VATT-KESKUSTELUALOITTEITA
VATT DISCUSSION PAPERS

422

WAGE AND EARNINGS LOSSES OF DISPLACED WORKERS IN FINLAND

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Helsinki 2007

I would like to express my gratitude to both Ossi Korkeamäki and Tomi Kyyrä who have been invaluable in helping this study to be completed. In addition, I owe thanks to Panu Poutvaara and Hanne Ahonen for their many comments on earlier drafts of this paper. Seija-Liisa Ahonen kindly typeset this in VATT-format. Naturally, the author is solely responsible for any mistakes that may remain.

ISBN 978-951-561-717-0 (nid.)
ISBN 978-951-561-718-7 (PDF)

ISSN 0788-5016 (nid.)
ISSN 1795-3359 (PDF)

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Oy Nord Print Ab

Helsinki, May 2007

APPELQVIST, JUKKA: WAGE AND EARNINGS LOSSES OF DISPLACED WORKERS IN FINLAND. Helsinki, VATT, Valtion taloudellinen tutkimuskeskus, Government Institute for Economic Research, 2007, (C, ISSN 0788-5016 (nid.), ISSN 1795-3359 (PDF), No 422). ISBN 978-951-561-717-0 (nid.), ISBN 978-951-561-718-7 (PDF).

Abstract: The purpose of this study is to investigate the cost of job displacement for private sector workers displaced in Finland during the years 1992 and 1997. Our main goal is to measure the ways in which involuntary job loss affects the subsequent labor income of displaced workers when compared to similar workers who were not displaced. Our main finding is that displaced workers suffer substantial and persistent losses in both monthly wages and annual earnings. The severity of these losses is related to the time during which the displacement happened: the workers who were displaced in 1992 (during the recession) suffered considerably larger losses than the workers who were displaced in 1997. The final section of the study discusses possible explanations for the estimated losses.

Key words: displacement, earnings losses, unemployment

APPELQVIST, JUKKA: WAGE AND EARNINGS LOSSES OF DISPLACED WORKERS IN FINLAND. Helsinki, VATT, Valtion taloudellinen tutkimuskeskus, Government Institute for Economic Research, 2007, (C, ISSN 0788-5016 (nid.), ISSN 1795-3359 (PDF), No 422). ISBN 978-951-561-717-0 (nid.), ISBN 978-951-561-718-7 (PDF).

Tiivistelmä: Tässä tutkimuksessa pyritään selvittämään irtisanomisesta syntyvää kustannusta Suomessa vuosina 1992 ja 1997 irtisanotuille yksityisen sektorin työntekijöille. Tutkimuksen pääasiallisena tarkoituksena on selvittää, miten irtisanominen vaikuttaa tuleviin työtuloihin, kun vertailuryhmänä käytetään vastaavia ei-irtisanottuja työntekijöitä. Tutkimuksen keskeinen tulos on, että irtisanotuksi tulemisella on pitkäkestoinen ja suuruudeltaan huomattava vaikutus sekä vuosiansioihin että uudelleen työllistyneiden työntekijöiden kuukausipalkkoihin. Menetysten suuruus on sidoksissa irtisanomisen ajankohtaan: irtisanomisella on oleellisesti suurempi vaikutus vuonna 1992 (lama-aikana) irtisanottujen työntekijöiden ryhmässä kuin vuonna 1997 irtisanottujen ryhmässä. Lopuksi työssä tarkastellaan mahdollisia selityksiä saaduille tuloksille.

Asiasanat: irtisanominen, ansionmenetykset, työttömyys

Contents

1. Introduction

As a result of downsizing or firm exit, a large number of workers is forced to leave their jobs every year. Some of these displaced workers are able to find equally good employment elsewhere, whereas others experience unemployment spells or must be willing to accept a significant reduction in earnings in order to find work again. Since many people are, directly or indirectly, affected by job displacement at some point in their life, it is not surprising that the costs of job loss have been a focus of intensive study. A typical conclusion in these studies has been that displaced workers suffer large and persistent losses as a consequence of their dismissal.[1]

Worker displacement is typically defined as permanent and involuntary separation of workers with established work histories initiated by economic factors unrelated to job performance. In practice, we can take separations involving a mass layoff or a plant closure to be displacements, since they are likely to be exogenous from the worker's standpoint. In contrast, firings for cause, endings of temporary contracts, or voluntary quits are not displacements. (See, for example, Fallick 1996; Kletzer 1998; Kuhn 2002.)

All economies are constantly changing for various reasons. As a part of this process, new firms enter and old firms exit the market or plants are relocated. Sometimes older production technologies become obsolete or new products are introduced causing a decrease in the demand for previously successful products. One consequence of these dynamic forces is that some plants expand and hire more workers while others are forced to lay off their employees when they cannot adapt to the new circumstances or compete against their rivals.

Technological advances, sectoral reallocation, and the possibility to restructure production more efficiently are, undeniably, fundamental sources of economic growth. These factors ultimately underlie the constant rise in our standard of living. At the same time, it is equally clear that such changes in production cannot come without adjustment costs. For many workers, industrial adjustment means that their current jobs are terminated. In the worst case, it also means that there is little demand for the skills they have acquired over the years. The reason for this may be that the production is being relocated, typically to a country that offers lower production costs, or simply that there is no demand anymore for the goods or services previously produced by those individuals.

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[1] The most influential study on the cost of involuntary job loss in the US is the one by Jacobson *et al.* (1993). According to their estimates, the earnings of displaced workers are roughly 25% lower than they would have been otherwise even five years after separation. For reviews of earlier studies on the costs of job displacement in the US, see Fallick (1996) and Kletzer (1998).

The purpose of this study is to investigate the cost of job displacement for the displaced workers in Finland. A linked employer-employee panel data, which has been constructed from administrative records by Statistics Finland, is used to identify all private sector workers who were displaced in Finland during the years 1992 and 1997. These two groups of workers are followed over a nine-year period beginning three years before and ending five years after the displacement took place: from 1989 until 1997 and from 1994 until 2002, respectively. Both Ordinary Least Squares (OLS) and Fixed Effects (FE) models are used to estimate the consequences of displacement. Our main task will be to measure the ways in which involuntary separation at some point in time affects annual earnings and monthly wages after displacement when contrasted with similar workers who were not displaced.

The years chosen for this study reflect markedly different macroeconomic conditions in Finland. In the beginning of 1990s, Finland suffered a severe recession, and the employees who were displaced in 1992 faced an exceptionally difficult labour market situation.[2] However, given the fast recovery from the recession, the Finnish macroeconomic climate was dramatically changed by the end of 1990s. Consequently, the workers displaced in 1997 encountered an entirely different situation. The first case, in which the job loss took place in 1992, is an extreme case that highlights the severe consequences that may follow from a displacement during a deep recession. It should be seen as an interesting, albeit nearly unique, special case while keeping in mind just how atypical the Finnish labour market conditions were in 1992. In many ways, the latter case is more typical and hence more in line with the research on displacement conducted elsewhere.[3]

Despite active research elsewhere, little is known about the consequences of worker displacement in Finland. There is no reason to think that the results from similar studies from other countries are directly applicable if we want to know about the process of industrial adjustment in Finland given the differences in institutional characteristics. This study is an attempt to provide more accurate estimates on the cost of job loss in Finland.

The main focus of the research on worker displacement has always been empirical. This study will follow the same tradition by applying similar methods to Finnish data. However, in addition to the empirical results, the research on displacement also offers some promise for better understanding the mechanisms

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[2] The Finnish real GDP dropped approximately 14 percent between 1990 and 1993 causing the unemployment levels to reach 20 percent. For a discussion of the Finnish recession, see, e.g., Honkapohja and Koskela (1999).

[3] Similar analysis was conducted for all displacements taking place between 1991 and 2000 to make sure that different base years do not produce erratically changing results; more on this topic in Section 5.

of wage determination in general and the role different institutional characteristics and macroeconomic factors play in them.

The rest of this study is organized as follows. We begin in Section 2 by reviewing the empirical literature on worker displacement both in Europe and the US. In Section 3 we describe our data and the technique used for identifying displaced workers. In Section 4 we discuss in more detail our empirical methods and the specifications used. The estimation results are presented and discussed in Section 5. Section 6 includes some discussion on possible explanations that could be given to explain the results. Finally, Section 7 concludes.

2. Literature Review

2.1 Background

Empirical study of the consequences of job displacement using the methods that have now become standard originated in the US in the beginning of 1990s. Quite a few studies on displacement had already been published earlier, but they had suffered from methodological drawbacks. Though this research had been able to establish some rough findings, it could not focus on the most interesting issues and is not directly comparable with later work.[4]

These early studies had used a somewhat simplistic strategy of comparing the earnings of the same workers before and after displacement. Perhaps the most significant problem with this approach is that it leaves out the earnings growth that would have taken place had the worker stayed with the same employer. Similarly, this method cannot measure macroeconomic factors that would have influenced earnings at later dates if the workers had not been displaced. The method is also unable to detect possible changes in the earnings that may have taken place already before the actual displacement happens. (See, for example, Jacobson *et al*. 1993.)

At best, the studies comparing the same workers before and after displacement can be taken as giving rough estimates of the short-term costs of job loss. For the above reasons, practically all of the recent studies on the costs of job loss have employed a methodology that involves a comparison of displaced workers with a control group of similar workers who did not experience displacement. This methodology has been influenced by earlier literature on policy evaluation. These evaluation methods have been developed to estimate treatment effects: for example, the ways in which social programs, such as training, affect labour market outcomes.[5] Similar methods were first introduced to the study of worker displacement by Ruhm (1991) and Jacobson *et al*. (1993).

The use of control groups is best seen as an attempt to construct a counterfactual scenario that can be used to mimic the alternative in which the workers who actually were displaced would not have been displaced. Perhaps the most important consequence of this new methodological approach is that it shifts the focus of displacement research to the dynamic long-term effects of displacement. As a result, this has made the whole discussion vastly more interesting given that it is not particularly surprising that displaced workers have lower earnings immediately following displacement.

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[4] We will not discuss the results from these early studies in detail; for a review, see Hamermesh (1989).

[5] For a review, see Blundell and Costa Dias (2000) or Pekkarinen (2006).

One important characteristic of these methods is that their implementation requires fairly sophisticated data sets. Most of the early research was conducted using the Displaced Worker Survey (DWS) which is a supplement to the Current Population Survey carried out by the US Bureau of the Census. The DWS only includes information on workers who have actually been displaced and it cannot be used to construct relevant control groups. It is also clear that to estimate the long-term effects of displacement we need panel data, since we need information on individuals at more than one point in time to see how their labour market status changes over time. One reason for the increased interest in the consequences of job loss is the fact that suitable longitudinal data sets have become available in many countries in recent years.

2.2 Data Sources

Different studies on worker displacement that we will review in Sections 2.3 and 2.4 use data collected from different types of sources. Setting more nuanced differences aside, the resulting data sets used can be divided into two broad classes: data based on administratively maintained records and data from survey studies. Both types of data have their pros and cons.

The main problem with data sets constructed from administrative records is that typically they only include information on the employment status, not on the reasons behind separations. Therefore, the identification of displaced workers is more complicated and must be done indirectly through a process of inference as will be explained later.[6] This process is not perfectly accurate, which implies that the results may include some bias. On the other hand, data from administrative records is highly reliable in other respects and there is little reason to doubt the data regarding individual earnings or control variables. In addition, the data sets are usually very large compared to data sets that come from survey studies. Large samples make it possible to reliably estimate the effects of displacement even for fairly small specifically chosen groups (elderly workers, highly educated workers etc.).

When data is collected from survey studies, several potentially troubling issues arise. At first, it may seem that the advantage that comes from using survey data is the precise identification of displacement events. However, this may in fact not be the case. In all survey studies, the occurrences of displacements are self-reported. Clearly, the self-reported reasons for separations, given by the workers themselves, raise several worries. It has been noted that in many cases workers and firms disagree on the reasons behind a separation and it is unclear which party should be trusted (see, for example, Kuhn 2002). Some workers might be unwilling to admit that they have been displaced. Others might claim that they have been displaced even though, in reality, they were fired for a just cause. It is

[6] The details of this method are explained in Section 3.

also likely that some workers classify themselves as displaced when their fixed-term contract expires, whereas others do not. It has also been noted that often workers only report recent displacements and leave out earlier ones, especially if they have been re-employed (see, for example, Jacobson *et al*. 1993). All these factors may cause bias in survey studies.

In addition to the problems just listed, the survey studies raise other similar worries regarding self-reported data and recall bias. In general, all self-reported data on earnings, employment levels etc. is less reliable than data taken directly from administrative records like tax records. It also seems likely that survey studies include more self-selection, since they typically do not require displacements to take place due to a mass-layoff or plant closure that would capture the idea of exogenous involuntary separation more accurately. Finally, sample attrition can be a problem for many longitudinal survey studies.

Both types of data also have some problems in common. Typically, there is no exact information on the amount of hours worked. Some studies estimate annual or quarterly earnings, whereas others estimate monthly, weekly or hourly wages. However, the exact amount of work done during the period chosen is unknown. Consequently, the estimates for earnings losses confound earnings reductions resulting from (1) lower hourly wages, (2) unemployment, (3) nonemployment, and (4) involuntary part-time jobs. This makes the exact comparison of different studies difficult. In addition, most data sets do not have information on individuals who are not employed or at least part of the labour force. Instead, the analysis is restricted to individuals with some labour market attachment even after displacement. It follows that not all costs resulting from joblessness are included. Furthermore, it is a possible source of selection bias if displacement pushes least productive workers permanently out labour force.[7]

2.3 Results from the US

The most influential single study on the costs of job loss has been the already mentioned paper by Louis Jacobson, Robert LaLonde, and Daniel Sullivan (1993). Unlike most others before them, Jacobson *et al*. did not approach the estimation problem by using the Displaced Worker Survey. Instead, they constructed a longitudinal data set from unemployment insurance tax reports and quarterly reports firms give on employment. The use of administrative records and longitudinal data allowed Jacobson *et al*. to implement the method in which a control group and a group of displaced workers are compared over time.

The data in Jacobson *et al*. was collected from the state of Pennsylvania and it contained information on workers' quarterly earning from 1974 to 1986. In

[7] The data used in our study makes it possible to estimate losses following displacement regardless of the labour force participation, see, Section 3.

accordance with the general definition of ”displacement”, they only focused on workers with strong labour market attachment; in this case, workers who had six or more years of tenure. Jacobson *et al*. also required that everyone included in the sample had positive earnings for every year.[8] Since administrative records in Pennsylvania do not make a distinction between quits and layoffs, they used a method in which displacement status is inferred from sudden large changes in employment. If a firm reduced employment by more than 30 percent, Jacobson *et al*. inferred that the reduction was a mass-layoff and the separations were involuntary. One advantage of this method is that it made it plausible to think that, in addition to being involuntary, the separations were exogenous and did not have a significant connection with job performance.[9]

Jacobson *et al*. estimated that the quarterly earnings of displaced workers were approximately 25 percent lower five years after separation when contrasted with continuously employed workers. They also found evidence of some decline in earnings prior to displacement. However, the quarterly employment levels were not similarly affected except for the first year following separation. Due to data restrictions, Jacobson *et al*. were not able to separate earnings losses following from lower hourly wages and earnings losses following from reduced employment during a quarter.

Following Jacobson *et al*., others have applied basically the same method using data from other sources.[10] Schoeni and Dardia (1996) used administrative data from California to study quarterly earnings of displaced workers who worked in durable goods manufacturing between 1989 and 1994.[11] Their estimates of the long-term losses were on the order of 17 to 25 percent four years after separation. No evidence of decline in earnings prior to displacement was found.[12]

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[8] The requirement that earnings must be positive was placed because the data did not distinguish unemployed individuals with zero earnings from individuals who had moved to a different state (and probably *de facto* had positive earnings). It follows from the restriction that the study underestimates the true costs of displacement by excluding workers who were altogether discouraged from working following their displacement. Similar restrictions have been used in many later studies as well.

[9] Basically the same method has later been used in several other studies that use data collected from administrative records. It is also used in our study. The technique is useful, since administrative records rarely have direct information on displacement status; more on this in Sections 3 and 4.

[10] One potential problem regarding the interpretation of the results found by Jacobson *et al*. (1993) comes from the fact that all of their data is from the state of Pennsylvania. This may lead to some bias since the industrial structure in Pennsylvania is dominated by traditional industries like automobile industry.

[11] It should be noted that nearly 2/3 of the workers in the sample used by Schoeni and Dardia (1996) worked in one of the aerospace sectors. Clearly, this raises worries if the results are interpreted as estimating the costs of job loss for workers in general.

[12] Also Schoeni and Dardia (1996) required strictly positive earnings for every year from everyone included in the sample. Again, this was done, at least partly, because it was impossible to distinguish otherwise individuals with no earnings from individuals who had moved to a different state. Furthermore, due to lack of data, they could not place any restrictions on the length of pre-displacement tenure.

Instead of using data from just one state, both Ruhm (1991) and Stevens (1997) tackled the problem of estimating the consequences of job loss by using the Panel Study of Income Dynamics (PSID). The PSID is a nationally representative longitudinal survey study conducted in the US every year. Ruhm (1991) estimated that four years after displacement the weekly wages of workers displaced between 1971 and 1975 were approximately 14 percent lower than the wages of workers in the comparison group. Initially, the displaced workers suffered from high unemployment but the changes in employment levels were transitory. Stevens (1997) estimated that both annual earnings and hourly wages for workers displaced between 1969 and 1986. She estimated that both types of losses are still approximately 9 percent even over six years after displacement when contrasted with continuously employed workers.[13] Like Jacobson *et al.* (1993), also Stevens (1997) found evidence of pre-displacement earnings losses.

The studies reviewed in this section can be taken as establishing the basic findings on the costs of job loss in the US. Even though there are some differences in results and methods, the studies taken together give a fairly consistent picture of the consequences of displacement. In all of the studies, the reduction in employment that followed displacement was relatively short-lived. On the other hand, the wage losses were persistent and were estimated to be in the neighbourhood of 10-25 percent still several years after the displacement had taken place.

2.4 Results from Europe

More recently, similar studies on the costs of worker displacement have also been done in Europe and elsewhere. The picture that emerges from these studies is not as clear as the early research from the US might suggest. Most studies have been able to quantify some costs that the displaced workers suffer. However, there seems to be significant variation in the outcomes of displaced workers in different countries and labour market situations.

Couch (2001) used survey data from the German Socio-Economic Panel (1986-1996) to investigate the cost of job loss for German employees. His sample included re-employed displaced workers who had been dismissed due to plant closure. He did find evidence of losses, but they were estimated to be only 6.5 percent two years after the displacement. No evidence of pre-displacement wage losses was found.[14]

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[13] Also Stevens (1997) required positive earnings for every year from everyone included in the sample.

[14] Also Burda and Mertens (2001) studied the costs of job loss in Germany. They did not find any evidence of significant long-terms losses for those workers who were re-employed (in many cases with the same employer) and working full-time. Even the short-term losses were found to be fairly modest. We will not discuss in detail their estimation strategy which differs methodologically from all other studies.

Bender *et al*. (2002) used administrative data to study displacement in both Germany (1984-1990) and France (1984-1989). They focus on changes in daily wages for re-employed workers with at least four years of tenure prior to displacement when contrasted with continuously employed workers. Bender *et al*. did not find evidence of large wage losses for most workers. Only workers who remained unemployed for more than a year after the displacement had taken placed were penalized after re-employment.

Huttunen *et al*. (2005) used matched employer-employee data from administrative records to study the costs of worker displacement in Norway for workers displaced in 1991. Again, the estimated losses were fairly small: approximately 2-5 percent in the first year after displacement and 1-2 percent seven years after displacement. Unlike many others, Huttunen *et al*. did not use continuously employed workers as their control group. Instead, both voluntary and involuntary separations taking place at later dates were allowed also in the control group.

Also Hijzen *et al*. (2006) used administrative data in their study in which they estimate wage losses of British workers displaced due to firm closure between 1994 and 2002. They estimated the initial wage loss to be roughly 40 percent but to die out fairly rapidly: no difference in wages was found five years after displacement. Average earnings of displaced workers were lower than the earnings of individual in the control group but the difference was mainly due to non-employment, not lower wages. Like Huttunen *et al*. (2005), also Hijzen *et al*. used control group in which separations at later times were allowed.

All of the European studies reviewed so far have estimated the earnings or wage losses to be fairly modest and temporary. In this respect, the results from these studies seem to differ significantly from those of the studies reviewed in Section 2.3. However, it would be premature to conclude that the costs of job loss are simply lower in Europe. Some other European studies have come up with results that are more in line with the studies from the US.

Boreland *et al*. (2002) used data from the British Household Panel Survey (BHPS) over the period 1991-1996. They used a control group of continuously employed workers and estimated that the loss in weekly wages for re-employed workers is approximately 14 percent. If only individuals who work full-time are included, the loss is only 10 percent. In any case, the estimates are more comparable with the earlier results from the US.

Margolis (1999) used administrative records to study displacements of workers with four or more years of tenure that took place in France between 1984 and 1989 due to firm closure. Margolis estimated that, depending on the specifications used, daily wages were 4-15 percent lower and total annual earnings 16-24 percent lower five years after displacement. These estimates are fairly high; they resemble the estimates of, for example, Jacobson *et al*. (1993) more than the estimates from some other European studies reviewed earlier.

Also a recent still unpublished study by Carneiro and Portugal (2003) estimated the wage losses following displacement to be fairly large for Portuguese employees. They used employer-employee matched data from administrative records and estimated that the average hourly earnings differential of displaced workers relative to continuously employed workers was approximately 10% three years after displacement. These results are within the lower bounds of similar studies from the US.

In sum, significant efforts have been made to study the costs of job loss in Europe in recent years. Yet it is hard to give a concise summary of all the studies, as there is fairly significant variation in the results. Some studies, like the ones by Bender *et al*. (2002), Huttunen *et al*. (2005), and Hijzen *et al*. (2006), seem to indicate that the long-term costs of job loss are small or non-existent. On the other hand, studies by Boreland *et al*. (2002), Margolis (1999), and Carneiro and Portugal (2003) estimated the long-term losses to be much larger and more similar with the earlier studies from the US.[15]

[15] Recently, some papers have been published on the cost of job loss in other countries as well (see, e.g., Orazem *et al*. 2005; Lehmann *et al*. 2005, 2006; Kaplan *et al*. 2005). We will, however, only focus the estimates from Western Europe and the US. Different institutional characteristics complicate the interpretation of results from, for example, transitional economies.

3. Data Description and Sample Construction

3.1 Data Description

Our empirical analysis has been conducted using the Finnish Longitudinal Employer-Employee Data (FLEED). The FLEED is a linked employer-employee database that has been constructed by Statistics Finland for research purposes. It combines data from several administrative registers and includes detailed information regarding employment and earnings for all Finnish permanent residents between ages 16 and 70. The data is collected at the individual level using a unique social security number to identify different statistical units.

In addition to earnings data, the FLEED includes information on various relevant background factors like education, marital status, age, location of residence etc. Furthermore, it includes unique identification codes for all of the firms and plants operating in Finland. The information on plants and individuals has been linked in a manner that makes it possible to identify all the workers that worked for some plant at the end of any given year.

One main advantage of the FLEED data used in our study is that it includes all Finnish residents, not just those who are currently working or part of the labour force. This is important because the losses following displacement may come in the form of unemployment spells or changes in labour force participation rather than lower wages. If all costs of job loss are to be included, we should not exclude people who are not working or even looking for work from our calculations. There is no reason to think that the members of the displacement group initially have less desire to work. Since our data includes information on the number of months worked, it is also possible to conduct a separate analysis to see how displacement affects monthly wages of re-employed workers.

3.2 Sample Construction

For the purposes our study, we construct two separate samples using the years 1992 and 1997 as base years. The sample construction procedure is identical in both cases. For both years, we identify a group of displaced workers as well as a group of workers who were not displaced at that time. The first group is the treatment group and the second the comparison group. Both treatment groups and the corresponding control groups are then followed over a nine-year period beginning three years before and ending five years after the displacement took place: from 1989 until 1997 and from 1994 until 2002, respectively.

Our analysis focuses on workers who all have initially had a strong labour market attachment. Specifically, we require that everyone included in the sample has three or more years of tenure with the same private sector employer before the possible event of displacement. We also require that during these three years everyone included in the sample had exactly one employer and did not have any unemployment spells. The employers are identified using plant codes and we only include workers from plants that employ at least ten workers during the base year.

In addition, we require that during the base year, 1992 or 1997, the age of everyone included in the sample was between 21 and 52. The age restriction has been placed to make sure that everyone in the sample is potentially suitable for being in the labour force during the whole period. Furthermore, by excluding individuals over 52 years of age, we rule out the possibility of early retirement via the so-called unemployment tunnel that could potentially influence our results.[16] Finally, we only include individuals who are present every year in our data and were not self-employed at any point during our time-frame.[17]

We do not require continuous employment of workers in the control group after the base year. In other words, it is possible that also the members of the control group are displaced at later dates. Similarly, we do not keep track of future displacements that the members of the displacement group may encounter. These displacements are interpreted either as independent events that could have happened to workers in the control group as well, or as consequences of the initial displacement. In the latter case, it is correct to include in the original estimates the additional costs that follow from later displacements.[18]

Since the workers who have been displaced are not directly identified in the data, an indirect process of inference must be used to form the treatment and control groups. The process is essentially the same as the one that was initially used by Jacobson *et al.* (1993) and that has later been applied in similar studies that use data from administrative records. The same procedure is applied to both years 1992 and 1997 and the corresponding samples are constructed separately.

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[16] In Finland, displaced elderly workers are allowed to collect earnings-related unemployment benefits until the age of 60 which is the time when they become eligible for the unemployment pension benefit. This system is known as the ”unemployment tunnel”. There is good reason to think that it increases unemployment among elderly workers who have been displaced (see, e.g., Kyyrä and Wilke 2006). The age criterion for the eligibility for these benefits used to be 53 but it was raised to 55 in 1997. In any case, displaced workers in our study cannot directly enter the unemployment tunnel in either of the samples, since we require that the displaced workers are at most 52 years old during the base year.

[17] Self-employed are left out because we are interested in the effects of displacement on labour income. Self-employed individuals form a special group in this respect. Typically, self-employed have little labour income, whereas they may have other significant sources of income. Our sample construction procedure leaves out a potentially interesting, albeit surely quite small, group of workers who are pushed to becoming self-employed as a consequence of being displaced.

[18] There is some evidence to indicate that later displacements may significantly increase the costs from job loss (see Stevens 1997).

Using the years 1992 and 1997 as base years, we divide the sample into those who have stayed and those who have separated. Stayers are workers who still have at the end of the base year the same plant identification code they did previously, i.e., workers who still work for the same employer for whom they have been working for, at least, the past three years. The rest of the workers have separated, i.e. in the end of the base year do not work at the same plant at which they worked previously.

All separations are potential cases of displacement. However, we only count as displacements those separations in which workers were separated from plants from which at least 50 percent of their employees left during the base year. Other separations are classified as being unclear and are excluded from the sample.[19] Also displaced workers who are re-employed by their original employer are excluded. At end of the sample construction procedure, we are left with two nine-year-long balanced panels. The first one has 2,400,921 observations (266,769 individuals) and the second one 2,519,550 observations (279,950 individuals).

The intuitive definition given for ”displaced worker” in Section 1 characterizes displacements as involuntary and permanent separations of workers with established job histories that happen for reasons unrelated to job performance. The definition is too vague to exactly specify which separations are displacements. However, many of the criteria used in our sample construction procedure can be seen as giving specific empirical content to the intuitive definition. For instance, we have required that at least 50 percent of the workers leave at the same time, which makes it plausible to assume that the separation was involuntary and unrelated to job performance. We have also excluded displaced workers who were re-employed by the same plant to make sure that the separation was permanent. In addition, we have placed several criteria for previous tenure. This was done mostly to guarantee that the workers had established job histories, but also partly to strengthen the case for the inference that the separation was involuntary.

Naturally, the mechanism used to construct the treatment and control groups is not 100 percent accurate. Since the data does not directly identify the workers who were displaced, it can never be known for sure which separations were actual displacements and which ones voluntary separations, endings of temporary contracts, or firings for cause. It is, for example, possible that some workers who end up being classified as displaced actually voluntarily left their jobs at that very moment for a reason that did not have anything to do with the reduction in employment at that particular plant. However, it does not seem likely that this kind of classification error seriously jeopardizes the relevance of our study: if 50 – 100 percent of the employees leave from a plant during a period of one year, it

[19] Different criteria for defining the displacement group were tried to check the robustness of the results; see Section 5.

is probable that most of them were forced to leave due to plant closure or downsizing. This is particularly likely given our sample construction criteria that make it probable that many of the workers in our sample have a fairly strong attachment to their current employer in the beginning of the base year.[20]

In any case, the analysis of our results should be made with all these caveats in mind. It is also possible to interpret the sample construction procedure as a *definition* of displacement given for the purposes of this study. In this case, it remains unclear how well our specific technical definition corresponds to some other intuitive definition people may have about displacement. When interpreting the results, it should also be kept in mind that our sample is by no means a random sample from the whole Finnish population, nor is it intended as one. The effects of involuntary separation for some other type of group could obviously differ.

3.3 Descriptive Statistics

Tables 1 and 2 present summary statistics on different groups formed with the procedures described above. Table 1 contains information on the relative sizes of displacement groups and control groups formed in both base years. Table 2 includes data on some variables that characterize workers belonging to different groups.

Table 1 Displacement Status.

GROUPS	N		%	
	Year 1992	*Year 1997*	*Year 1992*	*Year 1997*
Non-displaced	248 987	270 491	93.3%	96.6%
Displaced	17 782	9 459	6.7%	3.4%
• Plant closure	6 685	4 322	2.5%	1.5%
• Downsizing	11 097	5 137	4.2%	1.8%
TOTAL	266 769	279 950	100%	100%

[20] Even if some of the workers did actually leave ”quasi-voluntarily” in anticipation of future layoffs, it seems that counting them as displaced is appropriate.

Table 2. Some general characteristics of workers in different groups.

VARIABLE	NON-DISPLACED		DISPLACED	
general	*Year 1992*	*Year 1997*	*Year 1992*	*Year 1997*
• age (average)	38.7 years	40.0 years	38.2 years	39.4 years
• tenure (average)	12.3 years	12.6 years	10.8 years	10.7 years
gender				
• men	58.5 %	60.9%	59.5%	57.4%
• women	41.5%	40.1%	40.5%	42.6%
education				
• secondary/higher	20.4%	24.3%	21.1%	31.4%
• master's/higher	4.3%	5.1%	4.0%	7.1%
industry				
• manufacturing	50.4%	51.5%	46.9%	32.3%
• construction	3.9%	2.7%	11.1%	1.9%
• sales	15.9%	15.6%	16.5%	15.9%
• service	6.8%	9.3%	3.7%	21.3%
• transportation	13.3%	11.3%	18.0%	21.2%

The displacement and non-displacement groups seem rather similar. But there are certain differences. For example, the members of both displacement groups seem to be slightly younger on average and to have shorter pre-displacement tenures. Also the share of women seems to be slightly higher among displaced workers. In addition, the incidence of displacement seems to differ between industries. The share of workers employed in manufacturing is larger in both control groups, whereas the share of service and transportation sectors seems to be higher in both treatment groups. Finally, the relative share of displaced workers is considerably higher in 1992 compared to 1997: 6.7 percent vs. 3.4 percent. This is natural given that 1992 is the year when Finland was in the middle of an exceptionally severe recession.

Figures 1, 2, and 3 present some descriptive data on different groups. Figure 1 shows the average annual earnings, Figure 2 the average monthly wages, and Figure 3 the average employment levels for different groups. Time is measured relative to the base year t = 0, which is the year when the displacements happen (either 1992 or 1997).

Figure 1. Average Annual Earnings.

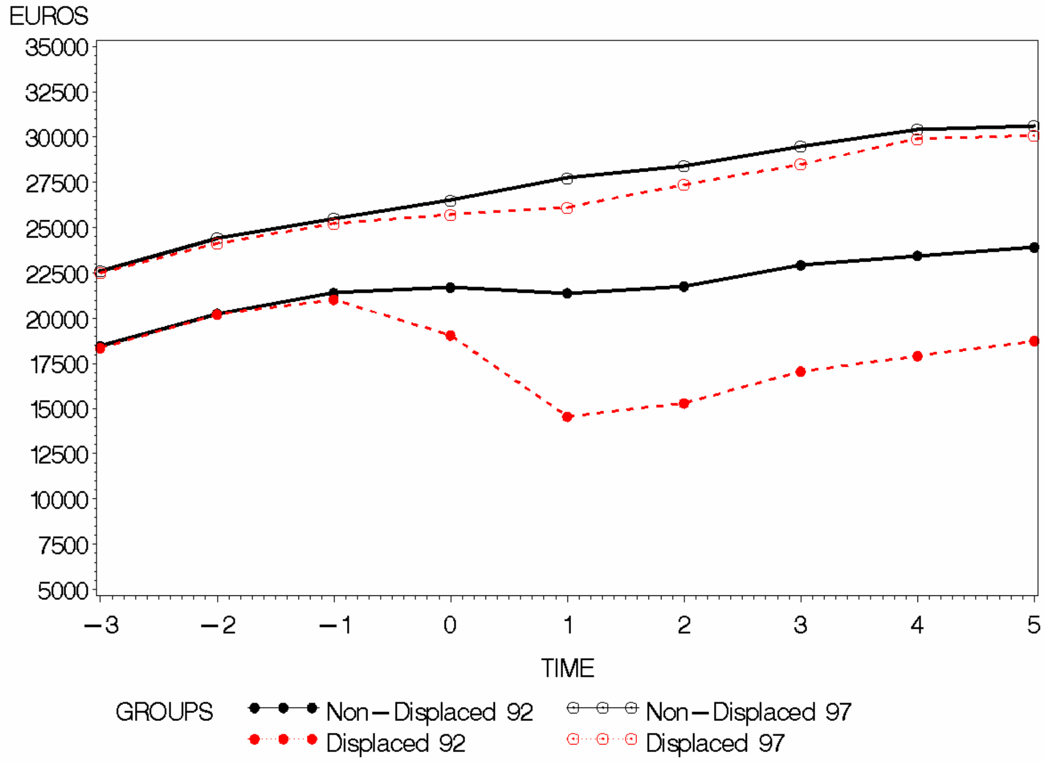

Figure 2. Average Monthly Wages.

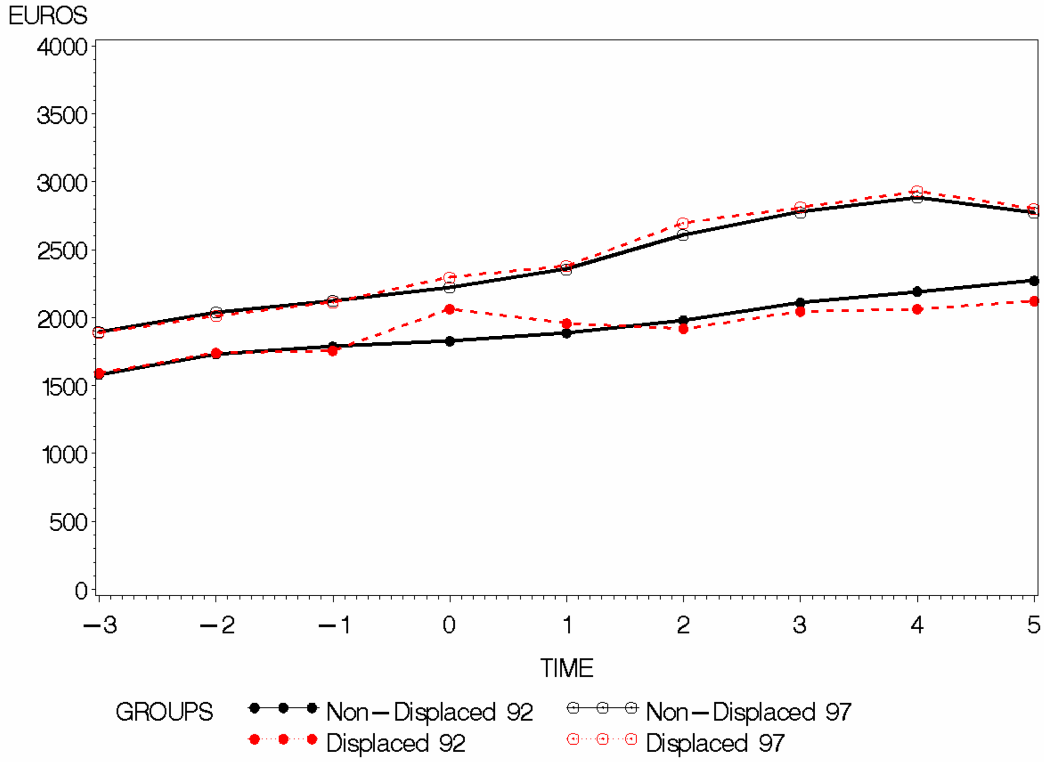

Figure 3. *Average Employment Levels.*

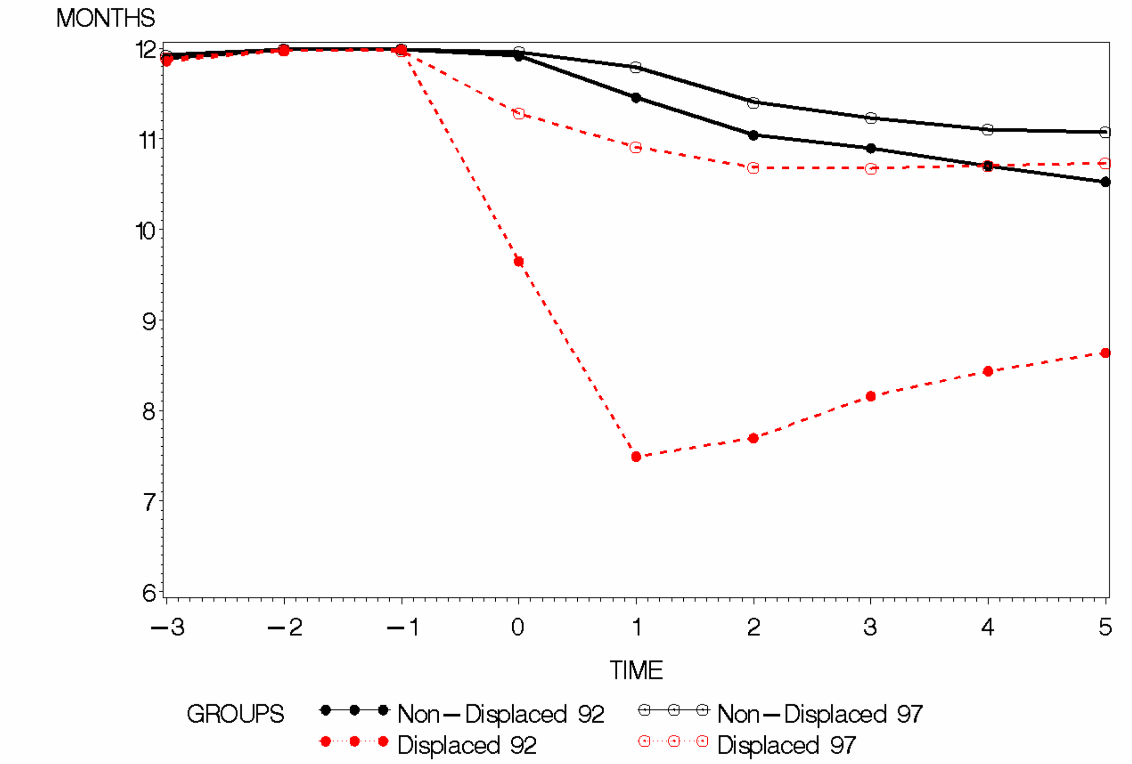

Figure 1 shows that on average displaced workers earn less after the displacement. The difference is much larger for the first displacement group. The differences in monthly wages are much smaller, as can be seen from Figure 2. As a matter of fact, the workers displaced in 1997 seem to have slightly higher monthly wages following displacement.

The peak seen in the monthly wages of displaced workers during the year in which the displacement happened follows probably from severance compensation given to displaced workers, or cash compensation given to re-employed workers who could not utilize their holiday entitlement from their previous employer. It is also possible that some displaced workers were quickly re-employed after receiving an advance notification of the coming displacement and were allowed to collect earnings from two employers for some period of time. Since we do not have direct information on actual wages, the variable “monthly wages” has been computed by dividing the annual labour income by the number of months worked during that year. Anything that changes annual earnings without affecting the number of months worked will increase monthly wages in our study.

Figure 3 shows how many months the individuals in different groups worked on average during each year. The first displacement group clearly stands out: the employment levels drop dramatically in 1992–1993 and the following recovery is slow. A similar but smaller drop is evident in the second displacement group as well. It can also be seen that the average number of months worked decreases slowly in both of the control groups. This is natural, since both voluntary and involuntary separations were allowed for the members of the control groups after the base year.

Figures 1-3 are only supposed to provide background for the actual empirical analysis of displacement effects. None of the many characteristics that possibly affect earnings and employment levels have been controlled. The specifics of our estimation method are explained in the next section and the results are reported in Section 5.

4. The Econometric Model

4.1 Evaluating Displacement Effects

The goal of this study is to estimate the impact of displacement on subsequent earnings and wages. The task is carried out by using an estimation method based on an analogy between displacement and some type of treatment, like job training. We will use a dummy variable D_i to indicate the displacement status for any given worker *i*. $D_i = 1$ indicates a treated unit, i.e., a displaced worker, and $D_i = 0$ indicates a non-treated unit, i.e., a non-displaced worker. The outcome that follows treatment is $Y_i(D_i)$. In our analysis, it will be either annual earnings or monthly wages.[21]

In principle, the treatment effect is the difference between the outcome after treatment and the outcome without treatment:

$$(1)\quad Y_i(D_i = 1) - Y_i(D_i = 0).$$

This way of formulating the treatment effects is not very helpful in practice, since an individual cannot both receive a treatment and not receive a treatment at the same time. For any given individual *i*, we can only observe

$$(2)\quad Y_i = D_i \times Y_i(D_i = 1) + (1 - D_i) \times Y_i(D_i = 0).$$

In other words, what we observe is always either $Y_i(D_i = 1)$ or $Y_i(D_i = 0)$, depending on the value of D_i.

In practice, our goal is to estimate the effects of displacement on those workers who were displaced. The average treatment effect on the treated is the expected change in Y_i that comes from displacement for the displaced workers. Formally, the effect can be stated as

$$(3)\quad \mathrm{E}\left[Y_i(D_i = 1) \middle| D_i = 1\right] - \mathrm{E}\left[Y_i(D_i = 0) \middle| D_i = 1\right] = \mathrm{E}\left[Y_i(D_i = 1) - Y_i(D_i = 0) \middle| D_i = 1\right].$$

This formulation is still not very helpful from a practical point of view because in order to estimate (3) we would still need to observe the same individuals both with and without the treatment. As was explained in Section 2.1, a comparison group must be used to mimic the counterfactual scenario in which those workers who actually were displaced would not have been displaced. When a control group is used, we can in fact estimate

[21] As was explained in Section 3.3, since we do not have direct information on wages or salaries that firms pay to their employees, the variable "monthly wages" is defined as annual labour income that has been divided by the number of months worked during that year.

(4) $\mathrm{E}\left[Y_i(D_i=1)\middle|D_i=1\right]-\mathrm{E}\left[Y_i(D_i=0)\middle|D_i=0\right]$.

Ideally, membership in the treatment or the control group would be determined randomly. If a random assignment is used, it follows that all individual characteristics, observable as well as unobservable, have identical distributions in both groups. In such a setting, we can interpret (4) as $\mathrm{E}\left[Y_i(D_i=1)-Y_i(D_i=0)\middle|D_i=1\right]$. This is to say that we can interpret it as an estimate of the causal effects of displacement on the displaced.

However, in non-experimental settings random assignment is impossible to achieve. Hence, there is a good chance that using (4) to estimate the causal effects of displacement gives biased results. We can overcome this problem by conditioning the estimates on pre-treatment characteristics X_i, i.e., by re-formulating (4) as

(5) $\mathrm{E}\left[Y_i(D_i=1)\middle|D_i=1,X_i\right]-\mathrm{E}\left[Y_i(D_i=0)\middle|D_i=0,X_i\right]$.

Now, (5) is an unbiased estimate of the displacement effect if X_i is able to control for all relevant differences between the two groups making the outcome $Y_i(D_i)$ independent of the displacement status. In other words, if $Y_i(D_i)\perp D_i|X_i$, it follows that (5) can be interpreted as $\mathrm{E}\left[Y_i(D_i=1)-Y_i(D_i=0)\middle|D_i=1,X_i\right]$ and we can take it to measure the causal effects of displacement on the displaced. We will come back to this assumption later in Sections 4.3 and 5.1.

4.2 Specifications Used

Our analysis uses two econometric models to study the effects of displacement empirically. The first is an Ordinary Least Squares (OLS) model and the second a Fixed Effects (FE) model that includes individual level fixed effects terms for workers. Two separate versions of both models have been estimated. In the first one, the dependent variable is the natural logarithm of annual labour income that has been divided by the number of months worked during that year, in the second one, simply the natural logarithm of the annual labour income.[22]

Our OLS specification is

(6) $\log y_{it}=\gamma_t+X_{it}\beta_1+Z_i\beta_2+\sum_{k=-3}^{5}D_{it}^{k}\delta_k+\varepsilon_{it}$.

Equation (6) includes time dummies γ_t, as well as two vectors of control variables X_{it} and Z_i that specify information on individuals *i*. The time dummies γ_t capture general changes in earnings at different times. The vector X_{it} contains

[22] The fact that some individuals are unemployed and have no annual earnings causes difficulties for the logarithmic transformation in the latter case; the issue will be discussed in detail in Section 5.1.

control variables with values that change over time. Such variables include, for example, education, marital status, place of residence etc. The vector Z_i, on the other hand, includes terms with no intertemporal variation. Such terms include gender, first language, tenure before displacement, industry classification before displacement etc.[23, 24]

The terms most relevant for the purposes of estimating the costs of job loss are the displacement dummies D_{it}^{k}. These variables measure the time relative to the base year and indicate whether an individual belongs to the treatment group or the control group at any given moment in time. In practice, these terms tell us how the earnings of displaced individuals differ from the earnings of non-displaced individuals at different times. The parameter estimates δ_k of the displacement dummies D_{it}^{k} can be interpreted as the expected difference in earnings/wages, during a given year, between displaced and non-displaced workers who are otherwise observationally identical.[25]

Finally, we have the error term ε_{it}. It should be noted that in none of our models is it assumed that the variance of the error term ε_{it} is constant. Instead, we use robust standard errors that allow for heteroskedasticity in all our specifications. Furthermore, in the OLS models, we use standard errors that are also robust to within-*i* clustering. In other words, the standard errors tolerate serial correlation that is created by the fact that every individual was observed at different times and these observations are correlated.

The FE model used is essentially the same as the one used by Jacobson *et al.* (1993). Basically the same specification has been used in all of the studies reviewed in Sections 2.3 and 2.4. The FE specification is

$$(7)\quad \log y_{it} = \gamma_t + X_{it}\beta_1 + \alpha_i + \sum_{k=-3}^{5} D_{it}^{k}\delta_k + \varepsilon_{it}^{*} \ .$$

The explanations for most of the terms in Equations (7) are the same as the ones given above. The only difference is that the vector of time-invariant control terms

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[23] See Appendix A for a list of definitions for all the control variables used in our specifications.

[24] It is possible to argue that all of the control variables in our specifications should be fixed to pre-displacement values to rule out endogeneity that may rise if displacement itself causes changes in those variables. A separate analysis in which all variables were time-invariant was conducted, but the results showed little systematic change. We decided not to fix some of the variables to pre-displacement values in order to make the models otherwise better. However, some variables had to be fixed to pre-displacement values, since not doing so would have in essence controlled for unemployment. Variables like this include, e.g., employer size, industry classification etc.

[25] The estimated relative loss in earnings or wages following from displacement can easily be calculated from the parameter estimates δ for the dummy variables D_{it} by simply inserting the estimates into the exponent function. This follows from the fact that the wage ratio (or earnings ratio) between the two groups is $\delta = \log y^{DISP} - \log y^{NON-DISP} = \log\left(\frac{y^{DISP}}{y^{NON-DISP}}\right) \Leftrightarrow e^{\delta} = \left(\frac{y^{DISP}}{y^{NON-DISP}}\right)$.

Z_i has been replaced with a vector of individual fixed-effects α_i. The fixed-effects α_i capture both observable and unobservable individual characteristics that potentially have impact on earnings or wages. In the FE specifications, the error term ε_{it}^* is assumed to be uncorrelated over time.

4.3 Potential Sources of Bias

As described in Section 4.1, an ideal situation would allow us to first observe a group of people over a period of time without the treatment. Later, the same people would be observed over the same period while this time including the treatment. The treatment-effect would be the difference between the two cases. Obviously, this is not possible, since an individual cannot both belong to the treatment group and the control group at the same time. The best we can do is to construct the two groups in such a way that makes it plausible that they are reasonably similar in relevant respects.

The best way to construct the groups would be to randomly divide all of the workers into two groups. Again, it is clear that such experiments are not possible in practice. Instead, we use mass-layoffs to simulate an experiment in which the membership in the treatment group is based on random assignment. This way the displacements are to a large extent exogenous and the selection bias is minimized.

However, it should be emphasized that the treatment group and the comparison group do not have to be identical. Even when mass-layoffs are used to identify displacements, it must be acknowledged that displacements are never truly random. As a matter of fact, in Section 3.3 we saw that there are some observable differences between the two groups. However, this is not a source of bias, since controls for these factors have been included in our specifications. More generally, there is no bias as long as we are able to control for any such intergroup heterogeneity that there may still be, in so far as it may influence earnings or wages.

For example, the OLS models are not affected if there is correlation between displacement and individual characteristics like gender, education, or age. There will only be bias in our OLS estimates if the vectors of independent variables X_{it} and Z_i do not control all the factors that jointly influence both earnings and the probability of displacement.

Similarly, in the FE models, it makes no difference if firms choose whom to displace in a way that depends on any of workers' constant characteristics, since they are controlled by the fixed-effects terms. This includes all unobservable factors that might affect productivity as long as they are time-invariant. In addition, a vector X_{it} controls for observable factors that change over time. An advantage of panel data is precisely the possibility to use FE models that provide effective tools for controlling unobservable factors. In this respect, the FE models have a clear advantage over the OLS models when it comes to controlling potentially relevant individual worker characteristics.[26]

One way to spell out the connection between the two models is to assume that the error term of the OLS model can be analyzed as

$$(8)\quad \varepsilon_{it} = \alpha_i + u_{it}.$$

Now we can see that, even though the OLS estimation results are conditional on X_{it} and Z_i, the unobservational part of the error term that is related to each individual is left out. This poses no problems if α_i is random and uncorrelated with both X_{it}, Z_i, and D_{it}^k, but the analysis will be biased if that it is not true. The use of mass layoffs or plant closures makes the assumption of uncorrelatedness reasonably plausible, but by no means certain. The FE models are less likely to be biased because they allow for correlation between α_i and X_{it}, Z_i, or D_{it}^k.The only shortcoming is that now the coefficients β_2 for the time-invariant variables Z_i cannot be identified.

Even so, since it is impossible in practice to guarantee that the displacements are truly exogenous, it is also impossible to guarantee that no bias is left in the estimates. For example, it is possible that the probability of displacement is higher in industries or local labour market conditions with reduced labour demand (see, for example, Huttunen *et al.* 2005). We have included in our specifications some controlling variables for different industries and locations, but the set of variables is not rich enough to capture all potentially relevant factors. [27]

One last potential source of bias comes from the use of downsizing plants to assign membership in the treatment group. In our sample, some displaced workers were separated from downsizing plants, whereas others from plants that exited altogether. It seems that the latter situation might be closer to the random case in which the displacement is exogenous. If the displacement follows from downsizing, there might be some room for selection inside the plant. It is possible that firms attempt to get rid of their worst workers. If that is the case, then the group of displaced workers consists of workers who are less productive than the workers in the control group. Consequently, the estimated costs of job

[26] One case that cannot be captured by either one of the models is a situation in which unobservable but non-constant factors are correlated with displacement. This could happen, e.g., if a temporary reduction in worker productivity caused the displacement to happen. It seems unlikely that bias like this seriously affects our results.

[27] On the other hand, it seems that selection plays a smaller role here than in many other settings in which similar methodology has been applied. The inclusion into our treatment group is considerably closer to being random than, e.g., inclusion into a training programs often is. The latter involves an active decision to participate or at least to participate seriously.

loss will be biased upwards. Again, it is likely that the rich set of control variables is able to take care of most of the bias that might otherwise result from this source. This issue will be analyzed in detail in Section 6.2.

5. Results

5.1 The Main Displacement Effects

Most of the research on the effects of job loss has focused on estimating changes in monthly, weekly, daily, or hourly wages of re-employed displaced workers. The first version of our model is similar in this respect. It focuses on estimating the effects of displacement on monthly wages by approximating wages using data on annual labour income of re-employed workers divided by the number of months each individual worked during that year in question.

Table 3 contains the main regression results from both OLS and FE models regarding monthly wages. All models include time fixed-effects and the same vector of control variables with values that change over time. Such variables include, for example, education, marital status, and place of residence. In addition, the FE models include individual fixed-effects, whereas the OLS models have an additional vector of control variables with constant values instead. Variables with constant values include gender, first language, tenure before displacement, industry classification before displacement etc. The estimates for the control variables are not of direct interest in this study and we do not report them in the main text.[28] Instead, we only report the parameter estimates for the displacement dummies that can be used to calculate the wage ratio between displaced and non-displaced workers.

[28] The estimated values of the control variables can be found from Table 6 that has been included in Appendix B.

Table 3. The Effect of Displacement on Monthly Wages.

MODEL	OLS		FE	
Variable	*Year 1992*	*Year 1997*	*Year 1992*	*Year 1997*
Displaced at *t=-3*	0.007† (0.003)	-0.000† (0.004)		
Displaced at *t=-2*	0.008† (0.003)	-0.008† (0.004)	0.001† (0.003)	-0.007† (0.007)
Displaced at *t=-1*	-0.018 (0.003)	-0.015 (0.004)	-0.023 (.0.003)	-0.013 (0.004)
Displaced at *t=0*	0.095 (0.003)	0.029 (0.004)	0.083 (0.004)	0.028 (0.004)
Displaced at *t=1*	-0.044 (0.005)	-0.011† (0.005)	-0.085 (0.005)	-0.019 (0.004)
Displaced at *t=2*	-0.080 (0.004)	-0.008† (0.005)	-0.109 (0.004)	-0.011† (0.005)
Displaced at *t=3*	-0.076 (0.004)	-0.004† (0.005)	-0.099 (0.004)	-0.004† (0.005)
Displaced at *t=4*	-0.084 (0.004)	-0.008† (0.005)	-0.101 (0.004)	-0.007† (0.005)
Displaced at *t=5*	-0.085 (0.004)	-0.010† (0.005)	-0.100 (0.004)	-0.008† (0.005)
N	2,300,679	2,477,676	2,300,679	2,477,676
R^2	0.388	0.378	0.740	0.740

(1) The dependent variable is the natural logarithm of the annual labour income that has been divided by the number of months worked during that year.
(2) Robust standard errors are in parentheses.
(3) All specifications include time fixed-effects and a vector of control variables; a full list of variables is included as Appendix A.
(4) All parameter estimates are statistically significant at the 0.001 level, unless marked with †.

The estimates reported in Table 3 show that the relative changes in monthly wages for re-employed workers are quite noticeable and persistent for those workers who were displaced in 1992. After an initial positive peek that takes place during the year of displacement, the relative wages change in favour of non-displaced workers and the effect persists. The loss in monthly wages is as high as 8 - 9.5 percent still at t = 5, i.e., in 1997, five years after displacement.[29]

[29] The correct explanation for the temporary peak seen in monthly wages during the displacement year is unknown. As was explained in Section 3.3, it may follow from severance compensation or cash

However, Table 3 also shows that for the 1997 group, there is no similar difference in the monthly wages of displaced and non-displaced workers after displacement. For the 1997 group, all of the parameter estimates on changes in monthly wages are small and in most cases not even statistically significant.

The fact that the estimates for the two groups chosen for analysis differ so much does not mean that the results are arbitrary. As noted in Section 1, a similar analysis was initially conducted for all displacements taking place between 1991 and 2000 to make sure that different base years do not produce erratically changing results. The analysis shows that the losses were at their highest for workers displaced in the middle of the recession in 1992. The losses gradually decreased when the base year was changed to a later year until the year 1997 was reached. Moving the base year beyond 1997 did not significantly influence the results anymore. Based on this preliminary analysis, the years 1992 and 1997 were chosen for a more detailed investigation because they help to bring out the results effectively. Reporting and interpreting the results would become unnecessarily complicated if a separate analysis were conducted for every year.[30]

The estimates for the first displacement group should be seen as an extreme case that highlights the consequences that may follow from a displacement during a recession. In many ways, the latter case is more in line with the research on displacement conducted elsewhere. By 1997, Finland had recovered from the recession and the labour market had moved back to a more typical equilibrium state.

In addition to the analysis of the changes in monthly wages, we have included a version of the same model in which the relative changes in annual earnings of displaced workers are estimated when all workers are included regardless of their labour market participation. However, the analysis of the changes in annual earnings that come from displacement is more complicated and we cannot give a single numerical estimate for the losses. The problem is that when all workers are included, our sample will include some individuals with zero earnings and the logarithm function is not defined in those cases.

One traditional way of handling zero values in similar situations is to use some monotonic transformation such as log $(\lambda + y_{it})$, where $\lambda > 0$. Using this transformation in fact simply means that a small constant λ is added to all values

compensation given for re-employed workers who could not utilize their vacation days from their previous employer.

[30] Also some additional analysis was conducted to investigate whether changes in the criteria used for constructing the treatment and the control groups influenced the results. Any changes were found to be small and uninteresting. Perhaps a more thorough sensitivity analysis would still be in order, but it is unfortunately impossible to include it at this point.

of the variable y_{it} making them strictly positive. An alternative would be to treat zero values as outliers and exclude them from the sample.[31]

Neither one of the choices is entirely satisfactory. If we exclude all zero values, we will end up with estimates that almost certainly underestimate the actual losses from displacement. One way of formulating the problem is to say that excluding zero values increases selection bias, since those displaced workers who have non-zero earnings do not constitute a random subset of all displaced workers.[32] On the other hand, if a constant amount is added to all earnings to make them strictly positive, there really is no way to specify how much exactly we should add to them. It seems clear that we should only add a constant that is relative small in comparison to typical annual earnings, but there is no single number that could be defended as the correct choice. Using a transformation such as $\log(\lambda + y_{it})$ works in a technical sense, but it makes analyzing the results more complicated, since they do not have an intuitively obvious interpretation anymore. One way to think about it is to say that some alternative source of earnings is assumed for everyone and the possible changes coming from displacement are evaluated against that background.

Ideally, it would be better to use a model that does not require modifying earnings data before taking logarithms. One option might be to use a Least Absolute Deviation (LAD) regression and estimate changes in median earnings. This method is less sensitive to outliers such as zero values. Alternatively, one could use a two-step Heckman estimation in which all zero values are first excluded and the results are adjusted to balance the resulting selection bias. Both of these methods are, however, difficult to implement when panel data is used and, therefore, beyond the scope of this study. The best we can do at this point is to analyze the way in which different ways of handling zero values influence the results. This will give a good overall picture of the earnings changes of displaced workers, but it will not produce a single estimate with an intuitively obvious interpretation.

If the number of zero values was very small in proportion to other values, then the problems outlined above would not have terribly interesting ramifications. However, it turns out that in our case that is not true. Consequently, even fairly small differences in the way zeros are handled influence the results, especially in the 1992 group in which the displacements happened during a time when it was

[31] Using an altogether different model that does not involve taking logarithms of the earnings would, of course, be a third option. This option was not chosen because a semilog model similar to ours has nearly always been used in previous studies on displacement.

[32] However, it should be noted that, e.g., Jacobson *et al.* dropped all cases in which an individual never had positive earnings after displacement. They state that without this sample restriction their estimates for the displacement effects would have been approximately 15 percentage points larger. On the other hand, in their data, zero value may have indicated that the individual in question had moved to a different state. (See Jacobson *et al.* 1993, 689.)

difficult to find employment.[33] In order to give a more complete picture of the change in annual earnings that takes place after displacement, we have estimated several versions of the model using different transformations to handle zero values. The estimates are reported in Tables 4 and 5 in columns labelled (1) – (5). The first four columns, respectively, correspond to adding 1, 10, 100, and 1000 euros to all annual earnings.[34] The fifth column reports estimates that we get when all observation that have zero annual earnings are excluded from the sample. Table 4 has the estimates for the 1992 group and Table 5 for the 1997 group. All of the estimates are from the OLS models, but the FE estimates are quite similar and they have been included separately in Appendix C.

[33] The proportion of zero values is 3.0% in the first sample, and 1.1% in the second one, when both displaced and non-displaced workers are included. However, during the year immediately after displacement, the proportion of zero values among displaced workers rises to 16.4% in the 1992 group, and to 3.5% in the 1997 group.

[34] In other words, they correspond to transformations log $(1 + y_{it})$, log $(10 + y_{it})$, log $(100 + y_{it})$, and log $(1000 + y_{it})$.

Table 4. The Effect of Displacement on Annual Earnings (the 1992 group).

MODEL	(1)	(2)	(3)	(4)	(5)
Variable					
Displaced at *t=-3*	-0.020†	-0.010†	-0.001†	0.008†	0.019
	(0.012)	(0.010)	(0.007)	(0.004)	(0.003)
Displaced at *t=-2*	-0.003†	0.004†	0.010†	0.014†	0.023
	(0.013)	(0.010)	(0.007)	(0.005)	(0.003)
Displaced at *t=-1*	0.018	0.013	0.008†	0.003†	-0.003†
	(0.004)	(0.004)	(0.003)	(0.003)	(0.003)
Displaced at *t=0*	-0.263	-0.247	-0.229	-0.193	-0.198
	(0.009)	(0.007)	(0.006)	(0.005)	(0.005)
Displaced at *t=1*	-1.981	-1.616	-1.235	-0.800	-0.543
	(0.027)	(0.021)	(0.015)	(0.009)	(0.010)
Displaced at *t=2*	-1.487	-1.230	-0.963	-0.655	-0.473
	(0.025)	(0.020)	(0.014)	(0.009)	(0.009)
Displaced at *t=3*	-1.290	-1.063	-0.828	-0.562	-0.383
	(0.025)	(0.020)	(0.014)	(0.009)	(0.009)
Displaced at *t=4*	-1.123	-0.924	-0.719	-0.489	-0.325
	(0.026)	(0.020)	(0.014)	(0.009)	(0.008)
Displaced at *t=5*	-1.015	-0.829	-0.639	-0.432	-0.260
	(0.026)	(0.020)	(0.015)	(0.009)	(0.008)
N	2,400,140	2,400,140	2,400,140	2,400,140	2,328,879
R^2	0.083	0.099	0.128	0.189	0.237

(1) Robust standard errors are in parentheses.
(2) All specifications include time fixed-effects and a vector of control variables; a full list of variables is included as Appendix A.
(3) All parameter estimates are statistically significant at the 0.001 level, unless marked with †.

Table 5. The Effect of Displacement on Annual Earnings (the 1997 group).

MODEL	(1)	(2)	(3)	(4)	(5)
Variable					
Displaced at *t=-3*	0.004† (0.004)	0.003† (0.004)	0.002† (0.004)	0.002† (0.004)	-0.002† (0.004)
Displaced at *t=-2*	-0.001† (0.004)	-0.002† (0.004)	-0.003† (0.004)	-0.003† (0.003)	-0.006† (0.004)
Displaced at *t=-1*	-0.010† (0.004)	-0.011† (0.004)	-0.012† (0.004)	-0.011† (0.004)	-0.014 (0.004)
Displaced at *t=0*	-0.084 (0.007)	-0.079 (0.006)	-0.073 (0.006)	-0.061 (0.005)	-0.063 (0.005)
Displaced at *t=1*	-0.417 (0.020)	-0.341 (0.016)	-0.264 (0.012)	-0.175 (0.008)	-0.097 (0.007)
Displaced at *t=2*	-0.374 (0.022)	-0.303 (0.017)	-0.231 (0.013)	-0.150 (0.009)	-0.073 (0.007)
Displaced at *t=3*	-0.290 (0.022)	-0.235 (0.017)	-0.179 (0.013)	-0.116 (0.009)	-0.056 (0.007)
Displaced at *t=4*	-0.249 (0.023)	-0.199 (0.019)	-0.149 (0.014)	-0.095 (0.009)	-0.036 (0.007)
Displaced at *t=5*	-0.208 (0.025)	-0.169 (0.020)	-0.128 (0.015)	-0.083 (0.010)	-0.039 (0.008)
N	2,519,550	2,519,550	2,519,550	2,519,550	2,490,760
R^2	0.077	0.102	0.147	0.227	0.297

(1) Robust standard errors are in parentheses.
(2) All specifications include time fixed-effects and a vector of control variables; a full list of variables is included as Appendix A.
(3) All parameter estimates are statistically significant at the 0.001 level, unless marked with †.

Despite the difficulties in interpreting the exact values of these estimates, it is clear from the results reported in Tables 4 and 5 that displacement has a sizeable negative effect on annual earnings of displaced workers in both groups. It can also be seen that the effect is considerably higher for the workers displaced in 1992 during recession. For both groups, the largest loss occurs at t = 1, i.e., in 1993 or 1997. This was to be expected, since all of the workers were still employed in the beginning of the base year t = 0. The exact timing of job loss is unknown, but it may have happened at any point during that year. If a worker was displaced towards the end of the year, he or she probably had normal earnings up to that point. Even when all zero values have been excluded, the annual earnings of displaced workers are approximately 41.9 percent lower at t = 1 in the 1992 group. A corresponding estimate for the 1992 group is 9.2 percent. Furthermore, in the 1992 group, the annual earnings of displaced workers are almost 23 percent lower than in the comparison group still five years after displacement even according to the lowest of the estimates. A corresponding estimate in the 1997 is less than 4 percent.

If the transformation log $(1 + y_{it})$ is used, i.e., when $\lambda = 1$ so that only one euro is added to annual earnings, we get the estimates in column (1). Now the initial loss is estimated to be as high as 86 percent in the 1992 group and approximately 34 percent in the 1997 group; still a large loss, but much more typical in the light of earlier research. Moreover, the losses for the 1992 group are very persistent. Still in 1997, i.e., at t = 5, the workers displaced in 1992 have nearly 64 percent lower annual earnings than the workers in the comparison group. Again, a corresponding estimate for the 1997 group is much lower: roughly 18.8 percent. This estimate is within the bounds of earlier estimates from similar studies. The estimates in columns (2) – (4) fall in between these two extremes.[35]

The easiest way to analyze the results presented in Tables 3, 4, and 5, and other similar estimates that we will discuss in Section 5.2, is by using figures that plot the relative wages or earnings of displaced workers contrasted with those of non-displaced workers. This is what we will do in the following. The numerical estimates can be found from Appendix D. All of the figures have been drawn using the estimates from OLS models, since they extend to the period t = -3 which could not be estimated in the FE models. For the annual earnings, we will use estimates corresponding to the transformation log $(1000 + y_{it})$ in all of the figures. Even though the exact level of losses is unclear, the figures do convey important information on the incidence of losses for different groups of workers. In addition, they can be used to analyze the way the relative wages and earnings change over time.

[35] As was noted earlier, the parameter estimates for the control variables are not of direct interest in this study. In general, they will not be reported, but we have included as an example in Appendix C the estimates of control variables corresponding to the model in column (4).

Figure 4. The Main Displacement Effects.

Figure 4 depicts the estimated wage and earnings changes in a single graph which makes it easier to compare the different groups. It is noticeable that in all cases the annual earnings and monthly wages of displaced and non-displaced workers are very similar prior to the base year. This result is important as it indicates that the relative changes which begin at t = 0 actually follow from displacement and not, for example, from inherent differences between the groups. In other words, it gives credibility to the assumption that our results are not significantly biased by selection. The fact that the initial differences between the groups are so small compared to the differences that follow after displacement is in the end the main reason for concluding that our method is reliable.

5.1 Displacement Effects for Smaller Groups

Section 5.1 reported the estimated average treatment effects on all of the treated workers. Since the samples used are quite large and somewhat heterogeneous, it is also interesting to see whether the effects of job loss depend on worker characteristics. In this section, graphs similar to those above are used to present the estimation results for smaller, more specific groups.

Figure 5 includes the estimates for annual earnings estimated separately for men and women.

Figure 5. *The Effect of Displacement on Annual Earnings by Gender.*

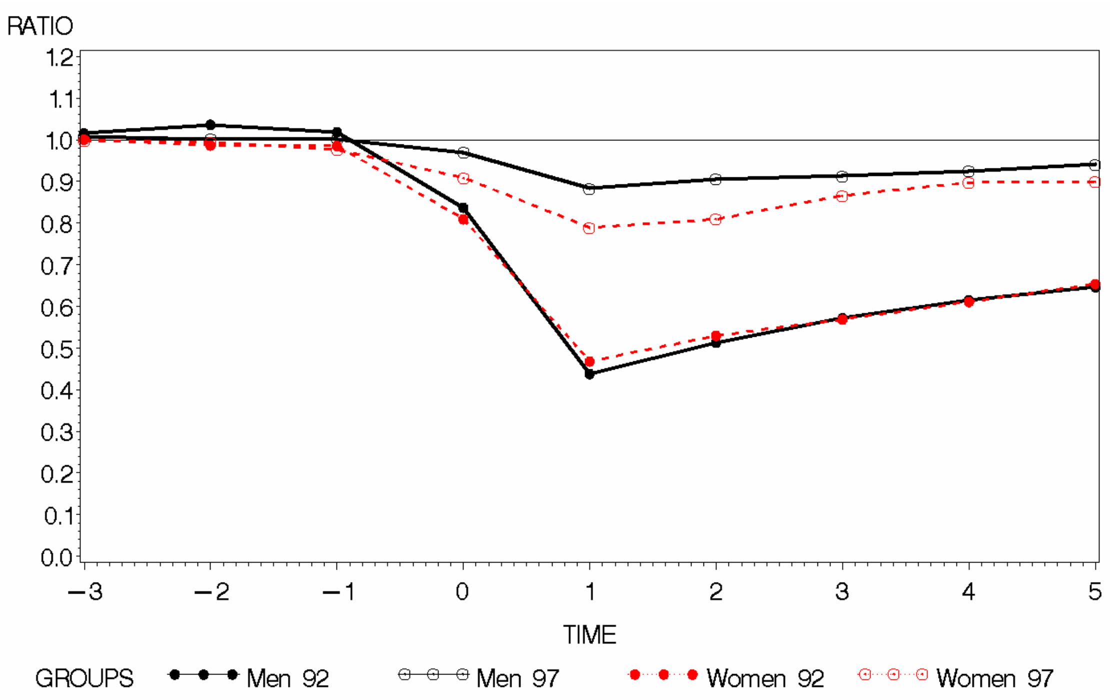
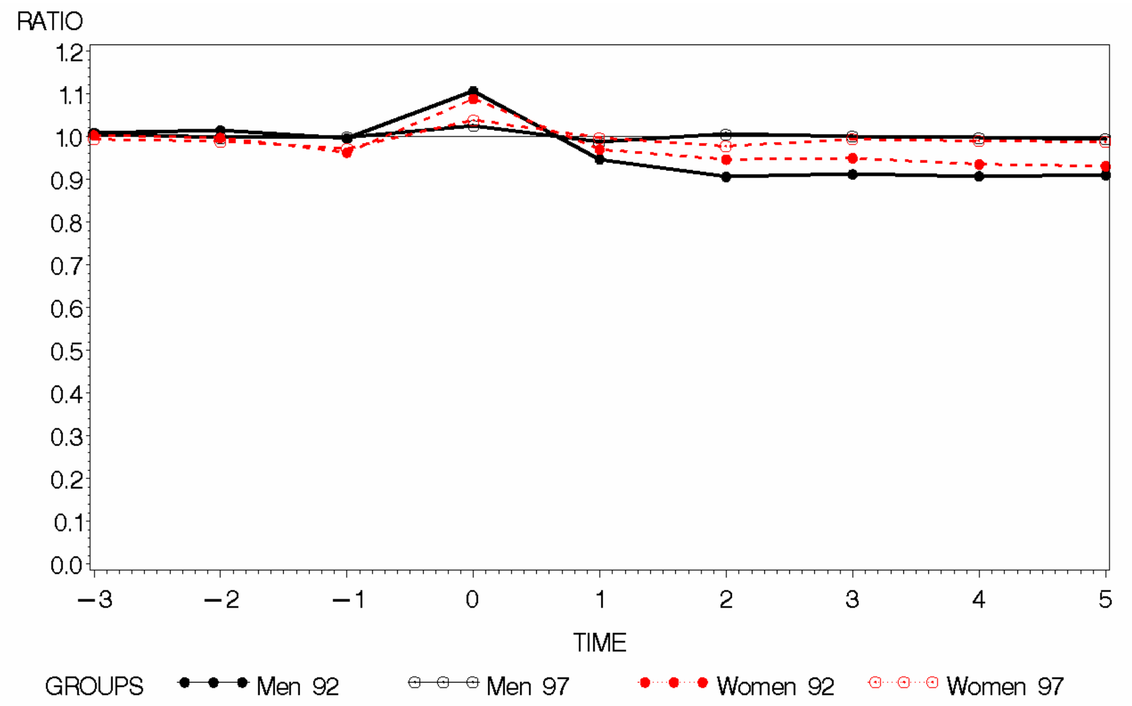


Figure 5 shows that in the 1997 group, displacement has a larger impact on earnings for women. No similar difference can be seen when the year 1992 is used as a base year. Larger losses for women have also been reported in some earlier studies (see, e.g., Kuhn 2002). Thus, it seems that the cost of displacement is higher for women in normal circumstances, whereas in unusual situations, like during a deep recession, factors like gender become less important.

Figure 6 reports estimates on monthly wages separately for men and women.

Figure 6. The Effect of Displacement on Monthly Wages by Gender.



Interestingly, the negative change in relative monthly wages is larger for men in the first displacement group. One explanation for this could be that men are more inclined to accept new employment even if it pays less than what they received in their earlier jobs. For women, there may be a larger probability of declining the job offer and staying outside labour force altogether. Both men and women in this first displacement group do, however, receive lower monthly wages. For the workers displaced in 1997, there is little difference between men and women. This is natural, since there is little negative wage change to begin with.

Figures 7 and 8 include estimates on changes in both annual earnings and monthly wages analyzed separately for different age groups. In order to keep the number of graphs reasonable, results are presented separately for the two displacement groups.

Figure 7. The Effect of Displacement by Age Group (the 1992 Group).

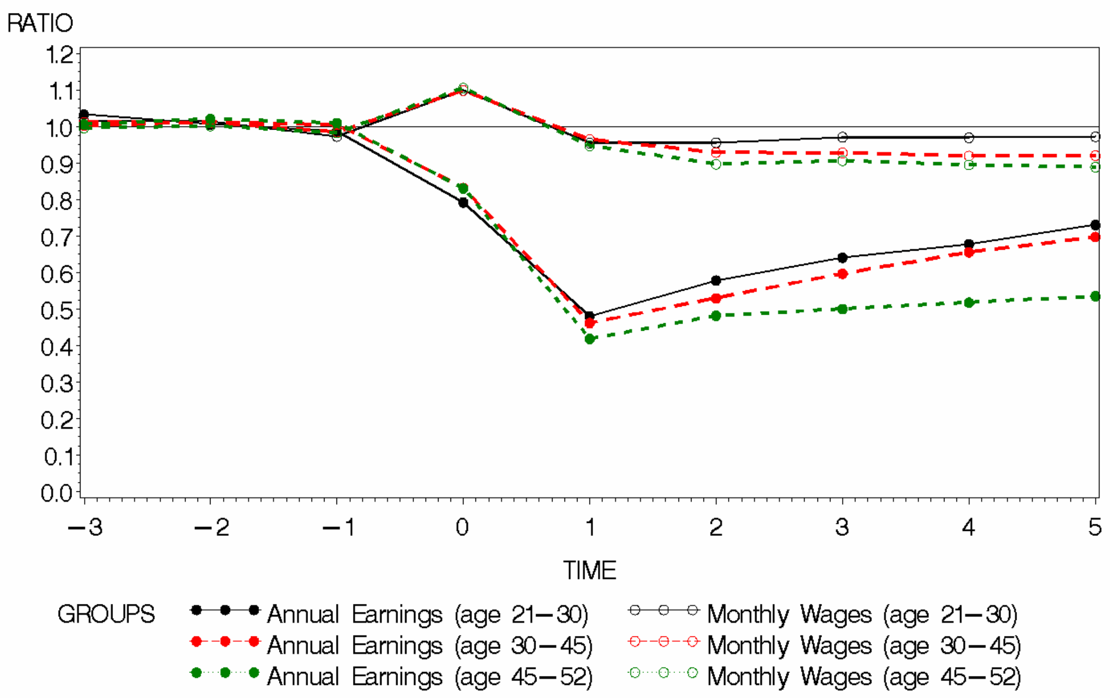


Figure 8. The Effect of Displacement by Age Group (the 1997 Group).

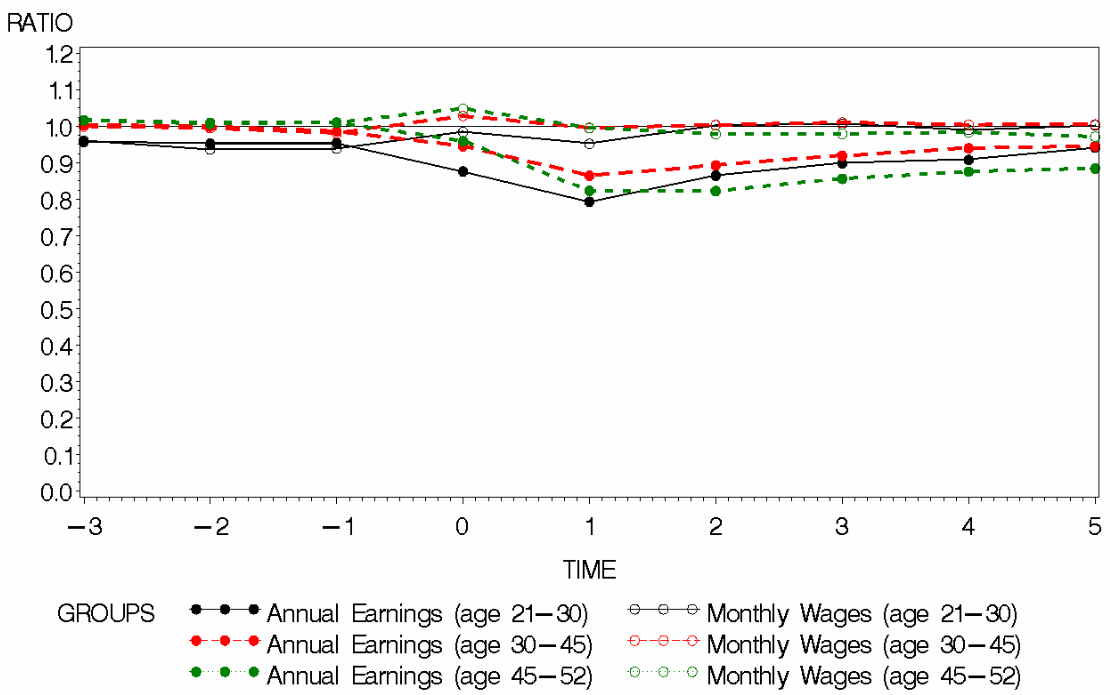


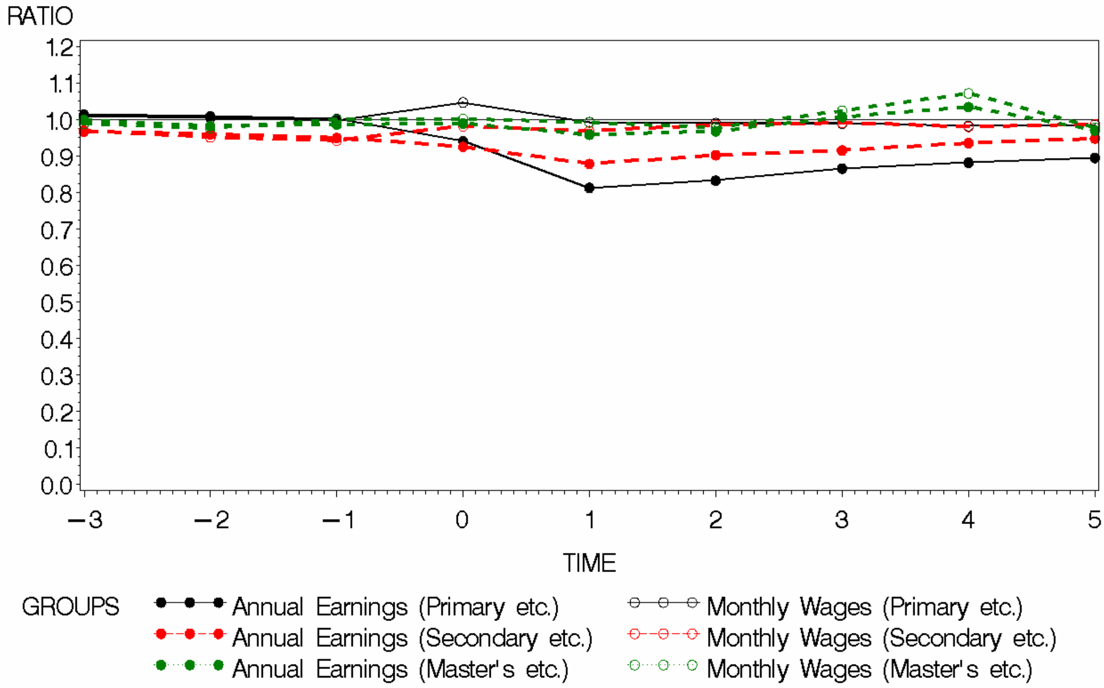
Figure 7 shows that those displaced workers who were at least 45 years of age in 1992 suffered much more dramatic losses in annual earnings following displacement. After some initial recovery that took place between 1993 and 1994, no significant improvement in relative annual earnings was detected between 1994 and 1997. In other words, their annual earnings only grew roughly at the same rate as the earnings in the control group did. Similarly, the negative change in monthly wages was larger for elderly workers. From Figure 7 it can also be seen that for the youngest displaced workers, the relative wage loss is fairly small even in the 1992 displacement group. This is not particularly surprising, since young people typically have smaller wages and hence there is less room for wage loss after re-employment.

Figure 8 shows that also in the second displacement group, the earnings of elderly workers drop more, at least in the long run, than the earnings in other age groups. The drop in annual earnings is also fairly high for young workers. Again, there is little inter-group difference in monthly wages for the workers displaced in 1997, since the changes are minimal for all age groups.

Figures 9 and 10 present similar estimates for groups formed based on three broad educational categories. Again, the results have been reported in separate figures according to the base year.

Figure 9. The Effect of Displacement by Level of Education (the 1992 Group).

Figure 10. The Effect of Displacement by Level of Education (the 1997 Group).



From Figures 9 and 10, it can be seen that the connection between the level of education and the losses in annual earnings following displacement is quite clear in both displacement groups. The losses are considerably smaller for workers with master's or doctoral degrees. As a matter of fact, from Figure 10, it can be seen that in the second displacement group there is no significant cost from job loss for highly educated workers. In both groups, the drop in earnings is largest for the group with least education, i.e., for workers who have not completed secondary education. The cost of job loss for the rest of the workers lies between these two extremes. The middle group includes workers who have all completed their secondary education, but do not have graduate degrees like master's or doctoral degrees.[36] Figure 9 shows that in the first displacement group also the change in monthly wages is largest for the least educated workers. However, for most of the years following displacement, the middle group has the smallest estimate. Again, in the second displacement group, none of the workers seem to undergo important changes in monthly wages following displacement.

[36] Workers in the middle group may have completed other post-secondary studies and they may, e.g., have bachelor's degrees etc.

6. What Explains Wage and Earnings Losses?

6.1 Suggested Explanations for the Displacement Effects

Most studies on job loss have come to the conclusion that displaced workers suffer wage or earnings losses. In many cases, the losses are large and persistent. Yet it seems fair to say that little consensus exists as to what explains the observed losses. The problem is not so much that one could not come up with suggestions that perhaps could be used to explain the losses. At least in principle, there are several well-known, not necessarily mutually exclusive, frameworks that may explain empirical findings on the effects of job loss. However, little actual theoretical work has been done to model the mechanisms related to displacement.[37] So far no one has been able to explicitly use any of these potential explanations in a particularly illuminating way. In addition, it is hard to distinguish empirically between different alternatives.

Perhaps the most often suggested explanation for the costs of job loss makes use of the human capital theory (Becker 1975). The idea is that displaced workers lose firm-specific, or perhaps industry-specific, human capital when they are displaced. Consequently, their productivity suffers and potential new employers will not value them as highly as their previous employer did.

Human capital is commonly divided into specific and general. General human capital is transferable between jobs and therefore valued by different employers. Specific human capital, however, is restricted to some narrow domain. For example, on-the-job training may increase human capital so specific that it is only valued inside a single firm. The distinction is not clear cut: sometimes skills may be valued to some extent by other employers within the same industry or similar industries. It is plausible to think that displaced workers, who in most studies have several years of tenure, may have non-transferable human capital that is not valued by other potential employers. Perhaps some additional evidence in favour of human capital hypothesis is provided by the fact that workers with little education suffered largest losses in our study.[38] It is fairly natural to think that human capital received from secondary and post-secondary studies is more general and hence more easily transferable between jobs.

Still, even if we accept the basic premises of the human capital theory, it is not entirely clear what the outcome should be as far as displacement goes. One might argue, for example, that the loss in human capital should lead to large initial losses without significant long-term losses. The idea is that displaced workers should be able to catch up with non-displaced workers and reach similar levels of

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[37] None of the articles reviewed in Sections 2.3 and 2.4 include attempts to theoretically model the mechanisms that lead to losses after displacement.

[38] See Figures 9 and 10 in Section 5.2.

human capital in some reasonable time. Yet, persistent losses that last for years have been reported in many studies. To explain such losses, permanent or extremely persistent deterioration of human capital has to be postulated. Clearly, simply postulating precisely this type of firm-specific human capital without independent evidence is not particularly convincing.

An alternative explanation that has sometimes been suggested is based on the search-matching theory (see, e.g., Jovanovic 1979). The idea is that the cost of job loss comes from losing a high-quality job match whose value is destroyed as a consequence of displacement. Again, the notion has some plausibility, since displacement studies typically focus on workers with established job histories. Such workers probably have better than average job matches given that tenure is related to earlier quits and layoffs. For example, the workers in our study had stayed with the same employer for at least three years, suggesting that they must have been relatively happy with their jobs prior to displacement.

A match is good when the worker is productive and receives high wages in return. It is natural to assume that some of the displaced workers will accept job matches which are not as good as the ones they previously had. Consequently, they will suffer losses.[39] On the other hand, the search-matching framework seems to have the same difficulties in explaining long-term losses from displacement. It is unclear why displacement would permanently change the quality of job matches.

A third possible explanation can be formulated by using the model of deferred compensation taken from the contract theory (Lazear 1981). The model suggests that older workers are paid high wages, not because they are worth what they are paid at that time, but instead to motivate them throughout their careers. The idea is that higher wages paid to elderly employees are a form of deferred compensation that motivates young workers to work more efficiently and discourages elderly workers from taking early retirement. The model predicts that there will be a mismatch between productivity and wages inside a firm: young workers are paid less than their marginal product, whereas pay exceeds productivity for older workers. Contract theories thus imply that positive correlation between tenure and earnings does not necessarily follow from changes in human capital or from a better match.

According to this hypothesis, the costs of job loss come from losing seniority inside a firm. If wages are determined by seniority, it follows that re-employed workers have lower wages after displacement. Furthermore, the losses are permanent and lead to lower life-time earnings because displaced workers lose the larger earnings which they had delayed until later stages of their career. In

[39] The deterioration of matches happens on average; in principle, displacement may be a good thing for some workers.

this way, deferred compensation may partly explain our finding that elderly workers suffered larger losses after displacement. On the other hand, it is likely that older workers also have more firm-specific human capital, as well as more highly valued matches. So, the three hypotheses are intertwined, and therefore hard to separate empirically. Besides, also young workers had considerable losses which cannot be explained by deferred compensation.

All of the hypotheses listed are better suited for explaining changes in monthly wages rather than annual earnings. Yet one of our main findings was that the losses from displacement are mostly related to changes in annual earnings. It seems that to explain our findings, we must explain why displaced workers are unable to find work after displacement. Human capital or deferred compensation models do not seem particularly helpful in this respect. Search framework does a better job at explaining lower levels of employment following displacement. It is also possible that the fairly generous Finnish unemployment benefits contribute to the problem. Still, it is hard to think that the search theory could explain all of the estimated losses in annual earnings. In theory, the search should only continue until the expected return from a possible better match is equal to the cost of longer unemployment duration.

Finally, in Section 5 we saw that macroeconomic factors are decisive in determining the nature of losses of displaced workers.[40] The losses were much higher if the displacement happened during a recession when unemployment was high. Macroeconomic explanations for unemployment often focus on reasons explaining why market wages are set above the market clearing level.[41] If such models are on the right track, then it is natural to expect that some displaced workers are unable to find work after displacement. Since we have tried to guarantee that the displacement itself is exogenous, the lower annual earnings explained by resulting unemployment should basically be attributed to bad luck. One possible conclusion could be that displacement leads a worker to accidentally lose his/her privileged job market position and this raises the probability of adverse consequences.

6.2 The Role of the Displacement Type

The results presented in Section 5.2 show that there is some heterogeneity in the effects of displacement for different groups of workers defined by individual characteristics such as age, gender, or education. So far we have said little about the possibility that also the nature of displacement could make a difference for the resulting outcome. There is, however, some reason to expect that it matters whether the source of displacement is downsizing or plant closure. Although,

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[40] For similar conclusions, see, e.g., Helwig (2001), Kaplan *et al*. (2005), and Eliason and Storrie (2006).

[41] Perhaps the most important such explanations are efficiency wage models (Shapiro and Stiglitz 1984) and various wage bargaining models (see, e.g., Calmfors and Driffill 1988).

generally speaking, there is little theoretical discussion on the consequences of displacement, Robert Gibbons and Lawrence Katz (1991) have formulated a model that attempts to formalize the mechanisms explaining how the displacement type affects the resulting outcome.

Gibbons and Katz's model is a two-period asymmetric information model.[42] In the model, a signal sent by the informed party in the first period leads to an adverse selection problem among the uninformed parties in the second period. Since Gibbons and Katz's model, unlike any of the models that were informally discussed above, directly formalizes the wage-determination processes related to displacement, we will go over it in detail. One advantage of Gibbons and Katz's model is the way it gives fairly straightforward predictions that can be tested with our empirical setting. We will discuss these predictions in Section 6.2.3 where we will present results on the cost of job loss estimated separately according to the type of displacement.

6.2.1 The Signalling Model of Gibbons and Katz (1991)

Gibbons and Katz's model is based on a few simple assumptions about the nature of displacements. The basic idea is that when a firm makes a decision to retain a worker, i.e., not to displace him/her, a positive signal is given to the market indicating that the worker in question is of high ability. This will lead to a situation in which other firms compete for those workers and bid up their wages. Consequently, it is unprofitable for the initial employer to retain workers who are in fact of low ability. These workers will be displaced or offered so low wages that they will voluntarily leave. The result is that displacement sends a negative signal on worker's productive ability provided that other firms believe that the initial employer had discretion over whom to displace.[43] It follows that displaced workers will be offered lower wages after displacement.

Gibbons and Katz assume that if all workers are displaced at the same time, the market does not make the same inference. Using the earlier terminology, they assume that a displacement due to downsizing sends a negative signal to the market, whereas a displacement due to plant closure does not. If Gibbons and Katz are right, otherwise observationally identical workers who are displaced due to downsizing will have lower wages and earnings after displacement compared with other displaced workers.

The model of Gibbons and Katz has four main elements.

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[42] For an introduction to the role of asymmetric information in economic models, see, e.g., Macho-Stadler and Pérez-Castrillo (2001).

[43] One complication for the empirical relevance of the model has to do with the fact that it may not always be possible for an employer to choose freely who among the workers will be displaced.

(1) *The production technology*. Each worker has a constant productive ability η which is not necessarily the same for every worker. The first-period output for each worker is $y_1(\eta) = \eta$. If the worker stays with the same employer, the second-period output is $y_2(\eta) = \eta + s$, where $s>0$. If the worker changes employers, the second-period output is the same as the first-period output, i.e., $y_2(\eta) = y_1(\eta) = \eta$. Perhaps the most natural interpretation for s is to think of it as measuring firm-specific human capital that increases with tenure and is lost if a worker moves to a new firm.[44]

(2) *The information structure*. When the first period begins, no informational asymmetries exist. However, the information is imperfect regarding the productive ability of each worker. All firms have the same observational data at their disposal from which they can draw inferences on worker's productivity. Based on such observable characteristics, all firms conclude that the worker's productive ability has a probability distribution P(η) on $[\eta_L, \eta_H]$, and a density function f(η).[45] When the first period ends, the worker's current employer is able to observe the actual first period output and comes to know what the actual productive ability of that worker is. The asymmetry is created by the fact that other potential employers do not have that same information.

(3) *The commitment and contracting possibilities*. All wages are determined at the beginning of each period, and there are no conditional or long-term contracts. The first-period employer makes a decision to either displace or retain a worker at the beginning of the second period. It is impossible to make any commitments regarding second-period wages or displacements at the first period.[46]

(4) *Timing*. At the beginning of the second period, the employer makes a decision to either displace or retain the worker based on his/her first-period output. If the worker is displaced, the resulting separation is permanent. After displacement, other employers make simultaneous wage offers to the displaced worker who accepts the highest offer. If the employer does not displace the worker, the decision to retain a worker is observed by other potential employers who simultaneously offer him/her new second-period wages. However, the initial employer can observe these offers and is able to make a counter offer regarding the second-period wage. The worker chooses the offer that gives the highest second period wage, unless he/she is forced to move for exogenous reasons.[47] A

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[44] One can also interpret s, for example, as a mobility cost that comes from changing jobs (see Gibbons and Katz 1991, 354).

[45] It has to be assumed that $\eta_L + s < E(\eta)$: otherwise, the initial employer will not displace anyone. In addition, Gibbons and Katz assume that f(η) is log concave, i.e., they assume that ln f(η) is concave in η. This assumption is not necessary, but it simplifies some derivations.

[46] If contingent contracts could be used, so that each worker would receive pay exactly according to what he/she produced, the firms would not care about the productive ability of their work force.

[47] For an example of an exogenous move, Gibbons and Katz give a situation in which a person has to accompany a spouse to a different location.

probability of exogenous separation is μ. The worker chooses the current employer if his offer is exactly the same as the best competing offer.

6.2.2 Determining the Equilibria

It can be shown that Gibbons and Katz's model described above has a continuum of perfect Bayesian equilibria. All of these equilibria share the same feature that workers displaced from downsizing plants have lower post-displacement wages than workers displaced due to plant closure.

Players have the following strategies.

The prospective employers. Each prospective employer makes a second-period wage offer. A prospective employer i makes an offer $w_{mi}(D)$ to any worker who was displaced and $w_{mi}(ND)$ to any worker who was not displaced. For simplicity, Gibbons and Katz assume that there are only two prospective employers, i = 1, 2.

The initial employer. The initial employer has a displacement decision rule $R(\eta)$ that represents the displacement decision based on worker's productive ability η. $R(\eta) = 1$ means that the worker in question is displaced and $R(\eta) = 0$ that the worker is not displaced. The second-period wage offer by the current employer made to a non-displaced worker is $w_f[\eta, w_{m1}(ND), w_{m2}(ND)]$. The wage offer decision is based on the actual observed productivity η and the other competing offers the worker has received from prospective employers, i.e., $w_{m1}(ND)$ and $w_{m2}(ND)$.

The model can be solved starting from the end by using backwards induction in three stages. [1] The first stage is to calculate $w_f[\eta, w_{m1}(ND), w_{m2}(ND)]$, i.e., the best response wage offer the initial employer makes to a non-displaced workers once it knows how productive the worker is and has seen the second-period offers by other firms. [2] Next, we must calculate the optimal wage offers made to non-displaced workers by other prospective employers based on their beliefs about the displacement decision rule $R(\eta)$ the initial employer has. The optimal wage offers of prospective employers are calculated taking into account the best response wage offer w_f that was computed earlier. [3] The last stage is to calculate the optimal displacement decision rule $R(\eta)$ that the initial employer uses. At this stage, the employer must have in mind the best response wage offers prospective employers will use. In equilibrium, it must also be the case that the hypothesis the market had in stage [2] regarding $R(\eta)$ was correct. In what follows, we will go over the three stages in detail.

[1] The maximum offer a non-displaced worker receives from the job market is $w_m = \max \{w_{m1}(ND), w_{m2}(ND)\}$. The firm's best response is to match w_m with an equally good offer if the worker's ability satisfies $\eta + s \geq w_m$. If the initial firm makes an equally good counter offer, the worker remains continuously

employed, unless he/she is forced to move for exogenous reasons. It follows that the employment contract continues with probability $1 - \mu$. If the workers ability does not satisfy $\eta + s \geq w_m$, the initial firm makes a wage offer that is less than w_m and the worker accepts instead the offer w_m made by a new employer. The response of the initial employer is therefore

$$(9)\ w_f(\eta, w_m) = \begin{cases} \text{if } \eta + s \geq w_m \Rightarrow \text{offer } w_m \\ \text{if } \eta + s < w_m \Rightarrow \text{offer less than } w_m \end{cases}.$$

[2] In equilibrium, it must be that prospective employers are able to anticipate what the initial firm will do once it sees the new wage offers. In addition, the prospective employers must have a correct account of the decision rule $R(\eta)$ used by the initial employer. Gibbons and Katz assume that the prospective employers believe that the initial firm displaces a worker whose productive ability is less than some cut-off, denoted by η_D. In the second period, prospective employers compete for non-displaced workers by making them wage offers. This competition continues until a point is reached at which the expected profit from hiring a new worker by a prospective employer is zero.[48] It follows that w_m must satisfy

$$(10)\ \mu[E(\eta \mid \eta \geq \eta_D) - w_m] + (1-\mu)\text{prob}[\eta + s < w_m \mid \eta \geq \eta_D] * [E(\eta \mid \eta_D \leq \eta < w_m - s) - w_m] = 0.$$

The left-hand side of condition (10) is the expected profit a prospective employer gets from hiring a new worker. The expected profit consists of two elements. First, prospective employers know that the worker must quit his/her job for exogenous reasons with probability μ. If this happens, it does not make any difference how much the initial employer offers because the worker must accept the market wage w_m. In this case, the expected profit for a prospective employer from employing a non-displaced worker is $E(\eta \mid \eta \geq \eta_D) - w_m$, i.e., worker's expected productivity given that he/she was not displaced minus w_m. Second, in most cases the worker is not forced to move for exogenous reasons. Instead, with probability $1-\mu$ the worker will accept a wage offer w_m only if it is higher than what the initial employer offers. This only happens if $w_m > \eta + s \Leftrightarrow \eta < w_m - s$, as can be seen from (9). When there is no exogenous move, the probability that a worker accepts an offer from a prospective employer is therefore $\text{prob}[\eta + s < w_m \mid \eta \geq \eta_D]$. If the offer is accepted, the expected profit is $E(\eta \mid \eta_D \leq \eta < w_m - s) - w_m$.

[3] In equilibrium, the initial employer knows that he will be forced to compete for his non-displaced employees in the second period and that the competing

[48] If the expected profit is higher than zero, some competing employer will try to attract that worker by making a higher offer. This is an example of Bertrand wage competition.

market wage offer w_m must satisfy (10).[49] The initial employer knows that it will not be profitable to keep the least productive workers. This gives rise to the following displacement decision rule $R(\eta)$ which corresponds to the belief the prospective employers had about $R(\eta)$ in stage [2]

$$(11)\ R(\eta) = \begin{cases} \text{if } \eta < \eta_D \Rightarrow \text{displace} \\ \text{if } \eta \geq \eta_D \Rightarrow \text{retain} \end{cases}.$$

Now we have reached an equilibrium, as long as η_D satisfies

$$(12)\ \eta_D + s \leq w_m,$$

where w_m is the market wage determined from (10) as a function of η_D. The displacement rule $R(\eta)$ would not make sense without the condition (12), but Gibbons and Katz show that (12) is satisfied given that $\eta_D \leq \eta^* < \eta_H$, where η^* is the unique solution to

$$(13)\ \eta^* + s = E(\eta \mid \eta \geq \eta^*).$$

Now we can see that the model does not determine any specific displacement rate, but instead a range of possible rates $[\eta_L, \eta^*]$. Consequently, the model has a continuum of equilibria each of which corresponds to a particular choice of η_D. The highest possible displacement rate η^* decreases with s. In the limit, $\eta^* \to \eta_L$ as $s \to (E(\eta) - \eta_L)$. Similarly, $\eta^* \to \eta_H$ as $s \to 0$. Furthermore, the range of quit rates varies inversely with η_D. In other words, when more workers are displaced, i.e., when η_D is closer to η^*, then fewer workers will "voluntarily" quit. Similarly, when η_D is closer η_L, more workers will end up quitting their jobs. That is why it is somewhat misleading to talk about voluntary quits, since it makes little difference for the initial employer whether a worker is displaced or induced to quit.

In the resulting equilibria, the workers are divided into three distinct groups.[50] The first group consists of workers who have the lowest productive ability and who will be displaced. The second group consist of workers for whom $\eta_D \leq \eta < w_m - s$ holds. These workers are retained at first, but the initial employer will not find it profitable to employ them after the competing employers have made their wage offers. The initial employer will use the rule w_f, as described in (9), and induce these workers to "voluntarily" quit. The third group consists of the most productive workers. They will all be retained and offered the same wage which is equal to the market wage w_m. The interesting feature of these equilibria is the resulting mismatch between productivity and wages. Since all non-displaced

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[49] Gibbons and Katz show that the equation (10) has a unique solution for every value of η_D (see Gibbons and Katz 1991).

[50] The exception is the one equilibrium in which no one is displaced, i.e., the equilibrium that follows if $\eta_D = \eta_L$.

workers are paid the same wage, the initial employer cannot use different wages to retain workers with differing productive ability.[51]

So far we have only focused on the wage determination process for non-displaced workers. To complete the description of Gibbons and Katz's model, we still have to specify what happens to displaced workers both in cases of downsizing and plant closure. If the initial employer decides to displace a worker, then other potential employers try to attract him/her by offering wages based on his/her expected productivity. Since prospective employers believe that the initial employer uses the displacement rule R(η) derived in [3], they think that a worker is displaced when $\eta < \eta_D$. Therefore, their second-period wage offer to a displaced worker will equal

(14) $w_2(D) = E(\eta \mid \eta < \eta_D)$.

As explained earlier, Gibbons and Katz assume that a displacement due to plant closing does not cause prospective employers to make any inferences regarding the productive ability of the displaced worker. In this case, the second-period wage offer made to a worker displaced due to plant closing is simply

(15) $w_2(PC) = E(\eta)$.

Now we can see that $w_2(PC) = E(\eta) > E(\eta \mid \eta < \eta_D) = w_2(D)$, which is what we wanted to show. In sum, Gibbons and Katz have demonstrated that the post-displacement outcome depends on the nature of displacement. Otherwise observationally equivalent workers receive higher wage offers if the displacement happened because of a plant closing rather than downsizing.

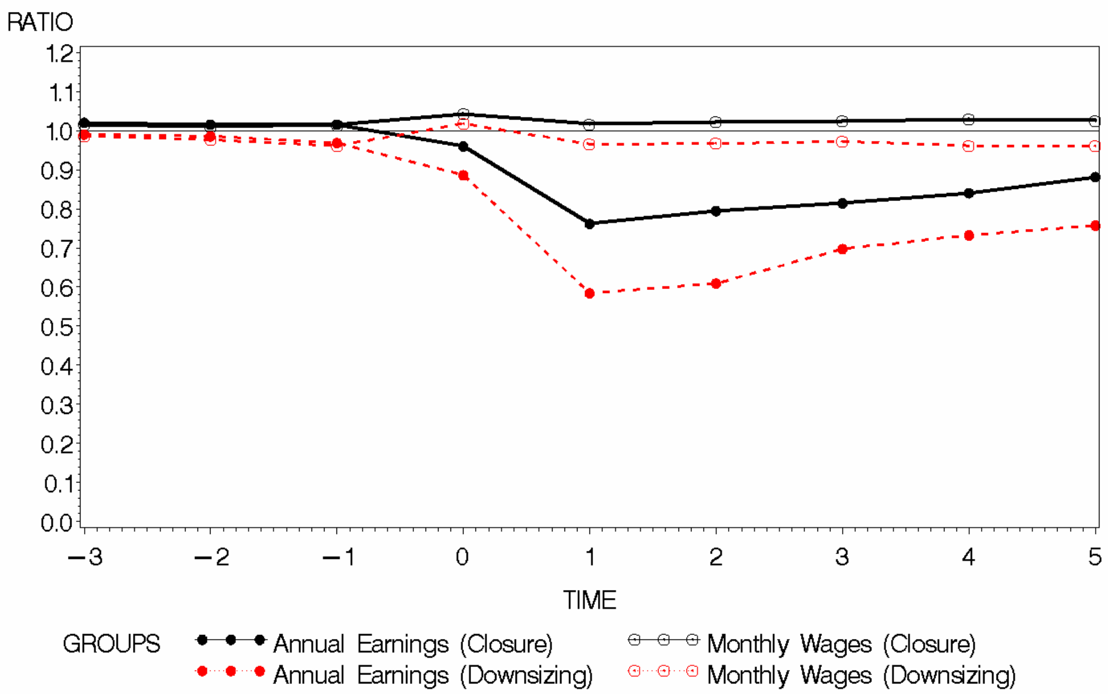
6.2.3 Testing the Predictions

Figures 11 and 12 present estimates on changes in both annual earnings and monthly wages analyzed separately according to the type of displacement. Again, we report the results separately for the two displacement groups to keep the figures readable.

[51] "[I]f the firm could retain low-ability workers at a low wage, then it would also retain high-ability workers at this low wage, thereby destroying the market's willingness to allow *any* workers to be retained at the low wage" (Gibbons and Katz 1991, 352 fn.). For the prospective employers, all workers are initially identical; only the displacement decision itself signals something about their productivity.

Figure 11. *The Effect of Displacement by Displacement Type (the 1992 Group).*

Figure 12. *The Effect of Displacement by Displacement Type (the 1997 Group).*



From Figure 11, it can be seen that for the first displacement group the type of displacement does not affect the results in a dramatic way. Even so, it is clear that the workers displaced from downsizing plants suffer slightly higher losses. Figure 12 has similar estimates for the second displacement group. Here the difference between the two groups is more pronounced and it is remarkable that the displacement effect is much larger for workers who were displaced from downsizing plants.

In short, it can be concluded from Figures 11 and 12 that the losses in both annual earnings and monthly wages are consistently larger for the workers who have been displaced from downsizing plants when compared with workers who have been displaced due to plant closing.[52] Our results are therefore consistent with the predictions of Gibbons and Katz's model. On the other hand, it is clear that other mechanisms must be involved as well, since also the workers who were displaced due to plant closing suffer sizeable losses. The difference between the results in Figure 11 and Figure 12 is also quite natural in light of Gibbons and Katz's model. Perhaps, the negative signal from being displaced due to downsizing is stronger during better times and less important during a recession when displacements are common.[53]

[52] For similar results, see Doiron (1995), Huttunen *et al*. (2005), and Fredriksen *et al*. (2006). An alternative explanation for the results may be that workers who were displaced from a downsizing plant search new employment less intensively because they hope to be recalled (see Katz and Meyer 1990).

[53] Gibbons and Katz assume that when a worker is displaced due to plant closing, no negative inference is made by the market. This seems like a natural assumption, since it is unclear why a displacement due to plant closing should give grounds for any negative conclusions. On the other hand, it is plausible that even a very small negative signal can lead to sizeable losses on average when the general labour market situation is difficult. As was concluded in Section 6.1, our results clearly indicate that once displaced workers have difficulties in finding new employment, especially when unemployment levels are high. Perhaps these difficulties are partly explained by negative signals associated with displacement in general.

7. Concluding Remarks

In this study, we have estimated the costs of involuntary job loss for Finnish workers using linked employer-employee data. Our first finding is that even re-employed workers displaced in 1992 suffer substantial and persistent losses in monthly wages: still five years after displacement their monthly wages are approximately 8 - 9.5 percent lower than in the control group. The same is not true for the workers who were displaced in 1997. In the 1997 group, the monthly wages of re-employed workers were not affected by displacement.

Previous studies on the consequences of job loss have typically focused only on re-employed workers. This has been done partly due to lack of data. One of the advantages of the FLEED data used in our study is that it includes all Finnish residents, not just those who are employed or part of the labour force. This has made it possible for us to estimate also the losses in annual earnings for all previously employed workers regardless of their post-displacement labour market status.

As was explored in detail in Section 5.1, the interpretation of the results on annual earnings is complicated by some technical difficulties and it should be done cautiously. Even so, our results make it clear that displacement has a sizeable negative effect on annual earnings and that the relative magnitude of the following losses is importantly related to the time of displacement. Even according to the lowest of our estimates, the annual earnings of displaced workers initially drop by approximately 41.9 percent in the 1992 group. A corresponding estimate for the 1997 group is 9.2 percent. Furthermore, in the 1992 group, the annual earnings of displaced workers are almost 23 percent lower than in the comparison group still five years after displacement even according to the lowest of the estimates. A corresponding estimate in the 1997 is less than 4 percent.

The gap between the estimated losses in annual earnings and monthly wages shows that, at least in our study, the most important consequence of displacement is the way it leads to reduced average levels of employment. Studying the wage changes of displaced workers who have been re-employed is interesting in itself, but it can give a misleading picture of the full impact of displacement.

Our study also indicates that the timing of the displacement event may have a decisive role in determining the severity of its consequences. In our study, we focused on displacements that happened in either 1992 or 1997. Those years were chosen because they reflect markedly different macroeconomic conditions in Finland. The big difference in the estimated losses for the two groups demonstrates the role played by the general labour market situation at the time when the displacements take place. In 1992, Finland was in the middle of a deep recession and the workers who lost their jobs at that time faced an exceptionally difficult labour market situation. Our study shows that displacement at that time led to extremely large earnings losses. By 1997, the labour market had moved back to a more typical state. Consequently, the losses from displacement were much smaller.

More careful study of the ways in which the surrounding economic conditions influence the outcomes of displaced workers must be left to further research. Typical explanations previously suggested for the displacement effects include the loss of human capital, valuable employer-employee matches, or deferred compensation. All of these explanations have some plausibility and they probably all play a role in explaining the costs of job loss. None of them seem, however, well-suited to explain all of the long-term effects displacement has on annual earnings in our study. It seems that to explain these results, we would in essence need to explain why displaced workers have persistently so much lower levels of employment after displacement. The explanation for the reduced levels of employment seems to be tied to the general employment situation and perhaps other economic conditions at the time of displacement.

Our results also show that there is some heterogeneity in the effects of displacement for different groups of workers. For example, elderly workers and workers with little education experienced considerably steeper drops in earnings and wages relative to similar non-displaced workers. Also women suffered on average larger losses in annual earnings, but not in monthly wages. In addition, the nature of displacement seems to be related to the resulting outcome: workers displaced from downsizing firms experience larger average losses than workers displaced due to plant closure. We have included some preliminary discussion on these results in Sections 5 and 6. However, it seems fair to say that the mechanisms behind these effects are not yet well-understood. Much more work needs to be done in analyzing the factors that determine the ways in which displacement influences subsequent labour market outcomes.

Since so little theoretical discussion exists on the mechanisms that lead to losses after displacement, it is difficult to give any policy suggestion to alleviate the problems that displaced workers experience. It seem clear, however, that society as a whole loses because so much productive potential is wasted due to slow recovery following displacement. Anything that could be done to facilitate the recovery process would lead to important long-term efficiency gains. This seems to be especially true when the labour market situation is difficult, as it was in Finland in the early 1990s.

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Appendices

Appendix A. List of Control Variables.

Variable	Definition	OLS	FE
v1990 - v2002	year dummies	X	X
	General Worker Characteristics		
age1	age	X	
age2	(age^2/100)	X	
gender	gender	X	
language	native speaker of Finnish or Swedish	X	
hs diploma	high school diploma	X	X
married1	married	X	X
married2	married * woman	X	X
tenu1	pre-displacement tenure less than 10 yrs	X	
tenu2	pre-displacement tenure over 10 yrs but less than 20 yrs	X	
	Level of Education		
school1	vocational training etc.	X	X
school2	bachelor's degree etc.	X	X
school3	master's degree or doctoral degree	X	X
	Field of Education		
education1	education	X	X
education2	arts	X	X
education3	business or social science	X	X
education4	natural science	X	X
education5	engineering	X	X
education6	agriculture	X	X
education7	health or social work	X	X
education8	service	X	X
	Employer Characteristics (pre-displacement)		
size1	less than 50 employees	X	
size2	over 50 but less than 250 employees	X	
industry1	manufacturing	X	
industry2	construction	X	
industry3	sales	X	
industry4	service	X	
industry5	transportation	X	
	Location of Residence		
location1	Southern Finland	X	X
location2	Eastern Finland	X	X
location3	Northern Finland	X	X

Appendix B. Estimates for the Control Variables

Table 6. Control Variables (Dependent Variable: Monthly Wages).

MODEL	**OLS**		**FE**	
Variable	*Year 1992*	*Year 1997*	*Year 1992*	*Year 1997*
v1990	0.077 (0.001)		0.088 (0.001)	
v1991	0.102 (0.001)		0.123 (0.001)	
v1992	0.112 (0.001)		0.142 (0.001)	
v1993	0.127 (0.001)		0.164 (0.001)	
v1994	0.166 (0.001)		0.207 (0.001)	
v1995	0.219 (0.001)	0.061 (0.000)	0.266 (0.001)	0.072 (0.001)
v1996	0.249 (0.001)	0.092 (0.000)	0.303 (0.001)	0.112 (0.001)
v1997	0.275 (0.001)	0.122 (0.001)	0.336 (0.001)	0.150 (0.001)
v1998		0.162 (0.001)		0.197 (0.001)
v1999		0.201 (0.001)		0.241 (0.001)
v2000		0.244 (0.001)		0.290 (0.001)
v2001		0.281 (0.001)		0.332 (0.001)
v2002		0.272 (0.001)		0.329 (0.001)
age1	0.038 (0.001)	0.041 (0.001)		
	-0.036	-0.040		

age2	(0.001)	(0.001)		
gender	0.267 (0.002)	0.269 (0.002)		
language	0.045 (0.013)	0.037 (0.010)		
hs diploma	0.104 (0.002)	0.103 (0.002)	-0.002† (0.009)	0.005† (0.010)
married1	0.065 (0.001)	0.062 (0.001)	0.022 (0.001)	0.023 (0.001)
married2	-0.112 (0.002)	-0.087 (0.002)	-0.112 (0.002)	-0.089 (0.002)
tenu1	0.056 (0.001)	0.048 (0.001)		
tenu2	0.083 (0.002)	0.076 (0.002)		
school1	0.141 (0.002)	0.134 (0.002)	0.114 (0.006)	0.175 (0.006)
school2	0.314 (0.003)	0.320 (0.003)	0.195 (0.008)	0.283 (0.008)
school3	0.479 (0.004)	0.498 (0.004)	0.308 (0.012)	0.447 (0.010)
education1	-0.001† (0.019)	-0.072 (0.018)	0.060† (0.040)	0.014† (0.039)
education2	-0.067 (0.007)	-0.118 (0.006)	-0.002† (0.020)	-0.031† (0.020)
education3	0.035 (0.002)	0.031 (0.002)	-0.026 (0.007)	-0.018† (0.006)
education4	0.052 (0.006)	0.043 (0.006)	-0.026† (0.012)	0.013† (0.009)
education5	0.023 (0.001)	0.027 (0.001)	0.002† (0.007)	0.017 (0.004)
education6	-0.071 (0.004)	-0.057 (0.004)	-0.026† (0.011)	-0.065 (0.015)
education7	-0.018 (0.005)	-0.017 (0.004)	0.108 (0.014)	0.053† (0.014)

education8	0.028 (0.003)	0.009 (0.003)	0.005† (0.008)	-0.023 (0.008)
size1	-0.103 (0.001)	-0.125 (0.001)		
size2	-0.073 (0.001)	-0.083 (0.001)		
industry1	-0.043 (0.002)	0.008 (0.002)		
industry2	0.025 (0.003)	0.030 (0.003)		
industry3	-0.015 (0.002)	-0.009 (0.002)		
industry4	-0.008† (0.003)	-0.019 (0.003)		
industry5	0.049 (0.003)	0.051 (0.003)		
location1	0.082 (0.002)	0.063 (0.002)	0.056 (0.009)	0.083 (0.008)
location2	-0.013 (0.002)	-0.022 (0.002)	0.002† (0.011)	-0.006† (0.011)
location3	0.042 (0.002)	0.027 (0.002)	0.021† (0.012)	0.014† (0.012)

(1) Robust standard errors are in parentheses.
(2) All parameter estimates are statistically significant at the 0.001 level, unless marked with †.

Table 7. Control Variables (Dependent Variable: log (1000 + annual earnings).

MODEL	OLS		FE	
Variable	*Year 1992*	*Year 1997*	*Year 1992*	*Year 1997*
v1990	0.068 (0.001)		0.076 (0.002)	
v1991	0.162 (0.001)		0.177 (0.001)	
v1992	0.168 (0.001)		0.187 (0.001)	
v1993	0.120 (0.001)		0.142 (0.001)	
v1994	0.072 (0.002)		0.094 (0.001)	
v1995	0.094 (0.002)	0.066 (0.000)	0.115 (0.001)	0.075 (0.001)
v1996	0.085 (0.002)	0.096 (0.000)	0.102 (0.002)	0.114 (0.001)
v1997	0.075 (0.002)	0.122 (0.001)	0.085 (0.002)	0.147 (0.001)
v1998		0.138 (0.001)		0.168 (0.001)
v1999		0.109 (0.001)		0.142 (0.001)
v2000		0.117 (0.001)		0.152 (0.001)
v2001		0.122 (0.001)		0.159 (0.001)
v2002		0.098 (0.002)		0.133 (0.001)
age1	0.084 (0.001)	0.066 (0.001)		
age2	-0.102 (0.001)	-0.074 (0.001)		

gender	0.244 (0.003)	0.265 (0.002)		
language	0.146 (0.021)	0.094 (0.014)		
hs diploma	0.109 (0.003)	0.104 (0.002)	-0.055 (0.016)	-0.035† (0.014)
married1	0.122 (0.002)	0.087 (0.002)	0.097 (0.003)	0.059 (0.002)
married2	-0.152 (0.003)	-0.108 (0.003)	-0.229 (0.004)	-0.174 (0.003)
tenu1	0.074 (0.002)	0.061 (0.002)		
tenu2	0.126 (0.003)	0.094 (0.002)		
school1	0.151 (0.003)	0.139 (0.002)	0.183 (0.010)	0.197 (0.007)
school2	0.319 (0.004)	0.323 (0.003)	0.330 (0.014)	0.317) (0.009
school3	0.460 (0.006)	0.483 (0.004)	0.494 (0.018)	0.499 (0.013)
education1	-0.030† (0.029)	-0.066† (0.022)	0.015† (0.056)	-0.024† (0.040)
education2	-0.057 (0.010)	-0.112 (0.008)	-0.193 (0.031)	-0.139 (0.025)
education3	0.055 (0.003)	0.040 (0.003)	-0.115 (0.012)	-0.033 (0.008)
education4	0.098 (0.009)	0.062) (0.007	-0.135† (0.020)	-0.036† (0.015)
education5	0.041 (0.002)	0.043 (0.002)	-0.055 (0.012)	0.023 (0.007)
education6	-0.045 (0.006)	-0.041 (0.005)	-0.079 (0.022)	-0.105 (0.024)
education7	0.004† (0.006)	-0.001† (0.005)	-0.102 (0.019)	-0.054 (0.017)
education8				

	0.016 (0.004)	0.002† (0.003)	-0.087† (0.014)	-0.066† (0.011)
size1				
	-0.126 (0.002)	-0.135 (0.002)		
size2				
	-0.095 (0.002)	-0.092 (0.002)		
industry1				
	-0.079 (0.003)	-0.014 (0.003)		
industry2				
	-0.12 (0.005)	0.025 (0.004)		
industry3				
	-0.058 (0.004)	-0.025 (0.003)		
industry4				
	-0.029 (0.004)	-0.026 (0.003)		
industry5				
	0.004† (0.004)	0.038 (0.003)		
location1				
	0.148 (0.003)	0.058 (0.002)	0.328 (0.018)	0.248 (0.013)
location2				
	0.018 (0.004)	-0.033 (0.003)	-0.131 (0.023)	-0.079 (0.017)
location3				
	0.096 (0.004)	0.018 (0.003)	-0.006† (0.026)	-0.041† (0.019)

(1) Robust standard errors are in parentheses.
(2) All parameter estimates are statistically significant at the 0.001 level, unless marked with †.

Appendix C. Additional Estimation Results.

Table 8. The Effect of Displacement on Annual Earnings (FE: the 1992 group).

MODEL	(1)	(2)	(3)	(4)	(5)
Variable					
Displaced at *t=-2*	0.019† (0.023)	0.016† (0.018)	0.012† (0.013)	0.008† (0.008)	0.004† (0.006)
Displaced at *t=-1*	0.042† (0.020)	0.027† (0.016)	0.012† (0.012)	-0.002† (0.007)	-0.017† (0.006)
Displaced at *t=0*	-0.236 (0.020)	-0.231 (0.016)	-0.223 (0.012)	-0.197 (0.007)	-0.216 (0.006)
Displaced at *t=1*	-1.951 (0.027)	-1.598 (0.021)	-1.228 (0.015)	-0.803 (0.009)	-0.626 (0.009)
Displaced at *t=2*	-1.455 (0.025)	-1.210 (0.019)	-0.954 (0.014)	-0.657 (0.008)	-0.533 (0.008)
Displaced at *t=3*	-1.256 (0.025)	-1.041 (0.019)	-0.818 (0.013)	-0.563 (0.008)	-0.440 (0.008)
Displaced at *t=4*	-1.088 (0.025)	-0.900 (0.019)	-0.707 (0.014)	-0.489 (0.008)	-0.376 (0.008)
Displaced at *t=5*	-0.978 (0.026)	-0.804 (0.020)	-0.626 (0.014)	-0.431 (0.009)	-0.308 (0.008)
N	2,400,140	2,400,140	2,400,140	2,400,140	2,328,879
R^2	0.364	0.393	0.443	0.535	0.571

(1) Robust standard errors are in parentheses.
(2) All specifications include time fixed-effects and a vector of control variables; a full list of variables is included as Appendix A.
(3) All parameter estimates are statistically significant at the 0.001 level, unless marked with †.

Table 9. The Effect of Displacement on Annual Earnings (FE: the 1997 group).

MODEL	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**
<u>*Variable*</u>					
Displaced at *t=-2*	-0.003† (0.015)	-0.003† (0.012)	-0.003† (0.010)	-0.004† (0.007)	-0.003† (0.005)
Displaced at *t=-1*	-0.011† (0.015)	-0.011† (0.012)	-0.011† (0.009)	-0.011† (0.007)	-0.011† (0.005)
Displaced at *t=0*	-0.082 (0.015)	-0.077 (0.012)	-0.070 (0.009)	-0.059 (0.006)	-0.060 (0.005)
Displaced at *t=1*	-0.413 (0.019)	-0.337 (0.015)	-0.259 (0.011)	-0.172 (0.007)	-0.108 (0.007)
Displaced at *t=2*	-0.369 (0.019)	-0.298 (0.015)	-0.225 (0.011)	-0.146 (0.007)	-0.082 (0.007)
Displaced at *t=3*	-0.282 (0.019)	-0.228 (0.015)	-0.172 (0.011)	-0.112 (0.007)	-0.060 (0.006)
Displaced at *t=4*	-0.240 (0.020)	-0.190 (0.016)	-0.140 (0.012)	-0.088 (0.008)	-0.038 (0.007)
Displaced at *t=5*	-0.198 (0.022)	-0.159 (0.017)	-0.119 (0.013)	-0.076 (0.008)	-0.038 (0.007)
N	2,519,550	2,519,550	2,519,550	2,519,550	2,490,760
R^2	0.392	0.433	0.500	0.608	0.657

(1) Robust standard errors are in parentheses.
(2) All specifications include time fixed-effects and a vector of control variables; a full list of variables is included as Appendix A.
(3) All parameter estimates are statistically significant at the 0.001 level, unless marked with †.

Appendix D. Estimation Results for Smaller Groups

Table 10. The Effect of Displacement on Monthly Wages (Men).

MODEL	OLS		FE	
Variable	*Year 1992*	*Year 1997*	*Year 1992*	*Year 1997*
Displaced at *t=-3*	0.009† (0.004)	0.007† (0.004)		
Displaced at *t=-2*	0.014 (0.004)	-0.003† (0.004)	0.006† (0.004)	-0.010† (0.004)
Displaced at *t=-1*	-0.004† (0.003)	-0.002† (0.004)	-0.011† (0.004)	-0.008† (0.004)
Displaced at *t=0*	0.101 (0.004)	0.025 (0.005)	0.088 (0.005)	0.018 (0.004)
Displaced at *t=1*	-0.055 (0.006)	-0.014† (0.006)	-0.099 (0.006)	-0.026 (0.005)
Displaced at *t=2*	-0.099 (0.005)	0.005† (0.007)	-0.129 (0.005)	-0.003† (0.005)
Displaced at *t=3*	-0.093 (0.005)	0.000† 0.007	-0.117 (0.005)	-0.008† (0.006)
Displaced at *t=4*	-0.097 (0.005)	-0.003† (0.007)	-0.116 (0.005)	-0.011† (0.005)
Displaced at *t=5*	-0.094 (0.005)	-0.006† (0.006)	-0.112 (0.005)	-0.014† (0.005)
N R^2	1,353,432 0.333	1,508,131 0.337	1,353,448 0.753	1,508,140 0.740

(1) The dependent variable is the natural logarithm of the annual labour income that has been divided by the months worked during that year.
(2) Robust standard errors are in parentheses.
(3) All specifications include time fixed-effects and a vector of control variables; a full list of variables is included as Appendix A.
(4) All parameter estimates are statistically significant at the 0.001 level, unless marked with †.

Table 11. The Effect of Displacement on Monthly Wages (Women).

MODEL	OLS		FE	
Variable	*Year 1992*	*Year 1997*	*Year 1992*	*Year 1997*
Displaced at *t=-3*	0.003† (0.005)	-0.007† (0.006)		
Displaced at *t=-2*	-0.003† (0.005)	-0.011† (0.006)	-0.007† (0.006)	-0.003† (0.007)
Displaced at *t=-1*	-0.038 (0.005)	-0.029 (0.007)	-0.040 (0.006)	-0.019† (0.007)
Displaced at *t=0*	0.084 (0.006)	0.038 (0.007)	0.074 (0.006)	0.045 (0.007)
Displaced at *t=1*	-0.031 (0.007)	-0.003† (0.007)	-0.064 (0.007)	-0.007† (0.008)
Displaced at *t=2*	-0.055 (0.006)	-0.023† (0.009)	-0.080 (0.007)	-0.020† (0.009)
Displaced at *t=3*	-0.052 (0.006)	-0.007† (0.009)	-0.071 (0.006)	0.001† (0.008)
Displaced at *t=4*	-0.067 (0.006)	-0.011† (0.009)	-0.079 (0.006)	0.000† (0.009)
Displaced at *t=5*	-0.072 (0.006)	-0.013† (0.008)	-0.082 (0.006)	0.001† (0.008)
N	947,231	969,530	947,231	969,536
R^2	0.255	0.251	0.624	0.613

(1) The dependent variable is the natural logarithm of the annual labour income that has been divided by the months worked during that year.
(2) Robust standard errors are in parentheses.
(3) All specifications include time fixed-effects and a vector of control variables; a full list of variables is included as Appendix A.
(4) All parameter estimates are statistically significant at the 0.001 level, unless marked with †.

Table 12. The Effect of Displacement on Monthly Wages (Group I: Age 21-30).

MODEL	OLS		FE	
Variable	*Year 1992*	*Year 1997*	*Year 1992*	*Year 1997*
Displaced at *t=-3*	0.015† (0.009)	-0.040† (0.014)		
Displaced at *t=-2*	0.014† (0.008)	-0.065 (0.014)	-0.005† (0.011)	-0.025† (0.018)
Displaced at *t=-1*	-0.027† (0.009)	-0.063 (0.014)	-0.043 (0.011)	-0.025† (0.018)
Displaced at *t=0*	0.095 (0.010)	-0.016† (0.016)	0.072 (0.012)	0.017† (0.019)
Displaced at *t=1*	-0.046 (0.013)	-0.049† (0.017)	-0.086 (0.014)	-0.029† (0.019)
Displaced at *t=2*	-0.045 (0.012)	0.003† (0.021)	-0.078 (0.013)	0.029† (0.022)
Displaced at *t=3*	-0.029 (0.011)	0.006† (0.020)	-0.059 (0.012)	0.027† (0.021)
Displaced at *t=4*	-0.031 (0.010)	-0.009† (0.022)	-0.053 (0.012)	0.013† (0.023)
Displaced at *t=5*	-0.028 (0.010)	0.003† (0.019)	-0.051 (0.012)	0.023† (0.021)
N R^2	274,902 0.309	197,916 0.313	274,906 0.583	197,916 0.579

(1) The dependent variable is the natural logarithm of the annual labour income that has been divided by the months worked during that year.
(2) Robust standard errors are in parentheses.
(3) All specifications include time fixed-effects and a vector of control variables; a full list of variables is included as Appendix A.
(4) All parameter estimates are statistically significant at the 0.001 level, unless marked with †.

Table 13. The Effect of Displacement on Monthly Wages (Group II: Age 30-45).

MODEL	OLS		FE	
Variable	*Year 1992*	*Year 1997*	*Year 1992*	*Year 1997*
Displaced at *t=-3*	0.012† (0.004)	0.000† (0.005)		
Displaced at *t=-2*	0.011† (0.004)	-0.005† (0.005)	-0.002† (0.004)	-0.004† (0.005)
Displaced at *t=-1*	-0.015 (0.004)	-0.019† (0.006)	-0.025 (0.004)	-0.018† (0.006)
Displaced at *t=0*	0.094 (0.005)	0.028 (0.005)	0.076 (0.005)	0.027 (0.006)
Displaced at *t=1*	-0.036 (0.006)	-0.005† (0.006)	-0.083 (0.006)	-0.012† (0.006)
Displaced at *t=2*	-0.073 (0.005)	0.004† (0.007)	-0.11 (0.005)	0.000† (0.007)
Displaced at *t=3*	-0.074 (0.005)	0.010† (0.007)	-0.103 (0.005)	0.009† (0.007)
Displaced at *t=4*	-0.083 (0.005)	0.004† (0.007)	-0.106 (0.005)	0.006† (0.006)
Displaced at *t=5*	-0.083 (0.005)	0.005† (0.007)	-0.105 (0.005)	0.007† (0.006)
N R^2	1,325,403 0.375	1,336,435 0.362	1,325,415 0.730	1,336,444 0,721

(1) The dependent variable is the natural logarithm of the annual labour income that has been divided by the months worked during that year.
(2) Robust standard errors are in parentheses.
(3) All specifications include time fixed-effects and a vector of control variables; a full list of variables is included as Appendix A.
(4) All parameter estimates are statistically significant at the 0.001 level, unless marked with †.

Table 14. The Effect of Displacement on Monthly Wages (Group III: Age 45-52).

MODEL	**OLS**		**FE**	
Variable	*Year 1992*	*Year 1997*	*Year 1992*	*Year 1997*
Displaced at *t=-3*	-0.003† (0.006)	0.016† (0.005)		
Displaced at *t=-2*	0.002† (0.005)	0.007† (0.005)	0.005† (0.005)	-0.010† (0.004)
Displaced at *t=-1*	-0.017 (0.005)	0.011† (0.005)	-0.012† (0.005)	-0.006† (0.004)
Displaced at *t=0*	0.101 (0.006)	0.047 (0.006)	0.097 (0.007)	0.030 (0.005)
Displaced at *t=1*	-0.054 (0.009)	-0.004† (0.007)	-0.092 (0.008)	-0.031 (0.005)
Displaced at *t=2*	-0.108 (0.008)	-0.021† (0.008)	-0.130 (0.007)	-0.044 (0.006)
Displaced at *t=3*	-0.098 (0.008)	-0.021† (0.009)	-0.121 (0.007)	-0.040 (0.007)
Displaced at *t=4*	-0.111 (0.008)	-0.016† (0.009)	-0.129 (0.007)	-0.038 (0.007)
Displaced at *t=5*	-0.117 (0.008)	-0.029 (0.008)	-0.133 (0.007)	-0.047 (0.007)
N R^2	700,358 0.424	943,310 0.406	700,358 0.808	943,316 0.798

(1) The dependent variable is the natural logarithm of the annual labour income that has been divided by the months worked during that year.
(2) Robust standard errors are in parentheses.
(3) All specifications include time fixed-effects and a vector of control variables; a full list of variables is included as Appendix A.
(4) All parameter estimates are statistically significant at the 0.001 level, unless marked with †.

Table 15. The Effect of Displacement on Monthly Wages (Education Group I: Master's / higher).

MODEL	OLS		FE	
Variable	*Year 1992*	*Year 1997*	*Year 1992*	*Year 1997*
Displaced at *t=-3*	0.007† (0.016)	-0.012† (0.017)		
Displaced at *t=-2*	-0.009† (0.016)	-0.024† (0.018)	-0.010† (0.019)	-0.011† (0.018)
Displaced at *t=-1*	-0.016† (0.015)	0.000† (0.019)	-0.016† (0.018)	0.014† (0.019)
Displaced at *t=0*	0.017† (0.018)	0.002† (0.017)	0.015† (0.020)	0.016† (0.017)
Displaced at *t=1*	-0.008† (0.020)	-0.008† (0.020)	-0.029† (0.020)	0.002† (0.019)
Displaced at *t=2*	-0.061† (0.023)	-0.023† (0.024)	-0.075 (0.022)	-0.005† (0.021)
Displaced at *t=3*	-0.042† (0.019)	0.024† (0.024)	-0.044† (0.019)	0.037† (0.021)
Displaced at *t=4*	-0.067† (0.022)	0.069† (0.023)	-0.067† (0.022)	0.083 (0.020)
Displaced at *t=5*	-0.034† (0.019)	-0.022† (0.022)	-0.034† (0.020)	-0.005† (0.020)
N R^2	97,548 0.270	125,802 0.253	97,548 0.672	125,802 0.696

(1) The dependent variable is the natural logarithm of the annual labour income that has been divided by the months worked during that year.
(2) Robust standard errors are in parentheses.
(3) All specifications include time fixed-effects and a vector of control variables; a full list of variables is included as Appendix A.
(4) All parameter estimates are statistically significant at the 0.001 level, unless marked with †.

Table 16. The Effect of Displacement on Monthly Wages (Education Group II: Secondary Etc.).

MODEL	OLS		FE	
Variable	*Year 1992*	*Year 1997*	*Year 1992*	*Year 1997*
Displaced at *t=-3*	0.026† (0.009)	-0.031 (0.009)		
Displaced at *t=-2*	0.016† (0.008)	-0.050 (0.009)	-0.006† (0.009)	-0.018† (0.009)
Displaced at *t=-1*	-0.017† (0.009)	-0.059 (0.010)	-0.037 (0.009)	-0.026† (0.009)
Displaced at *t=0*	0.078 (0.009)	-0.018† (0.010)	0.048 (0.010)	0.015† (0.009)
Displaced at *t=1*	0.010† (0.011)	-0.032† (0.011)	-0.051 (0.011)	-0.002† (0.010)
Displaced at *t=2*	-0.014† (0.010)	-0.015† (0.012)	-0.065 (0.010)	0.017† (0.011)
Displaced at *t=3*	-0.025† (0.010)	-0.009† (0.012)	-0.064 (0.010)	0.025† (0.011)
Displaced at *t=4*	-0.038 (0.010)	-0.020† (0.012)	-0.072 (0.010)	0.020† (0.011)
Displaced at *t=5*	-0.042 (0.010)	-0.013† (0.011)	-0.078 (0.010)	0.025† (0.011)
N	378,581	484,561	378,581	484,564
R^2	0.339	0.318	0.719	0.718

(1) The dependent variable is the natural logarithm of the annual labour income that has been divided by the months worked during that year.
(2) Robust standard errors are in parentheses.
(3) All specifications include time fixed-effects and a vector of control variables; a full list of variables is included as Appendix A.
(4) All parameter estimates are statistically significant at the 0.001 level, unless marked with †.

Table 17. The Effect of Displacement on Monthly Wages (Education Group III: Primary Etc.).

MODEL	**OLS**		**FE**	
Variable	*Year 1992*	*Year 1997*	*Year 1992*	*Year 1997*
Displaced at *t=-3*	0.001† (0.003)	0.010† (0.004)		
Displaced at *t=-2*	0.005† (0.003)	0.005† (0.004)	0.003† (0.004)	-0.004† (0.004)
Displaced at *t=-1*	-0.020 (0.003)	-0.004† (0.004)	-0.020 (0.004)	-0.013† (0.004)
Displaced at *t=0*	0.101 (0.004)	0.046 (0.004)	0.094 (0.004)	0.034 (0.005)
Displaced at *t=1*	-0.058 (0.005)	-0.007† (0.005)	-0.095 (0.005)	-0.029 (0.005)
Displaced at *t=2*	-0.098 (0.005)	-0.009† (0.006)	-0.121 (0.005)	-0.026 (0.005)
Displaced at *t=3*	-0.090 (0.004)	-0.011† (0.006)	-0.110 (0.004)	-0.025 (0.005)
Displaced at *t=4*	-0.097 (0.004)	-0.018† (0.006)	-0.109 (0.004)	-0.031 (0.006)
Displaced at *t=5*	-0.097 (0.004)	-0.015† (0.006)	-0.108 (0.004)	-0.027 (0.005)
N	1,822,534	1,864,075	1,822,550	1,864,087
R^2	0.301	0.289	0.716	0.713

(1) The dependent variable is the natural logarithm of the annual labour income that has been divided by the months worked during that year.
(2) Robust standard errors are in parentheses.
(3) All specifications include time fixed-effects and a vector of control variables; a full list of variables is included as Appendix A.
(4) All parameter estimates are statistically significant at the 0.001 level, unless marked with †.

Table 18. *The Effect of Displacement on Monthly Wages (Displacement Type: Plant Closure).*

MODEL	OLS		FE	
Variable	*Year 1992*	*Year 1997*	*Year 1992*	*Year 1997*
Displaced at *t=-3*	0.009† (0.005)	0.015† (0.005)		
Displaced at *t=-2*	0.003† (0.005)	0.010† (0.005)	-0.006† (0.006)	-0.005† (0.005)
Displaced at *t=-1*	-0.014† (0.005)	0.015† (0.005)	-0.022 (0.005)	0.000† (0.005)
Displaced at *t=0*	0.089 (0.006)	0.042 (0.006)	0.073 (0.006)	0.026 (0.006)
Displaced at *t=1*	-0.027 (0.008)	0.016† (0.006)	-0.061 (0.007)	-0.004† (0.006)
Displaced at *t=2*	-0.062 (0.006)	0.022† (0.008)	-0.089 (0.006)	0.005† (0.007)
Displaced at *t=3*	-0.070 (0.006)	0.024† (0.008)	-0.092 (0.006)	0.007† (0.007)
Displaced at *t=4*	-0.073 (0.006)	0.029 (0.008)	-0.089 (0.006)	0.013† (0.007)
Displaced at *t=5*	-0.079 (0.006)	0.025 (0.007)	-0.092 (0.006)	0.009† (0.007)
N R^2	2,213,435 0.393	2,433,252 0.379	2,213,451 0.746	2,433,267 0.741

(1) The dependent variable is the natural logarithm of the annual labour income that has been divided by the months worked during that year.
(2) Robust standard errors are in parentheses.
(3) All specifications include time fixed-effects and a vector of control variables; a full list of variables is included as Appendix A.
(4) All parameter estimates are statistically significant at the 0.001 level, unless marked with †.

Table 19. The Effect of Displacement on Monthly Wages (Displacement Type: Downsizing).

MODEL	OLS		FE	
Variable	*Year 1992*	*Year 1997*	*Year 1992*	*Year 1997*
Displaced at *t=-3*	0.005† (0.004)	-0.014† (0.005)		
Displaced at *t=-2*	0.010† (0.004)	-0.024 (0.005)	0.005† (0.004)	-0.009† (0.005)
Displaced at *t=-1*	-0.021 (0.004)	-0.039 (0.006)	-0.023 (0.004)	-0.024 (0.006)
Displaced at *t=0*	0.099 (0.004)	0.018 (0.005)	0.088 (0.005)	0.030 (0.006)
Displaced at *t=1*	-0.054 (0.006)	-0.035 (0.006)	-0.10 (0.006)	-0.031 (0.006)
Displaced at *t=2*	-0.092 (0.005)	-0.034 (0.007)	-0.122 (0.005)	-0.024 (0.007)
Displaced at *t=3*	-0.079 (0.005)	-0.028 (0.007)	-0.103 (0.005)	-0.014† (0.007)
Displaced at *t=4*	-0.092 (0.005)	-0.039 (0.007)	-0.109 (0.005)	-0.023 (0.007)
Displaced at *t=5*	-0.088 (0.005)	-0.040 (0.007)	-0.105 (0.005)	-0.022 (0.007)
N	2,247,648	2,439,905	2,247,664	2,439,920
R^2	0.390	0.379	0.743	0.740

(1) The dependent variable is the natural logarithm of the annual labour income that has been divided by the months worked during that year.
(2) Robust standard errors are in parentheses.
(3) All specifications include time fixed-effects and a vector of control variables; a full list of variables is included as Appendix A.
(4) All parameter estimates are statistically significant at the 0.001 level, unless marked with †.

Table 20. The Effect of Displacement on Annual Earnings (Men).

MODEL	OLS		FE	
Variable	*Year 1992*	*Year 1997*	*Year 1992*	*Year 1997*
Displaced at *t=-3*	0.015† (0.006)	0.007† (0.004)		
Displaced at *t=-2*	0.036 (0.006)	0.001† (0.004)	0.021† (0.011)	-0.005† (0.008)
Displaced at *t=-1*	0.018 (0.004)	0.002† (0.004)	0.004† (0.010)	-0.005† (0.008)
Displaced at *t=0*	-0.178 (0.006)	-0.032 (0.005)	-0.191 (0.009)	-0.037 (0.007)
Displaced at *t=1*	-0.825 (0.012)	-0.124 (0.009)	-0.838 (0.012)	-0.129 (0.009)
Displaced at *t=2*	-0.667 (0.012)	-0.100 (0.010)	-0.679 (0.011)	-0.104 (0.009)
Displaced at *t=3*	-0.559 (0.012)	-0.091 (0.011)	-0.570 (0.011)	-0.095 (0.009)
Displaced at *t=4*	-0.486 (0.012)	-0.079 (0.012)	-0.497 (0.011)	-0.082 (0.009)
Displaced at *t=5*	-0.436 (0.012)	-0.061 (0.012)	-0.448 (0.011)	-0.065 (0.010)
N	1,405,526	1,529,622	1,405,526	1,529,622
R^2	0.155	0.189	0.523	0.613

(1) The dependent variable: log (1000 + annual earnings).
(2) Robust standard errors are in parentheses.
(3) All specifications include time fixed-effects and a vector of control variables; a full list of variables is included as Appendix A.
(4) All parameter estimates are statistically significant at the 0.001 level, unless marked with †.

Table 21. The Effect of Displacement on Annual Earnings (Women).

MODEL	OLS		FE	
Variable	*Year 1992*	*Year 1997*	*Year 1992*	*Year 1997*
Displaced at *t=-3*	0,001† (0.007)	-0.002† (0.006)		
Displaced at *t=-2*	-0.010† (0.007)	-0.006† (0.005)	-0.013† (0.012)	-0.002† (0.011)
Displaced at *t=-1*	-0.015† (0.005)	-0.024 (0.006)	-0.012† (0.011)	-0.018† (0.011)
Displaced at *t=0*	-0.211 (0.007)	-0.096 (0.008)	-0.207 (0.011)	-0.087 (0.011)
Displaced at *t=1*	-0.759 (0.014)	-0.237 (0.014)	-0.753 (0.013)	-0.227 (0.013)
Displaced at *t=2*	-0.635 (0.013)	-0.212 (0.014)	-0.627 (0.012)	-0.200 (0.013)
Displaced at *t=3*	-0.564 (0.014)	-0.144 (0.014)	-0.553 (0.013)	-0.130 (0.012)
Displaced at *t=4*	-0.493 (0.014)	-0.108 (0.015)	-0.480 (0.013)	-0.092 (0.013)
Displaced at *t=5*	-0.425 (0.014)	-0.106 (0.015)	-0.410 (0.014)	-0.088 (0.014)
N	994,614	989,928	994,614	989,928
R^2	0.134	0.133	0.484	0.519

(1) The dependent variable: log (1000 + annual earnings).
(2) Robust standard errors are in parentheses.
(3) All specifications include time fixed-effects and a vector of control variables; a full list of variables is included as Appendix A.
(4) All parameter estimates are statistically significant at the 0.001 level, unless marked with †.

Table 22. The Effect of Displacement on Annual Earnings (Group I: Age 21-30).

MODEL	**OLS**		**FE**	
Variable	*Year 1992*	*Year 1997*	*Year 1992*	*Year 1997*
Displaced at *t=-3*	0.032† (0.011)	-0.044† (0.015)		
Displaced at *t=-2*	0.006† (0.012)	-0.049 (0.013)	-0.027† (0.021)	-0.004† (0.025)
Displaced at *t=-1*	-0.012† (0.008)	-0.047 (0.013)	-0.045† (0.019)	-0.004† (0.025)
Displaced at *t=0*	-0.232 (0.013)	-0.132 (0.019)	-0.265 (0.019)	-0.090 (0.025)
Displaced at *t=1*	-0.733 (0.023)	-0.232 (0.028)	-0.767 (0.023)	-0.191 (0.028)
Displaced at *t=2*	-0.547 (0.022)	-0.145 (0.028)	-0.580 (0.021)	-0.107 (0.027)
Displaced at *t=3*	-0.445 (0.023)	-0.107 (0.030)	-0.477 (0.021)	-0.070† (0.028)
Displaced at *t=4*	-0.388 (0.023)	-0.096† (0.031)	-0.421 (0.021)	-0.061† (0.029)
Displaced at *t=5*	-0.314 (0.022)	-0.060† (0.031)	-0.347 (0.022)	-0.023† (0.031)
N	286,325	201,249	286,325	201,249
R^2	0.185	0.218	0.495	0.531

(1) The dependent variable: log (1000 + annual earnings).
(2) Robust standard errors are in parentheses.
(3) All specifications include time fixed-effects and a vector of control variables; a full list of variables is included as Appendix A.
(4) All parameter estimates are statistically significant at the 0.001 level, unless marked with †.

Table 23. The Effect of Displacement on Annual Earnings (Group II: Age 30-45).

MODEL	**OLS**		**FE**	
Variable	*Year 1992*	*Year 1997*	*Year 1992*	*Year 1997*
Displaced at *t=-3*	0.003† (0.006)	0.004 (0.005)		
Displaced at *t=-2*	0.012† (0.006)	0.000 (0.005)	0.010† (0.010)	-0.003† (0.008)
Displaced at *t=-1*	0.005† (0.004)	-0.014 (0.005)	0.003† (0.009)	-0.016† (0.008)
Displaced at *t=0*	-0.184 (0.006)	-0.056 (0.007)	-0.186 (0.009)	-0.057 (0.008)
Displaced at *t=1*	-0.773 (0.012)	-0.145 (0.010)	-0.775 (0.011)	-0.145 (0.010)
Displaced at *t=2*	-0.636 (0.012)	-0.113 (0.011)	-0.637 (0.011)	-0.113 (0.009)
Displaced at *t=3*	-0.516 (0.011)	-0.084 (0.011)	-0.517 (0.010)	-0.083 (0.009)
Displaced at *t=4*	-0.422 (0.011)	-0.062 (0.011)	-0.423 (0.010)	-0.060 (0.010)
Displaced at *t=5*	-0.360 (0.011)	-0.056 (0.012)	-0.361 (0.011)	-0.054 (0.010)
N R^2	1,371,749 0.188	1,353,186 0.236	1,371,749 0.542	1,353,186 0.612

(1) The dependent variable: log (1000 + annual earnings).
(2) Robust standard errors are in parentheses.
(3) All specifications include time fixed-effects and a vector of control variables; a full list of variables is included as Appendix A.
(4) All parameter estimates are statistically significant at the 0.001 level, unless marked with †.

Table 24. The Effect of Displacement on Annual Earnings (Group III: Age 45-52).

MODEL	**OLS**		**FE**	
Variable	*Year 1992*	*Year 1997*	*Year 1992*	*Year 1997*
Displaced at *t=-3*	0.006† (0.008)	0.017 (0.005)		
Displaced at *t=-2*	0.021† (0.008)	0.010† (0.005)	0.014† (0.015)	-0.007† (0.011)
Displaced at *t=-1*	0.010† (0.005)	0.010† (0.005)	0.002† (0.014)	-0.008† (0.011)
Displaced at *t=0*	-0.185 (0.008)	-0.041 (0.007)	-0.194 (0.014)	-0.059 (0.010)
Displaced at *t=1*	-0.871 (0.018)	-0.195 (0.014)	-0.880 (0.017)	-0.212 (0.012)
Displaced at *t=2*	-0.729 (0.017)	-0.195 (0.015)	-0.738 (0.015)	-0.212 (0.012)
Displaced at *t=3*	-0.692 (0.018)	-0.155 (0.015)	-0.702 (0.016)	-0.171 (0.012)
Displaced at *t=4*	-0.658 (0.018)	-0.133 (0.017)	-0.668 (0.016)	-0.148 (0.013)
Displaced at *t=5*	-0.625 (0.019)	-0.123 (0.018)	-0.636 (0.018)	-0.137 (0.015)
N R^2	742,066 0.210	965,115 0.220	742,066 0.543	965,115 0.607

(1) The dependent variable: log (1000 + annual earnings).
(2) Robust standard errors are in parentheses.
(3) All specifications include time fixed-effects and a vector of control variables; a full list of variables is included as Appendix A.
(4) All parameter estimates are statistically significant at the 0.001 level, unless marked with †.

Table 25. The Effect of Displacement on Annual Earnings (Education Group I: Master's / higher).

MODEL	OLS		FE	
Variable	*Year 1992*	*Year 1997*	*Year 1992*	*Year 1997*
Displaced at *t=-3*	0.007† (0.027)	-0.001† (0.017)		
Displaced at *t=-2*	0.043† (0.018)	-0.018† (0.017)	0.038† (0.039)	-0.015† (0.022)
Displaced at *t=-1*	0.014† (0.016)	-0.014† (0.018)	0.010† (0.037)	-0.010† (0.022)
Displaced at *t=0*	-0.062† (0.021)	-0.011† (0.018)	-0.064† (0.036)	-0.006† (0.022)
Displaced at *t=1*	-0.290 (0.040)	-0.042† (0.025)	-0.290 (0.041)	-0.035† (0.024)
Displaced at *t=2*	-0.263 (0.040)	-0.033† (0.029)	-0.262 (0.040)	-0.023† (0.026)
Displaced at *t=3*	-0.208 (0.039)	0.007† (0.030)	-0.205 (0.039)	0.017† (0.025)
Displaced at *t=4*	-0.200 (0.040)	0.034† (0.032)	-0.197 (0.041)	0.046† (0.027)
Displaced at *t=5*	-0.155 (0.039)	-0.030† (0.034)	-0.154 (0.042)	-0.017† (0.031)
N	100,333	127,233	100,333	127,233
R^2	0.184	0.168	0.522	0.602

(1) The dependent variable: log (1000 + annual earnings).
(2) Robust standard errors are in parentheses.
(3) All specifications include time fixed-effects and a vector of control variables; a full list of variables is included as Appendix A.
(4) All parameter estimates are statistically significant at the 0.001 level, unless marked with †.

Table 26. The Effect of Displacement on Annual Earnings (Education Group II: Secondary etc.).

MODEL	OLS		FE	
Variable	*Year 1992*	*Year 1997*	*Year 1992*	*Year 1997*
Displaced at *t=-3*	0.031† (0.011)	-0.034 (0.009)		
Displaced at *t=-2*	0.026† (0.010)	-0.041 (0.008)	-0.003† (0.018)	-0.006† (0.013)
Displaced at *t=-1*	0.003† (0.009)	-0.052 (0.009)	-0.025† (0.017)	-0.015† (0.013)
Displaced at *t=0*	-0.131 (0.012)	-0.077 (0.011)	-0.158 (0.017)	-0.039† (0.013)
Displaced at *t=1*	-0.506 (0.021)	-0.129 (0.015)	-0.531 (0.020)	-0.090 (0.014)
Displaced at *t=2*	-0.413 (0.021)	-0.103 (0.017)	-0.436 (0.019)	-0.062 (0.014)
Displaced at *t=3*	-0.323 (0.020)	-0.088 (0.017)	-0.346 (0.018)	-0.047 (0.015)
Displaced at *t=4*	-0.283 (0.020)	-0.067 (0.018)	-0.305 (0.018)	-0.024† (0.015)
Displaced at *t=5*	-0.248 (0.020)	-0.053† (0.018)	-0.269 (0.019)	-0.009† (0.016)
N	391,066	490,788	391,066	490,788
R^2	0.183	0.227	0.566	0.636

(1) The dependent variable: log (1000 + annual earnings).
(2) Robust standard errors are in parentheses.
(3) All specifications include time fixed-effects and a vector of control variables; a full list of variables is included as Appendix A.
(4) All parameter estimates are statistically significant at the 0.001 level, unless marked with †.

Table 27. The Effect of Displacement on Annual Earnings (Education Group III: Primary etc.).

MODEL	OLS		FE	
Variable	*Year 1992*	*Year 1997*	*Year 1992*	*Year 1997*
Displaced at *t=-3*	0.000† (0.005)	0.013 (0.004)		
Displaced at *t=-2*	0.007† (0.005)	0.009† (0.004)	0.008† (0.009)	-0.004† (0.008)
Displaced at *t=-1*	0.001† (0.003)	0.002† (0.004)	0.002† (0.008)	-0.011† (0.008)
Displaced at *t=0*	-0.215 (0.005)	-0.061 (0.006)	-0.212 (0.008)	-0.073 (0.008)
Displaced at *t=1*	-0.892 (0.010)	-0.207 (0.010)	-0.888 (0.010)	-0.218 (0.009)
Displaced at *t=2*	-0.730 (0.010)	-0.183 (0.011)	-0.725 (0.009)	-0.194 (0.009)
Displaced at *t=3*	-0.633 (0.010)	-0.144 (0.011)	-0.628 (0.009)	-0.155 (0.009)
Displaced at *t=4*	-0.551 (0.010)	-0.126 (0.011)	-0.545 (0.009)	-0.135 (0.009)
Displaced at *t=5*	-0.488 (0.010)	-0.111 (0.012)	-0.481 (0.010)	-0.120 (0.010)
N	1,906,683	1,898,262	1,906,683	1,898,262
R^2	0.144	0.147	0.506	0.566

(1) The dependent variable: log (1000 + annual earnings).
(2) Robust standard errors are in parentheses.
(3) All specifications include time fixed-effects and a vector of control variables; a full list of variables is included as Appendix A.
(4) All parameter estimates are statistically significant at the 0.001 level, unless marked with †.

Table 28. The Effect of Displacement on Annual Earnings (Displacement Type: Plant Closure).

MODEL	OLS		FE	
Variable	*Year 1992*	*Year 1997*	*Year 1992*	*Year 1997*
Displaced at *t=-3*	0.015† (0.007)	0.017 (0.005)		
Displaced at *t=-2*	0.003† (0.008)	0.012† (0.005)	-0.009† (0.013)	-0.004† (0.009)
Displaced at *t=-1*	0.007† (0.005)	0.013† (0.005)	-0.005† (0.012)	-0.004† (0.009)
Displaced at *t=0*	-0.187 (0.008)	-0.028 (0.006)	-0.198 (0.012)	-0.043 (0.009)
Displaced at *t=1*	-0.682 (0.014)	-0.108 (0.011)	-0.692 (0.014)	-0.123 (0.010)
Displaced at *t=2*	-0.609 (0.014)	-0.082 (0.012)	-0.618 (0.013)	-0.097 (0.010)
Displaced at *t=3*	-0.534 (0.014)	-0.064 (0.012)	-0.542 (0.013)	-0.079 (0.010)
Displaced at *t=4*	-0.468 (0.014)	-0.044 (0.013)	-0.476 (0.013)	-0.058 (0.011)
Displaced at *t=5*	-0.401 (0.014)	-0.029† (0.014)	-0.407 (0.014)	-0.042 (0.012)
N	2,300,298	2,473,317	2,300,298	2,473,317
R^2	0.180	0.228	0.528	0.608

(1) The dependent variable: log (1000 + annual earnings).
(2) Robust standard errors are in parentheses.
(3) All specifications include time fixed-effects and a vector of control variables; a full list of variables is included as Appendix A.
(4) All parameter estimates are statistically significant at the 0.001 level, unless marked with †.

Table 29. The Effect of Displacement on Annual Earnings (Displacement Type: Downsizing).

MODEL	**OLS**		**FE**	
Variable	*Year 1992*	*Year 1997*	*Year 1992*	*Year 1997*
Displaced at *t=-3*	0.003† (0.006)	-0.012 (0.005)		
Displaced at *t=-2*	0.020† (0.006)	-0.017 (0.005)	0.018† (0.010)	-0.004† (0.009)
Displaced at *t=-1*	0.000 (0.004)	-0.031 (0.005)	-0.001† (0.009)	-0.016† (0.009)
Displaced at *t=0*	-0.197 (0.006)	-0.088 (0.007)	-0.196 (0.009)	-0.072 (0.009)
Displaced at *t=1*	-0.872 (0.012)	-0.232 (0.011)	-0.87 (0.011)	-0.213 (0.011)
Displaced at *t=2*	-0.684 (0.011)	-0.207 (0.012)	-0.681 (0.010)	-0.187 (0.010)
Displaced at *t=3*	-0.579 (0.011)	-0.160 (0.012)	-0.575 (0.010)	-0.139 (0.010)
Displaced at *t=4*	-0.503 (0.011)	-0.137 (0.012)	-0.498 (0.010)	-0.114 (0.011)
Displaced at *t=5*	-0.451 (0.011)	-0.130 (0.013)	-0.446 (0.011)	-0.105 (0.012)
N R^2	2,339,990 0.184	2,480,652 0.228	2,339,990 0.531	2,480,652 0.608

(1) The dependent variable: log (1000 + annual earnings).
(2) Robust standard errors are in parentheses.
(3) All specifications include time fixed-effects and a vector of control variables; a full list of variables is included as Appendix A.
(4) All parameter estimates are statistically significant at the 0.001 level, unless marked with †.

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