Boosting the economy without raising the public debt ratio? The effects of public investment shocks in the European Union

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Abstract

This paper provides new evidence on the effects of public investment shocks on output, unemployment, private investment, and public debt in the European Union. Using forecast errors, we identify public investment shocks and estimate their effects in the 27 EU member countries. The results indicate that public investment shocks (a) boost output and reduce unemployment in the short to medium run, (b) do not crowd out private investment, and (c) do not jeopardise public debt sustainability.

JEL-Codes: E32, F02, Q48, E62.

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1. Introduction

The Draghi Report highlights that public investment is essential to achieve economic and strategic objectives in Europe. Increased public investment should help fill a total €800 billion annual investment gap, which amounts to around 4.5% of EU GDP (Draghi 2024). Other studies also highlight the need for additional public investment (e.g. Pisani-Ferry and Tagliapietra 2024; Heimberger and Lichtenberger 2023).

This paper provides new empirical evidence for the European Union (EU) on how public investment affects macroeconomic outcomes and public debt. We contribute to the literature on the macroeconomic effects of public investment (e.g. Abiad et al. 2016; Masten and Grdovic Gnip 2019; Deleidi et al. 2020; Ciaffi et al. 2024), as we are the first to use European Commission archive data to identify public investment shocks via forecast errors and trace their effects in the 27 EU member countries from 2000 to 2023.

2. Public investment shock identification

A short discussion of modelling choices and different shock identification methods with regard to fiscal multipliers is available in the appendix. We identify public investment shocks as the forecast error of public investment. We define a public investment shock as the difference between the actual – i.e. ex-post – value of the public investment ratio (i.e. general government gross fixed capital formation in percent of GDP) and the forecast of the public investment ratio provided by the European Commission in the Autumn forecast (published in October or November) of the same year (Abiad et al. 2016).

This tackles the two main empirical problems: fiscal foresight and endogeneity. The fiscal foresight problem arises as households and firms receive information about changes in public investment in advance, which may lead them to changing their spending behaviour before the policy changes actually occur. This could lead to inconsistent econometric estimates (e.g. Leeper et al. 2013). By using forecast errors, we align the information known to firms and households with our econometric information set. Furthermore, the use of forecast errors tackles the endogeneity problem: changes in fiscal policy may be endogenous to cyclical conditions. Since fiscal policy typically responds with substantial lags to the business cycle and we use information about public investment and the economy captured in forecasts until autumn of the same year, endogeneity is unlikely to be a concern.

3. Econometric estimation

Based on existing literature (Gechert 2015), we hypothesise that the average cumulative output multiplier of public investment in EU member states exceeds one. The magnitude of the macroeconomic effects remains an empirical question.

We estimate impulse-response functions from local projections (Jorda 2005), which is more flexible than standard VAR approaches and less sensitive to lag choices (Jorda and Taylor 2025). Our econometric approach is based on baseline regression equation (1), which we estimate separately for each response horizon k (with $k = 0, \dots\ 3$), where k = 0 is the impact horizon:

$$y_{i,t+k} - y_{i,t-1} = \beta_k F_{i,t} + \sum_{l=1}^{2} \gamma_{k,l} Z_{i,t-l} + \delta_i^k + \theta_t^k + \varepsilon_{i,t}^k \quad (1)$$

In this equation, $y_{i,t+k}$ represents the response variable of interest (log of real GDP, unemployment rate, private investment ratio or public-debt-to-GDP ratio) k periods after the public investment shock, and $y_{i,t+k} - y_{i,t-1}$ gives the cumulative response of y at horizon k to the investment shock. $F_{i,t}$ is the public investment forecast error in percent of GDP in country i and year t. $Z_{i,t-l}$ is a vector of controls that we choose based on the existing literature. We include lags of the control variables to capture their dynamics and reduce omitted-variable bias. The controls comprise: real GDP growth, which accounts for lagged economic dynamics; the long-term nominal interest rate, which helps to partial out the impact of financial conditions and monetary policy; the public debt ratio, which accounts for pre-shock debt developments; the real effective exchange rate, which conditions on external competitiveness and trade-related demand conditions; and the respective endogenous variable. δ_i^k are country-fixed effects, θ_t^k are time-fixed effects and $\varepsilon_{i,t}^k$ is the stochastic residual. To avoid biased standard errors, we use the Driscoll and Kraay (1998) standard error estimator robust to serial correlation and cross-sectional correlation.

4. Data

Our sample covers the 27 EU member countries over the time period 2000-2023. To calculate the public investment forecast errors, we used archive data of the European Commission from the AMECO database on public investment forecasts.[1] Archive data for

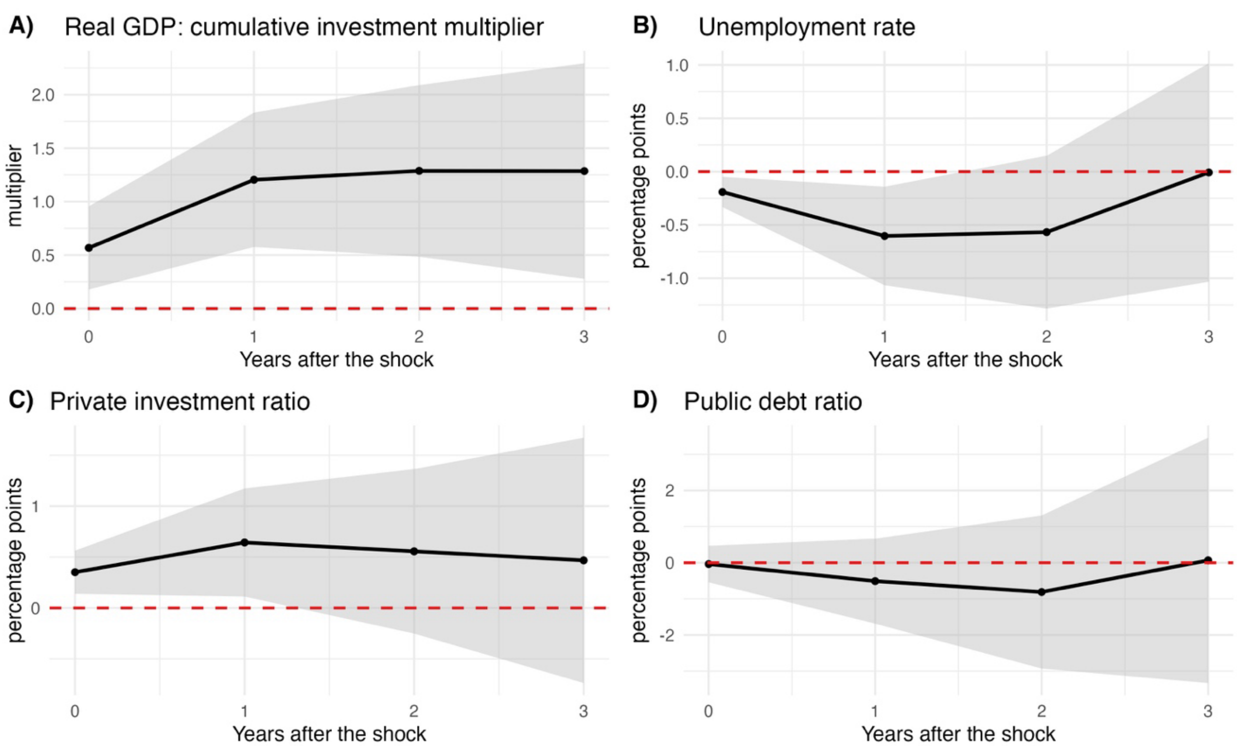
[1] A statistical break in the European System of Accounts (ESA 95 to ESA 2010) introduced reclassifications of private and public investment. To account for this, we compute forecast errors in two regimes: (i) for 2000–2012, we compare the Autumn-of-year forecast with ESA 95 ex-post values from the AMECO Autumn 2013 vintage; (ii) for 2014–2023, we

the forecasts over 2010-2023 were publicly available. We received publicly unavailable European Commission forecasts for the period 2000-2009 from the statistical support of the AMECO database. We obtained the data for the other variables used in the econometric analysis from the AMECO database published in Autumn 2024.

5. Econometric results

Figure 1 shows our findings regarding the response of real GDP (panel A), the unemployment rate (panel B), the private investment ratio (panel C) and the public debt ratio (panel D) to a 1 percentage point of GDP public investment shock.

Figure 1: The cumulative effects of a 1 percentage point of GDP public investment shock on real output, the unemployment rate, the private investment ratio and the public debt ratio.



compare the Autumn-of-year forecast with ESA 2010 ex-post values from the AMECO Autumn 2024 vintage. For 2013, to avoid a mechanical zero while remaining consistent with ESA 95, we compare the Autumn 2013 forecast with the Spring 2014 ex-post values. ESA 2010 officially replaced ESA 95 in September 2014.

Source: AMECO (Autumn 2024), AMECO archive; own calculations based on equation (1). Shaded areas show the one standard error confidence interval. The red line represents the zero effect. Sample: 27 EU countries over the time period 2000-2023.

In terms of the output effect, we find an impact multiplier of 0.6: an additional €1 of public investment raises real GDP by about €0.6 (in period 0). The cumulative multiplier increases over the response horizon and, three years after the shock, stands at 1.3.[2]

The unemployment rate falls by 0.2 percentage points on impact and by 0.6 percentage points two years later, before returning to zero in the third year. The point estimates for the private investment ratio response are positive throughout the response horizon, but the uncertainty band mostly includes 0. Our results are not consistent with crowding-out effects, and are instead weakly suggestive of the crowding-in of private investment.

The public debt ratio does not rise in response to the public investment shock. Although the point estimates are negative, the uncertainty band is wide, so that we cannot rule out the absence of an effect three years after the shock.

We conducted several robustness checks to assess the sensitivity of our results. First, we replaced real GDP growth in the controls with the output gap as a cyclical indicator. Second, we added an additional lag of the control variables to test dependence on lag structure. Third, we included the primary fiscal balance to account for the overall fiscal stance. Fourth, we excluded Ireland, since its GDP data are distorted by multinational corporate activity and may be unreliable (e.g. Economides and Nikolaishvili 2023). Fifth, we excluded the years 2020-2023 from the sample to check for the role of outliers related to the Covid-19 crisis. Table 1 shows that the cumulative multiplier estimates are robust. They decline slightly when controlling for the output gap, the primary balance, or when excluding the COVID-19 crisis years; they increase modestly with an additional lag or when excluding Ireland. In all cases, however, the peak estimates remain close to the baseline value of 1.3.

[2] Note that the multiplier estimates are obtained by scaling the real GDP response by the response of public investment itself to the investment shock and by normalising to make them dimensionless.

6. Discussion and conclusions

We contribute to the literature on the effects of public investment by providing the first shock identification for the 27 EU member countries based on public investment forecast errors of the European Commission. On average, public investment shocks in EU member countries have favourable macroeconomic effects in the short to medium run: public investment boosts output, reduces unemployment, and neither crowds out private investment nor raises the public debt ratio.

Our estimated cumulative public investment multipliers fall within the range reported in the literature. The impact multiplier of 0.6 and the one-year multiplier of 1.2 are consistent with the meta-analysis by Gechert (2015), who reports an average public investment multiplier of 1.4 (with a standard deviation of 0.9). Our results are directly comparable to Abiad et al. (2016), who also use forecast errors to identify public investment shocks; their cumulative peak multiplier of 1.4 for 17 OECD countries over 1985–2013 is closely aligned with our results for 27 EU countries over 2000-2023.

Multipliers may be particularly large and persistent when public investment spending addresses clear infrastructure needs (e.g. Clemens et al. 2025), supports education and institutional capacity (e.g. Saccone et al. 2022), and promotes R&D (e.g. Ciaffi et al. 2024)

As with any empirical approach, our estimation strategy is subject to certain limitations. First, the effects of public investment may vary across EU country groups or individual EU countries. Second, our identification strategy does not allow us to differentiate between different forms of public investment. Therefore, future research should explore the transmission channels of public investment shocks in greater depth and examine how their effects vary across EU countries and investment categories.

Another important issue to be addressed in future research is whether budget-neutral public investment shocks in EU member states (financed by an increase in taxes and/or a decline in other spending components) have different effects than debt-financed investment (financed by issuing government bonds). Abiad et al. (2016) show that the output effects of debt-financed public investment may be larger than for budget-neutral investment, but the latter may come with more favourable outcomes for the public debt ratio.

Table 1 / Robustness checks for public investment multiplier

Response horizon	Cumulative multiplier – lower bound	Cumulative multiplier – point estimate	Cumulative multiplier – upper bound
Baseline findings: see Figure 1 A)			
0	0.18	0.57	0.96
1	0.58	1.20	1.83
2	0.49	1.29	2.09
3	0.28	1.29	2.29
Cyclical conditions: output gap instead of GDP growth			
0	0.18	0.57	0.96
1	0.54	1.13	1.73
2	0.40	1.16	1.93
3	0.15	1.14	2.13
Lag structure: additional lag			
0	-0.02	0.23	0.48
1	0.41	0.89	1.36
2	0.40	1.15	1.89
3	0.34	1.35	2.37
Fiscal stance: primary balance			
0	0.17	0.55	0.93
1	0.54	1.18	1.82
2	0.43	1.24	2.05
3	0.22	1.24	2.26
Country group: exclude Ireland			
0	0.38	0.78	1.18
1	0.69	1.36	2.04
2	0.63	1.46	2.30
3	0.42	1.42	2.42
Time period: Exclude Covid-19 crisis years			
0	0.22	0.66	1.09
1	0.45	1.19	1.93
2	0.26	1.16	2.06
3	0.04	1.13	2.22

Source: own estimations based on local projections (see equation 1). The lower and upper bound estimates show the one standard error confidence interval. The response horizon is 0 on impact, 1 for one year after the *public investment* shock, etc.

Data availability statement: Data and replication files are available via: https://github.com/heimbergecon/pubinveu.

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Supplementary appendix

Why may fiscal multiplier values differ at the theory level? Modelling choices and underlying assumptions can substantially affect multiplier values (e.g. Ramey 2019). Real business cycle models, which incorporate utility-maximising households and exclude Keynesian demand effects, typically produce multipliers close to zero. New Keynesian DSGE models or structural macroeconomic models that allow for traditional Keynesian effects in the short run and rely on neoclassical features in the long run often find multipliers close to or above 1 (Gechert 2015). Recent macroeconomic models with heterogeneous agents, bound by precautionary saving motives, deliver deficit spending multipliers above 1 that do not peter out quickly (Auclert et al. 2024). Including hysteresis effects (long-run supply-side effects) into agent-based models yields sizeable and persistent effects of fiscal policy on macroeconomic performance (e.g. Bassi and Lang 2016). Overall, a range of theoretical models with different transmission channels may yield public investment multipliers exceeding one. Furthermore, one must distinguish between different forms of government spending, since the macroeconomic effects of public investment or spending on R&D and education may substantially exceed those of government consumption (e.g. Antolin-Diaz and Surico 2025).

However, empirical studies report a wide spectrum of estimates. Public investment multipliers are frequently found in a range of 1 to 4, substantially higher than those associated with government consumption (e.g. Gechert, 2015; Ciaffi et al. 2024).

When it comes to empirical estimation, researchers have developed a variety of identification strategies to address endogeneity concerns, which arise from fiscal policy and economic growth influencing each other simultaneously, making it difficult to isolate causal effects. Common shock identification approaches include the use of narrative records, forecast errors, sign restrictions, and the exploitation of time lags between fiscal policy implementation and its macroeconomic effects (e.g., Ramey, 2016).

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