Structural change in the ICT sector: Where have former Nokia employees ended up?

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Abstract

This study empirically examines the reemployment of employees displaced from a high-tech firm. Since 2008, the plummeting market share of Nokia, the world's largest mobile phone manufacturer at the time, has resulted in massive layoffs and the downsizing of its workforce. We analyze the labor market status of more than twenty thousand former Nokia employees in Finland who left the company during 2009-2014. Using a unique matched employee-employer dataset, we identify the key factors associated with the probability of reemployment. Our findings show that the majority of former Nokia employees were successful in becoming reemployed. According to the latest available data from 2017, more than three-quarters of these employees found new jobs. Reemployment was often found in the service sector. Employees with higher education levels and those who had held senior positions at Nokia were more successful in finding new jobs than others. An additional year of education is positively associated with the probability of reemployment in the third year after displacement. The average difference in the estimated probability of employment of the senior staff members and other former Nokia employees one year after exit was 22 percentage points in favor of the senior staff members.

Keywords: *Reemployment, former employees, Nokia, probit model, matched employer-employee data*
JEL codes: *J01, J21, J23, J64, L16*

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1. Introduction

Reemployment of a displaced workforce is critically important both for the individual employees and for society as a whole. At the individual level, long-term unemployment is known to affect future earnings (see, e.g., Ruhm 1991; Stevens 1997; Huttunen et al. 2011; Angelov and Eliason 2016; Plum 2019; Verho 2020) but may also cause knowledge obsolescence (De Grip and Van Loo 2002) and adverse impacts on health and wellbeing (see Paul and Moser 2009 and Wanberg 2012 for reviews and meta-analyses). For the economy, unemployment entails the depreciation of human capital and is associated with substantial financial costs (Knotek 2007; Ochsen and Welsch 2011; Matatov and Orusova 2020).

In this study we examine the reemployment of the former employees of Nokia, the world's largest mobile phone manufacturer from 1998-2012 and the former flagship of the Finnish industry. Nokia has been a leading company in the ICT sector and has contributed significantly to the economic growth of Finland (Ali-Yrkkö et al. 2000). The downfall of Nokia began in 2008 when Apple and Google entered the mobile phone market and Nokia failed to compete in the growing smart phone segment. As a result, many thousands of Nokia's employees in Finland left the company between 2009 and 2014. To conduct this study, we obtained the formal authorization from Nokia that allowed us to identify Nokia's units in the data and to trace the reemployment of its former employees. Using a unique matched employee-employer dataset, we examine the labor market status of former Nokia employees in the years following their displacement from Nokia during the period 2009-2014 and identify the key factors associated with the probability of their reemployment.

Most of the previous empirical literature on reemployment focus on examining mixed samples of individuals displaced from multiple workplaces. For instance, Schwerdt et al. (2010) utilize a data sample that comprised of Austrian employees in the private sector who experienced plant closures. Huttunen et al. (2011) use a sample consisting of workers displaced from Norwegian manufacturing plants. Tate and Yang (2015) and Hane-Weijman et al. (2018) use matched employer-employee data on workers made redundant from plant closures. Gathmann et al. (2020) use administrative data on firms and workers and Blien et al. (2021) use worker-level data to study mass layoffs in Germany. The objectives of the above-mentioned studies vary from quantifying the spillover effects of mass layoffs and the likelihood of returning to work to measuring wage differences and investigating whether the costs of job displacement vary between blue and white collar workers. None of these studies however focus on workers who were displaced from a specific plant that closed down or experienced a mass layoff.

Only a handful of studies focus specifically on former employees of a specific company or a specific plant after its closure or a mass layoff. Hinde (1994), Tomaney et al. (1999) and Shuttleworth et al. (2005), for example, examine the labor market experiences of workers who became redundant due to the closure of specific shipbuilding plants located in the UK and identify the factors that affected the reemployment of workers. The results by Hinde (1994) highlight the importance of re-training and distance as a barrier to reemployment stability. Tomaney et al. (1999) state that different groups of former shipbuilding plant workers fared differently in the labor market depending on their personal characteristics. The results by Shuttleworth et al. (2005) are similar to the previous analyses of industrial redundancies by Hinde (1994) and Tomaney et al. (1999). Shuttleworth et al. (2005) find that job-related training can be a successful response to redundancy of workers and confirm that personal characteristics such as age and skill level influence employability.

The studies by Bailey et al. (2012) and Bailey and De Ruyter (2015) focus on the specific cases of plant closures in the automotive manufacturing sector and investigate how job loss affects the employment trajectories of workers in the context of economic restructuring. The findings by Bailey et al. (2012) are in the vein of studies on redundancies in shipbuilding suggesting that younger and more skilled workers are reemployed quickly, while older and less skilled and less experienced workers need more time to find new jobs. A more recent work by Goos et al. (2021) investigate the reemployment of workers from a large car plant but in the context of routine-biased technical change. They find that re-employment probabilities are considerably higher for workers with nonroutine task competencies and with digital skills than workers with routine task competencies.

Perhaps the closest study to ours in terms of context is conducted by Jolkkonen et al. (2012). They focus on the reemployment of displaced workers from the closed-down mobile telephone cover manufacturer, Perlos Ltd plants, located in

eastern Finland. The Perlos Corporation grew from a Nokia subcontractor into a globally operating limited company but closed down its production in Finland in 2007. Their findings fall within the results reported by the above-mentioned studies. They conclude that white-collar workers and younger job seekers had better chances of reemployment, and that gender and the occupational status were also important predictors for reemployment.

The main limitations of the previous studies that focus on workers displaced from a specific company or a specific plant, is that they mainly rely on survey or interview data and use rather small data samples varying from a few hundreds to a few thousands of workers. In contrast, the present work is a quantitative case study that uses a sample of more than twenty thousand former Nokia employees representing a relatively similar group of workers who were formerly employed by the same company.

This study contributes to the literature on the reemployment of displaced workers from a specific plant or company in three ways. First, while earlier studies on the reemployment of terminated workers from one employer typically use survey data, we use unique longitudinal register-based linked employer-employee data that include the entire Finnish working population. The main advantage of our sample is that it allows us to observe all displaced former Nokia employees over the study period, not a sub-sample of workers as in other studies. Second, we expand the existing literature on the reemployment of redundant workers from a single plant or firm by examining the reemployment of employees from a high-tech firm. This, to our knowledge, has not been previously reported in the literature. Previous works we are aware of focus on such industries as shipbuilding and automotive manufacturing. Third, our study contributes to the stream of literature on the downfall of Nokia. The most widely explored themes among those studies include the reasons for company's failure to maintain its competitive position in the mobile phone market (Ali-Yrkkö et al. 2013; Cord 2014; Van Rooij 2015; Lamberg et al. 2019), the strategic decisions of Nokia (Vuori and Quy Huy 2016; Peltonen 2019), and the internal leadership problems that led to its downfall (Nykänen and Salminen 2014; Laamanen et al. 2016; Doz and Wilson 2017). However, only a few studies have specifically considered former Nokia employees (Pajarinen and Rouvinen 2013), which can be explained by the lack of or restricted access to individual worker data from a single employer. The present study is, to our knowledge, the first to analyze the reemployment of former Nokia employees and their post-Nokia careers.

The rest of this paper is structured as follows. Section 2 sets the stage for the analysis. Section 3 explains the dataset and econometric method used. Section 4 presents the descriptive analysis. Section 5 reports the results. Section 6 contains the summary and conclusions.

2. The Nokia case

Nokia was the flagship of the Finnish industry from the mid-1990s to the early 2000s. Its success helped the Finnish economy recover from the deep recession of the early 1990s. During Nokia's golden years, its mobile device business line gained increasing significance and became Nokia's core business area. In year 2008, Nokia was operating in almost 140 countries and employed more than 23 thousand people in Finland and 102 thousand abroad. Alongside Nokia's increased international operations, it increasingly contributed to the Finnish economy. Approximately one-fifth of Finland's GDP growth could be attributed to the growth of Nokia in 1995-2000 (Ali-Yrkkö 2010).

While Nokia was still growing in the early 2000s, Finland's ICT sector started to experience slowdowns and stagnation due to a number of factors, including outsourcing, overinvestment, and growing uncertainty in the financial markets. Exports from the Finnish electronic equipment industry started to decline, which resulted in considerable layoffs within the ICT sector. Nokia's downfall started soon after Apple introduced the iPhone in 2007. Although Nokia was the world's largest mobile phone manufacturer at the time, it failed to compete in the emerging smartphone segment and quickly began losing its net sales in 2008. Nokia's troubles were echoed throughout the whole Finnish economy, especially in its declining ICT sector.

Decreasing demand for Nokia mobile phones was reflected in its decreasing turnover and market share, which eventually led to massive cost reductions and the downsizing of its workforce in Finland[1] and worldwide. As Nokia's market share in mobile phones was plummeting, the company made a strategic decision to withdraw from the mobile phone market and focus on networks and wireless infrastructure. To keep Windows phones on the market, Microsoft acquired Nokia's mobile phone business in early 2014 (Ali-Yrkkö et al. 2013).[2]

After its exit from the mobile device market, Nokia reorganized itself around its networks business line. In 2016, Nokia acquired Alcatel-Lucent, which was formerly one of its competitors in the wireless infrastructure industry, and by the end of the same year, Nokia was among the top three companies in the global telecom infrastructure industry. Nokia remains an important company in Finland, employing approximately 6,000 people in Finland and 92,300 people abroad in 2019.

Having this background, the present study focuses on the former Nokia employees, who left the company during the period from 2009 to 2014, the period of Nokia downsizing jobs. Having the data on more than twenty thousand workers, we examine the labor market status of these employees in the years following their displacement.

3. Data and methods

3.1 Data

This study utilizes a unique matched employer-employee dataset for Finland covering the 2009-2017 period. The key benefit of our register-based dataset is that it covers in practice the entire working population and all operating companies in Finland. Employees can be identified and traced over time through a unique anonymized ID. Similarly, companies are traced through a unique anonymized firm ID. Based on these identifiers, we can match every employee with his or her employer in every observation year and analyze employees' cross-firm mobility. In addition, Nokia has granted us formal permission to identify its business units in the data, which allows us to study the labor market status of its former employees after they left the company.

Our data include measures of both employer and employee characteristics. Data on employee characteristics originate from several Statistics Finland panel data modules, which cover the total Finnish population and include information such as employees' labor market status, occupation, level of education, gender, and age. Data on employer characteristics are based on linked nationwide business register data and financial statement data, providing us with information such as companies' age and size, industry and geographical location, and scale of business operations, as well as other background and business performance measures for companies in Finland.

The present study focuses specifically on former Nokia employees who left the company for 2009-2014, the period of Nokia's severe troubles. The sample includes both voluntary and involuntary leavers. Since Nokia actively encouraged voluntary resignation by offering compensation packages, the distinction between voluntary resignation and involuntary displacement is somewhat blurred in this case. Further, individuals who were transferred to other companies due to Nokia's outsourcing[3] and those who took voluntary redundancy packages are also present in our data. Since it would be potentially misleading and also practically impossible to distinguish between the groups of voluntary and involuntary

[1] *To help its laid-off employees find new employment opportunities, Nokia introduced the Bridge program in 2011. The program offered Nokia employees different paths to reemployment, such as offering support in becoming an entrepreneur or providing requalification training. In Finland Bridge program was available to 5,000 employees. As a result, approximately 400 start-ups were established in Finland by 2013, most of them in the ICT and service industries.*

[2] *Due to this deal, many former Nokia employees around the world were transferred to Microsoft. In Finland, more than four thousand employees moved to Microsoft.*

[3] *For example, Symbian developers were outsourced to Accenture in 2011 and information management was outsourced to TCS and HCL Technologies in 2013. In 2014, Nokia sold its mobile device business to Microsoft.*

leavers in our data, all former Nokia employees who left the company during the period 2009-2014 are included in the analysis. Henceforth, we use neutral terms such as "*exit*" and "*leave*" to refer to both voluntary resignation and involuntary displacement.

3.2 Econometric specification

One of our research questions is what kinds of individuals were successful in finding new jobs and which characteristics were associated with the probability of reemployment. Although the descriptive analysis of the reemployment of former Nokia employees presented in Section 4 provides some insights into the answer to this question, a more thorough analysis is required to isolate the contribution of particular factors. To study the effect of individual characteristics and those characteristics related to former employment on employment status, the probability of being employed is estimated using a simple probit approach. Thus, we interpret the explanatory variables as being associated with an unobserved propensity for reemployment, for which we can only observe one binary output, i.e., employed or non-employed.

We model whether individual i has ever been reemployed (D_i=1) using a binary probit model:

$$D^*_i = \alpha' \mathbf{X}_i + \varepsilon_i, \text{ where } \varepsilon_i \sim N(0,1)$$

$$Pr(D_i = 1) = Pr(D^*_i > 0) = \Phi(\alpha' \mathbf{X}_i),$$

where $D_i = \{0,1\}$ is a dummy variable for employment status, equal to one if individual i is employed[4] and zero otherwise[5], $\mathbf{X}_i$ is a vector of explanatory variables, α is a vector of associated coefficients, and $\Phi(\cdot)$ is the cumulative distribution function for the standard normal distribution. An individual i in equation (1) is referred to as a "*former Nokia employee*", a person who was employed by Nokia in year t but is no longer.

Our second research question is how different characteristics associate with the probability of reemployment immediately after leaving Nokia and over time. To provide answers to this question, we estimate the probability of reemployment immediately after leaving Nokia in year t+1, in the subsequent years t+2 and t+3, and in 2017, the latest year for which data are available.

A number of factors are likely to be relevant for reemployment. Along with certain personal characteristics of the former employees such as age, gender and education, we include a set of explanatory variables relating to the characteristics of an individual's former employment at Nokia, such as being employed in a specific Nokia business unit or the individual's former position. Table 1 provides a description of these characteristics in terms of mean values and standard deviations. From our sample of 21,330 former Nokia employees,[6] almost two-thirds are men and just over one-third are women. Young adults (aged between 16 and 34 years old) constitute approximately one-third of the sample, middle-aged adults (35 to 54 years old) constitute two-thirds, and older adults (55 years or older) constitute the rest of the sample. In relation to schooling, employees were generally highly educated with an average of 15 years of education.

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[4] *The status "employed" also includes self-employed individuals. For instance, Nokia encouraged its former employees to start new companies as a part of its Bridge program. Kiuru et al. (2013) examined these companies and their operations. The perceptions and experience of individuals who participated in the Bridge program were examined in a study by Rönnqvist et al. (2015).*

[5] *The status "non-employed" refers to all nonworking individuals (i.e., unemployed, retired, studying, or of other non-employed status).*

[6] *Note that in the analyses, we use gross outflows from Nokia. In each year, Nokia also recruited new workers and that is why the net outflows reported in Nokia's annual reports are smaller than the numbers reported here. In addition, there may be differences in the exact timing of the measurement of worker status and how half-time workers, trainees, etc., are treated.*

Table 1. *Means and standard deviations of the explanatory variables.*

Characteristic	Mean	Std. Dev.
Gender, share (%)		
Female (ref.)	0.35	0.48
Male	0.65	0.48
Age, share (%)		
16 to 29 years (ref.)	0.10	0.30
30 to 34 years	0.18	0.38
35 to 39 years	0.24	0.43
40 to 44 years	0.21	0.41
45 to 49 years	0.13	0.33
50 to 54 years	0.07	0.25
55 to 59 years	0.05	0.21
60 years or more	0.03	0.16
Education (years)	15.17	3.08
Occupational status at Nokia, share (%)		
Senior staff	0.52	0.50
Junior staff	0.20	0.40
Other (ref.)	0.27	0.45
Job tenure at Nokia (years)	11.07	5.75
Job tenure at Nokia, share (%)		
Less than 3 years (ref.)	0.12	0.32
4 to 7 years	0.19	0.39
8 to 11 years	0.20	0.40
12 to 15 years	0.26	0.44
16 years or more	0.23	0.42
Nokia unit of employment, share (%)		
Networks	0.18	0.38
Other (ref.)	0.82	0.38
Geographical location of Nokia unit, share (%)		
Uusimaa (ref.)	0.38	0.49
Southwest Finland	0.27	0.44
Pirkanmaa	0.18	0.38
Central Finland	0.01	0.11
Northern Ostrobothnia	0.16	0.37
Exit year, shares (%)		
2009 (ref.)	0.14	0.35
2010	0.13	0.34
2011	0.15	0.35
2012	0.26	0.44
2013	0.12	0.33
2014	0.21	0.40

Note: "ref." indicates the reference category used in the probit analysis. The total number of observations N = 21,330.

Regarding the characteristics of the employees' former employment at Nokia, approximately half of the sample were senior staff members[7], while the rest were almost equally divided between junior staff members and other employees. Nokia's unit of employment is the business unit in which individuals were employed during the last year of their employment. Almost 40 percent of employees were employed in business units located in the Uusimaa (capital area) region, approximately 30 percent were in units located in the Southwest Finland region, and the rest were in units situated in other locations.

Job tenure at Nokia indicates the total number of years a person had worked for Nokia. The average value of 11 years suggests that the majority of former Nokia employees had quite a long career at Nokia. Approximately half of our sample is composed of long-tenured former Nokia employees with more than 12 years of tenure with Nokia, and only 12 percent of the sample includes short-tenured employees who worked for Nokia for less than three years. Regarding the exit year, the largest share of employees (approximately one quarter of the sample) left Nokia in 2012, followed by leavers in 2014 (21 percent).

4. Descriptive analysis

In this section, we analyze different groups of former Nokia employees in terms of their new employment immediately and a few years after leaving Nokia. We first consider the labor market status of all former Nokia employees and then discuss the differences in the labor market status between groups with different schooling levels and former occupational statuses at Nokia. Finally, we examine which type of companies recruited former Nokia employees and how these individuals spread throughout society and across the different industries in the economy.

4.1 How successful were former Nokia employees in their reemployment?

The employment status in 2017 of former Nokia employees, who left the company during the period from 2009 to 2014, is illustrated in Figure 1. The employment status is described by the shares of employed, unemployed, retired, studying and other individuals. The latter group of other individuals includes former Nokia employees who moved abroad and those individuals whose labor market status could not be identified based on the labor market register data. According to the latest available data (Figure 1), about 77 percent of former Nokia employees have found new jobs by 2017 and approximately 10 percent remained unemployed. Note that the unemployment rate calculated based on our sample of former Nokia employees for 2017 is about 11 percent, which is very close to the unemployment rate during the same year in Finland (11.3 percent).[8]

[7] *Senior staff members include employees who worked in upper white-collar positions and junior staff includes employees in clerical positions at Nokia.*

[8] *Figures for the whole economy have been calculated from population statistics (Statistics Finland).*

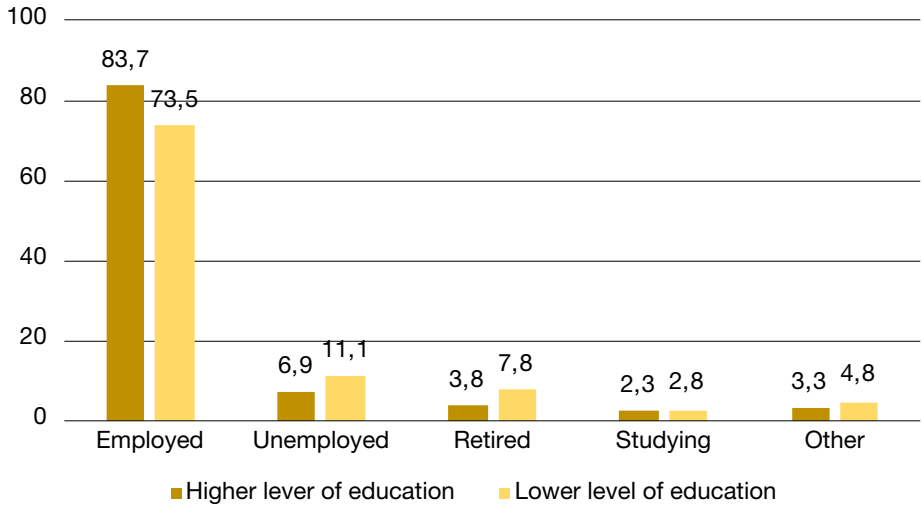

Figure 1. *Labor market status of former Nokia employees: the shares of employed, unemployed, retired, studying and other in 2017 (in percentage). Source: authors' calculations.*

Table 2 further reveals how the situation with the labor market status of former Nokia employees has changed over time (one, two and three years after leaving Nokia). Already one year after leaving Nokia, approximately 62 percent of its former employees were reemployed, while the share of unemployed was about 23 percent. The share of unemployed individuals decreased over time, while the share of employed individuals increased during the second and third years. About 9 percent of employees one year after leaving Nokia were studying. The share of retired workers remained rather low over the study period (about 2-3 percent of all former Nokia employees). Based on our sample of the former Nokia employees, the calculated unemployment rate three years after leaving Nokia is about 20 percent. This rate is relatively high compared to the general duration of unemployment in Finland. For comparison, between years 2014 and 2017, only 9.5 percent of the unemployed persons had a duration of unemployment of at least three years[9].

Table 2. *Labor market status of all former Nokia employees: the shares of employed, unemployed, retired, studying and other in 2017 (in percentage).*

	***t*+1**	***t*+2**	***t*+3**
Employed	61.8	67.6	68.3
Unemployed	22.6	18.1	16.9
Retired	2.2	2.4	3.0
Studying	8.5	7.0	5.9
Other	4.9	4.8	5.9

Note: Sample size is 21,330.

[9] *Calculated based on the figures of Statistics Finland. Number of unemployed at the end of the year by the duration of unemployment in 2010 to 2018, Statistics Finland [referred: 9.5.2022]. Access method: http://www.stat.fi/til/tyokay/2018/02/tyokay_2018_02_2019-05-24_tau_001_en.html.*

Consider next the labor market status of former Nokia employees in relation to their educational background. We note that in general our sample is represented by well-educated individuals. As evident from the descriptive statistics (Table 1), the average education level of workers is slightly above 15 years that corresponds to tertiary education (ISCED levels 5 and 6[10]). The labor market status is defined by two categories of former Nokia workers:

i. Employees with a higher level of education: the subsample includes 7,766 individuals with a master's degree or above (ISCED levels 7 and 8).

ii. Employees with a lower level of education: the subsample includes 13,564 individuals with a qualification below a master's degree (ISCED levels 6 and below).

Thus, approximately two-thirds of our sample includes employees with a lower educational level, and one-third had a higher level of education.

Figure 2 presents the labor market situation of workers with higher and lower levels of education in 2017. The figure illustrates the percentage shares of employed, unemployed, retired, studying and other individuals. Some differences can be observed as regards education level and reemployment. As high as 84 percent of former Nokia workers with a higher level of education were reemployed in 2017 in contrast to 74 percent of employed workers with a lower education level. The shares of workers with a lower education level in other labor market status categories, including unemployed, retired, studying and other, exceeded that of workers with a higher education level. This observation confirms with previous studies that workers with better education and skill level are successful in becoming reemployed.

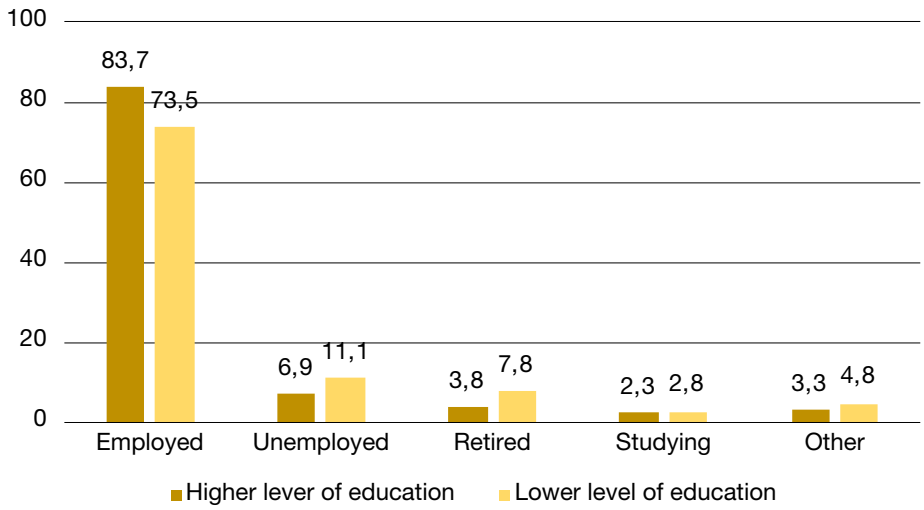

Figure 2. *Labor market status of former Nokia employees with higher and lower education levels: the shares of employed, unemployed, retired, studying and other in 2017 (in percentage). Source: authors' calculations.*

Table 3 clarifies the labor market status of workers by education level in the following years after leaving Nokia. There are clear differences in reemployment of higher and lower educated workers. Employees with a higher level of education are reemployed better than those with a lower level of education. For comparison, 71 percent of the more-highly educated individuals found new jobs within one year after leaving Nokia, compared to 57 percent of less educated individu-

[10] *UNESCO Institute for Statistics, 2012. International standard classification of education: ISCED 2011. Int. Stand. Classif. Educ. (ISCED) 2011.*

als in the same year. Regarding the unemployed individuals, 26 percent of individuals with less education did not find new jobs one year after exit, while the share of unemployed individuals with a higher level of education was only 17 percent. The unemployment situation though improved over second and third years. The shares of unemployed individuals decreased to 11 and 7 percent for individuals with lower and higher levels of education, respectively (see Figure 2). Table 3 further reveals that a larger share of former Nokia employees with a lower level of education decided to pursue their studies after leaving Nokia than did those with a higher level of education. This difference is especially evident immediately after exit, as the rate for studying is twice as high for those with a lower level of education than for those with a higher level. Finally, there are also some differences in employees' decisions to retire. A larger share of people with a lower degree retired than of those with a higher degree.

Table 3. *Labor market status of former Nokia employees with higher and lower education levels: the shares of employed, unemployed, retired, studying and other after one, two and three years since leaving Nokia (in percentage).*

	***t*+1**	***t*+2**	***t*+3**
Higher level of education			
Employed	70.9	75.8	75.9
Unemployed	17.3	13.7	12.7
Retired	1.3	1.4	1.6
Studying	5.2	4.4	4.4
Other	5.3	4.7	5.4
Lower level of education			
Employed	56.6	62.9	63.9
Unemployed	25.6	20.7	19.3
Retired	2.7	3.0	3.8
Studying	10.4	8.5	6.8
Other	4.8	4.9	6.2

Note: The sample sizes for the subsamples of employees with higher and lower education levels are 7,766 and 13,564, respectively, in each year.

Comparing the unemployment rates for 2017 calculated based on the subsamples of highly and less educated employees with the corresponding unemployment rates in the economy[11] reveals further insights. The unemployment rates among highly and less educated former Nokia employees were 7.6 and 13.1 percent, respectively. However, the unemployment rates among higher education graduates and nongraduates during the same year in Finland were 5.4 and 12.4 percent, respectively. The higher unemployment rates among the group of former Nokia employees suggest that it was challenging for the labor market to absorb all of the individuals with both higher and lower education levels and match them to the needs of the labor market at that time.

We consider next the labor market status of former Nokia employees according to their former occupational status at Nokia. More specifically we consider the labor market status of employees classified into the following categories:

i. Former senior employees: the subsample includes 13,285 individuals who had worked in upper white-collar occupations.

ii. Former non-senior employees: the subsample includes 8,045 individuals who had worked in all other positions.

Figure 3 illustrates the labor market status of employees classified according to former occupational status at Nokia in 2017. More than 80 percent of former Nokia senior employees had found new employment by 2017 and only 8 percent

[11] *Figures for the whole economy have been calculated from population statistics (Statistics Finland).*

of them remained unemployed. The share of employed of former non-senior employees was considerably lower, about 71 percent, and the share on unemployed higher, as much as 12 percent. A difference is also observed between the shares of former senior and non-senior employees in the category of retired individuals.

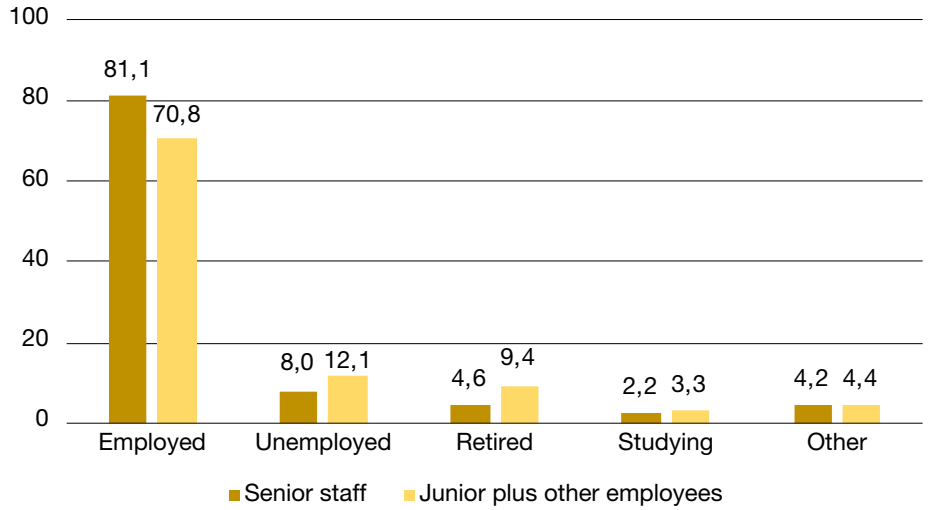

Figure 3. *Labor market status of former Nokia employees according to their former occupational status at Nokia: the shares of employed, unemployed, retired, studying and other in 2017 (in percentage). Source: authors' calculations.*

Table 4 further describes the labor market status of these two groups one, two and three years after leaving Nokia. Nearly 71 percent of senior employees were reemployed one year after leaving Nokia, and the situation for this group further improved in later years. In contrast, less than half of the junior/other employees had found new employment within one year after exit. Even though their situations improved over time, the difference in reemployment between these two groups persisted. Quite a large proportion of those individuals occupying non-senior positions at Nokia sought additional education, especially within one year after leaving Nokia. For instance, one year after exit, approximately 14 percent were studying, but in the latest year, the share had decreased to 3.3 percent, which may be explained by a short duration of training.

Table 4. *Labor market status of former Nokia employees according to their former occupational status at Nokia (%).*

	t+1	t+2	t+3
Senior staff			
Employed	70.7	73.2	72.9
Unemployed	17.7	15.2	14.2
Retired	1.5	1.8	2.0
Studying	5.1	4.9	4.7
Other	4.9	4.9	6.2
Junior plus other employees			
Employed	47.1	58.5	60.6
Unemployed	30.6	22.9	21.3
Retired	3.2	3.6	4.6
Studying	14.2	10.5	7.9
Other	4.9	4.5	5.5

Note: The sample sizes of the subsamples of senior and non-senior employees are 13,285 and 8,045, respectively, in each year. Senior staff includes those who worked in upper white-collar occupations at Nokia, and all others are classified into the non-senior staff category.

4.2 Where did former Nokia employees end up?

Having examined an overview of the differences in the labor market status of former Nokia employees, we next consider who their new employers were. According to the most recent data from 2017, more than four-fifths (86 percent) of the former Nokia employees who had left Nokia from 2009-2014 found new jobs in companies and less than one-fifth (14 percent) found jobs in the public sector or somewhere else. Next, we look in more detail at the companies that hired these former Nokia employees (Table 5).

Regarding the industry classification, the service sector was the largest employer in the private sector, accommodating two-thirds of former Nokia employees (Table 5). Just over 30 percent were reemployed in the ICT service sector, 21 percent in other service sectors and 15 percent in Other knowledge-intensive business services. Somewhat surprisingly, the share of manufacturing companies as employers was rather modest. Less than 10 percent of former workers recruited by companies were employed by companies in ICT manufacturing, and 19 percent were employed by companies in other manufacturing sectors. This may at least partly reflect the difficulties in the Finnish manufacturing industry during and after the global financial crisis. Further, the downfall of Nokia also affected many suppliers in ICT manufacturing. Only 4 percent of former Nokia employees found new employment in some other industries. In sum, only 40 percent of the former Nokia employees were reemployed in the ICT industry. Thus, as many as 60 percent found a new job in a non-ICT industry.

Table 5 further reveals that former Nokia employees found new jobs in companies of very different sizes. The largest majority were hired by large companies with personnel of more than 250 people. Medium-sized companies with staff between 50 and 249 people hired approximately one-third of the former Nokia employees. Another third of the employees were recruited by small or micro companies with staff of less than 50 people. In terms of the hiring company's age, almost two-thirds of former Nokia employees were employed in well-established companies that had operated for more than eleven years. Another one-third found new jobs in companies that had operated for 3 to 10 years. Only 5 percent of former Nokia employees who left from 2009-2014 were employed in start-up companies in 2017.

Table 5. *Share of former Nokia employees hired by companies classified by industry, size, and age.*

Companies' classification	Share
Industry:	
Services (total)	67.6
ICT services	31.2
Other knowledge-intensive business services	15.0
Other services	21.4
Manufacturing (total)	28.2
ICT manufacturing	9.6
Other manufacturing	18.6
Other industries (total)	4.2
Size:	
Large (over 500 people employed)	28.9
Large (250 to 499 people employed)	11.8
Medium (50 to 249 people employed)	26.7
Small (10-49 people employed)	17.1
Micro (fewer than 10 people employed)	15.5
Firm Age:	
11 years or more	62.9
6 to 10 years	16.9
3 to 5 years	15.2
Less than 2 years	4.9

Note: Share of all former Nokia employees hired by each type of company.

In conclusion, the majority of former Nokia employees found new employment immediately after leaving Nokia or a few years later. However, we discovered some differences when considering different groups of employees in terms of their education and former position at Nokia. Those with a higher level of education and a senior position were more successful in their reemployment. Most of those who found new jobs were recruited by well-established, large companies in the service sector. Overall, former Nokia employees ended up working in very different parts of the economy.

5. Factors predicting the probability of reemployment

This section focuses on the factors that predict the probability of finding a new job after leaving Nokia. The average marginal effects of the probit model and their standard errors are reported in Table 6. The reported results apply to all former Nokia employees who left Nokia from 2009-2014, including those individuals who retired, sought additional education, moved abroad, or left the labor market for some other reason. In our view, it is essential to account for these groups in the analysis because, for instance, the decision to retire may depend on that person's ability to find a meaningful new job. However, we have also estimated the model excluding the groups of employees who no longer participate in the labor market. The results of this alternative model specification are presented in the Appendix. We find the estimation results to be very robust across these two specifications.

Table 6 reveals that most of the marginal effects are highly statistically significant. It should be noted that we do not claim that there is necessarily a direct causal relationship between the factors under consideration and future employment, but we believe that these factors can be useful predictors of the probability of former Nokia employees' reemployment. When considering the impact of the explanatory variables on the probability of reemployment in terms of predictive causality, we begin with the controls for personal characteristics such as gender, age, and education. Gender appears to be an important predictor of the probability of reemployment. This relation is particularly strong in the first year after leaving Nokia but decreases in the second and third years after exit. The link between gender and employment is consistently statistically significant. It might be tempting to view this result as evidence of gender discrimination in the labor market, but the difference may equally well be due to average gender differences in background characteristics, such as different attitudes among males and females towards layoffs in general. In other words, gender does not necessarily affect employment itself, but on the basis of gender, one can still predict the likelihood of future reemployment.

Age seems to be another critical factor for predicting the probability of reemployment. Compared to that of the youngest group of individuals (from 16 to 29 years old), the predicted probability of employment starts to decrease among those older than 35 years. The group of individuals 60 years old or above has the lowest probability of reemployment. The differences among the age groups in terms of employment probability become even more pronounced two or three years after exit. We further find that education is a significantly positive predictor of reemployment. This result is consistent with our earlier observations from the descriptive analysis (see Table 3), in which we observed from the data that workers with more years of education were more likely to be reemployed than workers with a lower level of education. Based on the results of probit analysis, one additional year of education is associated with a higher probability of reemployment of 0.7 and 1.4 percentage points one year and in the third year after exit, respectively.

We consider next the associations of former occupational status at Nokia and job tenure with the probability of reemployment. One's former position at Nokia exhibits a significantly positive relationship with the probability of future employment. The results suggest that senior staff members were more likely to find new employment than other former Nokia employees: the average difference in the estimated probability of employment one year after exit was 22 percentage points in favor of the senior staff members compared to other former Nokia employees. Even though this difference in the probability of employment decreases over time, it remains positive and statistically significant. Junior staff positions also appear to be positively related to finding a new job compared to other employees: we find a 17 percentage points difference one year after exit, which decreases to 3.5 in the third year after exit. This association is positive throughout the first three years after exit but almost disappears when considering the results for year 2017.

Regarding other background factors, it is interesting to note that there is a statistically significant negative relation between the years of employment at Nokia (i.e., job tenure) and the probability of reemployment one year after leaving Nokia (up to 5.5 percentage points). However, this relationship becomes positive in the later years after exit. This result may appear somewhat puzzling at first glance. Although the marginal effect is not very large, we believe the changing sign on the job tenure variable may have a natural explanation. First, some laid-off workers, especially experienced workers, received so-called departure packages that served as severance pay. Second, experienced workers were more likely to be covered by earnings-related unemployment coverage than workers who had shorter careers at Nokia. Third, involuntary displacement was likely a psychologically devastating experience, especially for employees with a long career at Nokia, which likely had a negative effect on their ability to search for a new job. Altogether, these three reasons may have negatively affected the motivation of the most experienced former Nokia employees to search for reemployment opportunities immediately after leaving Nokia. However, the latest available data suggest a significantly positive effect of employment at Nokia on the probability of reemployment. For instance, the probability of employment was higher for individuals with 12-15 years of job tenure (5.5 percentage points) than for those with less than three years of experience working at Nokia.

Considering the differences across Nokia's units, we find that former employees of the Networks unit were less likely to find reemployment than employees of other units, especially during the first year after exit. In later years, however, the differences between different units seem to have disappeared. We also find significant regional differences in reemployment probabilities. One year after leaving Nokia, the probability of reemployment was the highest in the Uusimaa region and lower in all other regions. This is not surprising since Uusimaa, including the capital city Helsinki, is the most densely populated area with the largest job market in Finland. Over the years, however, the regional differences decreased and even disappeared for the Northern Ostrobothnia region. When considering the differences across the exit years, we find that if an employee left Nokia in any year other than 2009, that employee had a significantly higher probability of reemployment. Note that in year 2009, which is the reference exit year in our estimation, the general unemployment rate had increased as a result of the financial crisis. After 2009, reemployment opportunities for former Nokia employees improved significantly.

Table 6. *Probit results. The coefficients reported are average marginal effects. Robust standard errors are in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.*

	t+1		t+2		t+3		Latest data	
Male	0.081***	(-0.007)	0.039***	(-0.007)	0.028***	(-0.007)	0.022***	(-0.006)
Age (16 to 29 years, ref.):								
30 to 34 years	0.004	(-0.012)	0.000	(-0.012)	-0.032***	(-0.012)	-0.022**	(-0.009)
35 to 39 years	-0.031**	(-0.013)	-0.031**	(-0.013)	-0.048***	(-0.012)	-0.035***	(-0.009)
40 to 44 years	-0.063***	(-0.014)	-0.084***	(-0.014)	-0.089***	(-0.013)	-0.089***	(-0.011)
45 to 49 years	-0.084***	(-0.015)	-0.129***	(-0.015)	-0.153***	(-0.015)	-0.127***	(-0.012)
50 to 54 years	-0.138***	(-0.017)	-0.231***	(-0.018)	-0.258***	(-0.018)	-0.282***	(-0.016)
55 to 59 years	-0.261***	(-0.019)	-0.428***	(-0.020)	-0.490***	(-0.019)	-0.687***	(-0.016)
60 years or more	-0.457***	(-0.023)	-0.632***	(-0.020)	-0.703***	(-0.017)	-0.861***	(-0.011)
Education	0.007***	(-0.001)	0.012***	(-0.001)	0.014***	(-0.001)	0.012***	(-0.001)
Occupational status at Nokia (other workers, ref.):								
Senior staff	0.220***	(-0.013)	0.128***	(-0.013)	0.090***	(-0.013)	0.042***	(-0.010)
Junior staff	0.173***	(-0.013)	0.089***	(-0.013)	0.035***	(-0.012)	0.005	(-0.010)
Job tenure at Nokia (less than 3 years, ref.)								
4 to 7 years	-0.031***	(-0.011)	-0.019	(-0.012)	0.014	(-0.012)	0.024**	(-0.011)
8 to 11 years	-0.055***	(-0.012)	-0.028**	(-0.013)	0.016	(-0.013)	0.041***	(-0.012)
12 to 15 years	-0.055***	(-0.013)	-0.007	(-0.013)	0.024*	(-0.013)	0.055***	(-0.012)
16 years or more	-0.054***	(-0.014)	-0.023*	(-0.014)	0.015	(-0.014)	0.051***	(-0.012)
Nokia unit (other Nokia business units, ref.):								
Networks	-0.056***	(-0.009)	-0.029***	(-0.009)	0.000	(-0.009)	-0.015**	(-0.008)
Geographical location of Nokia unit (Uusimaa, ref.):								
Southwest Finland	-0.046***	(-0.009)	-0.075***	(-0.010)	-0.067***	(-0.009)	-0.030***	(-0.008)
Pirkanmaa	0.006	(-0.009)	-0.024***	(-0.009)	-0.070***	(-0.009)	-0.013*	(-0.008)
Central Finland	-0.067***	(-0.026)	-0.017	(-0.026)	0.015	(-0.026)	0.080***	(-0.017)
Northern Ostrobothnia	-0.104***	(-0.009)	-0.046***	(-0.009)	-0.024***	(-0.009)	0.010	(-0.008)
Exit year (2009, ref.):								
2010	0.188***	(-0.013)	0.100***	(-0.012)	0.043***	(-0.012)	0.024**	(-0.010)
2011	0.301***	(-0.012)	0.070***	(-0.012)	0.004	(-0.012)	0.047***	(-0.010)
2012	0.069***	(-0.011)	0.038***	(-0.011)	0.037***	(-0.010)	0.067***	(-0.009)
2013	0.197***	(-0.013)	0.067***	(-0.012)	0.037***	(-0.012)	0.053***	(-0.011)
2014	0.396***	(-0.011)	0.093***	(-0.012)	0.009	(-0.012)	0.061***	(-0.010)
Wald test	4178.792***		2488.319***		2153.306***		2806.762***	
Pr(reemployment)	0.618		0.676		0.683		0.772	
Log pseudolikelihood	-11555.170		-11933.603		-11944.053		-9255.985	
R2(pseudo)	0.185		0.112		0.104		0.191	

6. Conclusions

This study explores the subsequent career paths of former Nokia employees and identifies the key factors associated with their probability of reemployment. In order to be able to perform this study, we obtained the permission from Nokia that allows us to identify its units in the register-based data of Statistics Finland. Using a unique matched employee-employer dataset, we examine the labor market status of more than twenty thousand former employees of Nokia who left the company from 2009 to 2014. We assess their market status immediately after leaving Nokia and a few years later. To our best knowledge, this is the first study that explores the post-Nokia career of its former employees after leaving the company.

Our results for the most recent year 2017 reported in our data show that the majority of former Nokia employees found new employment after Nokia. By 2017, about 77 percent of individuals have found new jobs, 10 percent remained unemployed, and the rest retired or returned to study. The unemployment rate of former Nokia employees calculated for 2017 was about 11 percent, which is very close to the unemployment rate during the same year in Finland (11.3 percent). Majority of former Nokia workers were recruited by companies. More than half of these individuals were reemployed by companies in the service sector, and the rest of them by companies in the ICT industry.

Results about the labor market status of former Nokia employees the following years after leaving Nokia show that the reemployment process was not very fast and took time. For instance, three years after leaving Nokia 17 percent of workers remained unemployed. Taking into account education level, the shares of unemployed constituted to 13 and 19 percent in the groups of workers with higher and lower level of education, respectively. The shares of unemployed in the groups of workers occupying senior and non-senior positions in Nokia were 14 and 21 percent, respectively. While there are differences found in the reemployment between different groups, the shares of unemployed individuals three years after leaving Nokia remained considerably high.

Regarding the factors explaining the probability of reemployment of former Nokia employees, we find that one's level of education and former position at Nokia are significant predictors of reemployment probabilities. The results reveal that senior staff members were more likely to find new employment than other former Nokia employees. Further, men were more likely to find reemployment than women. Employee age was a critical factor that negatively correlated with the probability of employment. In this respect our findings are in line with the results of previous studies showing that age, gender, education level and previous occupational status are important predictors of reemployment. Regarding the background characteristics relevant to the Nokia case specifically, the employee's former Nokia unit and his or her geographical location also had varying relationship on reemployment probabilities. Compared to that in the Uusimaa region, the probability of employment in other regions was consistently lower, especially in Southwest Finland. Nokia tenure was positively associated with the reemployment only in latest year reported in our data. The probability of employment was higher for individuals with 12-15 years of job tenure than for those with less than three years of experience working at Nokia.

Our analysis adds to the handful of existing studies that examine reemployment of a displaced workforce from a single employer. The contribution of this paper is threefold. Firstly, in contrast to previous works which mainly rely on survey data, our study builds on a unique business register employer-employee data of Statistics Finland that include the entire Finnish working population. The value of this contribution is that it allows us to compare the results obtained with data from records of a statistical agency to the results obtained from surveys and interviews. Secondly, to our knowledge, this is the first study that have empirically examined the reemployment of former employees of a high-tech firm, such as Nokia. Thirdly, the present study contributes to the research on the downfall of Nokia and is the first to analyze the reemployment of former Nokia employees and their post-Nokia careers.

Finally, the main limitation of the present study is the non-causal analysis of factors affecting the reemployment of former Nokia employees. In our follow-up study (Hasanov et al. 2021), we attempt to estimate the causal effects of hiring former Nokia workers and identify the causal impact of knowledge spillovers via labor mobility. Regarding avenues for future research, it would be interesting to investigate the effects of Nokia's downfall on the Finnish startup scene and the extent to which the ICT sector in Finland was shaped by Nokia's influence. Another possible line of research worthy of exploration is the economic impacts of a shock to a larger firm in a small economy by using the case of Nokia's downfall and its aggregate

implications for the Finnish economy. Future research may also look at the Nokia case from a policy-making perspective identifying its implications on the survival of the whole ICT sector.

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Appendix

Appendix. *Probit results for employed and unemployed only.*

	t+1		t+2		t+3		Latest data	
Education	0.003**	(-0.001)	0.005***	(-0.001)	0.006***	(-0.001)	0.004***	(-0.001)
Male	0.037***	(-0.007)	0.011*	(-0.006)	0.006	(-0.006)	0.007	(-0.005)
Age (16 to 29 years, ref.):								
30 to 34 years	-0.007	(-0.011)	-0.013	(-0.009)	-0.025***	(-0.009)	-0.014**	(-0.006)
35 to 39 years	-0.061***	(-0.012)	-0.060***	(-0.010)	-0.063***	(-0.009)	-0.032***	(-0.007)
40 to 44 years	-0.106***	(-0.013)	-0.111***	(-0.011)	-0.105***	(-0.010)	-0.076***	(-0.008)
45 to 49 years	-0.139***	(-0.014)	-0.153***	(-0.013)	-0.171***	(-0.013)	-0.112***	(-0.010)
50 to 54 years	-0.191***	(-0.017)	-0.263***	(-0.016)	-0.281***	(-0.016)	-0.241***	(-0.015)
55 to 59 years	-0.341***	(-0.019)	-0.505***	(-0.020)	-0.562***	(-0.019)	-0.458***	(-0.028)
60 years or more	-0.327***	(-0.034)	-0.453***	(-0.041)	-0.258***	(-0.060)	-0.047	(-0.093)
Occupational status at Nokia (other workers, ref.):								
Junior officer	0.159***	(-0.014)	0.078***	(-0.013)	0.044***	(-0.012)	0.022**	(-0.010)
Senior officer	0.217***	(-0.014)	0.127***	(-0.013)	0.108***	(-0.012)	0.066***	(-0.010)
Job tenure at Nokia (Less than 3 years, ref.):								
4 to 7 years	-0.032***	(-0.011)	-0.036***	(-0.011)	-0.011	(-0.011)	0.008	(-0.010)
8 to 11 years	-0.045***	(-0.012)	-0.048***	(-0.012)	-0.014	(-0.012)	0.017	(-0.011)
12 to 15 years	-0.058***	(-0.012)	-0.044***	(-0.012)	-0.017	(-0.012)	0.023**	(-0.011)
16 years or more	-0.057***	(-0.013)	-0.055***	(-0.013)	-0.025*	(-0.013)	0.021*	(-0.011)
Nokia unit (other Nokia business units, ref.):								
Networks	-0.033***	(-0.008)	-0.018**	(-0.008)	-0.008	(-0.008)	-0.009	(-0.007)
Geographical location of Nokia unit (Uusimaa, ref.):								
Southwest Finland	-0.055***	(-0.009)	-0.102***	(-0.009)	-0.095***	(-0.009)	-0.042***	(-0.007)
Pirkanmaa	-0.009	(-0.009)	-0.032***	(-0.008)	-0.078***	(-0.008)	-0.017***	(-0.007)
Central Finland	-0.088***	(-0.025)	-0.060**	(-0.025)	-0.042*	(-0.024)	0.015	(-0.017)
Northern Ostrobothnia	-0.103***	(-0.010)	-0.055***	(-0.009)	-0.029***	(-0.008)	-0.010	(-0.007)
Exit year (2009, ref.):								
2010	0.202***	(-0.013)	0.090***	(-0.011)	0.032***	(-0.010)	0.029***	(-0.009)
2011	0.312***	(-0.013)	0.033***	(-0.012)	-0.020*	(-0.011)	0.028***	(-0.009)
2012	0.059***	(-0.013)	0.003	(-0.010)	-0.005	(-0.010)	0.033***	(-0.008)
2013	0.189***	(-0.014)	0.033***	(-0.012)	0.003	(-0.011)	0.015	(-0.010)
2014	0.338***	(-0.012)	0.050***	(-0.011)	-0.003	(-0.011)	0.018**	(-0.009)
Wald test	3352.454***		2359.719***		2107.049***		1189.473***	
Pr(reemployment)	0.732		0.788		0.802		0.890	
Log pseudolikelihood	-8379.096		-8159.651		-7878.595		-5800.348	
Number of observations	17999		18290		18165		18512	

*The coefficients reported are average marginal effects. Robust standard errors are in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.*