



Government employment and local multipliers in Greek municipalities

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Abstract

This paper studies the impact of the remarkable increase in the share of public employment on the private sector across 156 Greek municipalities using Census data (1981–2011). To capture causal effects, we implement an instrumental variables approach, based on a shift-share design. We find that an additional job in the public sector creates nearly 0.7 jobs in the non-tradable sector (construction and services), whilst no significant effects are detected for the tradable sector (manufacturing). The findings appear to be robust to different estimation strategies, spillovers from contiguous regions, and to the inclusion of confounding factors. Importantly, we document that the most recent decline in the number of public servants did not significantly affect the private sector.

JEL Classification J45 · H70 · R12

1 Introduction

Research on local employment multipliers has a long tradition in the economics literature (see, for instance, Daly 1940; Hildebrand and Mace 1950; Thompson 1959). More recently, a re-evaluation of this concept by Moretti (2010) has sparked renewed interest in the research community, seeking to measure whether an expansion of the tradable sector causes an increase in the number of jobs in the non-tradable sector (see, e.g. Moretti and Thulin 2013; Kazekami 2017; Van Dijk 2017, 2018; Goos et al. 2018; Lee and Clarke 2019; Osman and Kemeney 2021). Usually, these studies report significant contributions, though the magnitude of the local multiplier depends on how well-paid are employees in the tradables and the elasticity of labour supply.

A closely related strand of the literature, which starts with Faggio and Overman (2014), concerns local multipliers on the private sector created by an increase in

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the share of government employment. In principle, additional public sector jobs can exert two opposite effects on local employment. On the one hand, the public sector may contribute to private employment growth through consumption spillovers. These effects are expected to be felt mainly in sectors whose products are sold locally. However, public employment may also generate crowding-out effects, either by substituting privately provided services or by reducing competitiveness in export-oriented sectors. The main mechanism through which this occurs is rising labour costs and prices for local non-traded products (see, e.g. Auricchio et al. 2019).¹ Overall, the labour market consequences of public employment on the private sector could be either positive or negative, and thus, an empirical question that we attempt to address in this study.

Typically, these studies exploit the variation in public employment across local labour markets within countries, in order to assess its contribution on the private sector.² For instance, Faggio and Overman (2014), using English data, find a positive multiplier in the non-tradable sector and crowding-out effects in the tradable sector. Overall, the impact on private employment appears to be negligible, as the sector-specific effects cancel each other out. In contrast to the above study, Auricchio et al. (2019) explore the effects of a recent reduction in public employment, using Italian data over the period 2001–2011. These authors have shown that private employment grew more in those municipalities that experienced the largest public sector downsizing. More recently, Auricchio et al. (2020), argue that the crowding-out effects of public employment are more pronounced in the South of Italy. Lastly, Jofre-Monseny et al. (2020), based on Spanish data between the years 1980 and 2000, document significant crowding-in effects, especially in the non-tradable sector. On balance, there is little empirical consensus whether public employment crowds-in or crowds-out private employment.³

This paper contributes to the existing literature on local government multipliers by focusing on the interesting case of Greece. Following the end of the military junta on 24 July 1974, the democratic regime shift coincided with an unprecedented public sector expansion, whose labour market effects have been largely unexplored

¹ A complementary explanation from a search-model perspective, is that the prospect of finding a job in the public sector might make employees more reluctant to fill vacancies in the private sector (Caponi 2017).

² For similar applications concerning non-European countries, see Ranzani and Tuccio (2017); Aldan (2020); Fallah (2021). Ranzani and Tuccio (2017) reveal an adverse impact on the private economy in Ghana, Mali, and Mozambique, which, however, materialize through the agricultural sector. Aldan (2020), exploiting data for Turkish regions, provides estimates that indicate a positive causal effect on formal private employment. Similarly, Fallah (2021), documents a robust multiplier effect in the West Bank.

³ Some prior work has also explored the effects of public employment on labour market performance using either time-series techniques for a single country or cross-country regressions (see, e.g., Malley and Moutos 1996; Demekas and Kontolemis 2000; Algan et al. 2002; Behar and Mok 2019). Typically, these studies incorporate public employment into macroeconomic models and conclude that it can crowd out private sector employment by increasing real wages or through higher taxation.

in the literature.⁴ To motivate the empirical analysis, we present in Fig. 1 evidence on the evolution of employment across the three main sectors of economic activity, between the years 1981 and 2011. To facilitate the interpretation, we normalize the data, assuming 1981 as the base year. As can be seen, two patterns emerge clearly from this figure. First, as discussed above, public employment has grown strongly over this period. Specifically, the absolute number of public sector jobs in 2011 appears to be nearly 2.2 times as high as the one in 1971.⁵ Second, concerning private employment, the evidence is consistent with the idea of employment ‘deindustrialization’, as revealed by the sharp decline in manufacturing and the development of the service sector.⁶ Based on these stylized facts, the main aim of this study is to formally assess whether and to what extent the remarkable increase in the number of public sector jobs has contributed to these developments in the private sector, during the era of the Third Hellenic Republic. To do so, we use data from the latest available Greek census surveys (1981–2011) and exploit the variation in the decadal change of public jobs as a share of total employment at the beginning of each decade, at the municipality level, as in Faggio and Overman (2014).

Second, unlike existing studies (with the exception of Auricchio et al. 2019) which have focused on the effects of public sector expansions, we also estimate, using data from an external dataset, the effects of the public sector during the most recent period (2012–2019), characterized by a sharp decline in the number of public servants. These developments were dictated by Greece’s 2009 severe fiscal crisis, and a series of measures intended to stabilize its debt.

The key findings are the following. Our ordinary least squares (OLS) results indicate a substantial public employment multiplier that operates through the non-tradable sector. However, we acknowledge that public employment could be a consequence as much as a cause of private employment (see, for instance Alesina et al. 2001), thereby threatening the validity of the OLS results. Hence, to address these concerns, we also implement instrumental variables approach by employing a Bartik-type (1991) shift-share instrument that attributes the initial distribution of public jobs across municipalities to the contemporaneous, national-level growth in public employment. We also follow the approach introduced by Conley et al. (2012) to test how likely is the exclusion restriction assumption to be violated. Our 2SLS estimates confirm that public employment displays a positive association with private

⁴ To the best of the author’s knowledge, with the exception of Demekas and Kontolemis (2000), no previous study has attempted to address the relationship between employment in the public and the private sector of the Greek economy. These authors, relying on cointegration analysis, have shown that the expansion of the public sector in the early 1980s led to higher unemployment. See, also, Alogoskoufis (1995), for an overall assessment of the post-1974 changes on the macroeconomic performance of Greece.

⁵ It is worth noting that the expansion of the public sector has taken place through patronage hiring practices, which, along with other deep institutional weaknesses have cumulatively contributed to the 2009 fiscal crisis in Greece (see, e.g., Phelps 2015). See Chortareas et al. (2016) for recent evidence on political opportunism in Greece.

⁶ Following the discussion in Rodrik (2016), Greece’s ‘deindustrialization’ could be characterized as ‘premature’, in the sense that the economy has never fully reached its industrial capacity, before shifting toward services.

employment, though the magnitude of the estimated effect is slightly lower than the one we found through the OLS estimator.

Our preferred specification suggests that an additional job in the public sector contributes to the expansion of the private sector by about 0.90 jobs. The effects appear to be driven by the service and construction sectors. By contrast, we fail to detect significant multipliers in manufacturing. The findings of a positive multiplier stand in contrast to the evidence for other developed countries such as the UK, Italy, and Germany (see, e.g. Faggio and Overman 2014; Senftleben-König 2014; Auricchio et al. 2020) but are similar to the ones reported by Jofre-Monseny et al. (2020) and Aldan (2021) for the cases of Spain and Turkey, respectively.⁷ Interestingly, our analysis reveals that the expansion of the public sector in a municipality causes a migration response from the rest of the municipalities. Overall, public sector expansions cause the number of local unemployed to rise, as public employment stimulates the creation of fewer jobs relative to the number of jobseekers that attracts.

The remainder of the paper proceeds as follows. The next section considers the economic arguments surrounding the interplay between the public and the private sectors of the economy. Section 3 describes the data and our identification strategy. In Sect. 4, we present the empirical results and carry out a series of robustness checks. The last section draws conclusions.

2 Mechanisms

Before we proceed to the formal empirical analysis, it is important to understand the theoretical basis behind the relationship between the public and the private sector. Following Faggio and Overman (2014),⁸ we consider a local economy that produces a nationally traded good and a non-traded good that is consumed locally. The model further considers that public employees are better paid than their counterparts in the private sector.⁹ Employees can find a job in the private sector at the market wage or compete for a job in the public sector. Assuming risk neutrality, the expected wage in the public sector (i.e. the probability of finding a job multiplied by the public sector wage) must be equal to the remuneration of labour in the private sector.

⁷ Apart from the literature discussed in the main text, our study is also closely related to two recent contributions which focus on understanding the effects of relocation programs in Germany and the UK (Faggio 2019; Becker et al. 2021). Both studies find small public employment multipliers in the nontradable sector.

⁸ More precisely, these authors build on Moretti's (2010) intuition about local multipliers of the tradable industries.

⁹ Such an assumption is fully consistent with the developments in the Greek labour market, both before and after the Greek fiscal crisis (see, e.g., Christopoulou and Monastiriotis 2016). As discussed in Depalo et al. (2015), Greece displays one of the highest public sector premia in the eurozone.

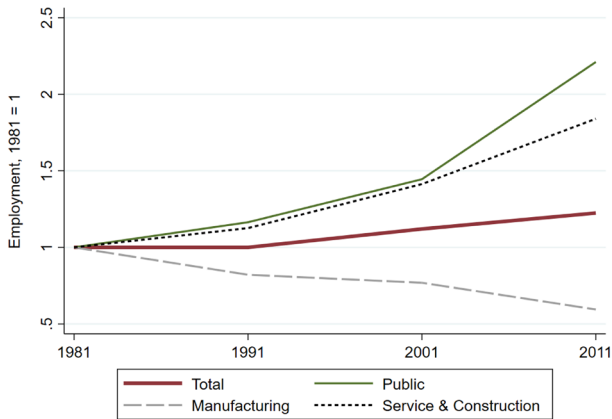


Fig. 1 Evolution of employment over the period 1981–2011. Public employment is defined as the sum of employment in public administration, education, and health. Total employment is defined as the sum of employment in all industries of economic activity. Author's elaborations on IPUMS data

Within this context, an increase in the share of public employment raises local income and boosts the demand for complementary, non-traded goods and services.¹⁰ On the other hand, public employment might exert a demand-reducing effect for substitute non-traded services. Insofar as the positive effects of the public sector are more pronounced, employment in the non-tradable sector must grow. By contrast, employment in the tradable sector is not expected to be significantly affected if local demand absorbs a small fraction of its output. However, as argued by Auricchio et al. (2019), in locations with strong public employment, non-tradable employment might be lower due to reduced competitiveness as a result of the higher local prices for labour and non-tradables. Consequently, employment in that sector might fall as a result of an increase in the number of public servants. Overall, the net impact on private sector employment is theoretically indeterminate.

On balance, the unemployment rate must fall to restore the equality between the expected earnings in the two sectors of economic activity. However, we cannot rule out the possibility of an increase in the number of unemployed, since the expansion of the public sector may trigger internal migration from other regions, which, in turn, translates into an increased number of job seekers. Hence, the overall effect depends on the magnitudes of the effects on employment and the number of job seekers (see, e.g. Faggio and Overman 2014; Jofre-Monseny et al. 2020).

¹⁰ As discussed in Faggio and Overman (2014) the size of the local multiplier depends on the elasticity of labour supply. Specifically, the higher the elasticity, the lower the rise in labour costs, which, in turn, translates into more jobs in the nontradable sectors. By the same token, we should expect the effects to vary according to the elasticity of housing supply.

3 Data and identification

To assess the impact of public employment on the private sector, we exploit the latest four available census 10% microdata, issued by the Hellenic Statistical Authority, i.e. the 1981, 1991, 2001, and 2011 waves.¹¹ We limit the sample to individuals between the ages of 16 and 64 years. The individual-level observations are then collapsed at the municipality level. Our final sample includes 156 municipalities consistently harmonized across census years by the Minnesota Population Center, IPUMS (Minnesota Population Center 2020). The largest municipality in 2011 was Athens, with 642,480 inhabitants, and the smallest was the Rest of Department Evrytania, with 1830 inhabitants.¹² In order to be able to study the effects of the more recent decline in public sector jobs, we also exploit data from the Greek Labour Force Survey (GRLFS), which have been released on quarterly basis (2012q1–2019q4).

Following Faggio and Overman (2014) we construct the key independent variable in our analysis as the decennial change of public employment normalized by total employment at the beginning of each decade, that is,

$$\left(\frac{N_{i,t}^{\text{publ}} - N_{i,t-10}^{\text{publ}}}{N_{i,t-10}} \right) \quad (1)$$

where $N_{i,t}^{\text{publ}}$ stands for public employment in municipality i and period t , and $N_{i,t}$ is total local employment. In-line with earlier studies, our imperfect measure on public employment is constructed by adding jobs in three sectors, namely, public administration and defence; education; health, and social work.

By the same token, letting $N_{i,t}^{\text{priv}}$ denoting private employment, its contribution to employment growth is given by:

$$\left(\frac{N_{i,t}^{\text{priv}} - N_{i,t-10}^{\text{priv}}}{N_{i,t-10}} \right) \quad (2)$$

To keep consistency with existing work, we obtain private employment by aggregating employment in construction, services, and manufacture. That is, we discard mining; agriculture, fishing, and forestry, as well as utilities (electricity, gas, and water; transportation, storage, and communications), in which there is significant involvement of the public sector.

To uncover the magnitude of the public sector multiplier we fit an Ordinary Least Squares (OLS) regression à la Faggio and Overman (2014):

$$\left(\frac{N_{i,t}^{\text{priv}} - N_{i,t-10}^{\text{priv}}}{N_{i,t-10}} \right) = \beta_R \left(\frac{N_{i,t}^{\text{publ}} - N_{i,t-10}^{\text{publ}}}{N_{i,t-10}} \right) + \delta_R X_{it} + \alpha_r + \varphi_t + \lambda_{rt} + f_i \quad (3)$$

¹¹ The data can be accessed at: <https://international.ipums.org/international/>.

¹² The implementation of the 2010 “Kallikratis” programme has reduced drastically the number of municipalities from 1033 to 332. Note, however, that the International IPUMS merges, whenever possible, contiguous municipalities into residual groups, so as to meet the 20,000 threshold.

Because both our main variables of interest are normalized by initial total employment, the parameter β_R indicates the number of newly created /destroyed private sector jobs associated with an additional public servant. Following existing studies, vector X_{it} is the set of municipality-specific controls that includes the logarithm of total employment, the share of university graduates, and the unemployment rate, which enter at their levels at the beginning of the decade. These are standard variables which capture the size of the local labour market, the level of human capital, and local labour demand (see, e.g. Elhorst 2003). Our model also includes the population contribution to growth, which is computed in an analogous way as in Eq. (1).¹³ Besides, we control for pre-trends in private employment growth (i.e. we introduce the lagged dependent variable) that are intended to capture systematic differences between municipalities at the start of the decade (i.e. heterogeneous pre-trends).¹⁴ However, since some of these variables might be endogenous, we also report estimates based on a parsimonious bivariate specification, to establish whether our main analysis suffers from “bad controls” issues, in the spirit of Angrist and Pischke (2008).¹⁵ Descriptive statistics for the variables used in this study are displayed in Table 1.

Lastly, vectors α_r and φ_t denote region¹⁶ and decade fixed effects, respectively, which are intended to capture time-invariant region characteristics and common period shocks across municipalities. We also introduce in our full specification region-specific linear trends, denoted as λ_{rt} .

However, the OLS estimates of the local public employment multipliers might suffer from potential endogeneity, which can arise for two reasons.¹⁷ First, the government may direct public resources into lagging areas, as a means to improve the standards of living (see, e.g. Alesina et al. 2001). This would bias the estimated effect of public employment negatively. On the other hand, we would expect to see a positive bias if public employment expanded more into more populated regions (i.e. due to increased demand for public services). Second, there might be unobserved factors correlated with both main variables of interest. To mitigate these concerns,

¹³ It is important to control for population growth, since it constitutes a potential confounder, that it is likely to be correlated with the two variables of interest simultaneously. For instance, a higher private employment growth could lead to a higher population growth, which, in turn, could increase demand for public sector services (and, thus for public servants).

¹⁴ Please, note that the introduction of the lagged dependent variable as regressor might bias the results, if it is correlated with the error term (Nickell 1981). Unfortunately, with the data at our disposal (we have only three periods) it is not feasible to address this issue by alternatively estimating dynamic panel data models. Nevertheless, the results we obtain when we do not account for pre-trends (available upon request) appear to be consistent with those presented in the text. It is therefore preferable to include this variable, in order to show that our results are robust to heterogeneous pre-trends. This strategy also makes our results comparable with previous related studies, which are also based on OLS/2SLS regressions with the lagged private employment variable in the set of controls (e.g., Faggio and Overman 2014; Auricchio et al. 2019).

¹⁵ For instance, the logarithm of employment.

¹⁶ In particular, we include NUTS 1 level dummies, namely for Northern Greece, Central Greece, Attica, Aegean Islands and Crete.

¹⁷ Another issue deserving attention and which calls for an instrumental variables approach is, of course, potential measurement error in the main explanatory variable of interest.

we estimate the impact of government employment on private employment using a 2SLS approach. Following prior work, we employ a shift-share instrument that is obtained by interacting the initial distribution of public employment across municipalities (i.e. at the beginning of each decade) with the national growth in public employment¹⁸:

$$\text{Bartik}_{i,t} = \left(\frac{N_{i,t-10}^{\text{publ}}}{N_{i,t-10}} \right) \times \left(\frac{N_t^{\text{publ}} - N_{t-10}^{\text{publ}}}{N_{t-10}^{\text{publ}}} \right) \quad (4)$$

To further improve our identification strategy, we exclude each municipality's contribution to the countrywide component of the instrument. This mitigates concerns about mechanical correlations between the endogenous variable and the instrument, as suggested by Autor and Duggan (2003).

The underlying identification assumption is that the imputed instrument captures the exogenous component of public employment. It is worth noting that this strategy may be highly relevant within the context of the current paper since the spatial distribution of public employment in Greece is mainly decided by the central government. A preliminary inspection of the data in Fig. 2 indicates that both the actual public employment and the predicted (instrument), grew more between 1981 and 2011 in almost all the core municipalities, including the largest ones, the capital city Athens and Thessaloniki. Of course, however, we investigate our instrument's relevance in more detail in the next section, based on the coefficient of the shift-share predicted public employment in the first-stage regression and the corresponding F-statistics on the excluded instrument.

Before we proceed with our regression analysis, we illustrate in Fig. 3 the general pattern in the data. As it is evident, there is a notable positive correlation between the share of public employment and the private sector,¹⁹ robust to the exclusion of the municipality of Thermaikos which stands as an outlier. Notice, however, that in our regression model, we winsorize the variables at their fifth and ninety-fifth percentiles and the shift-share instrument to its first and ninety-ninth percentiles, to minimize the risks of obtaining results driven by particular influential observations.²⁰

¹⁸ Prominent applications of the Bartik-style (1991) instrument, outside the current paper's context, include Card (2001) and Moretti (2010). More precisely, Card (2001) uses this approach to analyze the labour market effects of migration, whilst Moretti (2010) to estimate local multipliers of the tradable sector on employment in non-tradable sectors.

¹⁹ The correlation between the two main variables of interest can also be seen in Fig. 2, which displays the distribution of the changes in public and private employment relative to initial total employment, averaged across the three decades considered in this study.

²⁰ The results when using the data without winsorization are qualitatively similar to the ones presented in the main text, and available upon request.

Table 1 Descriptive statistics

Variable	Obs	Mean	Std.Dev	Min	Max
Private employment contribution	468	0.074	0.145	-0.267	1.738
Manufacturing employment contribution	468	-0.017	0.055	-0.241	0.433
Service and construction employment contribution	468	0.091	0.11	-0.13	1.305
Public employment contribution	468	0.071	0.076	-0.079	0.759
Public employment contribution, rest	468	2.27	3.331	0.018	18.333
Bartik instrument	468	0.054	0.041	0.005	0.194
Population, growth	468	0.308	0.78	-1.838	9.56
Working-age population, growth	468	0.244	0.552	-1.179	6.957
Unemployment, growth	468	0.089	0.073	-0.067	0.748
Inactive, growth	468	0.027	0.217	-0.391	2.305
Skilled share	468	0.112	0.074	0.011	0.449
Total employment	468	9.596	0.671	7.251	12.428
Unemployment rate	468	0.13	0.055	0.03	0.313
MSH	468	0.076	0.056	0.001	0.39
Female participation	468	0.437	0.094	0.154	0.644
Pensioners	468	0.165	0.053	0.059	0.34
Routine task intensity	468	-0.065	0.253	-0.826	0.567

4 Results

Here we summarize and discuss the main findings of the study, obtained using the methods described in Sect. 3. Our baseline regressions control for the municipality size, the local labour market conditions, the share of the population with a university degree, the growth in population and pre-trends. We also check the robustness of the findings to the inclusion of potential confounding variables, i.e. co-determinants of the key variables. To gain further insights on the effects of public employment on the private sector, we consider a split between tradables and non-tradables. We also explore whether the multiplier is age-specific. Lastly, we complement the main analysis by measuring the effects of the more recent decline in the number of public jobs.

4.1 Effects on total private sector employment

We start by reporting in the top part of Table 2 our preliminary OLS estimations for the 156 municipalities analysed in this study, using data for three decades, namely 1981–1991; 1991–2001, and 2001–2011. The dependent variable is the contribution of private employment. Clustered robust standard errors at the municipality level are reported in parentheses below the estimated coefficients.

Column 1 displays the point estimate on the public employment variable only controlling for regional and decade fixed effects. The remaining specifications include the set of additional municipality-level controls described in the previous

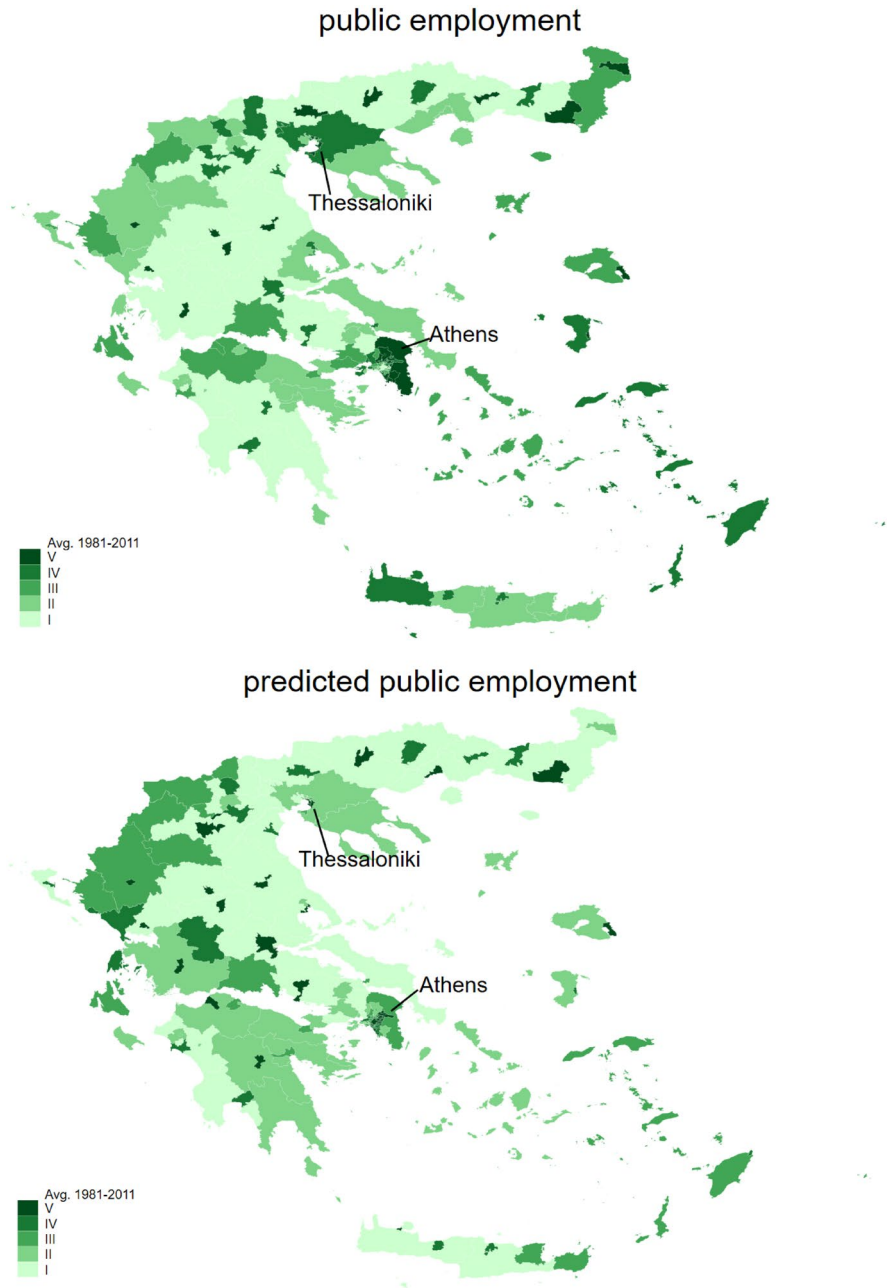


Fig. 2 This map shows the spatial distribution of the public employment contribution to total employment growth, and the Bartik-style instrument, across 156 Greek municipalities (average quintiles, 1981–2011). More intense green colours indicate higher growth rates between 1981 and 2011. Author's elaborations on IPUMS data

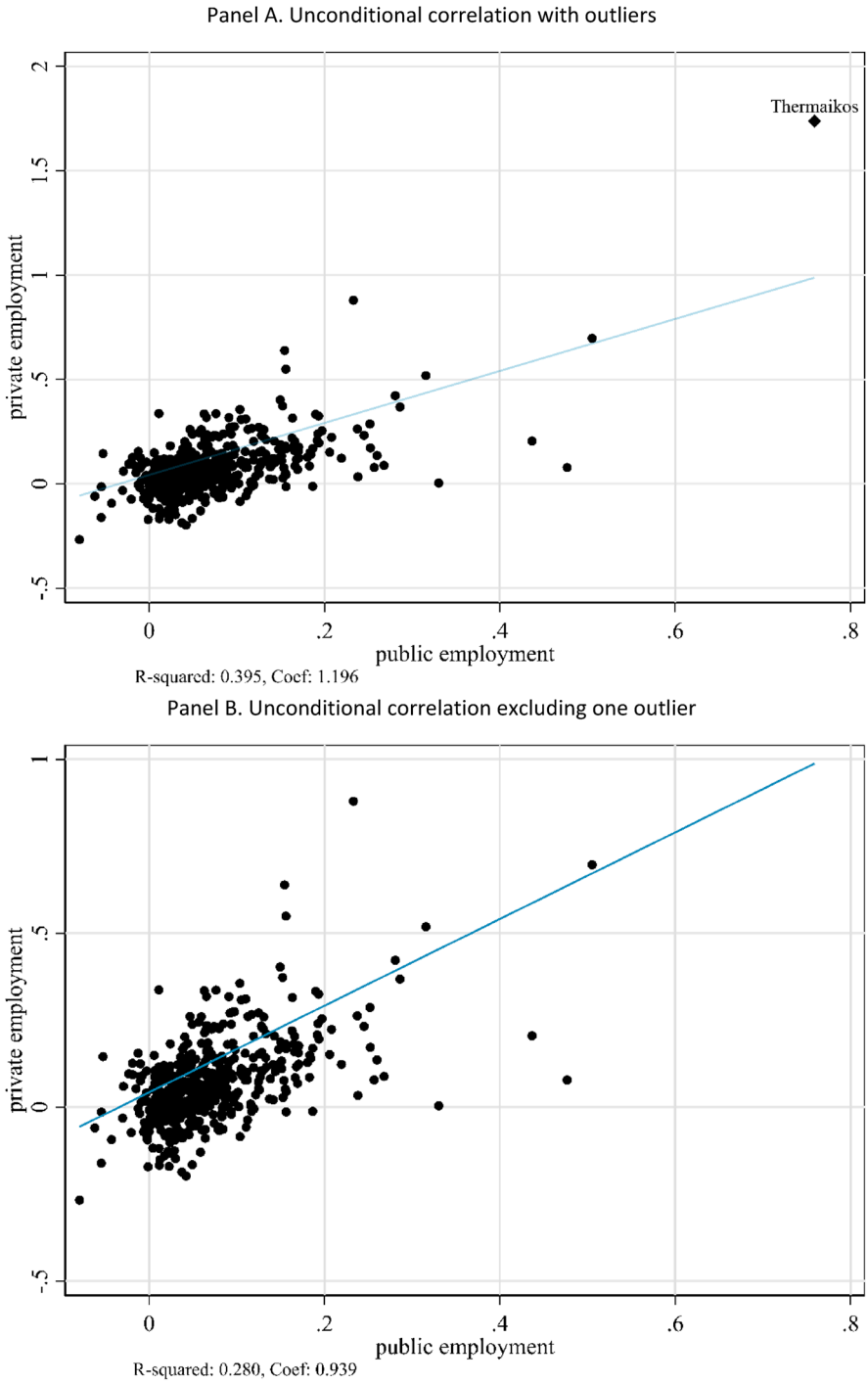


Fig. 3 Scatterplot of private employment against public employment with and without outliers. Author's elaborations on IPUMS data

Table 2 Impact of public sector on private employment

	Dependent variable: decadal change in private employment/initial total employment			
	(1)	(2)	(3)	(4)
<i>[A] OLS</i>				
Public employment	1.163*** (0.130)	1.056*** (0.130)	1.054*** (0.123)	0.966*** (0.095)
<i>R</i> ²	0.337	0.374	0.463	0.569
<i>[B] 2SLS</i>				
Public employment	0.869** (0.367)	1.158** (0.562)	0.985** (0.456)	0.902*** (0.277)
Total employment (log)		− 0.008 (0.013)	− 0.009 (0.012)	0.008 (0.009)
High-skilled		− 0.239 (0.146)	− 0.242* (0.127)	− 0.241*** (0.091)
Unemployment rate		− 0.564** (0.263)	− 0.515** (0.239)	− 0.409* (0.220)
Population growth		0.061*** (0.019)	0.070*** (0.018)	0.063*** (0.020)
Private employment (lagged)		− 0.200*** (0.068)	− 0.180** (0.074)	− 0.188*** (0.063)
Central Greece	0.016 (0.013)	0.022* (0.012)	0.031 (0.041)	− 0.033 (0.032)
Attica	0.030** (0.013)	0.020 (0.013)	− 0.011 (0.036)	− 0.060** (0.030)
Aegean Islands and Crete	0.053*** (0.017)	0.045** (0.019)	0.051* (0.027)	0.039 (0.025)
Year Effects	Yes	Yes	Yes	Yes
NUTS1-specific trends	No	No	Yes	Yes
Weights	No	No	No	Yes
Observations	468	468	468	468
<i>First-stage results</i>				
Bartik instrument	0.592*** (0.121)	0.515*** (0.158)	0.601*** (0.152)	0.809*** (0.165)
Kleibergen-Paap <i>F</i> -test	23.61	10.29	14.95	24

This table presents OLS and 2SLS estimates for 156 Greek municipalities using data for three periods (1981–1991, 1991–2001 and 2001–2011). All variables have been computed by aggregating individual-level data drawn from IPUMS. Public employment is the decadal change in public jobs divided by total employment at the beginning of each period. Robust standard errors, clustered by municipality, in parentheses. *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$

section. These variables enter at their levels at the start of each decade. We also include the growth of population, to account for agglomeration economies, and the contribution of the private sector to total employment over the previous decade. The inclusion of the region-specific linear trend is where the discrepancy between columns 2 and 3 lies. The last specification is identical to the full specification shown in column 3, but for the fact that we weight the regression by the total population in each municipality. Importantly, these modifications return parameter estimates that are quite identical in qualitative terms through specifications. Comparing the estimates reported in specifications 1 through 4, we find that the inclusion of the potential confounding factors does not significantly affect the size of the public sector multiplier. The estimated coefficients of interest range between 0.97 and 1.16, indicating that the expansion of the public sector is associated with higher private employment. Assuming a causal interpretation, the estimates in the last specification imply a multiplier of nearly 97, that is, for every additional 100 governmental hirings, the private sector expands by 97 jobs.^{21,22}

In panel B of Table 2, we address concerns on reverse causality and unobserved confounders by using instrumental variables. As discussed above, the direction of the bias could be either positive or negative, depending on whether public jobs are distributed by the central government as a means to combat unemployment or private employment growth increases the demand for public sector services. On the other hand, potential measurement error in the public employment variable can attenuate the estimates towards the null.

Before discussing the 2SLS findings, we provide pieces of evidence in support of the instrument's relevance. The last rows in Table 2 offer the first-stage results. As we observe, the instrument is strongly, positively correlated with the potential endogenous variable through specifications. This leads to the conclusion that our instrumental variable is strong and relevant.²³

However, there is yet another requirement concerning the validity of the IV results, namely, that the instrument affects the outcome variable only through its correlation with the public employment variable (i.e. the exclusion restriction).²⁴ Though not directly testable, we can obtain an indication of whether our shift-share instrument is 'plausibly exogenous', by following the approach introduced by Conley et al. (2012). This method can be illustrated briefly by modifying the empirical model to include the influence of the instrument on the outcome variable. Formally, the empirical specification can now be stated as:

²¹ At the bottom of panel A, we also report Oster's δ which suggests that selection on unobservables should be three to six times as high as selection on observables in order to render the analysis invalid.

²² In the Appendix Table A1, we have replicated the OLS analysis using municipality fixed effects instead of the NUTS-1 dummies. Reassuringly, the results indicate that the main conclusions of the paper are not driven by unobserved municipality-specific heterogeneity.

²³ The last row of this table presents the weak instruments test, which always exhibit a value above the rule-of-thumb of 10.

²⁴ As discussed in Goldsmith-Pinkham et al. (2020), the main threat concerning the exogeneity of the shift-share instrument comes from the potential correlation between the initial shares used to construct the instrument and the pre-sample characteristics.

$$\left(\frac{N_{i,t}^{\text{priv}} - N_{i,t-10}^{\text{priv}}}{N_{i,t}} \right) = \beta_R \left(\frac{N_{i,t}^{\text{publ}} - N_{i,t-10}^{\text{publ}}}{N_{i,t}} \right) + \gamma \text{Bartik}_{i,t} + \delta_R X_{it} + \alpha_i + \varphi_t + \lambda_{it} + \epsilon_i \quad (5)$$

The main idea surrounding this approach is that the key parameter of interest, β_R , can be consistently estimated by subtracting the term γBartik from the dependent variable. However, one drawback is that it is impossible to estimate the parameter γ from Eq. (2) while instrumenting at the same time the potentially endogenous right-hand-side regressor. One possible way to overcome this limitation, that is proposed by Fatás and Mihov (2013), is to estimate β_R for different values of γ and construct the corresponding union of confidence intervals. We do so by assuming that the parameter γ is distributed over the support $[-\delta\beta_R, \delta\beta_R]$, where δ stands for the proportion of the estimated coefficient β_R that can be attributed to the indirect impact of the instrument on the outcome variable. Assuming further that δ can be at most 30%,²⁵ and β_R equals 0.9 (as we found in column 4, Table 2), implies that γ ranges between -0.27 and 0.27 . As is evident from Fig. 4, the 90% confidence bands do not cross the zero-reference line. On the basis of these findings, we could be confident that our strategy would yield robust estimates when the exclusion restriction is mildly violated. Of course, the estimates would be rendered insignificant (i.e. the bounds would cross the zero-reference line) once we consider a higher cut-off level. In the current application, this would happen for values of δ greater than 40%.²⁶ On the basis of these findings, we could be confident that our strategy would deliver robust results even if the effect of the instrument on private employment through other channels is up to 40% of the second estimates, shown in Table 2.

Keeping these issues in mind, the second-stage results confirm the OLS evidence we discussed earlier in this section. Our bivariate specification with decade and NUTS2 dummies yields a multiplier of 87. The estimates appear to be consistent once we include further controls. However, the estimated coefficient on the public employment variable appears to be slightly weaker than the one we found above, signifying the presence of positive bias in the OLS regressions. Our preferred specification in column 4 indicates that 100 additional public sector jobs raise local private sector employment by about 90 jobs.

4.2 Effects by sector, age group and other outcomes

Thus far, we have analysed the interplay between public employment and total private employment. However, the theoretical model we discussed above predicts that public employment may affect employment in sectors of economic activity

²⁵ Since the parameter γ is an unknown, Fatás and Mihov (2013) argue that setting γ to range between -0.3β , and 0.3β (where β is the coefficient on the main independent variable of interest), constitutes a reasonable assumption that enables testing whether the results withstand a mild violation of the exclusion condition. Following this line of reasoning, we use the same cut off level as in Fatás and Mihov (2013), to check if our results could be rendered insignificant when the effect of the instrument on private employment through channels other than public employment is 30% of the 2SLS correlation between private and public employment.

²⁶ Similar results are reported in Fatás and Mihov (2013).

differently.²⁷ Hence, to uncover how much of the effect of public employment can be attributed to the non-tradable and/or the tradable sector, respectively, we also estimate separate models using employment in construction/services (non-tradables) and manufacturing (tradables) as the left-hand-side variables. We report in Table 3 the results based on the specification with the full set of controls with weights. The first column replicates the total effects we found in Table 2 using weighted 2SLS. Concerning the effects on tradable and non-tradable sectors, the 2SLS regressions reveal a pattern consistent with the theoretical model discussed in Sect. 2. Specifically, the coefficient on the public employment variable indicates a strong positive contribution to the non-tradable sectors. By contrast, the results for manufacturing appear to be insignificant at the standard levels of statistical significance. These findings reinforce the idea of consumption spillovers, which tend to translate into employment increases in sectors that produce locally consumed goods.²⁸

Table 4 explores whether age groups capitalize the employment gains we found above differently. Specifically, we distinguish between individuals aged below 35 years and above. For each age group we estimate three separate models, considering the effects of the public sector on private employment in services, construction and manufacturing. Each regression uses an age-specific dependent variable, while keeping the same explanatory variables. Given that the public sector usually recruits young individuals, we would expect the newly created jobs in the private sector to be occupied mostly by their senior counterparts. Interestingly, the patterns that emerge between the demographic groups, indicate that the multiplier is somewhat stronger for senior individuals. Consistent with the aggregate effects reported earlier in this section, the effects are sizable and significant in the non-tradable sector. There is also a weak but significant multiplier effect in construction for the young cohort. On the other hand, the impact of the public sector in manufacturing appears to be negligible.

In addition to the composition effects between tradable and non-tradable sectors, it is important to explore the influence public employment may exert on other outcome variables. For instance, a public sector expansion might encourage population movements from other regions. This might be the case when newly recruited public servants and their relatives relocate or if specific demographic groups, who consume public services more heavily, move towards regions that present a great number of such opportunities. It is also not straightforward that a significant public employment multiplier causes the number of unemployed individuals to decline if the labour force grows simultaneously (either through increased participation by local residents or due to internal migration from other regions). To gain further insight on these issues, we use as outcomes, the working-age population, the unemployment rate and the inactivity. All variables are again expressed as decadal changes

²⁷ The theory discussed in Sect. 2 implies that the magnitude of the local multiplier might vary with the wages paid to the public servants. To consider this possibility, we have run regressions splitting public employment into a skilled and an unskilled component. However, we failed to detect significant discrepancies, possibly due to the compressed wage structure prevailing in the Greek public sector.

²⁸ We have also run regressions by gender and found almost equally sized multipliers. The results are available upon request.

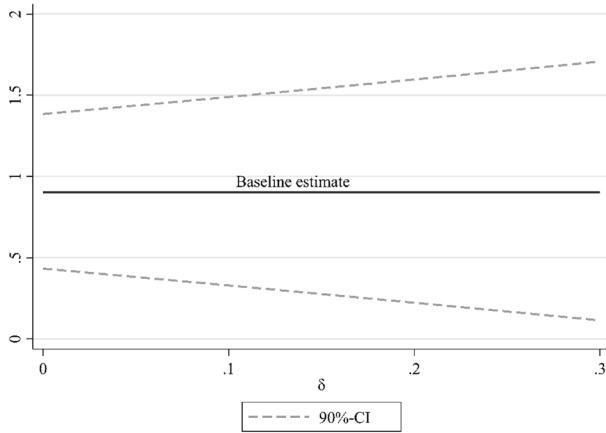


Fig. 4 This figure plots the 90% confidence bands of public employment based on union of confidence intervals approach developed by Conley et al. (2012). The solid line corresponds to the benchmark 2SLS estimate reported in Table 2, Column 4

Table 3 Effects by sector

	(1)	(2)	(3)
	Total	Service and construction	Manufacturing
Public employment	0.902*** (0.277)	0.685*** (0.206)	0.143 (0.122)
Controls	Yes	Yes	Yes
Pre-trends	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
NUTS1 FE	Yes	Yes	Yes
NUTS1-specific trends	Yes	Yes	Yes
Weights	Yes	Yes	Yes
Observations	468	468	468
<i>First-stage results</i>			
Bartik instrument	0.809*** (0.165)	0.821*** (0.167)	0.814*** (0.166)
Kleibergen-Paap <i>F</i> -test	24	24.09	24.02

This table presents 2SLS estimates for 156 Greek municipalities using data for three periods (1981–1991, 1991–2001 and 2001–2011). The set of control variables includes the share of university graduates over the working-age population; unemployment rate; female labour force participation; population growth. Pre-trends include the lagged contribution of each dependent variable. All variables have been computed by aggregating individual-level data drawn from IPUMS. Public employment is the decadal change in public jobs divided by total employment at the beginning of each period. All specifications include broad region dummies, namely Central Greece, Attica, Aegean Islands and Crete (omitted category: Northern Greece). Robust standard errors, clustered by municipality, in parentheses *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$

Table 4 Effects by age and sector of economic activity

	Young (age < 35)			Senior (age > 35)		
	(1)	(2)	(3)	(4)	(5)	(6)
	Service	Construction	Manufacturing	Service	Construction	Manufacturing
Public sector contribution	0.252*** (0.072)	0.089* (0.050)	0.090 (0.065)	0.445*** (0.121)	0.010 (0.050)	0.042 (0.077)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Pre-trends	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
NUTS1 FE	Yes	Yes	Yes	Yes	Yes	Yes
NUTS1-specific trends	Yes	Yes	Yes	Yes	Yes	Yes
Weights	Yes	Yes	Yes	Yes	Yes	Yes
Observations	468	468	468	468	468	468
First-stage results						
Bartik instrument	0.806*** (0.167)	0.818*** (0.168)	0.820*** (0.168)	0.842*** (0.168)	0.814*** (0.164)	0.808*** (0.165)
Kleibergen-Paap <i>F</i> -test	23.23	23.76	23.84	25.19	24.51	23.89

This table presents 2SLS estimates by age group and sector for 156 Greek municipalities using data for three periods (1981–1991, 1991–2001 and 2001–2011). The set of control variables includes the share of university graduates over the working-age population; unemployment rate; female labour force participation; population growth. Pre-trends include the lagged contribution of each dependent variable. All variables have been computed by aggregating individual-level data drawn from IPUMS. Public employment is the decadal change in public jobs divided by total employment at the beginning of each period. All specifications include broad region dummies, namely Central Greece, Attica, Aegean Islands and Crete (omitted category: Northern Greece). Robust standard errors, clustered by municipality, in parentheses *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$

normalized by lagged total employment. Table 5 presents the estimates from this empirical exercise. The pattern that emerges clearly from these data is that public employment serves as an important motivator to internally migrate in Greece. It is also evident that public employment is associated with higher inactivity. On the other hand, the effect on the growth of the unemployed is positive and significant, which suggests that the labour force grows more than the number of the newly created jobs in both the public and the private sector. Overall, these findings appear to be quite consistent with the ones shown in Jofre-Monseny et al. (2020) for Spain.

4.3 Robustness checks

Table 6 checks the stability of our prior findings to the inclusion of further controls that constitute important determinants of regional labour market performance. In particular, in columns 1, 6, and 11 we introduce the migrant share (MSH). This choice is motivated by Cortes (2008) who argues that the presence of migrants

Table 5 Effects on other outcomes

	(1) Working-age population	(2) Unemployment	(3) Inactive
Public employment	6.283*** (1.121)	0.863*** (0.226)	2.022*** (0.549)
Controls	Yes	Yes	Yes
Pre-trends	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
NUTS1 FE	Yes	Yes	Yes
NUTS1-specific trends	Yes	Yes	Yes
Observations	468	468	468
<i>First-stage results</i>			
Bartik instrument	0.762*** (0.169)	0.813*** (0.185)	0.753*** (0.169)
Kleibergen-Paap <i>F</i> -test	20.34	19.39	19.76

This table presents 2SLS estimates for 156 Greek municipalities using data for three periods (1981–1991, 1991–2001 and 2001–2011). The set of control variables includes the share of university graduates over the working-age population; unemployment rate; female labour force participation; population growth. Pre-trends include the lagged contribution of each dependent variable. All variables have been computed by aggregating individual-level data drawn from IPUMS. Public employment is the decadal change in public jobs divided by total employment at the beginning of each period. All specifications include broad region dummies, namely Central Greece, Attica, Aegean Islands and Crete (omitted category: Northern Greece). Robust standard errors, clustered by municipality, in parentheses *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$

contributes to the expansion of the service sector. Specifications 2, 7, and 12 include the female labour force participation. In columns 3, 8, and 13 we add the share of pensioners (i.e. the number of individuals above 65 years old relative to the total population). We would expect a positive association with the expansion of the service sector, as older individuals consume heavily private services and female workers are more involved in outsourcing household production than their counterparts outside the labour force (see, e.g. Moreno-Galbis and Sopraseduth 2014). Columns 4, 9, and 14 include a measure of regional routine task intensity, obtained from Goos et al. (2010).²⁹ This modification is in the spirit of Autor and Dorn (2013), who

²⁹ This measure, calculated by the authors using data from the O*NET database, is defined as the ratio between routine task importance and the sum of abstract and service task importances, with higher values indicating that routine tasks are more important than the others in each occupation. To be able to merge the routine indicator in our dataset, we have translated the IPUMS occupation categories until 1991 and in 2011 into ISCO88, from ISCO68 and ISCO08, respectively. To that aim, we have used Jann's (2019) routine/crosswalk, iscodegen, in STATA. For an application with data from Goos et al. (2010) in another European country, see Ortega and Verdugo (2014).

Table 6 Robustness

	Service and construction															Manufacturing				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)					
Public employ- ment	1.122*** (0.380)	0.908*** (0.310)	1.166*** (0.403)	0.880*** (0.308)	1.699*** (0.595)	0.911*** (0.285)	0.658*** (0.229)	0.626*** (0.314)	0.614*** (0.235)	1.070*** (0.420)	0.084 (0.154)	0.161 (0.137)	0.438*** (0.177)	0.205 (0.141)	0.478*** (0.236)					
MSH	0.366* (0.199)				0.438* (0.241)	0.408*** (0.156)				0.407** (0.174)	-0.091 (0.084)				-0.014 (0.099)					
Female partici- pation		0.164** (0.070)			0.198*** (0.074)		0.110* (0.059)			0.116** (0.058)	0.038 (0.031)				0.058* (0.033)					
Pensioners			0.301 (0.187)		0.443** (0.208)		0.005 (0.143)			0.125 (0.148)			0.285*** (0.072)		0.277*** (0.082)					
Routine task intensity				-0.024 (0.044)	-0.009 (0.044)				0.008 (0.031)	0.008 (0.028)				-0.056** (0.024)	-0.041 (0.025)					
Observations	468	468	468	468	468	468	468	468	468	468	468	468	468	468	468					
Year Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes					
NUTS1-spe- cific trends	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes					
Bartik	0.682*** (0.186)	0.740*** (0.165)	0.626*** (0.169)	0.730*** (0.165)	0.529*** (0.183)	0.686*** (0.187)	0.750*** (0.167)	0.653*** (0.170)	0.745*** (0.168)	0.532*** (0.185)	0.682*** (0.186)	0.748*** (0.166)	0.636*** (0.170)	0.733*** (0.166)	0.531*** (0.182)					
Instrument	13.44	20.13	13.77	19.58	8.374	13.44	20.23	13.93	19.69	8.332	13.49	20.16	13.91	19.36	8.459					
Kleibergen- Paap <i>F</i> -test																				

This table presents 2SLS estimates for 156 Greek municipalities using data for three periods (1981–1991, 1991–2001 and 2001–2011). The set of control variables includes the share of university graduates over the working-age population; unemployment rate; female labour force participation; population growth. Pre-trends include the lagged contribution of each dependent variable. All variables have been computed by aggregating individual-level data drawn from IPUMS. Public employment is the decadal change in public jobs divided by total employment at the beginning of each period. All specifications include broad region dummies, namely Central Greece, Attica, Aegean Islands and Crete (omitted category: Northern Greece). Robust standard errors, clustered by municipality, in parentheses *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$

contend that the service sector expands more in initially routine task intensive areas. In the remaining specifications, we plug into our model all the additional covariates simultaneously. With the exception of routine task intensity, all these variables were also calculated using the IPUMS dataset.

As we observe, the results are in agreement with our expectations, with the notable exception of the elderly share, which appears to significantly affect the growth in manufacturing jobs rather than the growth of employment in the service sector. Consistent with the discussion above, the immigrant share and the female labour force participation are strongly correlated with a higher growth in services. Importantly, the public employment variable retains its positive sign through specifications. However, the effects on the private sector are stronger, once we control for the share of the elderly individuals. However, keeping in mind that some of these controls may also be endogenous to the developments in the private sector (for instance, female participation or the elderly share could be higher in areas with a more vibrant service sector), the estimated multipliers should be interpreted with caution.

A second possible drawback is that a municipality may be affected by public employment in contiguous labour markets. We take this concern into account by introducing to our model a spillover term that captures the public employment contribution in the rest of the local labour market, i.e. in the remaining municipalities within the same NUTS2 level region. Following Auricchio et al. (2019), we normalize the decadal changes in public employment in contiguous municipalities by using the same denominator, $N_{i,t}$, as in the construction of the main public employment variable.³⁰ We report the results with this slight modification in Table 7. Reassuringly, the coefficient on the public employment variable remains in the same ballpark as the estimates we presented in Table 2. Encouragingly, the spillover terms do not appear to be significant correlated with the private employment variable. Overall, we consider this further evidence that our main results are not contaminated by biases related to spillover issues.³¹

For completeness, we replicate the main analysis using more recent data from an external source. In particular, we exploit the information provided by the Greek Labour Force Survey (GRLFS) over the period 2011–2019. We do so, in order to explore the effects of a public sector downsizing that took place as a result of Greece's severe fiscal issues in 2009 (see Fig. 5). This empirical exercise could be informative, not only within the current setting, but also for international studies on local government multipliers. As argued in Auricchio et al. (2019), the initial

³⁰ Specifically, the spillover term is defined as: $\left(\frac{N_{NUTS2,t}^{publ} - N_{NUTS2,t-10}^{publ}}{N_{i,t-10}} \right)$, where $N_{NUTS2,t}^{publ}$ is the public employment in the NUTS2 region, excluding each municipality's own contribution.

³¹ In Appendix Table A2, we follow Moretti and Thulin's (2013) approach to re-estimate the basic model without the largest region (in terms of employment) in the sample. These authors argue that the shift-share instrument performs best in applications with many small regions. As can be seen, the results remain robust to removing the largest region, in our case the city of Athens (see Appendix figure A1) from the sample. We thank an anonymous referee for bringing this into our attention.

Table 7 Spillovers from contiguous municipalities

	(1)	(2)	(3)
	Total	Service and construction	Manufacturing
Public employment	0.832*** (0.308)	0.602*** (0.227)	0.144 (0.139)
Public employment, rest	0.004 (0.003)	0.003 (0.002)	0.001 (0.001)
Controls	Yes	Yes	Yes
Pre-trends	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
NUTS1 FE	Yes	Yes	Yes
NUTS1-specific trends	Yes	Yes	Yes
Weights	Yes	Yes	Yes
Observations	468	468	468
<i>First-stage results</i>			
Bartik instrument	0.747*** (0.164)	0.757*** (0.166)	0.753*** (0.166)
Kleibergen-Paap <i>F</i> -test	20.63	20.82	20.68

This table presents 2SLS estimates for 156 Greek municipalities using data for three periods (1981–1991, 1991–2001 and 2001–2011). The set of control variables includes the share of university graduates over the working-age population; unemployment rate; female labour force participation; population growth. Pre-trends include the lagged contribution of each dependent variable. All variables have been computed by aggregating individual-level data drawn from IPUMS. Public employment is the decadal change in public jobs divided by total employment at the beginning of each period. All specifications include broad region dummies, namely Central Greece, Attica, Aegean Islands and Crete (omitted category: Northern Greece). Robust standard errors, clustered by municipality, in parentheses *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$

development of the public sector matters when examining the effects on local labour markets. Thus, one would expect to see more significant multiplier effects when an underdeveloped public sector expands as compared to a downsizing of an already saturated public sector. Unfortunately, the GRLFS data are available at a higher order of geographical aggregation (13 NUTS1 regions), and, thus, the results might not be completely comparable. To construct the shift-share instrument, we use 2006 as the base year. The findings reported in Table 8 are in agreement with Auricchio et al. (2019), as the public employment multiplier on the non-tradable sector ceases to be significant. On the other hand, the public sector now exhibits a statistically

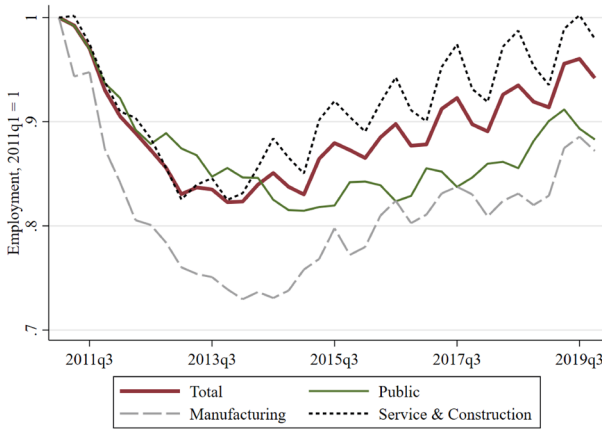


Fig. 5 Evolution of public and private employment over the period 2011–2019. Author’s elaborations on GRLFS data

Table 8 Effects using LFS data, 2012q1–2019q4

	(1) Total	(2) Service and construction	(3) Manufacturing
Public employment	-0.394 (0.517)	0.097 (0.379)	-0.292*** (0.081)
Controls	Yes	Yes	Yes
Pre-trends	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
NUTS1 FE	Yes	Yes	Yes
NUTS1-specific trends	Yes	Yes	Yes
Weights	Yes	Yes	Yes
Observations	104	104	104
<i>First-stage results</i>			
Bartik instrument	-2.248*** (0.387)	-2.246*** (0.389)	-2.246*** (0.387)
Kleibergen-Paap <i>F</i> -test	33.65	33.23	33.57

This table presents 2SLS estimates for 13 NUTS2 regions using data for the period 2012–2019 (the second quarter for each year). The set of control variables includes the share of university graduates over the working-age population; unemployment rate; female labour force participation; population growth. Pre-trends include the lagged contribution of each dependent variable. All variables have been computed by aggregating individual-level data drawn from GRLFS. Public employment is the quarterly change in public jobs divided by total employment at the beginning of each period. All specifications include broad region dummies, namely Central Greece, Attica, Aegean Islands and Crete (omitted category: Northern Greece). Robust standard errors, clustered by NUTS2, in parentheses *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$

significant negative impact on manufacturing. As discussed above, though we cannot conclude decisively, this finding probably highlights the significant differences between the two periods we analysed in this study.

5 Conclusions

Drawing on recent studies which focus on how the public sector shapes local labour markets, this is the first systematic empirical analysis on public employment and local multipliers with Greek data. We focus on the period 1981–2011, when the number of public jobs increased at unprecedented levels. We deal with the potential endogeneity of public employment by implementing the shift-share methodology pioneered by Bartik (1991). Our findings suggest that private employment has grown more in those municipalities which experienced the highest public sector employment expansions. Specifically, our benchmark regression indicates a local multiplier of 90. This result survives several robustness checks, including potential confounding factors and economic spillovers from other regions within the same NUTS2 region. We establish the main findings using employment in non-tradable sectors as the dependent variable. In contrast, we find that additional public jobs neither expand nor shrink the manufacturing sector.

Hence, our results could be justified by the fact that non-tradable employment depends more strongly on local demand as compared to employment in tradable industries. As a result, an increase in the share of public employment boosts local income, which, in turn, translates further into higher employment in the service and construction sectors. On the other hand, the employment effects are negligible in sectors that produce goods that are sold nationally. However, we show that the additional jobs created directly and indirectly by an expansion of the public employment do not decrease unemployment due to internal migrant from other regions.

Overall, these findings closely fit with in qualitative terms what is found in Jofre-Monseny et al. (2020) for the case of Spain, and partly those reported in Faggio and Overman (2014) for the UK. They are, however, in stark contrast with Auricchio et al. (2019) for Italy, implying that the effects of public employment are country-specific. Following the line of reasoning in Auricchio et al. (2019), the discrepancies may stem from the fact that we focus on a period that started with an underdeveloped public sector, whereas they look at the effects of a public sector downsizing. We provide evidence in favour of this argument, using recent quarterly data from the Greek Labour Force Survey, when the number of public servants declined substantially.

Appendix 1: Variable immunohistochemical profile

See Tables 9 and 10; Fig. 6.

Table 9 Impact of public sector on private employment with municipality fixed effects

	(1)	(2)	(3)	(4)
<i>Dependent variable: decadal change in private employment/initial total employment</i>				
Public sector contribution	0.816*** (0.137)	0.749*** (0.127)	0.801*** (0.115)	0.744*** (0.084)
Controls	No	Yes	Yes	Yes
Pre-trends	No	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes
Municipality FE	Yes	Yes	Yes	Yes
NUTS1-specific trends	No	No	Yes	Yes
Weights	No	No	No	Yes

This table presents OLS estimates with municipality fixed effects for 156 Greek municipalities using data for three periods (1981–1991, 1991–2001 and 2001–2011). All variables have been computed by aggregating individual-level data drawn from IPUMS. Public employment is the decadal change in public jobs divided by total employment at the beginning of each period. Robust standard errors, clustered by municipality, in parentheses. *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$

Table 10 Impact of public sector on private employment, excluding Athens from the sample

	(1)	(2)	(3)	(4)
Public sector contribution	0.876** (0.357)	1.161** (0.567)	0.983** (0.459)	0.882*** (0.296)
Controls	No	Yes	Yes	Yes
Pre-trends	No	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes
NUTS1-FE	Yes	Yes	Yes	Yes
NUTS1-specific trends	No	No	Yes	Yes
Weights	No	No	No	Yes
Observations	465	465	465	465
<i>First-stage results</i>				
Bartik instrument	0.611*** (0.121)	0.510*** (0.161)	0.596*** (0.155)	0.760*** (0.161)
Kleibergen-Paap F -test	25.39	10.07	14.72	22.33

This table presents 2SLS estimates by age group and sector for 156 Greek municipalities using data for three periods (1981–1991, 1991–2001 and 2001–2011). The set of control variables includes the share of university graduates over the working-age population; unemployment rate; female labour force participation; population growth. Pre-trends include the lagged contribution of each dependent variable. All variables have been computed by aggregating individual-level data drawn from IPUMS. Public employment is the decadal change in public jobs divided by total employment at the beginning of each period. All specifications include broad region dummies, namely Central Greece, Attica, Aegean Islands and Crete (omitted category: Northern Greece). Robust standard errors, clustered by municipality, in parentheses *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

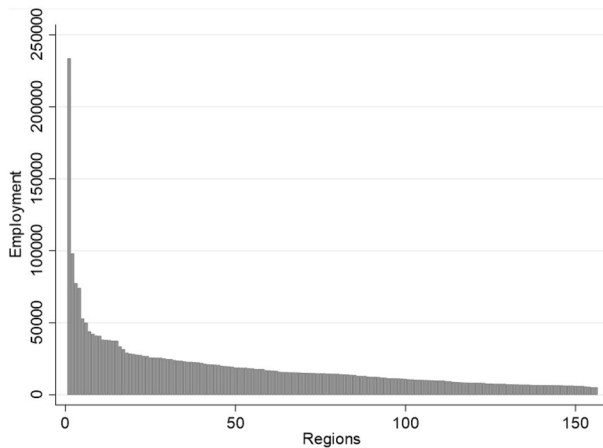


Fig. 6 Average employment over the 1981–2011 period in 156 Greek municipalities. Author's elaborations on IPUMS data

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Data availability The data that support the findings of this study can be accessed through the website of IPUMS-International and the Hellenic Statistical Authority.

Declarations

Conflict of interest The author declares that he has no conflict of interest.

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