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The Effects of an Education-Leave Program on Educational Attainment and Labor-Market Outcomes

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Abstract

I study the effect of an education leave subsidy for the employed on labor-market outcomes and educational attainment using Finnish administrative linked employer-employee panel data and matching methods. The adult education allowance is available to employees with at least eight years of work experience and allows them to take a leave for 2–18 months to participate in an education program while being compensated for a substantial part of their forgone earnings. I find large positive treatment effects on educational attainment and changing occupation. The treatment effects on earnings and employment are negative during the lock-in period and close to zero afterward. Treatment effects on pseudo-outcomes are small and with one exception not statistically significant, which supports the credibility of the identification strategy. Sensitivity analyses show that unobserved variables should have a fairly large effect on treatment assignment to change the results.

Keywords: Adult Education, Education Leave, Linked Employer-Employee Data, Program Evaluation

JEL: I22, J24, H43, C21, M53

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Introduction

Lifelong learning and adult education are important policy objectives in many countries, at least since the early 2000s (OECD 2005, OECD 2013). The rationale is that adult education is thought to bring benefits to the individual undertaking the education and society at large. It is argued that individuals gain in terms of higher wages, better employment opportunities, and increased well-being, while the societal benefits come from social outcomes, such as improved civic participation.

The role of adult education is underscored by the structural changes taking place in the labor market. It has been widely documented that occupational structures are changing rapidly (Goos and Manning 2007, Acemoglu and Autor 2011, Autor and Price 2013, Goos et al. 2014) and that the skills needed in the labor market are changing, within and between occupations (Spitz-Oener 2006). These developments mean that many individuals need to update their skills over their lifetime.

One policy tool that encourages adults to upgrade their skills is called education leave programs[1]. In this program, employees have the right to take a prolonged study leave and are partly compensated for their lost earnings. Such programs exist in Austria, Finland, France, Norway, Spain, and Sweden, for example (Bassanini 2004). These programs compensate individuals for lost earnings, because they are an important determinant of the private rate of return on education, especially for adults (OECD 2003).

Despite the policy interest, little is known about the impact of programs aimed at increasing participation in adult education or training for employed workers. Most analyses of government-sponsored adult education focus on the unemployed or those under the threat of unemployment (McCall et al. 2016), and to my knowledge, education leave programs have not been evaluated rigorously even though they are quite common. McCall et al. (2016) recently suggested that more evidence is needed about the effectiveness of training programs for the employed and that more welfare-relevant outcomes, such as wages or hours of work, should be studied in addition to employment.

[1] These are also called training-leave programs in the literature. I use education leave because many employees use the leave to obtain a new educational degree.

To partly fill this gap in the literature, I analyze the impact of a Finnish policy instrument called the adult education allowance on educational attainment, employment, wages, and changing occupation using rich administrative data and matching methods. The adult education allowance is subject to eligibility criteria, of which the main criterion is the requirement of eight years of work history. The purpose of the adult education allowance is to support employees' voluntary vocational education, and the allowance is intended for full-time education programs at the secondary or tertiary level. The allowance period may vary from 2 to 18 months. Employees are able to utilize this allowance because they are allowed by law to take a study leave for two years and then be reinstated at their previous workplace at the previous terms of employment after the education leave. The amount of the allowance is earnings-related and is roughly similar in level to unemployment benefits. All education is free in Finland (except for material costs) so the allowance is intended to diminish the opportunity costs of education.

The adult education allowance is a major program. In 2011, the year that I study, the total amount of subsidies was about €70 million, since then the amount has increased to over €200 million. These are significant numbers compared to the training programmes for the unemployed, whose budget was about €250 million in 2011[2].

In the analysis I focus on 2011, because it is the first year after a major reform concerning the adult education allowance in late 2010.[3] The treatment group consists of the 6362 individuals who received the allowance in 2011 and for whom the relevant pre-program data are available from the Finnish Linked Employer-Employee Data (FLEED), which contains labor-market and earnings data on the whole working-age population from 1990 to 2014. The comparison group is formed from the population of Finnish employees in 2011, for whom the relevant pre-program data are available (1,709,355 observations). I use propensity score matching to estimate the treatment effect on the treated.

[2] http://budjetti.vm.fi/indox/sisalto.jsp?year=2011&lang=fi&maindoc=/2011/TAE/he/he.xml&opennode=0:1:359:663:1449:1497:1513:

[3] The reform increased the allowance by about 40%, and the regulation concerning the length of the allowance period was clarified.

Identification of the causal effect of the adult education allowance is based on the conditional independence assumption (CIA), which says that conditional on observed covariates, the treatment is as good as randomly assigned. In practice, this means that I need to observe a rich set of variables that affect both selection to treatment and the outcomes. I argue that the information content of the FLEED is rich enough to make the assumption plausible. Recently, Lechner and Wunsch (2013) studied what kind of control variables are needed to remove selection bias in studies of training programs for the unemployed. They identified a key set of covariates, which include pre-treatment outcomes, short-term labor market history, and a number of personal characteristics. The FLEED contains all the key covariates identified by Lechner and Wunsch (2013). Moreover, recently Caliendo et al. (2017) showed that typically unobserved variables, such as psychological attributes or social networks, do not affect the estimated treatment effects, when one uses rich administrative data, which allow one to control for pre-treatment outcomes and labor-market history.

The credibility of the estimated treatment effects also depends strongly on the quality of matching (Imbens and Rubin 2015). The FLEED contains a large number of potential comparison-group members compared to the number of treated individuals, which means that high-quality matches can be found. I assess the quality of matching following the advice in Imbens and Rubin (2015), finding that the matches are of high quality.

I study the effects of the adult education allowance up to 2015. I find that earnings dip as employees start an education program. In 2013, the earnings start to converge to the earnings of the comparison group and reach the average earnings of the comparison group by 2015. The results for employment are similar. The difference in employment rates between the treatment and comparison group is driven by some treated individuals continuing an education program until 2015. Concerning the other outcomes, I show that the treated attain more new educational degrees and that they change their occupations much more frequently than the comparison group. Given the long lock-in period, a longer evaluation period could show better economic outcomes for the treated.

I assess the plausibility of the conditional independence assumption following the methods in Imbens and Rubin (2015). The results of these tests largely support the plausibility of the CIA. In anddition, I analyze the sensitivity of the results to violations of the CIA following Rosenbaum (2002) method. This

method determines how strongly unobservable factors should be driving selection into treatment to change the inference concerning the results. I show that the results are robust to the unobserved factors that have a quite large impact on participation.

Finally, I conduct subsample analyses to study whether the treatment effects are heterogeneous. If the treatment effects vary substantially among different groups, it may be possible to improve the impact of the subsidy by targeting the groups that benefit the most. The results show that the treatment effects are heterogeneous and that employees in the private sector and lower educated employees use the subsidy to make bigger changes: they change their field of education and occupation more often than others.

This paper is related to three strands of literature. The first is the literature on government-sponsored training for the unemployed, which has been reviewed by Card et al. (2010), and McCall et al. (2016). Much of this literature uses nonexperimental data, and I follow the methods used in this strand of literature. This literature shows that the effects of training programs take years to materialize and depend a lot on the business cycle and program details.

The second strand is the much smaller literature on training subsidies for employed workers (Schwerdt et al. 2012, Hidalgo et al. 2014, Dauth and Toomet 2016, Gorlitz and Tamm 2016). Schwerdt et al. (2012) conducted a field experiment, in which Swiss employees received training vouchers ranging from 200 to 1500 Swiss francs. The authors did not find any effects on employment, educational attainment, or wages one year after the experiment. Hidalgo et al. (2014) conducted a randomized experiment in which low-skilled Dutch workers received training vouchers worth €1000. They find that the vouchers increase training participation but do not affect job mobility or wages. Gorlitz and Tamm (2016) investigated a German training voucher program and compared participants to employees who received the voucher and intended to attend training but did not do so for random reasons. The voucher covered 50% of training costs up to a maximum subsidy of €500. They found that the vouchers did not affect employment or wages but had an impact on the job tasks of the voucher recipients. Dauth and Toomet (2016) analyzed a German training subsidy program for older workers. The training can take a variety of forms and lasts 115 days, on average. They found that the program has a positive impact on employment. The adult education allowance that I study differs

from these studies in the nature of the education and the sums of money involved: The subsidy period lasts 2–18 months (the actual education may take even longer), and the education subsidy is, on average, more than €1300 per month. Thus compared to the previous studies this program offers longer periods of education and considerably higher levels of compensation. The wide availability of the education leave program means that the potential costs of the program are very large. In 2011, the program costs totaled €70 million, and since then, the costs have risen.

The third strand is the literature on the impact of adult education on labor-market outcomes (e.g. Stenberg 2011, Blanden et al. 2012, Hällsten 2012). Blanden et al. (2012) used panel data techniques and find that in the United Kingdom (UK), women gain in terms of wages from attaining certified qualifications as adults, but men do not. Stenberg (2011) studied Swedish low-skilled employees and finds that adults who complete formal education experience wage gains. Hällsten (2012) showed that earning a tertiary degree in adulthood strongly increases the employment rate but has only small effects on employment earnings in Sweden. My focus differs from these studies as I consider not only those who complete a degree but also those who start a program or complete only part of the degree program. Thus, I focus on the impact of the adult education allowance and not on completing a degree.

Adult education allowance

The adult education allowance is granted by the Education Fund, which is administered jointly by the employers' organizations and trade unions. The Education Fund receives its financing from the Unemployment Insurance Fund, which, in turn, is financed by investment income and compulsory unemployment insurance contributions collected from employers and employees.

The allowance is an education leave program, which means that employees have the right to take a prolonged study leave and are compensated partly for the forgone earnings. Employees are entitled to a study leave for a maximum of two years if their employment relationship has lasted for at least one year.[4] The purpose of the adult education allowance is to support employees' voluntary vocational education. The allowance period may vary from 2 to 18 months, and an individual may

[4] The employer may postpone the study leave by six months if it would lead to considerable harm for the employer. Employers who employ more than five employees may postpone the study leave at most twice.

receive the allowance only once. The allowance is intended for full-time studies at the secondary or tertiary level.

All employees who fulfill the following criteria are eligible for the adult education allowance. The applicant must

- Have at least eight years of work experience
- Have an ongoing employment relationship or pension-insured entrepreneurship that has lasted for at least one year
- Be on unpaid education leave for at least two months
- Be enrolled at an educational institution
- Not receive other public funding for the education program.[5]

Eligible education programs include programs that lead to a degree and vocational training programs that are organized by a Finnish educational institution under government supervision. The education programs do not need to relate to the work carried out at the current employer. In practice, the studies take a variety of forms. Some employees finish their degrees, and some start completely new degrees, which means that the actual education program may be as short as several months or as long as four to five years.

The adult education allowance is designed to partly reimburse wages lost while the employee attends the education program. This opportunity cost is the main cost component, as all publicly provided education in Finland is free. Students pay only for study materials and some other minor fees. The allowance consists of a fixed monthly allowance and an earnings-related component. In 2011, the monthly allowance was €553.41 per month, and the earnings-related component was 45% of the difference between an employee's monthly earnings and the monthly allowance. If the monthly wage exceeded €2702.70, the earnings-related component was 20% of the amount exceeding this threshold. Finally, the allowance was capped at 90% of the employee's monthly earnings.[6] The

[5] Other possible sources of funding are study grants from the Social Insurance Institution KELA (means tested, approximately €80–250 per month, for a fixed period) or grants from private foundations.

[6] Formally, the allowance is determined by $Max\left\{0.9*E, I\left(E \le 2707\right)*0.45*\left(E-M\right)+I\left(E>2707\right)*\left(0.45*\left(2707-M\right)+0.2*\left(E-2707\right)\right)\right\}$, where E is earnings, M is the fixed monthly allowance, and $I\left(\cdot\right)$ is an indicator function.

average allowance was €1304 per month, and the maximum allowance was €4138 per month in 2011 (Koulutusrahasto 2011).

These institutional features mean that the employee is the main decision maker concerning the adult education allowance. The employer cannot deny the employee an education leave, does not bear any direct costs of the education , and cannot alter the employment contract in any way due to the employee's decision to attend an education program.

Data

I use Statistics Finland's FLEED, which contains the whole working-age population between ages 15 and 70.[7] The FLEED is based on administrative register data and thus is detailed and reliable. To these data, I match the Education Fund's client register. This data set is used to identify the persons who receive the adult education allowance. The FLEED contains the outcomes (annual earnings, employment, occupation, and educational attainment) and the variables needed for credible matching (personal characteristics, labor market, and education histories). These data are rich, and I can follow persons over time from 1988 to 2014. I use the data from 2005 onward due to changes in the content of some variables.

The treatment group consists of the persons who first received the adult education allowance in 2011. The control group is formed from the working-age population. I drop from the control group persons who later apply for the adult education allowance. The original data from the Education Fund contain 6904 persons whose allowance period begins in 2011. I find pre-program data for 6362 of these individuals and outcomes for 6337-6362 depending on the outcome. The FLEED contains 1,709,355 employed persons with all necessary pre-program data in 2011 as potential controls. I observe the outcomes for 1,702,502-1,709,355 individuals, who form the potential control group.

The outcomes I consider are annual earnings, employment, educational attainment, and changing occupation. The annual earnings include earnings from employment and taxable social benefits, such as the adult education allowance. Employment status is measured at the last week of the year. Educational attainment is measured by the change in the level of education or the field of education.

[7] A description of the data is available at https://taika.stat.fi/fi/aineistokuvaus.html#!?dataid=YA244_19882014_jua_henkilot_000.xml

The level and field of education are measured with two-digit educational codes, which are based on theThe International Standard Classification of Education (ISCED). Change in occupation is defined as a change in the two-digit occupational code. The occupational classification follows the International Standard Classification of Occupations (ISCO).

Table 1 shows selected summary statistics comparing the pre-treatment variables of the potential control groups and the treatment group. On average, the treatment group is a bit younger and contains a much larger proportion of women. The annual earnings of the treatment group are, on average, lower and much less dispersed than in the group of potential controls. The educational attainment between the groups also differs: The treatment group has a higher level of education, and the group's field of education is more often Health and Welfare and less often Technology. A notable difference between the groups is that the treated are much more often employed in the public sector and less often in the private sector. Manufacturing workers are underrepresented among the treated, whereas professionals and service and sales workers are overrepresented among the treated.

Table 1 Selected Summary Statistics

	Potential Controls		Treatment Group	
	Mean	Std Dev	Mean	Std Dev
Age (10 years)	4.16	1.12	3.86	0.79
Female	0.52	0.50	0.79	0.41
Annual Earnings (1000€)	35.79	25.64	32.64	12.79
Level of Education				
Upper Secondary	0.52	0.50	0.42	0.49
Lowest Level Tertiary	0.17	0.37	0.16	0.37
Lower-Degree Level Tertiary	0.16	0.36	0.25	0.43
Higher-Degree Level Tertiary	0.14	0.35	0.16	0.37
Doctoral	0.01	0.12	0.01	0.11
Field of Education				
General	0.08	0.27	0.07	0.25
Educational Science	0.03	0.17	0.06	0.23
Humanities and Arts	0.05	0.22	0.08	0.26
Social Sciences and Business	0.20	0.40	0.21	0.41
Natural Sciences	0.03	0.16	0.02	0.15
Technology	0.29	0.46	0.10	0.30
Agriculture and Forestry	0.04	0.20	0.02	0.15
Health and Welfare	0.16	0.37	0.31	0.46

Services	0.12	0.32	0.13	0.33
Employer Type				
Private	0.55	0.50	0.40	0.49
State	0.10	0.30	0.10	0.30
Municipality	0.25	0.43	0.41	0.49
Foreign-owned	0.10	0.30	0.08	0.27
Occupation				
Managers	0.04	0.20	0.02	0.15
Professionals	0.22	0.41	0.27	0.44
Technicians and associate professionals	0.21	0.41	0.25	0.43
Clerical support workers	0.07	0.26	0.07	0.26
Service and sales workers	0.19	0.39	0.26	0.44
Skilled agricultural workers	0.03	0.16	0.01	0.08
Craft and related trades workers	0.10	0.30	0.03	0.17
Plant and machine operators	0.08	0.26	0.04	0.20
Elementary occupations	0.06	0.24	0.04	0.20

The number of observations is 1,727,795 for the potential controls and 6,423 for the treatment group.

Methods

Framework

I adopt the standard potential outcomes framework, where each individual i has potential outcomes $Y_i(1)$ and $Y_i(0)$ that correspond to outcomes with and without an adult education allowance. For each individual, only one of these potential outcomes is observed. For example, for persons who receive the adult education allowance, we do not observe their outcomes in the absence of the allowance. The receipt of an adult education allowance is denoted by $W_i = 1$, and the observed outcome is $Y_i^{obs} = W_i Y_i(1) + (1 - W_i) Y_i(0)$. The treatment effect for individual i is the difference between the potential outcomes, $\Delta = Y_i(1) - Y_i(0)$. The evaluation problem arises because one cannot observe the treatment effect owing to missing data: A potential outcome is missing for each individual. I assume that there are no general equilibrium effects, that is, that the treatment of an individual does not affect the outcomes of other individuals.[8] This assumption likely holds as the

[8] This is often called SUTVA (or stable unit treatment value assumption) in the statistical literature.

number of employees receiving the adult education allowance is small compared to the eligible population.

Identification

I am interested in estimating the average treatment effect on the treated $\tau_{ATT} = E\left(Y_i(1) - Y_i(0) \mid W = 1\right)$, which is unobservable, because one cannot observe $E\left(Y_i\left(0\right) \mid W = 1\right)$. Thus, to estimate τ_{ATT}, I need to estimate $E\left(Y_i\left(0\right) \mid W = 1\right)$. To do this, I impose the conditional independence assumption (CIA) $Y_i\left(0\right) \perp W_i \mid X_i$ and the common support assumption $\Pr\left(W_i = 1 \mid X_i = x\right) < 1 \ \forall x \in \mathrm{X}$.

Together, these assumptions mean that one can estimate what would have happened in the absence of treatment to the treated individuals by using the observations from the comparison group. In practice, this assumption requires that we observe all variables that affect both participation and the outcomes in the absence of participation. Thus, I assume that the variation in participation status conditional on X is driven by variables that are independent of $Y_i\left(0\right)$. Note that the individuals may self-select based on $Y_i\left(1\right)$, because we focus on τ_{ATT}. This does not pose a problem for the evaluation, because $Y_i\left(1\right)$ is observable for the treated. This model for receiving the treatment makes economic sense when there are variables Z that are independent of $Y_i\left(0\right)$ and which affect the participation decision.[9] These unobserved instrumental variables create the variation in the treatment status. In this case, one such variable is knowledge of the adult education allowance. A recent study by the Education Fund showed that only 13% of the potential users of the allowance are aware of it (Koulutusrahasto 2014). It is plausible that differences in awareness of the allowance affect participation status conditional on a rich set of matching variables.

The identification depends on the conditional mean independence assumption, and I argue below that the data I use make this assumption plausible. I also assess the assumption following the ideas of Imbens (2015) and Imbens and Rubin (2015) and perform a sensitivity analysis proposed by Rosenbaum (2002).

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[9] More formally, $\tau_{ATT} = E\left(Y_i\left(1\right) - Y_i\left(0\right) \mid W_i = 1\right) = E\left\{E\left(Y_i\left(1\right) \mid W_i = 1, X_i = x\right) - E\left(Y_i\left(0\right) \mid W_i = 1, X_i = x\right) \mid W_i = 1\right\}$
$= E\left\{E\left(Y_i^{obs} \mid W_i = 1, X_i = x\right) - E\left(Y_i^{obs} \mid W_i = 0, X_i = x\right) \mid W_i = 1\right\} \quad \left(\text{by CIA}\right)$.

Estimation

The average treatment effect for the treated, and especially the unobserved counterfactual term $E\left(Y_i\left(0\right)|W=1\right)$, can be estimated using various methods. I use propensity score matching because the data set is quite large, and other methods, such as covariate matching and inverse probability weighting estimators, require significantly more computing time.[10] Rosenbaum and Rubin (1983) show that instead of conditioning on X_i in the previous equations, one can condition on the estimated probability of treatment or the propensity score $\hat{P}\left(X_i=x\right)$.[11] The standard errors account for the estimation of the propensity score (Abadie and Imbens 2016).

I use a logit model to estimate the propensity score and perform single nearest-neighbor matching with replacement. The persons start to receive the adult education allowance in 2011, and I measure the earnings and employment outcomes in 2011–2015 and occupation and education outcomes in 2011–2014, as the latter variables are not yet available for 2015. I also study the cumulative outcomes from 2011 to 2014–2015.

In selecting the matching variables, I follow the recent literature on evaluating training programs. Recently, Lechner and Wunsch (2013) considered the variables that are needed in matching analyses of training programs to remove selection bias. Although they consider programs for the unemployed, their study provides useful guidelines for the factors that need to be controlled. They find that the key variables are basic individual characteristics, pre-treatment outcomes, and short-term labor-market history. Other studies have emphasized the role of recent labor-market history and the region of residence (Heckman et al. 1998, Mueser et al. 2007).

I measure all covariates in 2010 or earlier. The basic characteristics that I consider are gender, age, nationality, native language, marital status, number of children younger than 3, 7, and 18 years old, level of education, field of education, region of residence (20 categories), occupation (two-digit ISCO), household disposable income, and amount of debt.

[10] In Appendix D, Table D1, I show that the main results are similar when using inverse probability weighting or regression adjustment.

[11] $\tau_{ATT}=E\left\{E\left(Y_{1i}|W_i=1,\hat{P}\left(X_i=x\right)\right)-E\left(Y_{0i}|W_i=0,\hat{P}\left(X_i=x\right)\right)|W_i=1\right\}$

I use pre-treatment outcomes from the previous six years (all models include the other pre-treatment outcomes). This means that I match on history of educational attainment in all analyses. This is important because the history of educational attainment works as a proxy for tastes and motivation for education.

Short-term labor-market history is captured by employment status (employed, unemployed, and out-of-labor force), annual working days during the previous six years, changing employer in 2005–2010, and tenure in current employment. These variables act as a proxy for individual ability, motivation, and other such determinants of participation and outcomes.

I measure the employer characteristics by the number of employees, the two-digit industry code, and the employer's legal form (private, state, municipality, foreign-owned). The receipt of sickness allowanc during the previous six years captures health considerations. I take cube roots of all monetary variables to reduce the scale of the variables. Otherwise, the logits have difficulty in converging. I also include some quadratic terms and interactions to improve the balance of the covariates. The complete specification of the model for the propensity score is given in Appendix A.

Together, these variables should capture the determinants of applying for the adult education allowance, as well as the outcomes. However, matching balances only the observed variables. Therefore, it is always possible that unobserved variables, such as motivation, bias the results. Recently, Caliendo et al. (2017) studied the impact of usually unobserved factors, such as psychological attributes and social networks, on matching evaluations of active labor-market programs. They find that accounting for these attributes does not change the estimated treatment effects when using rich administrative data that contain labor-market history data.

Assessing the quality of matching

I assess the quality of matching by calculating the standardized differences of the covariates X.

$\Delta_{x,k} = \frac{\overline{x}_{k,t} - \overline{x}_{k,c}}{\sqrt{\sigma^2_{x_k,t} + \sigma^2_{x_k,c}/2}}$, where $\overline{x}_{k,j}$, $j = t, c$ denote the sample means of covariate k in treatment group *t* and control group *c* and $\sigma^2_{x_k,j}$, $j = t, c$ denotes the sample variance for the two groups. These standardized differences are more useful than t-tests in assessing the covariate balance, because in

large samples even small differences in the covariates would be statistically significant although the practical difference in the means is small.

Assessing the plausibility of the conditional independence assumption

The CIA cannot be directly tested, but its plausibility can be assessed. The idea is to estimate the treatment effect on a pseudo-outcome, that is, an outcome variable known to be unaffected by the treatment. Finding a treatment effect of zero increases the plausibility of the CIA, whereas finding a nonzero treatment effect decreases the plausibility of the assumption. Imbens (2015) and Imbens and Rubin (2015) argue that lagged outcomes can be used to assess the plausibility of the CIA in the following way. Suppose that X includes lagged outcomes $Y_{i,t-1}...Y_{i,t-p}$ and time-invariant characteristics Z_i. Under the CIA, $Y_i(0)$ is independent of the treatment given the history of dependent variables and the other variables in X. Then it is plausible that $Y_{i,t-1}$ is independent of the treatment conditional on $Y_{i,t-2}...Y_{i,t-p}$ and the other variables in X.[12] One can assess the plausibility of the CIA by testing whether $Y_{i,-1} \perp W_i \mid Y_{i,-2},...,Y_{i,-T}, Z_i$. I test this condition by estimating the treatment effect of the adult education allowance on outcomes in 2010, while conditioning on outcomes in 2009 and earlier.

Sensitivity analysis

The key identifying assumption is that there are no unobserved variables that affect selection to treatment and the outcomes. The sensitivity of the results to the failure of this assumption can be analyzed. Suppose that the probability of the treatment depends not only on X_i but also on some unobservable covariate U_i, $P_i = \Pr(W_i = 1 \mid X_i, U_i) = F(\beta X_i + \gamma U_i)$, where F is the logistic function. To assess how big γ should be to change the results, Rosenbaum (2002) suggests the following analysis. Consider any matched pair of individuals. Then the odds ratio of participation in the treatment is $\frac{P_i(1-P_j)}{P_j(1-P_i)} = \frac{\exp(\beta x_i + \gamma u_i)}{\exp(\beta x_j + \gamma u_j)} = \exp(\gamma(u_i - u_j))$, where the second equality follows from

[12] More formally, (Imbens 2015, p. 395) shows that to carry out this analysis, one needs, in addition to the CIA, to assume $Y_i(1), Y_i(0) \perp W_i \mid Y_{i,-1},...,Y_{i,-T}, Z_i$ and the following stationarity and exchangeability condition: $f_{Y_{i,s}(0)|Y_{i,s-1}(0),...,Y_{i,s-(T-1)}(0),Z_i,W_i}(y_s \mid y_{s\text{-}1}, \ldots, y_{s\text{-}(T\text{-}1)}, z, w)$ is independent of i and s.

the fact that matching balances the covariates. In Rosenbaum (2002) terminology, the study is free of hidden bias when $\gamma = 0$ or $u_i = u_j$. If there is hidden bias, then the probability of participation is different in each matched pair, and the difference in the probability is determined by γ.

Next we ask, how does γ affect the inference concerning the average treatment effect on the treated? To do this, we need to choose a test statistic for the treatment effect and for continuous outcomes. Wilcoxon's signed-rank test statistic can be used. It calculates the sum of the ranks of the pairs where the treated had higher outcomes than the controls. This test statistic is then compared to the expected sum of the ranks under the null hypothesis of no treatment effect. The distribution of this test statistic is unknown (because it depends on γ), but Rosenbaum (2002, Chapter 4) shows that the distribution can be bounded by two known distributions for different values of γ when $u_i - u_j \in [-1,1]$. Varying the value of γ changes the distribution of the test statistic under the null hypothesis and thus, the statistical significance of the result. This test statistic can be calculated for various values of $\Gamma = e^{\gamma}$. Therefore, how much hidden bias is needed to overturn the conclusion reached when assuming that the study is free of hidden bias can be analyzed. This analysis does not show whether hidden bias is present or not, nor does it suggest relevant magnitudes of hidden bias. However, this analysis shows how strong the selection bias must be to change the inference concerning the treatment effects.

Results

Quality of matching

Table B1 in Appendix B shows the results of the balancing tests, which reveal that the covariates balance very well. For example, the median standardized difference is 0.8%, and the largest standardized difference in the absolute value is 3.4%. The variance ratios are also quite close to 1 for most variables. The variance ratio is outside the 0.95–1.05 interval only for 14% of the variables. Thus, the means and the variances are very similar in the treatment and comparison groups, indicating a good balance of the covariates. Figure A1 shows that the distribution of the linearized propensity score is very similar for the treatment and comparison groups.

Plausibility of the CIA

To address the plausibility of the CIA, I estimate the treatment effects on pseudo-outcomes, using the lagged values of the dependent variables as the pseudo-outcomes. For change in the occupation and employment, I use two-year lags, whereas for other variables I use one-year lags. I use two-year lags for employment because all persons in the treatment group (and thus, in the comparison group) are employed in 2010. For changes in occupation, I use a two-year lag because a change in the occupational classification makes it impossible to calculate changes in occupation between 2009 and 2010. In Table 2, most of the treatment effects are statistically significant, which increases the plausibility of the conditional independence assumption. The only significant coefficient is found for annual earnings, which shows a difference of €940. Eventhough this is statistically significant, the magnitude is quite small. The standardized difference is only 4.6%, which can be considered to be small.

Table 2 Assessing the CIA: Average Treatment Effects for Pseudo-Outcomes

	(1) Earnings t-1	(2) Employment t-2	(3) Change in occupation t-2	(4) Change in the Level of Education t-1	(5) Change in the Field of Education t-1
ATT	-0.942***	-0.002	0.011	0.002	0.002
	(0.224)	(0.002)	(0.006)	(0.002)	(0.002)
N	1715717	1715717	1715717	1715717	1715717
N Comparison group	1709355	1709355	1709355	1709355	1709355
N treatment group	6362	6362	6362	6362	6362

Table reports average treatment effect on the treated and standard errors, * p<0.05, ** p<0.01, *** p<0.001.
Standard errors take into account the estimation of the propensity score.
The specification of the model for propensity score is given in Appendix A1
In each column, the model for the propensity score omit the lagged value of the dependent variable

Treatment effects

Figure 1 plots the estimated treatment effects on annual earnings from 2005 to 2015.[13] The groups are matched to be similar until 2010, and after that, the earnings of the subsidy recipients start to dip as they take a leave from their job. The earnings difference is largest in 2012, when it is about €5600.

[13] Tables of the treatment effects are provided in Appendix C.

After that, the earnings of the treatment group start to increase, and they reach the level of the comparison group in 2015, where the point estimate is about –€300 but is not statistically significant. The lock-in period can be defined to last until the end of 2013 as the last persons receive the subsidy starting from the end of 2011 and receive the subsidy until late 2013. In practice, some employees are enrolled in an education program after they have exhausted the subsidy.

The results are robust to alternative wage measures. Figures D2 through D4 in Appendix D show that the results concerning annual earnings are robust to using the cube root of the earnings (this serves a similar purpose as taking logs but allows for zeros), trimming 1% from each tail of the earnings distribution, or focusing on those who are employed in 2014–2015.

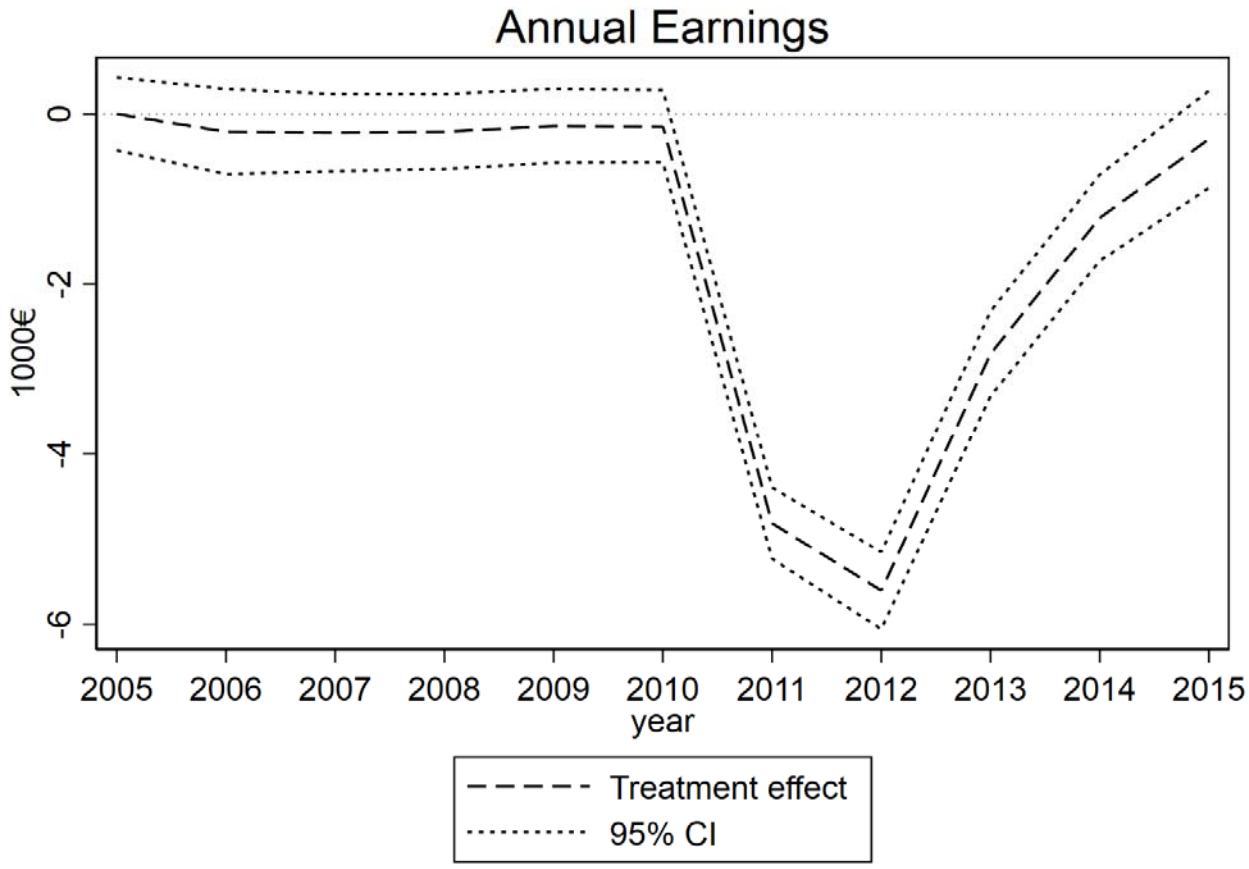

Figure 1 Estimated Treatment Effects on Annual Earnings

Figure 2 shows the results for employment. In 2010, everyone is employed due to the institutional features of the adult education allowance. In 2011, the treatment group is less likely than the comparison group to be employed, as the treatment group is enrolled in an education program, and in 2012, this difference is the largest. Then the employment rates of the two groups start to converge, but the treatment group's rate does not reach the comparison group during the observation period. In 2015, the treatment group is 1.7 percentage points less likely to be employed. In Appendix D, Figure D1 shows that this is due to some of the treatment group still enrolled in an education program in 2015. Thus, the adult education allowance is not used as a pathway to retirement or leaving the labor force.

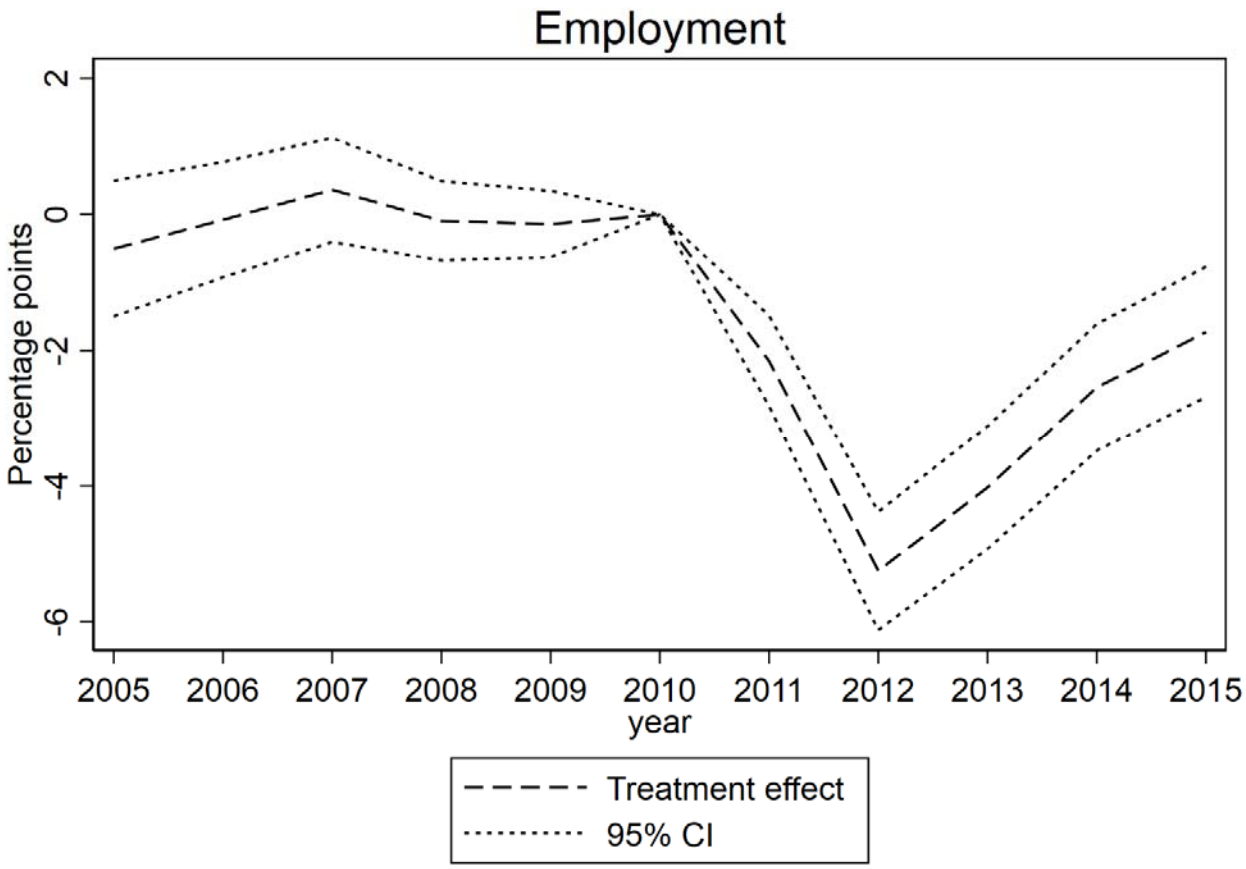

Figure 2 Estimated Treatment Effects on Employment

Although the adult education allowance has negative treatment effects on annual earnings and employment, the allowance has a positive effect on changing occupation. Figure 3 shows that the

treatment group switches occupations more often than the comparison group starting in 2012. The positive effect persists up to 2014, and the point estimates are about 7 to 9 percentage points each year. After 2013, the effect declines, which is natural as many of the treated have finished their degrees and have already changed occupations. These differences are quite large, given that, on average, about 14% of the employees in the sample change occupations during a given year. The year 2010 is extrapolated in the graph, because of a change in the occupational classification, which makes it difficult to accurately define changes in occupation.

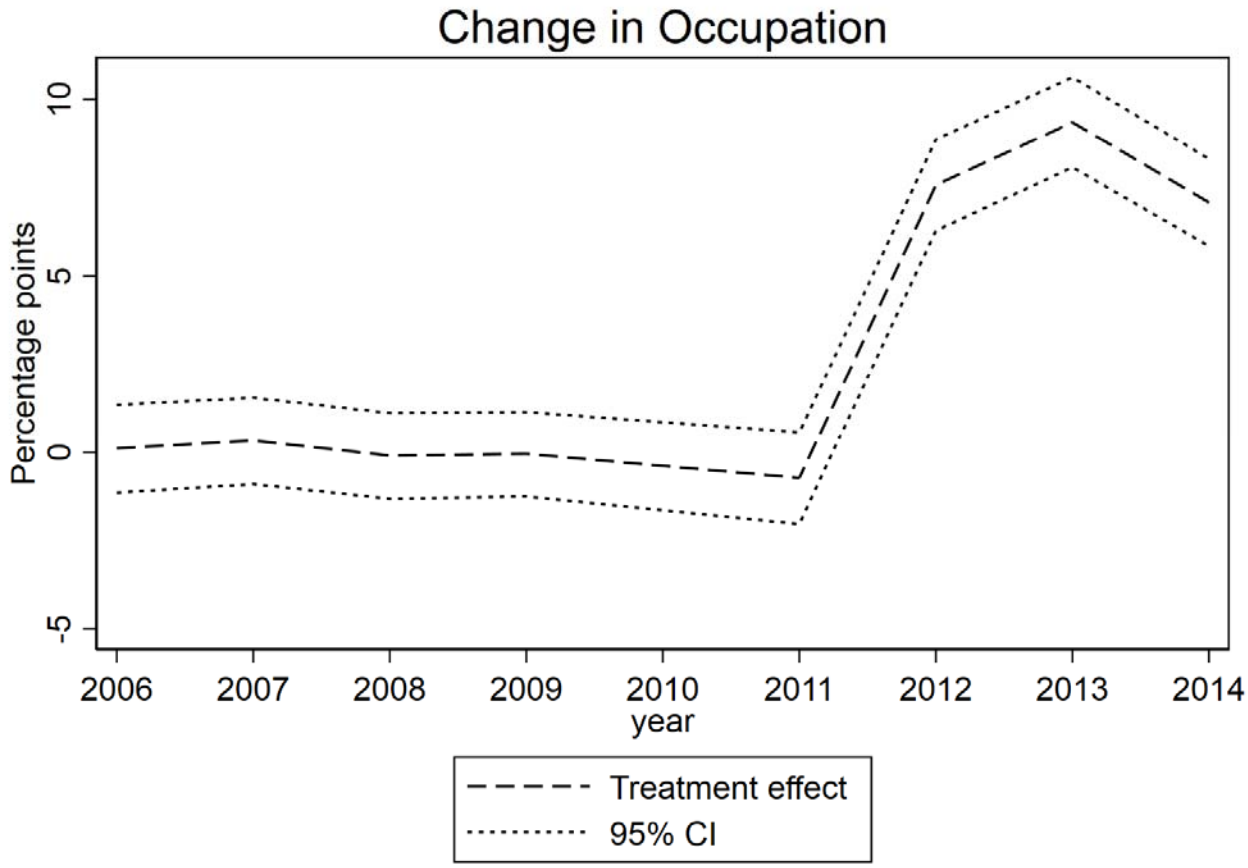

Figure 3 Estimated Treatment Effects on Changing Occupation

The last two sets of results concern educational attainment. Figure 4 shows the results for changes in the level of education. The figure reveals that the treatment group attains new degrees more often than the comparison group in 2011–2014, but the difference decreases after 2013. The estimated

treatment effects are sizable, as they range from 5% points to more than 10% points. In this sample, on average, about 1.3% of employees attain a new degree each year.

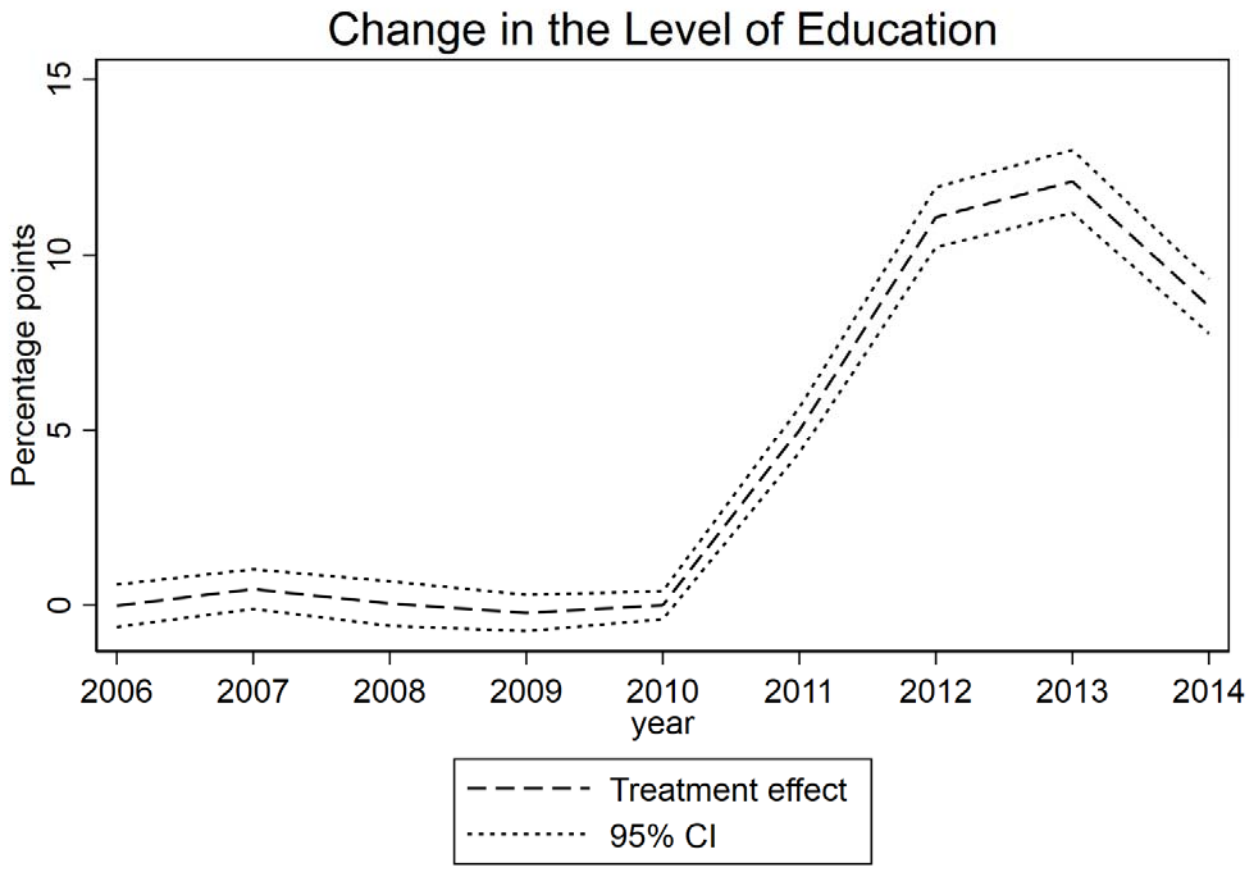

Figure 4 Estimated Treatment Effects on Changing the Level of Education

Figure 5 shows the results for changes in the field of education. The results are similar to the results for changes in the level of education; the only difference is that the treatment effects are somewhat smaller. The adult education allowance, thus, is used more often to attain a higher degree in the same field of education than to change fields of education.

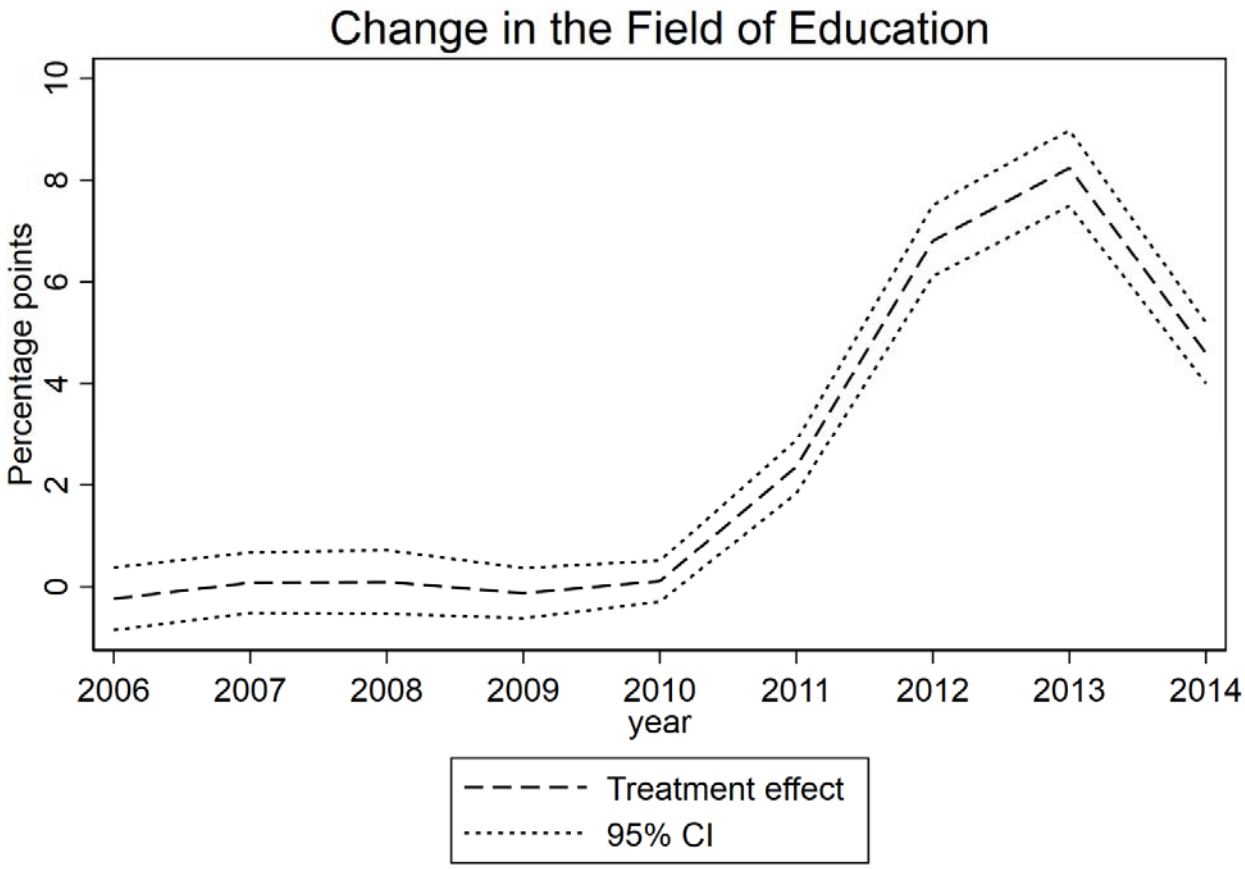

Figure 5 Estimated Treatment Effects on Changing the Field of Education

One way to summarize the results is to look at cumulative treatment effects, which are shown in Table 3. Here, I sum all the outcome variables from 2011 to 2014–2015. I use these cumulative results to assess the sensitivity of the results to violations of the CIA and to conduct subsample analyses.

Table 3 Cumulative Treatment Effects

	(1) Annual Earnings	(2) Employment	(3) Change in Occupation	(4) Change in the Level of Education	(5) Change in the Field of Education
ATT	-14.188***	-0.157***	0.626***	0.371***	0.216***
	(1.098)	(0.015)	(0.032)	(0.007)	(0.006)
N	1708839	1715717	1714592	1714592	1714592
N Comparison group	1702502	1709355	1708237	1708237	1708237
N treatment group	6337	6362	6355	6355	6355

The table reports the average treatment effects on the treated and standard errors, * p<0.05, ** p<0.01, *** p<0.001.
Standard errors take into account the estimation of the propensity score.
The specification of the model for the propensity score is given in Appendix A1.

Sensitivity analysis

To estimate the sensitivity of the results to violations of the CIA, I estimate Rosenbaum bounds for the cumulative outcomes. The results are given in Table 4. The table reports the significance level of the treatment effect corresponding to different values of $\Gamma = e^{\gamma}$. The larger Γ, the stronger the hidden bias, that is, the more the probability of participation deviates from 50% in each matched pair. Positive selection bias arises from treated individuals being more likely to experience positive outcomes (negative bias is defined analogously).

Table 4 shows that for cumulative annual earnings, employment, and changing occupation, Γ larger than 1.4, 1.6, and 1.95, respectively, render the treatment effect statistically insignificant. To put this result into perspective, these magnitudes are similar to changing employers in the previous year. The coefficient on employer change in t–1 in the propensity score logit is –0.32, which translates to an odds ratio of 1.38. This effect has to be considered quite large, because to be able to take study leave,

the employment relationship has had to continue for at least one year. This effect is also larger than the odds ratio of 1.37 between those with lower-degree level tertiary education (the educational group with the highest coefficient in the propensity score logit) compared to those with secondary education (the reference group).

The treatment effects on educational attainment are even more robust to violations of the CIA. In these estimations, to change the results, Γ should exceed 11 in the case of level of education and 7.0 in the case of field of education.

Table 4 Rosenbaum Bounds for the Cumulative Outcomes

Annual Earnings				
	Γ			
	1.3	1.35	1.4	1.45
Critical P-value	0.000	0.001	0.025	0.223
Employment				
	Γ			
	1.5	1.55	1.6	1.65
Critical P-value	0.001	0.007	0.039	0.143
Changing Occupation				
	Γ			
	1.85	1.9	1.95	2
Critical P-value	0.000	0.003	0.023	0.112
Changing the Level of Education				
	Γ			
	9	10	11	12
Critical P-value	0.000	0.001	0.041	0.28
Changing the Field of Education				
	Γ			
	5	6	7	8
Critical P-value	0.000	0.000	0.009	0.254

Note. Table reports critical p-values for different values of Γ for the cumulative outcomes. Critical p-values represent the bound on the statistical significance level of the estimated treatment effect. In the case of Annual Earnings, the critical p-values are for the case of negative self-selection and for the other variables for the case of positive self-selection.

Heterogeneity of the Treatment Effects

I report two types of subsample analyses to analyze the heterogeneity of the treatment effects.[14] The first subsample analysis is motivated by occupational restructuring and the resulting need for some employees to update their skills or change occupations. In this analysis, I compare those who are employed in the private sector and those who are employed in the public sector. The occupations more typically found in the public sector (e.g., healthcare and education) are less threatened by automation or globalization compared to the private sector (see e.g. Table 1 in Goos et al. 2014). Thus, it is likely that the training needs in these sectors may differ. Moreover, public sector employees are overrepresented among the recipients of the adult education allowance as 65% of the recipients work in the public sector whereas in the whole data set, public sector employees account for 49% of all employees.

[14] The model for the propensity score is slightly different from the full specification because finely grained categorical variables would lead to singleton dummy variables for some subsamples. In these analyses, I omit three occupational dummies due to low cell counts, the industry is a one-digit level, and employment status is employed or other instead of employed, unemployed, or out-of-labor force.

Table 5 Cumulative Treatment Effects by Sector

	(1) Annual Earnings	(2) Employment	(3) Change in Occupation	(4) Change in the Level of Education	(5) Change in the Field of Education	(6) Annual Earnings 2015
			Public Sector			
ATT	-9.834***	-0.030	0.376***	0.420***	0.176***	0.825*
	(1.386)	(0.016)	(0.035)	(0.010)	(0.008)	(0.356)
N	594915	596887	596590	596590	596590	595267
N comparison group	591653	593614	593319	593319	593319	592001
N treatment group	3262	3273	3271	3271	3271	3266
			Private Sector			
ATT	-18.972***	-0.266***	0.887***	0.310***	0.266***	-2.076***
	(1.672)	(0.025)	(0.052)	(0.010)	(0.010)	(0.443)
N	1113655	1118559	1117732	1117732	1117732	1114824
N Comparison group	1110580	1115470	1114648	1114648	1114648	1111744
N treatment group	3075	3089	3084	3084	3084	3080

The table reports the average treatment effect on the treated and standard errors, * p<0.05, ** p<0.01, *** p<0.001.
Standard errors take into account the estimation of the propensity score.
The specification of the model for the propensity score is given in Appendix A1

The results in Table 5 show that employees in the private sector experience large wage losses, change their field of education and occupation more often, and improve their level of education less often than employees in the public sector. Thus, it seems that the nature of the education is different: In the private sector, education is more often about redirecting one's career, and in the public sector, education is more often about advancing on the same career path. These results suggest that to adapt to occupational restructuring, the Education Fund could target private sector employees in publicity efforts.

The second subsample analysis is motivated by the findings of the prior literature that lower educated employees may benefit more from training (Schwerdt et al. 2012) and that often public programmes are aimed at lower educated employees (e.g. Stenberg 2011, Hidalgo et al. 2014). In Table 6, I split the sample to a subsample of employees with upper secondary education and employees with higher

levels of education. The results in Table 6 show that for the upper secondary education subsample the treatment effects on the changing field of education and occupation are larger than in the high-income group, while the effect on changing the level of education is similar. The treatment effects on annual earnings in 2015 a bit smaller for the higher education group. The cumulative annual earnings are more negative for the higher education group, which partly reflects their higher earnings before the subsidy period. The cumulative effects on employment are more negative for the upper secondary education subsample, which is due to their longer study periods.

Table 6 Cumulative Treatment Effects by the Level of Education

	(1) Annual Earnings	(2) Employment	(3) Change in Occupation	(4) Change in the Level of Education	(5) Change in the Field of Education	(6) Annual Earnings 2015
At Least Lowest Level Tertiary Education						
ATT	-17.435***	-0.148***	0.460***	0.368***	0.133***	-0.798*
	(1.521)	(0.018)	(0.040)	(0.009)	(0.006)	(0.377)
N	820027	823307	822660	822660	822660	820745
N Comparison group	816363	819628	818987	818987	818987	817073
N treatment group	3664	3679	3673	3673	3673	3672
Upper Secondary Education						
ATT	-9.985***	-0.174***	0.813***	0.374***	0.339***	-0.108
	(1.264)	(0.025)	(0.051)	(0.011)	(0.011)	(0.479)
N	888812	892410	891932	891932	891932	889616
N Comparison group	886139	889727	889250	889250	889250	886942
N treatment group	2673	2683	2682	2682	2682	2674

The table reports the average treatment effect on the treated and standard errors, * p<0.05, ** p<0.01, *** p<0.001.
Standard errors take into account the estimation of the propensity score.
The specification of the model for the propensity score is given in Appendix A1

Conclusion

In this paper, I evaluate an adult education allowance program using rich administrative panel data and matching methods. The adult education allowance is available for employees with at least eight years of work experience, allows employed persons to take a study leave for 2–18 months, and compensates a substantial portion of lost earnings. These features mean that the adult education

allowance is an education leave program, which are common in many European countries. I estimate average treatment effects on the treated persons on annual earnings, employment, changing occupations, and educational attainment. This evaluation contributes to the small literature on education or training subsidies for the employed.

I find that the program substantially improves the educational attainment of participants and that the participants change occupations more often than the comparison group. The earnings of the treated drop as they start their education program and reach the level of the comparison group four years after the subsidy period starts. The effect on employment is small and negative during the observation period. Treatment effect analyses of the pseudo-outcomes support the plausibility of the conditional independence assumption on which the identification depends. Sensitivity analysis shows that quite large departures from the conditional independence assumption would be needed to overturn the results.

The results show that the adult education allowance achieves its goal, which is to support employees' voluntary vocational studies. However, the economic impact of the allowance is negative during the time period studied. Previous studies have shown that education and training programs with long lock-in periods should have longer evaluation horizons. In the present study, the lock-in periods range from several months to several years. It may be that in the longer run, the economic impacts could be more positive.

The adult education allowance that I study differs from previous studies on adult education subsidies in the nature of the training and education and the sums of money involved: The education periods are longer and the subsidies much larger. Despite the longer education periods and substantial subsidies, the key results are similar: The subsidies improve education participation, have some impact on the type or work in which the employees engage, and have small or nonexistent effects on employment and earnings after the lock-in period.

Prior literature has argued that education and training subsidies for employed individuals should be targeted at distinct groups in order to have positive impacts on labor-market outcomes (Schwerdt et al. 2012). Similarly, Manski (2001) contends that subsample analyses are important in finding out how heterogeneous the treatment effects are. In Finland, the adult education allowance is untargeted, and

subsample analyses show that the treatment effects vary between employees in different sectors and according to the employees' level of education. Employees in the private sector and lower educated employees change their field of education and occupation more often than highly educated or employees in the public sector.

From the perspective of occupational restructuring, the allowance is somewhat misallocated: the occupational groups mostly utilizing the allowance are not threatened by automation or outsourcing. If manufacturing workers used the allowance more often, they might be better able to cope with occupational restructuring.

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Appendix A: Logit Model for the Propensity Score

Table A 1: Logit Model for the Propensity Score

	Coefficient	Standard error
Female	-1.107	-0.706
Age	2.755***	-0.171
Age # Age	-0.377***	-0.021
Nationality:Other	0.289	-0.232
Language: Swedish	-0.797***	-0.092
Other	-0.653***	-0.178
Marital Status: Married or cohabiting	0.032	-0.034
Divorced or separated	-0.015	-0.049
Widow	0.071	-0.171
Level of Education		
Lowest Level Tertiary	0.066	-0.049
Lower-Degree Level Tertiary	0.269***	-0.046
Higher-Degree Level Tertiary	-0.181**	-0.063
Doctoral or equivalent	-0.227	-0.139
Field of Education		
ducational Science	-0.691***	-0.092
Humanities and Arts	-0.375***	-0.08
Social Sciences and Business	-0.567***	-0.068
Natural Sciences	-0.535***	-0.106
Technology	-0.908***	-0.074
Agriculture and Forestry	-0.434***	-0.106
Health and Welfare	-0.560***	-0.073
Services	-0.492***	-0.068
Male # No. of children under 3 yrs old	-0.01	-0.085
Female # No. of children under 3 yrs old	-0.433***	-0.053
Male # No. of children under 7 yrs old	0.11	-0.066
Female # No. of children under 7 yrs old	0.186***	-0.034
Male # No. of children under 18 yrs old	-0.165***	-0.038
Female # No. of children under 18 yrs old	0.053**	-0.018
Region		
Varsinais-Suomi	-0.140**	-0.052
Satakunta	0.083	-0.069
Kanta-Häme	-0.046	-0.075
Pirkanmaa	-0.089	-0.05
Päijät-Häme	0.048	-0.071
Kymenlaakso	-0.082	-0.08
Etelä-Karjala	-0.106	-0.095
Etelä-Savo	0.223**	-0.077

Pohjois-Savo	0.082	-0.065
Pohjois-Karjala	0.273***	-0.074
Keski-Suomi	0.067	-0.062
Etelä-Pohjanmaa	-0.329***	-0.087
Pohjanmaa	-0.245*	-0.098
Keski-Pohjanmaa	0.068	-0.119
Pohjois-Pohjanmaa	0.214***	-0.05
Kainuu	-0.405**	-0.138
Lappi	0.076	-0.078
Occupation		
Clerical support workers	0.094	-0.135
Skilled agricultural, forestry and fishery workers	-0.18	-0.27
Chief executives, senior officials and legislators	0.495*	-0.219
Administrative and commercial managers	0.493**	-0.189
Production and specialised services managers	0.416*	-0.163
Hospitality, retail and other services managers	-0.092	-0.305
Science and engineering professionals	-0.042	-0.141
Health professionals	0.294	-0.158
Teaching professionals	0.715***	-0.132
Business and administration professionals	0.347**	-0.127
Legal, social and cultural professionals	0.593***	-0.13
Science and engineering associate professionals	0.084	-0.142
Health associate professionals	0.095	-0.132
Business and administration associate professionals	0.026	-0.121
Legal, social, cultural and related associate professionals	0.621***	-0.128
Information and communications technicians	-0.026	-0.163
Customer services clerks	0.222	-0.15
Numerical and material recording clerks	-0.354*	-0.176
Other clerical support workers	0.381*	-0.172
Personal service workers	-0.063	-0.144
Sales workers	0.285*	-0.14
Personal care workers	0.577***	-0.129
Protective services workers	0.576***	-0.165
Building and related trades workers, excluding electricians	0.108	-0.214
Metal, machinery and related trades workers	0.055	-0.182
Handicraft and printing workers	-0.047	-0.341
Electrical and electronic trades workers	0.469*	-0.207
Food processing, wood working, garment and other craft and related trades workers	-0.022	-0.241
Stationary plant and machine operators	0.369*	-0.161
Assemblers	0.555**	-0.203
Drivers and mobile plant operators	0.378*	-0.19
Cleaners and helpers	0.11	-0.153
Labourers in mining, construction, manufacturing and transport	0.233	-0.183

Food preparation assistants	0.022	-0.204
Occupation unknown	0.42	-0.216
Firm size	3.101***	-0.63
Firm size # Firm size	-5.195**	-1.826
Industry		
Crop and animal production, hunting and related service activities	0.161	-0.626
Manufacture of food products	0.09	-0.611
Manufacture of beverages	0.667	-0.687
Manufacture of leather and related products	0.634	-0.643
Manufacture of wood and of products of wood and cork	0.711	-0.61
Manufacture of paper and paper products	0.864	-0.61
Printing and reproduction of recorded media	0.958	-0.641
Manufacture of chemicals and chemical products	0.652	-0.617
Manufacture of basic pharmaceutical products and pharmaceutical preparations	0.587	-0.655
Manufacture of rubber and plastic products	0.459	-0.632
Manufacture of other non-metallic mineral products	0.31	-0.64
Manufacture of basic metals	0.337	-0.634
Manufacture of fabricated metal products except machinery and equipment	0.47	-0.608
Manufacture of computer, electronic and optical products	0.535	-0.598
Manufacture of electrical equipment	0.375	-0.624
Manufacture of machinery and equipment n.e.c.	0.478	-0.601
Manufacture of motor vehicles, trailers and semi-trailers	1.08	-0.647
Manufacture of other transport equipment	0.677	-0.667
Other manufacturing	0.586	-0.63
Repair and installation of machinery and equipment	0.723	-0.624
Waste collection, treatment and disposal activities; materials recovery	-0.028	-0.637
Construction of buildings	0.461	-0.614
Civil engineering	0.26	-0.649
Specialised construction activities	-0.028	-0.61
Wholesale and retail trade and repair of motor vehicles and motorcycles	0.111	-0.618
Wholesale trade, except of motor vehicles and motorcycles	0.273	-0.593
Retail trade, except of motor vehicles and motorcycles	0.532	-0.59
Land transport and transport via pipelines	0.396	-0.608
Water transport	1.2	-0.624
Air transport	1.356*	-0.612
Warehousing and support activities for transportation	0.785	-0.604
Postal and courier activities	0.847	-0.608
Accommodation	1.043	-0.603
Food and beverage service activities	0.789	-0.592
Publishing activities	0.526	-0.603
Programming and broadcasting activities	0.187	-0.625
Telecommunications	0.605	-0.612
Computer programming, consultancy and related activities	0.859	-0.597

Information service activities	1.004	-0.625
Financial service activities, except insurance and pension funding	0.686	-0.598
Insurance, reinsurance and pension funding, except compulsory social security	0.747	-0.608
Real estate activities	0.346	-0.621
Legal and accounting activities	0.424	-0.607
Activities of head offices; management consultancy activities	0.533	-0.616
Architectural and engineering activities; technical testing and analysis	0.806	-0.595
Scientific research and development	1.082	-0.603
Advertising and market research	0.372	-0.622
Other professional, scientific and technical activities	0.328	-0.622
Veterinary activities	0.683	-0.739
Employment activities	0.54	-0.599
Travel agency, tour operator and other reservation service and related activities	0.643	-0.643
Security and investigation activities	0.838	-0.618
Services to buildings and landscape activities	0.523	-0.597
Office administrative, office support and other business support activities	0.75	-0.61
Public administration and defence; compulsory social security	0.967	-0.588
Education	0.85	-0.587
Human health activities	1	-0.586
Residential care activities	1.071	-0.586
Social work activities without accommodation	0.864	-0.586
Creative, arts and entertainment activities	0.548	-0.616
Libraries, archives, museums and other cultural activities	0.752	-0.61
Gambling and betting activities	1.055	-0.678
Sports activities and amusement and recreation activities	0.318	-0.615
Activities of membership organisations	1.05	-0.59
Other personal service activities	0.062	-0.618
Employer Type: State	-0.053	-0.068
Municipality	-0.089	-0.056
Foreign-owned	0.021	-0.054
Male # Employed t-2	-0.439	-0.541
Male # Unemployed t-2	-0.029	-0.433
Female # Employed t-2	-0.505	-0.417
Female # Unemployed t-2	-0.593*	-0.27
Female # Other t-2	0.216	-0.28
Male # Employed t-3	-0.429	-0.335
Male # Unemployed t-3	-0.752	-0.393
Female # Employed t-3	-0.259	-0.219
Female # Unemployed t-3	-0.555*	-0.223
Female # Other t-3	0.312	-0.198
Male # Employed t-4	-0.422	-0.247
Male # Unemployed t-4	-0.971**	-0.354
Female # Employed t-4	-0.197	-0.161

Female # Unemployed t-4	-0.478**	-0.171
Female # Other t-4	-0.202	-0.157
Male # Employed t-5	0.480*	-0.212
Male # Unemployed t-5	-0.013	-0.283
Female # Employed t-5	0.383**	-0.129
Female # Unemployed t-5	0.05	-0.142
Female # Other t-5	0.102	-0.144
Male # Employed t-6	0.233	-0.187
Male # Unemployed t-6	0.159	-0.223
Female # Employed t-6	0.118	-0.113
Female # Unemployed t-6	-0.106	-0.122
Female # Other t-6	0.358**	-0.119
Male # Tenure	-0.096	-0.151
Female # Tenure	0.232*	-0.096
Male # Tenure # Tenure	-0.076	-0.069
Female # Tenure # Tenure	-0.164***	-0.042
Male # Working days t-1	0.590***	-0.157
Female # Working days t-1	1.010***	-0.1
Male # Working days t-2	0.343**	-0.118
Female # Working days t-2	0.129**	-0.046
Male # Working days t-3	0.09	-0.095
Female # Working days t-3	0.151***	-0.037
Male # Working days t-4	-0.025	-0.079
Female # Working days t-4	0.039	-0.032
Male # Working days t-5	-0.007	-0.066
Female # Working days t-5	0.044	-0.03
Male # Working days t-6	0.151**	-0.054
Female # Working days t-6	0.091***	-0.025
Cube Root of Annual Earnings t-1	15.695***	-3.153
Cube Root of Annual Earnings t-2	9.342**	-3.494
Cube Root of Annual Earnings t-3	6.395*	-3.242
Cube Root of Annual Earnings t-4	7.377**	-2.858
Cube Root of Annual Earnings t-5	-0.053	-1.584
Cube Root of Annual Earnings t-6	9.759***	-2.097
Cube Root of Annual Earnings t-1 # Cube Root of Annual Earnings t-1	-38.815***	-5.409
Cube Root of Annual Earnings t-2 # Cube Root of Annual Earnings t-2	-9.953	-5.942
Cube Root of Annual Earnings t-3 # Cube Root of Annual Earnings t-3	-9.51	-5.633
Cube Root of Annual Earnings t-4 # Cube Root of Annual Earnings t-4	-8.077	-4.961
Cube Root of Annual Earnings t-5 # Cube Root of Annual Earnings t-5	3.235	-2.62
Cube Root of Annual Earnings t-6 # Cube Root of Annual Earnings t-6	-14.651***	-3.859
Cube Root of Household's Disposable Income t-1	0.78	-0.413
Cube Root of Household's Disposable Income t-2	0.857	-0.503
Cube Root of Household's Disposable Income t-3	-0.147	-0.483

Cube Root of Household's Disposable Income t-4	0.462	-0.44
Cube Root of Household's Disposable Income t-5	-0.899*	-0.457
Cube Root of Household's Disposable Income t-6	-0.756*	-0.384
Cube Root of Debts	0.106	-0.079
Male # Years Since Latest Degree	-0.350*	-0.159
Female # Years Since Latest Degree	0.135	-0.087
Male # Years Since Latest Degree # Years Since Latest Degree	-0.069	-0.05
Female # Years Since Latest Degree # Years Since Latest Degree	-0.154***	-0.026
Change in Occupation t-2=1	0.116**	-0.04
Change in Occupation t-3=1	0.014	-0.041
Change in Occupation t-4=1	-0.003	-0.041
Change in Occupation t-5=1	0.035	-0.039
Change in Employer t-1=1	-0.320***	-0.046
Change in Employer t-1=2	-0.349	-0.394
Change in Employer t-2=1	-0.079	-0.041
Change in Employer t-2=2	-0.078	-0.184
Change in Employer t-3=1	-0.032	-0.043
Change in Employer t-3=2	-0.018	-0.136
Change in Employer t-4=1	0.031	-0.04
Change in Employer t-4=2	0.175	-0.102
Change in Employer t-5=1	0.056	-0.041
Change in Employer t-5=2	0.155	-0.084
Male # Change in the Field of Education t-1=1	-0.197	-0.26
Female # Change in the Field of Education t-1=1	-0.154	-0.151
Male # Change in the Field of Education t-2=1	-0.156	-0.258
Female # Change in the Field of Education t-2=1	0.277*	-0.124
Male # Change in the Field of Education t-3=1	0.061	-0.21
Female # Change in the Field of Education t-3=1	0.015	-0.114
Male # Change in the Field of Education t-4=1	0.02	-0.221
Female # Change in the Field of Education t-4=1	-0.009	-0.116
Male # Change in the Field of Education t-5=1	-0.480*	-0.226
Female # Change in the Field of Education t-5=1	-0.061	-0.112
Male # Change in the Level of Education t-1=1	0.054	-0.245
Female # Change in the Level of Education t-1=1	-0.061	-0.154
Male # Change in the Level of Education t-2=1	0.059	-0.237
Female # Change in the Level of Education t-2=1	-0.055	-0.132
Male # Change in the Level of Education t-3=1	0.209	-0.204
Female # Change in the Level of Education t-3=1	0.125	-0.115
Male # Change in the Level of Education t-4=1	0.131	-0.214
Female # Change in the Level of Education t-4=1	0.055	-0.115
Male # Change in the Level of Education t-5=1	0.275	-0.205
Female # Change in the Level of Education t-5=1	-0.081	-0.114
Received Sickness Allowance t-1=1	0.082	-0.064

Received Sickness Allowance t-2=1	0.117	-0.067
Received Sickness Allowance t-3=1	0.135	-0.069
Received Sickness Allowance t-4=1	0.033	-0.069
Received Sickness Allowance t-5=1	0.09	-0.07
Received Sickness Allowance t-6=1	0.134	-0.071
Observations	1715717	

Standard errors in parentheses

All variables are measured at t-1 unless otherwise noted

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Appendix B: Balancing tests

Table B 1: Standardized differences

	Standardized Differences		Variance Ratio	
	Raw	Matched	Raw	Matched
Female	0.60	0.00	0.66	1.00
Age	-0.31	0.03	0.50	1.00
Age # Age	-0.38	0.03	0.47	1.00
Nationality:Other	-0.02	-0.01	0.78	0.88
Language: Swedish	-0.16	0.00	0.43	1.01
Other	-0.05	-0.02	0.60	0.83
Marital Status: Married or cohabiting	0.06	0.02	0.99	1.00
Divorced or separated	-0.03	0.00	0.91	1.00
Widow	-0.04	0.01	0.64	1.20
Level of Education: Lowest Level Tertiary	-0.02	0.01	0.97	1.01
Lower-Degree Level Tertiary	0.23	0.00	1.42	1.00
Higher-Degree Level Tertiary	0.05	0.01	1.10	1.02
Doctoral or equivalent	-0.03	0.01	0.79	1.12
Field of Education: Educational Science	0.13	0.01	1.81	1.03
Humanities and Arts	0.11	0.01	1.51	1.05
Social Sciences and Business	0.01	-0.01	1.01	0.99
Natural Sciences	-0.01	0.03	0.91	1.19
Technology	-0.49	0.00	0.44	1.01
Agriculture and Forestry	-0.10	-0.01	0.58	0.92
Health and Welfare	0.37	-0.01	1.61	0.99
Services	0.03	0.01	1.07	1.02
Male # No. of children under 3 yrs old	-0.07	0.02	0.75	1.13
Female # No. of children under 3 yrs old	0.23	0.00	2.20	1.03
Male # No. of children under 7 yrs old	-0.10	0.02	0.75	1.09
Female # No. of children under 7 yrs old	0.36	0.00	2.22	1.04
Male # No. of children under 18 yrs old	-0.26	0.01	0.54	1.09
Female # No. of children under 18 yrs old	0.51	0.00	1.72	1.02
Region: Varsinais-Suomi	-0.03	0.00	0.91	0.99
Satakunta	0.01	0.01	1.03	1.03
Kanta-Häme	0.00	0.00	0.99	1.02
Pirkanmaa	-0.02	0.01	0.94	1.02
Päijät-Häme	0.01	0.02	1.07	1.10
Kymenlaakso	-0.02	-0.02	0.91	0.92

Etelä-Karjala	-0.03	-0.02	0.83	0.86
EteläSavo	0.03	0.00	1.18	1.02
Pohjois-Savo	0.01	-0.01	1.05	0.96
Pohjois-Karjala	0.03	0.01	1.19	1.04
Keski-Suomi	0.01	0.00	1.03	1.02
Etelä-Pohjanmaa	-0.07	-0.01	0.68	0.93
Pohjanmaa	-0.09	-0.01	0.58	0.94
Keski-Pohjanmaa	0.00	-0.02	0.97	0.86
Pohjois-Pohjanmaa	0.06	0.01	1.22	1.02
Kainuu	-0.05	0.00	0.63	1.04
Lappi	0.00	0.02	0.98	1.12
Occupation: Clerical support workers	-0.01	0.01	0.95	1.05
Skilled agricultural, forestry and fishery workers	-0.16	-0.02	0.26	0.81
Chief executives, senior officials and legislators	-0.02	0.00	0.78	0.97
Administrative and commercial managers	-0.06	-0.01	0.54	0.94
Production and specialised services managers	-0.07	0.03	0.57	1.29
Hospitality, retail and other services managers	-0.05	0.02	0.39	1.44
Science and engineering professionals	-0.13	0.02	0.48	1.16
Health professionals	0.00	-0.03	0.99	0.82
Teaching professionals	0.21	0.01	1.81	1.03
Business and administration professionals	0.00	-0.01	0.99	0.97
Legal, social and cultural professionals	0.09	-0.02	1.57	0.92
Science and engineering associate professionals	-0.11	0.01	0.54	1.10
Health associate professionals	0.18	0.00	1.84	0.99
Business and administration associate professionals	-0.05	0.01	0.84	1.03
Legal, social, cultural and related associate professionals	0.16	0.01	2.18	1.05
Information and communications technicians	-0.03	0.00	0.76	0.98
Customer services clerks	0.04	0.00	1.28	0.97
Numerical and material recording clerks	-0.05	0.00	0.64	0.95
Other clerical support workers	0.03	0.02	1.28	1.16
Personal service workers	-0.05	0.01	0.77	1.08
Sales workers	0.00	-0.01	0.98	0.98
Personal care workers	0.23	-0.03	1.80	0.95
Protective services workers	0.05	0.01	1.63	1.05
Building and related trades workers, excluding electricians	-0.18	0.00	0.23	0.98
Metal, machinery and related trades workers	-0.18	0.02	0.28	1.22
Handicraft and printing workers	-0.03	0.00	0.54	0.93
Electrical and electronic trades workers	-0.10	-0.01	0.37	0.90

Food processing, wood working, garment and other craft and related trades workers	-0.07	0.00	0.38	1.00
Stationary plant and machine operators	-0.07	0.01	0.64	1.04
Assemblers	-0.02	0.00	0.84	0.98
Drivers and mobile plant operators	-0.13	-0.02	0.43	0.88
Cleaners and helpers	-0.03	-0.01	0.81	0.93
Labourers in mining, construction, manufacturing and transport	-0.07	0.00	0.53	1.02
Food preparation assistants	-0.01	0.00	0.86	1.05
Occupation unknown	-0.05	0.00	0.54	1.07
Firm size	0.34	0.01	1.22	1.01
Firm size # Firm size	0.27	0.01	1.63	1.08
Crop and animal production, hunting and related service activities	-0.17	-0.01	0.26	0.89
Manufacture of food products	-0.07	-0.01	0.49	0.86
Manufacture of beverages	-0.01	0.00	0.84	1.00
Manufacture of leather and related products	-0.02	0.01	0.68	1.15
Manufacture of wood and of products of wood and cork	-0.04	0.01	0.62	1.12
Manufacture of paper and paper products	-0.04	0.00	0.68	1.00
Printing and reproduction of recorded media	-0.02	-0.01	0.77	0.88
Manufacture of chemicals and chemical products	-0.03	-0.01	0.64	0.90
Manufacture of basic pharmaceutical products and pharmaceutical preparations	0.00	-0.01	1.02	0.86
Manufacture of rubber and plastic products	-0.04	0.01	0.55	1.12
Manufacture of other non-metallic mineral products	-0.05	0.00	0.43	0.94
Manufacture of basic metals	-0.05	0.00	0.43	0.95
Manufacture of fabricated metal products except machinery and equipment	-0.09	0.01	0.39	1.11
Manufacture of computer, electronic and optical products	-0.02	0.01	0.84	1.10
Manufacture of electrical equipment	-0.04	0.01	0.54	1.09
Manufacture of machinery and equipment n.e.c.	-0.09	0.01	0.46	1.16
Manufacture of motor vehicles, trailers and semi-trailers	-0.01	0.01	0.78	1.27
Manufacture of other transport equipment	-0.03	-0.01	0.48	0.83
Other manufacturing	-0.04	-0.01	0.55	0.86
Repair and installation of machinery and equipment	-0.07	0.00	0.40	0.96

Waste collection, treatment and disposal activities; materials recovery	-0.09	-0.01	0.25	0.84
Construction of buildings	-0.13	0.00	0.29	1.00
Civil engineering	-0.07	0.02	0.30	1.86
Specialised construction activities	-0.18	0.00	0.21	0.98
Wholesale and retail trade and repair of motor vehicles and motorcycles	-0.12	0.00	0.26	1.00
Wholesale trade, except of motor vehicles and motorcycles	-0.12	0.02	0.49	1.21
Retail trade, except of motor vehicles and motorcycles	0.00	0.00	1.01	0.99
Land transport and transport via pipelines	-0.11	0.01	0.45	1.09
Water transport	0.01	-0.03	1.11	0.63
Air transport	0.05	-0.02	2.34	0.79
Warehousing and support activities for transportation	-0.03	0.00	0.70	1.02
Postal and courier activities	0.02	0.01	1.23	1.07
Accommodation	0.03	0.00	1.50	1.00
Food and beverage service activities	0.01	0.02	1.04	1.11
Publishing activities	0.00	-0.02	0.95	0.78
Programming and broadcasting activities	-0.02	-0.02	0.76	0.71
Telecommunications	0.00	-0.03	0.95	0.70
Computer programming, consultancy and related activities	-0.03	0.00	0.83	1.03
Information service activities	0.01	0.01	1.24	1.16
Financial service activities, except insurance and pension funding	0.00	-0.01	1.03	0.92
Insurance, reinsurance and pension funding, except compulsory social security	-0.01	0.01	0.84	1.21
Real estate activities	-0.06	-0.01	0.42	0.82
Legal and accounting activities	-0.04	0.00	0.61	0.95
Activities of head offices; management consultancy activities	-0.03	0.02	0.63	1.42
Architectural and engineering activities; technical testing and analysis	-0.08	0.01	0.59	1.12
Scientific research and development	0.01	0.00	1.10	1.02
Advertising and market research	-0.02	-0.01	0.70	0.85
Other professional, scientific and technical activities	-0.02	0.02	0.72	1.47
Veterinary activities	0.00	-0.01	0.94	0.63
Employment activities	-0.08	0.02	0.50	1.20

Travel agency, tour operator and other reservation service and related activities	0.00	-0.01	1.10	0.79
Security and investigation activities	0.02	0.00	1.34	1.03
Services to buildings and landscape activities	-0.07	-0.01	0.60	0.94
Office administrative, office support and other business support activities	-0.01	0.01	0.88	1.21
Public administration and defence; compulsory social security	0.07	0.02	1.29	1.05
Education	0.15	0.01	1.46	1.03
Human health activities	0.20	-0.01	1.58	0.99
Residential care activities	0.20	0.00	2.17	1.00
Social work activities without accommodation	0.20	-0.03	1.92	0.93
Creative, arts and entertainment activities	0.00	0.02	1.00	1.28
Libraries, archives, museums and other cultural activities	0.01	-0.01	1.19	0.88
Gambling and betting activities	0.01	0.02	1.38	2.25
Sports activities and amusement and recreation activities	-0.03	0.00	0.64	0.93
Activities of membership organisations	0.05	-0.01	1.35	0.97
Other personal service activities	-0.07	0.03	0.41	1.73
Employer Type: State	0.01	0.02	1.03	1.05
Municipality	0.35	0.00	1.29	1.00
Foreign-owned	-0.07	0.00	0.82	1.00
Male # Employed t-2	-0.54	0.00	0.65	1.00
Male # Unemployed t-2	-0.16	0.00	0.20	0.94
Female # Employed t-2	0.64	0.00	0.69	1.00
Female # Unemployed t-2	-0.10	-0.01	0.34	0.92
Female # Other t-2	-0.02	-0.01	0.75	0.85
Male # Employed t-3	-0.55	0.00	0.65	1.00
Male # Unemployed t-3	-0.15	0.01	0.12	1.30
Female # Employed t-3	0.63	0.00	0.71	0.99
Female # Unemployed t-3	-0.09	-0.03	0.40	0.66
Female # Other t-3	0.01	0.02	1.14	1.23
Male # Employed t-4	-0.54	0.00	0.65	1.00
Male # Unemployed t-4	-0.13	0.00	0.13	1.00
Female # Employed t-4	0.62	0.00	0.75	1.00
Female # Unemployed t-4	-0.06	-0.02	0.58	0.78
Female # Other t-4	0.01	0.01	1.13	1.06
Male # Employed t-5	-0.52	0.00	0.65	1.00
Male # Unemployed t-5	-0.13	0.01	0.21	1.31
Female # Employed t-5	0.63	0.00	0.78	0.99

Female # Unemployed t-5	-0.03	-0.01	0.81	0.92
Female # Other t-5	0.02	-0.02	1.18	0.88
Male # Employed t-6	-0.50	0.00	0.64	1.01
Male # Unemployed t-6	-0.13	0.00	0.29	1.06
Female # Employed t-6	0.62	0.00	0.83	1.00
Female # Unemployed t-6	-0.02	-0.01	0.88	0.94
Female # Other t-6	0.06	-0.01	1.50	0.96
Male # Tenure	-0.47	0.01	0.20	1.04
Female # Tenure	0.13	0.02	0.66	1.04
Male # Tenure # Tenure	-0.37	0.01	0.08	1.08
Female # Tenure # Tenure	-0.05	0.02	0.39	1.19
Male # Working days t-1	-0.57	0.00	0.68	1.00
Female # Working days t-1	0.65	0.00	0.69	1.00
Male # Working days t-2	-0.55	0.00	0.67	1.00
Female # Working days t-2	0.66	0.00	0.71	1.00
Male # Working days t-3	-0.55	0.00	0.67	1.00
Female # Working days t-3	0.64	0.00	0.74	1.01
Male # Working days t-4	-0.54	0.00	0.66	1.00
Female # Working days t-4	0.63	0.01	0.76	1.00
Male # Working days t-5	-0.52	0.00	0.65	1.00
Female # Working days t-5	0.63	0.01	0.80	1.00
Male # Working days t-6	-0.51	0.00	0.65	1.00
Female # Working days t-6	0.62	0.01	0.82	1.00
Cube Root of Annual Earnings t-1	-0.06	0.02	0.41	0.96
Cube Root of Annual Earnings t-2	0.03	0.03	0.35	0.96
Cube Root of Annual Earnings t-3	0.01	0.02	0.36	0.97
Cube Root of Annual Earnings t-4	0.04	0.02	0.34	0.99
Cube Root of Annual Earnings t-5	0.06	0.00	0.36	1.00
Cube Root of Annual Earnings t-6	0.07	0.02	0.35	0.97
Cube Root of Annual Earnings t-1 # Cube Root of Annual Earnings t-1	-0.13	0.02	0.38	0.99
Cube Root of Annual Earnings t-2 # Cube Root of Annual Earnings t-2	-0.05	0.03	0.36	0.99
Cube Root of Annual Earnings t-3 # Cube Root of Annual Earnings t-3	-0.07	0.02	0.35	0.99
Cube Root of Annual Earnings t-4 # Cube Root of Annual Earnings t-4	-0.06	0.02	0.34	1.03
Cube Root of Annual Earnings t-5 # Cube Root of Annual Earnings t-5	-0.04	0.00	0.39	1.11
Cube Root of Annual Earnings t-6 # Cube Root of Annual Earnings t-6	-0.04	0.02	0.38	1.01

Cube Root of Household's Disposable Income t-1	0.06	0.00	0.66	0.68
Cube Root of Household's Disposable Income t-2	0.08	0.02	0.67	0.90
Cube Root of Household's Disposable Income t-3	0.03	0.01	0.66	0.98
Cube Root of Household's Disposable Income t-4	0.00	0.00	0.67	0.98
Cube Root of Household's Disposable Income t-5	-0.05	0.00	0.67	0.96
Cube Root of Household's Disposable Income t-6	-0.09	0.01	0.72	1.02
Cube Root of Debts	0.25	0.01	0.85	0.98
Male # Years Since Latest Degree	-0.65	0.00	0.23	0.98
Female # Years Since Latest Degree	0.14	0.01	0.56	1.03
Male # Years Since Latest Degree # Years Since Latest Degree	-0.60	-0.01	0.11	0.94
Female # Years Since Latest Degree # Years Since Latest Degree	-0.10	0.02	0.40	1.04
Change in Occupation t-2=1	0.01	-0.01	1.03	0.98
Change in Occupation t-3=1	0.00	0.01	1.01	1.03
Change in Occupation t-4=1	0.01	0.01	1.02	1.02
Change in Occupation t-5=1	0.05	-0.01	1.12	0.97
Change in Employer t-1=1	-0.11	0.01	0.77	1.02
Change in Employer t-1=2	-0.26	-0.01	0.29	0.96
Change in Employer t-2=1	0.03	-0.01	1.06	0.98
Change in Employer t-2=2	-0.28	-0.02	0.41	0.91
Change in Employer t-3=1	0.01	-0.01	1.03	0.99
Change in Employer t-3=2	-0.23	-0.01	0.55	0.96
Change in Employer t-4=1	0.05	0.00	1.11	0.99
Change in Employer t-4=2	-0.22	-0.01	0.64	0.98
Change in Employer t-5=1	0.09	-0.02	1.21	0.96
Change in Employer t-5=2	-0.21	-0.01	0.70	0.98
Male # Change in the Field of Education t-1=1	-0.06	0.00	0.47	1.00
Female # Change in the Field of Education t-1=1	-0.02	0.01	0.80	1.15
Male # Change in the Field of Education t-2=1	-0.08	0.02	0.38	1.31
Female # Change in the Field of Education t-2=1	0.01	0.01	1.05	1.06
Male # Change in the Field of Education t-3=1	-0.06	0.01	0.56	1.08
Female # Change in the Field of Education t-3=1	0.02	0.01	1.11	1.05
Male # Change in the Field of Education t-4=1	-0.08	-0.01	0.47	0.90
Female # Change in the Field of Education t-4=1	0.01	0.00	1.08	0.99
Male # Change in the Field of Education t-5=1	-0.09	-0.02	0.38	0.82
Female # Change in the Field of Education t-5=1	0.02	-0.01	1.17	0.96
Male # Change in the Level of Education t-1=1	-0.05	0.00	0.54	1.07
Female # Change in the Level of Education t-1=1	-0.03	0.00	0.75	1.02
Male # Change in the Level of Education t-2=1	-0.06	0.00	0.47	1.00
Female # Change in the Level of Education t-2=1	0.00	0.01	0.96	1.07

Male # Change in the Level of Education t-3=1	-0.04	0.00	0.68	0.97
Female # Change in the Level of Education t-3=1	0.03	0.00	1.22	1.01
Male # Change in the Level of Education t-4=1	-0.05	0.00	0.58	0.96
Female # Change in the Level of Education t-4=1	0.03	0.00	1.27	0.97
Male # Change in the Level of Education t-5=1	-0.06	-0.02	0.56	0.82
Female # Change in the Level of Education t-5=1	0.04	0.00	1.34	1.01
Received Sickness Allowance t-1=1	0.02	0.00	1.09	0.99
Received Sickness Allowance t-2=1	0.02	-0.01	1.12	0.97
Received Sickness Allowance t-3=1	0.02	0.01	1.11	1.06
Received Sickness Allowance t-4=1	0.01	0.02	1.07	1.09
Received Sickness Allowance t-5=1	0.02	-0.01	1.11	0.94
Received Sickness Allowance t-6=1	0.02	-0.01	1.14	0.93
Mean		1.0		
Median		0.8		
Max		3.4		

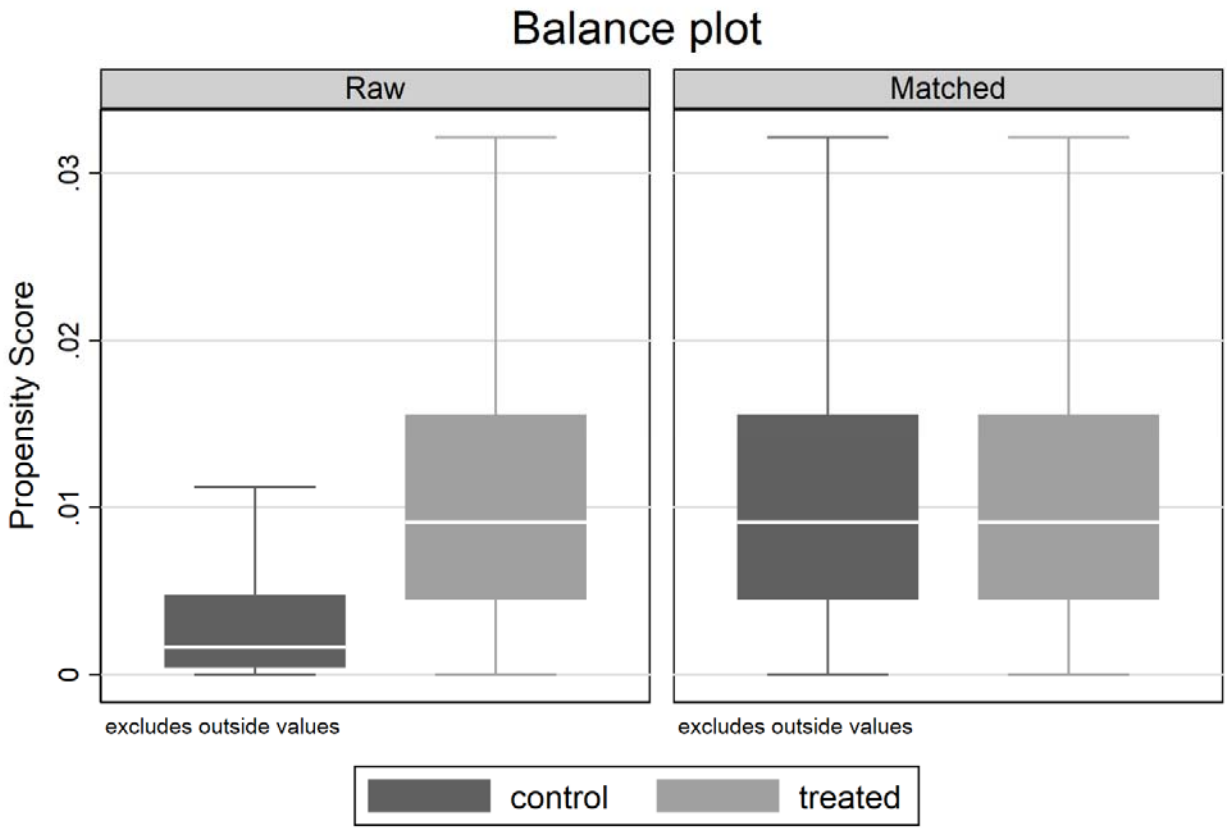

Figure B 1 Box plot of the Propensity Score

Appendix C: Tables of the Treatment Effects

Table C 1 Annual Earnings in €1000

	(1) 2005	(2) 2006	(3) 2007	(4) 2008	(5) 2009	(6) 2010	(7) 2011	(8) 2012	(9) 2013	(10) 2014	(11) 2015
ATT	0.001	-0.208	-0.220	-0.237	-0.139	-0.146	-4.813***	-5.604***	-2.815***	-1.220***	-0.298
	(0.218)	(0.256)	(0.231)	(0.225)	(0.222)	(0.217)	(0.214)	(0.230)	(0.254)	(0.258)	(0.291)
N	1715717	1715717	1715717	1715717	1715717	1715717	1715603	1714775	1714767	1715717	1710361
N Comparison group	1709355	1709355	1709355	1709355	1709355	1709355	1709245	1708419	1708406	1709355	1704015
N Treatment group	6362	6362	6362	6362	6362	6362	6358	6356	6361	6362	6346

Table reports average treatment effect on the treated and standard errors, * p<0.05, ** p<0.01, *** p<0.001.
Standard errors take into account the estimation of the propensity score.
The specification of the model for propensity score is given in Appendix A1

Table C 2 Employment

	(1) 2005	(2) 2006	(3) 2007	(4) 2008	(5) 2009	(6) 2010	(7) 2011	(8) 2012	(9) 2013	(10) 2014	(11) 2015
ATT	-0.005	-0.001	0.004	-0.001	-0.001	0.000	-0.022***	-0.052***	-0.040***	-0.025***	-0.017***
	(0.005)	(0.004)	(0.004)	(0.003)	(0.002)	(.)	(0.003)	(0.004)	(0.005)	(0.005)	(0.005)
N	1715717	1715717	1715717	1715717	1715717	1715717	1715717	1715717	1715717	1715717	1715717
N Comparison group	1709355	1709355	1709355	1709355	1709355	1709355	1709355	1709355	1709355	1709355	1709355
N Treatment group	6362	6362	6362	6362	6362	6362	6362	6362	6362	6362	6362

Table reports average treatment effect on the treated and standard errors, * p<0.05, ** p<0.01, *** p<0.001.
Standard errors take into account the estimation of the propensity score.
The specification of the model for propensity score is given in Appendix A1

Table C 3 Change in Occupation

	(1) 2006	(2) 2007	(3) 2008	(4) 2009	(5) 2011	(6) 2012	(7) 2013	(8) 2014
ATT	0.001	0.003	-0.001	-0.000	-0.007	0.076***	0.094***	0.071***
	(0.006)	(0.006)	(0.006)	(0.006)	(0.007)	(0.007)	(0.006)	(0.006)
N	1715717	1715717	1715717	1715717	1715717	1714998	1715002	1715717
N Comparison group	1709355	1709355	1709355	1709355	1709355	1708642	1708641	1709355
N Treatment group	6362	6362	6362	6362	6362	6356	6361	6362

Table reports average treatment effect on the treated and standard errors, * p<0.05, ** p<0.01, *** p<0.001.
Standard errors take into account the estimation of the propensity score.
The specification of the model for propensity score is given in Appendix A1
Results for the year t-1 do not exist, because of change in the occupational classification

Table C 4 Change in the Level of Education

Change in the Level of Education

	(1) 2006	(2) 2007	(3) 2008	(4) 2009	(5) 2010	(6) 2011	(7) 2012	(8) 2013	(9) 2014
ATT	-0.000	0.005	0.000	-0.002	0.000	0.050***	0.111***	0.121***	0.085***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.002)	(0.003)	(0.004)	(0.005)	(0.004)
N	1715717	1715717	1715717	1715717	1715717	1715717	1714998	1715002	1715717
N Comparison group	1709355	1709355	1709355	1709355	1709355	1709355	1708642	1708641	1709355
N Treatment group	6362	6362	6362	6362	6362	6362	6356	6361	6362

Table reports average treatment effect on the treated and standard errors, * p<0.05, ** p<0.01, *** p<0.001.
Standard errors take into account the estimation of the propensity score.
The specification of the model for propensity score is given in Appendix A1

Table C 5 Change in the Field of Education

	(1) 2006	(2) 2007	(3) 2008	(4) 2009	(5) 2010	(6) 2011	(7) 2012	(8) 2013	(9) 2014
ATT	-0.002	0.001	0.001	-0.001	0.001	0.024***	0.068***	0.082***	0.046***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.002)	(0.003)	(0.004)	(0.004)	(0.003)
N	1715717	1715717	1715717	1715717	1715717	1715717	1714998	1715002	1715717
Obs. in Comparison group	1709355	1709355	1709355	1709355	1709355	1709355	1708642	1708641	1709355
Obs. in treatment group	6362	6362	6362	6362	6362	6362	6356	6361	6362

Table reports average treatment effect on the treated and standard errors, * p<0.05, ** p<0.01, *** p<0.001.
Standard errors take into account the estimation of the propensity score.
The specification of the model for propensity score is given in Appendix A1

Appendix D: Robustness checks

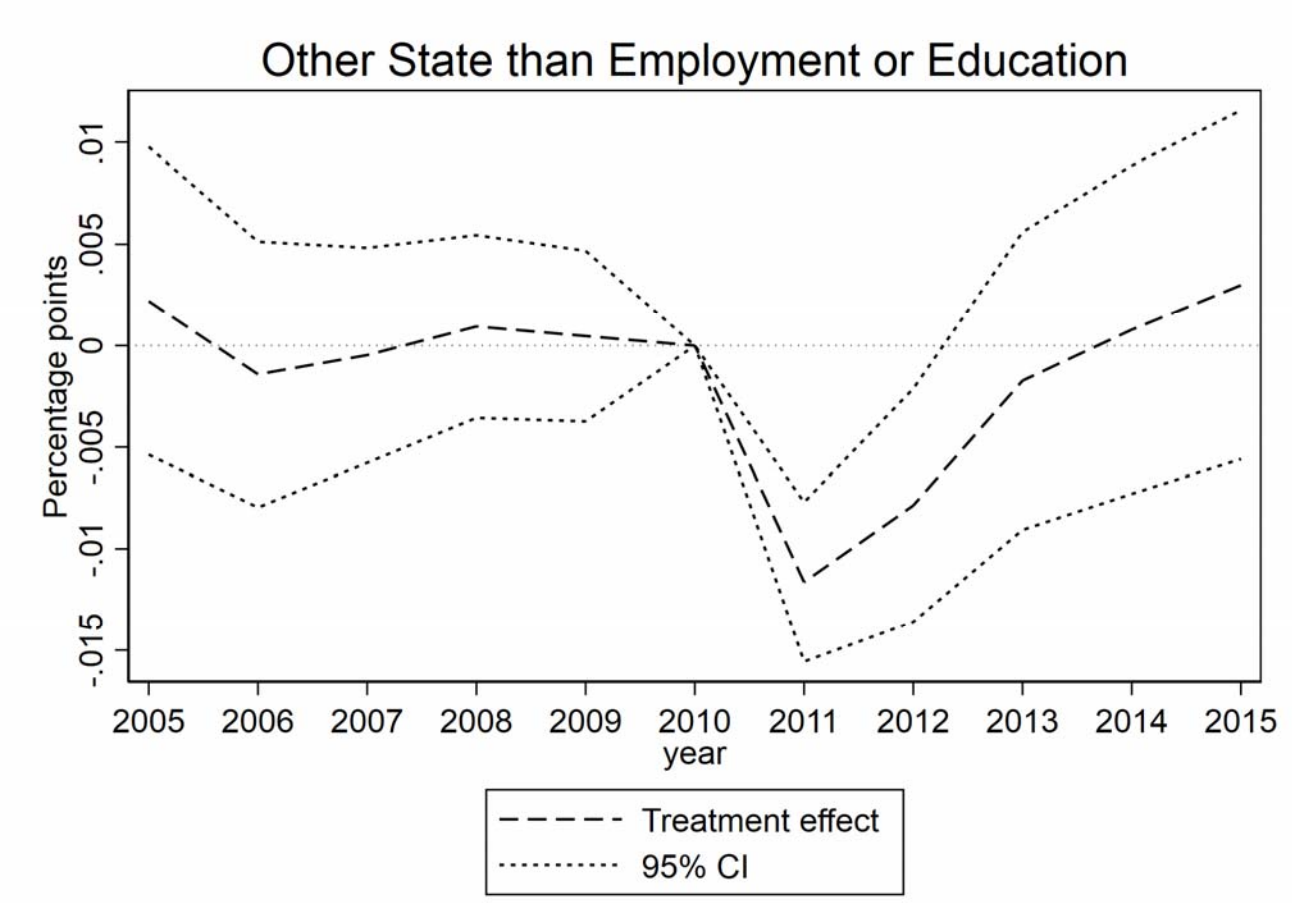

Figure D 1 Treatment effects on Other State than Employment or Education

Alternative earnings measures

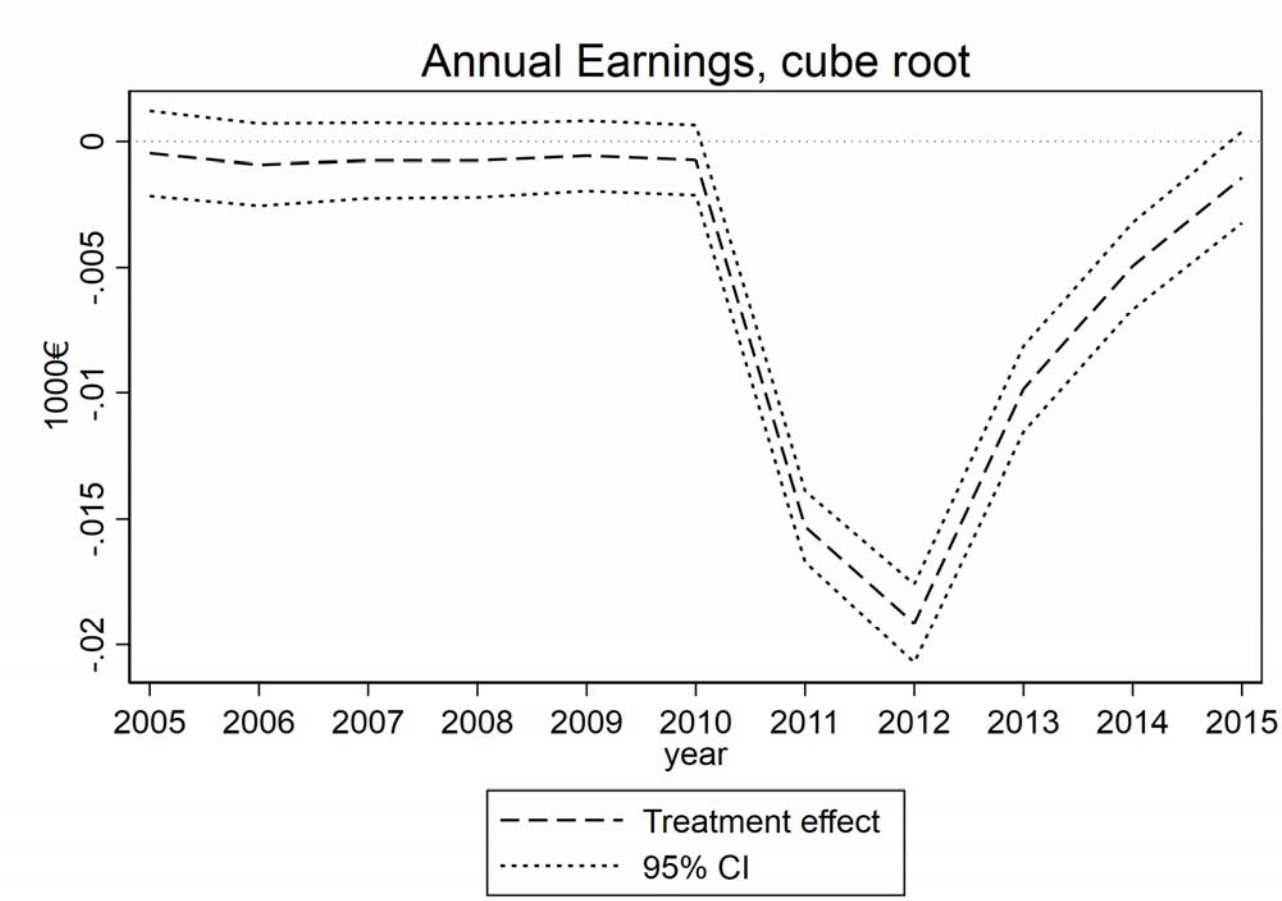

Figure D 2 Treatment Effects on the Cube Root of Annual Earnings

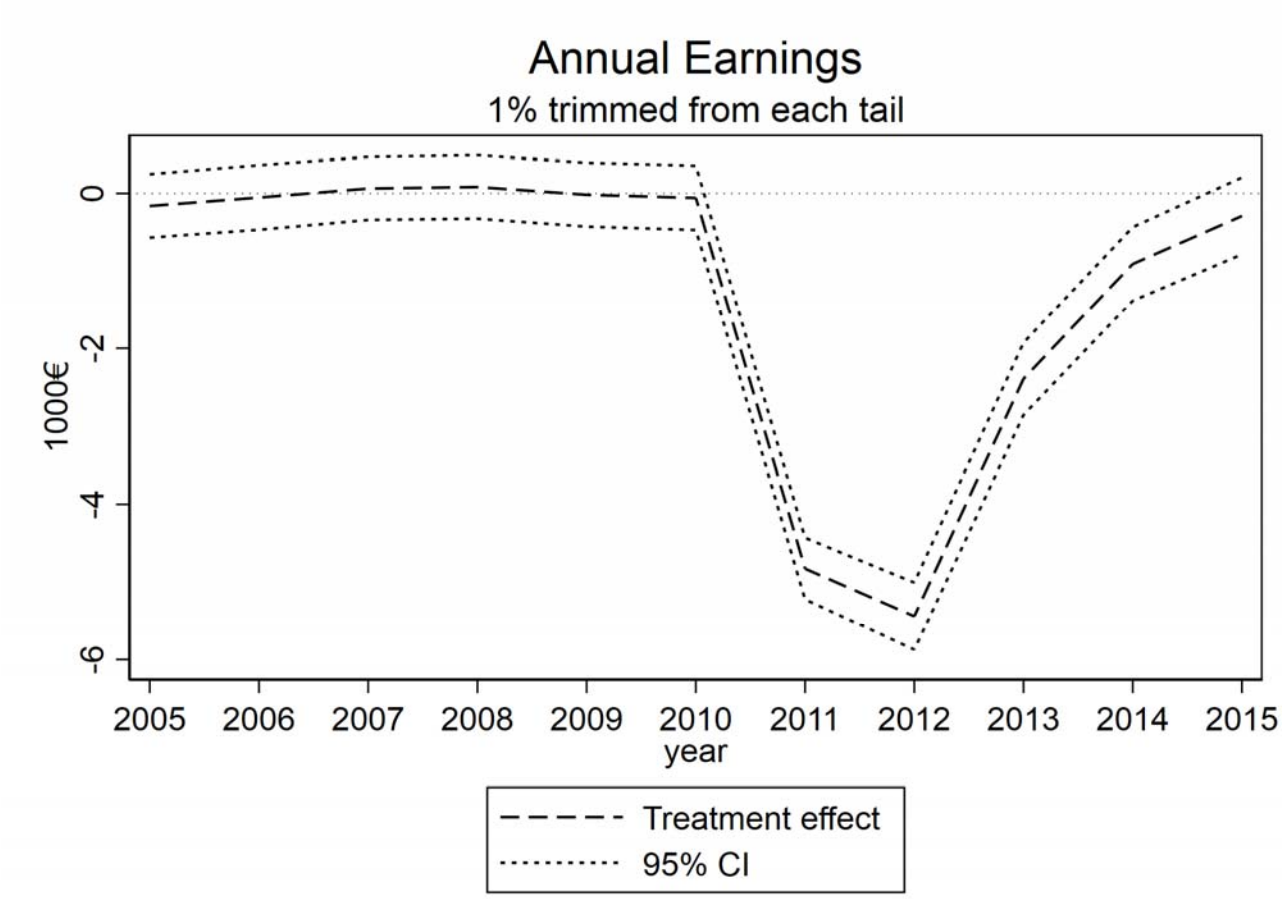

Figure D 3 Treatment Effects on Trimmed Annual Earnings

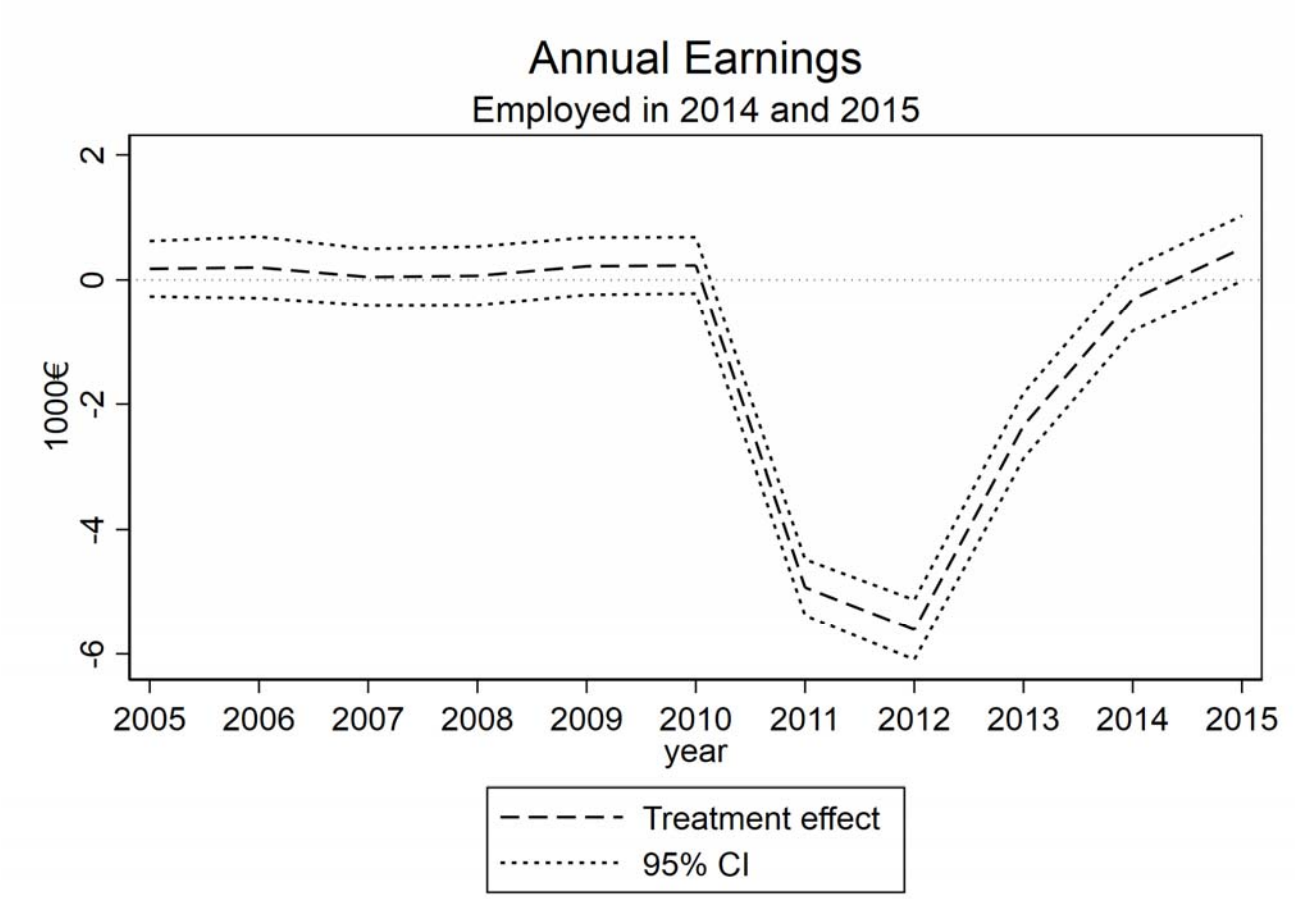

Figure D 4 Treatment Effects on Trimmed Annual Earnings for Those Who Are Employed in 2014 and 2015

Alternative estimation methods

Table D 1 Cumulative Treatment Effects: Propensity Score Matching, Inverse Probability Weighting (IPW), and Regression Adjustment (RA)

	(1) Annual Earnings	(2) Employment	(3) Change in Occupation	(4) Change in the Level of Education	(5) Change in the Field of Education
ATT PS matching	-14.188***	-0.157***	0.626***	0.371***	0.216***
	(1.098)	(0.015)	(0.032)	(0.007)	(0.006)
ATT IPW	-14.923***	-0.157***	0.649***	0.367***	0.217***
	(0.745)	(0.012)	(0.025)	(0.008)	(0.006)
ATT RA	-15.576***	-0.194***	0.689***	0.366***	0.214***
	(0.275)	(0.005)	(0.009)	(0.003)	(0.002)
N	1734145	1741405	1740179	1740179	1740179
Obs. in Comparison group	1727737	1734972	1733753	1733753	1733753
Obs. in treatment group	6408	6433	6426	6426	6426

The table reports the average treatment effect on the treated and standard errors, * p<0.05, ** p<0.01, *** p<0.001.
Standard errors take into account the estimation of the propensity score. Inverse probability weighting and regression adjustment estimators are described e.g. in Wooldridge (2010), Chapter 21.
The specification of the model for the propensity score is given in Appendix A1