The Local Labor Market Effects of Public Employment in Finland

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Abstract

This paper examines the impact of public sector employment on local labor markets in Finland across three periods (1996–2001, 2001–2006, and 2011–2016). Using OLS regression and an IV model with a shift-share instrument to address endogeneity, I estimate the effect of changes in public sector employment on private sector employment growth and other labor market outcomes.

In the earlier periods, increased public employment has a neutral or positive effects on private employment, primarily driven by migration and, to a lesser extent, reduced local unemployment. The last period shows a clear negative effect on private employment.

Theory suggest the impact of public sector employment depend on prevailing labor market conditions. These conditions vary across countries and can change over time. In Finland, the conditions during the early periods appears favorable, as high unemployment and large regional disparities meant that increased local labour demand resulted in reduced local unemployment and increased migration from other regions. Also, Finland's centralised wage-setting means rising local labor demand did not increase wage pressures that crowd out private sector growth. Conversely, the conditions during the last period became less beneficial in terms of facilitating positive effects from public employment growth, partly due to business cycle and partly due to structural changes.

The outcomes during public sector expansion align with studies on growth phases, while results from the contraction period mirror findings on public sector reductions. This supports the idea that decreases in public sector employment are not simply the reverse of increases. However, rather than the effects being inherently asymmetrical, which have been suggested in the literature, I argue that the impact may evolve over time as conditions change.

1 Introduction

1.1 Determinants of the labor market effects of public employment

The study of the public sector in labor economics has generated a substantial body of literature. Given that the public sector makes up around 20 percent of the labor market in most Western countries, this is not surprising. However, open questions remain regarding the dynamics between the public and private sectors within the labor market.

Depending on the assumed labor market conditions, theoretical models have estimated the effects of public sector employment on total employment to be negative, positive, or neutral.

The level of public wages is an important factor influencing the labor market effects of public employment (e.g. (Burdett, 2012), (Caponi, 2017))), with higher public wages increasing the crowding-out effect. Other factors influencing the effect include the mobility of workers between sectors (Cribb and Sibieta, 2015), the substitutability between public and private production (Algan et al., 2002).

Furthermore, migration affects the local effects from a change in public sector employment. The dynamics between migration and public sector employment has been theoretically studied ((Caponi, 2017)). Empiric results in (Roupakias, 2024) and (Jofre-Monseny et al., 2020) have shown that public sector employment can have a significant effect on interregional migration.

This paper contributes to the study of how local labor markets are affected by changes in public sector labor demand. Using OLS regression, I estimate the effect that local public sector employment changes have on local labor markets. I also construct an IV model, where public sector employment growth is instrumented using national public sector growth and the regional share of public sector employment. This instrumental approach addresses the potential endogeneity issue in the OLS estimates. The paper addresses the need for further research on the relationship between public sector employment and regional development noted in (Hansen and Eriksson, 2023).

The primary outcome examined is the effect of public sector employment on private sector employment growth. Additionally, I analyse the channels through which changes in total employment are realised, e.g. migration and reduced local unemployment.

As migration appears to be the primary adjustment channel for local employment, while the effect on local unemployment is modest. While it is beyond the scope of this paper to determine to what extent this effect represents a 'pure' regional transfer of job growth versus a reduction in national unemployment by encouraging unemployed individuals to migrate to new opportunities, this is a promising area for future research.

Since labor market conditions vary both geographically and in time, empirical findings are bound to differ between studies. Relevant differences between Finland and other countries are used to discuss the results. Also, changing labour conditions in Finland during the 20 year time period analysed, are used as a potential explanation for changing estimates over time. (Nguyen and Soh, 2017) finds that employment multipliers are affected by the business cycle. My results indicate that the business cycle and structural conditions, such as the growth of private welfare provision or increased labor mismatch, could indeed significantly alter the effects of public sector employment expansion or contraction.

1.2 The Regional Perspective

Besides depending on labor market conditions, the effect of public sector changes also depend on the geographical level at which the analysis is conducted. Depending on whether one is looking at the national or regional effect, the dynamics and conclusions can differ significantly.

Besides increasing the level of publicly provided services, nationally the case for increased public sector employment has often been that of it being a counter-cyclical fiscal policy tool to increase aggregate demand, in the spirit of Keynesianism. Regionally however it has often been argued that increased public employment regionally can be used as a tool for regional redistribution, in the spirit of what has been called Spatial Keynesianism (Hansen and Eriksson, 2023). My results offer insights into both perspectives. The results indicate that the effect is more positive in times of high unemployment, which is in line with Keynesian prediction, but also that the usefulness as a tool of regional redistribution depends on the prevailing labor market conditions locally and nationally, as well as the geographical position of the region.

A central consideration when analysing the regional effect of public sector employment is whether the financing of the public employment is done through increases in taxation in the same area. As pointed out by (Senftleben-König, 2014) this would mean that there is both an increase in public demand by the higher public spending, as well as a decreased private demand because of the increased taxation. If the financing is not done by taxing the same region as the employment increase, the case for crowding out is weaker, and the predicted outcome more positive. (Faggio and Overman, 2014) assumes in their model that the public good is funded by national taxation, arguing that a 100 percent increase in local public employment would only mean a six percent tax increase locally, as local taxes make up 25 percent of local area revenue, half of local spending is on employment and half of public employment is local government. In Finland, the corresponding figures are not as dramatic (60 percent, 44 percent, and 80 percent), but still the same calculation yields that a doubling of local public employment corresponds to only a 20 percent increase in local taxes. This means that in Finland, as well as in the UK, a large portion of the negative impact from increased taxation is spread out nationally rather than concentrated in the region.

Migration is a much stronger factor regionally than nationally. In most countries, there is substantial mobility within the country, meaning that a demand increase in one region leads to immigration from other regions. Interregional labour migration is therefore a key channel of adjustment to macroeconomic shocks (e.g. (Brandsma et al., 2014) (Cavalleri et al., 2021)). However, countries experience significantly less migration *between* each other compared to *within* their own borders. This implies that added job vacancies in the public sector will primarily be filled by individuals currently living in the country, being employed in the private sector or, preferably, not currently employed. In Finland, the vast majority of immigrants to a region comes from other regions rather than from outside Finland (annually approximately 50,000 from other countries, 300,000 between municipalities).

My study finds similar results to (Jofre-Monseny et al., 2020) and (Roupakias, 2024), namely that the positive employment effect from increases in public employment primarily stems from regional migration, not from decreased (local) unemployment or inactivity. Therefore, positive effects from public sector growth at a local level do not contradict a potential negative result at the national level.

The regional focus of this study means that the results can be used to explain developments in employment, unemployment, and migration in different regions. Furthermore, they can inform evaluations of regional development strategies involving public sector employment, an area where (Hansen and Eriksson, 2023) raises concerns about the need for more knowledge. However, these findings are not relevant when discussing increases in (financed) public employment at the national level. The theorethical assumptions and predictions are described in detail in chapter 4.1.

2 Literature

2.1 Labour Market Multipliers

(Moretti, 2010) estimates the effect on local labor markets resulting from an exogenous shock to the tradable sector. He uses a shift-share instrument introduced in (Bartik, 1991). The instrument is constructed by multiplying the national changes in employment per industry with the local industry structure to explain the increase in local employment. He estimates the effect on the tradable and non-tradable sector employment from an exogenous increase of one job in the tradable sector. He also introduces a "conceptual framework" where each city is a competitive economy that uses labor to produce traded (priced nationally) and non-traded goods (priced locally). Labour is mobile across sectors and geographically. A permanent increase in labour demand in the tradable sector results in increased demand in other sectors as well as general equilibrium effects on local prices. Demand in the non-tradable sector increases as total income in the city rises, resulting in more demand for restaurants, construction, etc. These new jobs in the non-tradable sector are divided between existing and new residents. The effect on the tradable sector is less clear, as higher local wages decreases their competitiveness, but intermediate demand and agglomeration affect the tradable sector positively.

Since its introduction more than 30 years ago, the Bartik instrument has been widely used and is labeled as "relatively standard"(Lee and Clarke, 2019). However, (Osman and Kemeny, 2022) and others point to the risks of incautious application and the need to address potential weaknesses of the instrument. These considerations are discussed in Chapter 7.

2.2 The Public Sector and the Local Labor Market Methodology

The empirical approach of this study follows the methodology introduced in (Faggio and Overman, 2014). (Faggio and Overman, 2014) alters the method in (Moretti, 2010) by applying it to the public and private sectors instead of the tradable and non-tradable sectors, estimating how many private sector (net) jobs are created when one public sector job is added to the local economy. They also examine differences between the effect on tradable and non-tradable private sectors, as well as examine the effect on other labor market outcomes, such as unemployment. The methodology is described in more detail in Chapter 4.1. They apply their model to English data. They do not find any statistically significant effect on private sector employment from an increase in public sector employment during either time period. Their (non-significant) estimates however align with their theoretical expectations: as in the short run, the effect on the private sector as a whole is zero, but is negative for the tradable sector and positive for the non-tradable. The total effect turns negative in the longer time period.

Since the publication of (Faggio and Overman, 2014), others have used similar methods on other data. The model has been applied to Germany (Senftleben-König, 2014), Italy (Auricchio et al., 2020), and Greece (Roupakias, 2024). (Jofre-Monseny et al., 2020) investigates the effect of public sector employment growth in Spain, using a different instrumental variable. (Roupakias, 2024) and (Jofre-Monseny et al., 2020) examines periods of substantial public sector growth, and find clear positive effects on private sector growth. (Senftleben-König, 2014) and (Auricchio et al., 2020) on the other hand, study periods of public sector decreases and find positive effects from public sector decreases (i.e. the opposite result of the studies mentioned earlier). These differences have led (Auricchio et al., 2020) to suggest that the effect might be asymmetric, and that 'the consequences of public sector employment downsizing are not simply the opposite of those of an increase'. This study contributes to the literature as, to my knowledge, it is the first 'Faggio'-style study to include both periods of public employment increases and periods of public sector decreases within the same dataset.[1]

As the labor market effect of changes in public sector employment may vary geographically and over time (Hansen and Eriksson, 2023), there is a need for empirical testing of (Faggio and Overman, 2014) in different economic contexts (as pointed out by (Jenkins, 2020)). Studies that have conducted similar estimations indeed use differing economic conditions as motivation for their studies. Adding Finland to the list of countries analysed can be motivated by differing conditions in Finland compared to those in earlier studies. These differences are discussed in the following chapter.

[1](Roupakias, 2024) includes a period of decrease in addition to his main analysis on increasing public sector, but this suffers from data limitations that makes the time period with decreasing public sector having weaker data than the period with increases.

2.3 Differences Between Countries

Although similar in many ways, Western European countries differ, and can be divided into different groups of countries with similar labor market conditions and public sector organization (see e.g.(Esping-Andersen, 1990) (Esping-Andersen, 1999)). Although 'Faggio'-style analysis have been conducted on Mediterranean countries, Continental European countries, as well as the UK, no Nordic countries have so far been analysed. Adding a Nordic country, with their distinctive features such as highly centralised wages and large public sectors, further motivates my analysis of Finland.

The table below compares the different European countries that have been analysed in the literature. First, the public sector wage gap varies across countries. All else being equal, one would expect a larger crowding-out effect in the UK and the Mediterranean countries due to the positive wage gap, with a smaller effect in Finland and Germany, where it is neutral or negative. Finland, in fact, has among the most neutral wage relationships between private and public sectors in the EU (Christofides and Michael, 2013) (Campos et al., 2017). Theoretical search and match-models show that higher public sector wages increases the crowding out effect, as worker bargaining power rises, leading to higher private sector wages and lower private sector employment ((Burdett, 2012), (Caponi, 2017)).

The structure of wage-setting is also key, as it affects the local impact of increased public sector labor demand. Wage-setting is more centralised in Finland than in many European countries (Poghosyan, 2018). This suggests a smaller effect on local wages from increased public sector labour demand, and thus less crowding-out. Estimates in Chapter 5.4 confirm that local wage effects from public sector demand increases are clearly smaller than those estimated for Germany (Senftleben-König, 2014).

Finland's large public sector could also impact how public sector employment influences the private sector, as studies suggests that a larger public sector may result in a more positive effect from public employment reduction (less positive effect from public employment increases) than an economy with a smaller public sector. It can also mean that an added public job in an economy more dependent on private services have a larger effect on the private sector, as demand for e.g. private daycare increases.

Finally, geographical mobility affects the impact of public sector employment increases. (Senftleben-König, 2014) notes that higher mobility creates a more elastic labor demand, decreasing upward wage pressure and thus crowding-out. However, comparisons of geographical mobility between countries are limited, due to difficulties in collecting comparable data across nations (Stillwell et al., 2016). (Stillwell et al., 2016) however offers a comparison between a selection of countries and notes considerable differences between several of the countries compared in table 1 below. Italy for example has the lowest 'Distance friction', meaning the probability of people moving between two regions are less affected by the distance between them compared to a high-friction country such as Finland. This means that all else being equal, Italy should have a more responsive national labour market between regions. This further motivates my study, both because of Finland as an interesting country to study because of high friction, but also because i will explicitly test for the effect of geographical mobility. This will be done using an indicator for how well a region is connected to other labour markets (see Chapter 6.1).

Table 1: Comparison between countries

	Finland	UK	Germany	Spain, Italy, Greece
Public sector wage gap*	Neutral	Positive	Negative	Positive
Wage centralisation****	High	Low	Medium	Medium/Low***
Internal migration friction**	High	Medium	Medium/High	Low (Italy)
Pub. share of employment (2016)	24	16	11	14-16

*wage gap Based on (Christofides and Michael, 2013)
**Based on comparison between a selection of Western countries in (Stillwell et al., 2016)
***Medium in Italy and Spain, low in Greece
****Based on (Poghosyan, 2018)

3 Data

3.1 Spatial Level of Analysis

There are theoretical reasons for choosing Functional Labour Markets (FLMs) as the unit of analysis, as this minimises the economic leakage from the multiplier effect (Lee and Clarke, 2019). However, the small number of FLMs in Finland, and the resulting difficulty of extracting statistical strength from the FLM-data means this paper focus on the results from municipality based analysis. This is in line with (Auricchio et al., 2020) and (Roupakias, 2024). These studies use various methods to handle the potential problems basing the data on municipalities rather than FLMs, and my study have adopted several of them (see Chapter 7). Most of these methods involve classifying the municipalities into FLMs. When this has been done, I have used a classification produced by Nordregio, which classifies every municipalities into one and only one FLM, based on commuting patterns (Jokinen et al., 2020).

Some studies of local economic multipliers focus on metropolitan areas, which can limit the generalisability of results to the broader national context, as these areas may differ systematically from the rest of the country (Osman and Kemeny, 2022). I include all Finnish municipalities, which aligns with best practices by ensuring that the data set represents both metropolitan and non-metropolitan areas, thereby enhancing the representativeness for Finland as a whole. Due to reasons discussed in Chapter 3.3 the largest and smallest municipalities are however dropped in the main analysis.

3.2 Data overviw

The data for this study was downloaded from Statistics Finland. The 309 municipalities were aggregated into 83 FLMs, with the data spanning from 1995 to 2017. Data is available for 1987-2021, but three periods marked by significant economic downturns—namely, the early 1990s financial crisis, the 2008 recession, and the 2020-2021 pandemic—were excluded. Although economic downturns are not inherently problematic for the estimations, correlations between industry structure, public sector employment, and sectors heavily impacted by these crises introduce uncertainty in interpreting results. Additionally, this study focuses on understanding effects during typical economic periods, not extreme events. Finally, in order to make all studied time periods equally long, 2018 and 2019 was dropped.

This analysis examines differences between two points in time rather than a continuous time series, following recommendations by (Lee and Clarke, 2019) and (Détang-Dessendre et al., 2016) to use time spans instead of yearly time series analysis with fixed effects. This approach captures effects that may not manifest immediately, which a yearly analysis might miss. However, following (Moretti and Thulin, 2013), each point in time is actually an average of three consecutive years to avoid abnormalities in single years—especially for smaller regions—that could distort results.

The data is divided into three intervals: two periods of public sector expansion (1996-2001 and 2001-2006) and one of contraction (2011-2016). To my knowledge, this is the first study of its type to include both periods of public employment increase and decrease within the same dataset. Although (Roupakias, 2024) does include a period of decrease alongside an analysis focused on public sector growth, data limitations result in weaker information quality for the contraction period.

3.3 Data descriptives

Figure 1 illustrates public and private employment trends over 1989-2019, highlighting the three specific periods analysed in this study: 1996-2001 (blue), 2001-2006 (green), and 2011-2016 (orange). The blue period is marked by weak public sector growth and rapid private sector expansion during the economic boom of the late 1990s. The green period shows still weak public sector growth, but more modest private sector gains compared to the first period, reflecting the “hangover” after the burst of the IT bubble. The orange period, impacted by the Euro crises, reflects fiscal tightening through reduced public employment and declining private sector job numbers.[2]

As my instrument is identified with the help of the national growth in the public sector, the flatness of public sector growth is problematic, as it limits the variation of the instrument. To circumvent this problem an alternative instrument is also used, where the public sector is split into different parts, local and state employment. (other studies e.g. (Auricchio et al., 2020) have tried splitting up the public sector in e.g. health, admin etc) Figure 2 shows the development for the state and local public employment separate. As can be seen the development of the state and local public employment differs,

[2]The seven largest municipalities 2011 is excluded in figure 1. This roughly corresponds with the censored data used in the analysis, although the exact composition differs for the different datasets as the calculation of the 98th percentile is done separately for each dataset. This also censor the highest and lowest values for the main variables of $contr_{pub}$ and $contr_{priv}$. The national numbers in the graph however, is mainly affected by the exclusion of the largest regions.

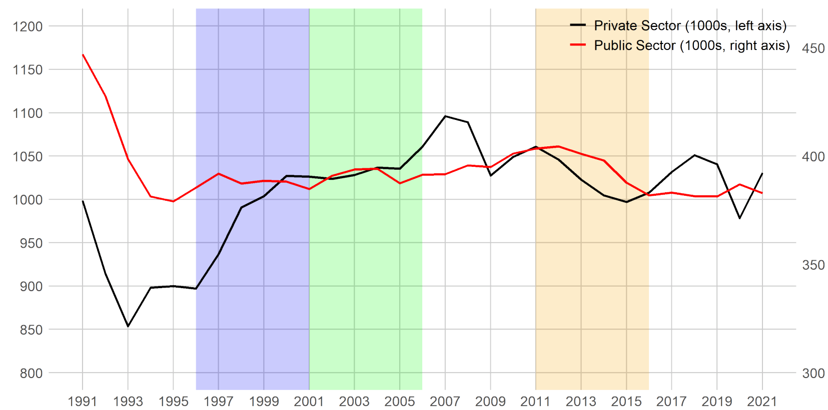

Figure 1: Number of people employmed in the Public and Private sector employment 1991-2021 (censored data), the three examined time-periods colored

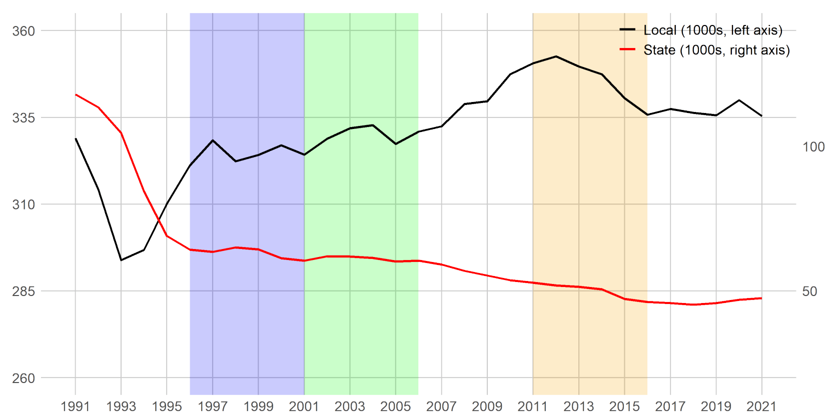

Figure 2: Number of people employmed in the state and local public sector employment 1991-2021 (censored data), the three examined time-periods colored

with the state employment seeing a gradual decline during all three periods, and the local seeing a clearly positive growth in the blue sector, a small growth in the green sector and a clear decline in the orange sector. As we will see in the results, this instrument is valid and reduces the first stage estimates so that they are in line with other studies. The first stage results are discussed in chapter 7. Note that the 'state' and 'local' does not describe the geographical placement of the employee, but rather if she is employed by the municipality or the central government.

Table 2 presents descriptive statistics, using municipalities as the spatial unit. The first three columns represent uncensored data, while the last three columns reflect data censored at the 2nd and the 98th percentiles for population size[3], and growth of the private and public sector[4]).

The censored dataset includes 50 fewer observations than the uncensored one, with significant changes in employment extremes. For instance, the minimum value of total employment increases

[3]The municipalities of Åland have been excluded, as the autonomous region of Åland decides on public spending independently from the Finnish Parliament.

[4]specifically, the "contribution of private/public sector", which is defined as the employment growth of the sector relative to the total employment in the region. More in Chapter 4.1

Table 2: Descritive Statistics, 1996-2001, uncensored and censored dataset

	Uncensored (N=309)			Censored (N=259)		
Statistic	Mean	Min	Max	Mean	Min	Max
Total employment, initial year	6,394	35.333	308,958	4,799	388	44,351
(totemp_y1)	(20,619)			(6,967)		
Private employment, initial year	4,433	26.667	217,902	3,297	205	31,666
(privemp_y1)	(14,496)			(4,661)		
Share of private employment	69.218	46.221	85.053	69.225	46.221	85.053
(privemp_ratio)	(7.792)			(7.548)		
Public employment, initial year	1,961.140	8.667	91,056	1,501	77	17,098
(pubemp_y1)	(6,190)			(2,400)		
Share of public employment	30.782	14.947	53.779	30.775	14.947	53.779
(pubemp_ratio)	(7.792)			(7.548)		
Total employment growth	5.261	−16.216	36.687	5.000	−11.556	28.239
(totempgrowth)	(8.929)			(7.047)		
Private employment growth	8.023	−25.430	59.531	8.322	−9.132	39.219
(privempgrowth)	(11.130)			(8.873)		
Private growth contribution	5.497	−19.474	34.098	5.701	−7.088	23.176
(contr_priv)	(7.561)			(5.994)		
Public employment growth	0.312	−29.960	69.868	−1.587	−29.960	22.267
(pubempgrowth)	(12.181)			(7.867)		
Public growth contribution	−0.236	−10.851	20.144	−0.701	−8.188	5.542
(contr_pub)	(3.689)			(2.446)		
Instrument 1	1.352	0.656	2.373	0.209	0.101	0.390
(IV1)	(0.347)			(0.056)		
Instrument 4	1.450	0.433	2.304	0.290	−1.352	0.716
(IV4)	(0.316)			(0.263)		
Population, initial year	10,443	62.000	361,567	8,554.620	824.667	71,946
(pop_y1)	(26,453)			(11,332)		
Population growth	−2.797	−16.701	17.467	−3.457	−15.117	11.049
(popgrowth)	(6.057)			(5.295)		
Population growth contribution	−5.347	−40.536	45.604	−6.656	−35.107	36.518
(contr_pop)	(12.950)			(11.234)		
Share with high education	24.113	9.737	46.780	24.426	14.268	45.002
(high_edu_shr)	(5.575)			(4.924)		
Share with low education	44.148	30.637	53.016	44.557	34.505	53.016
(low_edu_shr)	(3.652)			(3.218)		
Share with óther´education	31.739	19.363	53.421	31.018	19.813	46.306
(other_edu_shr)	(5.904)			(5.029)		
Unemployment rate, initial year	19.160	1.875	36.995	20.047	7.837	36.995
(unemp_rate_y1)	(6.311)			(5.620)		
Share of people over 65 years	28.711	8.299	59.677	28.419	10.256	51.811
(dependent_pop)	(8.217)			(7.486)		
Shr. of employed by municipality	26.344	11.741	42.625	26.394	11.741	40.722
(munemp_ratio)	(5.471)			(5.151)		
Shr. of employed by state	4.438	0.000	31.725	4.381	0.110	31.725
(stateemp_ratio)	(4.902)			(4.755)		
Growth of wage sum	10.526	−3.917	42.346	10.112	−3.917	42.346
(wagediff)	(5.220)			(4.865)		

from 35 to 321, while the maximum decreases from 309,000 to 44,000, with a more than two-thirds reduction in the standard deviation of total employment. Unemployment rates also show notable variation, with a mean of 19.9 percent and a standard deviation of 5.5 percent in the censored data. Other control variables presented in the table, which will be applied in the models, include the shares of highly/lowly educated individuals and the proportion of elderly residents (dependent_pop).

Table 3 presents descriptive statistics for the periods 2001–2006 and 2011–2016, similar to Table 2. In this table, variables such as employment figures and population metrics that exhibit minimal change between the time periods have been excluded for brevity[5].

Key differences between the two time periods are notable: the later period (2011–2016) exhibits a significantly more negative trend in employment growth compared to the earlier period (2001–2006). Interestingly, this decline occurs alongside a lower (initial year) unemployment rate. This combination of low growth and low unemployment will be further explored in Chapter 6.

Table 3: Descritive Statistics, 2001-2006 and 2011-2016, censored dataets.

	2001-2006 (N=261)			2011-2016 (N=260)		
Statistic	Mean	Min	Max	Mean	Min	Max
totempgrowth	−0.5	−17.7	15.7	−7.0	−25.2	13.0
	(6.2)			(6.1)		
privempgrowth	0.4	−21.0	17.9	−7.1	−23.1	15.9
	(7.2)			(7.5)		
contr_priv	0.4	−15.0	14.5	−5.1	−17.4	11.1
	(5.1)			(5.4)		
pubempgrowth	−2.5	−22.5	16.6	−6.3	−48.9	18.8
	(7.3)			(10.9)		
contr_pub	−0.8	−6.7	4.3	−1.9	−12.0	3.4
	(2.1)			(3.1)		
popgrowth	−1.6	−11.8	15.4	−3.0	−11.5	8.3
	(5.3)			(4.2)		
contr_pop	−5.0	−43.0	75.5	−9.4	−43.0	31.1
	(17.7)			(13.8)		
unemp_rate_y1	14.1	4.8	32.2	10.9	3.7	22.7
	(5.2)			(3.5)		

[5] All variables for both uncensored and censored data are available in Appendix A1.

4 Estimation

4.1 The model

The main model being estimated in this paper is the same as in (Faggio and Overman, 2014). Next follows a brief description of the model, which is basically a shorter version of the description in (Faggio and Overman, 2014):

Total employment in a region at time t, E_t, is the sum of private employment R_t and public sector employment B_t. The proportional change in total employment between time s and time t can be written:

$$\frac{E_t - E_s}{E_s} = \frac{R_t - R_s}{E_s} + \frac{B_t - B_s}{E_s}, \tag{1}$$

which decomposes total employment growth into the sum of the contributions from private and public sector employment growth. From this equation, and using the method from (Card, 2009), private sector contribution is explained by public sector contribution in the following model:

$$\frac{R_t - R_s}{E_s} = \alpha + \beta(\frac{B_t - B_s}{E_s}) + \gamma X + \epsilon. \tag{2}$$

The term "contribution of" will henceforth be used as the name of a variable divided by the total employment during the same period, again following (Faggio and Overman, 2014).

The interpretation of this model is that β is the multiplier effect on the private sector from one added public sector job. In other words, if $\beta = 0$ each added public sector job has no effect, and if $\beta = -1$ each public sector job added fully crowds out one private sector job (and result in no effect on total employment growth).

There is potential upward bias in β if successful private growth in a region leads to a higher increase of public sector. There is potential negative bias in β if government tries to offset negative shocks to local private sectors by reallocating jobs there. The potential bias of the β leads (Faggio and Overman, 2014) to introduce an instrument based on (Bartik, 1991) (Moretti, 2010).[6] The instrument uses initial shares of public sector employment and the national growth in public sector employment to predict region changes in public sector employment. The instrument is calculated as:

$$\frac{B_s}{E_s} \times \frac{B_{\mathrm{t}}^{\mathrm{FIN}} - B_{\mathrm{s}}^{\mathrm{FIN}}}{B_{\mathrm{s}}^{\mathrm{FIN}}}. \tag{3}$$

As mentioned earlier, I also construct an instrument where the public sector is split into state and

[6] Following (van Dijk, 2015)s critique of (Moretti, 2010),that the inclusion of the own region makes the instrument endogenous, I will exclude each region when calculating the instrument value for that specific region. This was also done in (Faggio and Overman, 2014).

local public sector. This instrument is calculated by:

$$\frac{C_s}{E_s} \times \frac{C_{\text{t}}^{\text{FIN}} - C_{\text{s}}^{\text{FIN}}}{C_{\text{s}}^{\text{FIN}}} + \frac{D_s}{E_s} \times \frac{D_{\text{t}}^{\text{FIN}} - D_{\text{s}}^{\text{FIN}}}{D_{\text{s}}^{\text{FIN}}}, \tag{4}$$

where C is state level public sector employment and D is local level public sector employment and FIN stands for the employment rate on the country level.

4.2 Specifications

Various configurations have been tested to assess the robustness of the results. The data varies with respect to the following characteristics: 1. spatial unit of analysis (municipality or FLM), 2. data type (uncensored data and data censored at the 2nd and 98th percentiles concerning population, public sector contribution, and private sector contribution), and 3. time periods analysed.

Censoring the largest regions aligns with the approach taken by (Moretti and Thulin, 2013), which is motivated by the assumptions underlying the instrumental variable. This assumes that no single region should significantly impact nationwide changes in employment. This is relevant in Finland, where a handful of municipalities account for a substantial portion of total employment. Besides addressing the risk of the largest regions impacting the instrument too much, this also decrease the impact of the smallest regions, which, when using an unweighted dataset, might disproportionately affect the results. The censoring on the $contr_{pub}$ and $contr_{priv}$ reduces the risk of results being driven by the most extreme observations.

(van Dijk, 2018) points out that in (Moretti, 2010), the weighting of observations based on total employment leads to results that are disproportionately influenced by the largest Metropolitan Statistical Areas (MSAs) and reflect the average multiplier for residents of a US MSA rather than the average multiplier for US MSAs. In this study, I will estimate both weighted and unweighted models, as there is a risk of biasing the results toward the largest regions while also relying too heavily on very small regions, which may not be representative.

My preferred specification is the unweighted and censored version. Censoring alleviates the concern of the largest units overly influencing the instrument. While the downside of the unweighted model is its reliance on smaller regions, this limitation is somewhat mitigated by the censoring.

The use of FLM-based data is theoretically preferred, but the practical need for statistical power means that most of the results presented will primarily rely on municipality-level data.

As robustness tests, there is a comparison between the results of all possible datasets, which is discussed in Chapter 7.1.

5 Results

We now turn to the results from various regression models. First, the main results on how changes in public sector employment affect private sector employment are presented in Chapter 5.1. Previous studies have estimated these effects as positive, neutral, or negative, with varying outcomes. My results show varying effects for Finland, depending on what time period that is examined.

Secondly, the effects on unemployment, labour force size, and commuting are presented in Chapter 5.2. These results shed light on the channels through which public sector employment affects the local economy: does it reduce local unemployment by creating jobs for unemployed individuals? Does it attract new residents or help retain the current population, thereby affecting the labour force size?

Thirdly, in Chapter 5.3, the effects on tradable and non-tradable industries are discussed. While theory and earlier studies show differing impacts of public sector employment on these two types of industries, this effect may not hold in an economy with highly centralized wage setting as Finland.

Finally, the impact on wages is explored in Chapter 5.4. All results presented in these chapters are then discussed in detail in Chapter 6.

5.1 The effect of public sector employment on private sector employment

This section presents summary tables for each of the three time periods, displaying estimates for OLS, IV with an instrument based on total public sector employment (IV1), and IV with an instrument based on a split of public sector employment into central and local (IV4). For each approach (OLS, IV1, IV4), results are shown in two specifications: one basic specification without controls (columns 1, 3, and 5), and another that includes various labour market controls (e.g., labor market size, unemployment level, proportion of highly educated workforce) and municipality characteristics likely to affect growth (e.g., population density, ratio of elderly people) in columns 2, 4, and 6. Chapter 7 includes further controls as robustness checks, with additional details available in Appendix A1.

Results indicate that increases in public sector employment during the first two periods (see Tables 4 and 5) lead to neutral or positive effects on private sector employment. In the OLS models, the estimates are around 0.3, while Wu-Hausman statistics in the IV models are not statistically significant, which indicate we should focus at the OLS results. This implies that for every 10 public sector jobs added in a region, approximately 3 private sector jobs are created. The first instrument (IV1) does not suggest any bias in the OLS estimates. Although unstable, the point estimates of the IV4 indicate that if anything, the OLS is negatively biased in the two earlier periods. This would correspond with a situation where the impact of the government trying to offset negative regional private sector developments by increasing (decreasing) the public employment more (less) in those regions.

Results from the final period (see Table 6) differ markedly from the earlier periods, with the OLS estimates showing a slight negative effect, rather than a positive one. The most striking shift in this period is that both IV1 and IV4 estimates are clearly negative, averaging around -2. Both instruments are valid, and the Wu-Hausman statistic indicate we should look at the IV results rather than the OLS, as the OLS seem to have a positive bias due to endogeneity. This positive bias may reflect simultaneous growth in both public and private sectors due to an increased demand for public services, such as daycare, driven by more working parents or more positive regional migration rates. Additionally, central government centralization policies could contribute to this positive bias if reductions in central government employment disproportionately affect regions with slower growth. Estimates are unstable, but the null hypothesis of no effect is clearly rejected (point estimate in the full-spec IV-models shows that 10 less public job leads to 22 more private sector jobs, with a standard deviation of around 11).

Table 4: Impact of public sector on private sector employment, unweighted, Municipaliy level, censored, 1996-2001

	Dependent variable:					
	contr_priv					
	OLS		*IV1*		*IV4*	
	(1)	(2)	(3)	(4)	(5)	(6)
contr_pub	0.648***	0.246*	0.291	0.062	−0.537	1.098
	(0.147)	(0.134)	(0.267)	(0.304)	(0.839)	(0.706)
log(totemp_y1)		0.312		0.393		−0.063
		(0.422)		(0.440)		(0.547)
high_edu_shr		0.006		−0.002		0.041
		(0.102)		(0.103)		(0.113)
unemp_rate_y1		−0.155***		−0.189**		0.004
		(0.058)		(0.077)		(0.143)
pop_density_y1		0.007*		0.007*		0.004
		(0.004)		(0.004)		(0.005)
dependent_pop		−0.420***		−0.422***		−0.411***
		(0.048)		(0.049)		(0.053)
Constant	6.154***	18.156***	5.905***	18.301***	5.325***	17.486***
	(0.374)	(3.658)	(0.409)	(3.678)	(0.713)	(3.977)
Weak instruments			0	0	0.00242	0.00472
Wu-Hausman			0.11887	0.54674	0.06227	0.18868
Observations	259	259	259	259	259	259
R^2	0.070	0.432	0.049	0.427	−0.164	0.341
Adjusted R^2	0.066	0.418	0.045	0.414	−0.168	0.325
Note:						*p<0.1; **p<0.05; ***p<0.01

Table 5: Impact of public sector on private sector employment, unweighted, Municipaliy level, censored, 2001-2006

	Dependent variable:					
	contr_priv					
	OLS		*IV1*		*IV4*	
	(1)	(2)	(3)	(4)	(5)	(6)
contr_pub	0.820***	0.356**	0.908***	0.312	1.992***	1.465
	(0.141)	(0.166)	(0.318)	(0.607)	(0.576)	(1.249)
log(totemp_y1)		0.601		0.615		0.248
		(0.440)		(0.477)		(0.618)
high_edu_shr		−0.030		−0.029		−0.066
		(0.101)		(0.103)		(0.117)
unemp_rate_y1		−0.080		−0.088		0.131
		(0.065)		(0.129)		(0.245)
pop_density_y1		0.005		0.005		0.008
		(0.005)		(0.005)		(0.006)
dependent_pop		−0.173***		−0.175***		−0.129*
		(0.045)		(0.051)		(0.069)
Constant	1.045***	3.103	1.118***	3.096	2.014***	3.290
	(0.321)	(3.436)	(0.399)	(3.437)	(0.584)	(3.732)
Weak instruments			0	0	1e-05	0.01578
Wu-Hausman			0.76082	0.94344	0.0154	0.29733
Observations	261	261	261	261	261	261
R^2	0.116	0.239	0.114	0.239	−0.120	0.105
Adjusted R^2	0.112	0.221	0.111	0.221	−0.125	0.084
Note:				*p<0.1; **p<0.05; ***p<0.01		

Table 6: Impact of public sector on private sector employment, unweighted, Municipaliy level, censored, 2011-2016

	Dependent variable:					
	contr_priv					
	OLS		*IV1*		*IV4*	
	(1)	(2)	(3)	(4)	(5)	(6)
contr_pub	−0.115	−0.356***	−1.210**	−1.991**	−1.949**	−2.185**
	(0.107)	(0.098)	(0.555)	(0.824)	(0.917)	(1.091)
log(totemp_y1)		−0.600		−0.356		−0.327
		(0.426)		(0.630)		(0.677)
high_edu_shr		0.166*		0.131		0.127
		(0.091)		(0.134)		(0.143)
unemp_rate_y1		−0.121		−0.420**		−0.456*
		(0.094)		(0.202)		(0.245)
pop_density_y1		0.002		0.006		0.007
		(0.004)		(0.006)		(0.006)
dependent_pop		−0.261***		−0.327***		−0.334***
		(0.040)		(0.067)		(0.076)
Constant	−5.349***	5.443	−7.436***	7.155	−8.845***	7.358
	(0.392)	(3.318)	(1.129)	(4.889)	(1.814)	(5.246)
Weak instruments			0.00026	0.00803	0.00723	0.0367
Wu-Hausman			0.02267	0.00524	0.0049	0.02306
Observations	260	260	260	260	260	260
R^2	0.004	0.272	−0.396	−0.533	−1.119	−0.736
Adjusted R^2	0.001	0.254	−0.402	−0.570	−1.128	−0.777
Note:				*p<0.1; **p<0.05; ***p<0.01		

5.2 Effects on unemployment, labour force and commuting

As (Faggio and Overman, 2014) points outs, a total increase in employment (private+public) can be realised through four different channels; 1) people moving into the area, 2) previously inactive individuals joining the labor force, 3) a reduction in (local) unemployment, and 4) an increase in net commuting. Most of the 'Faggio-style' studies that aim to estimate the employment effects of public sector changes have examined these different channels to better understand how total employment adjustments occur.

Before looking at my results, we can remind ourselves that the total effect of the different channels should be equal to the estimated effect on private sector employment from an increase in public sector employment, plus one (the one added public job). The first row of table 7 shows the resulting numbers from the estimates of contr_pub+1 for the different time periods, i.e., the numbers that the effect on unemployment, labour force and net migration should (approximately) add up to.[7]

Table 7: Estimates for public sector contribution on Labour Force, Unemployment and Net Commuting, censored, unweighted

	(1996-2001)	(2001-2006)	(2011-2016)
Total Effect	1.2	1.4	-1.2
Labour Force	1.0***	1.0***	-0.7
Unemployment	-0.3***	-0.1	0.1
Net Commuting	-0.1	0.3	-0.4
Note:			*p<0.1; **p<0.05; ***p<0.01

Examining the data, there appears to be a moderate effect on unemployment in the first period (-0.3) and a small, statistically insignificant effect in the two subsequent periods. This could be due to the higher unemployment rate in the earliest period (see Tables 2 and 3), which provides more opportunities for unemployed individuals to fill new jobs. Earlier studies also generally report limited effects on local unemployment. Although my study focuses on local impacts, an increase in public employment could reduce unemployment outside the local area. This external effect is included in the estimated change in the local labor force. Given that the data do not allow for a analysis of inactivity, and the time periods are too brief for substantial demographic shifts, net migration and net commuting emerge as the primary channels through which labor market adjustments would operate.

The effect on the labor force is clearly positive in the first two periods, explaining 1.0 out of the total

[7] The preferable model specification based on the discussion in chapter 5.1 being used for each year (OLS for 1996-2001 and 2001-2006, IV4 for 2011-2016. Results for all different specifications, including robustness tests can be found in the appendix A5.

effects of 1.2 and 1.4, respectively. In contrast, the final period has a notably lower estimate (-0.7), which accounts for much of the total difference shown in the first row of Table 7. This indicates that much of the positive total effect from the decrease in public sector employment estimated for the last period operate through an increase in the labor force. The lower and non-significant effect on labour force in the last period is a natural results from the fact that the estimated impact on private sector employment differ in the last period. Whereas an increase in public sector employment in earlier periods prompted migration into the region, a public sector decrease in the last period led instead to local residents finding jobs in the local private sector rather than relocating, which would be the analogous response to the regional migration observed in the first two periods. This could relate to housing market dynamics, as suggested by (Auricchio et al., 2020), although this explanation seems less applicable in the Finnish context (see Chapter 6). Instead there appears to be a shift in the relationship between inter-sectoral substitutability and interregional elasticity. This could reflect either increased inter-sectoral substitutability—which is unlikely given the relatively short period analysed—or a decrease in interregional elasticity. Chapter 6 offers some evidence of the latter, where fewer people are willing to relocate for job opportunities due to lower unemployment rates, as well as reduced regional unemployment disparities.

Finally, Table 7 shows the effects on net commuting in the last row. Although statistically insignificant, the data suggest a neutral effect in the first period, a positive effect in the second, and a negative effect in the third.

In sum, migration appears to be the primary adjustment channel for local employment in response to changes in public employment. The findings suggest that increases in local public sector employment has been a succesful form of regional redistribution, while it has had limited impact on reducing local unemployment, mainly confined to the first period. While it is beyond this paper's scope to determine to what extent this effect represents a 'pure' regional transfer of job growth versus a reduction in national unemployment by encouraging unemployed individuals to migrate to new opportunities, this is a promising area for future research using micro data on the individuals moving between sectors and regions during this time period.

5.3 Impact on tradable and non-tradable sector

The framework used by (Faggio and Overman, 2014) predicts a positive effect on the non-tradable sector with each additional public job due to increased service demand, while projecting a negative impact on local tradable industries for the same wage-competitiveness reasons. However, Finland's centralized wage-setting likely mitigates these sectoral differences. I outline the methodology and main findings here before examining how the results align with theoretical expectations and previous studies.

Following the literature, I categorise private sector industries as tradable (manufacturing)[8], neither tradable nor non-tradable (agriculture, forestry, fishing, mining, energy and water supply, and waste management)[9], or non-tradable (all remaining private employment). The primary outcome variable, representing total private sector growth contribution, is modified in the main models to include only tradable or only non-tradable sectors, thus estimating the number of tradable or non-tradable sector jobs created per additional public sector job.

Table 8 displays the estimated impact of one additional public sector job on tradable and non-tradable sectors.[10][11] Results for both sectors are consistent and relatively precise across the first two periods. In contrast, for the later period, the estimated effect on the tradable sector is more negative (-1.5) than for the non-tradable sector (-0.5). This suggests that the tradable sector benefits most from reductions in public sector employment, with a decrease of one public job leading to the creation of 1.5 tradable sector jobs. However, the estimates for the last period should be interpreted cautiously, as they have large standard errors. There is in fact no statistically significant difference between the tradable and non-tradable sectors in any of the periods.

Table 8: Effect of public sector employment on tradable and non tradable industry employment, censored, unweighted

	(1996-2001)	(2001-2006)	(2011-2016)
Tradable	0.1	0.1	-1.5*
	(0.1)	(0.1)	(0.8)
Non Tradable	0.1	0.0	-0.5
	(0.1)	(0.1)	(0.5)
Note:			*p<0.1; **p<0.05; ***p<0.01

The fact that there is no clear difference between the two sectors differ from earlier studies. The exact estimates of earlier studies vary because of each author using multiple different model specifications, but in brief, (Auricchio et al., 2020) and (Roupakias, 2024) estimate a smaller gap between tradable and non-tradable (around 0.3) and (Faggio and Overman, 2014) and (Jofre-Monseny et al., 2020) estimate larger differences (around 0.8). (Senftleben-König, 2014) lies in between with an estimate around 0.6. So, what could explain the difference between my results and earlier studies?

Two main theoretical arguments explain why an increase in public sector employment might positively impact non-tradable sectors more than tradable ones. First, increased public employment could

[8] Industry C according to the 2008 Industry Classification System (Statistics Finland) for 2011–2016, and Industry D according to the 1995 Classification System for 1996–2001 and 2001–2006.

[9] Industries A, B, D, and E per the 2008 Classification System; Industries A, B, C, and E per the 1995 Classification System.

[10] The preferred model specification (OLS for 1996–2001 and 2001–2006, IV4 for 2011–2016) is based on the discussion in Chapter 5.1.

[11] More detailed results are provided in the appendix A6.

exert upward pressure on local wages, which can negatively impact the tradable sector as it competes in broader markets where firms are not subject to the same wage pressures. Second, increased employment raises local demand, benefiting the non-tradable sector.

Given Finland's highly centralized wage-setting, the first argument may be weaker in the Finnish context, and the effect of the second argument alone is perhaps not strong enough to lead to a significant differences in the data. The small wage effect observed in Chapter 5.4 supports this interpretation.

While results from the last period are less stable, they merit a brief discussion. The estimates for this period shows a more positive (negative) effect on the tradable sector from a public sector decrease (increase), compared to the non-tradable sector. This is in line with earlier studies, which argues that this difference could be a result of the tradable sector suffering from decreased competitiveness due to higher wage pressure in the case of public sector increase. However, the wage effect discussed in the previous paragraph applies equally across all periods. Another possible explanation, which is explored in Chapter 6, is that the positive private sector response to a public sector reduction may partly stem from the alleviation of labor shortages, potentially benefiting the tradable sector more. This does not seem plausible, however, as labor shortages were reported more frequently in the non-tradable sector, and the public sector arguably share a labor pool more with non-tradable than tradable industries. The conclusion is that the difference in point estimates between tradable and non-tradable sector in the last period can not be explained, and that this coupled with the lack of statistically significant difference provide sufficient reason not to pursue further investigation.

5.4 Effect on wage level

In addition to estimating the effect on private sector employment, I also examine the impact of changes in public sector employment on local wages. Theory predicts an upward wage pressure locally, that leads to a crowding out effect. Given Finland's centralized wage-setting system, a smaller effect is expected than in other countries. The only other similar study that attempts to measure this effect is (Senftleben-König, 2014). She estimates that a one percent increase in public sector employment raises local wages by 2.2 percent. For my estimation, I use a measure of local wages that, while not ideal, should provide a reasonable approximation of changes in local wage levels. Overall, the results suggest that the local wage effect in Finland is minimal, and clearly smaller than in Germany, a country with a more decentralised wage formation process. Details about the calculations can be found in appendix A2.

6 Possible mechanisms for the results

My results have both similarities and differences with earlier studies. Starting with the main question of how the private sector employment is affected by a change in public sector employment, the outcomes in periods of public sector expansion are similar to studies examining similar growth phases, such as (Faggio and Overman, 2014), (Roupakias, 2024), and (Jofre-Monseny et al., 2020). Conversely, the results from the later period, which experienced a reduction in public sector employment, show a resemblance to findings from studies focused on periods of public sector contraction, like (Auricchio et al., 2020) and (Senftleben-König, 2014). These results seemingly support the notion that a decrease of public sector is not necessarily the opposite of an increase, which has been suggested in the literature.

To explain a possible asymmetric response to increases and decreases in public sector (Auricchio et al., 2020) suggests that it can be related to the functioning of the housing market; An increase in public sector leads to a combination of regional migration and construction of dwellings with an ambiguous effect on private sector wages, while a decrease leads to lower housing prices and lowered private wages, and an ambiguous effect on migration. This would in turn lead to a quadratic reaction on private employment from public sector employment. (Auricchio et al., 2020) does find some evidence there could indeed be a quadratic effect. In the case of Finland, however, this explanation does not seem to explain the difference between the early positive estimates and the later negative estimates. First of all, in chapter 5.4 we saw that the wage effect seem to be marginal. Also, (Cavalleri et al., 2021) shows that differences in employment opportunities, rather than wages or housing prices, is the main driver of migration in Finland. This stands in contrast to the case of Italy, where they see differences in income and housing prices as the main drivers of migration. I have also ran tests including a quadratic reaction on my dataset, which resulted in uncertain estimates that did not provide any support of a quadratic reaction (although we can not dismiss such a reaction based on these unstable results either).

Another suggestion in explaining the differing results in different papers is that the status of the public sector being decreased or increased matter. (Auricchio et al., 2020) and (Roupakias, 2024) suggests that there could be a difference between adding jobs in a rudimentary public sector, as was the case in Greece and Spain during the periods examined in (Roupakias, 2024) and (Jofre-Monseny et al., 2020), compared to a situation with a mature public sector such as Italy and Germany in (Auricchio et al., 2020) and (Senftleben-König, 2014). This argument cannot explain the differences between the results in Finland 1996-2001 compared to the last period (2011-2016), as the size of the public sector only changed slightly, and could be described as mature during both periods.

So if no of these explanations for differing effects seem to match the data, then what does? One possibility is that the status of the labour market has changed during the 20 year period that is being analysed. Specifically, there seems to have been 1. a decreasing unemployment gap, 2. decrease in regional unemployment differences and 3. an increasing labour shortage.

This suggests that rather than the effects being inherently asymmetric—where a decrease is fundamentally different from an increase—the impact may evolve over time as conditions change. These can change cyclically, with more favorable outcomes during recessions, or conditions can deteriorate due to structural factors.

The local unemployment effect is modest, and I don't find any significant result for an interaction between (local) unemployment and public sector employment (chapter 5.2). The labour force effect however, indicate that the migration effect is a central channel for the employment effect to work through, which imply that *national* labour market conditions influence the *local* labour market effect.

As the data does not permit me to test the influence of national labour market conditions on the results directly, we now turn to a simple theoretical model of migration decision, coupled with descriptive statistics.

6.1 Decreasing unemployment gap and decreasing regional unemployment differences

The results presented in Chapter 5.2 indicate that labour mobility between regions plays a crucial role in explaining the local effects of an increased public sector employment. To illustrate this, I set up a simple model of migration decision, based on additive Random Utility Maximization Model (RUM-models are often used in migration literature). In this model, individuals evaluate two regions based on their wages and the probability of being employed. Given the well-documented preference for staying in one's current location, the potential destination must offer an expected utility that exceeds that of the current residence by a margin above a certain threshold.

To simplify further, we assume there are no wage differences, meaning the only factor influencing the probability of moving - aside from home bias and the random component - is the probability of being employed in each region. We further assume that there is no on-the-job search, so only unemployed individuals will consider relocating.

At this stage we can conclude that the more unemployed people there are, the more people are taking a migration decision, and therefore more people are potentially moving to take the new job offered by the public sector. Next, if we model utility as:

$$U_i = (d_{\text{home}})homebias + jobprob + \varepsilon_i \tag{5}$$

where homebias is the utility of being at home, which has some value x. d_{home} is a dummy variable, which has value 1 if i=current residence region and 0 otherwise. variable ϵ is a random component of utility. The probability of moving can then be written as:

$$P(y=1) = P(U_1 > U_0) = P(jobprob_1 + \varepsilon_1 > jobprob_0 + homebias + \varepsilon_0)$$

$$= P(\varepsilon_0 - \varepsilon_1 < jobprob_1 - jobprob_0 - homebias) \tag{6}$$

If one define $jobprob_1 - jobprob_0$ as *unemployment rate*$_0$-*unemployment rate*$_1$, or *unemployment difference*, then the probability of moving can be written as:

$$= P(\varepsilon_0 - \varepsilon_1 < unemployment\ difference - homebias)$$

$$Pr(y=1) = F(unemployment\ difference - homebias), \varepsilon_0 - \varepsilon_1 \sim F \tag{7}$$

Thus, a person moves if the unemployment difference between A and B is above x. Greater disparities in unemployment between regions will consequently lead to more individuals being on the verge of making a move. As the number of people near the decision to migrate increases, the likelihood of nudging them towards staying (if the public sector creates a new job in their home region) or moving (if a job is created in the potential destination region) also increases.

In summary, this theoretical model suggests that both decreased unemployment nationally as well as smaller regional disparities in unemployment would decrease the local labour force effect from an increase in public sector employment. Next, we compare the Finnish development in relation to this.

Firstly, when examining the unemployment gap, as defined by the efficient unemployment level (Gäddnäs and Keränen, 2023), figure 3 shows that this gap has widened over time. The efficient unemployment level has risen, reflecting an increased mismatch problem in the labour market. At the same time, actual unemployment has decreased, resulting in a notable reduction in the unemployment gap. The difference between the last time period compared to the two earlier ones is clearest when looking at the initial year of the period, while looking at the mean for the whole period makes the time periods closer to each other, especially the second and the last one (Table 9).

Next, we turn to regional differences in unemployment. Given that the only relevant municipal-level data available for the entire time period is unemployment rate, we start by examining an indicator from (Layard et al., 2005). This indicator, which requires only regional and national unemployment rates, serves the purpose of measuring regional differences.

$$\text{Regional Differences} = var(\frac{u_i}{u}) \tag{8}$$

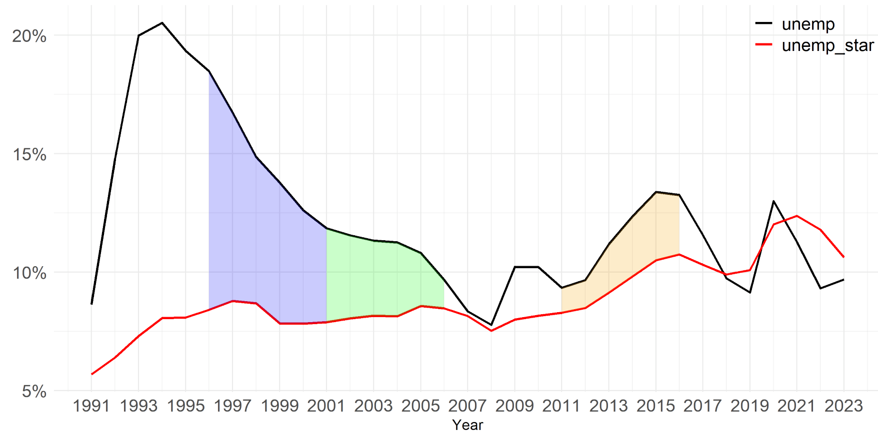

Figure 3: Real unemployment (unemp), efficient unemployment (unemp_star), and unemployment gap (colour fill) 1991-2023

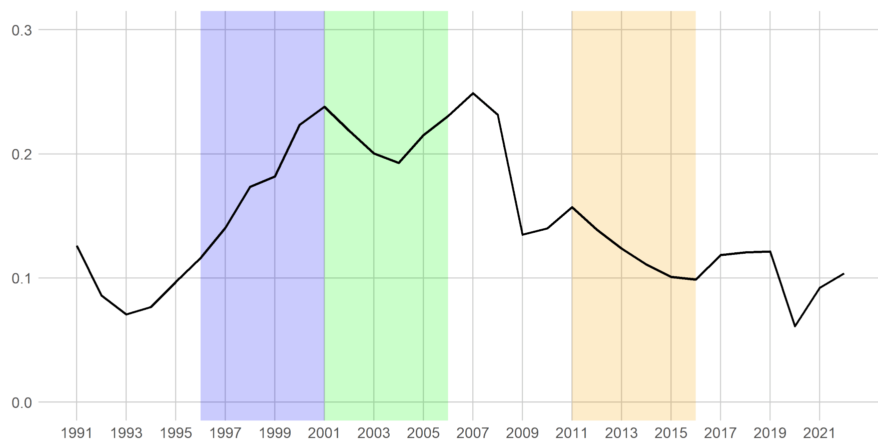

Figure 4: Regional mismatch (unemployment variance)

This analysis reveals that the Regional Differences indicator peaks during the middle period. The relationship between the first and the last period depends on if we are looking at the initial year or the average for the whole period. When looking at the whole period the regional differences are clearly lower in the last period, while looking at only the initial year, the regional differences are lowest in the first period (Table 9).

While not being clear cut, the descriptive statistics provide indicative evidence that the last period is the least favorable concerning the combination of regional unemployment differences and the national unemployment gap. The changing conditions could therefore potentially explain the change in effect between the time periods. The exact magnitude in which these factors are influencing the results is outside the scope of this paper to estimate, but it is a potential area for future research.

Another way to examine if interregional mobility affect the effect from changes in public employment is by looking at the geographical position of the regions. Gravity models of migration uses the geographical positions of regions to explain migration flows between regions, with the distance between

Table 9: Labour Market Indicators during the three time periods

	First year			*Whole period*		
	1996-2001	2001-2006	2011-2016	1996-2001	2001-2006	2011-2016
Reg. differences	0.12	0.24	0.16	0.18	0.22	0.12
Unemp. gap	10.1	4.0	1.1	6.5	2.9	2.0
Mean Unemp	19.8	13.7	10.2	15.9	12.3	12.4
Labour Shortage	7.1	11.1	19.0	9.4	12.8	13.1

pairs of regions coupled with the population sizes comprising the core 'gravity-variables' explaining migration flows. (see (Ramos, 2016) for an overview). In reference to the RUM-model described earlier in this chapter, the population size affects the number of people taking a migration decision, while distance affects the size of the home bias. Therefore, a person has a specific home bias (increasing as distance increases) depending on the potential destination she is considering moving to, so that a higher difference in unemployment is needed to make her move to a place far away. The standard gravity model is constructed as:

$$\text{MIG}_{ij} = \frac{\text{POP}_i^{\alpha} \cdot \text{POP}_j^{\beta}}{\text{DIST}_{ij}^{\gamma}} \tag{9}$$

where MIG_ij is migration flow from region i to region j, POP_i is total population of region i, $DIST_ij$ is distance between region i and region j, and finally n is the number of regions. To test if inter-regional elasticity affects the public sector employment effect, I calculate each region's predicted regional migration relative to it's population.[12] Assuming $\alpha = 1$ and $\beta = 1$, and $\gamma = 1.5$[13], the immigration to j, relative to POP_j becomes:

$$\text{Predicted relative immigration to region } j = \sum_{i=1}^{n} \frac{MIG_{ij}}{\text{POP}_j} = \sum_{i=1}^{n} \frac{\text{POP}_i}{\text{DIST}_{ij}^{1.5}} \tag{10}$$

I include the predicted relative immigration as an interaction variable with the public sector contribution in the models of Chapter 5.1, estimating the effect on private sector employment from a change in public sector employment. While the interpretation of the numerical value is not straight forward, a positive estimate means there is a more positive effect from public sector employment growth in regions the more access a region has to people willing to move into the region (i.e. higher interregional labour elasticity). Based on theory, we would expect a positive sign, as this would mean that increases in public sector (as in the earlier periods) are less likely to crowd-out local private sector and more likely to attract people from other regions. In times of decreasing public sector (as the last period) the positive effect of a decrease in public sector would be smaller, because people are more likely to move

[12]Distance data produced by Nordregio.

[13]This value for γ is in line with estimations in (Poghosyan, 2018) and (Cavalleri et al., 2021), while the values for α and β are not appropriate to use as the interpretation differs in the FE setting used in these studies. Normally the estimates would be a little bit smaller than 1, but this simplification should not be problematic for my estimations

away, and the private sector is less dependent on local labour force. The results are not as stable as one would hope (see appendix A7), but the overall picture is that the sign is indeed positive for all time periods. Just as the RUM-model earlier, these results suggests that the local effect of a public sector employment change depends on interregional labour elasticity. This elasticity can differ between regions, because of geographical position, and in time, because of changes in labour market conditions.

6.2 Increasing Labour Shortage

After showing indications that there could be less favourable conditions for increased local public sector labour demand to increase the local labour force, we now turn our attention to another labor market development that could influence the crowding-out effect of public employment: an increased labor shortage in the service sector. Given the results presented in Chapter 5.4, we can practically rule out significant crowding-out effects arising from wage increases in our data. Instead, public sector employment is constraining the availability of labor for businesses seeking to expand.

The Confederation of Finnish Industries (EK) provides quarterly data on labour shortages[14] separate for manufacturing, construction and service sector. Since the public sector arguably primarily shares it's labour pool with the service sector, I will focus on that one.[15] The data for service sector is not reliable before 2005, which means the time series is not covering the whole time period analysed in my paper. To circumvent this problem I have estimated an OLS on the data on 2005Q1-2019Q4, explaining the magnitude of labour shortage in the service sector by GDP growth and labour market tightness (defined as v/u), including 4 times lagged values.[16] The rationale for this simple regression model is that labour shortage depends on the status of the business cycle and the level of labour market mismatch. The model fit is quite good, and the predicted values suggest that similar to the unemployment gap, there was a significant increase in labour shortages between the first and last period. Figure 5 illustrates the real and predicted values. Utilising the predicted values, I compare the labour shortages across the three periods. Table 9 shows a clear increase in labor shortages, particularly when examining only the initial year. Just as in Chapter 6.1 we can see indicative evidence that conditions became less favourable for getting a positive multiplier effect from increased public employment.

[14] Jarruttaako jokin seuraavista tekijöistä erityisesti tuotantoa yrityksessänne? Alt: "Ammattityövoiman puute" [eng:Are any of the following factors slowing down production in your company in particular? Alt: "labour shortage"]

[15] the following results showing an increase in labour shortage does hold for the construction sector, but not for the manufacturing industry.

[16] The Regression Results can be found in the appendix A4.

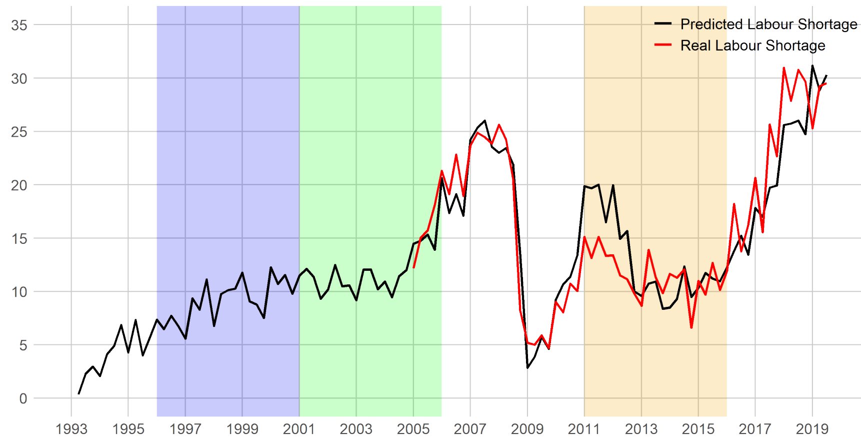

Figure 5: Real and predicted service sector labour shortage (percentage of companies experiencing labour shortage is slowing down their production)

7 Robustness checks

To assess the sensitivity of the results, a series of robustness checks were conducted. With the model including control variables in 4 as a starting point, various modifications were implemented. Controls for pre-trend in private employment growth were included to ensure that no significant factors were influencing both the outcome variable of private sector growth and the instrument's basis, (the share of public sector employment). Potential issues arising from the use of municipal-level data, rather than the theoretically preferred FLM-level were examined in several ways: 1. by running the OLS and IV analyses on FLM-based data; 2. by employing fixed effects for FLM and clustered standard errors at the FLM level; and 3. by including a mobility index (which measures commuting levels in the resident population) alongside instrumented public sector employment growth in the relevant FLM where the municipality is located. The mobility index, used in (Auricchio et al., 2020), is introduced in (Monte et al., 2018). The FLM public sector employment growth is instrumentalised in an analogous way to local public sector employment growth. The combination of the mobility index and the FLM public sector growth aims to control for the possibility that municipal results are influenced by changes in public sector employment within the same FLM.

The results indicate that the overall interpretation is robust for all the tested additional controls. However, the instrument is not valid for the FLM-based analyses conducted for the first and last time periods, leading me to disregard these results. The IV analyses based on FLM level data or with FLM fixed effects also generally exhibit large standard errors, which is why I don't use them for the main analysis, but the point estimates however are consistently leaning in the same direction as the municipality based estimates which the main analysis is based on.

In summary, this suggests that my use of municipal-level data, driven by practical necessity rather than theoretical preference, does not bias the results significantly enough to alter the overall interpretation. Given the estimates and the standard errors, the probability of the effect being positive is between 79 and 97 percent in 1996-2001, 81-98 percent in 2001-2006, while the probability of the effect being negative is 82-100 percent in 2011-2016.

Table 10: Estimates for public sector contribution in various extra controlled models, consored, unweighted

	Dependent variable:		
	contr_pub		
	(1996-2001)	(2001-2006)	(2011-2016)
Municipality based			
Full OLS	0.2*	0.4**	−0.4***
	(0.1)	(0.2)	(0.1)
Full IV1	0.1	0.3	-1.9**
	(0.3)	(0.6)	(0.8)
Full IV4	1.1	1.5	−2.2**
	(0.7)	(1.2)	(1.1)
Full OLS+pretrend	0.2	0.4**	−0.4***
	(0.1)	(0.2)	(0.1)
Full IV1+pretrend	-0.1	0.3	-2.0**
	(0.3)	(0.6)	(0.8)
Full IV4+pretrend	1.0	1.5	−2.1**
	(0.8)	(1.3)	(1.0)
Full IV1+mobility and spillover	–	0.3	-1.9
		(0.7)	(0.7)
Full IV4+mobility and spillover	–	1.4	−2.0**
		(1.1)	(0.9)
Full OLS+FLM Fixed effects	0.14	0.4*	-0.4***
	(0.15)	(0.24)	(0.1)
Full IV4+FLM Fixed effects	1.3	1.8	-0.8
	(1.5)	(1.8)	(0.5)
FLM-based Full OLS	0.4.	0.2	−0.4**
	(0.2)	(0.3)	(0.1)
FLM-based Full IV4	–	1.0	–
		(1.2)	
Note:			*p<0.1;**p<0.05; ***p<0.01 - =Weak Instrument

7.1 Uncensored and weighted results

The uncensored estimation results can be found in the appendix A3. The results are in line with the results based on the censored data.

In summary, the comparisons between the uncensored and censored results does not contradict that the most reasonable interpretation is that both the two first period have effects close to zero, while the last period has clear negative effect.

Comparing the weighted and unweighted models, one can start by noting that the two estimate different things, so differences between them are not necessarily problematic. As pointed out by (van Dijk, 2018), the unweighted model measures the effect on private employment in the average region, while the weighted model estimates the effect for the region for the average citizen. It is nonetheless interesting to see if the two differ. The overall picture remaines the same in the weighted models. Neutral or positive OLS in the first two periods and a negative OLS in the last period, which turns clearly more negative in the IV-analysis. The only larger difference is that IV1 passes the Wu-Hausman test in the second period and that the estimate is negative.

Conclusion: Although the weighted models do not estimate the same effect as the unweighted models, their results do not contradict the overall conclusion tof the main analysis.

7.2 Instrument Motivation

The Faggio-style Bartik instrument used in this paper has been described in chapter 4.1. While this instrument is well-established and has been shown to work across various countries, its relevance and exogeneity are not guaranteed. This chapter discusses the validity of the instrument for my analysis.

As mentioned in chapter 1.2 much of the financing of the local public sector employment depends on national rather than local taxation, with calculations showing that a theorethical doubling of local public employment on average is connected to only 20 percent increase in local taxes, with the remainder financed through national taxation. Consequently, local public employment is heavily influenced by central decisions regarding the location of state employees and the distribution of national income to local governments.

The instrument consists of two components: the first being the national change in public sector employment, and the second being the share of public sector employment within the regional labor market. Given that I have excluded the largest municipalities (see Chapter 4.2), no single municipality is large enough to realistically affect national public sector employment growth. However, concerning the second component, there is a potential risk that the regional share of public sector employment could correlate with private sector growth in the region. To mitigate such correlations, a pre-trend in private sector growth is included as a control variable in Chapter 7. This approach address any problematic correlations, and if such contamination were significant, we would expect differing results between the models with and without this control variable. Table 10 shows that including the pre-trend control does not change the estimates.

The weak instrument test results included in the tables of chapter 5, show that the instrument is very strong for all models and time periods, even though the Wu-Hausman test suggests that for the first two time periods, the instrument is unnecessary, as more efficient OLS estimates cannot be shown to suffer from endogeneity bias. A review of various model specifications in the robustness section (Chapter 7) confirms that the instrument passes the weak instrument test for nearly all model specifications. Next, we examine the first-stage results, which are statistically significants.

The tables below illustrate that the first-stage results of both instruments are statistically significant for all model specifications based on municipality data, where only the own municipality public growth is instrumented. The estimates also exhibit low p-values. [17] Comparing the estimates over time reveals that IV1 yields values of -26 in the first time period, -14 in the second, and 2 in the third. In contrast, IV4 shows values of 2 in the first period, -3 in the second, and 1 in the third. IV1 demonstrates significant variability in the first-stage estimates, with values considerably lower than those reported in other studies. Given that the change in total public sector employment for the first two periods was near zero (0.7), the variance of the instrument is reduced when instrumenting the public sector as a whole, as in IV1. By splitting public sector employment into local and state sectors, the variance increases because the two sectors exhibited diverging trends during the earlier periods, with local employment growing while state employment decreased. Consequently, the IV4 estimates are more moderate and align more closely with earlier studies. The first stage results vary in other studies, both in terms of magnitude and in terms of sign. Most are however not more than +/-2 (faggio reports estimates as low as -4). My IV4 results are all around this magnitude.

As pointed out by (Auricchio et al., 2020), the interpretation of the first stage is difficult, as the variation in the instrument is quite small compared to the actual variation, as the instrument is built on only the variation of public sector share and the total public sector employment growth. Following (Auricchio et al., 2020), I therefore look at the standardised coefficients, and conclude that even though the first stage estimates differ greatly between IV1 and IV4, both gives similar results when looking at how much the estimated impact of one SD of predicted public sector growth contribution estimates as SD of actual public sector growth contribution (IV1 has values between -0.6 and 0.2, while IV4 ranges between -0.1 and 0.2). This can be compared with about 0.5 in (Auricchio et al., 2020) and about 0.3 in (Roupakias, 2024) (own calculation). Therefore, the standardized coefficients for IV1 appear more consistent with earlier studies.

[17] The table shows estimates from the "full IV-model," meaning all variables except pre-trend and mobility are included. Robustness tests indicate that the results remain similar if these variables are included.

The signs of the first-stage estimates vary over time and between instruments. Both instruments exhibit the same sign and similar magnitudes in standardized coefficients for the second and third time periods. However, in the first time period, the two instruments yield differing signs in their first-stage estimates: IV1 is negative, while IV4 is positive. This discrepancy arises because IV4 differentiates between local and state public sectors. Given that these two components of the public sector had divergent trends during the first period, the variation in signs is not surprising.

Table 11: First stage results for instrumental variable as independent and public sector contribution as dependent, consored, unweighted ("full IV, meaning excluding pretrend and mobility)

	Dependent variable:		
	contr_pub		
	(1996-2001)	(2001-2006)	(2011-2016)
Municipality based			
IV1	-25.7^{***}	-13.7^{***}	2.0^{***}
IV4	1.8^{***}	-3.1^{**}	1.0^{**}
Note:			*p<0.1; **p<0.05; ***p<0.01

Finally, as pointed out by (Roupakias, 2024) and (Auricchio et al., 2020), besides showing that the instrument is strong, one should also address the possibility that the exclusion restriction does not hold. Both papers use the method of *Union of Confidence Intervals* from (Conley et al., 2012)[18]for testing if an instrument is 'plausably exogenous', by checking the sensitivity of the instrument to potential endogeneity. Writing a generic model as:

$$Y = \beta X + \gamma Z + \epsilon. \tag{11}$$

Where Z is an instrument for X. For the instrument to be exogenous one would assume $\gamma = 0$. If gamma is not zero, but was identified, the exogeneity problem could be solved by estimating:

$$Y - \gamma Z = \beta X + \epsilon. \tag{12}$$

With X instrumentalised by Z. As it is not possible to know γ, the method consists of estimating this model over a spectrum of values for γ, and then calculate the Confidence Intervals for each β. This enables us to see how big γ can be without 'eating up' all of the instrument's explanatory power. Following (Roupakias, 2024) and (Fatás and Mihov, 2013), I base the spectrum of variation on the β estimation of the main model (β =-2.09, 2011-2016 data, IV4, with controls[19]). This estimate

[18]See also the supplementary material of (Fatás and Mihov, 2013) for application.

[19]As I focus on the OLS rather than the IV in the earlier time period, this instrument validation focus on the last time period, 2011-2016.

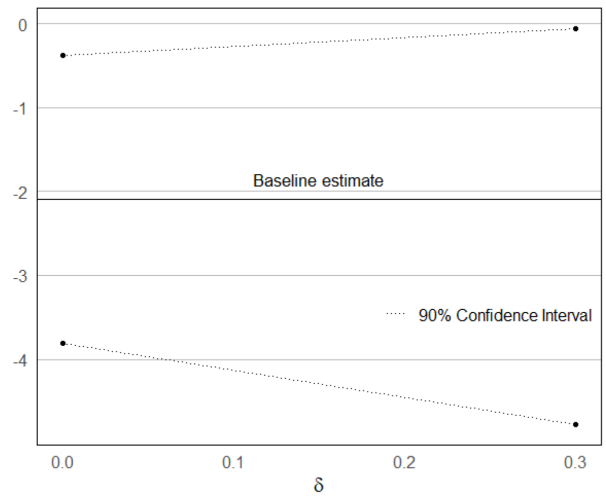

Figure 6: Test of Instrument 'Plausable exogeneity' by the *Union of Confidence Intervals* method proposed in (Conley et al., 2012)

is allowed to vary by a degree of δ, which means the spectrum becomes $[-\delta\beta, \delta\beta]$. I also follow (Roupakias, 2024) and (Fatás and Mihov, 2013) and allow up to 30 percent of the instrument effect to be 'indirect' (δ=0.3). This means the spectrum of γ is $[-0.627, 0.627]$. As can be seen in the graph below, the instrument is robust to the 30 percent variation, as it does not cross the zero-line. This means it passes the level set in the earlier studies.

The exact level of variation in δ and certainty level of the Confidence Interval is somewhat arbitrary, and increasing the variation and/or the certainty level will make all instruments fail eventually. The level used in this study follows (Roupakias, 2024), but while e.g. (Fatás and Mihov, 2013) has the same amount of variation (30 percent), the confidence interval they use is 95 percent rather than 90 percent, which naturally makes their test stricter. The variation that is needed for the estimate to cross the zero-line is 37 percent, which is similar to (Roupakias, 2024) who estimates a cut-off of 40 percent. I conclude that the instrument is robust to relativly high levels of endogeneity, based on a 90 percent certainty level.

8 Conclusions

Depending on assumptions of labor market conditions, theoretical models have suggested that public sector employment can have negative, positive, or neutral effects on total employment. As conditions vary between countries, empirical estimations are bound to differ vary depending on the country being studied. My results indicate that these varying outcomes can also be observed within the same country over time, as structural labour market conditions and the status of the business cycle change.

The results show that increased public employment during the earlier periods (1996-2001 and 2001-

2006) leads to a neutral or positive effect (0.3) on private sector employment. This means an increase of 10 public sector jobs result in 3 new private sector jobs. The positive effect mainly works through an increase of migration from other regions, but also through decreased (local) unemployment in the first period. Since effects more positive than -1 (full crowding out) correspond to a positive effect on total employment, these results suggest that growth in public employment significantly enhances total employment, thereby supporting the idea that public employment as a means of regional redistribution.

During the first period, marked by high unemployment, public sector employment also seem to have had a modest yet non-negligable effect reducing local unemployment. While it is outside the scope of this paper to estimate the effect of non-local unemployment from increases in local public employment, the importance of interregional migration as a channel for realising the increase in local total employment indicate that the *national* labour market conditions play a critical role in influencing *local* effects. Both the estimated local effects of public employment and the national conditions arguably facilitating a positive local effect seem to have worsened in the last time period.

The results for the last time period are clearly different from the earlier ones. The OLS is deemed to suffer from positive bias due to endogeneity, which is not the case in the earlier periods. The IV estimate show a clear negative estimate (-2.2). Given that the last period was characterized by a decline in public sector employment, we can interpret this as a decrease of 10 public sector jobs result in 22 new private sector jobs; however, the uncertainty of the estimate is considerable, with a standard error of 1.1. While the point estimates are highly uncertain, robustness checks validate the interpretation that the effects of public sector growth were neutral/positive in the early periods but turned negative in the last period.

Comparing these results with findings from other studies reveals both similarities and differences. Starting with the main question of how the private sector employment is affected by a change in public sector employment, we observe that the outcomes in periods of public sector expansion align closely with studies examining similar growth phases, such as those by (Faggio and Overman, 2014), (Roupakias, 2024), and (Jofre-Monseny et al., 2020). Conversely, the results from the later period, which experienced a reduction in public sector employment, show a resemblance to findings from studies focused on periods of public sector contraction, like (Auricchio et al., 2020) and (Senftleben-König, 2014). This means that the results seemingly support the notion that a decrease of public sector is not necessarily the opposite of an increase, which has been suggested in the literature.

To explain a possible asymmetric response to increases and decreases in public sector (Auricchio et al., 2020) suggests that it can be related to the functioning of the housing market. Another suggestion in explaining the differing results is that the size of the public sector matter. (Auricchio et al., 2020) and (Roupakias, 2024) suggests that there could be a difference between adding jobs in a rudimentary public sector, as was the case in Greece and Spain during the periods examined in (Roupakias, 2024) and (Jofre-Monseny et al., 2020), compared to a situation with a mature public sector such as Italy and Germany in (Auricchio et al., 2020) and (Senftleben-König, 2014). Neither of these seem plausable for the Finnish data analysed in this paper. Instead I propose a different line of argument using a simple theorethical model coupled with descriptive data. While not being clear cut, these make up indicative evidence that the last period is the least favorable when it comes to the combination of regional unemployment differences and national unemployment gap. The changing conditions could therefore potentially explain the change in effect between the time periods.

This suggests that rather than the effects being inherently asymmetric—where a decrease is fundamentally different from an increase—the impact may evolve over time as conditions change. These can change cyclically, with more favorable outcomes during recessions, in line with standard Keynesian logic. Additionally, it may indicate that conditions can deteriorate due to structural factors. Furthermore, the results may vary not only based on the development of the public sector but also in relation to the overall labor market conditions of which it is a part.

In Finland, the conditions during the early periods appears favorable, as high unemployment and relatively large regional disparities meant that increased local labour demand resulted in both a reduction in local unemployment and increased migration from other regions. Additionally, Finland's centralised wage-setting meant that rising local labour demand did not lead to upward wage pressures that could crowd out private sector growth. Conversely, the conditions during the last period seems to have become less beneficial in terms of facilitating positive effects from public employment growth, partly because of business cycle related declines in unemployment, and partly due to structural changes resulting in increased structural unemployment and decreased unemployment gaps. Looking ahead, these structural changes seem to have persisted, making public sector employment less likely to serve as an effective tool for decreasing local unemployment and facilitate regional job redistribution. A move towards more decentralising wage-setting in Finland, which is currently being discussed, could further diminish the usefulness, as increased local labour demand is more likely to lead to upward local wage pressure and crowding out. This is especially true if only the private sector wages move toward geographically decentralised while the public sector wages remain more or less nationally set and related to the national average of the private sector, as this would increase the wage gap between private and public sectors in low-productivity regions in need of regional redistribution.

Future research could use micro data to separate the migration response between people leaving employment in another region and people leaving unemployment. This could answer the still open question of how much of the positive effect in the early periods that is 'pure' regional redistrubtion of jobs, and how much is lowering (non-local) unemployment.

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A Appendices

A.1 Effect on Private Sector Employment

Table 1: Impact of public sector on private sector employment, unweighted OLS, Municipaliy level, censored, 1996-2001

	Dependent variable:					
	contr_priv					
	(1)	(2)	(3)	(4)	(5)	(6)
contr_pub	0.648***	0.311**	0.280*	0.246*	0.201	0.177
	(0.147)	(0.153)	(0.153)	(0.134)	(0.136)	(0.134)
log(totemp_y1)		0.343	0.511	0.312	0.352	1.073**
		(0.475)	(0.479)	(0.422)	(0.421)	(0.489)
high_edu_shr		0.439***	0.350***	0.006	0.009	−0.038
		(0.098)	(0.106)	(0.102)	(0.101)	(0.101)
unemp_rate_y1		−0.151**	−0.131**	−0.155***	−0.203***	−0.050
		(0.066)	(0.066)	(0.058)	(0.064)	(0.067)
pop_density_y1			0.009**	0.007*	0.006	0.005
			(0.005)	(0.004)	(0.004)	(0.004)
dependent_pop				−0.420***	−0.438***	−0.336***
				(0.048)	(0.049)	(0.056)
contr_pretrend					−0.115*	
					(0.066)	
mobility						8.287***
						(2.797)
Constant	6.154***	−4.488	−4.282	18.156***	17.290***	6.705
	(0.374)	(2.957)	(2.939)	(3.658)	(3.678)	(5.284)
Observations	259	259	259	259	259	259
R^2	0.070	0.249	0.262	0.432	0.438	0.451
Adjusted R^2	0.066	0.238	0.248	0.418	0.423	0.435
Residual Std. Error	5.792 (df = 257)	5.233 (df = 254)	5.199 (df = 253)	4.572 (df = 252)	4.554 (df = 251)	4.504 (df = 251)
6*** (df = 7; 251)	29.432*** (df = 7; 251)					

Note: *p<0.1; **p<0.05; ***p<0.01

Table 2: Impact of public sector on private sector employment, unweighted IV1, Municipaliy level, censored, 1996-2001

	Dependent variable:					
	contr_priv					
	(1)	(2)	(3)	(4)	(5)	(6)
contr_pub	0.291	−0.132	0.062	−0.100	−0.069	0.166
	(0.267)	(0.352)	(0.304)	(0.330)	(0.314)	(0.403)
contr_pubempgrowth_FLM						−0.030
						(0.037)
log(totemp_y1)		0.694	0.393	0.490	1.260**	0.788
		(0.506)	(0.440)	(0.446)	(0.537)	(0.783)
unemp_rate_y1		−0.208**	−0.189**	−0.269***	−0.083	−0.115
		(0.089)	(0.077)	(0.092)	(0.078)	(0.093)
high_edu_shr		0.337***	−0.002	−0.002	−0.052	−0.048
		(0.108)	(0.103)	(0.103)	(0.103)	(0.106)
pop_density_y1		0.011**	0.007*	0.007*	0.005	0.005
		(0.005)	(0.004)	(0.004)	(0.004)	(0.004)
dependent_pop			−0.422***	−0.445***	−0.329***	−0.328***
			(0.049)	(0.050)	(0.057)	(0.058)
contr_pretrend				−0.143**		
				(0.072)		
mobility					9.176***	10.726***
					(2.997)	(3.745)
Constant	5.905***	−4.187	18.301***	17.311***	5.664	10.279
	(0.409)	(2.982)	(3.678)	(3.713)	(5.453)	(7.921)
Weak instruments (contr$_p ub$)	0	0	0	0	0	0
Weak instruments (contr$_p ubempgrowth_F LM$)						0.23131
Wu-Hausman	0.11887	0.22021	0.54674	0.35779	0.45133	0.77748
Observations	259	259	259	259	259	259
Residual Std. Error	5.858 (df = 257)	5.273 (df = 253)	4.590 (df = 252)	4.598 (df = 251)	4.533 (df = 251)	4.668 (df = 250)

Note: *p<0.1; **p<0.05; ***p<0.01

Table 3: Impact of public sector on private sector employment, unweighted IV4, Municipaliy level, censored, 1996-2001

	Dependent variable:					
	contr_priv					
	(1)	(2)	(3)	(4)	(5)	(6)
contr_pub	−0.537	0.946	1.098	1.046	0.943	0.929
	(0.839)	(0.777)	(0.706)	(0.796)	(0.759)	(0.840)
contr_pubempgrowth_FLM						−0.005
						(0.057)
log(totemp_y1)		0.214	−0.063	−0.034	0.491	0.456
		(0.601)	(0.547)	(0.576)	(0.768)	(0.756)
unemp_rate_y1		−0.008	0.004	−0.019	0.053	0.041
		(0.157)	(0.143)	(0.184)	(0.123)	(0.220)
high_edu_shr		0.372***	0.041	0.040	0.007	0.005
		(0.113)	(0.113)	(0.113)	(0.116)	(0.124)
pop_density_y1		0.007	0.004	0.004	0.003	0.004
		(0.005)	(0.005)	(0.005)	(0.004)	(0.005)
dependent_pop			−0.411***	−0.417***	−0.356***	−0.355***
			(0.053)	(0.056)	(0.062)	(0.067)
contr_pretrend				−0.038		
				(0.101)		
mobility					5.511	5.936
					(4.014)	(7.436)
Constant	5.325***	−4.436	17.486***	17.232***	9.955	10.457
	(0.713)	(3.053)	(3.977)	(3.949)	(6.444)	(8.002)
Weak instruments ($contr_pub$)	0.00242	0.00508	0.00472	0.01248	0.00995	0.01412
Weak instruments ($contr_pubempgrowth_FLM$)						0.77635
Wu-Hausman	0.06227	0.33018	0.18868	0.25725	0.27442	0.60076
Observations	259	259	259	259	259	259
Residual Std. Error	6.479 (df = 257)	5.391 (df = 253)	4.924 (df = 252)	4.890 (df = 251)	4.786 (df = 251)	4.755 (df = 250)
Note:						*p<0.1; **p<0.05; ***p<0.01

Table 4: Impact of public sector on private sector employment, unweighted OLS, Municipaliy level, censored, 2001-2006

	Dependent variable:					
	contr_priv					
	(1)	(2)	(3)	(4)	(5)	(6)
contr_pub	0.820***	0.432**	0.451***	0.356**	0.354**	0.351**
	(0.141)	(0.168)	(0.168)	(0.166)	(0.166)	(0.169)
log(totemp_y1)		0.914**	0.827*	0.601	0.579	0.650
		(0.446)	(0.447)	(0.440)	(0.457)	(0.541)
high_edu_shr		0.094	0.073	−0.030	−0.028	−0.034
		(0.100)	(0.100)	(0.101)	(0.102)	(0.104)
unemp_rate_y1		−0.136**	−0.115*	−0.080	−0.077	−0.075
		(0.065)	(0.066)	(0.065)	(0.068)	(0.073)
pop_density_y1			0.008	0.005	0.005	0.005
			(0.005)	(0.005)	(0.005)	(0.005)
dependent_pop				−0.173***	−0.169***	−0.169***
				(0.045)	(0.051)	(0.052)
contr_pretrend					0.017	
					(0.096)	
mobility						0.438
						(2.800)
Constant	1.045***	−6.949***	−6.198**	3.103	2.986	2.481
	(0.321)	(2.486)	(2.521)	(3.436)	(3.503)	(5.257)
Observations	261	261	261	261	261	261
R^2	0.116	0.186	0.194	0.239	0.239	0.239
Adjusted R^2	0.112	0.173	0.179	0.221	0.218	0.218
Residual Std. Error	4.836 (df = 259)	4.666 (df = 256)	4.651 (df = 255)	4.529 (df = 254)	4.538 (df = 253)	4.538 (df = 253)
Note:						*p<0.1; **p<0.05; ***p<0.01

Table 5: Impact of public sector on private sector employment, unweighted IV1, Municipaliy level, censored, 2001-2006

	Dependent variable:					
	contr_priv					
	(1)	(2)	(3)	(4)	(5)	(6)
contr_pub	0.908***	0.275	0.312	0.297	0.297	0.295
	(0.318)	(0.630)	(0.607)	(0.621)	(0.657)	(0.674)
contr_pubempgrowth_FLM						0.001
						(0.013)
log(totemp_y1)		0.894*	0.615	0.594	0.686	0.703
		(0.504)	(0.477)	(0.485)	(0.692)	(0.779)
unemp_rate_y1		−0.151	−0.088	−0.087	−0.083	−0.081
		(0.140)	(0.129)	(0.128)	(0.117)	(0.112)
high_edu_shr		0.083	−0.029	−0.026	−0.033	−0.034
		(0.106)	(0.103)	(0.105)	(0.104)	(0.104)
pop_density_y1		0.008	0.005	0.005	0.004	0.004
		(0.005)	(0.005)	(0.005)	(0.006)	(0.006)
dependent_pop			−0.175***	−0.171***	−0.170***	−0.170***
			(0.051)	(0.054)	(0.052)	(0.053)
contr_pretrend				0.019		
				(0.098)		
mobility					0.616	0.555
					(3.510)	(3.341)
Constant	1.118***	−6.613**	3.096	2.962	2.220	2.103
	(0.399)	(2.905)	(3.437)	(3.513)	(6.106)	(6.617)
Weak instruments ($contr_pub$)	0	0	0	0	1e-05	1e-05
Weak instruments ($contr_pubempgrowth_FLM$)						0
Wu-Hausman	0.76082	0.79	0.94344	0.92907	0.93616	0.98023
Observations	261	261	261	261	261	261
Residual Std. Error	4.840 (df = 259)	4.661 (df = 255)	4.530 (df = 254)	4.539 (df = 253)	4.539 (df = 253)	4.547 (df = 252)
Note:						*p<0.1; **p<0.05; ***p<0.01

Table 6: Impact of public sector on private sector employment, unweighted IV4, Municipaliy level, censored, 2001-2006

	Dependent variable:					
	contr_priv					
	(1)	(2)	(3)	(4)	(5)	(6)
contr_pub	1.992***	1.777	1.465	1.469	1.367	1.377
	(0.576)	(1.198)	(1.249)	(1.259)	(1.107)	(1.121)
contr_pubempgrowth_FLM						−0.012
						(0.017)
log(totemp_y1)		0.325	0.248	0.278	−0.041	−0.200
		(0.670)	(0.618)	(0.599)	(0.941)	(1.103)
unemp_rate_y1		0.153	0.131	0.126	0.072	0.058
		(0.251)	(0.245)	(0.239)	(0.176)	(0.162)
high_edu_shr		−0.003	−0.066	−0.069	−0.039	−0.031
		(0.131)	(0.117)	(0.120)	(0.111)	(0.111)
pop_density_y1		0.011*	0.008	0.008	0.009	0.008
		(0.006)	(0.006)	(0.006)	(0.007)	(0.007)
dependent_pop			−0.129*	−0.135**	−0.161***	−0.156***
			(0.069)	(0.067)	(0.056)	(0.057)
contr_pretrend				−0.024		
				(0.114)		
mobility					−2.949	−2.274
					(4.712)	(4.206)
Constant	2.014***	−3.067	3.290	3.452	7.451	8.573
	(0.584)	(3.963)	(3.732)	(3.837)	(7.753)	(8.768)
Weak instruments ($contr_pub$)	1e-05	0.0109	0.01578	0.01703	0.00921	0.00041
Weak instruments ($contr_pubempgrowth_FLM$)						0
Wu-Hausman	0.0154	0.18907	0.29733	0.29689	0.28741	0.5502
Observations	261	261	261	261	261	261
Residual Std. Error	5.443 (df = 259)	5.188 (df = 255)	4.912 (df = 254)	4.924 (df = 253)	4.850 (df = 253)	4.863 (df = 252)

Note: *p<0.1; **p<0.05; ***p<0.01

Table 7: Impact of public sector on private sector employment, unweighted OLS, Municipaliy level, censored, 2011-2016

	Dependent variable:					
	contr_priv					
	(1)	(2)	(3)	(4)	(5)	(6)
contr_pub	−0.115	−0.288***	−0.293***	−0.356***	−0.376***	−0.363***
	(0.107)	(0.105)	(0.105)	(0.098)	(0.099)	(0.098)
log(totemp_y1)		0.114	0.124	−0.600	−0.633	−0.842*
		(0.443)	(0.444)	(0.426)	(0.427)	(0.498)
high_edu_shr		0.267***	0.247**	0.166*	0.168*	0.174*
		(0.094)	(0.098)	(0.091)	(0.091)	(0.092)
unemp_rate_y1		−0.379***	−0.369***	−0.121	−0.121	−0.158
		(0.091)	(0.092)	(0.094)	(0.094)	(0.102)
pop_density_y1			0.003	0.002	0.003	0.003
			(0.004)	(0.004)	(0.004)	(0.004)
dependent_pop				−0.261***	−0.246***	−0.284***
				(0.040)	(0.042)	(0.047)
contr_pretrend					0.087	
					(0.079)	
mobility						−2.361
						(2.502)
Constant	−5.349***	−10.044***	−9.763***	5.443	5.065	9.277*
	(0.392)	(2.517)	(2.542)	(3.318)	(3.334)	(5.247)
Observations	260	260	260	260	260	260
R^2	0.004	0.147	0.149	0.272	0.275	0.274
Adjusted R^2	0.001	0.134	0.133	0.254	0.255	0.254
Residual Std. Error	5.391 (df = 258)	5.019 (df = 255)	5.022 (df = 254)	4.657 (df = 253)	4.655 (df = 252)	4.658 (df = 252)

Note: *p<0.1; **p<0.05; ***p<0.01

Table 8: Impact of public sector on private sector employment, unweighted IV1, Municipaliy level, censored, 2011-2016

	Dependent variable:					
	contr_priv					
	(1)	(2)	(3)	(4)	(5)	(6)
contr_pub	−1.210**	−2.323**	−1.991**	−2.022**	−1.806**	−1.912**
	(0.555)	(1.005)	(0.824)	(0.832)	(0.716)	(0.745)
contr_pubempgrowth_FLM						−0.010
						(0.017)
log(totemp_y1)		0.659	−0.356	−0.485	−0.903	−0.770
		(0.745)	(0.630)	(0.622)	(0.679)	(0.740)
unemp_rate_y1		−0.823***	−0.420**	−0.415**	−0.464**	−0.480**
		(0.265)	(0.202)	(0.199)	(0.204)	(0.211)
high_edu_shr		0.229	0.131	0.138	0.151	0.140
		(0.154)	(0.134)	(0.133)	(0.125)	(0.131)
pop_density_y1		0.009	0.006	0.008	0.008	0.009
		(0.007)	(0.006)	(0.006)	(0.006)	(0.006)
dependent_pop			−0.327***	−0.273***	−0.368***	−0.391***
			(0.067)	(0.062)	(0.076)	(0.086)
contr_pretrend				0.318*		
				(0.162)		
mobility					−5.048	−6.281
					(3.654)	(4.229)
Constant	−7.436***	−12.442***	7.155	5.734	15.144*	15.404*
	(1.129)	(4.206)	(4.889)	(4.833)	(7.705)	(8.003)
Weak instruments ($contr_pub$)	0.00026	0.01183	0.00803	0.00608	0.0051	0.01743
Weak instruments ($contr_pubempgrowth_FLM$)						0.00216
Wu-Hausman	0.02267	0.0022	0.00524	0.00508	0.00711	0.01928
Observations	260	260	260	260	260	260
Residual Std. Error	6.384 (df = 258)	7.898 (df = 254)	6.757 (df = 253)	6.731 (df = 252)	6.351 (df = 252)	6.602 (df = 251)

Note: *p<0.1; **p<0.05; ***p<0.01

Table 9: Impact of public sector on private sector employment, unweighted IV4, Municipaliy level, censored, 2011-2016

	Dependent variable:					
	contr_priv					
	(1)	(2)	(3)	(4)	(5)	(6)
contr_pub	−1.949**	−2.769*	−2.185**	−2.128**	−1.891**	−1.968**
	(0.917)	(1.464)	(1.091)	(1.032)	(0.879)	(0.902)
contr_pubempgrowth_FLM						−0.010
						(0.017)
log(totemp_y1)		0.777	−0.327	−0.475	−0.907	−0.773
		(0.881)	(0.677)	(0.645)	(0.698)	(0.754)
unemp_rate_y1		−0.923**	−0.456*	−0.434*	−0.482**	−0.492**
		(0.365)	(0.245)	(0.230)	(0.233)	(0.239)
high_edu_shr		0.225	0.127	0.136	0.150	0.139
		(0.175)	(0.143)	(0.138)	(0.129)	(0.134)
pop_density_y1		0.010	0.007	0.008	0.008	0.009
		(0.008)	(0.006)	(0.006)	(0.006)	(0.006)
dependent_pop			−0.334***	−0.275***	−0.373***	−0.394***
			(0.076)	(0.065)	(0.083)	(0.091)
contr_pretrend				0.333*		
				(0.185)		
mobility					−5.207	−6.383
					(3.861)	(4.364)
Constant	−8.845***	−13.032***	7.358	5.777	15.492*	15.630*
	(1.814)	(4.930)	(5.246)	(5.003)	(8.157)	(8.392)
Weak instruments (contr$_pub$)	0.00723	0.04442	0.0367	0.035	0.02184	0.06996
Weak instruments (contr$_pubempgrowth_FLM$)						0.00184
Wu-Hausman	0.0049	0.01373	0.02306	0.02245	0.02925	0.06758
Observations	260	260	260	260	260	260
Residual Std. Error	7.866 (df = 258)	8.974 (df = 254)	7.188 (df = 253)	6.961 (df = 252)	6.528 (df = 252)	6.721 (df = 251)

Note: *p<0.1; **p<0.05; ***p<0.01

A.2 Wage effects

The wage level in region i, W_{i}, is calculated as:

$$W_{\mathrm{i}} = \frac{Wagesum_i}{EMP_i}. \tag{1}$$

Where W_i is wage level, and EMP_i is the number of employed people. This data has been downloaded from Statistics Finland. Since not all employed individuals are wage earners, the wage level will not be a correct estimate of the average worker's wage. Another limitation is that this dataset includes wages from both private and public sectors, introducing potential bias depending on whether public sector wages are higher or lower than private sector wages in region i. An increase in public sector employment not only affects wage pressure within the private sector but also shifts the public-private composition of wage earners. While this data is not ideal, and is not appropriate for estimating wage *level*, it should still provide a reasonable approximation of the *change* in wage level.

To address the potential correlation between previous wage growth and public sector employment, I control for pre-trend wage growth. Due to data limitations this is only possible for the two most recent time periods. However the inclusion of pre-trends does not alter the interpretation for either one of these two time periods.

In the first period, a one percent increase in public sector employment produces a slight upward pressure on wages (0.2 percent), which is only one-tenth of the effect estimated for Germany. In the last period, the effect ranges between -0.1 and +0.1 for most configurations, implying basically no wage effect on the local wages from increased public sector employment. For the middle period, the estimated effect is around -1 percent—a result that does not align well with theoretical expectations. Two potential explanations, both linked to data limitations, could account for this discrepancy. First, the result might stem from a compositional effect, as the increase in public sector employment may have involved the addition of lower-wage workers. Second, this outcome could be due to the fact that a substantial portion of the employment increase during the middle period is attributed to commuting. As a result, the rise in employment would not fully impact the wage sum calculated based on local residents. Overall, these findings suggest that the local wage effect in Finland is minimal, and clearly smaller than in Germany, a country with a more decentralised wage formation process.

1996-2001					
OLS/IV	**Controls**	**Pre-trend**	**Effect**	**Weak Ins.**	**Wu-Hausman**
OLS	No	No	0.31* (0.12)		
OLS	Yes	No	0.20. (0.11)		
IV1	No	No	1.14*** (0.23)	***	0.7
IV1	Yes	No	0.27 (0.24)	***	0.7
IV4	No	No	3.80** (1.10)	**	***
IV4	Yes	No	0.06 (0.30)	***	0.5
2001-2006					
OLS/IV	**Controls**	**Pre-trend**	**Effect**	**Weak Ins.**	**Wu-Hausman**
OLS	No	No	-0.05 (0.10)		
OLS	No	Yes	-0.03 (0.09)		
OLS	Yes	No	0.03 (0.10)		
OLS	Yes	Yes	0.03 (0.10)		
IV1	No	No	0.37 (0.28)	***	*
IV1	No	Yes	-0.02 (0.19)	***	0.9
IV1	Yes	No	-1.05* (0.43)	***	**
IV1	Yes	Yes	-1.05* (0.43)	***	**
IV4	No	No	-1.45** (0.49)	***	***
IV4	No	Yes	-0.99* (0.57)	***	**
IV4	Yes	No	-1.06* (0.44)	***	**
IV4	Yes	Yes	-1.06* (0.44)	***	**
2011-2016					
OLS/IV	**Controls**	**Pre-trend**	**Effect**	**Weak Ins.**	**Wu-Hausman**
OLS	No	No	-0.14** (0.05)		
OLS	No	Yes	-0.12** (0.04)		
OLS	Yes	No	-0.11** (0.04)		
OLS	Yes	Yes	-0.11** (0.04)		
IV1	No	No	0.22 (0.23)	***	.
IV1	No	Yes	0.05 (0.19)	***	0.3
IV1	Yes	No	-0.12 (0.24)	**	0.99
IV1	Yes	Yes	-0.12 (0.25)	**	0.99
IV4	No	No	0.64 (0.40)	**	**
IV4	No	Yes	0.27 (0.27)	**	.
IV4	Yes	No	-0.12 (0.25)	**	0.99
IV4	Yes	Yes	-0.12 (0.25)	**	0.98

Note: 'Controls' include: logged total employment, share of highly educated, population density, unemployment rate and ratio of dependent population. ONLY OLD OR ALSO YOUNG?

A.3 Uncensored results

Table 10: Impact of public sector on private sector employment, unweighted, Municipaliy level, uncensored, 1996-2001

	Dependent variable:					
	contr_priv					
	OLS			*instrumental variable*		
	(1)	(2)	(3)	(4)	(5)	(6)
contr_pub	0.329***	0.122	0.184	1.450*	0.561*	2.030
	(0.115)	(0.111)	(0.285)	(0.806)	(0.319)	(1.606)
log(totemp_y1)		0.868**		0.649		0.553
		(0.397)		(0.500)		(0.618)
high_edu_shr		0.163		0.273**		0.321*
		(0.100)		(0.137)		(0.192)
unemp_rate_y1		−0.089		0.357		0.551
		(0.066)		(0.278)		(0.544)
pop_density_y1		0.002		−0.00002		−0.001
		(0.003)		(0.004)		(0.005)
dependent_pop		−0.403***		−0.313***		−0.274**
		(0.051)		(0.082)		(0.130)
Constant	5.575***	8.077**	5.541***	−3.600	5.629***	−8.701
	(0.426)	(3.678)	(0.432)	(8.289)	(0.435)	(14.975)
Weak instruments			0	0.01943	0	0.22187
Wu-Hausman			0.61737	0.1089	0.48119	0.18656
Observations	309	309	309	309	309	309
R^2	0.026	0.422	0.021	0.150	0.013	−0.140
Adjusted R^2	0.023	0.411	0.018	0.133	0.010	−0.163
Note:						*p<0.1; **p<0.05; ***p<0.01

Table 11: Impact of public sector on private sector employment, unweighted, Municipaliy level, uncensored, 2001-2006

	Dependent variable:					
	contr_priv					
	OLS		*instrumental variable*			
	(1)	(2)	(3)	(4)	(5)	(6)
contr_pub	0.565***	0.305**	0.220	−0.166	0.346	−0.179
	(0.127)	(0.136)	(0.362)	(0.589)	(0.328)	(0.537)
log(totemp_y1)		0.572		0.807		0.814*
		(0.400)		(0.498)		(0.484)
high_edu_shr		−0.040		−0.018		−0.018
		(0.095)		(0.101)		(0.100)
unemp_rate_y1		0.044		−0.046		−0.049
		(0.066)		(0.129)		(0.121)
pop_density_y1		−0.004		−0.005		−0.005
		(0.003)		(0.003)		(0.003)
dependent_pop		−0.273***		−0.284***		−0.285***
		(0.048)		(0.051)		(0.051)
Constant	0.855**	5.241	0.574	4.069	0.677	4.037
	(0.372)	(3.484)	(0.467)	(3.828)	(0.448)	(3.784)
Weak instruments			0	0.00472	0	0.00237
Wu-Hausman			0.37257	0.50057	0.53754	0.44826
Observations	309	309	309	309	309	309
R^2	0.061	0.210	0.038	0.178	0.052	0.177
Adjusted R^2	0.058	0.194	0.035	0.162	0.049	0.160
Note:						*p<0.1; **p<0.05; ***p<0.01

Table 12: Impact of public sector on private sector employment, unweighted, Municipaliy level, uncensored, 2011-2016

	Dependent variable:					
	contr_priv					
	OLS		*instrumental variable*			
	(1)	(2)	(3)	(4)	(5)	(6)
contr_pub	0.076	-0.180^{*}	-2.028^{**}	-2.818^{***}	-2.875^{*}	-3.655^{*}
	(0.105)	(0.096)	(0.803)	(0.952)	(1.576)	(2.118)
log(totemp_y1)		-1.219^{***}		-2.338^{**}		-2.694^{*}
		(0.459)		(0.945)		(1.386)
high_edu_shr		0.142		0.275		0.318
		(0.097)		(0.186)		(0.247)
unemp_rate_y1		-0.267^{**}		-0.887^{***}		-1.083^{*}
		(0.106)		(0.295)		(0.551)
pop_density_y1		0.002		0.007		0.008
		(0.003)		(0.005)		(0.007)
dependent_pop		-0.329^{***}		-0.438^{***}		-0.473^{***}
		(0.046)		(0.094)		(0.137)
Constant	-4.250^{***}	16.215^{***}	-7.803^{***}	27.297^{***}	-9.234^{***}	30.814^{**}
	(0.438)	(3.604)	(1.486)	(7.794)	(2.767)	(12.141)
Weak instruments			0.00434	0.00587	0.02161	0.06308
Wu-Hausman			0.00633	0.00082	0.00593	0.02398
Observations	309	309	309	309	309	309
R^2	0.002	0.261	−1.299	−1.576	−2.558	−2.928
Adjusted R^2	−0.002	0.247	−1.307	−1.628	−2.570	−3.006
Note:				*p<0.1; **p<0.05; ***p<0.01		

A.4 OLS predicting Labour Shortage

Table 13: Regression Results

	Dependent variable:
	brist
mismatch	61.556***
	(12.516)
lag(mismatch, 1)	7.184
	(8.062)
lag(mismatch, 2)	19.650**
	(8.167)
lag(mismatch, 3)	−5.340
	(8.090)
lag(mismatch, 4)	−39.385**
	(14.656)
BNPgrowth	0.732*
	(0.370)
lag(BNPgrowth, 1)	−0.529
	(0.380)
lag(BNPgrowth, 2)	0.028
	(0.373)
lag(BNPgrowth, 3)	−0.219
	(0.378)
lag(BNPgrowth, 4)	0.571*
	(0.297)
Constant	1.601
	(2.292)
Observations	56
R^2	0.844
Adjusted R^2	0.809
Residual Std. Error	3.366 (df = 45)
F Statistic	24.311*** (df = 10; 45)
Note:	*p<0.1; **p<0.05; ***p<0.01

A.5 Robustness checks for Labour Force, Unemployment, Net Commuting

Table 14: Estimates for public sector contribution on labour force in various extra controlled models, censored, unweighted

	Dependent variable:		
	Labour force diff		
	(1996-2001)	(2001-2006)	(2011-2016)
Full OLS	1.0***	1.0***	0.1
Full IV1	0.8**	-0.2	-1.2 *
Full IV4	1.6**	−0.3	-0.7
Full OLS+pretrend	1.0***	1.0***	0.1
Full IV1+pretrend	0.7*	-0.3	-1.3 *
Full IV4+pretrend	1.5*	−0.3	-0.6
Full IV1+mobility and spillover	0.4	-0.8	-1.1 *
Full IV4+mobility and spillover	0.9^{not1}	0.3	-0.4
FLM-based Full OLS	0.7***	0.5**	0.3**
FLM-based Full IV4	1.1^{not1}	0.0	-3.0^{not1}
Note:	*p<0.1; **p<0.05; ***p<0.01 ;not1: Not sig. instrument		

Table 15: Estimates for public sector contribution on unemployment in various extra controlled models, consored, unweighted

	Dependent variable:		
	unemployment force diff		
	(1996-2001)	(2001-2006)	(2011-2016)
Full OLS	-0.3***	-0.1	-0.0
Full IV1	-0.2	0.2	-0.2
Full IV4	-0.7*	0.5	0.1
Full OLS+pretrend	-0.3***	-0.1	-0.0
Full IV1+pretrend	-0.0	0.1	-0.2
Full IV4+pretrend	-0.6	0.5	0.1
Full IV1+mobility and spillover	0.4	0.3	-0.5*
Full IV4+mobility and spillover	-0.7^{not1}	0.4	-0.2
FLM-based Full OLS	-0.5***	-0.4***	-0.1
FLM-based Full IV4	-1.3^{not1}	-0.3	0.6^{not1}

Note: *p<0.1; **p<0.05; ***p<0.01 ;not1: Not sig. instrument

Table 16: Estimates for public sector contribution on net commuting in various extra controlled models, censored, unweighted

	Dependent variable:		
	contr net com		
	(1996-2001)	(2001-2006)	(2011-2016)
Full OLS	-0.1	0.3	0.5^{***}
Full IV1	0.1	1.5^{**}	0.2
Full IV4	-0.2	3.2^{*}	-0.4
Full OLS+pretrend	-0.1	0.3	0.5^{***}
Full IV1+pretrend	0.2	1.5^{**}	0.2
Full IV4+pretrend	-0.1	3.2^{*}	-0.3
Full IV1+mobility and spillover	1.1^{***}	2.2^{***}	-0.2
Full IV4+mobility and spillover	0.2^{not1}	2.3^{*}	-0.7
FLM-based Full OLS			
FLM-based Full IV4			
Note:	*p<0.1; **p<0.05; ***p<0.01 ;not1: Not sig. instrument		

A.6 Effect on tradable and non-tradable sector

Table 17: Estimates for public sector employment on tradable private sector employment, censored, unweighted

	Dependent variable:		
	contr tradable		
	(1996-2001)	(2001-2006)	(2011-2016)
Full OLS	0.059	0.155	−0.053
	(0.089)	(0.122)	(0.061)
Full IV4	0.811	0.400	−1.460*
	(0.576)	(0.856)	(0.776)
Weak instruments	0.00472	0.01578	0.0367
Wu-Hausman	0.0763	0.6992	0.00015
Note:			*p<0.1; **p<0.05; ***p<0.01

Table 18: Estimates for public sector employment on non-tradable private sector employment, censored, unweighted

	Dependent variable:		
	contr non-tradable		
	(1996-2001)	(2001-2006)	(2011-2016)
Full OLS	0.092	0.071	−0.293***
	(0.104)	(0.121)	(0.070)
Full IV4	−0.388	0.652	−0.512
	(0.527)	(0.877)	(0.514)
Weak instruments	0.00472	0.01578	0.0367
Wu-Hausman	0.44375	0.50087	0.66759
Note:			*p<0.1; **p<0.05; ***p<0.01

A.7 Result of interaction between "predicted relative immigration to region" (PRI) and "public sector contribution"

The table below shows positive signs and p-values at least close to 0.1 level significance for the preferable models (based on weak instrument and Wu-Hausman statistics) for each time period. Due to problems getting statistically significant results when including this interaction terms, the number of control variables were lowered compared to the preferred model in the main results. Specifically, the control variables were "logged total employment" and "initial unemployment rate". As the main results is stable over different specifications, this exclusion of control variables is hopefully not problematic.

Table 19: Sign of estimate for interaction between "predicted relative immigration to region" (PRI) and $contr_{pub}$

	Dependent variable:		
	contr private		
	(1996-2001)	(2001-2006)	(2011-2016)
OLS	+ (p=0.8)	+ (p=0.11)	+ (p=0.8)
IV1	+ (p=0.099)	+ (p=0.02)	− (p=0.8)
Weak Instrument ($contr_{pub}$)	***	**	*
Weak Instrument ($contr_{pub}$)xPRI	***	***	0.6
Wu-Hausman	***	0.19	0.6
IV4	+ (p=0.34)	− (p=0.52)	+ (p=0.08)
Weak Instrument ($contr_{pub}$)	***	*	*
Weak Instrument ($contr_{pub}$)xPRI	0.27	0.25	0.18
Wu-Hausman	0.9	0.3	0.18
Note:			*p<0.1; **p<0.05; ***p<0.01