RETURNS TO EDUCATION IN TURKEY: IV ESTIMATES FROM A DEVELOPING COUNTRY

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Abstract

This paper uses the 2002-2015 Turkish Household Labor Force Survey to examine the effects of an educational expansion on educational outcomes and returns to schooling for men and women in the 1938-2000 birth cohorts. These birth cohorts were 15-64 years of age during the survey years of 2002-2015. I obtain statistically significant increase in educational attainment due to the educational expansion of the early 1960's. Returns to schooling are estimated using instrumental variables estimation. As such these estimates are interpreted as the causal effects of education on wages. Unlike the previous studies which estimated the returns for very young cohorts with the finding of null returns for men I am able to perform the estimations for older cohorts and find that there are statistically significant and positive returns to schooling for men and women.

JEL Classification: J18, J31, I21, I28

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1. Introduction

Investments in education are evaluated by rates of return to educational investments. This is the increase in labor market earnings associated with additional education. Garry Becker in his pioneering works on human capital introduced the concept of evaluating education by its rates of return just like any other form of investment. Literature on this topic confirms that increased levels of education benefit both the individual who acquired it in terms of his/her earnings and the society at large. These positive so called externality benefits include higher growth rates, fewer crimes, reduced fertility, improved individual and household nutrition and health, higher sensitivity to social and political issues and greater civic participation. There is a large literature on both the individual and the social benefits of education both of which demonstrate the extensive benefits associated with increased levels of investment in education. Therefore, it is important to estimate both the individual and the social returns to education. This paper will provide estimates of the returns to education at the individual level. The literature on the estimates of the returns to education is vast. The procedure used for this purpose is to estimate the Mincer earnings equation which relates individual earnings to education, training and experience in its most basic form. It is one of the most stable relationships in the economics literature confirmed empirically for hundreds of samples and countries. Early studies on this topic used OLS estimation or estimation with selection into employment or wage employment since earnings can be observed only for the employed. However recently such estimates are criticized for not having causal interpretation. Indeed they merely reported estimates of associations between earnings and education but not the causal effect of education on earnings. Therefore, recent studies strive to provide causal effects of education on earnings. Almost all of such studies are for developed countries. The evidence from developing countries are scanty. The evidence from MENA countries are even less frequent. We can cite two recent studies from MENA region one on Turkey (Aydemir and Kirdar 2014) and the other on Egypt (Assaad, Aydemir, Tayfur and Kirdar, 2016). The current study aims to provide further estimates of the causal returns to education in Turkey for men and women separately. The findings will contribute to our understanding of the causal effect of education on earnings. I expect to provide more accurate estimates of the returns to education in Turkey that will be of interest to the policy makers as well as individuals in guiding their decisions on investment in education.

This paper exploits variation in the years of schooling generated by the policy change of the early 1960's. It was an education expansion explained in the Section 3 below. I exploit the variation in years of schooling generated by this policy change to estimate returns to schooling for men and women in the birth cohort of 1938-2000. These birth cohorts were 15-64 years of age during the survey years of 2002-2015. The first stage regressions show a statistically significant increase in educational attainment due to education expansion. I find that education expansion increased the years of schooling by about one year for men. Returns to schooling are estimated using instrumental Variables (IV) estimation to examine the effect of education on log hourly wages. I find statistically significant and positive estimates of the returns to schooling. Various sensitivity analyses are conducted to ensure accuracy of the results. The results are robust to alternative definitions.

This paper contributes to the literature on the effects of educational policy changes on schooling and returns to education. It extends the previous literature by using a new instrumental variable carrying out the estimation for an older cohort. A previous study by Aydemir and Kirdar (2015) focused on a law change which extended the compulsory schooling years in 1997 affecting recent cohorts and younger age groups with the finding of null returns to education for men and very small for women. In contrast, I show that in the 1938-2000 birth cohorts the education expansion produced statistically significant and positive returns to schooling which are average estimates for a very long time period. As it was pointed out by Carneiro, Heckman and Vytlacil (2005) and Heckman, Urzua and Vytlacil (2006) different instruments selected to be used produce different estimates of the returns to education even with the same data since instrumental variable estimates approximate average effects among a specific and often a small peculiar group.

This paper is organized as follows. The next section provides background on education expansion and trends in educational outcomes. Section 3 discusses the data. Section 4 focuses on empirical methodology. Empirical results are presented in Section 5. Section 6 concludes.

2. Background on Turkey's Education Expansion

Up until 1997 the education system in Turkey consisted of five years of primary school, three years of middle school, three or four years of high school or vocational and technical high school and four years of university education. Until 1997 educational reform, five years of primary school was the only compulsory level of schooling. In 1997 the compulsory level of

schooling increased from five to eight years covering the middle school also. However, the most significant reforms related to education dates back to early 1960's. In this paper I consider these education reforms and define the instrumental variable used in this paper based on the education reforms of the early 1960's. The government that came into power with the military coup of May 27 1960 considered education as one of the foremost priority areas for the nation. Prior to these reforms the primary schooling used to be only three years in the villages as compared to the five years in the cities. The primary schooling was the only compulsory level of schooling. A law enacted in January 1961 increased the compulsory primary schooling from three to five years in the villages. This increased the number of years of schooling attained significantly since proportion of the rural population was much larger than that of the urban population during those years until 1980 when the proportion of urban population surpassed that of the rural population. The other measures were directed to increasing the number of teachers and building infrastructure. A law in 1960 stipulated that men could serve as primary school teachers in villages in order to satisfy their military service requirement. Further a series of laws enacted in 1961 allowed middle school graduates to become primary school teachers and high school graduates to become middle school teachers. These increased the number of teachers in the country significantly. In this paper I will refer to these reforms as the "education expansion" of the early 1960's. Karaoglan (2015) illustrates graphically the enormous increases in the numbers of students, teachers and school buildings following this period.

I define an instrumental variable based on the educational expansion of the early 1960's and call it Policy Dummy (PD1). I use the cohorts exposed to the educational expansion and those that are not exposed in this process. This is discussed further in the section on methodology. At this point, I discuss the Figures 1, 2 and 3 which illustrate the change in the schooling attainment of the cohorts over the policy change period. These Figures are drawn by using the Turkish Household Labor Force data from the 2002-2015 waves. Figure 1 shows the proportion of individuals who complete at least primary school of five years for boys and girls for the 1940-1965 birth cohorts. By the 1952 birth cohort more than 90 percent of men completed at least five years of primary schooling. In this figure the women's achievement was less than that of men but still over 90 percent over the birth cohorts after the policy change. Figure 2 shows the proportion of individuals completing at least middle school for a total of eight years of schooling. Similarly, Figure 3 shows proportion of individuals completing at least high school for a total of 11 years of schooling. In the latter two figures women's attainment exceeds that of men for the birth cohorts after the mid-1950's. As will be

seen in the data section, this is due to the fact that we are considering a sample of wage earners and it is well known that women wage earners are better educated than men wage earners. The important point to note in all their figures is the effect of the education expansion is evident beginning around the 1951-1952 birth cohort as marked by the vertical lines.

3. The Data

The data set that is used is the Turkish Household Labor Force Surveys (HLFS) covering the period of 14 years over 2002-2015. HLFS is a nationally representative survey of individuals. The data includes information on age, level of educational attainment, hours of work for the reference week, and earnings of individuals during the past month. The earnings include bonus payments and premiums. The analysis is restricted to wage and salary earners since there is no information in the data about earnings of self-employed individuals. The outlier observations are deleted by excluding top 0.5 and bottom 0.5 percent of the wage distribution. Further restrictions on the sample in particular for the age groups are explained in the empirical results section. Table 2 reports the main descriptive statistics. The sample sizes for the 15-64 age group are 661 757 for men and 186 992 for women.

In the HLFS surveys there is no information on completed years of schooling. The surveys report highest graduated level of schooling. Therefore, in order to find the years of schooling of an individual I assign 2 years for the group of illiterates and literates without a diploma from any school; five years for primary school completion; eight years for middle school completion; 11 years for high school or vocational and technical high school completion and finally, 15 years for completing a university or above degree. Table 2 reports the mean years of schooling as well as the distribution of education levels completed. The mean years of schooling is about a year and a half higher for women than for men. The educational distribution indicates that the proportion of illiterates and those literate without a degree is slightly larger for women than for men. However, the proportion of women with a university degree or above is almost twice that of men. Therefore, I can say that the sample of women is more educated than that of men. This is not unique to the data set we have for this study. The previous studies such as Tansel (2010) also find that the sample of women wage earners is more educated than the sample of men wage earners utilizing Household Income and Expenditure Survey Data.

The surveys include information on the monthly earnings and hours of work during the reference week. I compute hourly earnings from this information as monthly wages divided by weekly hours of work times 4.3. Table 2 reports the mean log hourly wages deflated by CPI base 2010. The table shows that the mean log hourly wages is slightly higher for women than for men.

In the HLFS surveys there is no information on the date of birth. The birth year of the individuals are computed by subtracting the reported age from the survey year. Table 2 shows that women are about three years younger than men. The educational expansion of the early 1960's affects the individuals born at 1952 or later assuming that the children start school at 6 years of age. Therefore, I define a Policy Dummy, indicated by PD1, as equal to 1 for those born in 1952 or later and zero for those born earlier. PD1 is used as an instrument for education. Table 2 shows that 97.9 percent of the total sample men and 99.3 percent of the total sample of women are exposed to this policy dummy. In other words, they are the treated group sometimes referred to as the sample of compliers.

4. Empirical Methodology

This paper estimates the causal effect of education on earnings in Turkey. Therefore, the aim is to ascertain the returns to education in Turkey. Several previous studies on returns to education in Turkey used selectivity corrected OLS estimates (Tansel 1994; Tansel 2001; Tansel 2010; Tansel and Bircan 2011) and found significantly high returns to schooling. Similarly, for Palestine selectivity corrected OLS method was used by Tansel and Daoud (2014). A recent study by Aydemir and Kirdar (2015) provided causal estimates of returns to schooling in Turkey which are nearly null for men and positive but very small for women They considered a very young cohort of wage earners. This study furthers the latter work and provides causal returns to schooling estimates for Turkey by using a different instrumental variable for the cohort of older wage earners. I use the instrumental variable estimation method. The education expansion that took place in the early 1960s is used as an instrument. This policy change is used successfully as a valid instrument in a different context on a health study in Turkey (Karaoglan, 2015). The rationale for using the IV methodology is that this method addresses the issue of endogeneity of education variable in the earnings equation and provides consistent estimates of the effect of education on earnings. I consider the following model:

$$\log w_i = \beta_0 + \beta_1 \text{Educ}_i + X\delta + u_i \qquad (1)$$

where w is the hourly wages of individual i. Educ is the individual's years of schooling. OLS estimates of Equation (1) are regarded as biased upward and inconsistent since years of schooling could correlate with the error term in this equation. This could be due to the fact that higher ability and motivated individuals attain higher education and higher wages. OLS gives biased and inconsistent estimates of the effect of education on earnings if ability is omitted which may be correlated with education.Griliches (1977) and Willis (1986 both provide surveys on omitted variables bias in the estimates of returns to education. Therefore, obtaining consistent estimates of β_1 requires use of techniques that take into account the endogeneity of the education. This issue is widely discussed in the literature, see for example Card (1999). Griliches find little ability bias in the returns to education estimates in the US. However he points out that the attenuation bias due to the measurement error may be large and more important. Angrist and Krueger find that OLS estimates do not differ much from the IV estimates in the US which suggest that endogeneity is not an empirically important issue of bias in the returns to education estimates. However Bound, Jaeger and Baker (1995) find problems with the explanatory power of instruments used by Angrist and Krueger[1]. I aim to obtain a consistent estimate of the parameter β_1. It is the percent change in wages as schooling increase by one year. The other covariates are included in X. They are controls for age and survey years which are defined as binary variables.

I use an instrumental variable strategy in order to obtain consistent estimates of the returns to schooling using educational expansion of the early 1960's as an instrumental variable for the educational attainment. The first stage specification of this process is:

$$\text{Educ}_i = \alpha_0 + \alpha_1 \text{PD1}_i + X\theta + v_i \qquad (2)$$

Where Educ_i is the years of schooling attainment of individual i and PD1 is a dummy variable for policy change of education expansion.

[1] Researchers used different instrumental variables as a source of exogenous variation in schooling to estimate the causal effect of education on wages. Angrist and Krueger (1991)and Acemoglu and Angrist (2001) used the institutional features of the education sytem namely persons who stay in school longer as a result. Kane and Rouse (1995), Card (1995), Connely Uusitalo and Maluccio (1997) used the distance to the nearest college as instrument. Duflo (2001) used new school construction at different locations in Indonesia. Many studies used changes in compulsory schooling laws for identification. Harmon and Walker (1995) and Oreopoulos (2006) compared bith cohorts that are affected by the law with those that are not affected.

Table 1 gives the birth cohorts of the individuals by their ages indicating whether or not they are exposed to the education expansion of the early 1960's. As can be observed in this table only the age group 51-63 includes birth cohorts that are exposed to the educational expansion and those that are not. Those who are 50 years of age or younger are all affected by the policy change and those who are 64 or older are all not affected by the policy change. Therefore, the age group of 51-64 defines the appropriate age group to study the effect of the educational expansion on years of schooling. In the empirical section I will consider alternative age groups as well.

Imbens and Angrist (1994) and Oreopoulos (2006) as well as Heckman (2001) in several articles and Lang (1993) discussed that Two Stage Least Squares (2SLS) can be interpreted as the Local Average Treatment Effect (LATE) which gives the treatment effect for the so called compliers which are the individuals who are exposed to the treatment. LATE could differ from the Average Treatment Effect (ATE) for the population especially if there is heterogeneity in the parameter of interest. However, these authors also discussed that LATE estimates will be closer to ATE estimates as the sample of those who are exposed to the treatment gets larger. In my case, the education expansion of the early 1960's affected a large segment of the population. Therefore, my 2SLS estimates of the returns to schooling are more likely to represent ATE estimates.

5. Empirical Results

5.1 First Stage Estimates: Impact of Educational Expansion on Educational Attainment

Table 3 presents the first stage estimation results by gender for alternative samples of age cohorts. PD1 stands for the Policy Dummy 1 for the educational expansion of the early 1960's. All models include cohort dummies defined for the age groups in Table 2 and survey year dummies.[2] Considering first the results for men, the results indicate that the effect of the

[2] In general researchers include a rural/urban dummy and the regional indicators as further controls in this equation. I did not follow this route since rural/urban dummy indicators are not available after 2013. I also did not include regional controls since they are not available in a comparable manner before 2004. These allow me to include the survey waves of 2002-2003 and 2014-2015 in my analyses. However, analyses which include the rural/urban indicator and the regional controls produced qualitatively similar results to the ones that are reported here.

educational expansion (PD1) on years of schooling are all positive and statistically significant across the three samples considered. The size of the coefficient estimates are slightly over one or close to one. Therefore, we can say that the educational expansion increased the men's educational attainment by about one year which can be considered modest. The F-statistics are much higher than the levels suggested by Steiger and Stock (1997) for a strong instrument. In contrast, I do not find statistically significant effect of the educational expansion on educational attainment of women. This result I believe is due to the very few observations for women during the pre-treatment period which will be addressed further at a later stage of the study.

5.2 Second Stage Results: Estimates of the Returns to Schooling

The second stage estimates are shown in Table 4. In this table The OLS and 2SLS (with PD1) estimates of the returns schooling are presented in the first two columns respectively. I will only consider the results for men in view of the poor first stage estimates with PD1 for women. This table presents the results for the age group 15-64. Both the OLS and the 2SLS estimates are positive and highly statistically significant. The endogeneity test strongly rejects the null hypothesis of exogeneity of education in the wage equation. The OLS estimate of the returns to schooling for men is about 0.090. This is similar to the previous OLS estimates (see Tansel, 2010). The 2SLS estimate for men is slightly lower at 0.070. These estimates are larger than that found by Kirdar and Aydemir with a different instrumental variable for a very young cohort of individuals. In fact, their 2SLS estimate of returns to schooling for men is null. As remarked earlier this is possible, since the instrument used and the sample considered are different although the data set is the same. However, these estimates are similar to the IV estimates of returns to schooling for other developing countries. For instance, Duflo (2001) found an estimate of ???? for Indonesia; Spohr (2003) found an estimate of ??? for Taiwan and Fang et al. (2012) found an estimate of 20 percent for China which is much higher than in Turkey. For developed countries estimates of returns to education vary widely from 0 for Germany (Pischke and von Wachter, 2008) to 15 percent in the UK (Oreopoulos, 2006).

5.3 Estimates for Different Levels of Education

This section presents the first stage and the second stage estimation results for different education levels. The first stage estimates of the effects of the education expansion (PD1) are

presented in Tables 5-A and 5-B for men and women respectively. The corresponding estimates of the returns to schooling of the second stage estimations are provided in Tables 5-C and 5-D for men and women respectively. It makes sense to examine the returns to schooling by edication level since the education expansion significantly affected the primary, middle and high school levels as it was shown in Figures 1, 2 and 3. Table 5-A indicates that for men the education expansion (PD1) increases the years of schooling by about 1.3 years at the primary, 0.98 years at the middle and 1.4 years at the high school levels. Table 5-B indicates that for women the education expansion (PD1) increases the years of schooling by about .87 years at the primary, 0.05 years at the middle and 0.48 years at the high school levels. These coefficient estimates are all statistically significant. For both men and women the increases are lower at the middle school level than at the other levels. The increases at all levels of education are lower for women then for men indicating that the effect education expansion women's schooling was less than that of men at all levels of schooling. The second stage estimates of returns to schooling for men are shown in Table 5-C. I note that all of the the estimates are statistically significant and positive. OLS estimates are larger than the 2SLS estimates. In both cases the returns to school estimates increase with the levels of education where the highest returns are for the high school level. The second stage estimates of returns to schooling for women are shown in Table 5-D. Here the results are mixed. Not all of the return estimates are positive or statistically significant.

5.4 Estimates with Alternative Definitions of PD1

This section presents the first stage and the second stage estimation results for alternative definitions of PD1. The first stage estimates of the effects of the education expansion (altenative definitions of PD1) are presented in Table 6-A for men and women. The corresponding estimates of the returns to schooling of the second stage estimations are provided in Table 6-B for men and women. It makes sense to examine the returns to schooling by education level since the education expansion significantly affected the primary, middle and high school levels as it was shown in Figures 1, 2 and 3. Table 6-A Column (1) uses a Policy Dummy where it takes a value of one for the cohorts born in 1951 or later and zero otherwise. This alternative is provided since some of the children may have started primary school at the age of seven in place of six as it was assumed in the previous definition so far. The estimates for this alternative are provided in Column (1) for men and Column (5) for women. The second alternative excludes both the 1951 and 1952 birth cohorts from the sample because of this fuzziness in the school start age. The estimates for this alternative are provided in Column (2) for men and Column (6) for women. In the cases for men the effect of

these alternative definitions for PD1 are all positive and statistically significant. In the cases for women the coefficient estimates are insignificant. These results may be due to the presence of very few observations before the 1952 cohorts for women. The second stage estimates of returns to schooling for men are shown in Table 6-B. The results are not provided for women. I note that all of the the estimates for men are statistically significant and positive. OLS estimates are larger than the 2SLS estimates.

5.5 Estimates with an Alternative Educational Policy Reform

In this section we consider an alternative educational policy reform namely the 1997 extension of the compulsory schooling from five to eight years. Effect of this educational reform on years of schooling and estimating the returns to education are studied by Aydemir and Kirdar (2015). They used the 2002-2013 survey waves of the HLFS and considered the age cohort of 18-26. I was able to replicate their results of null returns to schooling for men and about 3.8 percent returns for women. In this study used the 2002-2015 survey waves of HLFS and various age cohorts. Similar to Aydemir and Kirdar, I define the Policy Dummy (PD2) as taking the value of one for the birth cohorts 1987 or later and zero otherwise. The first stage results are reported in Table 3 for men and women for various samples restricted by age. All of the coefficient estimates of the Policy Dummy (PD2) defined by the extension of the compulsory schooling (referred to as CSL) are positive and statistically significant. They indicate that for men the CSL reform increased the years of schooling by about 0.40 years for men and by about 0.60 years for women. I note the larger effect of CSL on women than on men. The second stage results of returns to schooling are reported in Table 4 for man and women along with the OLS estimates. The result for men is negative and the result for women indicates a return of about two percent. Next, I remark on the first stage results by education level for men and women reported in Tables 5-A and 5-B respectively. These estimates are positive and statistically significant and indicate about one year increase in years of schooling at the middle school level and about 0.65 years of schooling at the high school level for both men and women. The corresponding estimates of the returns to schooling are reported in Tables 5-C and 5-D for men and women respectively. They are all positive and statistically significant. Tables 6-A and B report the results with alternative definitions of the PD2 due to CSL

Tables 3, 4, 5 and 6 also report the results when two instruments the PD1 and PD2 are used. These results are unremarkable as the estimates seen to be averages of the cases when PD1 and PD2 used separately.

6. Conclusions

This paper estimates returns to schooling for men and women in Turkey using instrumental variables method. As such these estimates are interpreted as the causal effects of education on wages. Unlike the previous studies which estimated the returns for very young cohorts with the finding of null returns for men I am able to perform the estimations for older cohorts and find that there are statistically significant and positive returns to schooling. The 2SLS results are obtained by using the exogenous variation in years of schooling brought about by the education expansion of the early 1960's. The instrument defined using this policy change brought about significant changes in years of schooling at various levels. The instrument defined as such satisfies the rules of instrument exogeneity and relevance. Further, the returns to schooling estimates can be considered close to the ATE estimates for the population since the education expansion was stipulated to affect schooling outcomes of the entire population. My estimates of the returns to schooling are smaller for the 2SLS estimates than for the OLS estimates. Further the estimates for women are found to be slightly less for women then for men. It is expected that these results will be useful to the policy makers and the individuals who are making the investments into education.

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MEEA conference, March 20-23, 2009 in Nice, France and ICE-TEA conference, September 1-3, 2010 in Girne, Republic of Northern Cyprus.

Figure 1: Proportion Completing at Least Primary School by Birth year and Gender

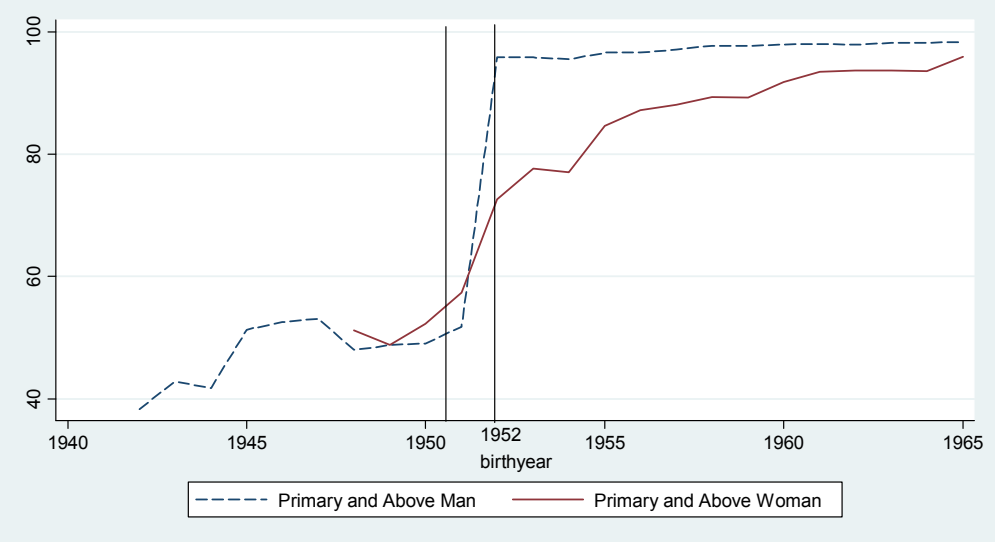

Figure 2: Proportion Completing at Least Middle School by Birth year and Gender

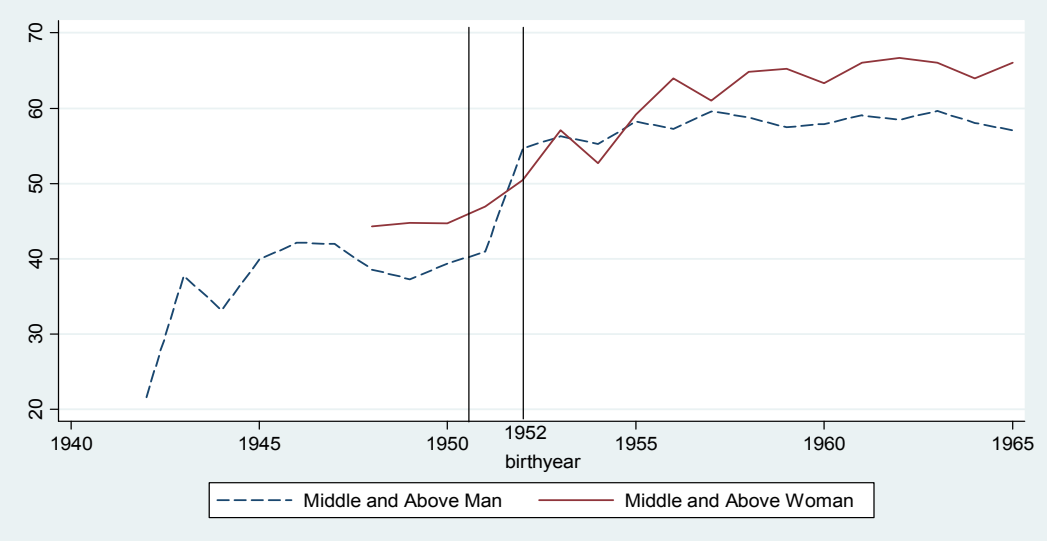

Figure 3: Proportion Completing at Least High School by Birth year and Gender

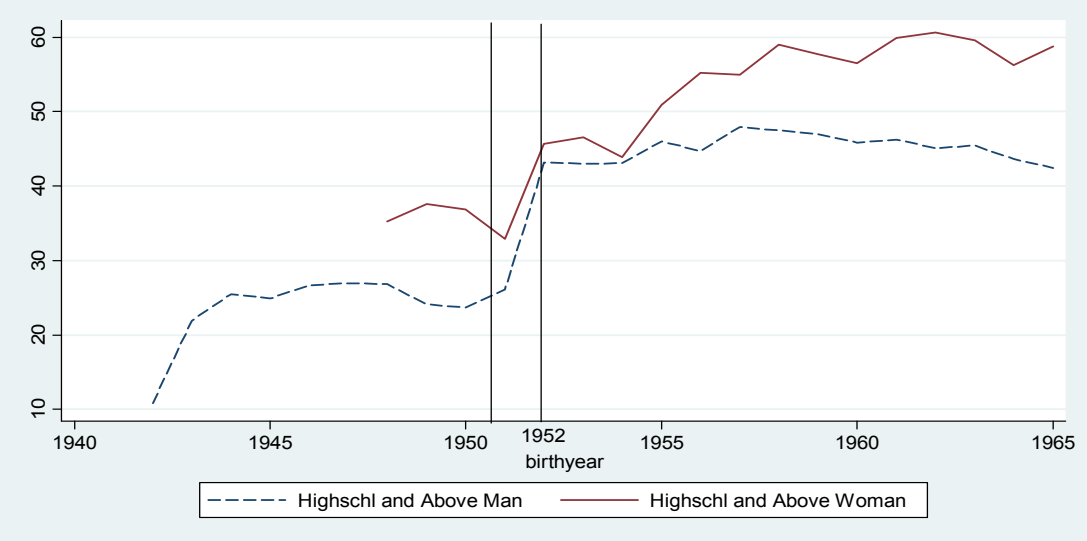

Table 1: Birth Year by Survey Year and Age, 2002-2015, Turkey

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Age														
50	**1952**	**1953**	**1954**	**1955**	**1956**	**1957**	**1958**	**1959**	**1960**	**1961**	**1962**	**1963**	**1964**	**1965**
51	1951	**1952**	**1953**	**1954**	**1955**	**1956**	**1957**	**1958**	**1959**	**1960**	**1961**	**1962**	**1963**	**1964**
52	1950	1951	**1952**	**1953**	**1954**	**1955**	**1956**	**1957**	**1958**	**1959**	**1960**	**1961**	**1962**	**1963**
53	1949	1950	1951	**1952**	**1953**	**1954**	**1955**	**1956**	**1957**	**1958**	**1959**	**1960**	**1961**	**1962**
54	1948	1949	1950	1951	**1952**	**1953**	**1954**	**1955**	**1956**	**1957**	**1958**	**1959**	**1960**	**1961**
55	1947	1948	1949	1950	1951	**1952**	**1953**	**1954**	**1955**	**1956**	**1957**	**1958**	**1959**	**1960**
56	1946	1947	1948	1949	1950	1951	**1952**	**1953**	**1954**	**1955**	**1956**	**1957**	**1958**	**1959**
57	1945	1946	1947	1948	1949	1950	1951	**1952**	**1953**	**1954**	**1955**	**1956**	**1957**	**1958**
58	1944	1945	1946	1947	1948	1949	1950	1951	**1952**	**1953**	**1954**	**1955**	**1956**	**1957**
59	1943	1944	1945	1946	1947	1948	1949	1950	1951	**1952**	**1953**	**1954**	**1955**	**1956**
60	1942	1943	1944	1945	1946	1947	1948	1949	1950	1951	**1952**	**1953**	**1954**	**1955**
61	1941	1942	1943	1944	1945	1946	1947	1948	1949	1950	1951	**1952**	**1953**	**1954**
62	1940	1941	1942	1943	1944	1945	1946	1947	1948	1949	1950	1951	**1952**	**1953**
63	1939	1940	1941	1942	1943	1944	1945	1946	1947	1948	1949	1950	1951	**1952**
64	1938	1939	1940	1941	1942	1943	1944	1945	1946	1947	1948	1949	1950	1951

Notes: The body of the table displays the birth years which are indicated in bold when the cohort is affected by the educational expansion. Those aged 50 and younger are all affected by the policy change. Those aged 64 and older are all not affected by the policy change. Only the age group 51-63 includes birth cohorts which are both affected and not affected by the policy change.

Table 2: Descriptive Statistics, 2002-2015, Turkey

	male		female	
	mean	**std.dev.**	**mean**	**std.dev.**
Treated (PD1=1)	0.979	0.143384	0.993	0.0833675
log hourly wages	1.41264	0.6760482	1.426348	0.7024368
years of schooling	9.094924	3.866005	10.68174	4.213764
Education				
not educated	0.023	0.149903	0.039	0.193595
primary	0.327	0.469117	0.205	0.403702
middle	0.177	0.381669	0.101	0.301329
high Sch	0.275	0.446514	0.267	0.442392
univ & above	0.2	0.4	0.388	0.487295
age	35.76202	10.02199	32.81358	9.496872
female	0	0	1	0
Cohort				
(15-19)	0.046	0.209485	0.062	0.241156
(20-24)	0.088	0.283295	0.156	0.362855
(25-29)	0.165	0.371181	0.194	0.395429
(30-34)	0.177	0.381669	0.179	0.383352
(35-39)	0.163	0.369366	0.158	0.364741
(40-44)	0.151	0.358049	0.127	0.332973
(45-49)	0.113	0.316593	0.075	0.263391
(50-54)	0.061	0.239330	0.034	0.181229
(55-59)	0.026	0.159135	0.012	0.108885
(60-64)	0.009	0.09444	0.004	0.063119
year				
2002	0.044	0.205095	0.041	0.198290
2003	0.044	0.205095	0.04	0.195959
2004	0.065	0.246526	0.055	0.227980
2005	0.069	0.253454	0.059	0.235625
2006	0.071	0.256825	0.065	0.246526
2007	0.072	0.258488	0.068	0.251746
2008	0.074	0.261771	0.07	0.255147
2009	0.074	0.261771	0.07	0.255147
2010	0.081	0.272835	0.076	0.264998
2011	0.085	0.278882	0.084	0.277388
2012	0.084	0.277388	0.09	0.286182
2013	0.083	0.275882	0.095	0.293215
2014	0.078	0.268172	0.091	0.287609
2015	0.078	0.268172	0.096	0.294591
N	661757		186992	

Table 3: First Stage Results by Gender, 2002-2015, Turkey

	man				woman			
First stage	**Age 15-64**	**Age 20-64**	**Age 25-64**	**Age 15-44**	**Age 15-64**	**Age 20-64**	**Age 25-64**	**Age 15-44**
One Instrument:								
PD1	**1.1583**	**0.994**	**0.894**		**0.049**	**0.043**	**0.034**	
Std. err	0.043	0.006	0.038		0.138	0.181	0.254	
Observation	661757	638351	613425		186992	175381	168511	
R-Square	0.025	0.023	0.021		0.066	0.066	0.056	
F-statistic	727.42	704.16	700.11		571.89	516.89	511.19	
One Instrument:								
PD2	**0.396**	**0.334**	**0.318**	**0.328**	**0.586**	**0.683**	**0.613**	**0.611**
Std. err	0.023	0.025	0.021	0.023	0.038	0.041	0.051	0.049
Observation	661757	638351	613425	523582	186992	175381	168511	163752
R-Square	0.024	0.029	0.026	0.028	0.067	0.069	0.063	0.0633
F-statistic	707.96	715.96	729.15	794.86	582.76	525.91	519.76	582.55
Two Instruments:								
PD1	**1.219**	**1.091**	**1.183**		**0.081**	**0.045**	**0.055**	
Std. err	0.043	0.031	0.039		0.138	0.180	0.150	
PD2	**0.445**	**0.599**	**0.618**		**0.588**	**0.631**	**0.689**	
Std. err	0.023	0.029	0.025		0.038	0.029	0.031	
Observation	661757	638351	613425		186992	175381	168511	
R-Square	0.025	0.023	0.045		0.067	0.061	0.062	
F-statistic	712.81	783.81	795.81		558.49	508.34	516.43	

Notes: Heteroscedasticity consistent standard errors are given in parenthesis. ***, ** and * indicate statistical significance at 1, 5 and 10 levels of significance. PD1 stands for Policy Dummy 1 for the educational expansion. PD2 stands for the Policy Dummy 2 for the extension of the compulsory schooling ın 1997. All models include survey year dummies and cohort dummies for the relevant age groups indicated in Table 2.

Tablo 4: Estimating of Returns to Schooling by Gender, 2002-2015, Turkey

Second stage Results	man				woman				
	OLS	**2SLS**	**2SLS**	**2SLS**	**OLS**	**2SLS**	**2SLS**	**2SLS**	**2SLS**
		with PD1	**with PD2**	**with PD1&PD2**		**with PD1**	**with PD2**	**with PD1&PD2**	age(15-44) **with PD2**
Education	0.089	0.067	-0.001	0.047	0.104	0.109	0.019	0.017	-0.007
	0.001	0.005	0.009	0.004	0.002	8.338	0.009	0.009	0.013
Observations.	661757	661757	661757	661757	186992	186992	186992	186992	163752
R-Square	0.444	0.433	0.181	0.385	0.527	-	0.288	0.272	0.141
EndogeneityTest	-	21.7	138.3	117.1		83.5	117.82	126.1	122.9

Notes: This table provides estimates for the age group 15-64, In all models for men the number of observations is 661,757 and for women they are 186,699 except in the last column where it is 163,752. For further explanations see notes to Table 3.

Table 5-A: First Stage Results for Men by Education Level, 2002-2015, Turkey

	man					
	Age(15-64)			Age(15-44)		
First stage	primary or less	middle or less	High school or less	primary or less	middle or less	High school or less
One Instrument:						
PD1	1.275***	0.984***	1.349***			
	0.011	*0.023*	*0.035*			
Observations	231026	347830	529564			
R-Square	0.17	0.1054	0.0421			
F-statistic	2057.6	1781.9	1010.77			
One Instrument:						
PD2	-	1.089***	0.646***	-	1.127***	0.650***
	-	*0.013*	*0.018*	-	*0.014*	*0.018*
Observations	231026	347830	529564	171747	271440	422630
R-Square	-	0.1179	0.0417	-	0.1098	0.0295
F-statistic	-	2021.3	1002.13	-	1761.89	676.53
Two Instruments:						
PD1	1.169***	1.142***	1.453***			
	0.011	*0.023*	*0.035*			
PD2	-	1.143***	0.703***			
	-	*0.013*	*0.018*			
Observations	231026	347830	529564			
R-Square	0.2796	0.1244	0.0448			
F-statistic	3735.61	2058	1034.14			

Notes: See notes to Table 3.

Table 5-B: First Stage Results for Women by Education Level, 2002-2015, Turkey

	woman					
	15-64			15-44		
First stage	primary or less	middle or less	High school or less	primary or less	middle or less	High school or less
One Instrument:						
PD1	0.866***	0.048***	0.475***			
	0.051	*0.079*	*0.12*			
Observations	45721	64520	114484			
R-Square	0.1711	0.1083	0.0853			
F-statistic	410.06	340.51	464.27			
One Instrument:						
PD2	-	0.969***	0.820***	-	1.127***	0.65***
	-	*0.029*	*0.034*	-	*0.013*	*0.018*
Observations	45721	64520	114484	171747	271440	422630
R-Square	-	0.1231	0.0897	-	0.1098	0.0295
F-statistic	-	393.78	490.52	-	1761.89	676.53
Two Instruments:						
PD1	0.634***	0.250***	0.674***			
	0.047	*0.079*	*0.121*			
PD2	-	0.976***	0.833***			
	-	*0.029*	*0.034*			
Observations	45721	64520	114484			
R-Square	0.2922	0.1233	0.09			
F-statistic	786.06	377.84	471.48			

Notes: See notes to Table 3.

Table 6-A: First Stage Results by Gender with Alternative Policy Dummy (PD1) Definitions, 2002-2015, Turkey

	man				woman			
	1951&=1	Birthyear (1951-1952) obs deleted	Birthyear (1986-1987) obs deleted	Birthyear (1951-1952 & 1986-1987) obs deleted	1951&=1	Birthyear (1951-1952) obs deleted	Birthyear (1986-1987) obs deleted	Birthyear (1951-1952 & 1986-1987) obs deleted
First stage	(1)	(2)	(3)	(4)	(5)	(7)	(8)	(9)
One Instrument:								
PD1	1.077***	1.195***	1.092***	1.213***	-0.336	-0.401	-0.305	-0.363
	0.049	*0.052*	*0.049*	*0.052*	*0.161*	*0.171*	*0.162*	*0.172*
Observations	661757	655397	633744	627384	186992	186268	175169	174445
R-Square	0.0243	0.024	0.0213	0.021	0.0657	0.0647	0.0595	0.0583
F-statistic	716.6	701.55	600.08	585.95	572.09	559.92	481.82	469.87
One Instrument:								
PD2	0.376***	0.386***	0.419***	0.431***	0.522***	0.525***	0.713***	0.717***
	0.022	*0.022*	*0.027*	*0.028*	*0.0378*	*0.037*	*0.045*	*0.045*
Observations	661757	655397	633744	627384	186992	186268	175169	174445
R-Square	0.024	0.0237	0.0209	0.0206	0.0667	0.0656	0.0608	0.0597
F-statistic	707.62	691.35	588.14	572.61	580.76	568.65	492.94	481.09
Two Instruments:								
PD1	1.139***	1.27***	1.145***	1.283***	-0.213	-0.263	-0.161	-0.202
	0.049	*0.052*	*0.049*	*0.052*	*0.161*	*0.171*	*0.163*	*0.172*
PD2	0.412***	0.425***	0.462***	0.4788354	0.519***	0.522***	0.710***	0.714***
	0.022	*0.022*	*0.028*	*0.0279475*	*0.037*	*0.037*	*0.045*	*0.046*
Observations	661757	655397	633744	627384	186992	186268	175169	174445
R-Square	0.0248	0.0246	0.0217	0.0215	0.0667	0.0656	0.0608	0.0597
F-statistic	701.29	687.86	586.71	574.03	556.64	545.06	472.44	461.1

Notes: See notes to Table 3.

Table 7: OLS Estimates of Returns to Schooling by Level of Education, 2002-2015, Turkey

VARIABLES	(man) OLS	(woman) OLS
Education		
primary	0.0943***	0.0666***
	(0.00424)	(0.00620)
middle	0.258***	0.242***
	(0.00432)	(0.00665)
high Sch	0.469***	0.524***
	(0.00425)	(0.00609)
univ & above	1.070***	1.144***
	(0.00432)	(0.00601)
Observations	661,757	186,992
R-squared	0.462	0.546

Notes: See notes to Table 3.