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Regional effects of mass layoffs in Finland

Master's Thesis

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Abstract

In my thesis, I study the causal effect of mass layoffs on local labor markets in Finland in 1989-2013. The analysis is conducted by comparing developments over time between commuting zones (CZ) that experience a mass layoff event and those that do not, attributing the difference to the layoff events. I focus on the effects on regional employment, income, population, unemployment and non-employment.

The topic is highly relevant from the point of view understanding the dynamics of local labor markets. Mass layoffs affect not only the individuals who lose their jobs, but potentially also people working in other firms operating in the same area through negative spillover effects, of which there is evidence in empirical literature. Understanding regional effects of mass layoffs is also important for designing public policy, since governments spend considerable financial resources on regional policies that aim at supporting struggling regions.

I find that in the layoff year, a mass layoff of 1% of CZ population leads to a 1.4% decline in employment that translates mainly to an increase in unemployment, while only a 0.1% of population migrates to other CZs. The effect on CZ-level income is also limited. In the medium term, employment appears to recover somewhat, while population and income decline further. Among those that stay in the layoff CZ, the share of unemployed improves relative to the initial decline, while the share of inactive population gradually increases.

keywords: mass layoff, regional effects, spillover effects

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Tiivistelmä

Tarkastelen pro gradu -tutkielmassani joukkoirtisanomisten kausaalista vaikutusta paikallisiin työmarkkinoihin Suomessa vuosina 1989-2013. Empiirisessä analyysissani vertailen, kuinka työssäkäyntialueet, joita kohtaa joukkirtisanomistilanne, kehittyvät verrattuna alueisiin, joissa ei tapahdu suuria irtisanomisia, tulkiten mahdollisen eron johtuvan irtisanomistapahtumasta. Keskityn tutkimuksessani erityisesti alueellisiin työllisyys-, ansio-, väestö- ja työttömyysvaikutuksiin sekä siirtymään aktiivisen väestön ulkopuolelle.

Tutkimukseni auttaa osaltaan ymmärtämään paikallisten työmarkkinoiden dynamiikkaa ja sitä, kuinka alueet reagoivat niitä kohtaaviin negatiivisiin työmarkkinashokkeihin. Joukkoirtisanomisten vaikutukset eivät rajoitu vain työntekijoihin, jotka menettävät työnsä niiden johdosta, vaan mahdollisesti myös muihin alueen asukkaisiin sekä yrityksiin erilaisten heijastusvaikutusten kautta, joiden olemassaolosta on löydetty näyttöä empiirisessä tutkimuksessa. Lisäksi alueellisten vaikutusten ymmärtäminen on tärkeää aluepolitiikan toteuttamisen kannalta, sillä niin Suomi kuin muutkin valtiot valtiot käyttävät merkittäviä summia julkista rahaa vaikeuksissa olevien alueiden tukemiseen.

Tutkimustulosten perusteella joukkoirtisanominen, jonka suuruus on 1% työssäkäyntialueen väestöstä, johtaa irtisanomisvuonna työllisyyden vähenemiseen 1.4%:lla. Tämä näkyy lähinnä työttömyyden kasvuna, kun taas vain 0.1% väestöstä muuttaa jollekin toiselle työssäkäyntialueelle. Myös vaikutukset alueellisiin tuloihin sekä siirtymä aktiivisen väestön ulkopuolelle ovat irtisanomisvuonna verrattain vähäisiä. Keskipitkällä aikavälillä työllisyyden lasku pysähtyy tai kääntyy jopa nousuun, kun taas alueelliset tulot laskevat sekä muuttajien määrä kasvaa. Työttömyysaste kohenee verrattuna lyhyen aikavälin kehitykseen, mutta siirtymä aktiivisen väestön ulkopuolelle lisääntyy.

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1 Introduction

Mass layoff events can have far-reaching economic impacts on several dimensions. For the individuals directly displaced by the layoffs, job loss is naturally a large negative shock. Moreover, mass layoffs do not only affect the displaced individuals, but also indirectly the regions concerned and thus other individuals living and working in the region. Consequently, it is not surprising that national and local governments devote significant financial resources in helping regions that face negative shocks caused by the troubles of individual firms or entire industries.

I study in my master's thesis the causal effect that large mass layoff events have on local labor markets in Finland. More specifically, I look at the impact of these events on regional employment, income, population, unemployment and non-employment. Instead of individuals, I am interested in how the layoff region is affected by such events. I focus on events that are large enough to affect the region where the layoff plant is situated. The analysis is restricted to plants that are operative in the tradable sector to ensure that the shocks are exogenous to developments in the local economy.

The question of regional impact of mass layoff is relevant both from a theoretical and a public policy point of view. Firstly, a local labor market is negatively affected by a mass layoff event through the direct effects of job loss on the individuals laid off. Secondly, potential negative spillover effects can exacerbate the initial shock, further negatively affecting the region. Spillover effects work through two channels. The first channel is multiplier effects that arise from the negative impact of the shock on aggregate demand. The second one is agglomeration effects, which refer to the benefits that firms get from locating close to each other. There is evidence of the existence of both multiplier and agglomeration effects in empirical literature. A study with German data finds that an initial mass layoff of 1.9% of municipal employment leads to a 3.7% decline in employment after four years, of which 1.4 percentage points in other firms than the layoff firm (Gathmann, Helm, & Schonberg, 2016). Another one that studies the effect of large plant openings on the local labor market finds that productivity of incumbent plants increases by 12% in five years after the opening

(Greenstone, Hornbeck, & Moretti, 2010).

The topic is also important for public policy. In Finland and elsewhere, governments use regional policies to mitigate the negative effects of mass layoffs by supporting the affected regions in various ways. When designing the appropriate policy, it is crucial to understand the magnitude of the direct and indirect regional effects of mass layoffs.

My study contributes to literature that studies how local labor markets are affected by local-level negative demand shocks. I analyze the joint impact of direct and indirect regional effects. The analysis provides empirical estimates on the effect of mass layoff events on local employment, income, population, unemployment and non-employment. This may help policymakers in assessing the impact of recent and future mass layoff events and in designing regional policies. In a broader sense, the study contributes to literature on the dynamics of local labor markets. The analysis relies on rich Finnish registry data that contains detailed information on all working-age Finnish residents from 1988 to 2014.

I find evidence of short and medium term negative effects on the number of employed individuals, cumulative income, population, employment rate, unemployment and non-employment in local labor markets that experience mass layoff events compared to labor markets that do not. In the short term, a mass layoff of 1% of local working-age population reduces the number of employed individuals by 1.4%. However, the effect on aggregate income is initially limited. Most of the short-term adjustment is through a rise in unemployment, as population declines by only 0.14%. In the medium term, the decline in the number of employed appears to reverse somewhat, while aggregate income and population decline further. Among those who stay in the layoff region, employment and unemployment rates improve compared to the initial shock, while the share of inactive population (consisting mainly of pensioners) gradually increases.

In the light of the results, negative spillover effects seem not to be particularly important in the Finnish context. Even though the number of employed intially declines by more than the size of the mass layoff, the decline does not continue in subsequent years. If anything, the number of employed appears to recover somewhat. This finding is in contrast with for example that of Gathmann et al. (2016), who find considerable spillover effects in their

study of the effects of mass layoffs on German municipal labor markets. This may be partly due to differences in methodology and also due to differences in the dynamics of local labor markets and regional policies.

The thesis is structured as follows. In section 2, I discuss the dynamics of local labor markets from a theoretical perspective and some relevant Finnish institutional characteristics. Section 3 reviews empirical research that focuses on labor market dynamics and the effects of labor market shocks. Section 4 provides details on the data and descriptive statistics, and section 5 outlines the empirical strategy. Section 6 presents and discusses results and section 7 concludes.

2 Theoretical considerations and institutional setting

In this section, I discuss theoretical considerations regarding direct and indirect regional effects of negative labor demand shocks. I also shortly present the institutional context in Finland, which may affect how regions respond to labor market shocks.

2.1 Theoretical considerations

When a firm lays off workers in a certain region, it affects not only the firm itself and its workers, but directly and potentially also indirectly the region where the firm is situated. The layoffs lead to a decline in employment and and thus income among the workers who lose their jobs. This is reflected also at the regional level, with potential negative effects on regional employment, income and also population if workers migrate in search of new employment.

A negative labor demand shock such as a mass layoff event may also have indirect effects on other firms operating in the same geographical area, often referred to as spillover effects. Conceptually, spillover effects can be divided into two components, agglomeration effects that affect firms operating in the tradable sector (firms that trade their goods or services on the national or the international market), and multiplier effects that affect firms operating in the non-tradable sector (firms providing goods and services that on the local market).

Agglomeration effects refer to the potential benefits that firms operating in the tradable sector get from situating close to each other. If there are agglomeration effects, the productivity of other firms increases when one firm hires new workers. Similarly, when a firm lays off workers or closes down its operations altogether, other firms may also be hurt.

Theoretically, agglomeration effects may arise from three different sources, which can all be understood as a reduction in different types of transportation costs[1]. Agglomeration happens as companies locate close to one another, which may bring several benefits. Firstly, clustering in the same region increases the size of the local labor pool, making the labor market "thicker". This may improve the quality of employee-employer matches by reducing

[1] see eg. (Glaeser, 2010)

the cost of job search. Secondly, agglomeration may be beneficial due to input-output relations, since locating close to providers of local services and intermediate goods may make firms more productive. Thirdly, agglomeration effects can stem from knowledge spillovers, as proximity to other firms and individuals may spur innovation. Their existence was famously acknowledged already in 1890 by Arthur Marshall, who described the flow of ideas in cities by saying that "The mysteries of trade ... were in the air" (Marshall, 2009).

Multiplier effects refer to the demand effects that an added job in the tradable sector in a region has on the non-tradable sector of the regional economy. When a firm hires more workers, they spend part of their salary on local goods and services, increasing employment in the non-tradable sector. In contrast, when a firm in the tradable sector lays off workers, firms in the non-tradable sector are also hurt through the negative effect of the layoffs on the demand for local goods and services. Thus, multiplier effects work through the impact that an added (or reduced) job has on the aggregate demand for local goods and services.

The impact of a negative labor demand shock depends on the dynamics of local labor markets. These dynamics can be analyzed with spatial equilibrium models. One such model is by Enrico Moretti (2011). The model assumes that workers are less than perfectly mobile between local labor markets and that land is not fixed in supply. Workers maximize their utility by making their location decision based on nominal wages, cost of housing, amount of local amenities such as clean air or proximity of nature and a personal preference for a certain location (due to eg. family ties). The stronger the personal preferences, the less mobile is labor. In equilibrium, workers must be indifferent between locations, since otherwise marginal workers would be better off by moving from one local labor market to another.

The model helps in analyzing the expected consequences of a negative labor demand shock, such as a mass layoff in one firm operating in the local labor market. Firstly, a mass layoff affects local labor demand negatively and puts downward pressure on wages, since for every wage level, there is less demand for labor[2]. Moreover, population declines as marginal workers are encouraged to move to a different local labor market. The relative importance of

[2]The model does not consider possible increases in unemployment, since it is a full employment model.

these two adjustment channels depend on the elasticity of labor supply and housing supply. The more mobile is labor and the more elastic is housing supply, the more individuals choose to migrate.

The model can also be modified to take into account potential agglomeration effects. Here, the productivity of firms in a region depends on the number of employees in the region. Thus, the initial negative effect of a layoff event is magnified, as a decline in the number of workers in the local labor market negatively affects the productivity of other firms, leading to further negative effects.

2.2 Some relevant institutional characteristics

Finland has several institutional characteristics that are important to take into consideration when analyzing the effects of labor market shocks. Firstly, there are both individual-level and region-level automatic stabilizers that help mitigate the impact of a negative labor demand shock. Secondly, targeted regional policies aim at supporting struggling areas.

At the individual level, a strong social safety net counters the loss of income in the event of job loss. Firstly, laid off individuals are often entitled to unemployment benefits that are linked to previous income for up to 500 days (Työttömyyskassojen Yhteisjärjestö, 2017). Also after this, registered job-seekers are entitled to a minimum support of 32.40 euros per day (Kansaneläkelaitos, 2017). In addition, those in need can apply for a separate housing subsidy. Together with a progressive tax rate, these monetary benefits mitigate the negative effect that job loss has on an individual's disposable income. This may lower the incentives of accepting especially relatively low salaried jobs and also of migrating in search of a job.

In addition to individual-level support, there exists also a municipality-level automatic stabilizer that dampens the negative effects of negative shocks on the affected regions. A system of redistribution of tax income from the state level to municipalities is used to help ensure an equal level of certain basic public services everywhere in Finland. In 2017, this redistribution amounted to 25% of municipal income (Ministry of Economic Affairs and Employment, 2017a).

To supplement these automatic stabilizers, disadvantaged regions and regions that are subject to a negative shock may be targeted with particular regional policies with the aim of directly supporting the area in question. Currently, firms investing in certain disadvantaged areas in eastern and northern Finland receive special investment support (Ministry of Economic Affairs and Employment, 2017b). Furthermore, since 2007 an area hit with mass layoff may be defined as a "region of sudden structural change", which makes it entitled to different forms of assistance. In years 2007-2011, 22 regions qualified for the assistance, with a total amount of allocated support of 220 million euros and state-backed loans and guarantees worth 500 million euros (Hytönen, Mella, & Pousi, 2011).

An additional potentially important factor affecting how regions adjust to labor market shocks is the structure of the Finnish housing market. According to figures by the European Union, the home ownership rate in Finland is relatively high (72.7%) compared to the Euro area average of 66.4% and 51.8% in its largest economy, Germany (Eurostat, 2017). This may reduce labor mobility, as migration often requires both the sale of existing property and the purchase of new property in the new region.

3 Review of empirical literature

In this section, I discuss empirical studies that aim at estimating the effects of job loss, both at the individual and the regional level. I also present papers that provide causal evidence on the presence and magnitude of spillover effects following positive or negative labor demand shocks. Lastly, I shortly discuss two studies that focus on the dynamics of Finnish local labor markets.

The paper that is probably closest to this study in its approach is that of Gathmann et al. (2016), who study the aggregate district-level spillover effects of mass layoffs in Germany and use matching methods to identify suitable control districts. The authors estimate that an initial layoff of 1.9% of regional employment multiplies to 3.7% after 4 years. They conclude that the local labor market adjusts mainly through out-migration and an increase in non-employment, rather than higher unemployment and find that the impact is larger for industries that are economically close to the layoff firm. The authors also find sizable spillover effects, as employment in other firms than the layoff firm is 1.4% lower 4 years after the mass layoff. They argue that agglomeration effects play a more important role than multiplier effects in explaining the decline in employment. The regional effects of labor market shocks has also been studied by for example Blanchard and Katz (1992), who focus on the dynamics of U.S. labor markets in 1950-1990, aiming to understand how local labor markets adjust to shocks. They find that most of the adjustment is through migration, as a decrease in employment in a local labor market of 1 worker is associated with an increase in unemployment by 0.3 workers and a decrease in participation rate by 0.05 workers. Thus, the implied increase in net out-migration is 0.65 workers.

Many studies focus on the individual-level effects of mass layoff events. Holm et al. (2017) look at skill reallocation after the closure of four shipyards in Denmark in 1987-2000. They find that workers who get new employment in industries that have demand for highly similar skills as the previous employer are more likely to get their skills re-employed. They also conclude that regional unemployment rates appear to increase only temporary, as most workers eventually find a new job and some leave the labor force altogether. Out-migration

does not appear to play a large role in skill reallocation. Huttunen et al. (2015) study regional mobility after mass layoffs and plant closures in Norway. They find that workers who have family ties in the layoff region are less likely to move and that movers experience higher income losses than stayers. However, the latter finding is driven by those movers for whom the migration decision depends on other factors than economic gains, such as family ties.

Using the same individual-level Finnish registry database that is used in this study, Appelqvist (2007) studies the cost of job loss in Finland. He finds that the negative impact is different depending on the phase of the business cycle. Workers laid off during the depression of early 1990's have on average 23% lower annual earnings five years after the layoff, compared to just 4% for workers laid off during economic expansion in the late 1990's.

In addition to the paper by Gathman et al. that was discussed earlier, several studies focus on the presence and magnitude of agglomeration and multiplier effects. Greenstone et al. (2010) look at agglomeration effects by studying the impact of large manufacturing plant openings on incumbent plants already operating in the local labor markets. The authors employ a dif-in-dif approach that uses regions that almost got the plant as counterfactuals. They find that the total factor productivity of incumbent plants increases by 12% in five years after the plant opening, providing evidence of agglomeration spillovers. Brascoupe et al. et al. (2010) test the three theories discussed in the previous section regarding the sources of agglomeration (larger labor pool, input-output linkages, knowledge spillovers) with U.S. manufacturing sector data. They find support for all of the sources of agglomeration and argue that agglomeration economies have a stronger effect on firms' location decisions than for example natural advantage. Glaeser and Resseger (2010) document a strong connection between productivity and city-size, especially for cities with high skill level. Their finding is compatible with the existence agglomeration economies and suggests that especially knowledge spillovers are an important source of these economies.

Two recent studies estimate the magnitude of multiplier effects. Moretti (2010) estimates the magnitude of local multipliers in the U.S. by using an IV empirical strategy that exploits the differences in industry structure between cities. The author finds that one additional

job in the manufacturing industry creates 1.6 additional jobs in the non-tradable sector. The multiplier is higher for high-skilled manufacturing (2.5) and higher still for the high-tech sector (4.9). Moretti and Thulin (2013) conduct a similar study with Swedish data, obtaining somewhat different multipliers. The overall multiplier for Sweden is 0.48, and again it is considerably higher for high-skilled workers (2.97).

Focusing on the rationale of regional policies, Kline and Moretti (2013) study the long-run impacts of one of the most ambitious regional economic development policies in the U.S., the Tennessee Valley Authority (TVA). By comparing counties that were part of the TVA program to counties similar in observable characteristics prior to the implementation of the program, the authors find evidence of local-level agglomeration economies in the manufacturing sector. They also develop an approach to study the nation-wide impact of the program, finding that the TVA increased national manufacturing productivity by approximately 0.3%

Several empirical studies focus on the dynamics of Finnish labor markets. Pehkonen and Tervo (1998) study the persistence of differences in unemployment rates between Finnish regions and municipalities between 1963-1993. They find that the differences are rather persistent over time, supporting both the hypothesis of slow adjustment mechanisms and of different equilibrium levels of unemployment. Hämäläinen and Böckerman (2004) look at migration flows in Finland in 1987-1997 and find, among other things, that housing prices and a large share of owner-occupancy housing reduces in-migration, especially for low-income households. However, they do not find evidence that owner-occupied housing restricts out-migration from regions of high unemployment.

4 Data and descriptive statistics

4.1 Data

The main data source in my study is Statistic Finland's FLEED database. It contains rich individual-level data on all Finnish residents aged 15-70 for years 1988-2014. For 1988, the database consists of approximately 3.6 million individuals. By 2014 the number increases to 3.9 million due to population growth. The database includes information on a wide range of variables, from education background to employment status and living conditions. It enables the identification of mass layoff events, since it includes employment information at the plant level. I restrict my analysis to individuals aged 15-64, which is the interval used by Statistics Finland for calculating the employment rate.

4.2 Definition of a mass layoff

The spatial unit of observation observation in my study is the commuting zone[3]. For example Moretti and Thulin use commuting zones when studying local multipliers in Sweden. Since people often cross municipal borders to go to work, especially in the vicinity of large cities, commuting zones arguably give a more accurate picture of actual employment patterns than municipalities.

In my analysis, I use the 2013 classification of commuting zones, which is based on 2010 commuting patterns. There are in total 40 commuting zones consisting of multiple municipalities in Finland according to the 2013 classification. In addition, 93 municipalities do not belong to any municipality, and are treated in the analysis as separate commuting zones. Figure 1 shows CZs with multiple municipalities in gray and one-municipality CZs in white One commuting zone, Maarianhamina, is excluded from the analysis, since it is

[3]A commuting zone consists of a central municipality and other municipalities from which at least 10% of employed individuals commute to the central municipality. A municipality is a central municipality if at least one other municipality belongs to its commuting zone and if less than 25% of employed individuals of the central municipality commute to any other municipality. A municipality can belong to only one commuting zone.

an autonomous region that differs from the rest of Finland in several dimensions such as legislation and is separated from the mainland.

I focus in my analysis on mass layoff that occur between 1989 and 2013. An event is defined as a mass layoff happening in year t if there is a decline in plant size of a plant operating in the tradable sector of more than 200 employees and of more than 1% of commuting zone employment between year *(t-1)* and year t[4]. The lower bound of 1% of commuting zone employment is used to restrict the analysis to events that constitute a sizable shock to the commuting zone labor market. The analysis is restricted to plants operating in the tradable sector to ensure that the layoff is due to factors exogenous to the commuting zone[5]. Layoffs of less than 200 employees are excluded, since small plants are more likely to rely on the local economy than larger ones. Including non-tradable sector plants (eg. construction firms) would mean that the firm in question relies on the local economy for its demand, which means that the shock is unlikely to be exogenous to the layoff region. In contrast, tradable sector firms by definition operate on the national, and due to the small size of the Finnish economy most often also on the international market, which makes the exogeneity assumption more plausible.

There are some additional criteria to be met for an event to qualify as a mass layoff. Firstly, The decline in plant size must meet the above-listed criteria also when comparing years *(t+1)* and *(t-1)*, to make sure that employment in the layoff plant does not recover in the year after the layoff. Secondly, cases where more than 30% of laid off individuals move to a single firm and cases where more than 70% of laid off individuals move to same three firms are excluded as fake layoffs. Thirdly, situations where two layoffs happen in the same commuting zone in consecutive years are combined as a single event happening in the first year.

[4]Or a plant closure that meets the criteria outlined here.

[5]The tradable sector is the part of the economy (eg. manufacturing) that trades or potentially could trade its goods and services on the international market

4.3 Descriptive statistics

Using the criteria presented above, I identify 29 mass layoff events that happen between 1989 and 2013. The number of event plants is 20 and the number of event CZs is 14, which means that some plants and CZs experience several mass layoffs. The limiting criteria for the size of the layoff as a percentage of CZ employment ensures that the mass layoff event are sizable shocks to the local labor markets. The size of the average shock is 3.3% of CZ employment, which is larger than that in the study by Gathmann et al. (1.9%).

Table 1: Descriptive statistics of layoff events

	Mean	Std. deviation
Size of layoff (of CZ employment)	3.3%	3.2%
Size of layoff plant	1511	1510
No. of employees laid off	510	396

Mass layoff plants shed on average one third of their employment in the mass layoff events. Thus, the events identified in the data are large shocks not only to the local economy, but also to the layoff plant. The standard deviations of all the three metrics are rather high, which means that there is relatively large variation in the sizes of individual shocks, layoff plants and in the number of employees laid off.

Figure 2 shows how employment in layoff plants evolves before and after the layoff event. Employment stays relatively constant in the four years before the layoff event and then declines sharply in the layoff year. In the four years after the mass layoff, the decline in employment appears increase somewhat.

A comparison of regional characteristics (Table 2) reveals differences between the 14 CZs that experience at least one mass layoff event during 1989-2013 and CZs that do not experience any mass layoff events. Firstly, mass layoff CZs have on average a 20% larger working age population than non mass layoff CZs. The difference is largely due to the many CZs in the non mass layoff group that consist of a single municipality, which often have a relatively small population. Mass layoff CZs have on average a somewhat lower

employed/pop ratio, a higher unemployment/pop ratio and a higher inactive/pop ratio than non mass layoff CZs. All these differences are statistically significant, but their economic magnitude is limited to 1-2 percentage points[6]. The working-age population of mass layoff CZs is 0.6 years older on average than that of non mass layoff CZs. It also appears to be less educated, with 4% of inhabitants holding at least a master level degree compared to 7% for non mass layoff CZs.

Table 2: Descriptive statistics of Commuting Zones

	(1)	(2)	
	Mass layoff	Non mass layoff	Difference (1-2)
Population	31,354	26,035	5,319
Employed/pop	0.62	0.64	-0.02*
Unemployed/pop	0.10	0.09	0.01*
Inactive/pop	0.16	0.15	0.01**
Income/pop (€)	23,724	25,245	-1,521**
Mean age	40.0	39.4	-0.60**
Masters/pop	0.04	0.07	-0.03**

Significance levels: *=0.05, **=0.01. All values except those for population and the number of employed are weighted by CZ population. Inactive population includes individuals on different forms of pension and otherwise inactive people. Income refers to the sum of taxable earned and capital income plus social transfers, such as unemployment benefits and housing subsidies. Income is in 2014 euros. Masters/pop shows the share of population having attained at least a graduate-level academic degree.

[6]Inactive individuals are defined as persons who are not employed, unemployed or students, but are either retired or otherwise inactive in the labor market

5 Empirical strategy

To identify local effects of mass layoffs, I use a differences-in-differences empirical strategy that compares developments in the event CZs to developments in CZs that do not experience a mass layoff in the same year. The main identifying assumption for causal interpretation of results when using a dif-in-dif strategy is that the event CZ would have evolved similarly as the control CZs had it not experienced a mass layoff event[7]. Since I am using information on all Finnish regions in my analysis, the control group is in effect the rest of Finland. Thus, the assumption is that in the absence of a mass layoff, the event CZ would have evolved in parallel with the rest of Finland.

Another important consideration regarding the empirical strategy is whether and to which extent the control group might be affected by the mass layoffs in the treatment group. For example, out-migration from one CZ is always in-migration to another CZ (if people do not move abroad), and thus a difference-in-differences approach may lead to an overestimation of the true effect. In the case of two equally sized CZs, the fact that the control group is affected by the layoff would lead to an overestimation of the true effect of a mass layoff on population by 100% as a decrease of one individual in the layoff CZ creates a corresponding increase in the control CZ. With 10 regions the bias already drops to 10%. In this study, with relatively few events and event regions and the whole of Finland as a control group, the bias caused by the control group being affected is not of practical relevance.

5.1 Main regression specification

I use the following main regression specification in my analysis:

$$Y_{i,t+j} = \alpha + \beta * LayoffSize_{it} + \gamma * Y_{i,t-1} + \theta_t + \epsilon_{it} \quad , when \qquad j = \{0, 1, 2, 3, 4\} \qquad (1)$$

The specification used is a lagged dependent variable model. The subscript i refers to the CZ in question, t to calendar year and j to year relative to the layoff event. The independent variable of interest is $LayoffSize_{it}$, which is defined as the size of the layoff as a share of CZ

[7] see eg. (Angrist & Pischke, 2008, Chapter 5)

population. It takes the value zero for CZs that do not experience a mass layoff in the event year and a value above zero for CZs that do. $Y_{i,t-1}$ is the value of the dependent variable one year before the layoff event. α is a constant, $theta_t$ includes year fixed effects and ϵ_{it} is the error term.

The specification compares developments in event CZs to those in non mass layoff CZs from the year of the event until 4 years after the layoff. The yearly coefficients are then interpreted as the difference in the level of the dependent variable between the treatment and the control group, compared to the situation one year before the event. The lagged dependent variable specification can be understood as a crude form of matching, since it forces the event region and the control regions to be similar in terms of the dependent variable prior to the layoff event.

Standard errors are clustered at the CZ level to take into account potential correlation of errors within CZs. The regressions are weighted by CZ population, because small and large regions may behave differently and without weighting this would give too much emphasis on what happens in small CZs.

As dependent variables of interest, I look at the log number of employed individuals, log of the sum of income in the CZ, log population and employment as a share of population, unemployment as a share of population and inactive individuals as a share of population.

A crucial requirement for a causal interpretation of results when using a dif-in-dif empirical strategy is that the trends of the treatment and control group are parallel prior to treatment. To analyze developments before the layoff year, I use a slightly different specification (2).

$$Y_{i,t+j} = \alpha + \beta * LayoffSize_{it} + \lambda * Y_{i,t+j-1} + \theta_t + \epsilon_{it} \quad , when \qquad j = \{-4, -3, -2, -1\} \quad (2)$$

The difference to the main specification is in the lagged dependent variable term. In the main specification, the control is always for the year before the layoff year, while in this specification, the values of the lagged dependent variable are for the previous year. The coefficients for years -4 to -1 relative to the layoff event are thus interpreted as the difference in yearly growth rate between the treatment and the control group.

5.2 Discussion of model choice

The main alternative dif-in-dif specification for my analysis would be a fixed effects model. The key difference between the models is in the likely mechanism that determines selection into the treatment. A fixed effect model assumes that the most important omitted variables are time-invariant, while a lagged dependent variable model assumes that selection depends more on developments before the treatment. Thus, using the latter model would be preferable if the mass layoff CZ was negatively affected by the layoff firm's difficulties already before the mass layoff event. As it would appear plausible that at least the layoff firm was having difficulties already before resorting to mass layoffs, this hypothesis seems sensible, which is why I choose the lagged dependent variable model as my main specification.

This said, it still difficult to assess whether the most important omitted variables are time-invariant or whether selection depends more on past developments in this context. Using a model that includes both a lagged dependent variable and fixed effects is not possible, since the estimates given by such a model would not be consistent (Angrist & Pischke, 2008, pp. 182-185). Thus, I employ a fixed effects model as a robustness check to see whether the results are sensitive to model choice.

6 Results

This section describes the empirical results of the study. I begin by presenting the results of the lagged dependent variable model, followed by a discussion of the results and their limitations. As a robustness check, I use a fixed effects model to see whether the results are sensitive to model choice.

6.1 Main results

As outlined in the empirical strategy section, the main regression specification uses a lagged dependent variable model with mass layoffs size as a percentage of CZ population as the independent variable interest. Table 3 shows the estimates for the variable of interest for log employment and log income from four years before to four years after the event year t=1.

As explained in the empirical strategy section, coefficients in years t-4 to t-1 are interpreted as differences in yearly growth rates while coefficients for t=0 and after estimate differences in the level of the outcome variable compared to t-1. Prior to the event in year t=0, the treatment group and the control group evolve largely similarly, which is clearly visible in figures 3 and 4. This gives support to the key identifying assumption of prior parallel trends. A coefficient of zero would mean that the growth rates are identical. Here, they differ somewhat from zero but the differences are mostly statistically insignificant.

In contrast to the similar trends before the layoff year, in the event year and after there is a clearly visible difference in trends. In the short term, a mass layoff leads to a large drop in employment, while the decrease in income is much smaller. In the layoff year, a mass layoff of 1% of CZ population leads to a 1.4% decline in the number of employed, while income goes down by only 0.29%, with the estimate being statistically insignificantly different from zero. In the medium term, the decline in employment appears to stabilize and even reverse somewhat, while the decline in income becomes gradually larger, reaching 0.88% after four years. However, in later years the estimates become increasingly imprecise, so that in t+4 the null hypothesis of no effect on employment cannot be rejected with 95% confidence.

A natural follow-up question is where does the decline in the number of employed individ-

Table 3: Lagged dependent variable regression results

	Dependent variable of interest	
	Log employed	Log income
	(1)	(2)
t-4	-.260* (.089)	-.255 (.146)
t-3	-.110 (.081)	-.051 (.103)
t-2	.108 (.100)	.092 (.067)
t-1	-.132 (.084)	.045 (.091)
t=0	-1.398** (.261)	-.291 (.206)
t+1	-1.024** (.149)	-.792** (.204)
t+2	-.895** (.175)	-.753** (.239)
t+3	-1.172** (.401)	-.624* (.256)
t+4	-.981 (.534)	-.880* (.383)
CZ fixed effects: No	Year fixed effects: Yes	

*Notes: Significance levels: *=0.05, **=0.01. The coefficients are for the independent variable of interest, mass layoff size as a percentage of CZ population. Mass layoff event happens between t-1 and t=0. Regression specification changes between t-1 and and t=0.*

uals show. Theoretically, workers that become unemployed can either choose to migrate or stay in the layoff CZ and try to find new employment there. To shed light on these patterns, table 4 shows lagged dependent variable estimates for the other outcomes of interest.

In the short term, only a small share of population migrates to a different labor market after a mass layoff event, and most of the decline in employment translates into higher unemployment. In the layoff year, population declines on average by 0.13%. Since the number of movers is relatively low, the layoff event puts downward pressure on the employment rate, which declines by 0.69 percentage points. This decline is mirrored mostly in an increase of

Table 4: Lagged dependent variable regression results

	Dependent variable of interest			
	Log pop	Empl./pop	Unempl./pop	Inactive/pop
	(1)	(2)	(3)	(4)
t-4	-.032 (.055)	-.130** (.029)	.096* (.038)	.007 (.025)
t-3	-.027 (.047)	-.045 (.049)	.041 (.069)	.048** (.015)
t-2	.016 (.055)	.050 (.058)	-.046 (.040)	.027 (.015)
t-1	-.005 (.041)	-.084 (.050)	.055 (.036)	-.003 (.021)
t=0	-.134** (.036)	-.693** (.116)	.575** (.123)	.036* (.015)
t+1	-.208** (.067	-.445** (.081)	.271** (.080)	.127** (.036)
t+2	-.270** (.097)	-.317** (.103)	.213* (.085)	.116** (.023)
t+3	-.268 (.171)	-.473* (.236)	.333 (.192)	.135** (.038)
t+4	-.373 (.221)	-.297 (.270)	.162 (.207)	.173** (.044)
CZ fixed effects: No Year fixed effects: Yes				

*Notes: Significance levels: *=0.05, **=0.01. The coefficients are for the independent variable of interest, mass layoff size as a percentage of CZ population. Mass layoff event happens between t-1 and t=0. Regression specification changes between t-1 and and t=0.*

unemployed/pop by 0.58 percentage points. There is practically no increase in the share of inactive population in the layoff year.

In the medium term, more people choose to migrate, which is visible in the continued decline of population that almost triples to 0.37% by t+4. Both the employment rate and the share of unemployed of population improve gradually, as visualized in figure 6. The share of inactive population increases in the medium term by 0.17 percentage points. Again, the medium term estimates must be interpreted with bigger caution than the short-term estimates due to lower precision.

6.2 Discussion of results

Based on the empirical results, it seems that in the short term most of the adjustment to a negative labor demand shock happens rather through an increase in CZ unemployment than through migration to other regions. In the medium term, the decline in population becomes more pronounced and also the share of inactive population gradually increases. The increasing importance over time of out-migration and the increase in the share of inactive population is broadly in line with the findings for example of Gathmann et al. (2016) and Blanchard & Katz (1992), who find that local labor markets adjust mainly through out-migration and that a decrease in employment is also associated with an increase in the share of inactive population.

The relatively low share of migrating workers suggests that labor may not be particularly mobile in the Finnish context. Considering the average employment rate of 0.6 and assuming that all the movers are those who were previously employed, the log population estimate of -.134 implies that around 0.22% ($\frac{.134}{.6}$) of employed population would decide migrate due to a mass layoff event. This would mean that approximately 1/7 of the decline in employment translates to a decline in population, while 6/7 shows as an increase in unemployment or non-employment.

There are many potential factors that can discourage migration even if employment prospects in a particular region deteriorate. A high rate of home ownership is one of the potential hindering factors, since selling a house or an apartment in a declining area may prove difficult. Existing family ties may also make migrating a less appealing option. In the short term, the financial pressure of seeking new employment is also limited by the combination of unemployment benefits that are tied to prior income and a progressive tax rate, which together dampen the decline in net income. This is also visible in the results, with a lower drop in CZ income compared to the drop in CZ employment especially in the first years after the layoff event.

The small initial drop in CZ income is probably mostly due to two factors. As mass layoffs can happen at any point of the year, laid off individuals still have earnings from the

layoff plant in the layoff year. Moreover, UI benefits are higher at the start of unemployment since they are tied to previous income. The later decline in aggregate income may be both a cause and effect of population decline.

In the short term, most of the decline in the employment rate translates to an increase in the share of unemployed population, while inactive/pop stays practically constant. However, in the medium term, the increase in inactive population and the increase in unemployment explain roughly equal shares of the decline in employment rate, as the share of unemployed population gradually decreases and the share of inactive population increases. One explaining factor could be selection, since it is plausible that those closer to retirement with weaker incentives to seek employment and also weaker labor market prospects are less likely to migrate than younger workers.

What is interesting is that in contrast to the study of Gathmann et al., there are no sizable spillover effects visible in the results. If spillover effects were considerable, one would expect the decline in employment to continue in the medium term. This is a clear difference between the the German study and my results. Whereas I find that the decline in employment stabilizes or recovers in the medium term, Gathmann et al. find that the decline in employment multiplies by a factor of more than 2.5 from 1.4% to 3.7% between the layoff year and four years after the layoff. Even though the German study uses a somewhat different empirical strategy, this alone should not amount to such a clear difference in the results.

The difference in results and the lack of visible spillover effects could at least partly be due to Finnish institutional characteristics discussed in section 2 that mitigate the decline in aggregate demand in the local economy. Firstly, there are several automatic stabilizers that dampen the decline in income at individual and regional level in the case of a negative shock. Secondly, there are also specific regional policies in place that are designed to support "regions of sudden structural change". Thirdly, a high rate of home ownership (72.7%) may discourage migration compared to Germany's 51.8%.

6.3 Limitations

There are some limitations that need to be considered when drawing conclusions from the results. Regarding internal validity, the rest of Finland is not necessarily the most suitable control group. Thus, results obtained by for example a matching strategy could be somewhat different to those seen here. A different definition of a mass layoff event could also yield different results.

When it comes to external validity, it is also worth noting that the estimates are for the average effect of mass layoffs in 1989-2013. The interval includes both severe downturns and times of rapid economic growth. It is plausible that the effects of mass layoffs are not identical in different phases of the business cycle. Unfortunately, the relatively low number of events does not allow for heterogeneity analysis of this sort. The results are also probably dependent on the Finnish context, as discussed in previous sections. A strong social safety net, patterns of home ownership and regional policies, for instance, are among factors that are likely to affect the results.

6.4 Robustness check: Fixed effects model

As discussed in the empirical strategy section, an alternative regression specification for the lagged dependent variable model would be a fixed effects model. To check whether the results are sensitive to regression specification, I use a fixed effects model as a robustness check. The regression specification for the robustness check is as follows.

$$Y_{it} = a_i + \beta * LayoffSize_{it} + \theta_t + \epsilon_{it} \tag{3}$$

The difference between the fixed effects specification and the lagged dependent variable model is that instead of lagged values of the dependent variable, the model includes a_i which controls for CZ fixed effects to account for differences between CZs that do not vary over time.

The fixed effects are shown in tables 5 and 6. Of main interest here is what happens between t-1 and t=0, compared to the lagged dependent variable specification. For example,

Table 5: Fixed effects regression results

	Dependent variable of interest	
	Log employed	Log income
	(1)	(2)
t-4	.121 (.560)	-.015 (.573)
t-3	.352 (.497)	.267 (.324)
t-2	.686 (.601)	.544 (.405)
t-1	.598 (.555)	.649 (.369)
t=0	-.977* (.386)	.343 (.301)
t+1	-.621 (.695)	-.280 (.518)
t+2	-.448 (.751)	-.201 (.576)
t+3	-.132 (.571)	.393 (.406)
t+4	.085 (.753)	.085 (.505)
CZ fixed effects: Yes	Year fixed effects: Yes	

*Notes: Significance levels: *=0.05, **=0.01. The coefficients are for the independent variable of interest, mass layoff size as a percentage of CZ population. Mass layoff event happens between t-1 and t=0.*

in the fixed effects specification, the number of employed declines by 1.58%, whereas the lagged dependent variable estimate is 1.4%. For population the figures are 0.21% compared to 0.13%, and for unemployment as a share of population 0.58% compared to 0.58%. As the results are largely similar also for the other outcome variables, the results appear not to be driven by model choice. Moreover, when the results of the different specifications are plotted in the same graphs in figures 8 and 9, the story they tell is largely similar. As a whole, the coefficients obtained with the fixed effects model provide confidence that the results are robust to the main alternative regression specification.

Table 6: Fixed effects regression results

	Dependent variable of interest			
	Log Pop	Employed/pop	Unemployed/pop	Inactive/pop
	(1)	(2)	(3)	(4)
T-4	.181 (.393)	-.033 (.124)	.069 (.049)	-.091 (.065)
T-3	.426 (.325)	-.065 (.137)	.082 (.100)	-.046 (.068)
T-2	.541 (.377)	.060 (.168)	-.017 (.108)	-.051 (.083)
T-1	.526 (.384)	-.001 (.124)	.012 (.108)	-.070 (.071)
T=0	.312 (.402)	-.752** (.084)	.638** (.104)	-.046 (.056)
T+1	.135 (.444)	-.459* (.201)	.285 (.173)	.045 (.045)
T+2	.055 (.447)	-.300 (.235)	.214 (.184)	.010 (.074)
T+3	.258 (.370)	-.229 (.220)	.165 (.190)	-.033 (.067)
T+4	.128 (.417)	-.029 (.271)	-.031 (.195)	-.006 (.074)
CZ fixed effects: Yes Year fixed effects: Yes				

*Notes: Significance levels: *=0.05, **=0.01. The coefficients are for the independent variable of interest, mass layoff size as a percentage of CZ population. Mass layoff event happens between t-1 and t=0.*

7 Conclusions

In this study, I have focused on the regional effects of mass layoffs. I find that in the short term, a mass layoff of 1% of CZ population leads to a 1.4% decline in employment that translates mainly to an increase in unemployment, while the decline in income and population is relatively limited. In the medium term, declines in population and income become more pronounced, while the share of unemployed in the layoff region improves and the share of inactive population increases.

The initial lack of considerable impact on income and population could at least partly be due to Finnish institutional context. UI benefits that are tied to previous income for approximately the first two years of unemployment mitigate the decline in earnings for those who lose their jobs and a high rate of home ownership may hinder migration. The medium term increase in the share of inactive population may reflect selection, as workers that are closer to retirement age may be less inclined to migrate than younger individuals.

What is interesting is the lack of visible spillover effects in the results, contrary to the German study by Gathmann et al., who find a continued decline in employment after mass layoff events. Among possible explaining factors to this difference are differences in empirical strategy and in institutional context. Whereas Gathmann et al. employ matching to find suitable control districts, I use the whole of Finland as a control group. In addition, for example the home ownership rate is considerably lower in Germany (51.8%) than in Finland (72.7%) which may affect migration choices and there may also be differences in labor market policies that can explain at least part of the difference in the results.

This study has contributed to literature that seeks to understand the dynamics of local labor markets. Its insights may also have practical relevance when designing regional policies after mass layoff events. A potential topic of future research would be to disentangle the direct and indirect regional effects of mass layoffs for a more accurate assessment of potential spillover effects.

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A Figures

Note: Error bars in figure 2 refer to the standard error of the mean, while in figures 3-7 they refer to the 95% confidence interval. The dashed vertical lines in figures 3-7 mark the change of regression specification.

Figure 1: Commuting Zones in 2013. Source: Statistics Finland

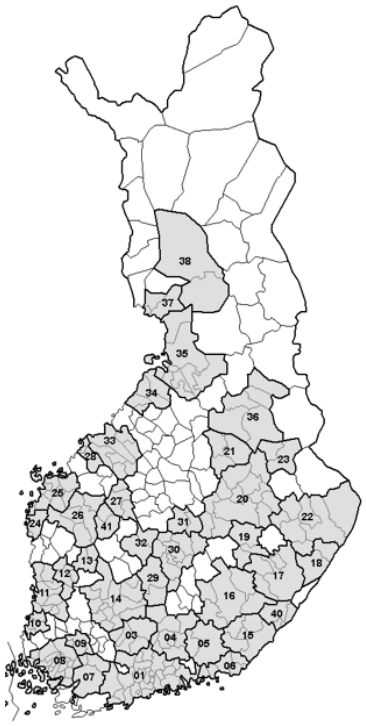

Figure 2: Employment in layoff plants

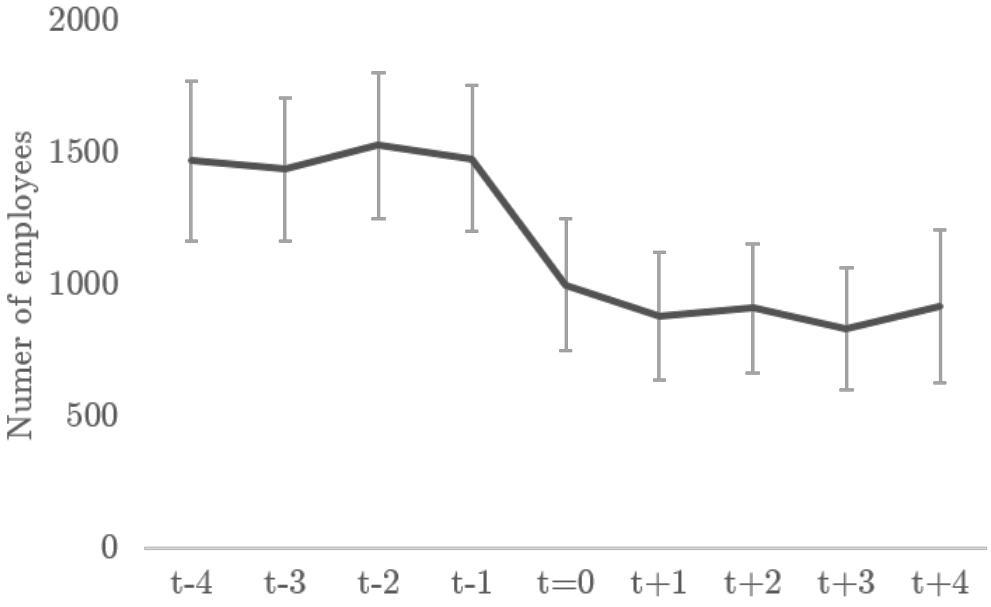

Figure 3: Effect of mass layoff on the number of employed

Figure 4: Effect of mass layoff on income

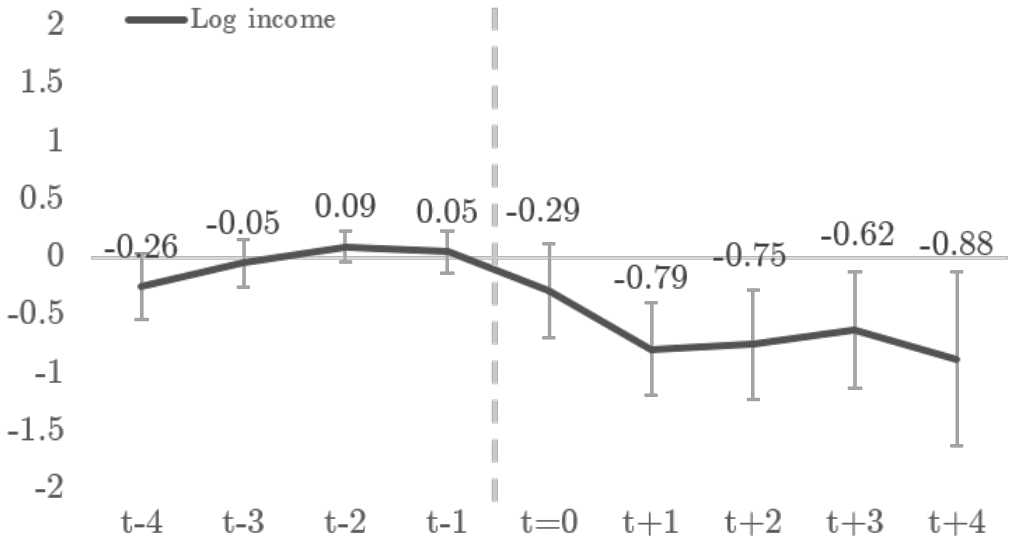

Figure 5: Effect of mass layoff on population

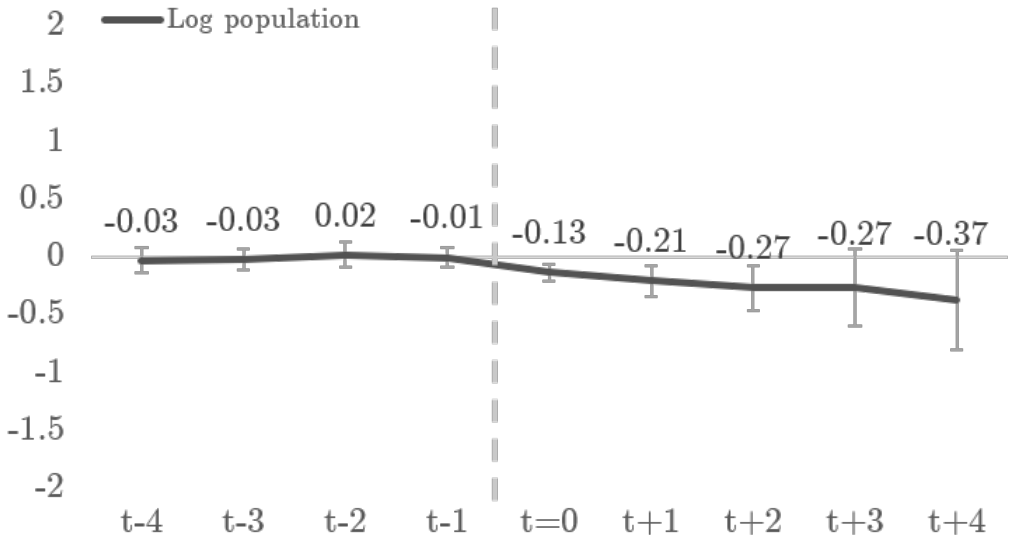

Figure 6: Effect of mass layoff on employment and unemployment rates

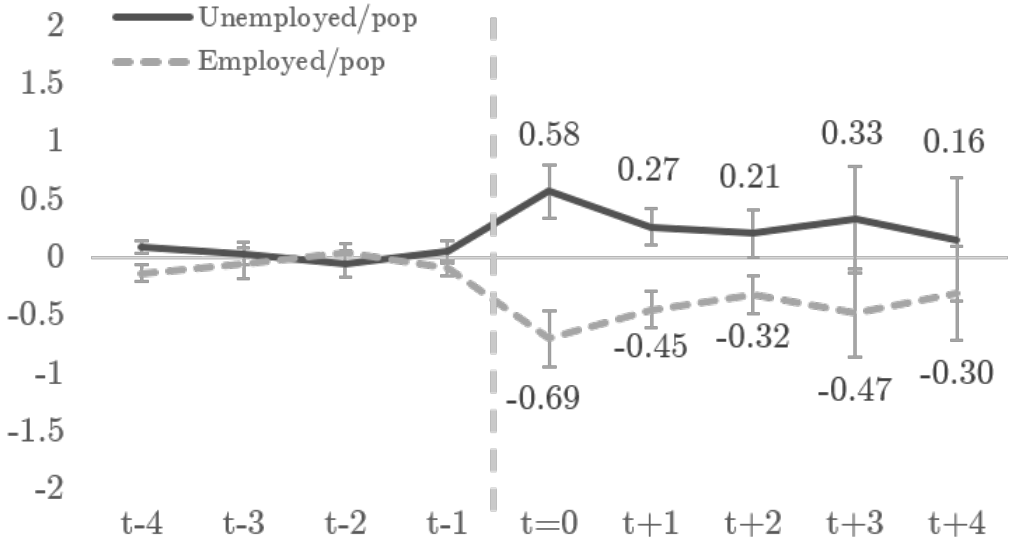

Figure 7: Effect of mass layoff on inactive/pop

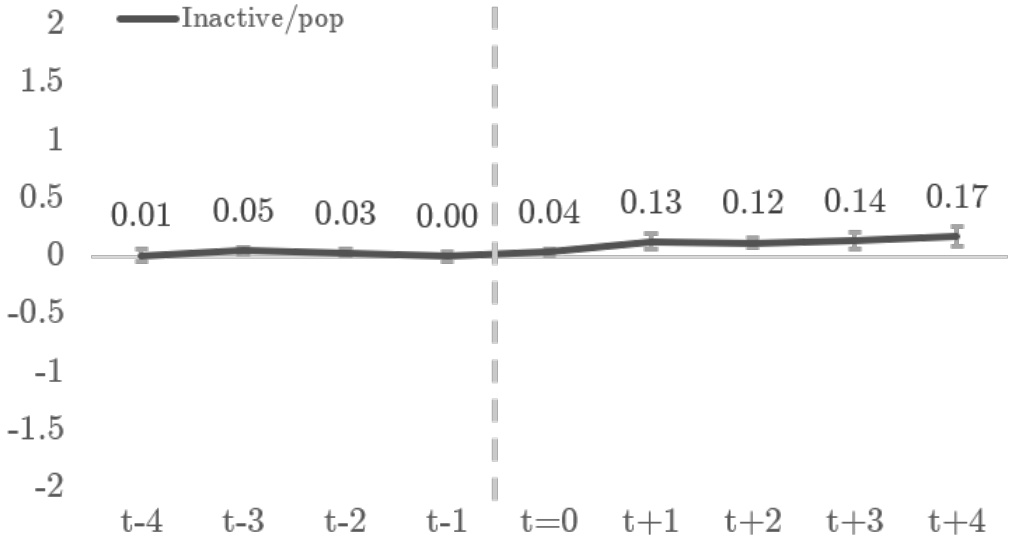

Figure 8: Comparison of log employed estimates

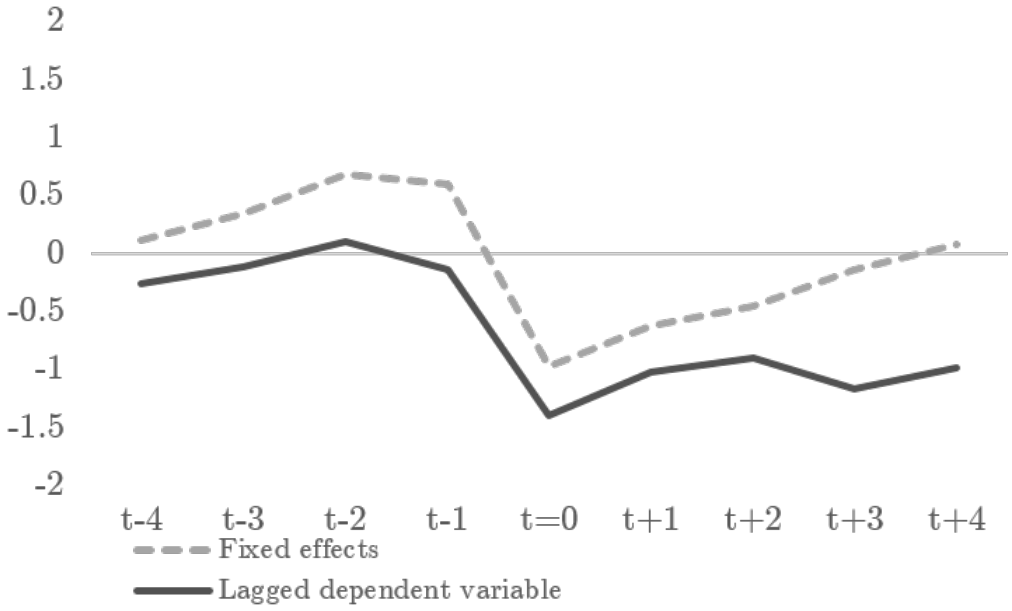

Figure 9: Comparison of lagged dep. var. & FE estimates