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Does it matter where and how governments spend?[☆]

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Abstract

This paper studies government spending multipliers in a panel of OECD countries. While recent literature has highlighted the differences in government consumption and investment effects, we extend this approach sectorally and report findings that suggest strong heterogeneities across sectors for government spending and output. Differences in price stickiness and sectors' position in the production network are the main drivers of these heterogeneities.

JEL classification: E60; E62

Keywords: Fiscal multiplier; Government investment; Government consumption; Sectoral heterogeneity; Sector-specific shocks

1. Introduction

Government spending's impact on the economy has been a subject of intense economic debate, especially after the recent financial crisis and the COVID-19 pandemic. Analyzing fiscal multipliers can provide insights into this matter. While prior research has focused on government multipliers' heterogeneity across countries focusing on economic fundamentals; or the state dependency on the economy, recent studies have shifted the focus to the origins of the spending multiplier and the multi-sectoral effects of the economy. In addition, recent literature shows that there has been a significant focus on the US economy, while there is limited evidence available for other countries.

We aim to contribute to the existing literature by estimating a panel VAR on selected OECD countries that focuses on the differences between government consumption and investment spending. In doing so, we investigate these differences at the

sectoral level, examining them from both a government and economic standpoint or combining both approaches. Furthermore, we offer an interesting perspective (usually neglected by the literature) by examining government spending according to the functions of the economy.

The output multipliers that we calculated at the sectoral level vary from -1 to 1 , depending on the type of government spending, whether it is consumption or investment, the sector in which the expenditure occurs, the function for which the spending happens, and the sector that the spending influences. We argue that these results are driven partially at the sectoral level by the differences in price stickiness across sectors and sectors' position in the production network. To our knowledge, this is the only paper that discusses these issues together.

This paper contributes to the fiscal multipliers literature in two ways. It first examines the effects of government consumption and investment shocks across different sectors, building on the work of [Boehm \(2020\)](#) and [Ramey \(2020\)](#). It then contributes to recent research on government multipliers at the sectoral level, following studies such as [Bouakez et al. \(2022, 2023\)](#), [Gabriel et al. \(2023\)](#) and [Cox et al. \(2020\)](#). By exploring the effects of government spending on the economy at the sectoral level, this paper aims to deepen our understanding of government spending multipliers.

The remainder of this paper is organized as follows. Section 2 explains the empirical approach and the data. Section 3 discusses the empirical results. Finally Section 4 concludes.

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2. Panel VAR specification and data

a. Methodology. To obtain pooled results from the impulse responses, a mean group estimator is used as described in [Pesaran and Smith \(1995\)](#). This estimator, which relies on a maximum likelihood framework, accounts for the cross-sectional dimension of the data and allows for country heterogeneity, producing parameters that are means of the group of countries used. The panel VAR model considered has the following representation:

$$y_{i,t} = A_i^p y_{i,t-p} + C_i x_t + \varepsilon_{i,t} \quad (1)$$

where $y_{i,t}$ denotes a vector comprising the n endogenous variables of unit i at time t , p shows the lag of the variable, and x_t is the vector of exogenous variables. The errors are normally distributed, and the residual variance-covariance matrix is heterogeneous across countries but characterized by a common mean $\varepsilon_{i,t} \sim N(0, \Sigma_i)$. Matrix A contains coefficients that represent the response of unit i to the p th lag of variable m of unit j at time t . Matrix C contains coefficients that represent the response of the endogenous variables to the exogenous variables. Vector $\varepsilon_{i,t}$ contains the residuals for the variables of unit i .

b. Identification Strategy and data. To identify government spending shocks, the most standard approach used in the literature is [Blanchard and Perotti \(2002\)](#), with government spending ordered first.¹ Government spending is predetermined relative to the other variables, responding with a minimum one lag delay to other shocks than to itself. The ordering of the endogenous variables will be as follows²:

$$\bar{X}_i = \begin{pmatrix} G \\ Y \\ C \\ I \\ TB \\ REER \end{pmatrix} \quad (2)$$

where G denotes government spending, Y is the GDP, C private consumption, I private investment, TB is the trade balance used as a share of GDP, and $REER$ is the effective exchange rate.

c. Data. To avoid anticipation³ effects present in VARs when estimating with quarterly data as argued by [Ramey \(2011\)](#), we use yearly data in this study, following the approach of [Born and Mueller \(2012\)](#), [Koh \(2017\)](#), and [Beetsma et al. \(2008\)](#). The data used are in real terms, logarithmic form, and detrended using a linear trend to deal with non-stationarity. We estimate all panel VARs with one lag, selected based on the Akaike Information Criterion (AIC) and the Bayesian Information Criterion (BIC). The dataset includes a yearly balanced panel of 18 OECD⁴ countries from 1995–2020. We use government spending data at both the sectoral and functional levels.⁵ The OECD COFOG and Stats databases provide most of the data, with the exception of sectoral output, which is obtained from the UN database.

¹ See [Ramey \(2016, 2019\)](#) for a detailed debate on the literature of identifying government spending shocks, with identification approaches varying from SVARs with contemporaneous restrictions, sign restrictions, medium horizons restrictions, narrative methods, and using DSGE models.

² The choice of the variables is done with respect to standard choices from the literature such as [Ravn et al. \(2012\)](#), [Ilzetzki et al. \(2013\)](#) and [Boehm \(2020\)](#).

³ Using annual data, we do not address potential fiscal foresight issues.

⁴ The countries taken into the analysis are chosen based on data availability in most of the specifications and are the following: Australia, Austria, Belgium, Czech Rep, Denmark, Estonia, Finland, France, Netherlands, Norway, Poland, Portugal, Slovak Rep, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

⁵ The Classification of the Functions of Government (COFOG) classifies government expenditure into ten main categories (divisions known as the 'COFOG level' breakdown) and offers a different perspective in terms of the usefulness of government spending.

3. Findings

In this section, we present the paper's main findings presented in the form of IRFs, while in the [Appendix](#), we provide the cumulative multipliers⁶ for each figure. The impulse responses are presented as follows:

In the first exercise ([Fig. 1](#)), we present the baseline panel VAR with results of a shock in general government spending, government consumption and government investment⁷ by showing the responses in output, private consumption, private investment, trade balance and the real effective exchange rate.

The above results show that a 1% increase in a general government spending shock causes a negative output response on impact, while the output response to a government investment shock is negligible. The estimated cumulative multipliers for the general government spending, government investment spending, and government consumption are respectively -0.46 , -1.28 and 0.87 . These results suggest that only government consumption can positively influence economic activity, private consumption and private investment.⁸ Our findings are in line with the results reported in [Boehm \(2020\)](#). The effects on the trade balance and the real effective exchange rate are also in line with the literature brought by [Ilzetzki et al. \(2013\)](#), [Ravn et al. \(2012\)](#) and [Born et al. \(2013\)](#), suggesting a higher initial trade deficit and higher REER. Our results also show that the impact of government investment on economic activity is minimal, suggesting that government investment shocks do not have high effects on the trade balance or exchange rate in the OECD countries.⁹

In [Fig. 2](#), we look at government spending at the sectoral¹⁰ level following the work of [Bouakez et al. \(2022\)](#) and [Klein and Linnemann \(2023\)](#). We investigate the sectoral origins of the government spending multiplier focusing on the distinction between government investment and government consumption by focusing on the responses of total output.

Our results show two important results worth highlighting. First, the output response to a government investment shock could be neutral or negative depending on the targeted economic sector for investment. The biggest adverse reaction to a government investment occurs in the services sector (on impact),¹¹ while the lowest negative response to a government investment shock occurs from the industrial, fuel and energy sectors. Our second result shows that not all government consumption shocks have a positive effect on the sectoral level.

⁶ We follow [Mountford and Uhlig \(2009\)](#) in calculating the multiplier by discounting it to the present value using the long-run average interest rate of the period of around 2.5%. Though not presented in the [Appendix](#), the multipliers are fairly robust to the method suggested by [Blanchard and Perotti \(2002\)](#) in calculating the cumulative multipliers as the ratio of the variable response to the shock.

⁷ Following the important results of [Boehm \(2020\)](#) in distinguishing between government consumption and investment and [Ramey \(2020\)](#) which discusses the macroeconomic consequences of infrastructure investment, in all steps of the analysis we clearly distinguish in our results between government consumption and government spending.

⁸ Total government spending multipliers closely track those of government investment spending in line with the work of [Antolin-Diaz and Surico \(2022\)](#), that argue this finding as suggestive evidence that the long-run effects of government spending on output are significantly shaped by public investment.

⁹ There are no studies that we are aware of that have looked previously at the impact of government investment on the trade balance and exchange rate highlighting an important contribution of this paper.

¹⁰ We use the same strategy to identify sectoral government spending shocks as in the case of government investment and consumption, using data from the OECD's COFOG database for each of the sectors used. Alternatively, information from the Input-Output matrix could be used to identify sectoral shocks; however, this approach presents challenges when incorporating it into a panel data setting, which is beyond the scope of this paper. We acknowledge this issue and leave it for future research.

¹¹ The cumulative multiplier shown in [Table 2](#) goes to -0.71 .

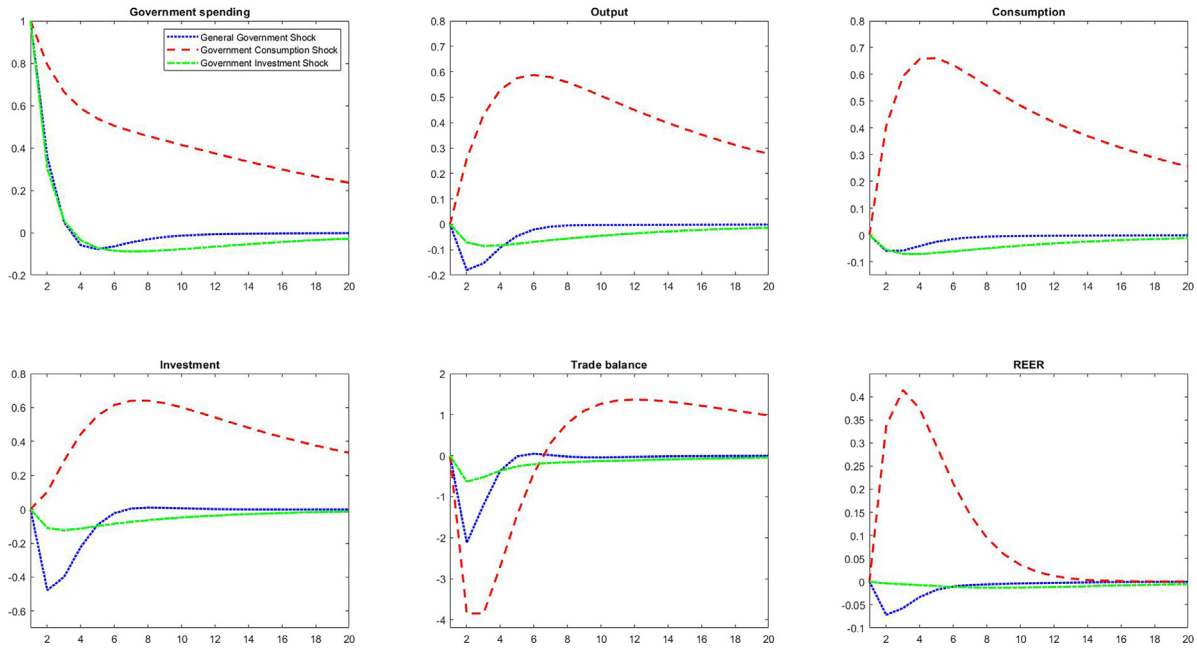


Fig. 1. Shocks in general government vs. government consumption vs. government investment. Notes: The figure shows the responses of output, private consumption, private investment, the trade balance and real effective exchange rate to three types of government spending shock, a general government (in blue), government consumption (in red) and government investment (in green). (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

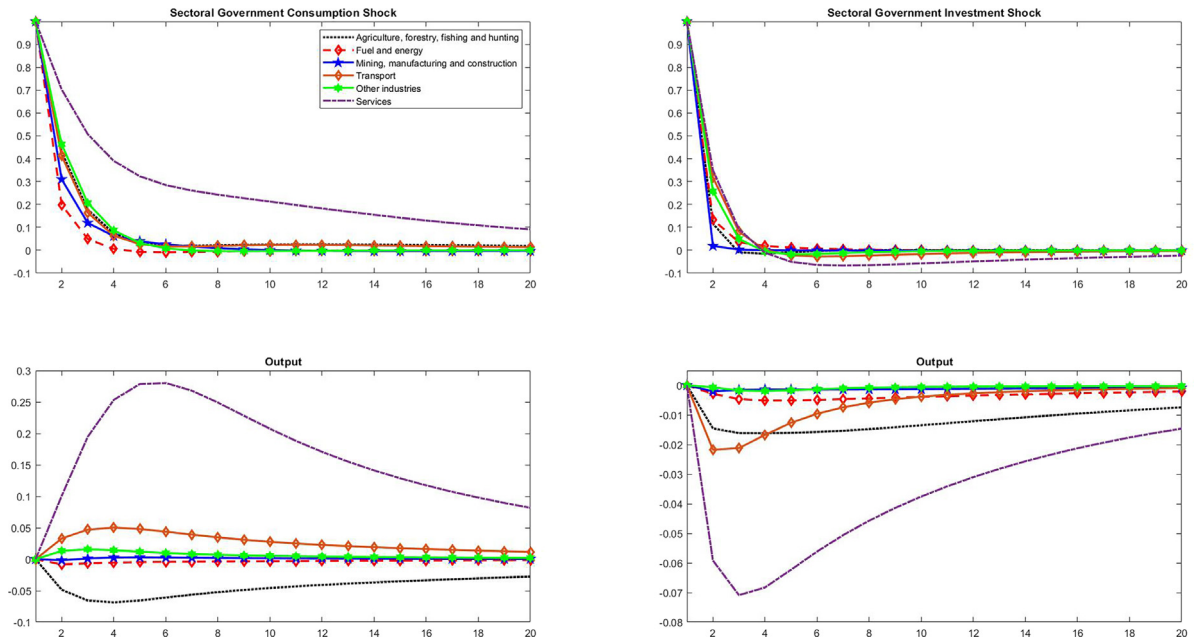


Fig. 2. Sectoral government shock: consumption (LHS) vs. investment (RHS). Notes: The figure shows the responses of total output to government consumption (LHS) vs. investment shock (RHS) for spending of government in six sectors as described in colors. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

Spending on sectors such as services and other industries has the highest positive contribution with cumulative multipliers of 0.56, and 0.24, while government consumption spending on agriculture, forestry, fishing, hunting, and fuel and energy negatively affects total output with multipliers of -0.36 and -0.04 . These results complement the work of [Bouakez et al. \(2022\)](#) that only reports a positive multiplier for aggregate output to sectoral government spending shocks for the US economy without focusing on the difference between government consumption and government investment.

In [Fig. 3](#), we present a unique perspective on the origins of the government spending multiplier focusing on the functions of government spending and the distinction between government investment and government consumption. While it is common for governments to report data according to the functions of their spending, surprisingly, this categorization has been neglected by the literature.

The results of sectoral government spending shocks are confirmed and highlighted more if we look at the spending from the distinctive perspective of the main functions of its activity. The

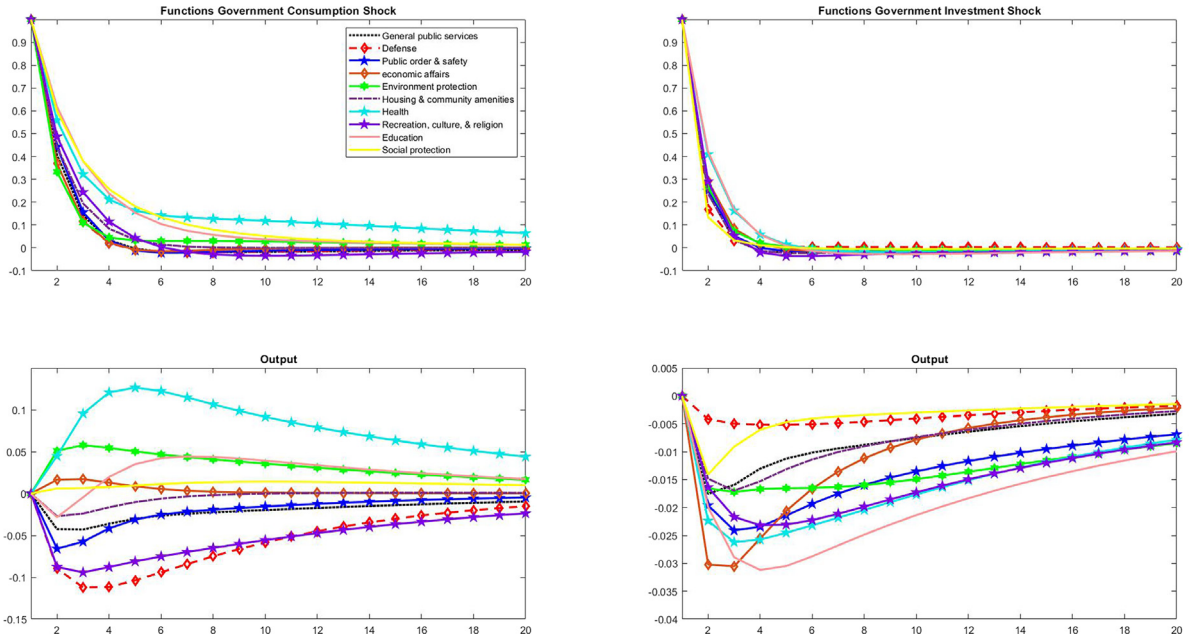


Fig. 3. Government shock according to functions: consumption (LHS) vs. investment (RHS). Notes: The figure shows the responses of total output to government consumption (LHS) vs. investment shock (RHS) for spending of government according to 10 functions as disaggregated by COFOG database shown in colors. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

results from Fig. 3 amplify the heterogeneity of output responses to the government consumption and investment shocks. Government consumption spending on functions such as health and environmental protection¹² and education contribute the most to a positive output multiplier with values of 0.37, 0.31, and 0.14, respectively. Meanwhile, defense, recreation, culture, and religion spending report negative multipliers of -0.69 and -0.54 . Moreover, our results show that government investment has a negative multiplier in each reported function.

In the above three exercises, we focused on the composition of government spending. However, in Fig. 4 we take a step back and shed light on the responses of four main sectors subject to government consumption and investment shocks. Finally, we investigate the government spending multiplier in a multi-sector economy following the work of Bouakez et al. (2023) and Gabriel et al. (2023).

The above figure reports sectoral output multipliers for agriculture, forestry and fishing; manufacturing, mining and construction; wholesale, retail trade and transportation; and services. Our analysis shows that the response of these four sectors to a government consumption shock are 0.31, 0.16, 0.15 and 0.89,¹³ and their response to a government investment shock is -0.29 , -0.32 , -0.45 , and -0.39 , respectively. The positive multipliers obtained by the government consumption shock are in line with the results of Bouakez et al. (2023), with distinct differences. First, although both results show a positive output multiplier, our results show a smaller impact, with our results being possibly affected by lower output multipliers in non-US OECD countries. The

¹² The literature on the US economy, such as Hasna (2022) and Batini et al. (2022) for the OECD countries, provide evidence that green public investments tend to produce positive output multipliers. Our paper's results suggest that not considering government consumption spending on what governments define as the environment could lead to bias in public investment green multipliers. Another explanation could be due to different definitions of what constitutes green and non-green used by the other authors.

¹³ These results are fairly in line with some of the multipliers reported by Gabriel et al. (2023) on the Eurozone area using sectoral regional data. Nevertheless, they do not distinguish between government investment and government consumption. They report -0.14 for Agriculture after 4 years of impact, 0.69 for services, 0.27 for construction, and 0.66 for the industry.

second difference is that they report values for a disaggregation level of 57 sectors and only for government consumption shock.

In Fig. 5, our work takes a middle ground by exploring the sectoral origins of the government spending multiplier in a multi-sector economy. In order not to complicate the analysis and to keep differences at a minimum and control for other types of heterogeneities, we focus only on sectoral government spending in manufacturing and services¹⁴ and the respective responses in the sectoral output of manufacturing and services. Highlighting the results in terms of services and manufacturing becomes important following the work of Cox et al. (2020). The authors highlighted the importance of relative price stickiness between sectors for fiscal policy transmission.

To explain some of the differences in the impulse responses in the above figure, we restrict our focus on the impact of sectoral government shocks on sectoral outputs, particularly services and manufacturing. A 1% shock in a government consumption shock in manufacturing and services respectively produces the max impact response for services at 0.4% while 0% for manufacturing. The multipliers for each are 0.71 and 0. The multipliers in the case of the government investment shock on services and manufacturing display similar differences with -0.20 and 0. These multipliers are slightly lower than the ones reported for services and manufacturing in Fig. 4, suggesting the possibility of spillovers when looking at the multipliers sectorally to a total government consumption and investment shock. These results are in line with the explanation given by Cox et al. (2020) that reports for the US, the effects of government spending shocks on output are higher in sticky price sectors such as services and lower in sectors where firms face more flexible prices such as manufacturing. The results are also in line with Bouakez et al. (2023) since services tend to be more upstream than manufacturing.¹⁵ They do not

¹⁴ The evidence presented in Bils and Klenow (2004), Klenow and Kryvtsov (2008) and Nakamura and Steinsson (2008) suggest that manufacturing can be considered a sector where firms face flexible prices while firms in the services sector adjust prices less frequently.

¹⁵ They argue that "when the government demands more goods from all the industries, sectors located upstream raise their production to meet not only

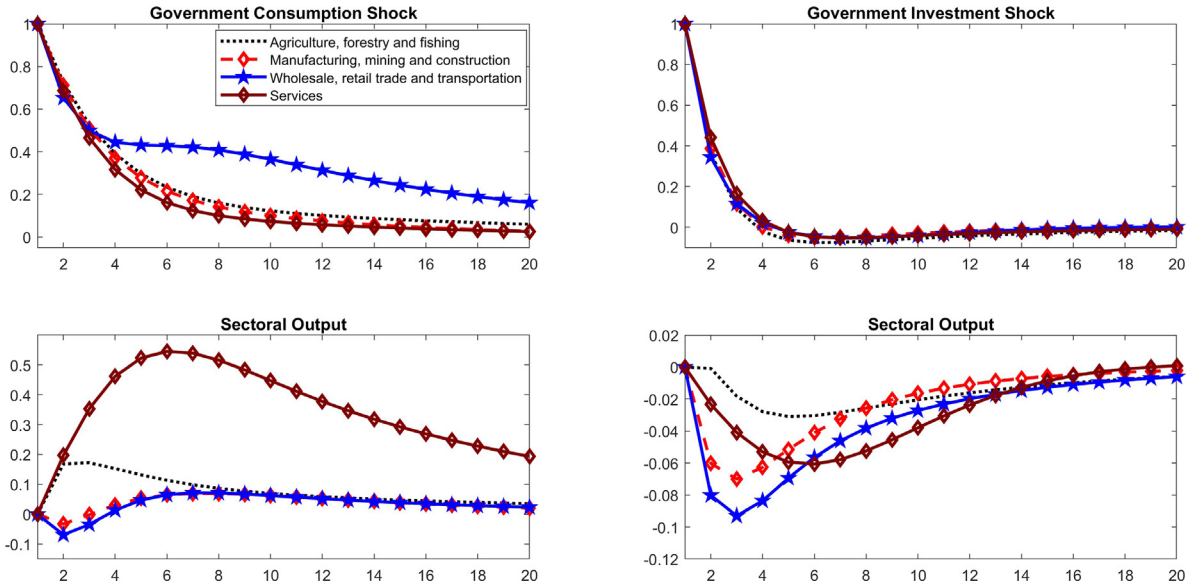


Fig. 4. Sectoral output responses to a government consumption (LHS) vs. government investment (RHS) shock. Notes: The figure shows the responses of sectoral output in four sectors as highlighted in colors to a government consumption (LHS) vs. investment shock (RHS). (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

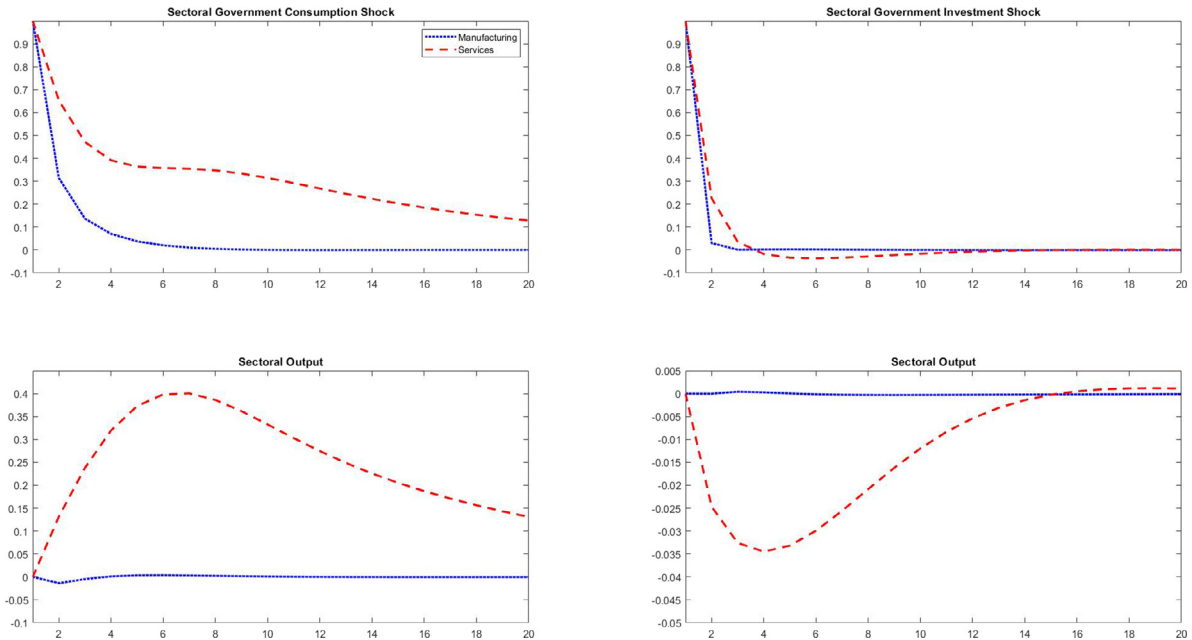


Fig. 5. Sectoral output responses of sectoral government consumption (LHS) vs. government investment (RHS) shock. Notes: The figure shows the responses of sectoral output in two sectors, manufacturing (in blue) and services (in red) as highlighted in colors to a sectoral government consumption in manufacturing and services (LHS) vs. a sectoral government investment (RHS) in manufacturing (in blue) and services (in red). (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

offer government investment results, which our paper confirms. Our paper contributes to their work by providing evidence for selected OECD countries.

the higher demand from the government, but also the additional demand for intermediate goods from their customer industries. The value added of upstream sectors therefore rises more than that of downstream sectors, *ceteris paribus*".

4. Conclusion

This paper tried to answer the question of what are the effects of government spending shocks. On a panel VAR approach for selected OECD countries, we bring further evidence investigating the sectoral origin of the government spending multiplier and its sectoral effects. An important feature of our analysis is relying on the distinction suggested by Boehm (2020) into

Table 1

Total output cumulative multipliers for Fig. 1.

General government spending	-0.46
Government consumption	0.87
Government investment	-1.28

Notes: The table shows the output cumulative multipliers for the respective government spending shocks calculated for Fig. 1 IRFs.

Table 2

Total output cumulative multipliers for Fig. 2.

Government consumption in agriculture, forestry, fishing and hunting	-0.36
Government consumption in fuel and energy	-0.04
Government consumption in mining, manufacturing, and construction	0.01
Government consumption in transport	0.06
Government consumption in other industries	0.24
Government consumption in services	0.56
Government investment in agriculture, forestry, fishing and hunting	-0.18
Government investment in fuel and energy	-0.05
Government investment in mining, manufacturing, and construction	-0.02
Government investment in transport	-0.01
Government investment in other industries	-0.09
Government investment in services	-0.71

Notes: The table shows the output cumulative multipliers for the respective sectoral government spending shocks calculated for Fig. 2 IRFs.

Table 3

Total output cumulative multipliers for Fig. 3.

Government consumption on general public services	-0.24
Government consumption on defense	-0.69
Government consumption on public order and safety	-0.22
Government consumption on economic affairs	0.05
Government consumption on environment protection	0.31
Government consumption on housing and community amenities	-0.05
Government consumption on health	0.37
Government consumption on recreation, culture, and religion	-0.54
Government consumption on education	0.14
Government consumption on social protection	0.06
Government investment on general public services	-0.12
Government investment on defense	-0.05
Government investment on public order and safety	-0.19
Government investment on economic affairs	-0.14
Government investment on environment protection	-0.17
Government investment on housing and community amenities	-0.12
Government investment on health	-0.18
Government investment on recreation, culture, and religion	-0.24
Government investment on education	-0.22
Government investment on social protection	-0.05

Notes: The table shows the output cumulative multipliers for the respective functions of the government spending shocks calculated for Fig. 3 IRFs.

looking at government consumption and investment separately. Our results suggest that government consumption multipliers, either for aggregate output or sectoral output are, on average, higher than government investment multipliers. For further evidence, we report results relying on the COFOG classification of government activities. By restricting our analysis to only two sectors, we provide an explanation that aligns with Cox et al. (2020) and Bouakez et al. (2023), suggesting that variations in price stickiness or sectors' position in the production network may drive differences between the sectors.

Data availability

Data will be made available on request

Table 4

Sectoral output cumulative multipliers for Fig. 4.

Government consumption shock	
Agriculture, forestry and fishing	0.31
Manufacturing, mining and construction	0.16
Wholesale, retail trade and transportation	0.15
Services	0.89
Government investment shock	
Agriculture, forestry and fishing	-0.29
Manufacturing, mining and construction	-0.32
Wholesale, retail trade and transportation	-0.45
Services	-0.39

Notes: The table shows the sectoral output cumulative multipliers for the respective government spending shocks calculated for Fig. 4 IRFs.

Table 5

Sectoral output cumulative multipliers for Fig. 5.

Sectoral government consumption shock	
Sectoral Manufacturing, mining and construction	0
Sectoral services	0.71
Sectoral government investment shock	
Sectoral manufacturing, mining and construction	0
Sectoral services	-0.20

Notes: The table shows the sectoral output cumulative multipliers for the respective sectoral government spending shocks calculated for Fig. 5 IRFs.

Appendix

See Tables 1–5.

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