WORKING PAPER

No 11/2013

Are workers more vulnerable in tradable industries?

Kent Eliasson and Pär Hansson

Economics

ISSN 1403-0586

http://www.oru.se/Institutioner/Handelshogskolan-vid-Orebro-universitet/Forskning/Publikationer/Working-papers/
Örebro University School of Business
701 82 Örebro
SWEDEN

Are workers more vulnerable in tradable industries?

Kent Eliasson* and Pär Hansson**

December 9 2013

Abstract

Reduced trade barriers and lower costs of transportation and information have meant that a growing part of the economy has been exposed to international trade. In particular, this is the case in the service sector. We divide the service sector into a tradable and a non-tradable part using an approach to identify tradable industries developed by Jensen and Kletzer (2006). We examine whether the probability of displacement is higher and income losses after displacement greater for workers in tradable services and manufacturing (tradable) than in non-tradable services. We also analyze whether the probability of re-employment is higher for workers displaced from tradable services and manufacturing than from non-tradable services. We find that in the 2000s the probability of displacement is relatively high in tradable services in comparison to non-tradable services and manufacturing. On the other hand, the probability of re-employment is higher for those displaced from tradable services. The largest income losses are found for those who had been displaced from manufacturing. Interestingly, the income losses of those displaced from manufacturing seems mainly to be due to longer spells of non-employment, whereas for those displaced in tradable services lower wages in their new jobs compared to their pre-displacement jobs appears to play a larger role.

Keywords: displacement costs, re-employment, earnings losses, tradable services
JEL: F16, J62, J63

* Growth Analysis, Studentplan 3, SE-831 40 Östersund
and Department of Economics, Umeå University, SE-901 87 Umeå
kent.eliasson@tillvaxtanalys.se

** Growth Analysis, Box 574, SE-101 31 Stockholm
and Örebro University School of Business, SE-701 82 Örebro
par.hansson@oru.se

1. Introduction*

Manufacturing has for a long time been looked upon as a sector exposed to international trade and international trade in merchandise is considerable. In recent years, growing international trade in services, due among other things to falling costs of information and communication, is a salient feature. Some researchers, e.g. Blinder (2006), have argued that this might have painful consequences for a growing number of displaced workers in the service sector owing to the increased internationalization of services. One of the key questions in this paper is therefore to compare the displacement costs of workers in tradable services, manufacturing and, since large parts of the service sector are and will continue to be non-tradable, non-tradable services.

A substantial body of literature on the costs of job displacement has emerged over the last 25 years.[1] Ruhm (1991), Jacobson et al. (1993), Stevens (1997), Kletzer and Fairlie (2003), and Couch and Placzek (2010) are examples of influential studies focusing on the United States. The literature for European countries is sparser. Important exceptions are Eliason and Storrie (2006), Hijzen et al. (2006), and Huttunen et al. (2011) who, in turn, focus on Sweden, the United Kingdom and Norway. The empirical evidence suggests substantial, often long-lasting, negative effects of displacement in terms of, for example wage and earnings losses and joblessness. The costs of job loss in manufacturing industries are particularly well studied, but some of the papers above also focus on displacement in the service sector. To our knowledge, there is no previous paper that, within a regression type framework, explicitly compares the costs of displacement in tradable and non-tradable sectors of the economy.

While data on international trade in merchandise is highly disaggregated, data on trade in services is not very detailed. This makes it hard to identify industries in the service sector that are exposed to international trade. To classify industries into tradable and non-tradable we make use of an approach developed by Jensen and Kletzer (2006). The basic idea here is that the degree of geographical concentration of industries tells us whether the activities within an industry can be expected to be traded domestically and at least potentially to be traded

* An earlier version of this paper was presented at the 15th annual conference of the European Trade Study Group (12-14 September 2013 at the University of Birmingham). The authors would like to thank participants at the conference for valuable comments.

[1] See Fallick (1996) and Kletzer (1998) for surveys of literature for the United States and OECD (2013) Annex 4A2 for a recent review of existing literature on wage and earnings effects of displacement.

internationally. Regionally concentrated industries are presumed to be tradable because the production in an industry is then localized to particular regions, whereas the consumption of the industry's output is spread out along with the incomes in the country.

When we divide the industries in the Swedish economy into tradable and non-tradable services and manufacturing we observe that over the past 20 years the employment share of non-tradable services has been close to constant, whereas the share of tradable services has grown and the share of manufacturing has declined.

We use administrative data to identify job displacements. Job displacements are defined as job separations from an establishment that from one year to the next ceased to operate or experienced a large reduction in employment. We estimate the probability of displacement and the probability of re-employment following displacement in Sweden over the period from 2000 to 2009 and compare the probabilities in tradable services, manufacturing and non-tradable services controlling for other factors (individual, establishment and regional) that might affect displacement and re-employment.

By using administrative data we have the opportunity to follow displaced individuals before and after displacement and then contrast their development with non-displaced individuals. The most common approach to estimate earnings losses of displacement in this setting was until recently to follow Jacobson et al. (1993) and use some type of fixed-effects model. In this paper, we will instead use conditional difference-in-differences matching as our main estimation strategy and compare the results from matching with those obtained using a standard fixed-effects model. The main contribution of this paper is that we examine in which of the sectors tradable services, manufacturing or non-tradable services the earnings losses after displacement are largest. We also make an attempt to determine whether observed earnings losses mainly are due to lower wages in post-displacement jobs or primarily the result of periods of non-employment following displacement.

Previous closely related studies, Jensen and Kletzer (2006, 2008), are based on the Displaced Worker Survey (DWS). The DWS is a survey of a cross-section of individuals who have been involuntary displaced during a preceding three-year period and that is nationally representative of the United States. Jensen and Kletzer (2006) report the incidence, scope and characteristics of job displacement in manufacturing, tradable non-manufacturing and not

tradable non-manufacturing from 2001 to 2003, while their 2008 paper is an update for 2003 to 2005. Jensen and Kletzer present their results as summary statistics for the different sectors, i.e. their analysis is not carried out, as in the present study, within a regression framework. This is important because, as will stand out clearly in the paper, there are considerable variations among the studied sectors in the characteristics of workers, establishments and locations. Another advantage with our study is that we can follow displaced workers for several years before and after displacement as well as compare their development with non-displaced individuals. In the paper we relate our findings for Sweden to Jensen and Kletzer's results for the United States.

Autor et al. (2013) is another, to some extent, related study. They analyze how exposure of import competition from China has affected the earnings and employment of US workers in manufacturing from 1992 to 2007. They find that there are significant worker-level adjustments to import shocks, e.g. in terms of lower cumulative earnings, and that the shocks had hit workers unevenly; for instance, individuals with low initial wage levels, low initial tenure, and with low attachment to the labor force are more severely affected. Increased import competition from China has also given rise to substantial job churning among high-wage workers. However, they appear to be better prepared than low-wage workers to cope with that because movements across employers involve less earnings losses for high-wage workers.

Yet another similar study is that by Hummels et al. (2011), which is based on matched Danish worker-firm data between 1995 and 2006. They examine earnings losses of displaced workers in offshoring firms and find that they suffer greater losses than other displaced workers.

To preview the results in the paper, our findings are that the probability of displacement is higher in sectors exposed to international trade. However, the prospects for re-employment seem to be brighter for displaced workers in tradable services than in manufacturing. In line with this we also find that the income losses are largest for displaced workers in manufacturing. However, it appears that while the main reason behind the earnings losses of those displaced in manufacturing is difficulties to find new jobs after displacement, lower wages in the new positions than in pre-displacement positions is a factor of greater importance for the earnings losses of those displaced in tradable services.

The plan of the paper is as follows. Section 2 defines important concepts, describes the data sample, and provides some descriptive statistics. In Section 2.1, we explain how to identify tradable service industries and we describe the development in manufacturing, tradable services and non-tradable services. Section 2.2 defines our measure of displacement and discusses the restrictions we place on the samples for the analysis. Section 2.3 presents Swedish displacement rates and describes some characteristics of displaced workers in different sectors. Section 3 contains the econometric analysis. In Section 3.1, we present the results from the probit regression analyses of displacement and re-employment, and in Section 3.2, we discuss the estimations of the income losses for the displaced. Finally, Section 4 summarizes and concludes.

2. Sectors and displacement

2.1 Manufacturing, tradable and non-tradable services

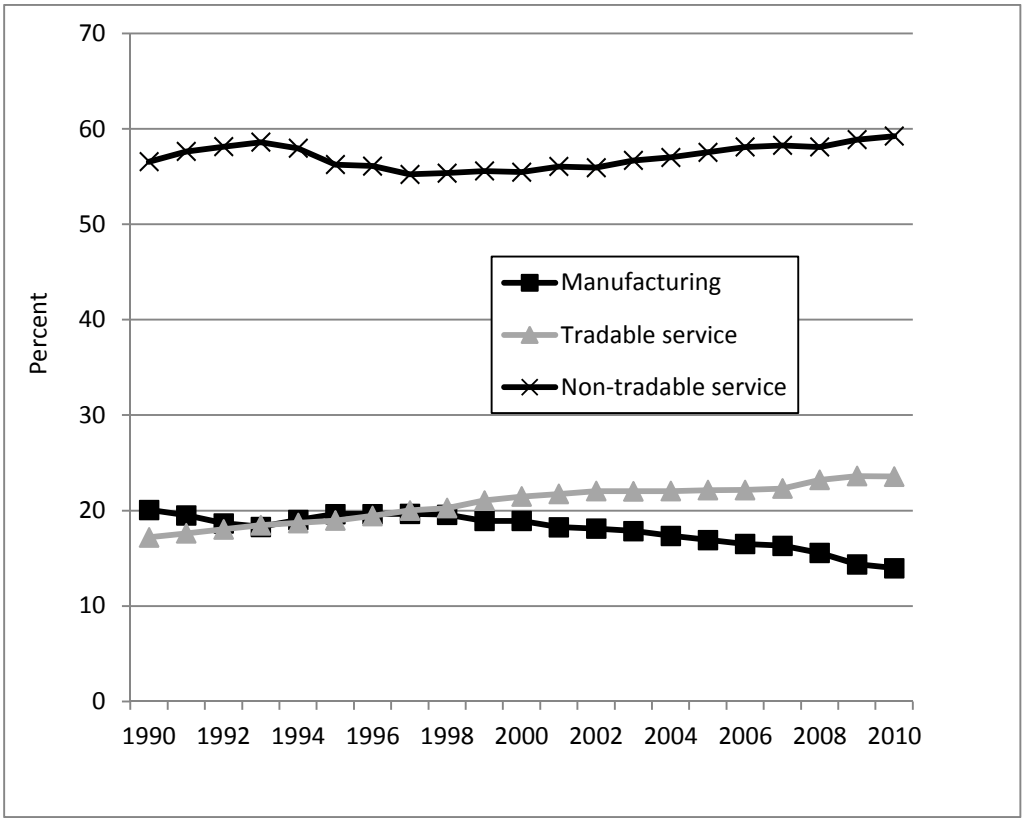
First we have to identify the industries in the tradable service sector. To this end we utilize an approach suggested by Jensen and Kletzer (2006). By measuring the regional concentration of different industries we determine which industries are tradable and non-tradable. We have in a recent article, Eliasson et al. (2012), calculated locational Ginis for various industries in the Swedish economy in 2005.[2] Based on these locational Ginis we classify industries according to where trade seems to occur regionally and where no regional trade appears to exist. It is well known that the industries in manufacturing industries are more or less exposed to international competition and that international trade in goods takes place on a large scale. Therefore, we use the size of the locational Ginis in manufacturing industries as a benchmark to identify industries in the service sector where international trade might exist. We establish the cut-off point between tradable and non-tradable industries, admittedly somewhat

[2] The calculations of locational Ginis are based on Statistics Sweden's Regional Labor Market Statistics (RAMS). Industries are primarily defined on three-digit NACE (Classification of Economic Activities in the European Community) level (172 industries), and as our geographic entity, we use a definition of functional labor market (FA) regions (72 regions).The FA regions are preferred to traditional administrative units such as municipalities or counties. The FA regions constitute integrated housing and labor market areas where most people can find both a place to live and a place to work. By their construction, they are defined to maximize internal commuting possibilities and minimize commuting flows across the regional borders. A complete list of the locational Ginis and employment in industries in 2005 and 1990 in Sweden can be found in Eliasson et al. (2012a) Table A1.

arbitrarily, as Ginis at 0.20.[3] This implies that all manufacturing industries are categorized as tradable, whereas the majority of industries within the sectors 'Construction', 'Education' and 'Wholesale and retail trade' are defined as non-tradables. One outstanding feature is that many of the dominating industries in tradable services are business, professional and technical service activities of different kinds.[4]

In our analysis we divide the economy into three broad sectors, manufacturing, tradable and non-tradable services, and Figure 2.1 shows how employment in those sectors has developed from 1990 to 2010.[5]

Figure 2.1. Employment shares of manufacturing, tradable and non-tradable services 1990-2010.



Source: Statistics Sweden, Register-based labor market statistics (RAMS).

[3] There is one exception. The industry 752 'Provision of services to the community as a whole' with a Gini at 0.235, which consists of 'Foreign affairs', 'Defense', 'Justice and judicial activities', 'Public security' and 'Fire service' and large employment (78,097 in 2010), has been moved from tradable services to non-tradable services.

[4] The three largest industries in tradable services in terms of employment in 2010 are: 741 'Legal and financial consulting' (94,665), 722 'Software consultancy and supply' (90,546) and 742 'Architectural, engineering and technical consulting' (77,553).

[5] We use a residual approach to define the service sector. This means that all activities not included in the primary sector, NACE 01-14, and in the secondary (manufacturing) sector, NACE 15-37, are classified as services.

It can be seen that, while the non-tradable service sector has remained almost constant between 1990 and 2010, the tradable service sector, from having a smaller share than manufacturing in 1990, has grown and the manufacturing sector has contracted. This shift within the tradable part of the Swedish economy from manufacturing to tradable services is an indication of the increased importance of the tradable service sector in recent years.

In Table 2.1, we separate the employment into skilled and less-skilled labor, where skilled labor is employees with some post-secondary education. The pattern of the employment changes differs very much between the sectors. In manufacturing the employment of skilled labor has increased considerably, whereas the employment of less-skilled labor has decreased substantially. In tradable services the employment of skilled labor has grown considerbly, whereas the employment of less-skilled labor has been more or less unchanged. Finally, in non-tradable services the employment of skilled labor has increased (in percentage points not as much as in tradable services) and the employment of less-skilled labor has fallen (in percentage points less than in manufacturing).

Table 2.1. Employment of skilled and less-skilled labor in manufacturing, tradable and non-tradable services 1990 -2010.

	Manufacturing			Tradable services			Non-tradable services		
Year	Skilled	Less-skilled	Skill share	Skilled	Less-skilled	Skill share	Skilled	Less-skilled	Skill share
1990	112	786	12.5	247	522	32.1	593	1 938	23.4
2010	168	447	27.4	531	507	51.2	961	1 648	36.8
Δ	56	-339	14.9	284	-15	19.1	368	-290	13.4
%	50.2	-43.2		115.0	-3.0		62.1	-15.0	

Source: Statistics Sweden, Register-based labor market statistics (RAMS).

Another striking feature is that the three studied sectors also differ regarding the share of skilled labor in the sector. Table 2.1 shows that skill intensity is considerably higher in tradable services than in manufacturing and in non-tradable services. In 2010, around half of the people employed in tradable services had some form of post-secondary education. Moreover, the share of skilled labor has increased fastest in this sector, while the slowest rate of increase can be found in non-tradable services. In other words, it seems that the share of skilled labor has grown faster in sectors exposed to international trade.[6] A plausible interpretation of this is that it is first and foremost in this part of the economy that the trend

[6] The proportion of skilled labor in the tradable service sector has increased by 19 percentage points, in the manufacturing industry by 15 percentage points and in the non-tradable service sector by 13 percentage points.

towards less-skilled jobs disappearing (manufacturing) at the same time as more skilled jobs are created (tradable services) has been particularly strong.

2.2 Definitions of displacement and sample restrictions

By job displacement we have in mind here involuntary job separations due to exogenous shocks such as results from structural changes. This means that we would wish that we could distinguish such job separation from other forms of job separation like voluntary quits. However, in practice that might be difficult.

To identify job displacement we use linked employer-employee data based on administrative registers kept by Statistics Sweden. The definition of displacement is based on the unit of establishments.[7] Displaced workers are defined as workers separated from an establishment between year *t*-1 and year *t* and the establishment in question has: (i) experienced an absolute reduction in employment of 5 employees or more and a relative reduction in employment of 30% between *t*-1 and *t* (*mass dismissal*), or (ii) closed down between *t*-1 and *t* (*establishment closure*).[8] In the analyses to follow, the two events are combined into a single category of displacement and attributed to year *t*.

We have placed several restrictions on the samples used in the analysis. To avoid quick job separations, for instance, owing to poor job matching or short temporary contracts we include only workers with at least one year of tenure with the same employer. We exclude those who work in the primary sector (agriculture, forestry and mining) as well as in public administration, defense, for private households or international organizations. Those who hold more than one job prior to displacement are also omitted. We also leave out employers, self-employed and unpaid family workers. The analysis covers workers from establishments with

[7] The reason for carrying out the analysis of displacement on the unit of establishments instead of firms is that the identity number of the firm is less stable, i.e. more of a variable than a time consistent identifier. The firm is more or less free to change identity number over time and this is commonly done in connection with changes in ownership or restructuring events such as acquisitions, splits or mergers. Statistics Sweden makes no real effort to construct time consistent identity numbers for firms. For establishments, on the other hand, they do invest considerable resources in constructing time consistent identity numbers, in particular for establishments with 10 or more employees. This means that using the firm's identity number will most likely lead to considerable overestimation of true displacement rates due to false firm deaths.

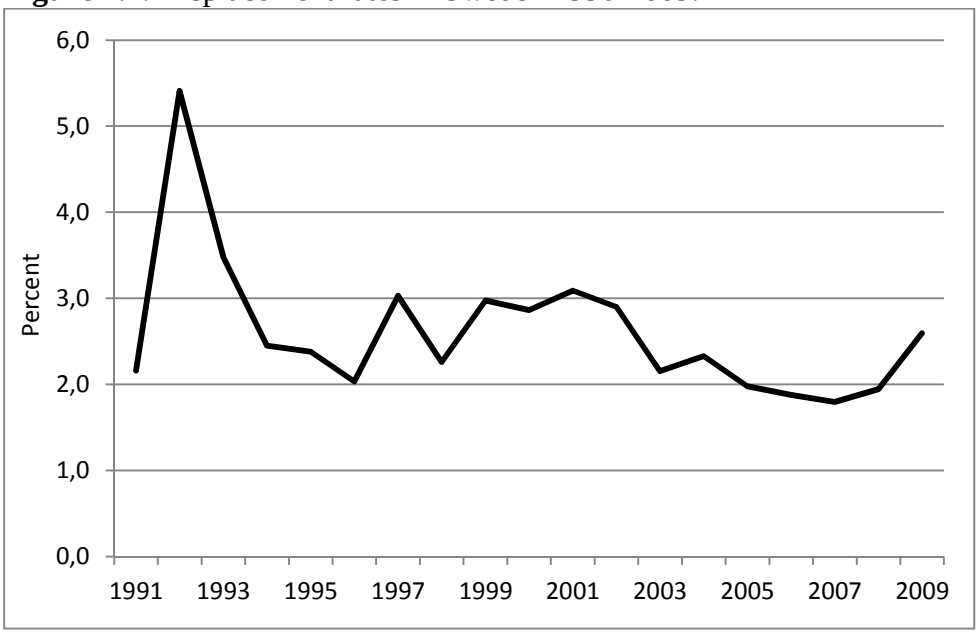
[8] If a worker is separated from an establishment according to the stated criteria but in year *t* is found to be employed in another establishment within the same firm, he/she will not be classified as displaced. This type of within-firm mobility of workers is most likely to be associated with organizational restructuring and not a consequence of real displacements. Not imposing this restriction would therefore risk introducing an upward bias in the number of true displacements.

10 employees or more in the year before displacement. Finally, we examine only workers aged 20 to 64 years the year prior to displacement. We eliminate young workers for the same reason as workers with short tenure. Older workers are omitted because for them it may be difficult to differentiate between displacement and retirement.

2.3 Displacement rates and characteristics of displaced workers

To give a long-term view of displacement in Sweden, in Figure 2.2 we show the risk of displacement in Sweden between 1990 and 2009. Displacement rates are expressed as the number of employees aged 20-64 who are displaced from one year to next as a proportion of all employees aged 20-64.

Figure 2.2. Displacement rates in Sweden 1990-2009.



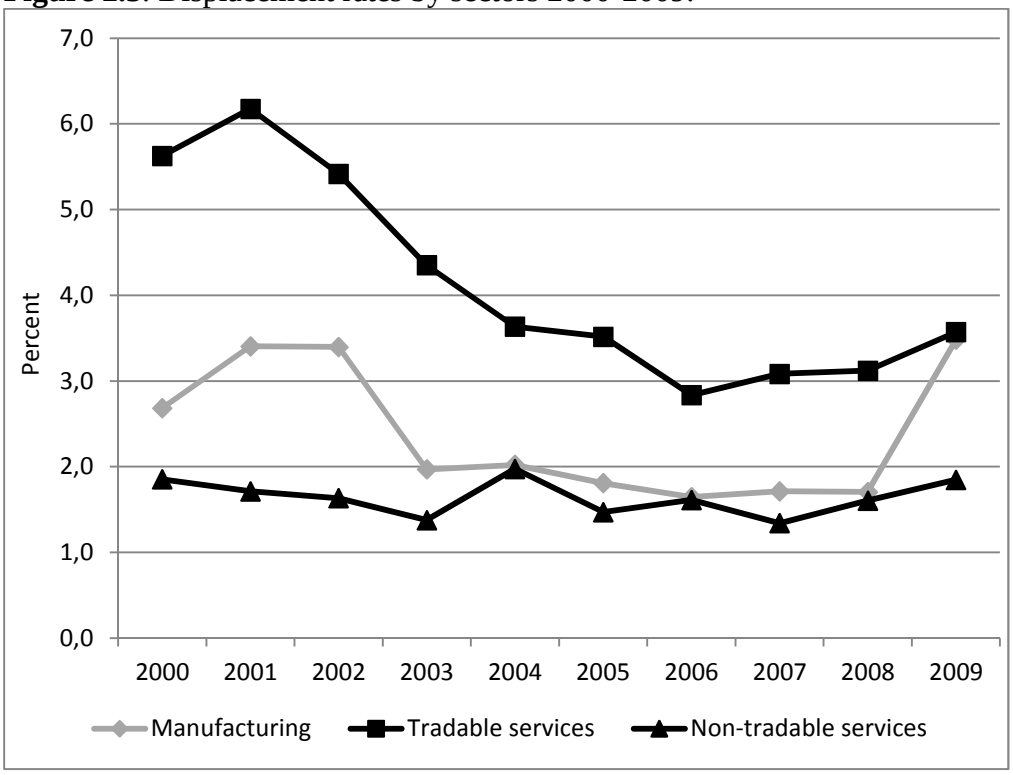
Source: Statistics Sweden, Register-based labor market statistics (RAMS).

With the exception of the crisis years of 1992/93 displacement rates have varied between 1.8% and 3.1%. The average for the 1994 to 2009 period is 2.4% and the highest rates for that period appear in the years around the turn of the millennium. We observe an increase in the displacement rate during the 2008/09 crises that nevertheless is not exceptionally high.

In Figure 2.3 we look at the displacement rates in manufacturing, tradable and non-tradable services between 2000 and 2009 and we can see that the rates were higher in the tradable sector, particularly in tradable services. The gap in displacement rates between tradable

services and manufacturing is largest at the beginning of the period, while they are practically the same during the 2008/09 crisis. This might be an indication that manufacturing was harder hit by that crisis than tradable services.

Figure 2.3. Displacement rates by sectors 2000-2009.



Source: Statistics Sweden, Register-based labor market statistics (RAMS).

If we compare the pattern in Figure 2.3 above with the descriptive results in Jensen and Kletzer (2006) for the years 2001-03 there are some similarities. Firstly, there is a big difference in displacement rates between tradable and non-tradable services, where non-tradable services have lower displacement rates. Secondly, displacement rates in tradable services are high both in Sweden and in the United States at the beginning of the 2000s. However, a notable difference between Sweden and the United States at that time is that in the United States the displacement rate in manufacturing is higher than the displacement rate in tradable services.

To examine whether there are any differences between displaced workers in manufacturing, tradable and non-tradable services, in Table 2.2 we present characteristics of displaced workers in these sectors in 2009. One of the most striking features is that the displaced workers in tradable services have a much higher level of education than in manufacturing;

48% of the displaced in tradable services have a post-secondary education while the corresponding share for manufacturing is 18%. Other interesting facts are that in tradable services, in comparison to manufacturing, the displaced have to a larger extent been working in smaller establishments, and regionally the displaced in tradable services are more concentrated to larger cities than manufacturing. Finally, the proportion of male workers is larger among the displaced, both in tradable service and in manufacturing, but less likely to be male in tradable services.

Table 2.2. Proportions of displaced workers by worker and establishment characteristics in different sectors, 2009.

	Manufacturing	Tradable services	Non-tradable services
Gender			
Men	0.76	0.62	0.60
Women	0.24	0.38	0.40
Age			
20-24	0.13	0.07	0.15
25-34	0.26	0.29	0.26
35-44	0.28	0.32	0.24
45-54	0.20	0.19	0.19
55-44	0.13	0.13	0.15
Level of education			
Less than secondary (ISCED 0-2)	0.17	0.07	0.14
Secondary (ISCED 3)	0.65	0.45	0.60
Post-secondary (ISCED 4-6)	0.18	0.48	0.25
Level of education unavailable	0.00	0.00	0.01
Establishment size			
10-49	0.35	0.50	0.60
50-99	0.19	0.16	0.20
100-199	0.15	0.13	0.11
200-499	0.16	0.18	0.06
500+	0.15	0.02	0.03
Sector in previous job			
Private	0.99	0.94	0.73
Public	0.01	0.06	0.27
Region of residence			
STOCKHOLM (SE11)	0.06	0.39	0.27
ÖSTRA MELLANSVERIGE (SE12)	0.16	0.13	0.16
SMÅLAND MED ÖARNA (SE21)	0.16	0.05	0.06
SYDSVERIGE (SE22)	0.11	0.13	0.14
VÄSTSVERIGE (SE23)	0.27	0.17	0.22
NORRA MELLANSVERIGE (SE31)	0.12	0.05	0.08
MELLERSTA NORRLAND (SE32)	0.04	0.05	0.04
ÖVRE NORRLAND (SE33)	0.07	0.03	0.04

Note: All variables refer to year *t*-1.

3. Econometric analysis of displacement, re-employment, and earnings losses

In the previous section we showed that the rate of displacement over the past decade was particularly high in tradable services. The descriptive statistics also indicated some interesting differences in pre-displacement characteristics for workers displaced from the various sectors. In this section we continue with an econometric analysis of displacement risks as well as re-employment probabilities. By using a regression framework to condition on a number of individual, establishment and regional variables, we will be able to more carefully study whether there are any differences in displacement risks and re-employment prospects for workers employed in the sectors in question. This is followed by an econometric analysis of the effect of job loss on labor earnings for workers displaced from the different sectors.

3.1 Displacement risks and re-employment opportunities

The analysis of displacement and re-employment is based on data for 2000-2009. For each year *t*, we have a population of about 1.9 to 2.2 million workers fulfilling the basic sample restrictions described in Section 2.2. From each of these years we have drawn a 10% random sample of individuals and then stacked these observations together, giving us a pooled sample with approximately 2.1 million individuals. This is the data set used for the probability of displacement analysis. Following the previously described definition of displacement, the sample includes roughly 49,000 individuals (2.3%) that between year *t*-1 and year *t* were displaced, either through establishment closure or mass dismissal. The sample of 49,000 displaced workers is then used in the likelihood of re-employment analysis. Approximately 43,000 (88%) of the individuals displaced between year *t*-1 and year *t* were re-employed by another establishment in year *t*.

Both the displacement and the re-employment analyses are based on probit regression models. In the former case, the dependent variable is coded as 1 if an individual was displaced between year *t*-1 and year *t*, and 0 otherwise. In the latter case, the dependent variable is coded as 1 if a worker displaced between year *t*-1 and year *t* was re-employed by another establishment in year *t*, and 0 otherwise. The specification of the probit models includes a number of individual, establishment and regional characteristics as explanatory variables. All explanatory variables refer to year *t*-1.

Table 3.1. Probit estimates of displacement and re-employment.

	Displacement		Re-employment	
	Coefficient	Std. error	Coefficient	Std. error
Sector				
Manufacturing	0.0772**	0.0061	-0.1153**	0.0213
Tradable services	0.2445**	0.0052	0.1052**	0.0194
Individual characteristics				
Age	-0.0161**	0.0013	0.1443**	0.0047
Age squared	0.0001**	0.0000	-0.0018**	0.0001
Male	0.0821**	0.0043	0.2466**	0.0161
Less than secondary	0.0137*	0.0066	-0.2663**	0.0247
Secondary	0.0114*	0.0046	-0.0806**	0.0186
Establishment characteristics				
Private	0.3412**	0.0059	0.1264**	0.0218
Size 50-99	-0.1105**	0.0056	0.0399	0.0217
Size 100-199	-0.1545**	0.0062	0.0855**	0.0246
Size 200-499	-0.1814**	0.0067	0.1468**	0.0266
Size 500+	-0.3939**	0.0069	0.2181**	0.0309
Regional characteristics				
Östra Mellansverige	-0.1800**	0.0062	-0.0096	0.0248
Småland med öarna	-0.3243**	0.0083	-0.0852**	0.0326
Sydsverige	-0.2002**	0.0066	-0.1203**	0.0259
Västsverige	-0.2364**	0.0060	-0.0760**	0.0236
Norra Mellansverige	-0.2329**	0.0082	-0.0601	0.0323
Mellersta Norrland	-0.1806**	0.0109	-0.0149	0.0435
Övre Norrland	-0.2685**	0.0104	-0.1051*	0.0410
Log likelihood	-217,462		-16,300	
Wald chi2(43)	25,914.2		2,191.9	
Prob > chi2	0.0000		0.0000	
Observations	2,078,377		48,602	

Notes: The model specifications also include time dummies that control for year-specific effects. **, * indicates significance at the 1% and 5% level respectively.

Table 3.1 presents estimates of the displacement and re-employment probit models. The first two rows report the effect of being employed in the manufacturing or tradable service sector compared to the reference category, which is the non-tradable service sector. Workers employed in tradable services clearly face the highest risk of job loss but, on the other hand, are most likely to be re-employed after displacement.[9] Workers employed in manufacturing

[9] Also in the United States in the beginning of the 2000s the re-employment rate is higher in tradable services than in manufacturing and non-tradable services (Jensen and Kletzer 2006, 2008).

confront the unfortunate combination of a comparatively high risk of displacement and the lowest chance of re-employment. This suggests relatively high costs of displacement for workers employed in manufacturing.

Turning to the individual characteristics of workers,[10] we see a non-linear effect of age on displacement and re-employment. The probability of displacement decreases with age at an increasing rate, whereas the likelihood of re-employment rises with age at a decreasing rate. The results indicate clear differences between men and women. Men are more likely to be displaced but, on the other hand, are more likely to be re-employed after job loss. We further find familiar educational attainment differences.[11] Workers with less than secondary or secondary education experience a higher risk of job loss than workers with post-secondary education (reference category). In terms of re-employment, the results clearly show that the likelihood of finding a new job after displacement is smaller the lower the level of education. This indicates relatively high costs of displacement for less educated workers.

Turning to the establishment characteristics, we find that workers employed in the private sector face a higher risk of job loss than workers employed in the public sector but, on the other hand, private sector workers are more likely to be re-employed after displacement. We also find that the probability of displacement decreases with the size of the establishment in terms of employment and, further, that the likelihood of re-employment in the event of job loss increases with establishment size (10-49 employees serves as reference category). This suggests relatively high displacement costs for workers employed at small establishment.

Finally, the results indicate some differences depending on region of residence, where we have used the Swedish NUTS 2 level as regional classification. The risk of displacement is higher for workers residing in the Stockholm region (reference category) than in any of the other seven included regions. The geographical pattern is less pronounced when it comes to re-employment, but in general the chance of finding a new job after displacement seems to be higher for workers residing in the Stockholm region.

[10] For the individual and establishment characteristics discussed below we get similar results as in many other OECD countries (OECD 2013 pp. 197-202).
[11] See e.g. Borland et al. (2002).

To summarize, the probit regression analyses show that workers employed in the two tradable sectors are most likely to be affected by job loss. But whereas workers employed in tradable services have relatively promising re-employment prospects in the event of displacement, this is not the case for workers employed in manufacturing. If we were to distinguish any specific group particularly hard hit in terms of high displacement risks and low re-employment probabilities that this would be young workers, with a low level of education, employed at small manufacturing establishments.

3.2 The effect of displacement on earnings

Previous literature on the effects of job displacement indicates that displaced workers not only suffer in terms of unemployment and wage losses during a short-term transition period but also face more long term costs of job loss. Even though most displaced workers get back into new jobs relatively quickly there are several reasons why job loss can lead to long lasting negative effects. Loss of firm- and industry-specific human capital, loss of seniority, high turnover in subsequent short-tenured jobs and multiple job losses are examples of suggested explanations of why displacement may cause negative effects also in the longer run. In this section, we continue by examining the effect of job loss on labor earnings for workers displaced from the different sectors.

The analysis focuses on displacements that occur in the years between 2000 and 2005. For each year *t*, we have a population of about 1.5 million individuals fulfilling the basic sample restrictions described in Section 2.2.[12] From each of these years we have drawn a 10% random sample of individuals, giving us a sample with six cohorts including roughly 885,000 individuals. Each individual is followed over a ten-year period *t*-5 to *t*+4. The sample is divided into a treatment group and a comparison group. The treatment group consists of workers who between year *t*-1 and year *t* were displaced, either through establishment closure or mass dismissal, according to the previously described definition of displacement. The comparison group consists of workers who were not displaced between year *t*-1 and year *t* (but who may have been displaced later). The sample includes roughly 25,000 displaced workers (2.8%) in the treatment group and about 860,000 non-displaced workers in the comparison group.

[12] The only exception is that we here restrict our attention to individuals aged 25 to 54 years of age in year *t*-1. This is to ensure that the individuals are of working age during the whole observation period.

The most common approach to estimate earnings losses from displacement have until recently been to follow Jacobson et al. (1993) and use some type of fixed-effects model. An alternative that has gained in popularity in the programme evaluation literature is various types of matching methods. The basic idea behind matching is to choose a comparable untreated (non-displaced) worker for each treated (displaced) worker and use these pairs to calculate the effect of the treatment (displacement) on the outcome of interest (earnings). We will use matching as our main estimation strategy and compare the results with those obtained with a fixed-effects specification. A similar approach can be found in a recent paper by Couch and Placzek (2010). Two advantages with matching over conventional parametric estimation techniques is that matching is more explicit in assessing whether or not comparable untreated observations are available for each treated observation and, further, that matching does not rely on the same type of functional form assumptions that traditional parametric approaches typically do. There are numerous papers suggesting that avoiding (potentially incorrect) functional form assumptions and imposing a common support condition can be important for reducing selection bias in studies based on observational data.[13]

More specifically, we will estimate the earnings losses from displacement using a conditional difference-in-differences-matching approach suggested by Heckman et al. (1997, 1998). The main parameter we are interested in estimating is the average treatment effect on the treated, *ATT*, which in our case corresponds to the average effect of displacement for those workers being displaced. The following set of equations gives the basic intuition behind the estimation strategy:

$$ATT_{t^+} = E(Y_{1t+}|X_{t-}, D_t = 1) - E(Y_{0t+}|X_{t-}, D_t = 0) = ATT + \bar{B} \quad (1)$$

$$ATT_{t^-} = E(Y_{1t-}|X_{t-}, D_t = 1) - E(Y_{0t-}|X_{t-}, D_t = 0) = \bar{B} \quad (2)$$

$$ATT_{t^+} - ATT_{t^-} = ATT + \bar{B} - \bar{B} = ATT \quad (3)$$

where t^- and t^+ denote time periods before and after potential displacement occurring at time t, $D_t = 1$ indicate that a worker is displaced at t and $D_t = 0$ indicates that a worker is not displaced at t, Y_1 represents earnings in the case of displacement and Y_0 represents earnings if

[13] See e.g. Heckman, Ichimura and Todd (1997), Heckman, Ichimura, Smith and Todd (1998), Dehejia and Wahba (1999, 2002) and Smith and Todd (2005).

not displaced, X denotes a set of observed pre-displacement covariates affecting both displacement probability and earnings, and finally $\bar{B}$ represents possible selection bias in the estimation of *ATT*.

Equation (1) represents a conventional cross-sectional matching estimator. This equation rests on an assumption of mean conditional independence, i.e. $E(Y_{0t+}|X_{t-}, D_t = 1) = E(Y_{0t+}|X_{t-}, D_t = 0)$. This assumption states that if we condition on a sufficiently rich set of pre-treatment covariates, we can use the earnings of non-displaced workers as an approximation of the earnings displaced workers would have received had they not been displaced (the counterfactual outcome). But if there are unobservable characteristics affecting both displacement and earnings, the assumption no longer holds and equation (1) will give a biased estimate of *ATT*. Equation (2) simply states that if we construct a matching estimate for pre-treatment outcomes we would expect to find bias only due to unobserved differences between displaced and non-displaced workers (i.e. the effect of a treatment cannot precede the treatment itself). Equation (3) show that if we take the difference between the post- and pre-treatment matching estimates we can remove the time-invariant portion of the bias. The conditional difference-in-differences-matching strategy thus extends conventional cross-sectional matching methods because it not only takes care of potential selection bias due to observable differences between displaced and non-displaced workers but also eliminates bias due to time-invariant unobservable differences between the two.

In the differencing, we let the average earnings during years *t*-3 to *t*-1 represent the pre-treatment outcome. We follow the typical procedure in the literature and base the matching on the predicted probability of displacement, the propensity score (Rosenbaum and Rubin, 1983), rather than on the pre-treatment covariates themselves. We use single nearest neighbor matching (with replacement) as our matching algorithm and match each displaced worker to the most comparable non-displaced worker with respect to the propensity score.[14] The following covariates are included in the propensity score: age, age square, male, level of education (three categories), establishment characteristics (private sector and five categories of employment size), region of residence (eight categories), and year of possible

[14] This algorithm trades reduced bias for increased variance (using additional neighbors would raise bias due to increasingly poorer matches but decrease variance because more information would be used to construct the counterfactual for each treated observation). Given the large relative number of non-displaced workers it might have been preferable to use additional neighbors and a kernel algorithm. The choice of single nearest neighbor is primarily motivated by ease of computability.

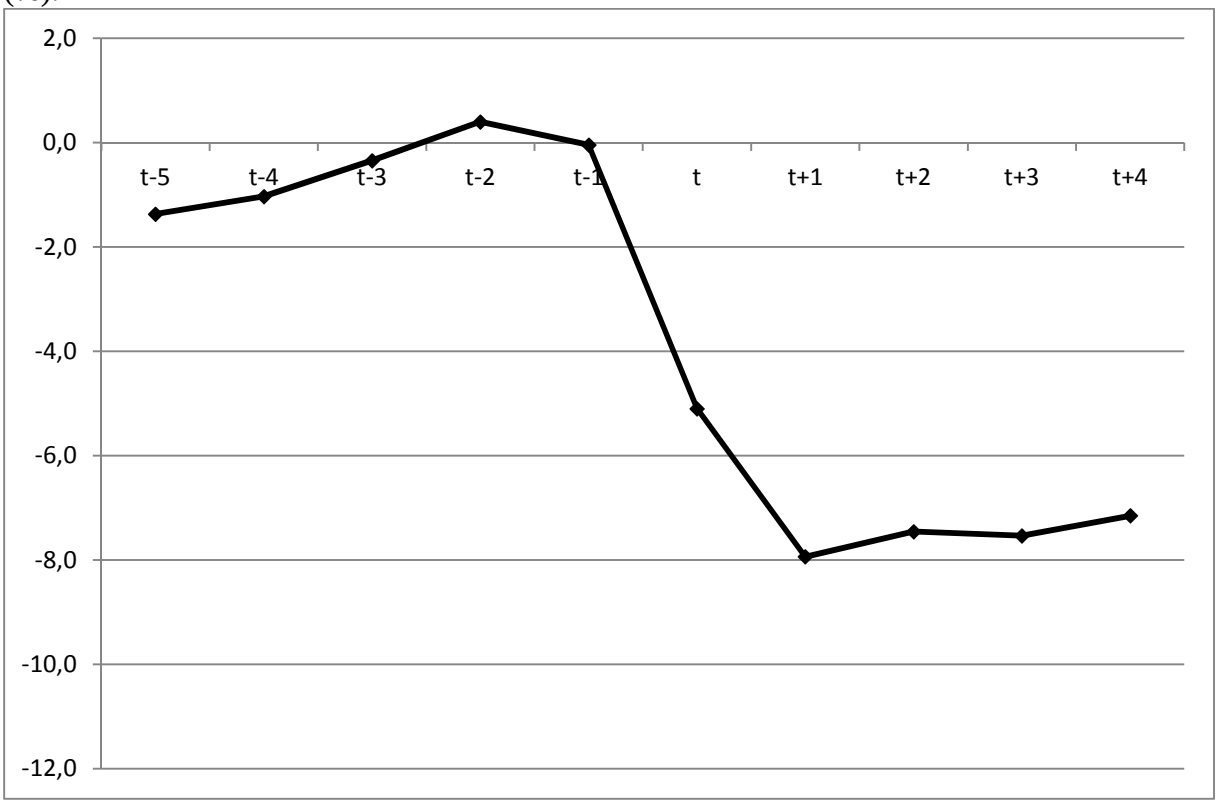
displacement. The estimates focusing on all sectors also include sector of employment (three categories). All variables refer to year *t*-1. In addition, the propensity score includes pre-treatment annual earnings for years *t*-5 to *t*-1.

The dependent variable in the analysis is real gross annual earnings (deflated by the 2009 consumer price index). Annual earnings can be considered a function of wage per hour, number of hours worked per week and the number of weeks worked per year. Annual earnings therefore capture the full costs of displacement in terms of lower wages as well as shorter hours and periods of non-employment. In some cases it can be interesting to distinguish between the effects of displacement on these various components. We will return to this issue below.

We begin by estimating the conditional difference-in-differences-matching estimates of the effect of displacement for workers in all sectors (save for the excluded sectors according to the base sample restrictions in Section 2.2). Figure 3.1 provides a graphical presentation of the results. The estimated effects in SEK have been converted into percentage losses using the average annual earnings of displaced workers during year *t*-3 to *t*-1. Table A1 in the Appendix present parameter estimates and associated standard errors together with some additional details. In the year of displacement, there is a sharp drop in earnings. The earnings decline continues during the first post-displacement year. The estimated effect corresponds to a reduction in annual earnings with 8% compared to the pre-displacement level. We find no signs of any substantial earnings recovery. In the fourth post-displacement year, annual earnings are still 7% below the pre-displacement level. The balancing indicators (see Table A1 in the Appendix) suggest that the matching has been fairly successful in balancing differences in observable attributes between the treatment and the comparison group. The mean standardized bias is reduced by roughly a factor of ten and the pseudo R^2 value drops practically to zero after matching.

When we compare the matching estimates with those obtained using a Jacobson et al. (1993) type of fixed-effects model, we find relatively small differences in the estimated effects (see Table A2 in the Appendix for the latter). This was also the case in Couch and Placzek (2010), who made comparisons between similar estimators.

Figure 3.1. Matching estimates of the effect of displacement on annual earnings, all sectors (%).



Note: Based on the estimates reported in Table A1, where more detailed information is available.

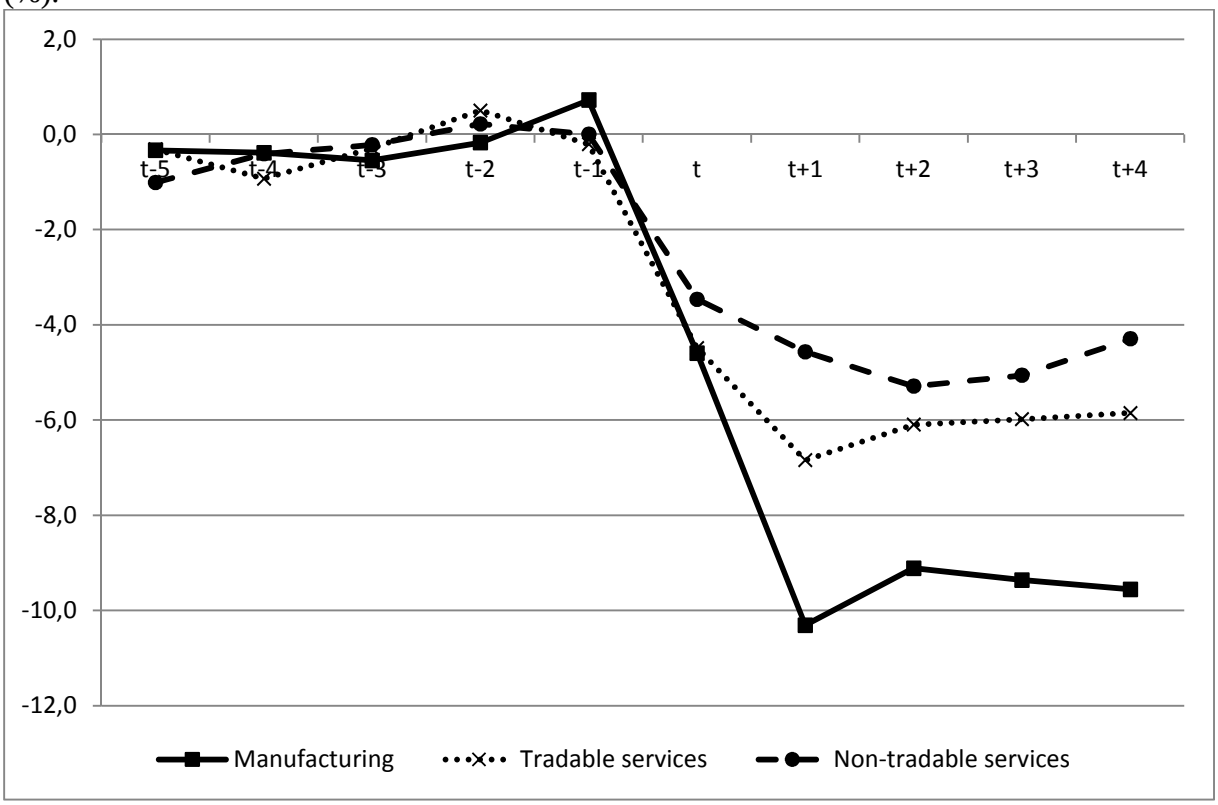
Our estimates of the effect of displacement for workers in all sectors are fairly similar to those reported by Eliason and Storrie (2006). They focus on displacements in Sweden in 1987 and find an initial earnings reduction corresponding to around 10% of annual pre-displacement earnings.[15] The earnings losses following displacement stands out as being rather low in Sweden, and also in some of the other Nordic countries, compared to the effects reported for the United States but also for some other European countries.[16]

Figure 3.2 provides a graphical presentation of the estimated effects of displacement for workers in manufacturing, tradable and non-tradable services (details are presented in Table A3 in the Appendix). For all sectors, we observe a significant drop in annual earnings in the year of displacement. The earnings drop continues during the first post-displacement year. Workers displaced from manufacturing experience the largest earnings losses (10%), followed by workers displaced from tradable services (7%) and workers displaced from non-tradable

[15] Our own calculations based on reported effects in SEK in relation to displaced workers reported average annual earnings in SEK two years prior to displacement.
[16] See e.g. Jacobson et al. (1993) and Couch and Placzek (2010) for results for the United States and the OECD (2013) for a broader review of findings.

services (5%).[17] After the first or second post-displacement year we see indications of a very modest recovery, but in the fourth post-displacement year earnings are still well below the pre-displacement level. In order to check whether there are any statistical differences between the point estimates for the three sectors, we have calculated 95% confidence intervals for each point estimate. It turns out that the estimated effect for manufacturing is significantly lower than the estimated effect for non-tradable services in the years *t*+1 to *t*+4 and also significantly lower than the estimated effect for tradable services in year *t*+1. Apart from that, there are no statistical differences between the point estimates.

Figure 3.2. Matching estimates of the effect of displacement on annual earnings, by sector (%).



Note: Based on the estimates reported in Table A3, where more detailed information is available.

When comparing the estimated effects of job loss on earnings for workers displaced from the different sectors with the previous results on re-employment opportunities, we find some similarities but also some interesting discrepancies. The relatively low probability of re-employment for workers displaced from manufacturing translates into the highest earnings losses during and following displacement for these workers. This result is perhaps not so

[17] Even though the data in Jensen and Kletzer (2006, 2008) do not allow for more formal econometric analyses one can discern similar patterns in the earnings losses among the displaced workers in the United States in the beginning of the 2000s.

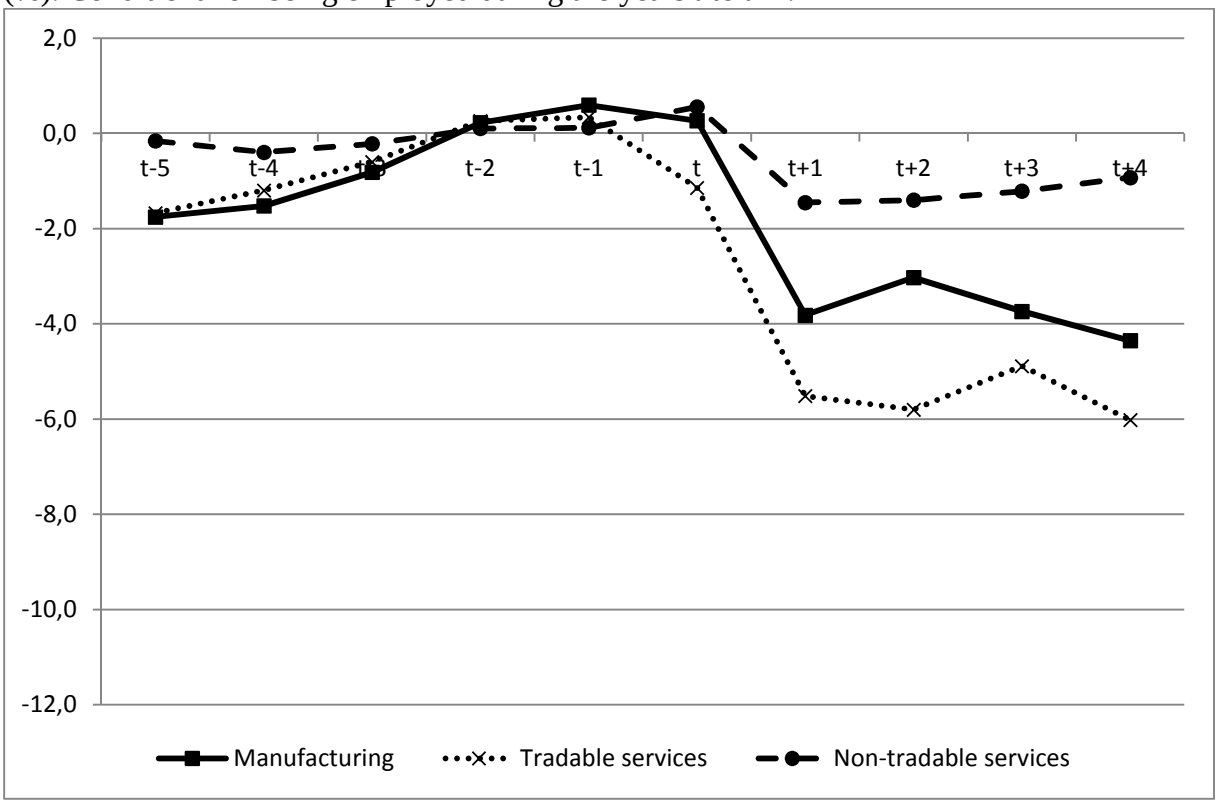
surprising since the dependent variable in the earnings analysis is real annual earnings, which among other things capture the costs of job loss in terms of periods of non-employment. The fairly high earnings losses for employees displaced from tradable services are more surprising in this sense. These workers on the one hand face the most promising re-employment opportunities in the event of job loss, but on the other hand suffer relatively high earnings losses from displacement. There are several possible explanations for this seemingly inconsistent story. Workers displaced from tradable services might, for instance, suffer particularly hard from loss of firm- and industry-specific human capital and seniority.

One approach to analyze whether observed earnings losses primarily are due to lower wages in subsequent jobs or mainly a result of periods of non-employment after displacement is to focus on earnings effects for workers who have found new jobs after displacement. If we condition on the workers being employed after displacement, the effect of displacement on annual earnings (or at least to a larger extent) must predominantly be due to lower wages in the new job. It is important to note that this type of conditioning on the future implies that we are no longer estimating the full costs of displacement on annual earnings. The effect that operates through spells of non-employment has (partly) been ruled out by definition.

Figure 3.3 provides a graphical presentation of the estimated effects of displacement when we condition on the displaced workers being employed in new jobs during the years *t* to *t*+4 (details are presented in Table A4 in the Appendix).[18] Note that we follow the official definition of employment status in Sweden and focus on the workers being employed in November each year. The workers are therefore not necessarily employed full-time during the year and hence may have experienced spells of non-employment during other parts of the year. If we compare with the previous figure, there are some striking changes in the results. One is that workers displaced from tradable services now experience the largest earnings losses (around 6%), followed by workers displaced from manufacturing (around 4%). The other is that the effect of displacement for workers in non-tradable services no longer is statistically significant (except for year *t*+1).

[18] We also condition on that non-displaced workers in the comparison group are employed during the years *t* to *t*+4.

Figure 3.3. Matching estimates of the effect of displacement on annual earnings, by sector (%). Conditional on being employed during the years *t* to *t*+4.



Note: Based on the estimates reported in Table A4 where more detailed information is available.

We interpret the relatively large reduction in estimated effects for workers displaced from manufacturing and non-tradable services as an indication that these workers find new jobs that pay wages that are fairly comparable with the wages in the pre-displacement jobs. This is particularly the case for workers displaced from non-tradable services. The fact that we find almost no reduction in the estimated effect for workers displaced from tradable services when conditioning on future employment indicate that these workers to a greater extent accept new jobs that pay lower wages than the pre-displacement jobs.

4. Concluding remarks

We have examined the costs of displacement in tradable and non-tradable sectors in Sweden in the 2000s. To this end we divided the economy into three sectors, manufacturing, tradable and non-tradable services, where the former two are expected to be tradable (at least potentially). Our results indicate that the probability of displacement, controlling for factors that might impact on displacement, is higher in the tradable sectors, particularly in tradable

services. However, when it comes to re-employment in the event of displacement the prospects for workers previously employed in tradable services are more promising than for workers earlier employed in manufacturing. Relatively low re-employment probabilities for workers displaced from manufacturing are also reflected in the relatively high income losses that this group of workers have after displacement. In other words, our results indicate that those displaced from tradable service fare better than those displaced from manufacturing.

Characteristic traits of the tradable service sector are that it is highly skill-intensive and that skill intensity grows faster there than in the other sectors. Over the last 20 years employment in tradable services has expanded, while the employment in manufacturing has contracted. Furthermore, in contrast to manufacturing that is more evenly spread out over Sweden,[19] tradable services are concentrated to the larger local labor market regions (big cities).[20] In sum, tradable services appear to be an expanding, dynamic and human capital intensive sector.

The workers displaced from tradable services nonetheless seem to suffer from relatively high income losses. Unlike those displaced in manufacturing, whose the earnings losses appear to be due to longer spells of non-employment, the earnings losses of those displaced in tradable services seem to emanate from lower wages in the new jobs compared to the wages in the pre-displacement jobs. Such wage decreases might indicate depreciations of firm- and industry-specific human capital and loss of seniority among those displaced from tradable services. However, to draw more definite conclusion on that issue calls for a more careful analysis and is an interesting question for further research.

[19] Specific manufacturing industries are of course strongly regionally concentrated.

[20] In Sweden, there is a strong positive and significant correlation on regional level between the share of employment in tradable service and the size of the local labor market region, whereas the same correlation with the share of employment in manufacturing is insignificant (Eliasson et al. 2012b figures 6.5 and 6.6). A similar pattern can be observed in the United States (Jensen 2011 chapter 8)

References

Autor, D., D. Dorn, G. Hanson and J. Song (2013), Trade adjustment: Worker level evidence. *NBER working paper 19226.*

Blinder, A. (2006), Offshoring: The next industrial revolution? *Foreign Affairs*, 85(2), 113-128.

Borland, J., P. Gregg, G. Knight and J. Wadsworth (2002), They get knocked down: Do they get up again?, in P. Kuhn (ed.), *Losing work, moving on: international perspectives on worker displacement*. WE Upjohn institute for employment research: Kalamazoo.

Couch, K. and D. Placzek (2010), Earnings losses of displaced workers revisited. *American Economic Review*, 100(1), 572-589.

Dehejia, R. and S. Wahba (1999), Causal effects in nonexperimental studies: Reevaluating the evaluation of training programs. *Journal of the American Statistical Association*, 94(448), 1053-1062.

Dehejia, R. and S. Wahba (2002), Propensity score matching methods for nonexperimental causal studies. *Review of Economics and Statistics*, 84(1), 151-161.

Eliason, M. and D. Storrie (2006), Lasting or latent scars? Swedish evidence on the long-term effects of job displacement, *Journal of Labor Economics*, 24(4), 831-856.

Eliasson, K., P. Hansson and M. Lindvert (2012a), Jobs and exposure to international trade within the service sector in Sweden. *The World Economy*, 35(5), 578-608.

Eliasson, K., P. Hansson and M. Lindvert (2012b), Global value chains and international competitiveness. *Growth Analysis WP/PM 2012:23*.

Fallick, B. C. (1996), A review of the recent empirical literature on displaced workers. *Industrial and Labor Relations Review*, 50(1), 5-16.

Heckman, J, H. Ichimura and P. Todd (1997), Matching as an econometric evaluation estimator: Evidence from evaluating a job training program. *Review of Economic Studies*, 64(4), 605-654.

Heckman, J, H. Ichimura, J. Smith and P. Todd (1998), Characterizing selection bias using experimental data. *Econometrica*, 66(5), 1017-1098.

Hijzen, A., R. Upward and P. Wright (2006), The income losses of displaced workers. *Journal of Human Resources*, 45(1), 243-269.

Hummels, D, R. Jørgensen, J. Munch and C. Ziang (2011), The wage effect of offshoring: Evidence from Danish matched worker-firm data. *NBER working paper 17496*.

Huttunen, K., J. Møen and K. Salvanes (2011), How destructive is creative destruction? Effects of job loss on job mobility, withdrawal and income. *Journal of the European Economic Association*, 9(5), 840-870.

Jacobson, L., R. LaLonde and D. Sullivan (1993), Earnings losses of displaced workers. *American Economic Review*, 83(4), 685-709.

Jensen, B. and L. Kletzer (2006), Tradable services: Understanding the scope and impact of service offshoring, in Brainard, L. and S. Collins (eds.), *Offshoring White-Collar Work − Issues and Implications, Brookings Trade Forum 2005*. Brookings: Washington DC, 75-116.

Jensen, B. and L. Kletzer (2008), "Fear" and offshoring: The scope and potential impact of imports and exports of services. Policy Brief 08-1, Peterson Institute for International Economics.

Jensen, B. (2011), *Global trade in services. Fear, facts, and offshoring*. Peterson Institute for International Economics: Washington DC.

Kletzer, L. and R. Fairlie (2003), The long-term costs of job displacement for young adult workers. *Industrial and Labor Relations Review*, 56(4), 682-698.

Kletzer, L. (1998), Job displacement. *Journal of Economic Perspectives*, 12(1), 115-136.

OECD (2013), Back to work: re-employment, earnings and skill use after job displacement. Chapter 4 in *Employment Outlook*, OECD: Paris.

Rosenbaum, P. and D. Rubin (1983), The central role of the propensity score in observational studies for causal effects. *Biometrika*, 70(1), 41-55.

Rosenbaum, P. and D. Rubin (1985), Constructing a control group using multivariate matched sampling methods that incorporate the propensity score. *The American Statistician*, 39(1), 33-38.

Ruhm, C. (1991), Are workers permanently scarred by job displacements? *American Economic Review*, 81(1), 319-324.

Smith, J. and P. Todd (2005), Does matching overcome Lalonde's critique of nonexperimental estimators? *Journal of Econometrics*, 125(1-2), 305-353.

Stevens, A. H. (1997), Persistent effects of job displacement: The importance of multiple job losses. *Journal of Labor Economics*, 15(1), 165-188.

Appendix

Table A1. Matching estimates of the effect of displacement on annual earnings for all sectors.

	SEK	%
t–5	-4,114**	-1.4
	(1,318)	
t–4	-3,103**	-1.0
	(1,111)	
t-3	-1,044	-0.3
	(891)	
t-2	1,182	0.4
	(619)	
t–1	-138	0.0
	(888)	
t	-15,295**	-5.1
	(1,563)	
t+1	-23,802**	-7.9
	(1,873)	
t+2	-22,364**	-7.5
	(1,654)	
t+3	-22,596**	-7.5
	(1,981)	
t+4	-21,452**	-7.2
	(1,805)	
Balancing indicators		
Mean bias before	11.9	
Mean bias after	1.0	
Pseudo R^2 before	0.052	
Pseudo R^2 after	0.001	
Untreated on support	836,338	
Treated on support	23,875	

Notes: The estimated parameters are based on conditional difference-in-differences (DID) propensity score matching using single nearest neighbor. For details on the specification of the propensity score, see Section 3.2. Approximate standard errors in parenthesis. ** and * indicate significance at the 1% and 5% levels respectively. Percentage effects are calculated as estimate divided by average annual earnings of displaced workers *t*-3 to *t*-1. The balancing indicators compare the distribution of covariates in the propensity score before and after matching to assess if the matching has been successful (enough) in balancing differences between the treatment and the comparison group. The standardized bias of a covariate is defined as the difference of the sample means in the treatment and the comparison group as a percentage of the square root of the average of the sample variance in the two groups (see Rosenbaum and Rubin, 1985). The table reports the mean value (over all covariates) of this bias and the value should drop considerably after matching due to a more similar distribution of covariates in the treatment and comparison group. The pseudo R^2 indicates how well the covariates in the propensity score explain the probability of displacement. After matching, the value should be fairly low because there should be no systematic differences in the distribution of covariates between the treatment and the comparison group.

Table A2. Fixed-effects estimates of the effect of displacement on annual earnings for all sectors.

	SEK	%
t	-10,698	-3.6
t+1	-19,967	-6.7
t+2	-19,483	-6.5
t+3	-17,828	-5.9
t+4	-16,591	-5.5
Observations		860,213

Notes: The estimated parameters are based on a fixed-effects regression model with the following specification:

$$y_{it} = \alpha_i + \gamma_t + X_{it}\beta + \sum_{k=-3}^{4} D_{it}^{k}\delta_k + \sum_{k=-3}^{4} C_{it}^{k}\theta_k + \epsilon_{it}$$

where y_{it} is real gross annual earnings, α_i is the individual fixed effect, γ_t is a set of time dummies that control for year-specific effects, X_{it} is a set of observed time-varying individual characteristics, D_{it}^{k} is a set of dummy variables capturing the event of displacement, C_{it}^{k} is at set of dummy variables for each year in the cohort, and finally ϵ_{it} is an error term assumed to have constant variance and to be uncorrelated across cohort-individuals and time, but may be correlated between individuals who appear in multiple cohorts. $D_{it}^{k} = 1$ if at time *t* worker *i* is *k* years after displacement or *-k* years before displacement. The parameters δ_k capture the difference in earnings before, during and after the year of displacement between displaced workers in the treatment group and non-displaced workers in the comparison group. We have estimated the model both with and without controls for time-varying individual characteristics. Since the results are very similar we restrict the presentation above to a specification without individual controls. Percentage effects are calculated as estimate divided by average annual earnings of displaced workers *t*-3 to *t*-1.

Table A3. Matching estimates of the effect of displacement on annual earnings by sector.

	Manufacturing		Tradable services		Non-tradable services	
	SEK	%	SEK	%	SEK	%
t–5	-0,983	-0.3	-1,107	-0.3	-2,420	-1.0
	(1,828)		(2,570)		(1,385)	
t–4	-1,127	-0.4	-3,283	-0.9	-0,981	-0.4
	(1,514)		(1,988)		(1,176)	
t-3	-1,602	-0.5	-1,044	-0.3	-0,530	-0.2
	(0,952)		(1,962)		(0,774)	
t-2	-0,510	-0.2	1,774	0.5	0,530	0.2
	(0,665)		(1,239)		(0,533)	
t–1	2,113*	0.7	-0,730	-0.2	0,001	0.0
	(1,011)		(1,645)		(0,746)	
t	-13,462**	-4.6	-15,857**	-4.5	-8,300**	-3.5
	(1,926)		(3,534)		(1,387)	
t+1	-30,203**	-10.3	-24,182**	-6.8	-10,947**	-4.6
	(2,130)		(3,688)		(1,563)	
t+2	-26,692**	-9.1	-21,541**	-6.1	-12,674**	-5.3
	(2,376)		(3,824)		(1,729)	
t+3	-27,418**	-9.4	-21,143**	-6.0	-12,125**	-5.1
	(2,482)		(4,077)		(1,997)	
t+4	-27,998**	-9.6	-20,673**	-5.9	-10,287**	-4.3
	(2,827)		(4,368)		(2,000)	
Balancing indicators						
Mean bias before	7.7		7.6		10.4	
Mean bias after	1.2		0.8		1.0	
Pseudo R^2 before	0.031		0.033		0.050	
Pseudo R^2 after	0.001		0.001		0.001	
Untreated on support	226,825		175,303		434,210	
Treated on support	6,267		9,733		7,874	

Notes: The estimated parameters are based on conditional difference-in-differences (DID) propensity score matching using single nearest neighbor. For details on the specification of the propensity scores, see Section 3.2. Approximate standard errors in parenthesis. ** and * indicate significance at the 1% and 5% levels. Percentage effects are calculated as estimate divided by average annual earnings of displaced workers *t*-3 to *t*-1. See Table A1 for an explanation of the balancing indicators.

Table A4. Matching estimates of the effect of displacement on annual earnings by sector. Conditional on being employed during the years *t* to *t*+4.

	Manufacturing		Tradable services		Non-tradable services	
	SEK	%	SEK	%	SEK	%
t–5	-5,284**	-1.8	-6,030*	-1.7	-0,394	-0.2
	(1,991)		(2,684)		(1,531)	
t–4	-4,586**	-1.5	-4,307	-1.2	-0,993	-0.4
	(1,644)		(2,236)		(1,282)	
t-3	-2,459*	-0.8	-2,154	-0.6	-0,547	-0.2
	(1,042)		(1,484)		(0,846)	
t-2	0,673	0.2	0,935	0.3	0,255	0.1
	(0,749)		(1,038)		(0,565)	
t–1	1,786	0.6	1,219	0.3	0,292	0.1
	(1,124)		(1,607)		(0,804)	
t	0,793	0.3	-4,119	-1.1	1,376	0.6
	(2,086)		(2,554)		(1,495)	
t+1	-11,490**	-3.8	-19,858**	-5.5	-3,619*	-1.5
	(2,190)		(3,970)		(1,616)	
t+2	-9,115**	-3.0	-20,877**	-5.8	-3,496	-1.4
	(2,727)		(3,402)		(1,800)	
t+3	-11,255**	-3.7	-17,591**	-4.9	-3,026	-1.2
	(2,904)		(3,538)		(2,020)	
t+4	-13,104**	-4.4	-21,667**	-6.0	-2,313	-0.9
	(3,367)		(4,120)		(2,205)	
Balancing indicators						
Mean bias before	8.3		7.9		12.3	
Mean bias after	1.7		1.8		0.9	
Pseudo R^2 before	0.034		0.032		0.053	
Pseudo R^2 after	0.002		0.001		0.001	
Untreated on support	204,747		158,294		388,815	
Treated on support	4,861		8,025		6,170	

Notes: The estimated parameters are based on conditional difference-in-differences (DID) propensity score matching using single nearest neighbor. For details on the specification of the propensity scores, see Section 3.2. Approximate standard errors in parenthesis. ** and * indicate significance at the 1 and 5 percent levels. Percentage effects are calculated as estimate divided by average annual earnings of displaced workers *t*-3 to *t*-1. See Table A1 for an explanation of the balancing indicators.