

This paper aims to quantify the effects of government expenditure and its components, i.e. government consumption and investment, on output and public debt sustainability. The Local Projections approach is applied to a dataset of 14 OECD countries considered for the 1981–2017 period. Fiscal policy shocks have been identified using the Blanchard and Perotti strategy and the narrative approach based on fiscal consolidation episodes. Multipliers of total government spending are above the unit and government investment multipliers are higher than consumption ones. Although all fiscal policy shocks reduce the public debt-to-GDP ratio, government investment is the most effective tool for promoting public debt sustainability.

JEL classifications: H50; H60; C33; E62

Keywords: Fiscal multipliers; Public debt sustainability; Government consumption and investment; Local Projections; OECD Countries

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1. Introduction

After the 2008 Global Financial Crisis, fiscal consolidation policies were implemented in many advanced countries in response to rising levels of government debt and to restore economic growth. Consolidation policies involved cutting government expenditure or raising taxes to stimulate economic activity, private consumption, and investment by reducing the public debt-to-GDP ratio and sovereign debt bond spreads (Corsetti et al., 2013; Alesina et al., 2015). Particularly, a significant and credible reduction in the public debt-to-GDP ratio would lead to lower long-term interest rates and corresponding higher asset prices, thus stimulating private expenditure (Ardagna, 2004). Such a policy prescription was motivated by the fact that the values of fiscal multipliers were expected to be below the unit or even close to zero so that fiscal consolidation policies would engender non-Keynesian effects. When looking at the dataset of the narratively identified fiscal policy shocks (Devries et al., 2011; Alesina et al., 2015), expenditure-based fiscal consolidation policies were toughly implemented in Southern peripherical euro area countries which experienced a fiscal retrenchment ranging between 1 % and 2 % of GDP during the 2010–2014 period. Although less strong, fiscal consolidation policies were also implemented in the US economy attaining 0.2 % of GDP during 2011–2013 (see Appendix 1, Table 1.1). Yet reality soon became more explicit in the subsequent years: fiscal consolidations generated negative impacts on economic growth, public debt-to-GDP ratios and unemployment rates dramatically increased, and interest rates stabilized after central bankers' announcements and thanks to unconventional monetary policies.

Many economists and international institutions questioned the underpinnings of fiscal consolidation policies and advocated a well-designed fiscal policy, pointing out that fiscal multipliers were often higher than assumed. Scholarly-based literature indicated that multipliers were underestimated by 0.7–1.3 units during the 2010–2011 period (Blanchard & Leigh, 2013; Gechert et al., 2019) and that austerity policies had been a drag on growth, especially during economic recessions (Guajardo et al., 2014; Jordà & Taylor, 2016). More recently, Fatás and Summers (2018) argued that fiscal consolidation policies are very likely to raise the public debt-to-GDP ratio through their long-term negative effects on GDP. In line with this perspective, the International Monetary Fund (IMF) (International Monetary Fund 2020) *Fiscal Monitor* advocates for a public investment stimulus to address the crisis caused by the COVID-19 pandemic. The IMF emphasized that productive public investment seeks to emerge economies from stagnation, not only by boosting short-term output and private investment but also by strengthening long-term productivity capacity. In this regard, the fiscal policy responses launched by many advanced countries in response to the COVID-19 crisis differ from those implemented after the Global Financial Crisis. For instance, the European Commission (EC) launched the most ambitious EU Research and Innovation plan of €100 billion and invested €800 billion in the NGEU to make European economies healthier, greener, and more digital. Similarly, the US administration launched a $5.2 trillion fiscal plan for the post-pandemic recovery, in which the Investment Plan of $1.2 trillion allocates $700 billion for the development of clean energy technologies. Additionally, the US administration launched in 2022 an investment plan of $370 billion in clean energy and climate action. Nevertheless, the Fiscal Policy Guidance for 2024 issued by the EC cautions against perpetually extending fiscal stimuli (European Commission, 2023). To lower the public debt-to-GDP ratio, the EC recommends member states with high (exceeding 90 %) and moderate (ranging between 60 % and 90 %) public debt-to-GDP ratios need to adopt fiscal consolidation policies based on the reduction of the net nationally financed primary current expenditure, namely excluding interest expenditure, and net of discretionary revenues and cyclical unemployment expenditures (European Commission, 2023).

Based on these premises, this paper aims to quantify the impact of total government expenditure and its components (i.e. government consumption and investment) on GDP and the public debt-to-GDP ratio. We apply the Local Projections approach to a dataset of 14 OECD countries considered for the 1981–2017 period. Fiscal policy shocks have been identified using the Blanchard and Perotti strategy and the narrative records of fiscal consolidation episodes released by Alesina et al. (2015). Our findings can be summarized as follows: i) fiscal multipliers are positive and, in general, above one; ii) government investment multipliers are higher than government consumption multipliers; iii) all spending shocks reduce the public debt-to-GDP ratio; iv) government investment is more effective than consumption in reducing the public debt-to-GDP ratio; v) all spending shocks produce persistent effects on both the output level and the debt-to-GDP ratio. Our findings are also confirmed when models are augmented by government expenditure expectations.

The paper is organized as follows. Section 2 provides theoretical and empirical literature. Section 3 describes data and methods. Sections 4 and 5 present the main findings, while Section 6 concludes by drawing some policy implications.

2. Fiscal multipliers and public debt sustainability: a theoretical and empirical overview

The empirical studies evaluating the impact of spending shocks on macroeconomic variables have usually employed Structural Vector Autoregressive (SVAR) models, as in the case of a seminal paper by Blanchard and Perotti (2002). More recently, scholarly-based literature has used the Local Projections (LP) approach (Auerbach & Gorodnichenko, 2017; Ramey & Zubairy, 2018) for its being considered a more flexible method than standard SVAR modelling (Jordà, 2005).[1] One of the critical aspects of using such methods is the selection of a suitable identification strategy. Within the VAR framework, four main identification strategies are employed: i) the recursive ordering (Bachmann & Sims, 2012); ii) the Blanchard and Perotti (BP), which is similar to a recursive ordering though it imposes an external parameter to model the relationship between net taxes and output (Blanchard & Perotti, 2002); iii) the sign restrictions approach (Mountford & Uhlig, 2009); iv) and the narrative approach (NA), usually based on historical episodes of changes in the fiscal policy stances typically determined by military build-ups, exogenous tax changes, or fiscal consolidations episodes (Ramey, 2011; Romer & Romer, 2010; Alesina et al., 2015). Within the LP approach, the identification is obtained using military expenditure, public investment, forecast errors of the rate of growth of government spending, and the narratively identified shocks (Auerbach & Gorodnichenko, 2017; Ramey & Zubairy, 2018). More recently, the SVAR and the LP have been combined by introducing the shocks identified in the SVAR in the LPs equation (Auerbach & Gorodnichenko, 2017; Ramey & Zubairy, 2018; Deleidi et al., 2023).

The empirical literature shows that real GDP increases in response to government spending shocks and that spending multipliers are positive, ranging from 0.8 to 1.5 (Deleidi et al., 2023). However, the magnitude of multipliers varies among different studies (Gechert, 2015). Such differences may depend on divergence in either the countries' peculiarities – such as the degree

[1] For an in-depth review of estimated multipliers using both the SVAR and LP, an interested reader may see, among others, Gechert (2015), Ramey (2019), and Deleidi et al., (2020, 2023).

of development of a country, the exchange rate regimes, and the accumulated public debt – or the related identification strategies and methods adopted to obtain fiscal policy shocks (Ilzetzki et al., 2013; Ramey, 2019). Yet, although most studies focus on the effects of total government expenditure on GDP, part of the literature assesses the impact of government spending components, such as government investment and consumption, or defence and non-defence expenditure (Auerbach & Gorodnichenko, 2012). Many studies confirm the superiority of multipliers of government investment compared to those associated with government consumption (Gechert, 2015; Deleidi & Mazzucato, 2021; Deleidi, 2022; Ciaffi et al., 2024b), whereas few analyses show that public investment is not more effective than government consumption in stimulating economic activity (Perotti, 2004a). While the former maintains that public investment is a policy tool that combines the short-run effects of supporting aggregate demand with the long-run supply effects and the creation of positive externalities in the private sector (Ramey, 2019), the latter supports the idea that government investment crowds out private one (Perotti, 2004a).[2]

The magnitude of fiscal multipliers has also important implications for public debt sustainability. The positive and close-to-one values of estimated multipliers and the permanent effects that fiscal consolidation policies may produce on GDP have allowed to question the idea that consolidation policies may reduce the public debt-to-GDP ratio (Fatás & Summers, 2018). This implies that fiscal consolidation policies may be self-defeating: a reduction in government expenditure generates a substantial fall in economic activity, thus leading to an increase in the public debt-to-GDP ratio both in the short and in the long run. Analytically, the public debt-to-GDP ratio dynamics can be represented as in equation 1:

$$b_t = \frac{1 + i_t}{(1 + g_t)} d_{t-1} + d_t \tag{1}$$

where b_t is the public debt-to-GDP ratio, i is the long-term government bond yield, g is the nominal growth rate of GDP, and d_t is the primary deficit-to-GDP ratio. A fiscal policy shock can influence the public debt-to-GDP ratio in various ways by affecting: i) the real GDP growth rate and the inflation rate, and then leading to further adjustments in the fiscal revenue and the primary deficit; and ii) the nominal interest rate on government bonds (Auerbach and Gorodinchenko, 2017). Equation 1 can be rearranged as follows in equation 2.

$$\dot{b} = b_{t-1}(i_t - g_t) + d_t \tag{2}$$

Equation 2 reveals that the change in the debt ratio depends on two factors: the primary deficit-to-GDP (d_t) ratio and the product of the lagged debt ratio (b_{t-1}) and ($i_t - g_t$). Consequently, the stability of the public debt is influenced by the interest-growth dynamics. From equation 2, we can derive the stability condition for the primary deficit in equation 3:

$$d_t = (g_t - i_t) b_{t-1} \tag{3}$$

[2] A debate on state-dependent multipliers began with the pioneering research by Auerbach and Gorodnichenko (2012). Many studies indicate that multipliers are larger in economic recessions than during expansions (Fazzari et al., 2015; Auerbach & Gorodnichenko, 2017). Such a perspective is motivated by the fact that the crowding-out effect on private consumption and investment is weaker during economic downturns because of the slower responsiveness of prices and interest rates to spending shocks and the presence of available excess capacity. On the contrary, Ramey and Zubairy (2018) estimate a-cyclical multipliers and Alloza (2022) claims that multipliers are higher during economic expansions than in recessions.

As shown in equation 3, when $g_t > i_t$, the government does not need to run a primary surplus to stabilize the debt ratio, while it can run a primary deficit. Moreover, the higher the debt ratio, the larger the primary deficit to stabilize the debt ratio. Contrarily, if $g_t < i_t$, the government needs to run a primary surplus to stabilize the debt ratio. In such instances, the larger the debt, the higher the required surplus (Blanchard, 2023; Heimberger, 2023).

However, when focusing on the determinants of the debt-to-GDP ratio dynamics, one of the key factors is the magnitude of fiscal multipliers that influence the GDP growth rate and then g_t in equation 1. Positive and sufficiently high multipliers raise the possibility of self-defeating fiscal consolidation plans as negatively impacting the real GDP.[3] On the contrary, a well-designed fiscal policy could improve debt dynamics and fiscal balance, by raising both GDP growth and revenues (Fatás & Summers, 2018). Indeed, to allow the public debt-to-GDP ratio (b_t) to decrease after a fiscal stimulus, the following condition needs to be fulfilled: $b_t * m_Y > 1$, where m_Y is the fiscal multiplier (Ciccone, 2013; International Monetary Fund, 2023).[4] If the previous condition holds, expansionary fiscal policies result in a lower debt-to-GDP ratio, while fiscal consolidations in a higher one. This condition implies that fiscal stimuli are more likely to reduce the debt-to-GDP ratio when countries face a high level of debt since the multiplier required to comply with the condition is lower.

In recent years, a few empirical studies have proved that fiscal consolidation policies are likely to be self-defeating (Ciaffi et al., 2024a). While some studies find that such effects are confirmed in the short- and medium-run and especially for those countries experiencing a debt-to-GDP ratio higher than 60 % (Eyraud & Weber, 2013), and during periods of weak and low economic growth (Abiad et al., 2016; Auerbach & Gorodnichenko, 2017), others reveal the long-term negative effects of fiscal consolidation due to its impact on potential output (Fatás & Summers, 2018; Fatás, 2019; Gechert et al., 2019). Finally, when assessing the different impacts that government consumption and investment may produce on public debt sustainability, it emerges that a fiscal shock dragged by a rise in government investment is followed by a reduction in the public debt-to-GDP ratio (Abiad et al., 2016), while an increase in public consumption harms the sustainability of the public debt (Petrović et al., 2021).

3. Data and methods

3.1. Data

To assess the effect of government expenditure and its components on GDP and the dynamics of the public debt-to-GDP ratio, we use the annual data provided by the OECD and the IMF in the Economic Outlook, National Accounts, and World Economic Outlook databases. Our analysis is based on a sample of 14 countries: Australia, Belgium, Canada, Denmark,

[3] The impact on output has a further indirect effect on the primary deficit through the impact on automatic stabilizers and tax revenue that can partly offset the initial consolidation effort. Both effects would mitigate or even eliminate the impact of consolidation policies on debt sustainability, at least in the short run. The mitigation effect is stronger if fiscal multipliers, the initial debt-to-GDP ratio, and automatic stabilizers are larger. Fiscal consolidation can also influence public debt-to-GDP ratio dynamics by affecting the interest and inflation rate. On the impact of fiscal policy on interest rates see Corsetti et al. (2013) and Cottarelli and Jaramillo (2012). On the effect of fiscal policy on inflation, see Auerbach and Gorodinchenko (2017) and Jørgensen and Ravn (2022).

[4] For a mathematical analysis of this condition, see Ciccone (2013). For the sake of simplicity, we assume a tax rate equal to zero and constant inflation and interest rates.

Finland, France, Germany, Ireland, Italy, Japan, the Netherlands, Spain, the UK, and the US. The study uses yearly macroeconomic data for the 1981–2017 period. We consider the following variables: GDP (Y), government consumption and investment expenditures (G), the short-term interest rate (i), and the public debt-to-GDP ratio (D/Y). To evaluate whether fiscal policy composition matters in affecting the dynamics of Y and D/Y, government expenditure is broken down into government consumption (G_C) and investment (G_I).[5] The use of annual data allows us to employ the narratively identified fiscal consolidation (FC) shocks developed by Devries et al. (2011) and updated by Alesina et al. (2015). They examined official documents to collect and determine the size, timing, and principal motivation behind any fiscal consolidation intervention.[6] FC shocks are measured as a percent of GDP and cover the 1981–2014 period. The variables are expressed in real terms using the GDP deflator and converted to USD dollars using the PPP index. All variables – excluding the interest rate, the debt-to-GDP ratio, and the fiscal consolidation shocks – are at logarithmic levels. Details on the construction of the variables and data sources are provided in Appendix 2 (Table 2.1).

3.2. Methods

The Local Projections (LP) method is used to estimate the effects of fiscal shocks on Y and D/Y. The LP approach (Jordà, 2005) entails the estimation of a single equation in which the variable of interest is considered in each horizon following the realization of the shock. The estimated model is formalized in equation 4:

$$y_{i,t+h} = \alpha_i + \delta_\tau + \beta^h shock_{i,t} + \vartheta_1^h z_{i,t-1} + \varepsilon_{i,t+h} \tag{4}$$

Where α_i and δ_τ are country and time fixed effects; y is the variable of interest (i.e. Y and D/Y) considered at each horizon $h = 0,\ 1,\ \dots H$; $shock_{i,t}$ is the identified fiscal shocks; $z_{i,t-1}$ contains the control variables and includes the lag of all variables incorporated in the model.[7] The interest rate is included to control for the stance of monetary policy. We first identify government spending shocks ($shock_{i,t}$) through different identification strategies that will be discussed in depth below. Second, we introduce shocks in the LP equations, and we estimate the impulse response functions (IRFs) for the five years ahead ($h = 5$). IRFs are computed following a twofold method. The first method scales the identified shocks ($w_{i,t}^G$) so that they are expressed as a percent of GDP (Auerbach & Gorodnichenko, 2017).[8] To do that, we first calculate the average government spending-to-GDP ratio ($s_i^G = G_i/Y_{i,}$) over the sample period for each country i, and then we construct the fiscal policy shock used in equation 4 as follows: $shock_{i,t} = s_i^G * w_{i,t}^G$.[9] We also employ a second method that rescales the fiscal shocks ($w_{i,t}$) using

[5] Net taxes are not included in the specified models since scholarly-based literature has shown that they do not lead to model misspecifications and thus do not alter the estimates of spending multipliers (Auerbach & Gorodnichenko, 2017; Ramey & Zubairy, 2018).

[6] For details on dataset structure, see Devries et al. (2011) and Alesina et al. (2015). The Netherlands is not included in the dataset due to a problem of exogeneity (Alesina et al., 2015; Fotiou, 2022). The NA approach is therefore applied to a set of 13 countries.

[7] When using the Fiscal Consolidation (FC) shocks, we include one lag of FC to control for serial correlation (Auerbach & Gorodnichenko, 2017; Ramey & Zubairy, 2018).

[8] In the literature on fiscal multipliers, several contributions divide the fiscal policy shocks by a measure of potential GDP (Ramey & Zubairy, 2018). However, available measures of potential output are sensitive to business cycle fluctuations (Auerbach & Gorodnichenko, 2017; Coibion et al., 2017).

[9] Similarly, for public investment and consumption shocks we use the following ratios: $s_i^{G\_I} = G\_I_i/Y_{i,}$

the value of $G_i/Y_{i,}$ at each point in time rather than its average (s_i^G) (Ramey & Zubairy, 2018). Additionally, we estimate cumulative effects namely the cumulative variation of Y and D/Y relative to the cumulative variation of government spending (Ramey & Zubairy, 2018).

Shocks introduced in equation 4 are computed using two different methods: i) the standard Blanchard and Perotti (BP) strategy; and ii) the narrative approach based on fiscal consolidation episodes (Devries et al., 2011; Alesina et al., 2015). In the first identification strategy, we assume that government spending does not respond contemporaneously to macroeconomic conditions. When considering total government expenditure (G), we propose a three-equation VAR model where total public spending (G) is ordered first, GDP (Y) is ordered second, and the interest rate (i) is the third ordered variable.[10] When considering government investment and consumption separately, we have a four-equation VAR model where public investment (G_I) is more exogenous than government consumption (G_C) as G_I depends on strategic decisions which are usually based on long-term political goals as well as on bureaucratic and institutional decisions based on feasibility studies that involve different policy-making institutions and take a long time to be implemented (Deleidi et al., 2023). Finally, to consider the role of fiscal foresight, we include government spending forecasts ($\Delta G^F_{t|t-1}$) as the first ordered variable in all VAR models.[11] The use of this variable helps us purify fiscal shocks from their potentially anticipated component and therefore identify unanticipated fiscal shocks ($w_{i,t}^{unexp}$) (Auerbach & Gorodnichenko, 2012). The second identification is based on the narrative approach and the fiscal consolidation (FC) shocks aimed at reducing public deficit and ensuring long-term financial sustainability. The identified episodes are argued and demonstrated to be exogenous and systematically uncorrelated with output dynamics (Devries et al., 2011; Alesina et al., 2015; Fotiou, 2022). The dataset provides fiscal consolidations both on the revenue and the spending sides. However, following Auerbach and Gorodnichenko (2017), we use the expenditure-based FC and we consider the unexpected component, that is the fiscal consolidation announced upon implementation at time t. [12][13] Additionally, when evaluating the effect of government consumption and investment, we use the total unexpected expenditure-based FC shocks since consolidation plans involve joined cuts in the different spending components (OECD, 2011). Finally, because expenditure-based FC are recorded as positive values by Devries et al. (2011) and Alesina et al. (2015), we follow Auerbach and Gorodnichenko (2017) and change the sign of the shocks so that they turn to be negative whenever they take a non-zero value. In doing so,

(*footnote continued*)
and $s_i^{G\_C} = G\_C_{i,}/Y_{i,}$.

[10] The inclusion of the short-term interest rate allows the Blanchard and Perotti identification strategy to be extended to consider the interaction between monetary and fiscal policies (Perotti, 2004b).

[11] We use the forecasts provided by the OECD in the Economic Outlook. Specifically, we use the forecasts made at $t-1$ for the growth rate of real government purchases for time t. These forecasts are available from year 1987, so this part of the empirical analysis is carried out for the period 1987–2017.

[12] These episodes consist of three different components in each year t: i) an unexpected shift in fiscal variables, announced upon implementation of the fiscal policy in year t; ii) a shift implemented at time t but announced in previous years; and iii) the announcement of future consolidation policies, which are announced at time t and realized from $t+1$ to $t+5$.

[13] Our analysis does not change qualitatively or quantitatively if we include both unanticipated and anticipated legislative announcements that are implemented in the same year, as done by Fotiou (2022) and in line with the work of Devries et al. (2011). Fotiou (2022) argue that the exclusion of future announcements will not lead to any bias because most of the plans have a one-year horizon.

estimated IRFs show the responses of GDP and the public debt-to-GDP ratio following a one-percent increase in government spending and its components.

To provide a robust picture, we estimate four different models. In Model 1, variables are in growth rates in equation 4. In Model 2, variables are in log-level to preserve any cointegration relationship that may exist among variables (Auerbach & Gorodnichenko, 2012). In Model 3, variables are in growth rates, and we apply Ramey and Zubairy's (2018) procedure to calculate IRFs. In Model 4, the variables are in log-level with a country-specific time trend. While Ramey and Zubairy's (2018) procedure is applied in Model 3 to compute IRFs, we use Auerbach and Gorodnichenko's (2017) method in Models 1, 2, and 4.

4. Fiscal multipliers

In this section, we report the impact of public expenditure and its components on GDP for the four different model specifications and the various identification strategies described in Section 3. In all the figures reported below (Figures 1–3), we display the dynamics responses of government spending and its components (G, G_I, and G_C) and the GDP (Y) to fiscal policy shocks. Cumulative fiscal multipliers are in Table 1.

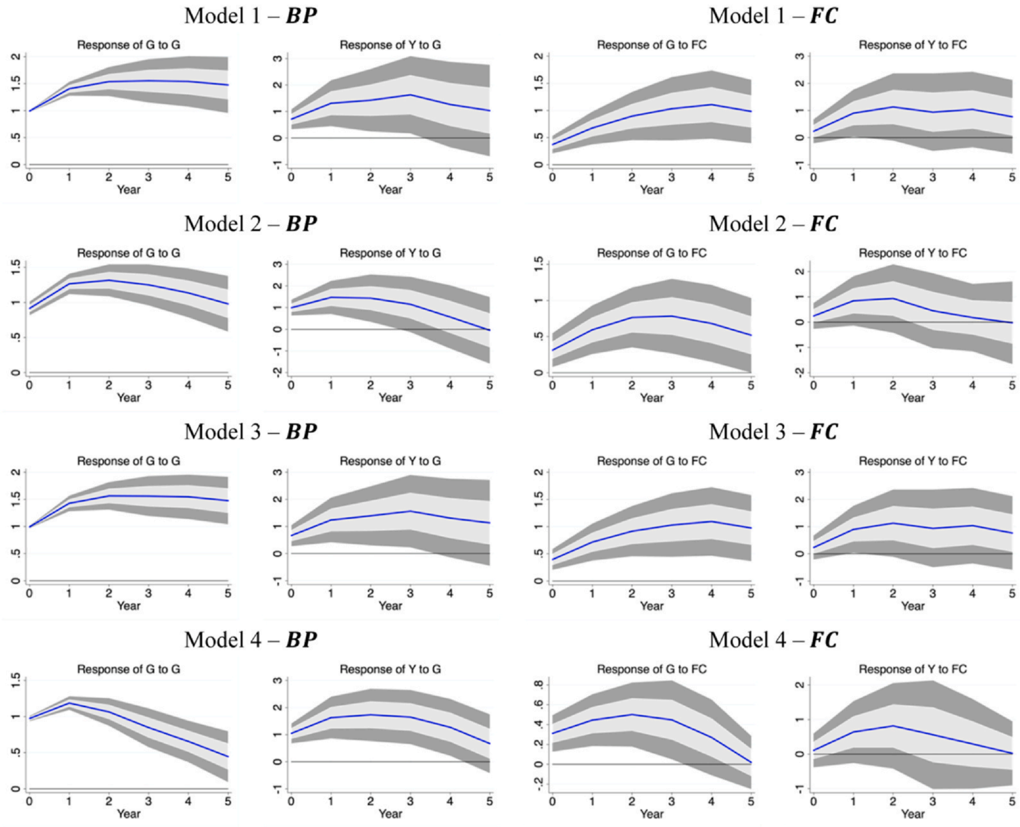

Figure 1. Impulse Response Functions of ***G*** on ***Y***. ***BP*** and ***FC*** identifications. Shaded areas represent 68 % and 95 % confidence intervals.

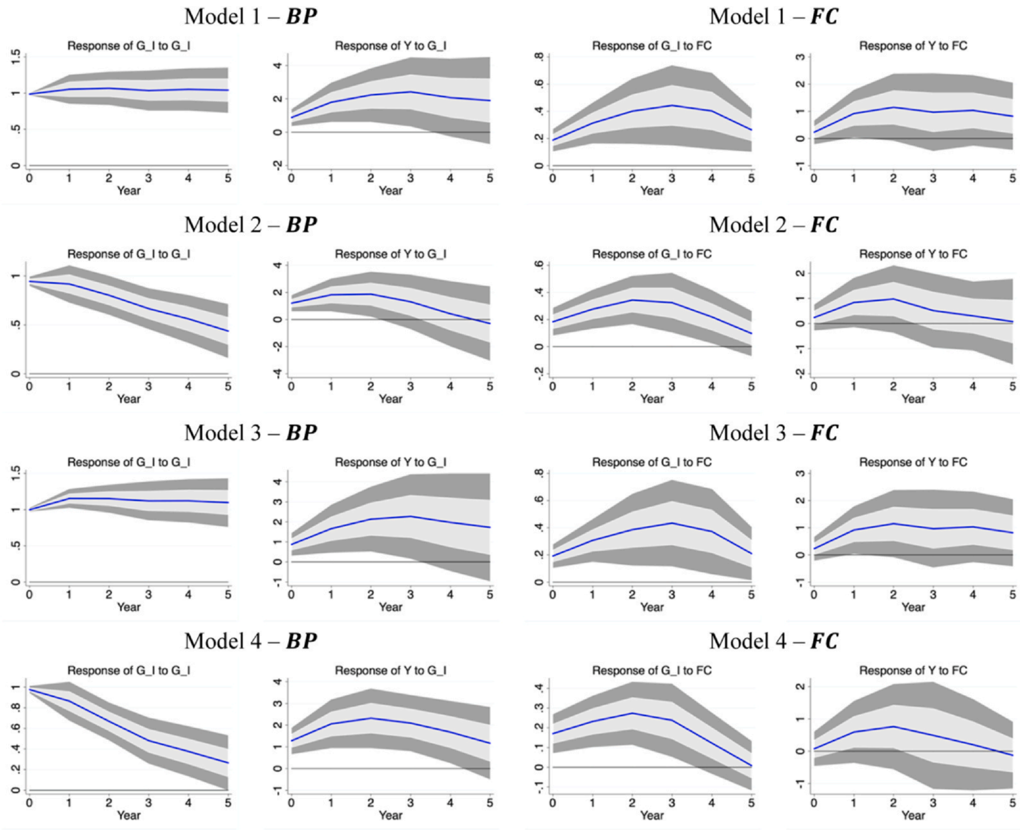

Figure 2. Impulse Response Functions of ***G_I*** on ***Y***. ***BP*** and ***FC*** identifications. Shaded areas represent 68 % and 95 % confidence intervals.

Starting with total public expenditure (*G*), Figure 1 plots the IRFs of Models 1–4 obtained through the BP identification strategy and the NA based on FC shocks. While the IRFs for the models estimated with fiscal expectations are in Appendix 3 (Figure 3.1), the cumulative multipliers calculated for all models and identifications are in Table 1. Using both the BP and FC identifications, the estimated IRFs show that fiscal policy shocks generate positive and long-lasting effects on government spending and GDP, which is reflected in the positive and often significant values of IRFs even five years after the initial shock. Yet, although high persistence is found in models using variables at the first differences (Models 1 and 3), a certain degree of persistence is also estimated in models employing log-level variables (Models 2 and 4). The cumulative multipliers in Table 1 show that the multipliers associated with total government spending are close to 1, with some differences between the different model specifications employed. The impact multipliers estimated using the BP strategy range from 0.67 to 1.09. Five years after the initial shock, multipliers are still positive assuming values ranging from 0.81 to 1.52. Average multipliers are computed in a range between 0.81 and 1.34. Models using the NA based on the FC engender impact multipliers ranging from 0.34 to 0.78. Five years after the initial shock, multipliers range between 0.72 and 1.21, and the average multipliers range from 0.96 to 1.04. When including fiscal expectations in the BP strategy, the estimated multipliers are

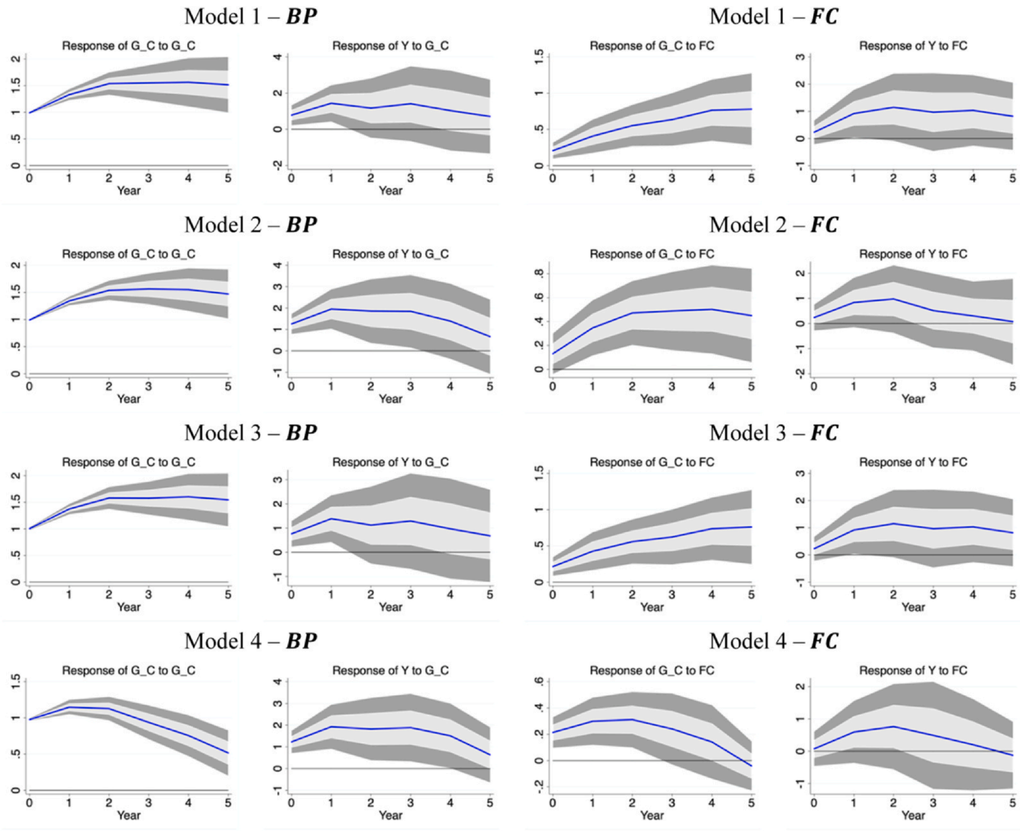

Figure 3. Impulse Response Functions of ***G_C*** on ***Y***. ***BP*** and ***FC*** identifications. Shaded areas represent 68 % and 95 % confidence intervals.

slightly higher than those obtained in models without expectations. Indeed, computed multipliers range from 0.83 to 1.13 on impact, from 0.92 to 2.01 after five years, and from 0.99 to 1.57 on average.

The IRFs obtained from models considering government consumption and investment separately are reported in Figures 2 and 3, while the IRFs of models considering expectations are in Appendix 3 (Figure 3.2 and 3.3). Even when considering the two different components of public expenditure, we find that fiscal shocks produce persistent effects in many model specifications. In many cases, the GDP responses are statistically significant even five years after the initial shock, both in the case of government investment and consumption. Additionally, our findings show that government investment is more effective than public consumption in boosting economic activity. When looking at the computed cumulative fiscal multipliers for the four different models and identification strategies in Table 1, government investment fiscal multipliers are on average close to 2, while those associated with government consumption are slightly above 1. Specifically, government investment identified through a BP produces an impact multiplier that ranges from 0.87 to 1.31. Five years after the initial shock, investment multipliers are between 1.37 and 2.92, and average multipliers are between 1.36 and 2.28. When using the NA, our findings are confirmed, and the multipliers range from 0.43 to 1.29 on impact,

Table 1
Cumulative Multipliers of ***G***, ***G_I***, and ***G_C*** on ***Y***. Significant estimates are in bold (68 % confidence bands).

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Average
Model 1 – *BP*							
G	**0.72**	**0.84**	**0.88**	**0.93**	**0.90**	**0.87**	0.86
G_I	**0.89**	**1.31**	**1.58**	**1.77**	**1.81**	**1.81**	1.53
G_C	**0.79**	**0.96**	**0.88**	**0.89**	0.84	0.77	0.86
Model 2 – *BP*							
G	**1.09**	**1.13**	**1.11**	**1.06**	0.95	0.81	1.03
G_I	**1.21**	**1.54**	**1.73**	**1.76**	1.60	1.37	1.54
G_C	**1.27**	**1.38**	**1.31**	**1.27**	**1.19**	1.06	1.24
Model 3 – *BP*							
G	**0.67**	**0.79**	**0.83**	**0.88**	**0.87**	**0.85**	0.81
G_I	**0.87**	**1.17**	**1.40**	**1.55**	**1.59**	**1.58**	1.36
G_C	**0.72**	**0.87**	**0.80**	**0.80**	0.75	0.70	0.77
Model 4 – *BP*							
G	**1.04**	**1.19**	**1.32**	**1.44**	**1.51**	**1.52**	1.34
G_I	**1.31**	**1.81**	**2.25**	**2.59**	**2.80**	**2.92**	2.28
G_C	**1.26**	**1.48**	**1.53**	**1.64**	**1.69**	**1.64**	1.54
Model 1 – *BP* with ΔG^F							
G	**0.83**	**0.97**	**0.99**	**1.08**	**1.08**	**1.08**	1.00
G_I	**1.00**	**1.49**	**1.76**	**2.02**	**2.11**	**2.18**	1.76
G_C	**0.92**	**1.05**	**0.94**	**0.97**	0.90	0.83	0.93
Model 2 – *BP* with ΔG^F							
G	**1.13**	**1.18**	**1.15**	**1.11**	1.02	0.92	1.09
G_I	**1.32**	**1.76**	**1.96**	**2.06**	2.01	1.96	1.85
G_C	**1.29**	**1.34**	**1.26**	**1.21**	1.09	0.96	1.19
Model 3 – *BP* with ΔG^F							
G	**0.83**	**0.97**	**0.99**	**1.07**	**1.05**	**1.04**	0.99
G_I	**0.99**	**1.44**	**1.73**	**2.01**	**2.13**	**2.24**	1.75
G_C	**0.91**	**1.02**	0.91	0.93	0.86	0.78	0.90
Model 4 – *BP* with ΔG^F							
G	**1.05**	**1.30**	**1.47**	**1.70**	**1.87**	**2.01**	1.57
G_I	**0.99**	**1.43**	**1.71**	**2.01**	**2.29**	**2.58**	1.83
G_C	**1.19**	**1.41**	**1.51**	**1.70**	**1.81**	1.83	1.57
Model 1 – *FC*							
G	**0.63**	**1.08**	**1.16**	**1.07**	**1.04**	**0.99**	0.99
G_I	**1.22**	**2.29**	**2.55**	**2.42**	**2.46**	**2.54**	2.25
G_C	**1.11**	**1.87**	**1.97**	**1.81**	**1.67**	**1.53**	1.66
Model 2 – *FC*							
G	0.78	**1.20**	**1.21**	1.01	0.85	0.72	0.96
G_I	**1.29**	**2.33**	**2.54**	**2.27**	**2.12**	**2.03**	2.10
G_C	**1.82**	**2.25**	**2.16**	**1.78**	**1.47**	**1.23**	1.78
Model 3 – *FC*							
G	**0.59**	**1.02**	**1.11**	**1.05**	**1.02**	**0.97**	0.96
G_I	**1.19**	**2.30**	**2.59**	**2.47**	**2.54**	**2.69**	2.30
G_C	**1.07**	**1.79**	**1.92**	**1.79**	**1.68**	**1.54**	1.63
Model 4 – *FC*							
G	0.34	**0.98**	**1.24**	1.24	1.22	1.21	1.04
G_I	0.43	**1.65**	**2.11**	2.10	2.04	1.91	1.71
G_C	0.34	**1.29**	**1.73**	1.80	1.75	1.71	1.44

from 1.91 to 2.69 five years after the shock, and from 1.71 to 2.30 on average. The model augmented by expectations produces multiplicative effects similar to those obtained with the standard BP strategy: the impact multipliers range between 0.99 and 1.32, and the 5-year and the average multipliers range from 1.96 to 2.58, and from 1.75 to 1.85, respectively. When looking at public consumption expenditure, the multipliers estimated using the BP strategy assume values that range from 0.72 to 1.27 on impact, from 0.70 to 1.64 five years after the shock, and from 0.77 to 1.54 on average. The government consumption multipliers estimated with the NA (FC) are slightly higher than those obtained with the BP strategy. Indeed, consumption multipliers are between 0.34 and 1.82 on impact, the 5-year multipliers range from 1.23 to 1.71, and the average multipliers are between 1.44 and 1.78. The multipliers estimated in models including expectations are in line with those obtained without expectations. Specifically, impact multipliers range between 0.92 and 1.29, 5-year multipliers are between 0.78 and 1.83, and average multipliers range from 0.90 to 1.57.

Our findings shed light on a few relevant issues for the fiscal policy literature. First, the estimated IRFs display a certain degree of persistence, showing that fiscal policy shocks may engender long-lasting effects on GDP. Such findings are validated using the Blanchard and Perotti identification, the narrative approach, and when considering government consumption and investment separately. Second, regardless of the adopted identification strategies and when controlling for feasible non-fundamentalness issues, the multipliers associated with total government spending are in many specifications above the unit, ranging on average between 0.81 and 1.57. Finally, our estimates confirm that fiscal policy composition matters and that government investment stimulates GDP more effectively than government consumption. While average government investment multipliers range from 1.36 to 2.30, average government consumption multipliers are between 0.77 and 1.78. Yet, despite the superiority of government investment, government consumption is associated with multipliers larger than the unit in many model specifications.

5. Government expenditure and public debt sustainability

In this section, we examine the fiscal sustainability of public debt by evaluating and quantifying the effects of an increase in public expenditure and its component on the public debt-to-GDP ratio. Our findings show that expansionary fiscal policies are followed by a lower public debt-to-GDP ratio and that fiscal consolidation policies are likely to be self-defeating. When considering the composition of a fiscal plan, the higher value of government investment multipliers than public consumption translates into a stronger reduction in the public debt-to-GDP ratio.

Figures 4–6 report the IRFs of the public debt-to-GDP ratio (D/Y) responses to different government spending shocks identified through BP and FC identification strategies. The IRFs for the models estimated with fiscal expectations are displayed in Appendix 3 (Figures 3.1–3.3). In Table 2 we show the corresponding cumulative effects estimated for all model specifications and identifications. Figures 4–6 show that fiscal policy shocks persistently affect government spending and its components as well as the public debt-to-GDP ratio in many model specifications. Figure 4 displays that a rise in government expenditure (G) reduces the public debt-to-GDP ratio. Figures 5 and 6 show that government investment (G_I) is more effective in reducing the public debt-to-GDP ratio than government consumption (G_C). In many model specifications, such effects are found to lower D/Y persistently since public debt responses are

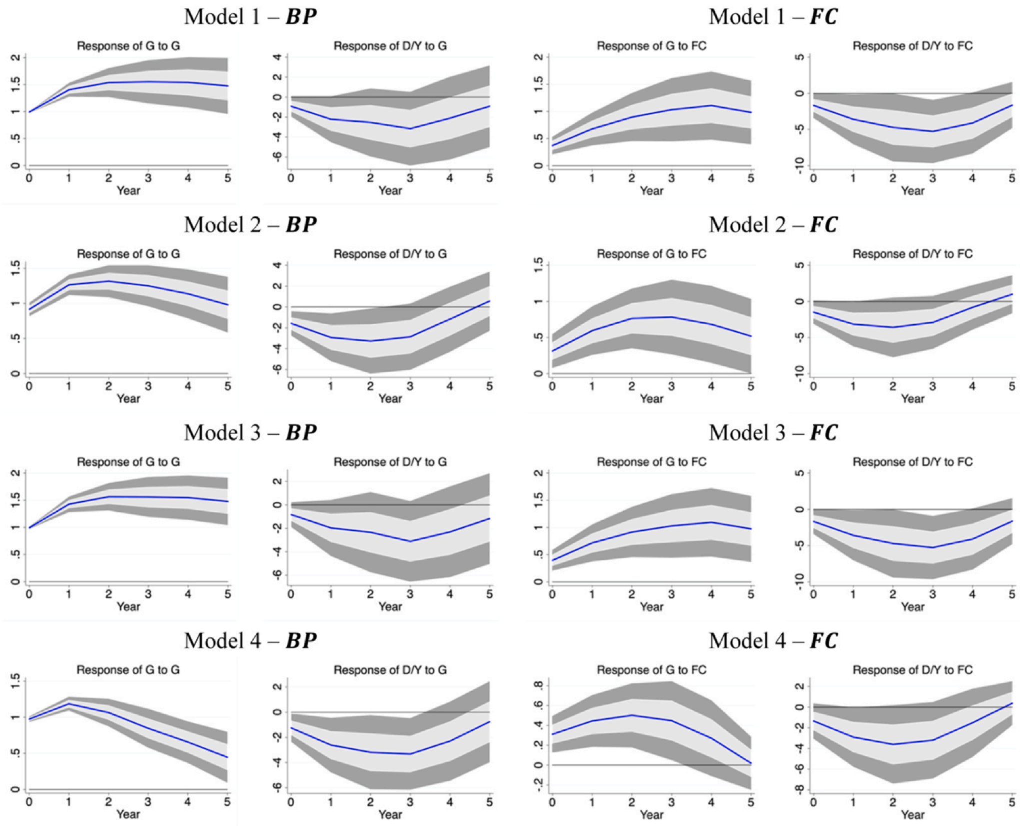

Figure 4. Impulse Response Functions of G on D/Y. BP and FC identifications. Shaded areas represent 68 % and 95 % confidence intervals.

negative and often statistically significant even five years after the realization of the spending stimuli.

When considering the BP identification and total government spending (G), after a 1 % of GDP increase in public expenditure the public debt-to-GDP ratio falls by a range from 0.84 to 1.73 % points on impact. The persistent effect of public spending on GDP translates into a reduction in D/Y that ranges between 1.40 % and 2.55 % points five years after the initial shock. The average reduction in D/Y ranges between 1.27 % and 2.06 % points. Slightly higher results are obtained when the model identified through a BP strategy is augmented by fiscal expectations. Indeed, we observe that a rise in government expenditure reduces the public debt-to-GDP ratio by a range from 0.85 to 1.96 % points on impact, from 1.88 to 2.64 five years after the realization of the spending stimuli, and from 1.72 to 2.39 % points on average. The NA leads to higher coefficients than those obtained with the BP strategy. Notably, a 1 % of GDP rise in public expenditure leads to a reduction in the public debt-to-GDP ratio of between 4.24 % and 4.76 % points on impact, between 3.01 % and 6.11 % points after five years, and between 4.36 % and 5.85 % points on average.

When evaluating the composition of a fiscal plan, the responses of the public debt-to-GDP ratio are in line with the fiscal multipliers obtained (see Table 1), and particularly government

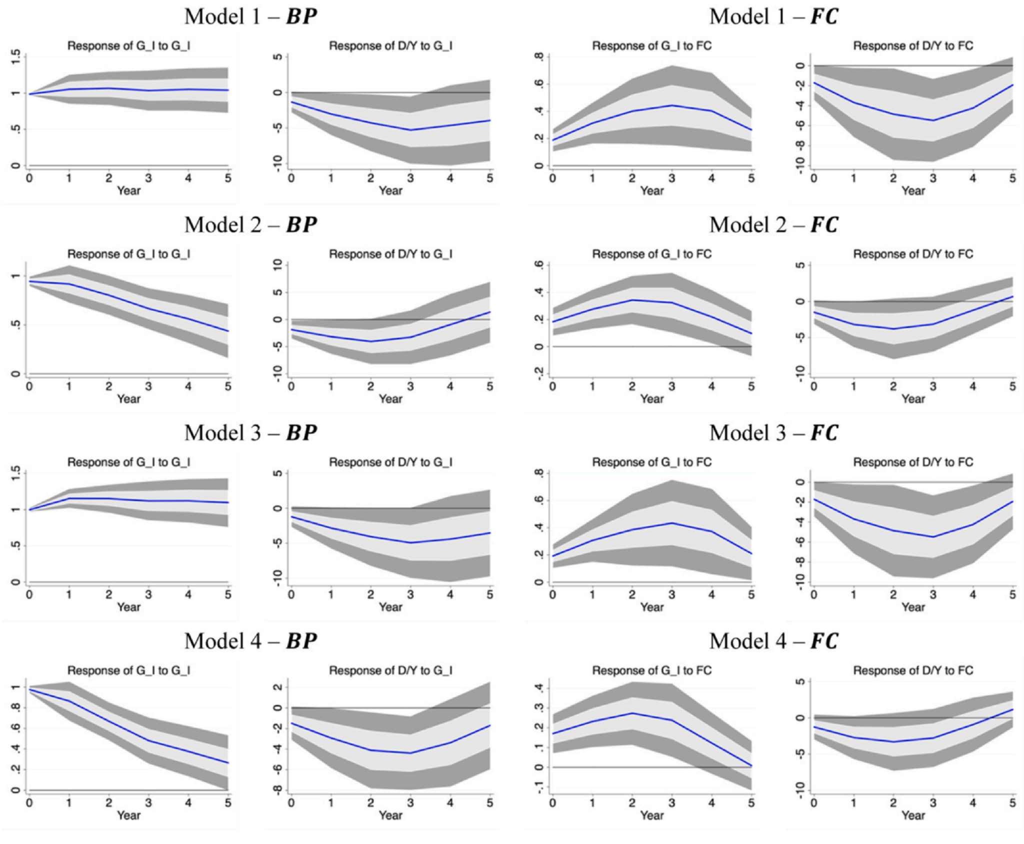

Figure 5. Impulse Response Functions of $\boldsymbol{G\_I}$ on $\boldsymbol{D/Y}$. $\boldsymbol{BP}$ and $\boldsymbol{FC}$ identifications. Shaded areas represent 68 % and 95 % confidence intervals.

investment is found to be more effective in lowering public debt than government consumption. The cumulative effects in Table 2 show that a 1 % of GDP increase in public investment identified through a BP is followed by a reduction of the public debt-to-GDP ratio by a range between 1.19 % and 1.87 % points on impact, between 2.58 % and 4.96 % points after five years, and between 2.43 % and 3.58 % points on average. The BP identification augmented by expectations indicates that the drop in D/Y is stronger compared to findings obtained in models not augmented by fiscal forecasts. A government investment shock lowers the public debt-to-GDP ratio by between 1.29 % and 1.97 % points on impact, between 3.12 % and 5.06 % points after five years, and between 2.91 % and 3.61 % points on average. The NA produces higher negative coefficients than those estimated through the BP strategy. Increasing government investment by 1 % of GDP reduces the public debt-to-GDP ratio by values ranging between 7.37 % and 9.12 % points on impact, 8.39 % and 11.53 % points after five years, and 9.49 % and 11.11 % points on average.

When assessing the impact of government consumption, increasing this class of government spending lowers the public debt-to-GDP ratio. A 1 % of GDP rise in government consumption in models identified using a BP strategy leads to a reduction in the public debt-to-GDP ratio which ranges between 0.67 % and 2.06 % points on impact, between 0.46 % and 3.18 % points

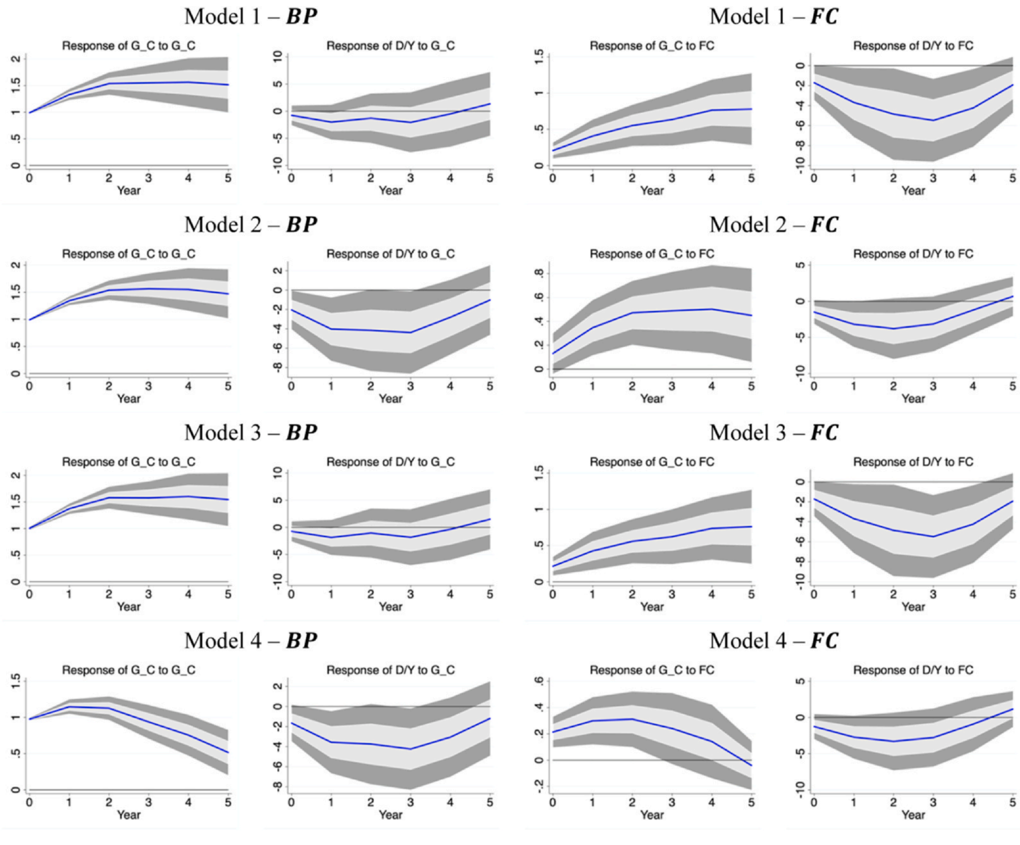

Figure 6. Impulse Response Functions of $\boldsymbol{G\_C}$ on $\boldsymbol{D/Y}$. $\boldsymbol{BP}$ and $\boldsymbol{FC}$ identifications. Shaded areas represent 68 % and 95 % confidence intervals.

after five years, and between 0.79 % and 2.75 % points on average. Models identified through a BP strategy and including expectations show that government consumption reduces the public debt-to-GDP ratio by values ranging between 1.30 % and 2.60 % points on impact, between 1.64 % and 3.65 % points after five years, and between 1.72 % and 3.18 % points on average. When using the NA, the reduction in D/Y following a rise in public consumption is higher than the one estimated using the BP strategies. Indeed, a 1 % of GDP rise in government consumption reduces the public debt-to-GDP ratio by a range between 5.9 % and 11.5 % points on impact, between 5.1 % and 8.4 % points after five years, and between 8.02 % and 8.3 % points on average.

Our findings are in line with those provided by Auerbach and Gorodnichenko (2017) and show that a rise in government expenditure engenders a reduction in the public debt-to-GDP ratio. When evaluating the composition of a fiscal plan, our findings confirm the widespread idea that government investment is more effective in lowering public debt than consumption spending (Abiad et al., 2016; Petrović et al., 2021). However, contrary to the existing literature that considers public investment as the sole promoter of public debt sustainability, our results show that also an increase in government consumption can lower the public debt-to-GDP ratio. Such results should then be considered in light of the estimates of fiscal multipliers provided in

Table 2
Cumulative effects of G, G_I, and G_C on D/Y. Significant estimates are in bold (68 % confidence bands).

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Average
Model 1 – *BP*							
G	**-0.93**	**-1.31**	**-1.44**	**-1.61**	**-1.56**	-1.40	-1.38
G_I	**-1.35**	**-2.14**	**-2.78**	**-3.36**	**-3.57**	**-3.60**	-2.80
G_C	-0.78	**-1.20**	-1.06	-1.14	-0.95	-0.62	-0.96
Model 2 – *BP*							
G	**-1.73**	**-2.06**	**-2.22**	**-2.24**	-2.00	-1.64	-1.98
G_I	**-1.87**	**-2.56**	**-3.21**	**-3.49**	-3.21	-2.58	-2.82
G_C	**-2.06**	**-2.60**	**-2.65**	**-2.69**	**-2.50**	-2.19	-2.45
Model 3 – *BP*							
G	**-0.84**	**-1.16**	**-1.29**	**-1.49**	**-1.49**	-1.37	-1.27
G_I	**-1.19**	**-1.86**	**-2.42**	**-2.91**	**-3.10**	**-3.10**	-2.43
G_C	-0.67	**-1.03**	-0.86	-0.95	-0.78	-0.46	-0.79
Model 4 – *BP*							
G	**-1.16**	**-1.62**	**-2.01**	**-2.42**	**-2.61**	-2.55	-2.06
G_I	**-1.53**	**-2.40**	**-3.40**	**-4.32**	**-4.85**	**-4.96**	-3.58
G_C	**-1.70**	**-2.46**	**-2.75**	**-3.15**	**-3.28**	-3.18	-2.75
Model 1 – *BP* with ΔG^F							
G	**-1.06**	**-1.51**	**-1.78**	**-2.00**	**-2.03**	**-1.97**	-1.72
G_I	**-1.31**	**-2.22**	**-2.93**	**-3.51**	**-3.69**	**-3.79**	-2.91
G_C	**-1.31**	**-1.84**	**-1.86**	-2.02	-1.95	-1.72	-1.78
Model 2 – *BP* with ΔG^F							
G	**-1.96**	**-2.41**	**-2.71**	**-2.71**	-2.45	-2.11	-2.39
G_I	**-1.97**	**-2.96**	**-3.87**	**-4.11**	-3.70	-3.12	-3.29
G_C	**-2.60**	**-3.20**	**-3.43**	**-3.51**	**-3.34**	-3.03	-3.18
Model 3 – *BP* with ΔG^F							
G	**-1.11**	**-1.58**	**-1.80**	**-2.00**	**-1.98**	-1.88	-1.73
G_I	**-1.29**	**-2.20**	**-3.01**	**-3.65**	**-3.92**	**-4.08**	-3.03
G_C	**-1.30**	**-1.80**	**-1.80**	-1.93	-1.86	-1.64	-1.72
Model 4 – *BP* with ΔG^F							
G	**-0.85**	**-1.46**	**-2.03**	**-2.43**	**-2.64**	-2.64	-2.01
G_I	**-1.39**	**-2.48**	**-3.56**	**-4.37**	**-4.80**	-5.06	-3.61
G_C	**-1.44**	**-2.26**	**-2.76**	**-3.30**	**-3.64**	-3.65	-2.84
Model 1 – *FC*							
G	**-4.51**	**-5.02**	**-5.14**	**-5.13**	**-4.74**	**-4.15**	-4.78
G_I	**-9.12**	**-10.78**	**-11.38**	**-11.70**	**-11.43**	**-10.90**	-10.88
G_C	**-8.28**	**-8.79**	**-8.79**	**-8.73**	**-7.78**	**-6.55**	-8.15
Model 2 – *FC*							
G	**-4.76**	**-5.11**	**-4.93**	**-4.54**	-3.82	-3.01	-4.36
G_I	**-8.13**	**-10.14**	**-10.50**	**-10.27**	-9.50	-8.39	-9.49
G_C	**-11.51**	**-9.80**	**-8.91**	**-8.06**	-6.60	-5.07	-8.33
Model 3 – *FC*							
G	**-4.24**	**-4.74**	**-4.92**	**-4.99**	**-4.66**	**-4.10**	-4.61
G_I	**-8.93**	**-10.83**	**-11.60**	**-11.94**	**-11.82**	**-11.53**	-11.11
G_C	**-8.01**	**-8.46**	**-8.57**	**-8.66**	**-7.82**	**-6.61**	-8.02
Model 4 – *FC*							
G	**-4.30**	**-5.61**	**-6.24**	**-6.48**	-6.36	-6.11	-5.85
G_I	**-7.37**	**-9.86**	**-10.74**	**-10.97**	-10.56	-9.35	-9.81
G_C	**-5.86**	**-7.72**	**-8.80**	**-9.41**	-9.05	-8.37	-8.20

Table 1. Indeed, a feasible reduction in the public debt-to-GDP ratio following a fiscal policy shock depends on the effects on output and hence on the magnitude of multipliers: the higher the value of the multipliers, the stronger the reduction in the public debt-to-GDP ratio. Since the multipliers of government investment are higher than consumption expenditure, government investment produces a larger reduction in the public debt-to-GDP ratio than consumption. However, as government consumption multipliers are larger than one in many model specifications, this class of spending can also promote public debt sustainability.

6. Conclusion and policy implications

Since many advanced countries were hit by the Global Financial crisis, the COVID-19 pandemic emergency, and the EU sovereign debt crisis, different fiscal policies have been implemented to facilitate economic recovery and attempt to reduce high public debts. Whereas after the Global Financial and the EU sovereign debt crises many governments were steered by fiscal consolidation policies, expansionary fiscal policies were launched in many advanced economies after the COVID-19 crisis. For instance, US and EU administrations launched fiscal plans of about $5.2 and €2 trillion respectively. During the Global Financial and EU sovereign debt crises, the supporters of fiscal consolidation policies assumed that fiscal multipliers were well below the unit, and fiscal consolidation policies were supposed to cause non-Keynesian effects. However, after a few years of slow economic growth and an increase in sovereign debts, many economists and international institutions started questioning the effectiveness of fiscal consolidation policies in boosting economic recovery. They pointed out that fiscal multipliers were higher than what had been assumed (Blanchard and Leight, 2013), and many studies confirmed that spending multipliers were close to the unit, ranging between 0.8 and 1.5. In addition, recent studies have demonstrated that fiscal consolidation policies are likely to be self-defeating as they result in a higher public debt-to-GDP ratio (Fatás & Summers, 2018; Fatás, 2019), while well-designed fiscal expansions may promote public debt sustainability (Auerbach & Gorodnichenko, 2017). Based on these premises, the current paper aims to enter these debates by quantifying the impact of an increase in government expenditure and its components (i.e. government consumption and investment) on GDP and the public debt-to-GDP ratio. To do this, the Local Projections approach has been applied to a dataset of 14 OECD countries considered for the 1981–2017 period. Fiscal policy shocks have been identified through the Blanchard and Perotti identification strategy and using the narrative approach based on fiscal consolidation episodes developed by Alesina et al. (2015).

Our findings support the idea that expansionary fiscal policies produce Keynesian effects. The estimated IRFs show that fiscal policy shocks engender persistent effects on GDP and the public debt-to-GDP ratio. The fiscal multipliers associated with total government expenditure are above the unit in many model specifications and range between 0.81 and 1.57 on average. When considering the composition of a fiscal plan, our findings confirm the superiority of government investment over public consumption, although the effect of public consumption should not be disregarded since multipliers are above the unit in many specifications. Indeed, while investment multipliers range between 1.36 and 2.30 on average, government consumption multipliers range from 0.77 to 1.78. The magnitude of fiscal multipliers has also important implications for public debt sustainability. When we evaluate the ability of expansionary fiscal policy to promote public debt sustainability, our findings confirm that expansionary fiscal policy can reduce the public debt-to-GDP ratio, both when considering total government expenditure and when spending is broken down by government consumption and investment. Although government investment leads to the highest reduction in the public debt-to-GDP ratio, also government consumption effectively promotes public debt sustainability. Our findings on fiscal multipliers and public debt sustainability are confirmed even when controlling for fiscal expectations.

In conclusion, our findings suggest that governments should carry out expansionary fiscal policies to promote economic growth and public debt sustainability. These implications are particularly noteworthy amid the ongoing discourse regarding the reform of EU fiscal regulations by the European Commission (European Commission, 2023). In this context, the Commission's recent recommendations emphasize the necessity for member states with high and moderate public debt-to-GDP ratios to reduce the level of net nationally financed primary current expenditure to reduce their public debt-to-GDP ratio. However, if these guidelines were to be implemented, the resultant reduction in government spending could adversely affect both economic growth and the long-term viability of public finances, particularly in countries characterized by high public debt-to-GDP ratios. Our results are in line with the prescription put forward by the (International Monetary Fund, 2020, 2023), which highlighted that a public investment push would be the most effective fiscal policy to promote GDP growth, thus potentially lowering the public debt-to-GDP ratio. Nonetheless, the beneficial effects of government consumption should be considered when setting an expenditure-based fiscal plan.

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Appendix 1

This appendix presents the data on expenditure-based fiscal consolidation episodes during the 2008–2014 period. The values in Table 1.1 refer to expected and unexpected expenditure-based fiscal consolidations and are in percent of GDP. Data are retrieved from the dataset on fiscal consolidation episodes (1981–2014) constructed by Devries et al. (2011) and updated by Alesina et al. (2015). From 2009, Ireland, Spain, Belgium, France, and Italy experienced severe episodes of expenditure-based fiscal consolidation policies, ranging between 0.73 % and 1.93 % of GDP during the 2010–2014 period. Fiscal consolidation plans intensified in Southern peripherical euro area countries with the burst of the sovereign debt crises. Although less strongly than EU countries, the United States, Canada, and the United Kingdom were steered by fiscal consolidation policies with a spending reduction ranging between 0.2 % and 0.5 % of GDP during the 2010–2014 period.

Table 1.1
Expenditure-based fiscal consolidation episodes 2008–2014. (Unexpected and expected fiscal consolidation). Values are in percent of GDP.

Country	2008	2009	2010	2011	2012	2013	2014	Average
Australia	0	0	0	0	0	0	0	0
Belgium	0	0	0.83	0.34	1.58	1.08	0.61	0.89
Canada	0	0	0.02	0.07	0.22	0.25	0.42	0.20
Germany	0	0	0	0.11	0.69	-0.03	0	0.25
Denmark	0	0	0	0.58	0.58	0.58	0	0.58
Spain	0	0	1.17	1.54	1.50	0.12	0.17	0.90
Finland	0	0	0	0	0.23	0.19	0.24	0.22
France	0	0	0	0.89	0.70	0.71	1.30	0.90
United Kingdom	0	0	0.26	0.29	0.51	0.80	0.66	0.50
Ireland	0	1.50	3.21	2.67	1.90	1.25	0.97	1.92
Italy	0	0	0.02	0.91	1.06	1.31	0.35	0.73
Japan	0	0	0	0	0	0	0	0
United States	0	0	0	0.04	0.14	0.38	0	0.19

Appendix 2

Table 2.1
Variables and description.

Name	Description	Source
Gross domestic product (Y)	Gross domestic product, volume at constant price and PPP	OECD National Account
Debt to GDP ratio (D/Y)	Public Debt-to-GDP ratio	Historical Public Debt Database (HPDD) and IMF Word Economic Outlook
Public consumption and investment (G)	Sum of Government final consumption expenditure and government fixed capital formation* (IGAA), value, local currency. (Variables in nominal terms converted to volume by applying the GDP deflator and PPP index)	OECD Economic Outlook (No 106 – November 2019) and OECD National Account
Public investment (G_I)	Government fixed capital formation. (Variables in nominal terms converted to volume by applying the GDP deflator and PPP index)	OECD Economic Outlook (No 106 – November 2019) and OECD National Account
Public consumption (G_C)	Government final consumption expenditure volume at constant price and PPP	OECD National Account
Fiscal consolidation shocks (FC)	Expenditure-Based fiscal consolidation shocks. (Values are in percent of GDP)	Fiscal Adjustment Plans released by the IGIER-Bocconi
Interest rate (i)	Short-term interest rate	OECD Key Short-Term Economic Indicators database
Public Expenditure forecast ($\Delta G^F_{t\mid t-1}$)	Growth rate of public expenditure forecast at time t forecasted at time $t-1$	OECD Economic Outlook No 39-100

* For missing data, we interpolated the series using the growth rates of net investment in non-financial assets. Source: International Monetary Fund, Government Financial Statistics (GFS).

Appendix 3

This appendix presents the IRFs of Models 1–4 obtained through the Blanchard and Perotti (BP) identification strategy augmented by expectations. Figures 3.1–3.3 display the responses of GDP (Y) and the public debt-to-GDP ratio (D/Y) to government spending (G) and its components (G_I and G_C). The estimated IRFs are similar to those reported in Sections 4 and 5 and show that a rise in government expenditure produces positive and persistent effects on GDP and lowers the public debt-to-GDP ratio even when including fiscal expectations.

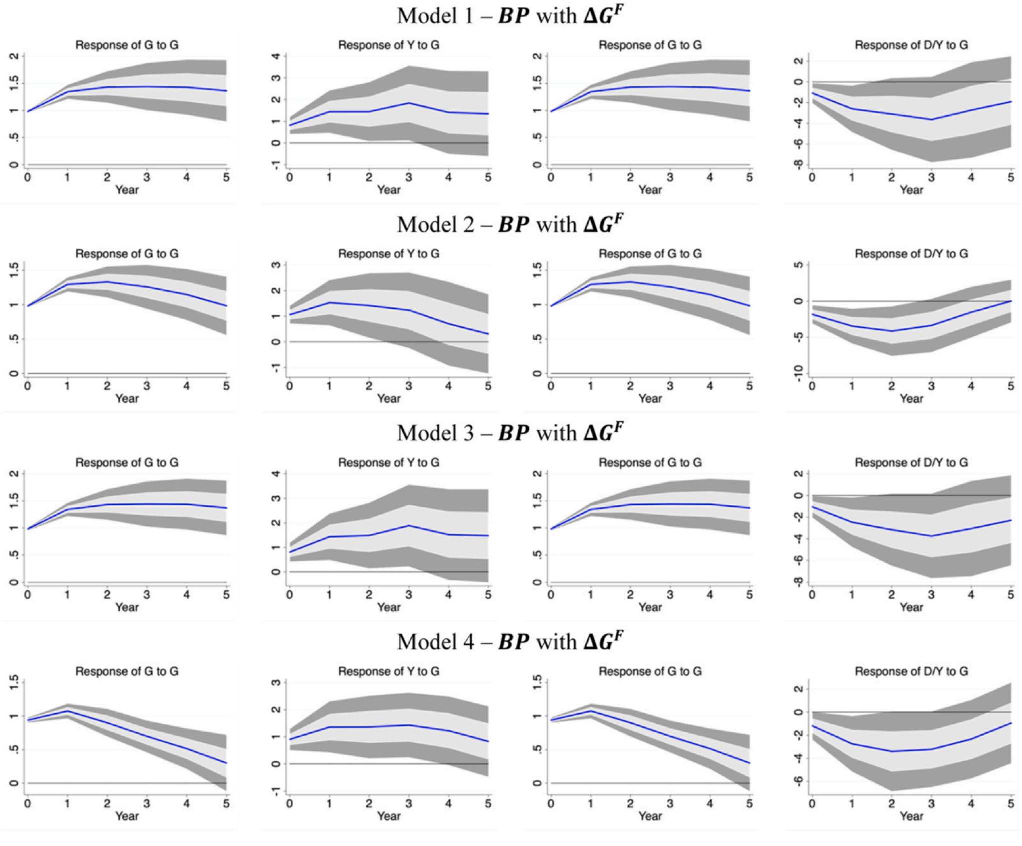

Figure 3.1. Impulse Response Functions $\boldsymbol{G}$ on $\boldsymbol{Y}$ and $\boldsymbol{D/Y}$. $\boldsymbol{BP}$ with $\boldsymbol{\Delta G^F}$ identification. Shaded areas represent 68% and 95% confidence intervals.

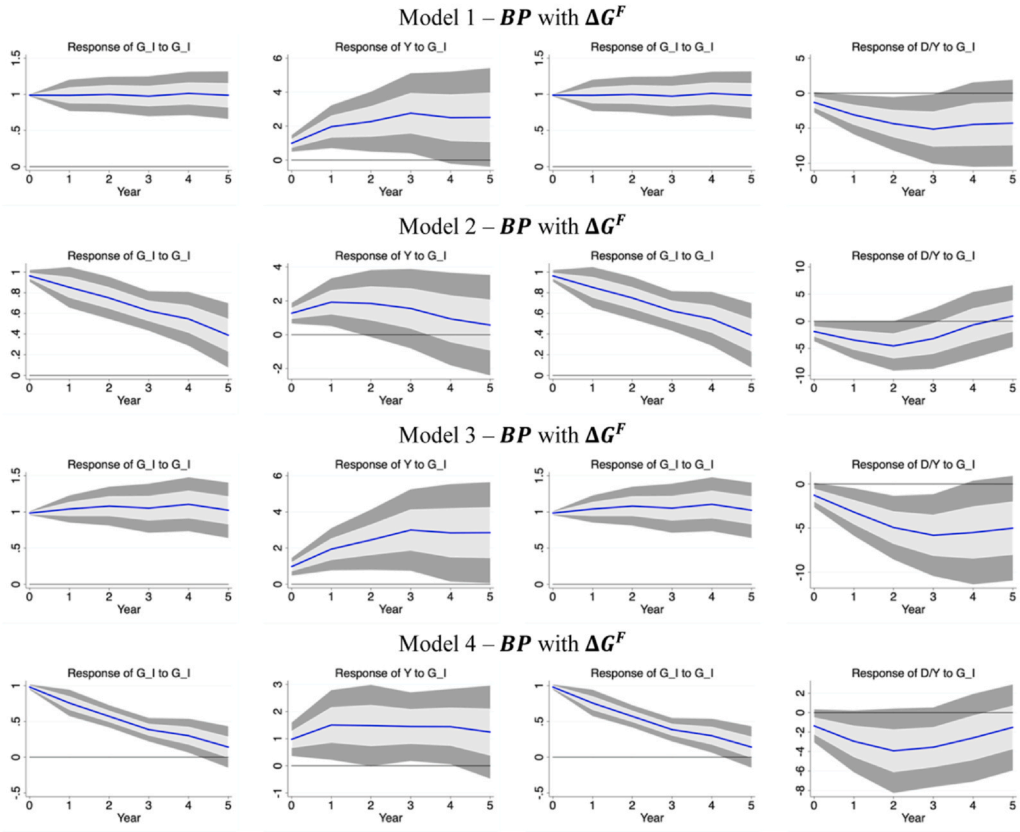

Figure 3.2. Impulse Response Functions $\boldsymbol{G\_I}$ on $\boldsymbol{Y}$ and $\boldsymbol{D/Y}$. $\boldsymbol{BP}$ with $\boldsymbol{\Delta G^F}$ identification. Shaded areas represent 68% and 95% confidence intervals.

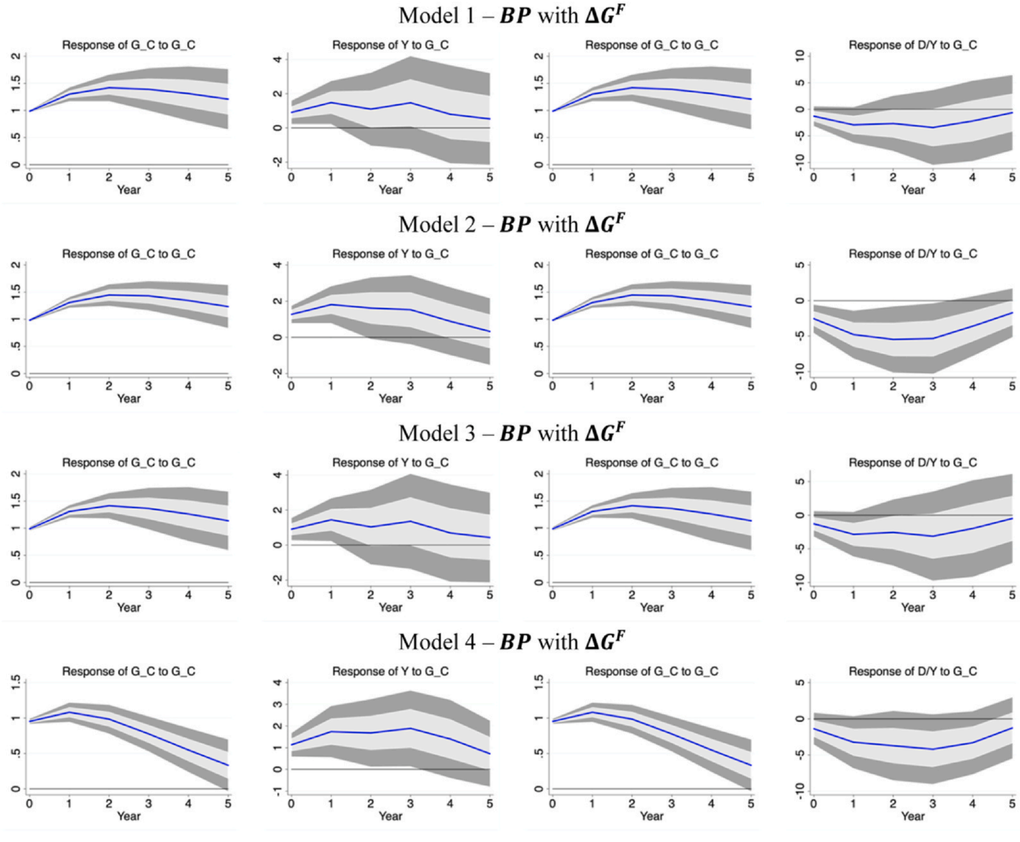

Figure 3.3. Impulse Response Functions G_C on Y and D/Y. BP with ΔG^F identification. Shaded areas represent 68% and 95% confidence intervals.

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