Decreased tracking, increased earning:

Evidence from the comprehensive Polish educational reform of 1999

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BWP 2016/2

Budapest Working Papers on the Labour Market

BWP – 2016/2

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March 2016

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Abstract

The Polish educational reform in 1999 is often considered successful as the results of the Polish students, and especially that of the low-performers, on the OECD PISA tests have improved significantly since the introduction of the new system. The reform extended the previous 8-year undivided comprehensive education to 9 years, core curricula were introduced and the examination, admission and assessment systems were changed. It has been argued before that this longer comprehensive education improved the test performance of worse performing students; hence increasing average performance and decreasing inter-school variation of test scores. However, the lack of reliable impact assessment on long-run labour market effects of this reform is awaiting.

In this paper, we aim to fill this gap by looking at the causal effects of the reform. By comparing the labour market outcomes of the pre- and post-reform cohorts, we find a non-negligible and positive effect. We look at employment and wages as outcomes. Using data from the EU-Statistics on Income and Living conditions, and pooling the waves between 2005 and 2013 and taking the 20-27 year-olds, we generate a quasi-panel of observations to estimate the treatment effect by difference-in-difference estimation.

We find evidence that the reform was successful on the long-run: the post-reform group is more likely to be employed and they also earn higher wages. On average, the treatment group is around 2-3% more likely to be employed, which effect is driven by the lowest educated. The post-reform cohort also earns more: we find an over 3% difference in real wages, which is also more pronounced for the lowest educated.

Keywords: Education reform, Poland, detracking, labor market, difference-in-difference

JEL codes: I21, I24, I26, J24

Kisebb szelekció, nagyobb kereset: Az 1999-es lengyel oktatási reform hatásának vizsgálata

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Összefoglaló

Az 1999-es lengyel közoktatási reformot gyakran tartják sikeresnek, mivel a lengyel diákok, és különösen a rosszul teljesítő diákok, OECD PISA teszteken elért eredményei szignifikánsan javultak az új rendszer bevezetése óta. A reform az eredetileg 8 évig tartó alapoktatást egy évvel, 9 évre hosszabbította meg, bevezetett egy központi alaptantervet, és megváltoztatta a vizsgák, a felvételik és az értékelések rendszerét is. Számos szerző a meghosszabbított alapképzésnek tulajdonítja a rosszabbul teljesítő diákok teszteredményeinek javulását, és ennek eredményeképp az átlagosan javuló teszteredményeket és a pontszámok csökkenő varianciáját. A reform hosszú távú, munkaerőpiaci hatásáról azonban mindezidáig nem készült kutatás.

Ebben a tanulmányban ezt a hiányt igyekszünk pótolni. Összehasonlítva a reform előtti és reform utáni kohorszok munkaerőpiaci jellemzőit arra a megállapításra jutunk, hogy a reformnak nem elhanyagolható, pozitív hatása volt a munkaerőpiaci esélyekre és a bérekre. Az EU-SILC 2005 és 2013 közötti adatbázisait használva egy kvázi-panel adatbázist hozunk létre a 20-27 éves fiatalokra. Ennek segítségével különbség-a-különbségekben módszer segítségével becsüljük a reform oksági hatását.

Bizonyítékot találunk arra, hogy a reform utáni kohorszok tanulói nagyobb valószínűséggel találnak állást és magasabb béreket keresnek. Összességében a kezelt csoport 2-3%-kal nagyobb valószínűséggel less foglalkoztatott, amely hatás a legalacsonyabb végzettségű munkavállalók megnövekedett esélyeinek tulajdonítható. A reform utáni kohorszok kb. 3%-kal magasabb béreket kapnak, amely különbség szintén nagyobb az alacsonyabban végzettekre.

1.   INTRODUCTION

Poland is often mentioned as a miracle in the OECD PISA reports (e.g. OECD 2010), due to the fact that the students' average test scores have improved significantly during the first decade of this century. From the PISA 2000, the average test scores in reading have skyrocketed from below the OECD average to being one of the forerunners within the OECD. Similar trends are apparent in math. These improvements are claimed to be the effect of the 1999 educational reform (Jakubowski 2015).[1]

In 1999, the Polish education system has been reformed greatly. The age of first selection was postponed from age 14 to 15 and thus, the number of years spent in general training was increased from eight to nine years. The former 8-year-long general school (primary and lower secondary level) was replaced by a 6-year-long primary and a 3-year-long lower secondary school. The compulsory years spent in education were also increased from 17 to 18, which change affected mainly students in the basic vocational schools (Jakubowski et al. 2010; Jung-Miklaszewska 2003). Besides this structural reform, several other changes were carried out: the curriculum, the examination, admission and assessment systems were all reformed.

In this paper, we take a look at the long run effects of this reform. There are a couple of studies that has looked at the long-run effects of similar reforms in the Scandinavian countries. Meghir and Palme (2005) and Pekkarinen, Uusitalo and Kerr (2009) have shown in the case of Sweden and Finland, respectively, that similar comprehensive education reforms helped to decrease inequalities by increasing the outcomes for the lower status people. These reforms took place in the 1950s in Sweden and in the 1970s in Finland. Both countries abolished tracking and both imposed a national curriculum on schools and lengthened compulsory schooling to 9 years from 7 or 8. Meghir and Palme (2005) demonstrated that the reform increased both the attainment and the later earnings of children with lowly educated parents. At the same time, the reform also decreased the earnings of those with highly educated parents. Pekkarinen, Uusilato and Kerr (2009) tested the effects of the Finnish comprehensive reform and concluded that it had only a small but an overall positive effect. It significantly reduced intergenerational income elasticity for boys, and it increased intergenerational income mobility. The novelty of these studies is that they could test the causal effects of an educational reform using difference-in-difference estimates exploiting the fact that the reform was implemented gradually across the countries.

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[1] The Ministry of National Education of Poland also praises the 1999 reform. see: "*Diversification of PISA survey results – lower secondary schools in Poland provide equal opportunities.*" http://men.gov.pl/en/?p=45 (Last downloaded on 7 March 2016.)

While the Polish reform of 1999 was similar in many aspects to the Scandinavian reforms it was introduced at one point in time for the whole country. Thus, we will compare the employment chances and real wages of pre-reform (control) and post-reform (treatment) cohorts directly. Pooling several years of cross-sectional surveys we generate a quasi-panel of time of survey and age brackets, which we will use to estimate difference-in-difference estimates, but unlike in the Scandinavian studies, the variance comes not from the time of implementation but from the time (year) of observation.

Results suggest that the 1999 reform in Poland was successful on the long-run. The post-reform group is more likely to be employed and they also earn higher wages. Similarly to the Scandinavian studies, this effect is likely to be driven by the lowest educated, which suggests that the reform has reached its initial goal of decreasing inequalities.

2.   THE EDUCATIONAL REFORM OF 1999 IN POLAND

During the transition from socialism to democracy, several parts of the Polish education system have changed. The system gradually became more decentralized, schools became more autonomous, ideological elements of history teaching were eliminated and The Russian language was not compulsory anymore. However, by the middle of the 1990s, the results of the International Adult Literacy Survey revealed further deficiencies in the education system and that urged the need for a major educational reform (see Wiśniewski 2001).

The educational reform of 1999 was one of the four reforms – of social security, health care, public administration and education – implemented by the government elected in 1997. The three main goals of the 1999 education reform were to increase the level of education in the society, to provide equal educational opportunities to everyone and to improve the quality of education (Bialecki, Johnson, and Thorpe 2002)

The 1999 educational reform changed the structure of the system from nursery school to higher education. It also reformed the curricula and the examination, assessment and application systems. It affected the qualification requirements for teachers and school administration and financing. We only address the structural, curricular and examination changes in detail as these affected the pupils directly.

STRUCTURAL CHANGES IN 1999

Undoubtedly, the most important structural change of 1999 was the one year increase in the length of comprehensive education. While the school starting age has not changed with this reform – it had been 7 for several decades and was only lowered to 6 in 2015 (Jakubowski 2015) – the length and structure of compulsory education have changed (see figure 1).

Before 1999 general education consisted of a one track primary and secondary level school, the general school. This school lasted for 8 years, usually till age 15, but not longer than age 17, the end of compulsory education. This 8-year general school was substituted by a 6-year primary school and a 3-year lower secondary school, the so-called gimnazjum. Thus, compulsory education has also been extended by one year, from age 17 to 18, until the end of the upper secondary level (see Jung-Miklaszewska 2003).

The symbol of the 1999 reform was the new institution, the gimnazjum. The aim of its introduction was to provide the same education for one more year for all students and to track them one year later. One of the main goals was to increase the level of education in rural areas (Jakubowski et al. 2010). Fewer gimnazjum were established than primary schools, as they were only opened in larger settlements. Although the gimnazjum also admits students based on residence, those living in small villages must travel to one of the assigned larger settlements around them. The mixing of students with different backgrounds and skills is more visible in rural areas where one gimnazjum collects the children from neighbouring villages. However, after a gimnazjum accepted all pupils from its catchment area, it can admit the best applicants from other areas to fill remaining places. In urban areas, this sorting mechanism became more general since it is easier to choose between gimnazjum in more populated areas and to travel to a gimnazjum which is not the closest one (Bialecki 2005).

The pre-reform general schools and the post-reform gimnazjum were followed by upper secondary tracks: academic secondary track or liceum, secondary vocational track or technikum and a basic vocational track. With the 1999 reform a fourth type of high school was introduced, the so-called profiled academic secondary track.

The liceum lasted 4 years in the old system and offered academic education and ended with the maturity examination (matura), which gave access to tertiary education. These licea were specialized in mathematics and physics, humanities, biology and chemistry, general education, ecology or sports. The technikum lasted 4 or 5 years, provided more work-related education and graduates acquired a qualification as a technician. It was also completed by the maturity examination which could lead to higher education. The basic vocational school lasted 3 years, aimed to produce skilled workers by providing training in a particular field, offered only a vocational certificate. After this type of school students could complete their secondary studies in supplementary technical tracks, only after these supplementary studies could students take the maturity examination.

During the 1999 reform, the liceum and technikum became one-year shorter, 3-years and 4-years, respectively, but basic vocational schools remained 3 years long. This was to adjust to the one year longer general education. The new profiled general secondary school lasted 3

years as well, and besides general education, it offered specialization in vocational or academic subjects.[2]

During the reform, 2-year supplementary academic and 3-year supplementary vocational secondary schools were also established. These give the opportunity to graduates from basic vocational schools to complete their education at secondary level. At the end of these schools they obtain a certificate of completion of the given type of school, or if they take the maturity examination, are given a maturity certificate.

Poland also signed the Bologna Declaration in 1999 along with 29 European countries; the typical three-level system of tertiary education – bachelor, master and doctorate – was thus introduced (Kwiek 2014). As a consequence, the first bachelor level graduates of the new system were entering the labour market around 2003, just around the time when the first 1999 reform cohort is expected to enter the labour market (Jung-Miklaszewska 2003).[3]

Figure 1.

Pre- and post-reform structure of the Polish education system

Before the reform of 1999

age		grade
6	Zero class (primary schools or kindergartens)	0
7		I
8		II
9		III
10	Comprehensive general schools	IV
11		V
12		VI
13		VII
14		VIII
	Entrance exam	
15	Academic secondary schools (*liceum*) / Secondary vocational schools (*technikum*) / Basic vocational schools	I
16		II
17		III
18		IV
19	Matura	V
	Matura	

After the reform of 1999

age		grade
6	Zero class (primary schools or kindergartens)	0
7		I
8		II
9	Comprehensive general schools	III
10		IV
11		V
12		VI
	Final test	
13	Comprehensive lower secondary schools (*gimnazjum*) ISCED 2A	I
14		II
15		III
	Final exam	
16	Academic secondary schools ISCED 3A / Profiled academic secondary schools ISCED 3B / Secondary vocational schools ISCED 3B / Basic vocational schools ISCED 3C	I
17		II
18		III
19	Matura Matura	IV
	Matura	

Source: Jakubowski et al. (2010:5)

The structural change was carried out gradually. Gimnazjum were already provided by September 1999, but the new system academic secondary schools, profiled academic secondary schools, vocational secondary schools and basic vocational schools were only established in 2002 while the supplementary general and technical secondary schools were opened in 2004. Therefore, until 2005, the secondary education institutions of the old system and the new upper secondary schools co-existed (Jung-Miklaszewska 2003). However, the cut-off was very clear-cut: those born before December 31. 1985. were to follow through in the old system, while those born after January 1. 1986. were to be educated in the new.[4] As for tertiary education, until 2008, the old 5-year-long programmes also existed along the new bachelor and master programmes. In 2008, the 5-year programmes were abolished and kept only for the some specific fields of study (Kwiek 2014).

The threshold in birth dates dividing the students studying in the old and new system was December 1985 – January 1986. Pupils born until 1985 followed the pre-reform curriculum; while those born in 1986 were the first who started their education in the newly established gimnazjum in 1999 and continued education completely in the new system.

CURRICULAR CHANGES

Before the transition, the general schools were required to follow a centrally determined curriculum. In the 1999 reform, a core curriculum was defined, which placed an emphasis on improving the skills and competencies of students (Wiśniewski 2001). The concept of core curricula extended the autonomy of schools and teachers, as general schools were to build their own core curricula around a centrally formulated core. Only the necessary skills and knowledge that students were to acquire by the end of their studies were determined. The curricula created by teachers needed to meet certain criteria; however the responsibility for the quality of education was delegated from the government to school level with this decentralization. Therefore, the examination and assessment system also needed to change in order to be able to evaluate the performance of schools (Jakubowski 2008).

CHANGES IN THE EXAMINATION, ASSESSMENT AND ADMISSION SYSTEM

Before 1999 students finished general school without any centralized exam taken during or at the end. However at the end of the 8th year they were obliged to write an entrance exam in each of the secondary schools they applied to. These examinations consisted of a test in Polish language and literature, mathematics and a chosen subject and were developed by the given liceum or technikum (Jung-Miklaszewska 2003).

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[4] Naturally, if one student born in 1985 repeated a class, s/he had to continue her/his studies in the new system.

Academic and vocational secondary schools were completed by the maturity examination. These exams were organised by the given schools and corrected by the teachers in these schools. A maturity exam written in the technikum was different from that written in a liceum, so the results were not comparable and, therefore, could not be taken into account when applying for higher education (Wiśniewski 2001). Thus, the requirements for admission to higher education institutions were to hold the certificate from the maturity examination and to pass the entrance examination. These entrance examinations varied between higher education institutions since each institution had its own selection system (Jung-Miklaszewska 2003).

Therefore, in line with the curricular reform, the examination system also needed to change by moving towards a centrally developed and coordinated system. With the 1999 reform, a low-stakes centralized test after the 6-year primary school was introduced. While this is low-stakes for the students, it is medium-stakes for schools as no financial strings are attached but their performance became comparable. The first test after the 6th year was carried out in 2002 (Jung-Miklaszewska 2003).

The individually organised entrance exams to upper secondary schools were also replaced by a central exam at the end of gimnazjum. The admission to upper secondary schools depends on the results of this exam together with the grades in the final year of the subjects of the chosen field. However, apart from this, each upper secondary school works out its own rules for admission (Smoczyńska et al. 2014).

Both types of tests are worked out and corrected by Regional Examination Boards in the framework of the standards set by the Central Examination Board since 2002.

In line with the reform, the admission system to higher education institutions also changed. The admission to the bachelor level is now on based on the results of the centralized and standardized maturity examination (Smoczyńska et al. 2014).

All in all, the examination system moved from internally organised examinations with non-comparable results to a system with external organisation and assessment. With this new construction the examination system became transparent, results became available for the students and teachers and the results at the school level became available for the public. According to Jakubowski (2015), this gave an incentive to schools to perform better, therefore to teachers to improve their teaching, and parents to choose better-performing schools for their children.

3.   DATA

The EU Statistics on Income and Living Conditions (EU-SILC) consists of detailed data on income on personal and household level, as well as data concerning labour, education and health status. The population in the EU-SILC comprises private households with all household members surveyed but only over 16 years of age are people interviewed personally for income data.

In this paper, we are utilizing the cross-sectional database of EU-SILC. The data from Poland are available between 2005 and 2013. The sample selection is conducted in a two-stage process. The stratification is based on regions coded by NUTS 2. In the first stage, the population is divided into primary sampling units, from which a random sample of PSU-s is drawn. Then, in the second stage, every sampled PSU is divided into secondary sampling units and from every sampled PSU SSU-s are randomly drawn. Every household in a selected SSU is eligible for the sample (see Eurostat 2014).

To generate a balanced "quasi-panel" we pool the cross-sectional datasets between 2005 and 2013 and keep only those between ages 20-27. This allows us to compare pre-reform and post-reform participants: in the first survey year, 2005, the members of the youngest control group are 20 years old; and in the last survey year, 2013, the oldest treatment group members are 27 (see table 1 below). This means in the sample we have 16 cohorts, 8 in the treatment (T1 to T8) and eight in the control group (C1 to C8). These are people born between 1978 and 1993 (see also table A2 and A3 in the appendix).

Table 1.

Distribution of treatment and control group cohorts by age and year of survey[5]

year of survey age	2005	2006	2007	2008	2009	2010	2011	2012	2013
20	C1	T1	T2	T3	T4	T5	T6	T7	T8
21	C2	C1	T1	T2	T3	T4	T5	T6	T7
22	C3	C2	C1	T1	T2	T3	T4	T5	T6
23	C4	C3	C2	C1	T1	T2	T3	T4	T5
24	C5	C4	C3	C2	C1	T1	T2	T3	T4
25	C6	C5	C4	C3	C2	C1	T1	T2	T3
26	C7	C6	C5	C4	C3	C2	C1	T1	T2
27	C8	C7	C6	C5	C4	C3	C2	C1	T1

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[5] For the number of observations, see the Appendix, table A2

There are in total 48557 observations in the sample with 23471 in the control group and 25086 in the treatment group. In Poland, it is compulsory to start school in the year when the child turns 7. Thus, the threshold is 1 January 1986. In the sample everyone born in 1986 or later is considered as treated – to have studied in the new system -, and everyone born until 31. December 1985. is considered as control.

Concerning the educational attainment, we rely on the ISCED classification: those with ISCED 2 or below are considered as low-educated, those with ISCED 3 or 4 are at the medium level and those with ISCED 5 or above are highly educated. Unfortunately even these very rough categories are hard to compare before and after the reform (see descriptive statistics section below).

Basic activity status in the EU-SILC classified into four categories: at work, unemployed, in retirement or early retirement, and other inactive. The first category covers those who work either full-time or part-time or is self-employed full-time or part-time. Students are considered inactive. When looking at employment chances we will compare employed people to the unemployed, as well as to the full population (inactive and unemployed merged). We will also run models on activity (active vs. inactive). We drop those in retirement or in early retirement as there are only 55 of these people in the full sample.

Data on income is collected as gross current monthly earnings, before the deduction of taxes and social insurance contributions. The income data is given in Euros. We converted this data to Polish Zloty, and to 2005 prices. The number of years spent at work, henceforth experience, is counted as the number of years spent as an employee or self-employed since the respondent first began a regular job.[6]

4.   DESCRIPTIVE STATISTICS

Before turning to the multivariate analysis it is useful to look at the descriptive results. As expected the distribution of age when highest education was achieved is different before and after the reform. While the EU-SILC does not provide information on the age when each level of education was attained, we can look at the age when the highest level of education was attained. The median age of finishing education for those who have attained only ISCED 2 or below is 16 after the reform while it was 15 for those before the reform. This is most likely due to the one year longer general (primary and lower secondary) education. On the other hand, there is not much difference between the control and the treated when we look at those, who have obtained ISCED 3. However, most likely due to the Bologna system, the post-reform

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[6] The summary of the variables can be found in the Appendix (table A1).

tertiary educated (ISCED 5) people are likely to finish education much earlier than the pre-reform cohort (see figure 2).

When looking at the full population, it is also apparent that post-reform people tend to finish education a bit later than the pre-reform: as a result, they start their first job a bit later as well. This difference is the highest for the younger people. At age 20 and at 21 post-reform cohorts start their first job 4-5 months later, on average. This is probably due to those low-educated, who stay another year in school. The difference in first job starting age disappears at later ages (see table 2).

Surprisingly, however, a later job starting does not go negatively together with experience. That is, treated people of the same age tend to have higher years of experience than the control group (see table 3).

This could be due to different employment chances, if post-reform cohorts have larger employment chances then – on average – they can gather more experience over a shorter period even if they start their first job at a later stage. Looking at the outcome measures it is obvious that there are large differences between the control and the treatment cohorts. For instance, people at age 20 are 12% more likely to be employed after the reform than before the reform. This difference slowly evaporates as people get older, but remains significant till age 22 and on average it is positive for the full sample. Moreover, this positive difference is even more pronounced for the low-educated (see table 4). The difference in employment chances, especially for the younger people, can explain the observed differences in experience.

Looking at the wages, similar differences can be found (see figure 3 below). Treated people tend to earn a bit more on average, which is due mainly to the fact that there are fewer people in the treatment at the bottom of the wage distribution. That is, the earning distribution tilted to the right, moving those on the bottom of the distribution to the middle. This is apparent in the full cohort as well as on the sample of low-educated.

From these descriptive statistics and from the research before us, we suspect that the 1999 comprehensive education reform of Poland had a non-negligible and positive effect on the Polish labour market. We assume that all people after the reform benefited from it, but it was especially those on the bottom of the education distribution – the low–educated, low–skilled – who stayed one more year in school, who benefited from the reform.

Figure 2.

Distribution of ages when highest educational level was attained
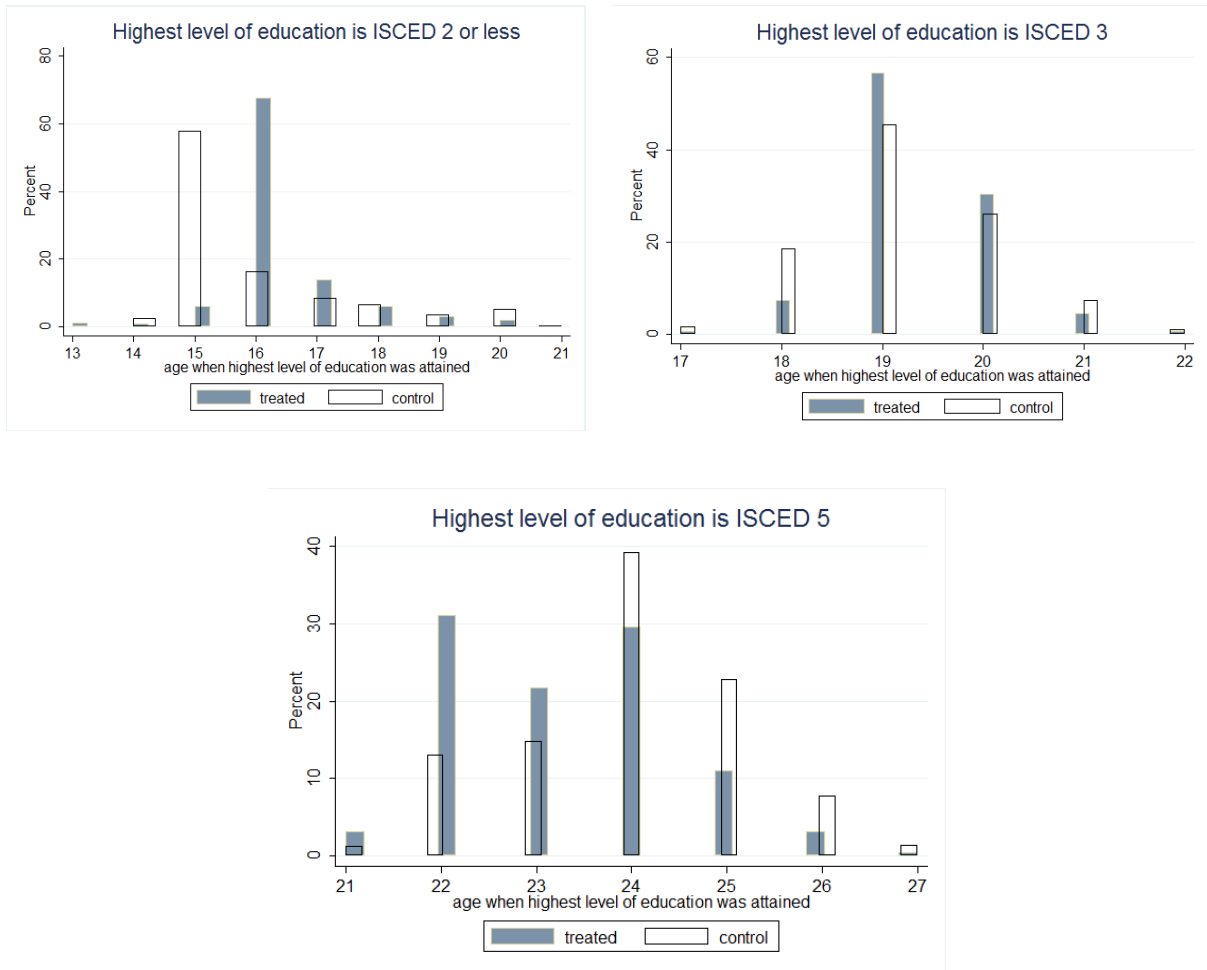
Table 2.

Ages when the control and treatment group members started their first job

age when the first job began			
age	control	treated	difference (st.err.)
20	18.14	18.49	0.346
			(0.136)**
21	18.87	19.31	0.444
			(0.096)***
22	19.52	19.70	0.176
			(0.083)**
23	20.00	20.02	0.020
			(0.082)
24	20.33	20.29	-0.041
			(0.088)
25	20.81	20.87	0.059
			(0.099)
26	21.12	21.21	0.084
			(0.121)
27	21.22	21.38	0.159
			(0.167)

*** p<0.01, ** p<0.05, * p<0.1

Table 3.

Mean years of experience by age

mean experience in years			
age	control	treated	difference (st.err.)
20	0.79	0.85	0.064
			(0.093)
21	0.99	1.11	0.117
			(0.066)*
22	1.36	1.64	0.277
			(0.061)***
23	1.83	2.22	0.385
			(0.067)***
24	2.36	2.84	0.484
			(0.078)***
25	2.79	3.24	0.451
			(0.092)***
26	3.44	3.81	0.364
			(0.118)***
27	4.23	4.40	0.172
			(0.166)

*** p<0.01, ** p<0.05, * p<0.1

Table 4.

Percentage of employed people among those who are active (employed or unemployed)

	Full sample			only ISCED 2 or below		
age	control	treated	difference (st.err.)	control	treated	difference (st.err.)
20	0.518	0.639	0.121	0.407	0.593	0.186
			(0.043)***			(0.098)*
21	0.603	0.700	0.097	0.440	0.590	0.150
			(0.025)***			(0.074)**
22	0.704	0.763	0.059	0.584	0.711	0.127
			(0.059)***			(0.069)*
23	0.768	0.791	0.024	0.542	0.680	0.138
			(0.017)			(0.077)*
24	0.797	0.810	0.013	0.621	0.647	0.025
			(0.017)			(0.076)
25	0.822	0.816	-0.006	0.597	0.581	-0.016
			(0.016)			(0.082)
26	0.835	0.866	0.031	0.646	0.672	0.026
			(0.016)**			(0.102)
27	0.852	0.818	-0.034	0.597	0.413	-0.184
			(0.024)			(0.136)

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Figure 3.

Distribution of real wages in 2005 PLN of treatment and control group
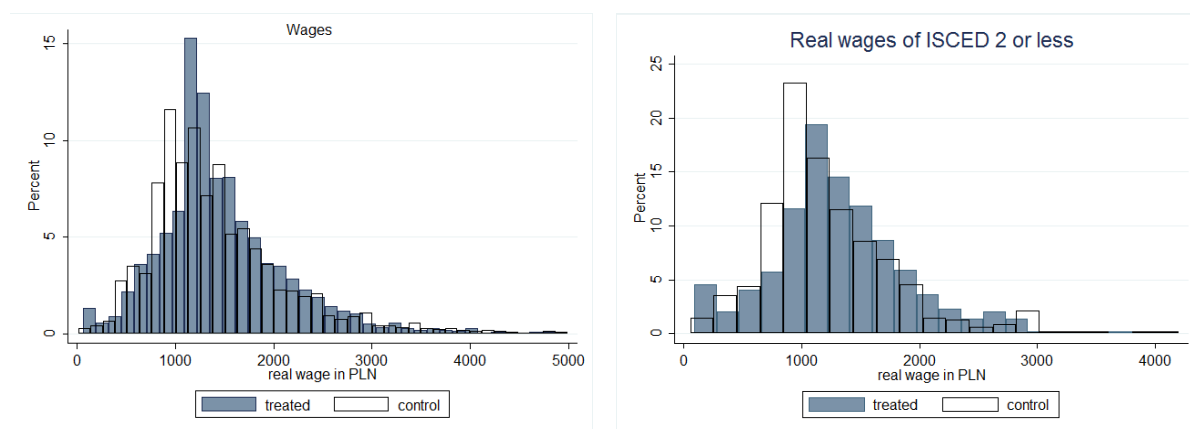
5. METHODOLOGY AND RESULTS

Obviously, the descriptive statistics cannot uncover causal differences between the treated and the control groups, as the selection into treatment was not random. However, as selection to the treatment group was determined by the year of birth, we assume that there are no unobservable individual differences between the two groups: there must be cohort-specific differences, which can be taken into account, since every member of the treatment group was born in later years than the members of the control group. Similarly, every survey year is different from the other: for example employment or wage outcomes recorded in the years of the great recession starting in 2008 must be different from the ones before. For this reason, we have opted for a difference-in-difference method where the age and the year of survey act as the two dimensions of the estimation (the first differences) and the treatment variable as the diff-in-diff (second difference) estimator. We use age and year of survey fixed effects in every regression.

The baseline specification of the multivariate model is the following:

$$Y_{asi} = \alpha + \beta \text{Treat}_{as} + \rho X_{asi} + \gamma_a + \delta_s + \varepsilon_{asi}$$

where Y is the outcome variable (employment or wage) for each individual (i). Treat is the treatment dummy, which can vary across cohorts (a) and year-of-survey (s). X is a factor of individual level variables (gender, experience and level of education, in some specifications), and γ and δ are cohort and year of survey fixed effects, respectively. ε is the idiosyncratic error term, while α, β and ρ are parameters to be estimated. In the regressions in Table 5 below, we also included a regional fixed-effects controlling for the potential differences in employment or wage composition across regions.

The results underline the pattern in the descriptive statistics. The baseline models show that treated cohorts are over 3% more likely to be employed than the control, and receive almost 3% higher wages. We argue that this effect is due solely to the reform of 1999.

Employment chances are not higher due to the higher activity rate of the treated, as there is no significant difference between the cohorts (in fact the post-treatment cohorts are less active if anything). Also, on average treated people are not likely to be more employed, when compared to the full population (unemployed and inactive).

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If we control for the potential differences in the level of educational attainment across generations – which is not necessary, if we are to look for the full direct effect of the reform – the results show that it is the low-educated, who benefit most from the reform. Low-educated is over 10% more likely to be employed than unemployed, but they are also over 6% more likely to be employed than to be unemployed or inactive (studying). They also earn 6% more after than before the reform (these wage effects are not significant, but are reasonable in size). People with a medium level of education do not seem to benefit from the reform. It is only the post-reform highly educated that are significantly less likely to be active, which is most likely due to the Bologna reform. Post-reform cohorts are more likely to be studying (and thus inactive) while already having a tertiary level degree.

Also, we must note, that while it is unlikely that the composition of the low-educated has changed much due to this reform of 1999, and thus the comparison of low-educated before and after the reform is meaningful, the composition of the tertiary educated has most likely changed due to the Bologna reform. There are more tertiary graduates (who are most likely to be younger and less skilled in average) after the Bologna reform, thus, the estimates of the treated higher educated cohort are likely to be biased upwardly (i.e. they are more negative that they should be), while the estimates of the treated medium educated are biased downwardly (towards zero).

Table 5.

The effect of the reform on labour market outcomes – linear models, full sample[7]

VARIABLES	(1) employed vs. unemployed	(2) employed vs. unemployed	(3) active vs. inactive	(4) active vs. inactive	(5) employed vs. all	(6) employed vs. all	(7) log wage	(8) log wage
Treated	**0.0342***	**0.103***	**-0.0119**	**-0.0201**	**-0.000909**	**0.0658***	**0.0317****	**0.0610**
	(0.0102)	**(0.0268)**	**(0.00946)**	**(0.0176)**	**(0.00983)**	**(0.0182)**	**(0.0156)**	**(0.0439)**
Educ.: medium		0.199***		0.0408***		0.159***		0.142***
		(0.0182)		(0.0136)		(0.0148)		(0.0268)
Educ.. high		0.261***		0.149***		0.293***		0.363***
		(0.0200)		(0.0149)		(0.0172)		(0.0270)
Educ.: medium * Treated		-0.0691***		0.0274		-0.0572***		0.000438
		(0.0262)		(0.0182)		(0.0187)		(0.0416)
Educ.. high * Treated		-0.0911***		-0.0437**		-0.128***		-0.130***
		(0.0279)		(0.0216)		(0.0220)		(0.0445)
Experience							0.0509***	0.0626***
							(0.00568)	(0.00564)
Experience^2							-0.00493***	-0.00492***
							(0.000650)	(0.000626)
Constant	0.564***	0.408***	0.342***	0.316***	0.192***	0.0742***	6.734***	6.599***
	(0.0212)	(0.0269)	(0.0127)	(0.0170)	(0.0141)	(0.0181)	(0.0320)	(0.0428)
Observations	24,393	23,269	39,187	37,560	39,233	37,605	15,450	15,447
R-squared	0.049	0.067	0.174	0.181	0.158	0.174	0.193	0.223
Regional fixed-effects	y	y	y	y	y	y	y	y
Age fixed-effects	y	y	y	y	y	y	y	y
Year-of-survey fixed effects	y	y	y	y	y	y	y	y

Robust standard errors clustered for PSU*year in parentheses, *** p<0.01, ** p<0.05, * p<0.1

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[7] Results are robust to functional form specifications. Similar regressions using conditional logit estimates for the employed regressions provide substantively similar results (see Drucker 2015)

ROBUSTNESS CHECKS

As a first robustness check to the baseline results, we estimated the baseline models on all possible birth year and age range samples, to see how much the choice of the sample affects the results. Results in table 6 below show all estimated treatment beta parameters and their standard errors. The results mostly underline the main results of the full sample analysis: Treated cohorts (those born in 1986, in this case) are on average 2,3% more likely to be employed than unemployed as compared to the 1985 cohort. These results are significant or marginally significant in most of the samples and are very rarely point to the negative direction. Also, the effects are more pronounced for the low-educated people. On average treated low-educated people are 7,7% more likely to be employed. This result varies a bit over the different samples but is likely to be significant in most of them. Similarly, treated earn around 4% more, and low-educated earn 5,6% more. While results for all levels of education are mostly significant, the point estimates tend to have a higher standard error for the low-educated sample. In short, this many sample analysis mostly confirmed the baseline full-sample results – treated are more likely to be employed and earn more.

An alternative robustness check to the baseline result is based on Kwon, Milgrom and Hwang (2010) idea of "detrending". Assuming that there is a trend in the dependent variables and accepting that the treatment captures the average differences between before and after treatment the difference might reflect the trend and not the effect of the reform. As the number of cases in the very early and very late birth cohorts is very low (see table A3 in the appendix) we have restricted the sample to birth-years between 1983 and 1988 where the number of observations is still large. In Table 7 below we replaced the treatment variable with birth-year dummies, while still keeping the year of survey and age fixed effects in the sample. In models 1, 3, 5 and 7 in table 7 we compare each birth-cohort to the first, 1983, birth cohort. Apparently there is a solid trend in employment chances (employed vs. unemployed) as well as in real wages while there is no trend in activity rate and in employment chance when compared to the full population (unemployed and inactive together). In models 2, 4, 6 and 8 we drop the 1988 birth-year dummies, thereby "de-trending" the dependent variables, and comparing each year between 1983 and 1988 to the mean of these two end years. If treatment has an effect, we should expect to see the year 1986 to be significantly different from this joint mean. And this is exactly what we see: treated people are likely to benefit a positive employment effect and a positive wage effect of the reform. While these effects are somewhat lower than before (cca. 2% in employment and 3,5% in wages) they are still significant and non-negligible.[8]

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[8] Moving the birth-year range by one or two years does not affect the substantive results in most of the cases.

Table 6.

Robustness checks: estimating the baseline models on different birth-year and age ranges. Estimated treatment effects and their standard errors

| birth year range | age range | Employed vs. Unemployed | | | | Wage | | | |
| | | full sample | | low-educated | | full sample | | low-educated | |
		Treat, β	s.e.	beta	s.e.	Treat,β	s.e.	beta	s.e.
1978-1993	20-27	0.0342	(0.0102)	0.1028	(0.0268)	0.0317	(0.0156)	0.0610	(0.0439)
1979-1992	20-27	0.0283	(0.0102)	0.0933	(0.0265)	0.0325	(0.0160)	0.0766	(0.0438)
1980-1991	20-27	0.0244	(0.0105)	0.0726	(0.0277)	0.0257	(0.0167)	0.0677	(0.0451)
1981-1990	20-27	0.0177	(0.0117)	0.0786	(0.0283)	0.0358	(0.0176)	0.0535	(0.0479)
1982-1989	20-27	0.0148	(0.0128)	0.0620	(0.0316)	0.0258	(0.0190)	0.0375	(0.0496)
1983-1988	20-27	0.0171	(0.0144)	0.0508	(0.0356)	0.0332	(0.0219)	0.0152	(0.0575)
1984-1987	20-27	0.0041	(0.0184)	-0.0265	(0.0438)	0.0626	(0.0276)	0.0798	(0.0719)
1985-1986	20-27	0.0239	(0.0123)	-0.0267	(0.0520)	0.0845	(0.0205)	0.0969	(0.0861)
1978-1993	20-26	0.0427	(0.0113)	0.1106	(0.0267)	0.0356	(0.0172)	0.0427	(0.0470)
1979-1992	20-26	0.0381	(0.0111)	0.1102	(0.0265)	0.0365	(0.0175)	0.0606	(0.0465)
1980-1991	20-26	0.0318	(0.0112)	0.0925	(0.0278)	0.0348	(0.0180)	0.0590	(0.0481)
1981-1990	20-26	0.0238	(0.0124)	0.0957	(0.0289)	0.0390	(0.0190)	0.0396	(0.0507)
1982-1989	20-26	0.0141	(0.0136)	0.0676	(0.0320)	0.0340	(0.0202)	0.0284	(0.0528)
1983-1988	20-26	0.0167	(0.0157)	0.0515	(0.0351)	0.0361	(0.0238)	0.0109	(0.0619)
1984-1987	20-26	0.0058	(0.0200)	-0.0241	(0.0430)	0.0594	(0.0286)	0.0736	(0.0792)
1985-1986	20-26	0.0298	(0.0131)	0.0136	(0.0537)	0.0851	(0.0225)	0.0882	(0.0957)
1978-1993	20-25	0.0396	(0.0130)	0.1169	(0.0291)	0.0313	(0.0205)	0.0286	(0.0537)
1979-1992	20-25	0.0347	(0.0128)	0.1166	(0.0290)	0.0317	(0.0206)	0.0471	(0.0534)
1980-1991	20-25	0.0297	(0.0131)	0.1066	(0.0300)	0.0384	(0.0209)	0.0603	(0.0546)
1981-1990	20-25	0.0178	(0.0138)	0.1010	(0.0308)	0.0452	(0.0218)	0.0492	(0.0567)
1982-1989	20-25	-0.0005	(0.0151)	0.0679	(0.0336)	0.0381	(0.0232)	0.0335	(0.0593)
1983-1988	20-25	0.0001	(0.0175)	0.0477	(0.0368)	0.0405	(0.0267)	0.0263	(0.0673)
1984-1987	20-25	-0.0096	(0.0223)	-0.0283	(0.0451)	0.0413	(0.0324)	0.0735	(0.0860)
1985-1986	20-25	0.0255	(0.0147)	0.0319	(0.0563)	0.0952	(0.0254)	0.1141	(0.1104)
1978-1993	20-24	0.0504	(0.0153)	0.1260	(0.0329)	0.0324	(0.0254)	0.0023	(0.0644)
1979-1992	20-24	0.0446	(0.0151)	0.1258	(0.0326)	0.0328	(0.0254)	0.0227	(0.0644)
1980-1991	20-24	0.0390	(0.0154)	0.1157	(0.0336)	0.0401	(0.0259)	0.0374	(0.0655)
1981-1990	20-24	0.0260	(0.0156)	0.1180	(0.0342)	0.0463	(0.0268)	0.0347	(0.0673)
1982-1989	20-24	0.0080	(0.0169)	0.0876	(0.0362)	0.0376	(0.0276)	0.0225	(0.0701)
1983-1988	20-24	0.0076	(0.0194)	0.0671	(0.0399)	0.0338	(0.0308)	0.0234	(0.0791)
1984-1987	20-24	-0.0080	(0.0246)	-0.0036	(0.0482)	0.0275	(0.0354)	0.0685	(0.0996)
1985-1986	20-24	0.0321	(0.0165)	0.0519	(0.0577)	0.1038	(0.0292)	0.1326	(0.1240)
1978-1993	20-23	0.0505	(0.0194)	0.1363	(0.0392)	0.0044	(0.0315)	0.0039	(0.0762)
1979-1992	20-23	0.0454	(0.0193)	0.1377	(0.0389)	0.0043	(0.0315)	0.0273	(0.0758)
1980-1991	20-23	0.0413	(0.0198)	0.1282	(0.0400)	0.0112	(0.0321)	0.0448	(0.0768)
1981-1990	20-23	0.0270	(0.0199)	0.1331	(0.0404)	0.0145	(0.0331)	0.0386	(0.0783)
1982-1989	20-23	0.0149	(0.0207)	0.1313	(0.0414)	0.0178	(0.0334)	0.0573	(0.0795)
1983-1988	20-23	0.0226	(0.0234)	0.1174	(0.0469)	0.0147	(0.0375)	0.0649	(0.0869)
1984-1987	20-23	-0.0165	(0.0306)	0.0263	(0.0569)	0.0024	(0.0447)	0.1193	(0.1013)
1985-1986	20-23	0.0491	(0.0197)	0.1040	(0.0657)	0.1207	(0.0351)	0.2107	(0.1428)
	Mean	0.023		0.077		0.040		0.056	

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Table 7.

The effect of the reform on labour market outcomes – de-trending, 1983 and 1988 cohorts

VARIABLES	(1) employed vs unemployed	(2) employed vs unemployed	(3) active vs inactive	(4) active vs. inactive	(5) employed vs all	(6) employed vs. all	(7) log wage	(8) log wage
Year of birth = 1984	0.0133	0.00135	-0.0213*	-0.0234**	-0.00754	-0.0132	0.0586***	0.00318
	(0.0126)	(0.0113)	(0.0128)	(0.0114)	(0.0136)	(0.0120)	(0.0188)	(0.0168)
Year of birth = 1985	0.0338***	0.00990	0.0215	0.0174	0.0381***	0.0267**	0.112***	0.00101
	(0.0129)	(0.0105)	(0.0136)	(0.0111)	(0.0146)	(0.0112)	(0.0194)	(0.0156)
Year of birth = 1986	0.0573***	**0.0215***	0.00464	**-0.00162**	0.0337**	**0.0166**	0.203***	**0.0367****
	(0.0149)	**(0.0123)**	(0.0136)	**(0.0117)**	(0.0151)	**(0.0119)**	(0.0210)	**(0.0164)**
Year of birth = 1987	0.0732***	0.0255*	0.00280	-0.00554	0.0340**	0.0112	0.199***	-0.0225
	(0.0170)	(0.0136)	(0.0146)	(0.0122)	(0.0161)	(0.0117)	(0.0261)	(0.0194)
Year of birth = 1988	0.0597***		0.0104		0.0285		0.277***	
	(0.0196)		(0.0159)		(0.0177)		(0.0282)	
Experience							0.0663***	0.0663***
							(0.00756)	(0.00756)
Experience²							-0.00646***	-0.00646***
							(0.000872)	(0.000872)
Constant	0.576***	0.599***	0.319***	0.323***	0.188***	0.199***	6.547***	6.658***
	(0.0331)	(0.0286)	(0.0211)	(0.0179)	(0.0223)	(0.0185)	(0.0516)	(0.0466)
Observations	14,205	14,205	23,232	23,232	23,256	23,256	9,067	9,067
R-squared	0.043	0.043	0.154	0.154	0.140	0.140	0.238	0.238
region fixed-effect	y	y	y	y	y	y	y	y
age fixed-effect	y	y	y	y	y	y	y	y
year-of-survey fixed-effect	y	y	y	y	y	y	y	y

Robust standard errors clustered for PSU*year in parentheses

*** p<0.01, ** p<0.05, * p<0.1

6.   CONCLUSION

The 1999 reform of the Polish education system has already been treated as a success story (Jakubowski et al. 2010; OECD 2010; Jakubowski 2015), however, no one has ever assessed its long-term labour market impacts. Similarly to two reforms during the 1950's in Sweden and the 1970's in Finland Poland has, among other things, decreased selection, lengthened compulsory schooling and imposed a national curriculum on schools. These changes in the education system of the Scandinavian countries have been shown to decrease inequality by increasing the earnings of the lower status people (see Meghir and Palme 2005; and Pekkarinen et al. 2009).

Our results are in line with the Scandinavian results. Using difference-in-difference estimates we find that the 1999 reform in Poland was successful on the long-run. Post-reform cohorts are more likely to be employed and they also earn higher wages. These effects are likely to be driven by the lowest educated, which suggests that the reform has reached its initial goal of decreasing inequalities. These results are robust to sample selection and alternative specifications.

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8. APPENDIX

Summary of independent variables

Variable	Obs	Mean	Std. Dev.	Min	Max
year of birth	48557	1985.7	3.60	1978	1994
female	48557	0.48	0.50	0	1
experience	26697	2.27	2.26	0	12
age when the first job began	23186	20.28	2.47	8	27
age	48557	22.87	2.57	19	27
level of educ.: low	43057	0.18	0.39	0	1
level of educ.: medium	43057	0.65	0.48	0	1
level of educ.: high	43057	0.17	0.37	0	1
treated	48557	0.52	0.50	0	1
gross real wage (PLZ)	16762	1473	795	15	16939
Labour market status					
at work	48557	0.44	0.50	0	1
unemployed	48557	0.12	0.33	0	1
retired	48557	0.00	0.03	0	1
inactive	48557	0.43	0.50	0	1

Number of observations in each age/year-of-survey cell

age	year of survey									
	2005	2006	2007	2008	2009	2010	2011	2012	2013	Total
19	929	814	679	657	626	586	532	497	529	5,849
20	843	821	732	623	572	569	538	499	485	5,682
21	860	730	732	655	523	528	498	511	464	5,501
22	926	773	687	655	546	539	518	496	486	5,626
23	812	801	665	658	573	491	503	469	424	5,396
24	746	708	732	618	582	523	495	489	420	5,313
25	790	644	618	640	558	515	494	479	467	5,205
26	708	676	587	555	567	534	499	495	465	5,086
27	675	599	603	531	488	527	515	501	460	4,899
Total	7,289	6,566	6,035	5,592	5,035	4,812	4,592	4,436	4,200	48,557

Number of observations in each year-of-birth/year-of-survey cell

year of birth	year of survey									
	2005	2006	2007	2008	2009	2010	2011	2012	2013	Total
1978	675	0	0	0	0	0	0	0	0	675
1979	708	599	0	0	0	0	0	0	0	1,307
1980	790	676	603	0	0	0	0	0	0	2,069
1981	746	644	587	531	0	0	0	0	0	2,508
1982	812	708	618	555	488	0	0	0	0	3,181
1983	926	801	732	640	567	527	0	0	0	4,193
1984	860	773	665	618	558	534	515	0	0	4,523
1985	843	730	687	658	582	515	499	501	0	5,015
1986	929	821	732	655	573	523	494	495	460	5,682
1987	0	814	732	655	546	491	495	479	465	4,677
1988	0	0	679	623	523	539	503	489	467	3,823
1989	0	0	0	657	572	528	518	469	420	3,164
1990	0	0	0	0	626	569	498	496	424	2,613
1991	0	0	0	0	0	586	538	511	486	2,121
1992	0	0	0	0	0	0	532	499	464	1,495
1993	0	0	0	0	0	0	0	497	485	982
1994	0	0	0	0	0	0	0	0	529	529
Total	7,289	6,566	6,035	5,592	5,035	4,812	4,592	4,436	4,200	48,557