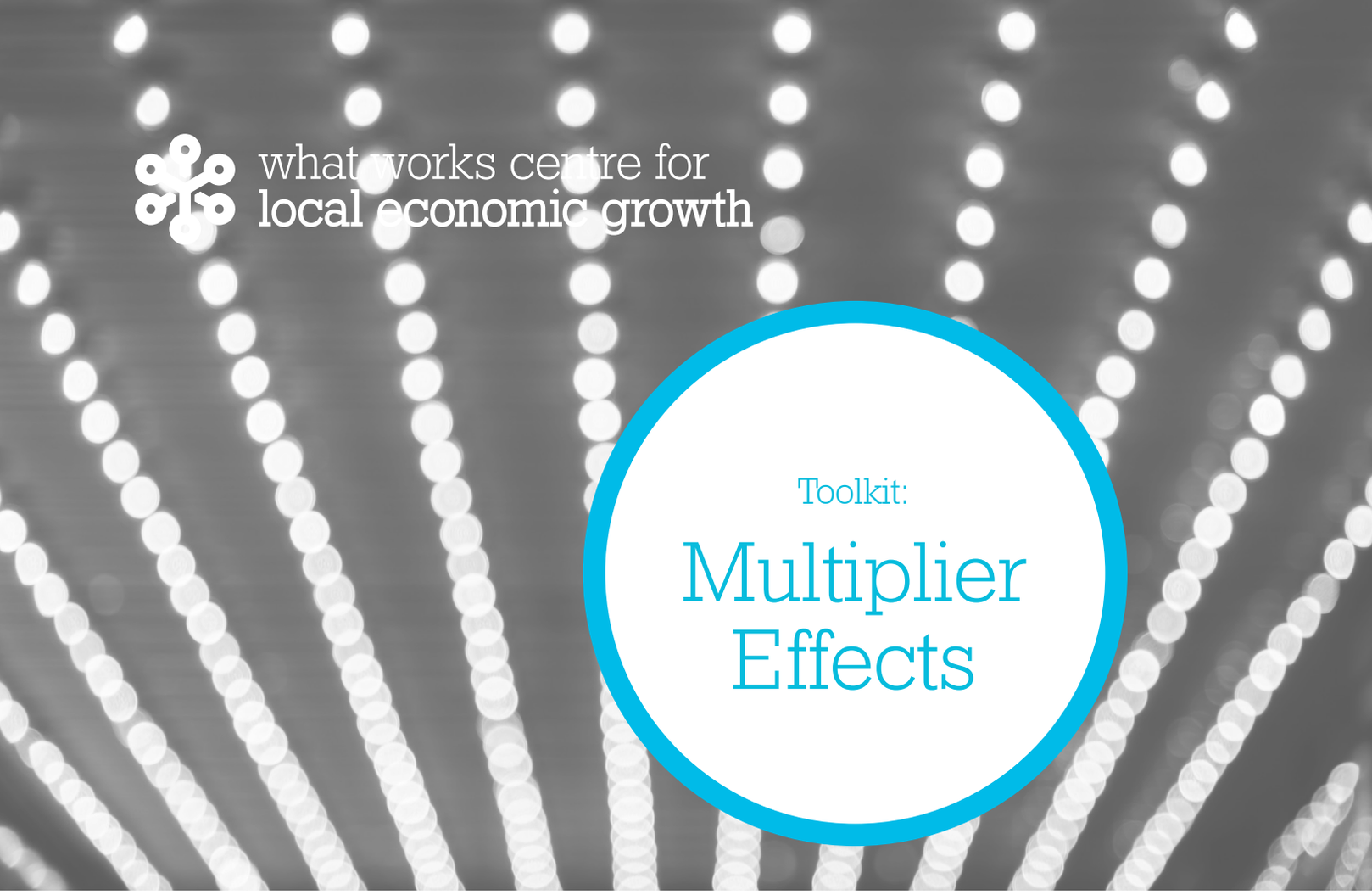

what works centre for
local economic growth

Toolkit:

Multiplier Effects

What are they?

Local economic development policies often aim to attract new employers to an area. New employers, public or private, directly increase local employment (providing they don´t merely displace existing jobs). They can also have indirect effects on local employment, in the same sector (for example, through agglomeration effects) or other sectors (for example, through increased demand for local goods and services). It is hoped that these effects will be positive leading to '**employment multipliers'**. Less optimistically, however, these positive effects may be offset by increases in local wages and prices.

Policymakers often use estimated multipliers to make the case for economic development spending. Many of these project appraisals predict significant positive multipliers using 'input-output' models that focus on the positive demand-side effects adjusted for 'leakages' from the local economy (demand that is served by firms from elsewhere). Less frequently, more complicated 'general equilibrium models' are used for an appraisal that allows for the possibility of offsetting price and wage effects.

This toolkit takes a very different approach and instead considers the available evidence on the size of the local multipliers that we see in practice. It does not rely on theoretical models and assumptions, instead of letting the data tell us about the balance of offsetting forces and the size of any multipliers.

How big are they?

The available evidence considers multipliers from three kinds of employment – in tradable sectors (that sell mostly outside the local economy); in tradable skilled and high-tech sectors, specifically; and in the public sector. The studies look at impacts from structural change (e.g., the growth of 'tradable' sectors like tech) as well as specific policies (e.g., public sector relocation). We found 18 studies that met our evidence standards for toolkits: 17 looking at employment multipliers, 3 of which are for the UK; and one study, from the US, that looks at real wage effects rather than employment.

In addition to evidence on the size of the multiplier effect some studies also consider whether the new jobs change the structure of the local economy. For example, do increases in public sector employment – which tend to increase demand for local services – shift private sector employment from manufacturing to services. Both the multiplier and the indirect effects on the wider economy are of key interest to policymakers.

We can summarise the findings as follows:

- Additional jobs in the tradable sector tend to increase employment in the non-tradable sector (e.g., local shops and restaurants). The average local multiplier is close to one: for each additional job in the tradable sector, 0.9 jobs are created in the non-tradable sector.
- The impact of additional jobs in the tradable sector on other tradable jobs is smaller: an additional job in the tradable sector creates, on average, 0.4 jobs in other parts of the tradable sector.
- Skilled jobs or jobs in high-tech industries generate larger multipliers: an additional high skilled job creates an average of 2.5 jobs in the non-tradable sector; For tech industries more generally, an additional job creates, on average, 1.9 jobs in the non-tradable sector.
- Growth in public sector employment has smaller multiplier effects on private sector employment: each additional job in the public sector creates, on average, 0.25 jobs in the private sector. Two studies report crowding out for manufacturing with effects offset or more than offset by a positive multiplier on services.

Things to consider

- The evidence on local multipliers can help inform more accurate appraisals for projects that create additional jobs.
- These jobs are new to the local economy, but they are not necessarily new jobs. This employment may simply be displaced from elsewhere (for example, from the area that used to house the government office)
- Jobs for high-skilled workers, those with degrees or above, appear to create the highest multipliers. High tech jobs also create higher multipliers, although that may be because many of these jobs are high-skilled rather than reflecting some specific feature of tech industry. More work is needed to disentangle these effects.
- Additional employment may have indirect effects elsewhere in the local economy. The study looking at real wages finds that growing tech employment in US cities also raises housing, and other living costs. While more work is needed on the size of the effects, policymakers should take these effects into account when considering the impact on poorer families who may not benefit from increased employment.

Annex: Evidence on Local Multipliers

How secure is the evidence?

This toolkit summarises the available empirical evidence on employment multipliers. This toolkit does not consider evidence based on qualitative or case study methods but focuses instead on econometric analysis and impact evaluations that seek to identify the causal effect of changes in local employment.

We looked for evidence on local multipliers in the non-tradable, tradable and private sectors arising from increased employment in the tradable sector (including the public sector). We focused on evidence from the OECD, in English. We considered any study that provided before-and-after comparisons or cross-sectional studies that control for differences between areas differently exposed to changes in the tradable sector. We also included more robust studies that exploit exogenous shocks in the tradable sector using an instrumental variable approach.[1] In summarising the evidence, we place greater emphasis on studies with stronger methods.

We found 17 studies of local multipliers in the non-tradable, the tradable, and the private sector. Most of the studies (10) focus on the employment multiplier in the non-tradable sector in response to an 'exogenous' increase in employment in the tradable sector, for example resulting from the relocation of civil servants or the 'shock' of China's entry into the World Trade Organisation. One study looks specifically at the multiplier from the high-tech sector. Six further studies focus on the multiplier effect of increases in public sector employment, including in two cases policies to relocate public sector institutions.

Most of the studies focus on the US (6).[2] The others used data on Spain (3), the UK (2), Germany (2), Italy (2), and Sweden (1). The remaining study estimates and compares local multipliers using data from the US, Sweden, and the EU.

Estimating job multipliers is challenging due to feedback effects across sectors. Almost all the studies deal with this 'endogeneity problem' using an instrumental variable approach. This results in a high number of studies (15) that use an IV strategy. Fourteen of these studies use a shift-share instrument (see BOX 1 for further details), one uses a change in the capital status of cities. In principle these studies could be classified as scoring 4 on the SMS scale. However, there is some variation in the extent to which these studies satisfy the criteria to be classified as SMS4 depending on the setting and instrument used. As a result, two out of 15 IV studies were scored as SMS3. The two remaining studies use credible identification strategies based on difference-in-differences and synthetic control methods and therefore, classified as SMS3.[3] Throughout the toolkit, we have placed greater emphasis on studies with stronger and more robust econometric methods.

1 See the Maryland Scientific Methods Scale (SMS) http://www.whatworksgrowth.org/resources/the-scientific-marylandscale/.
2 Study 7 provides US estimates that are comparable to study 6. We do not use these to avoid double counting.
3 Study 13 exploits the relocation of the German federal government from Berlin to Bonn during the Second World War. Study 14 uses neighbouring areas which are considered to be unaffected by the policy and which also share similar features with treated areas.

Box 1: A note on Bartik (shift-share) instruments.

Fifteen studies that quantify local multipliers adopt an instrumental variable method using a Bartik instrument. Such instruments should satisfy two conditions: 1) the relevance condition: the instrument is correlated with the main explanatory (and endogenous) variable; 2) the exclusion restriction: the instrument should not directly affect the outcome variable. The Bartik instrument is constructed as a weighted average of the national growth of tradable jobs in different industries (the "shift"), with weights that come from initial (or lagged) shares of tradable jobs by industry and local labour market area (the "shares"). For each local labour market area j, the instrument can be refined by considering industry employment in all labour market areas except j when computing the national growth of employment by industry.

The evidence

Our findings are summarized in Table 1.

In the first column, we summarise studies looking at the effect of an exogenous shock to employment in the tradable sector on employment in the non-tradable sector (10 studies). Nine of these studies [1,2,3,4,5,6,7,8,9] find statistically significant multipliers, with the remaining study [10] finding no effect.[4] Across all ten studies, the estimated multiplier ranges from 0.13-1.60 additional jobs, while the average is close to 1.

In the second column, we summarise three studies [6,7,8] looking at the effect of an exogenous shock to employment in the tradable sector on employment in the tradable sector.[5] Study 6 finds no effect. Studies 7 and 8 find multipliers of 0.33 and 0.64, respectively. The average of these two multipliers is 0.49 (0.41 if we include study [6]). For all three studies, the estimated tradable to tradable multiplier is smaller than the tradable to non-tradable multiplier (and the average is lower than the average for all ten studies discussed above).

In the third and fourth column, we summarise the five studies that look at the effect of an exogenous shock from tradable high-skilled jobs [6,7,9] or high-tech employment [6,7,10,11] on employment in the non-tradable sector. The precise definitions used vary by study.[6] For high-skilled the estimated multiplier ranges from 2.15-3.00 with a mean of 2.55. For all three studies, the estimated multiplier is larger than the tradable to non-tradable multiplier (and the average is higher than the average for all ten studies discussed above). Two of these studies [6,7] also look at the high-tech to non-tradable multiplier. While study [6] find a higher multiplier of 4.9 (compared to the high-skilled multiplier), study [7] reports a smaller multiplier of 1. The two studies [10,11] that only look at high tech report smaller multipliers of 0.7 and 0.9 with an average that is fairly similar to the non-tradable studies. The average of the four studies that report high-tech multipliers is larger than the average of the tradable to non-tradable multiplier.

4 Study [4] suggests that the tradable to non-tradable multiplier is larger in the Great Recession.

5 These studies derive multipliers in the tradable sector by regressing the change in the log number of jobs in a randomly selected part of the tradable on changes in the remaining part of the tradable sector.

6 Studies 6 and 7 define high-skill as those with at least a degree; study 9 as those earning above median wage. Studies 10 and 7 define high-tech using the EUROSTAT classification which includes pharmaceuticals, office machinery and computers, radio, television, and communication equipment, medical, precision, and optical instruments, watches and clocks, and aircraft and spacecraft. Study 6 considers machinery and computing equipment, electrical machinery and professional equipment as high-tech sectors. Study 11 uses an adaption developed by the Bureau of Labour Statistics in the US, which includes petroleum refinement, elements of manufacture of irradiation, electromedical and electrotherapeutic equipment R&D, manufacture of elements.

In the last column, we summarise the six studies [12,13,14,15,16,17] that look at the effect of public sector employment on employment in the private sector. Results are quite mixed with two studies reporting negative effects (i.e. crowding out), one study finding no effect and three studies finding positive multipliers. Two of these studies report crowding out for manufacturing (-0.4 for study [15] and -0.20 for study [13]) with effects offset or more than offset by a positive multiplier on services (0.5 for study [15] and 1.0 for study [13]). Three studies [12,13,17] suggest that price effects (increase in wages or house prices) seems to be behind crowding out effects.

Table 1: Multiplier Estimates

Shock in:	Tradable	Tradable	High tech tradable	High skilled tradable	Public sector	
Effect on:	Non-tradable	Tradable	Non-tradable	Non-tradable	Private sector	
Study						Country
1	1.13					Spain
2	0.67					Spain
3	0.53					US
4	1.10					US
5	0.55					US
6	1.60	[0.26]	4.90	2.50		US
7	0.48	0.33	1.00	3.00		Sweden
8	1.21	0.64				Europe/US (b)
9	1.60			2.15		US
10	[0.13]		0.70			Italy
11			0.90			UK
12					-0.70	Italy
13					0.80	Germany
14					0.60	UK
15					[0.21]	UK
16					1.30	Spain
17					-0.74	Germany
Mean	0.90	0.41	1.88	2.55	0.25	
Min	0.13	0.26	0.70	2.15	-0.74	
Max	1.60	0.64	4.90	3.00	1.30	

Note: insignificant studies in squared brackets

(a) This study provides US estimates that are comparable to study 6. We do not use these to avoid double counting.

(b) This study provides multipliers for Europe TL2/TL3, Sweden TL3, and US counties - we report the average (further details are presented below)

Study 1 (SMS 3) examines the effect of an exogenous shock to employment in the tradable sector on employment in the non-tradable sector in Spain. The study uses employment data at the province level (52 provinces) for the period 1995-2008. It applies an instrumental variable approach that considers several instruments such as location quotients for different levels of education, the specialisation coefficient, population density, road infrastructures, and the location quotient for non-market services. Using yearly changes from 1995-2008 results suggest that an additional job in the tradable sector creates 1.13 jobs in the non-tradable sector. When using long-difference, the estimated multiplier for two subperiods 1995-2001 and 2001-2007 increases to 2.1 jobs in the non-tradable sector for an additional job in the tradable sector.

Study 2 (SMS 3) examines the effect of an exogenous shock to employment in the tradable sector on employment in the non-tradable sector in Spain. The study uses data on employment from 103 Spanish Local Labor Market areas from 1999 to 2012. The empirical method accounts for spatial dependence using a spatial filter combined with an instrumental variable approach using a Bartik instrument. OLS estimates suggest that each additional job in the tradable sector creates 0.67 jobs in the non-tradable sector. However, using IV (and accounting for spatial dependence) results suggest that additional jobs in the tradable sector do not affect employment in the non-tradable sector

Study 3 (SMS 4) examines the effect of an exogenous shock to employment in the tradable sector on employment in the non-tradable sector and on employment in other parts of the tradable sector in the US. The study uses data from the Bureau of Economic Analysis on employment at the US metropolitan area level (123 MSAs) for the period 1980-2010. It combines a non-parametric spatial model to account for spatial spillovers, with an instrumental variable strategy which uses a Bartik shift-share instrument constructed with statewide employment growth (rather than national employment growth). The non-spatial IV method suggests that each additional job in the tradable sector creates 0.53 jobs in the non-tradable sector. Accounting for spatial spillovers, results suggest that each additional job in the tradable sector creates 0.49 jobs in the non-tradable sector.

Study 4 (SMS 4) examines the effect of an exogenous shock to employment in the tradable sector on employment in the non-tradable sector in the short and long run in the US. The study uses county-level data from the County Business Patterns for the period 1998-2015. It applies an instrumental variable approach using a Bartik shift-share instrument which does not include the own county when computing the national growth of employment by industry. Results suggest that each additional job in the tradable sector creates 1.1 jobs in other sectors of the county in the current year but reduces employment by 0.23 jobs in the next year and 0.32 jobs two years later. It also finds that the estimated multiplier seems lower during the boom and larger during the Great Recession.

Study 5 (SMS 4) examines the long-term employment multipliers in the US and compares the estimated multipliers to the ones obtained in Moretti (2010) – Study 13. The study uses US census data (1980, 1990, and 2000) aggregated at the US metropolitan area level (the metropolitan statistical areas MSAs). It applies an instrumental variables strategy using a refined Bartik shift-share instrument. The estimated multiplier for the non-tradable sector from an additional skilled job in the tradable sector ranges from 1.17 to 1.93 compared to 2.6 in Moretti (2010).

Study 6 (SMS 4) examines the effect of an exogenous shock to employment in the tradable sector on employment in the non-tradable sector in the long term. The study uses US census data (1980, 1990, and 2000) which is aggregated to local labour market regions and focuses on long-differences It applies an instrumental variable approach to estimate the multipliers using a Bartik shift-share instrument.

Results suggest that each additional job in the manufacturing sector creates 1.6 jobs in the non-tradable sector. Each additional skilled job in the tradable sector, creates 2.5 additional jobs in the non-tradable sector, while unskilled jobs created one additional job. The estimated multiplier also varies with the industry type, with high-tech industries showing the largest (4.9). Finally, it also finds that an additional job in the tradable sector has no employment effects in other parts of the tradable sector.

Study 7 (SMS 4) examines the effect of an exogenous shock to employment in the tradable sector on employment in the non-tradable sector in case of the US and Sweden. The study uses detailed Swedish data that match employer and employee for the period 1994-2004, and which is then aggregated at the local labour market area. It applies an instrumental variable approach which uses a Bartik shift-share instrument. Compared to study 6, the instrument is refined by not including the own region when computing the national growth of employment by industry. Each additional job in the tradable sector creates 0.48 jobs in the non-tradable sector in the case of Sweden, while it creates 1.6 jobs in the non-tradable sector in the US. The multiplier is higher for the high-tech sector: each additional job creates 1 job in the non-tradable sector in Sweden, and 4.9 jobs in the US. For Sweden the multiplier is higher still for higher educated/skilled: each additional job creates 3 jobs in the non-tradable sector, but it is lower than high tech for the US (2.5 jobs in the non-tradable sector). As the US estimates are comparable to study 6 we do not use them to avoid double counting.

Study 8 (SMS 4) estimates the effect of an exogenous shock to employment in the tradable sector on employment in the non-tradable sector in US counties and European regions. It uses three datasets: 1) Eurostat data on employment by sector (national level data, TL2 and TL3 regions)[7], period 1997-2006; 2) OECD dataset on employment in Sweden (TL3 regions) for the period 1991-2006; 3) US Bureau of Labor Statistics (county-level data), for the period 1991-2011. It applies an instrumental variable approach which uses a refined Bartik shift-share instrument. The study finds that multipliers are higher in the US than in Europe. Specifically, the multiplier in Europe range between 0.7 and 1, but is around 1.9 in the US. Finally, it also finds that the magnitude of the multiplier depends on the scale of the region. For instance, it finds a multiplier of 1.91 using US county-level data while Moretti, 2010 (Study 13) estimates a multiplier of 1.60 using US city-level data.

Study 9 (SMS 4) examines the effect of an exogenous shock to employment in the tradable sector on employment in the non-tradable sector in the US. The study uses US census data (1980, 1990, and 2000) aggregated at the US metropolitan area level (the metropolitan statistical areas MSAs). It applies an instrumental variables strategy using a Bartik shift-share instrument that does not include the own region when computing the national growth of employment by industry. Results suggest that an additional job in the tradable sector creates 1.6 jobs in the non-tradable sector. Findings are heterogeneous with respect to worker skill: each additional skilled worker in the tradable sector creates 2.0-2.3 jobs in the non-tradable sector. Finally, no statistically significant multiplier is found in the case of low-skilled workers.

Study 10 (SMS 4) examines the effect of an exogenous shock to employment in the tradable sector on employment in the non-tradable sector in Italy. The study uses census data (1981, 1991, 2001, and 2011) aggregated at the local labour market (LLM) level. It applies an instrumental variable strategy that uses a Bartik instrument. Results suggest that additional jobs in the tradable sector do not affect employment in the non-tradable sector. However, there is evidence of heterogeneous effects depending on the technology level of tradable jobs. For each additional job in the high-tech sector, 0.7 additional jobs are created in the non-tradable sector (although results appear to be sensitive to the inclusion of Milan).

7 TL stands for territorial level (A TL2 region is larger than TL3 region). TL2 and TL3 regions correspond to the second and third level NUTS regions, respectively. Broadly speaking, TL3 correspond to municipalities/cities, while TL2 to provinces.

Study 11 (SMS 4) examines the effect of an exogenous shock to employment in the high-tech industries on employment in the non-tradable sector in the UK. The study uses ONS data on UK local labour markets for the period 2009-2015. It applies an instrumental variable approach using a Bartik shift-share instrument that uses 2009 values to compute the initial shares, and with national employment growth computed without considering its own Local Authority. Results suggest that each additional job in the high-tech (or digital) industry creates 0.9 in the non-tradable service sector, with around two third of the jobs going to low-skilled residents. It also finds no effects on employment for mid-skilled workers, but positive wage effects.

Study 12 (SMS 4) examines the effect of an exogenous shock to public employment on employment in the private sector in Italy. The study uses census data (2001 and 2011) which is aggregated at the municipality level. It applies an instrumental variable strategy that uses a Bartik instrument. It takes advantage of the idea that reductions in local public employment which occurred between 2001 and 2011 depended mainly on central government decisions without considering local economic conditions. Results suggest that an additional job in the public sector reduces private employment by between .6 and .8 jobs in the private sector.

Study 13 (SMS 3) examines the effect of relocating the German federal government from Berlin to Bonn during the Second World War on private sector employment. The study uses a panel of 41 cities for the period 1925-1987. It applies a difference-in-differences strategy which compares the city of Bonn (the treated city) using 40 cities as for the control group as well as a synthetic control city constructed using a weighted average of the 40 non-treated cities. Results suggest an additional job in the public sector reduces employment in industry by 0.2 jobs and creates just above one additional job in another part of the private sector. The study also shows that previous findings can be explained using a simple economic geography model in which public sector employment increases productivities and amenities but can crowd out private employment through price effects.

Study 14 (SMS 3) examines the effect of public employment relocation (resulting from the 2004 Lyons Review) from London and the South East to other UK cities on private sector employment. The study uses data at the UK Local Authority level for the period 2003-2008. It applies a continuous difference-in-differences strategy based on a treatment intensity variable which is constructed as a non-parametric function of the distance to a relocation site. Focusing on short-term effects, results suggest an additional job in the public sector creates 0.6 jobs in the private sector. The relocation of public employment also affects the sectoral distribution service sectors at the expense of the manufacturing sector.

Study 15 (SMS 4) examines the effect of an exogenous shock to public employment on employment in the private sector in the UK. The study uses data at the UK Local Authority level for the period 2003-2007. It applies an instrumental variable approach using a refined Bartik instrument that does not include the own region when computing the national growth of employment by industry. Results suggest that an increase in public sector employment does not affect overall private sector employment. The lack of effect is explained by the fact that each additional job in the public sector creates 0.5 jobs in the non-tradable sector (construction and services) but reduces employment by 0.4 jobs in the tradable sector (manufacturing). Using a longer time period (1999-2007), the study finds no evidence of multipliers on the non-tradable sector and a larger crowding-out effect on the tradable sector, leading to an overall crowd-out effect on total private sector employment.

Study 16 (SMS 4) examines the effect of an exogenous shock to public employment on private employment in the long-run in Spain. It uses census data on employment and population for 1980, 1990, and 2001 at the urban area level. It uses a search and matching model embedded within a spatial equilibrium model with three sectors (public, tradable, and non-tradable) to simulate an expansion of the employment in the public sector. It also estimates the effect of an expansion in employment in the public sector on employment in the tradable and non-tradable sector applying an instrumental variable strategy which uses the change in the capital status of cities as the instrument. Results suggest that each additional job in the public sector creates 1.3 jobs in the private sector (mainly, in nontradable jobs). In addition, it finds that unemployment did not decrease substantially since labour market conditions are likely to attract more labour force to the city.

Study 17 (SMS 4) examines the effect of an exogenous shock to public employment on private employment in Germany. The study uses data from the Establishment History Panel aggregated at the district level for the period 2003-2007. It focuses on the long-differences (2003-2007), and applies an instrumental variable approach using a refined shift-share instrument that does not include the own district when computing the national growth of employment by sector and using 2003 values to compute initial shares. Results suggest that each additional job in the public sector reduces private sector employment by 0.74 jobs. It also finds that local gross daily wages increase: a one per cent increase in the public sector employment leads to a 2.2 per cent increase in wages. This crowding out effect is observed in the private tradable sector while employment in the private non-tradable sector remains unaffected.

Study 18 (SMS 4) examines the effect of tradable tech employment on wages and employment of workers in non-tradable sectors, as well as on local housing costs. The study uses data from the Quarterly Census of Employment and Wages, the Department of Housing and Urban Development, and the BLS Consumer Price Index for all Urban Consumers, for the period 2001-2015 for US metropolitan areas. It applies an instrumental variable approach using two different instruments: a Bartik shift-share instrument, and the stock of local patents per capita. An increase in high-tech jobs has a slight positive effect on real wages of workers in non-tradable sectors (that is, wages once housing and other costs are considered): a ten percent increase in local high-tech employment increases real wages in the non-tradable sector by between 0.1 and 0.7 percent. An increase in non-tradable jobs has a similar effect on real wages in non-tradable activities.

Studies included

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