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DOES EDUCATION AFFECT EARNINGS? AN APPLICATION FROM TÜRKİYE*

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Abstract

Education is an important determination for the earnings differentials. The differences in education and the earnings level are investigated in Mincer earnings function. In this study, return to education is investigated in Türkiye by Mincer earnings function using cross sectional data of the Household Budget Statistics micro data set in the years between 2011 and 2019. The return to education is estimated using semiparametric regression method and extended applying control function approach. The control function approach is used as instrumental variable and the 1997 education reform is applied as control function in the paper. The achieved findings of the study show that the education positively affects the earnings level in concerned period. Semiparametric regression estimation results indicate that this effect is higher for certain periods in each year. According to the control function approach results, the effect is negative in some periods contrary to semiparametric test results.

Keywords: Return to Education, Endogeneity, Semiparametric Regression, Control Function Approach

JEL Codes: I21, I26, J31

EĞİTİM KAZANÇLARI ETKİLER Mİ? TÜRKİYE'DEN BİR UYGULAMA

Abstract

Eğitim, kazanç farklılıkları açısından önemli bir belirleyicidir. Mincer kazanç fonksiyonunda eğitim ve kazanç düzeyindeki farklılıklar araştırılmaktadır. Bu çalışmada, Türkiye'de eğitimin getirisi, Hanehalkı Bütçe İstatistikleri mikro veri setinin 2011-2019 yıllarına ait kesit verileri kullanılarak Mincer kazanç fonksiyonu ile araştırılmaktadır. Eğitimde getiri, yarı parametrik regresyon yöntemi ve genişletilmiş kontrol fonksiyonu uygulanarak tahmin edilmektedir. Araştırmada araç değişken olarak kontrol fonksiyonu yaklaşımı kullanılmış ve kontrol fonksiyonu olarak 1997 eğitim reformu uygulanmıştır. Araştırmadan elde edilen bulgular, eğitimin söz konusu dönemdeki kazanç düzeyini olumlu yönde etkilediğini göstermektedir. Yarıparametrik regresyon tahmin sonuçları bu etkinin her yılın belirli dönemlerinde daha yüksek olduğunu göstermektedir. Kontrol fonksiyonu yaklaşımı sonuçlarına göre etki, yarı parametrik test sonuçlarının aksine bazı dönemlerde negatiftir.

Anahtar Kelimeler: Eğitimin Getirisi, İçsellik, Semiparametrik Regresyon, Kontrol Fonksiyonu Yaklaşımı

JEL Kodları: I21, I26, J31

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INTRODUCTION

Return to education is accepted as an important indicator of economic growth and development in countries all over the world. Estimating the investments in education is extensively used in empirical studies. Besides, the determination of earnings level based on the return to education increases the efficiency in labour markets. Human capital theory reveals the differences of human capital accumulation among workers as one of the reason of differences in earnings level. Thus, education level is indicated as the reason of the earnings differentials.

The earnings differentials issue is investigated in various studies as a significant research topic in labour markets literature. The earning function developed by Mincer (1974) points out the determinations of this difference. Mincer earning model presents the relationship between education as a factor of human capital and earnings level in labour markets successfully. Mincer analyses the impact of education and experience on the earnings level and reveals that these two factors affect the earnings positively. In addition, education and experience are important determinants on the earnings level according to Mincer. More educated and more experienced workers earn more than the workers who are less educated and less experienced.

Mincer (1974) indicates a model, in which earnings level is linear in education and quadratic in experience for estimating returns to education. The increase in schooling causes a rise in earnings level as well. Experience has also positive impact on the earnings, however this effect turns into negative in the following years. Various studies based on the Mincer earning model evaluate the experience in quadratic form (see, for example, Azam 2012; Tansel and Bodur 2012; Furno 2013). However, Murphy and Welch (1990), Seltzer and Frank (2007) and Stanfors and Burnette (2015) observe that quartic form fits a better estimation in the functional type of Mincer earnings function. According to the obtained results of these studies, there is not an exact functional form in the relationship between experience and earnings level in Mincer earnings model. Keele (2008) states a proper functional estimation as a better alternative method in the absence of the information of functional form. Identification failure of the parametric form among the variables causes invalid estimation results. In this way, not to identify a parametric form can be approved. Uncertainty in the functional form of the relationship between dependent variable and control variable enables using nonparametric and semiparametric regression methods.

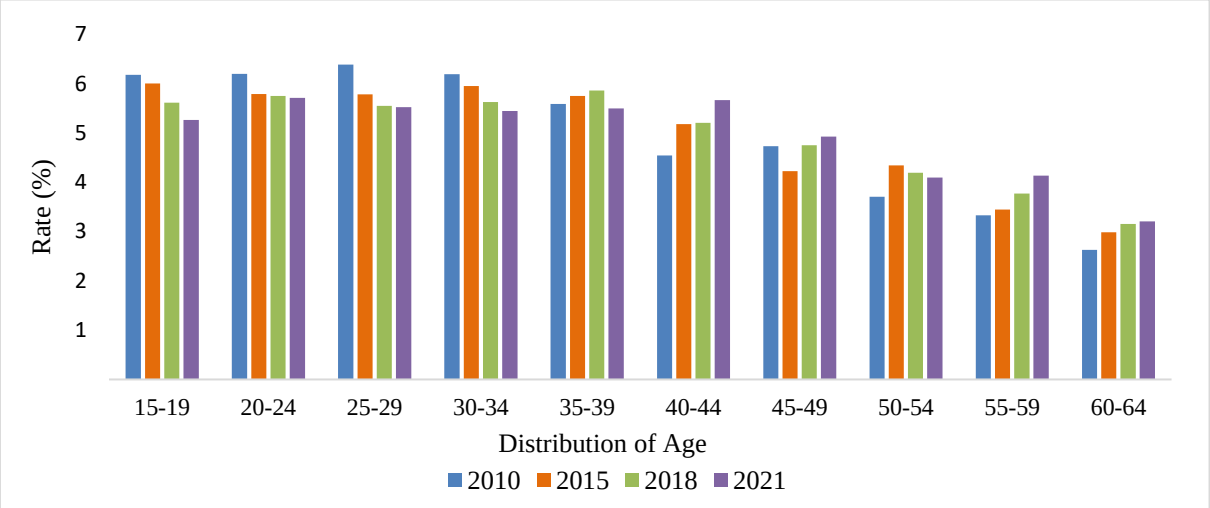
The schooling is considered as endogenous variable due to unobserved variables affecting earnings. Correlation of schooling with these unobserved variables in applying the Mincer earning function may cause inconsistent and biased estimation results. In the nonparametric regression method, the control function approach can be used to solve the endogeneity problem.

In this paper, the impact of schooling years as a proxy variable of education on the earning level in Türkiye is investigated. For this purpose, Mincer earnings model is estimated using semiparametric regression method considering the endogeneity problem in the study. In this context, the return to education in Türkiye is analysed by using cross sectional data set obtained from Turkish Statistical Institute in the period from 2011 to 2019. The rest of the paper is organized as follows: Section 2 involves labour participation in Türkiye. Empirical literature and methodology and data are presented in Section 3 and Section 4 respectively. Section 5 discusses results and finally Section 6 comprises conclusion and policy implication.

LABOUR PARTICIPATION IN TÜRKİYE

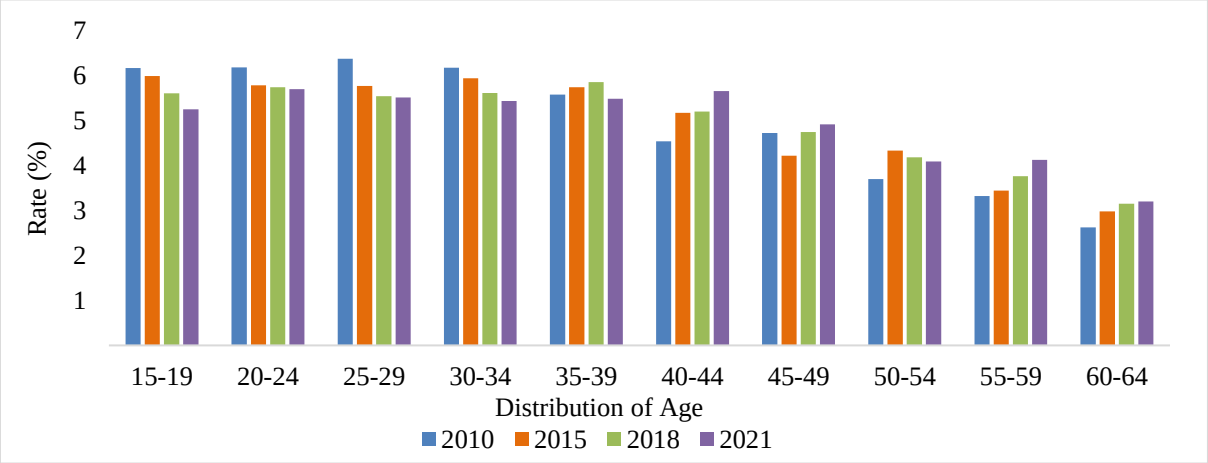
Dynamic and young population structure of Türkiye ensures the working age population to be most crowded part in all of age groups. According to Turkish Statistical Institute (TURKSTAT) (2022a), working age population rate is approximately 67% of total population in 2021. Population density is gathered in the young-age population groups in the concerning of males and females separately. Figure 1 and Figure 2 show age- group distribution of working age population in Türkiye for the years of 2010, 2015, 2018 and 2021 for males and females respectively.

Figure 1: Age distribution of working- age population (Males)



Source: TURKSTAT, 2022a

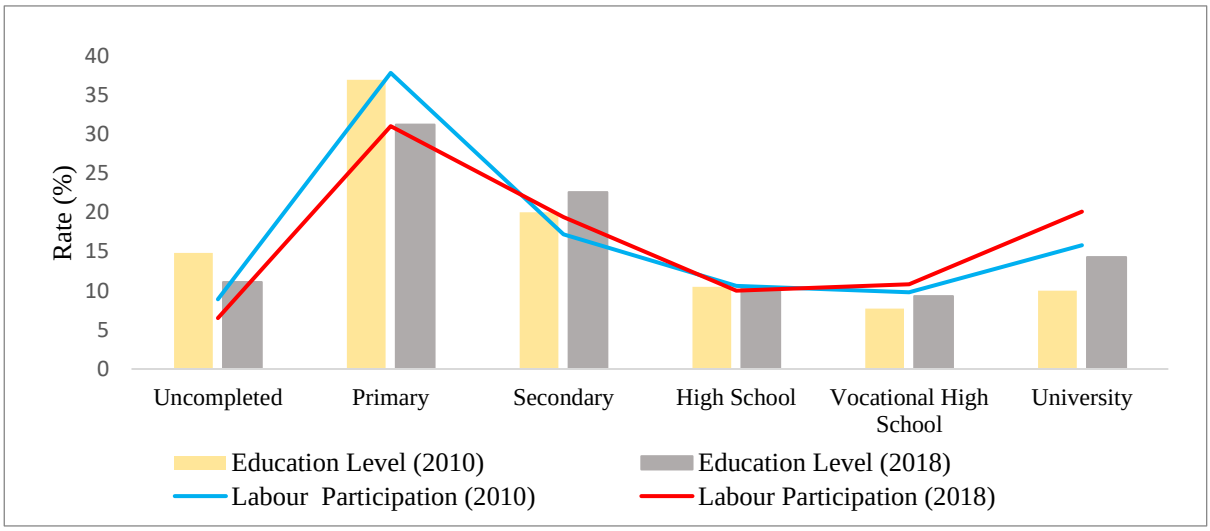
Figure 2: Age distribution of working- age population (Females)



Source: TURKSTAT, 2022a

According to the Figure 1 and Figure 2, working-age population intensification is in the 25-29 age group for both of genders in 2010. This intensity shifts to 30-34, 35-39 and 40-44 in the years 2015, 2018 and 2021 respectively. As can be easily seen from these figures, the age groups of 55-59 and 60-64 increase over time for both genders.

Figure 3: Labour participation rate by education level



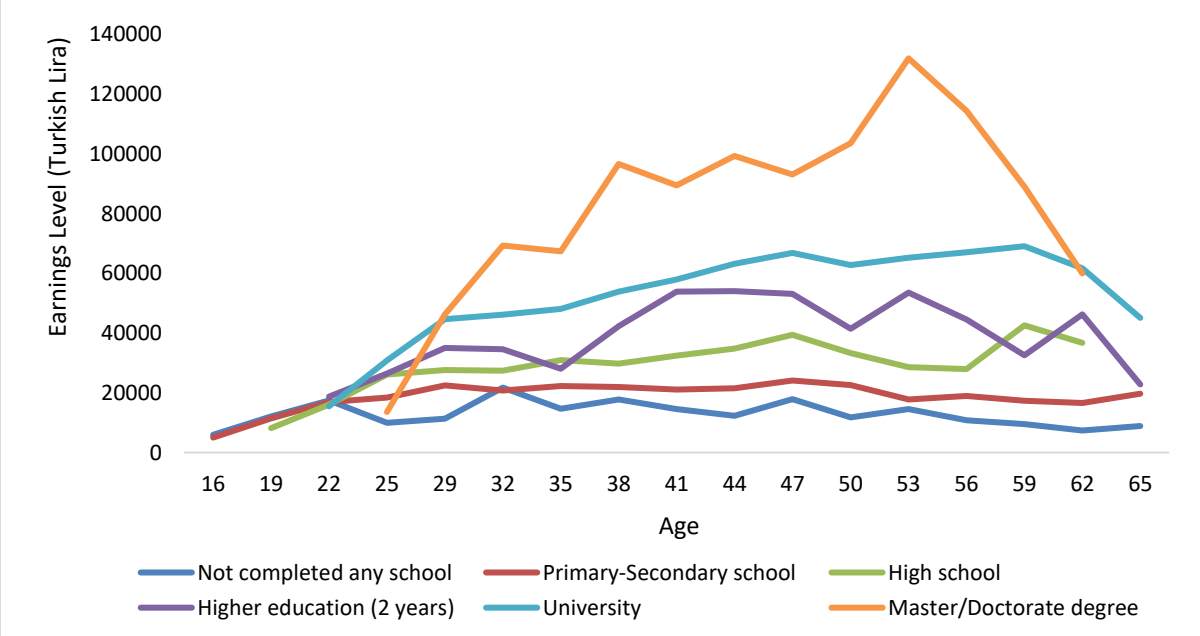
Source: TURKSTAT, 2019

Working age group varies due to the differentials in schooling level in the years. Figure 3 represents labour participation rate by education level in Türkiye in 2010 and 2018. The figure indicates that, compared to year of 2010, education profile shifts from the uncompleted any level of education to the primary and secondary schooling level in 2018.

According to the Figure 3, the rate of the employees who didn't complete any schooling level and primary school graduated decreases in years. However, share of vocational high school and university graduated workers tend to increase in 2018 compared to the rate in 2010. Besides, labour participation is gathered mostly in the level of primary school graduation as the rate of 37% in 2010. On the other hand, this intensity declines among primary school graduated employees and increases in the university graduated employees as the rate of 21% in 2018. According to the achieved data, education level tends to increase over time in Türkiye.

Figure 4 presents the impact of graduation level of schooling on the earnings differentials for Türkiye in 2019. Especially return to education for higher education and above is higher than other graduation levels by years. The earnings levels of employees who didn't complete any schooling level and completed primary-secondary schooling level is least in all of the graduation levels and the rate of these levels are almost same in all ages.

Figure 4: Distribution of the earnings due to schooling level in 2019



Source: TURKSTAT, 2022b

EMPIRICAL LITERATURE

Mincer earnings function is estimated for various countries in many empirical studies for decades. Return to education using Mincer earnings function was examined by Smith and Welch (1979), Psacharopoulos (1981) and Krueger (1993) in literature. Quality of schooling using Mincerian function was also estimated by Behrman and Birdsall (1983) and Card and Krueger (1992).

Various studies using semiparametric regression method to examine Mincer earnings function for different countries were successfully carried out. For example, Schafgans (1998) investigated ethnic earnings differentials for the years of 1988 and 1989 in Spain using semiparametric regression method. According to the results, returns to education of people in ethnic groups tend to rise. In another study, Dacuycuy (2005) tested linearity of the relationship between education and earnings for the period of 1994 and 1995 in Philippines using semiparametric regression method. The achieved results indicated that there is nonparametric relation in the model. Arce, Sperlich, & Fernandez, (2012) also used semiparametric regression model to investigate the impact of gender on the earnings level for Spain in 1995 and 2002. The study reveals that gender is an important determinant of the earnings differentials.

There are also different variations in a number of reported studies that examined the Mincer earnings function using instrumental variable. In an interesting work performed by Kharbanda (2014), the effect of education on earnings level in India for the period of 2004 and 2005 using semiparametric regression with control function approach was carried out. Education level of parents and spouses were used as instrumental variable in the study. The obtained results suggest that existence of the instrumental variables effects positively marginal return to education especially after high school graduation. Gabbriellini (2015) tested the return to education of Italy from 1995 to 2012 by semiparametric regression using control function approach. The achieved outputs from this study reveal that return to education is important for determination of earnings level.

Various studies on the investigation of return to education based on Mincer earnings function for Türkiye were also reported in literature. For example, Isfahani, Tunali, & Ragui (2009) examined return to education of Iran, Egypt and Türkiye for the period of 1988, 1994 and 2003. According to the achieved results from these studies, return to education tends to increase over time. Tansel and Daoud (2011) tested return to education in Palestine and Türkiye in the years of 2004 and 2008. The obtained results indicate that increase of education stage affects the earnings level positively for both of two countries. Tokatlıoğlu and Doğan (2021) examined the effect of education on earnings for Türkiye in 2017. They noticed positive effect of education on the earnings level and this impact is more for female employees who are in the low socio-economic statute.

The studies based on Türkiye using instrumental variables approach also emphasize that the impact of education on earnings level is important. Filiztekin (2011) used regional schooling years as instrumental variable to reveal return to education for 2004 and 2009 in Türkiye. According to the achieved results, there is a strong correlation between clustered levels of education and earnings level. Aydemir and Kırdar (2013) tested return to education using 1997 education reform as instrumental variable from 2002 to 2010 in Türkiye. The obtained results confirmed that return to education is much larger than the ordinary least squares (OLS) estimation results. Patrinos, Psacharopoulos, & Tansel (2021) also used 1997 education reform as instrumental variable to test private and social returns to investments in education in Türkiye in 2017. According to results of the study, men employees receive higher returns to education compared to women and disadvantaged young employees benefit more from the reform.

METHODOLOGY AND DATA

Methodology

Mincer earning function is an important way to estimate returns to education in empirical studies. This function is estimated by using various methods. In this study, two of these methods are used, namely, semiparametric regression model and instrumental variable estimation. Mincer framework assumes the impact of education and experience on earning level as an important determinant. Regression form of the Mincer earning function states as:

$$LnW = \alpha + \rho S + \beta_0 X + \beta_1 X^2 + \varepsilon \quad (1)$$

Where the semi-logarithmic function and *"W"* is the logarithmic form of the earnings of the individuals. *"S"* is the years of schooling and *"X"* is the years of potential experience of labour defined as "Age- schooling years- school starting age". In the earning function, "ρ" coefficient represents years of schooling and often named as the rate of return to education in literature.

Nonparametric regression method has no restrictive assumption about functional form among variables that used in the equation. In this direction, semiparametric regression method is used to investigate return to education based on Mincer earnings function in this study. Curse of dimensionality is accepted as an obstacle of estimation of nonparametric regression models (Hastie and Tibshirani 1990). Additive models are used to overcome this problem. Semiparametric regression models generalize the general regression techniques and enables the impact of variables to be evaluated separately as a special case of additive models. Semiparametric models include nonparametric and parametric variables and can be written as follows:

$$Y = f_j(X) + \beta_k(Q) + \varepsilon \text{ with j=}1,\ldots,J;\ k=1,\ldots,K \quad (2)$$

where the $f_j(X)$ is the unspecified functional form of j nonparametric variables and X is the set of the nonparametric variables. $B_k(Q)$ is named as the functional form of k parametric variables and Q represents set of the parametric variables in the function.

Existence of correlation between explanatory variables and error terms causes endogeneity in a regression function. In a standard linear regression model, $Y=\alpha X+\varepsilon$ and the endogeneity problem is symbolized by $E(\varepsilon|X) \neq 0$. In this case, OLS estimator is invalid and instrumental variable (IV) estimation is required. Instrumental variables containing consistent estimators of regression coefficients are used for correlated explanatory variables (Gujarati, 2015). The endogeneity problem may consist in nonparametric form of the function $f(.)$. Newey, Powell, & Vella (1999) developed the control function approach which considers a triangular system to overcome this problem. This system can be indicated as:

$$Y = f(X, Z_1) + \varepsilon \quad (3)$$

$$X = \mu(Z) + U, E[\varepsilon|U, Z] = E[\varepsilon|U], E[U|Z] = 0$$

where X implies d_x *x 1* vector of endogenous regressors and Z characterizes d_x *x 1* vector of instrumental variable. $\mu(Z)$ presents d_x *x 1* vector functions of Z instrumental variable. U is d_x *x1* vector of error term. Newey et al. (1999) concentrated on estimating $f(.,.)$ function consistently and developed three step estimation approach to decrease curse of dimensionality problem in nonparametric models. First step includes obtaining regressions of endogenous regressors separately on each exogenous regressors to estimate consistent residuals. Obtained residuals are used in the second step. In this step, regressions of dependent variable are carried out on each endogenous regressors, exogenous regressors and the residuals from first step regressions. In the last step, $f(.,.)$ function is estimated by backfitting algorithm (Ozabaci, Henderson, & Su, 2014).

Data

In this study, impact of education on earnings level in labour markets of Türkiye based on Mincer earnings function is investigated. For this purpose, three regression methods are used to estimate return to education. These methods are OLS, semiparametric regression method and semiparametric regression with control function approach respectively. For this purpose, annual data obtained from TURKSTAT Household Budget Statistics Micro Data Set is used. The data set is selected for the period between 2011 and 2019 as cross-sectional data and covers individuals aged between 15 and 65.

Table 1 gives detailed indication of the variables used in the study and sources of these variables. "Wage" is the logarithmic form of annual in-cash income. Completed years of schooling (*EDU*) and experience (*EXP*) are nonparametric variables in the function.

Table 1: Detailed indication of the variables

Symbol	Detailed Indication of Symbol	Source
Wage	Annual in-cash income earned by individuals	TURKSTAT Household Budget Statistics Micro Data Set
Nonparametric Variables		
EDU	Completed schooling years	
EXP	Experience years of individuals in labour markets	
Parametric Variables		
MS	Dummy variable that symbolizes marital status of individuals	
GEN	Dummy variable that symbolizes gender of individuals	
REF	Dummy variable that symbolizes education reform	Obtained by the authors

Years of schooling has changed in decades related to reforms in Türkiye. In this direction, changes in number of completed schooling years of individuals were taken into account in the study. Compulsory education was 5 until 1997 education reform that provided the compulsory education system to be extended to 8 years. According to Ministry of National Education (MEB), target of this reform is stated as generalization of the compulsory primary education throughout the country, rising quality of education and enhancing the attention to the primary education (Ministry of National Education, 2022). Middle school education was 3 years until the reform. Compulsory education was accepted as 8 years; specified as 5 years of primary school and 3 years of middle school after the education reform. High school completion degree was 3 years until 2005 and raised to 4 years since then. Another education reform was implemented in 2012. The primary school degree was reduced to 4 years and middle school degree requirement increased to 4 years with this reform. High school completion requirement remained as 4 years. The current reform is named as 4+4+4 education system since 2012. The concerned changes are considered depending on birth years of individuals in calculation of the schooling years for each individual in the study. Schooling level of illiterate individuals is evaluated as 0 years and the schooling degree of individuals who have no school completing degree is assigned as 2 years in the period of 2011-2014. There is no any distinction of illiterate individuals in the following years of questionnaire. For this reason, the schooling level of all individuals under the heading of those who did not complete school in these years was evaluated as 2 years. The additional 2 years after high school degree is assumed if the people completed higher educational institutions for 2 years. University graduation level is assumed as additional 4 years after high school graduation for the

individuals. Master degree is also assumed as 2 years, doctorate degree is evaluated as 5 years additionally after university graduation level for individuals.

The labour market experience is not available in the questionnaire. The potential experience formula is estimated as "age- schooling years-6" in which "6" is mostly used as school starting age in literature. Marital status (*MS*) and gender (*GEN*) are defined as parametric variables and added as dummy variables in the model. Estimation results of dummy variables in semi-logarithmic models are interpreted based on the Halvorsen- Palmquist (1980) approach. Results of *MS* and *GEN* coefficients are estimated by this approach in parametric and semiparametric regression models.

The years of schooling variable may be endogenous variable in the absence of unobserved facts. If there is a correlation between the unobserved factors and years of schooling, the estimation results will be inconsistent and biased (Patrinos et al. 2021). Control function approach is used to overcome this problem. 1997 educational reform (*REF*) is added as control function in the model. The individuals who were born in 1986 and after were affected by the 1997 education reform. *REF* is assumed as proxy dummy variable which is defined as "1" value for the individuals who were born in 1986 and later and "0" is evaluated for the people who were born before that year.

RESULTS

The impact of education on earnings level is investigated using Mincer earnings function between 2011 and 2019 for each year. In this section, three regression methods are estimated separately and results are compared. Firstly, the partial *F* test is calculated to investigate whether the impact of each explanatory variable on the dependent variable is significant or not. Secondly, likelihood ratio (LR) test is implemented to demonstrate model which has the best explanatory power (Keele 2008).

Table 2 represents the results of partial *F* test and LR test. (a) section of the results indicates that *EDU* and *EXP* nonparametric variables should take part in the model for all years. Section (b) concludes that *EDU* and *EXP* explanatory variables should be evaluated as nonparametrically in the function. According to the LR test results, explanatory power of the nonparametric model is better for each year.

Table 2: Partial *F* test and likelihood ratio (LR) test results

	Partial *F* Test				Likelihood Ratio (LR) Test
	EXP	EDU	EXP	EDU	
	(a)		(b)		
2011	162.83	529.61	170.45	41.85	805.81
	0.000	0.000	0.000	0.000	0.000
2012	185.72	569.42	212.25	48.54	1442
	0.000	0.000	0.000	0.000	0.000
2013	264.9	670.5	307.86	54.42	1448.2
	0.000	0.000	0.000	0.000	0.000
2014	318.94	773.03	376.7	83.99	1243
	0.000	0.000	0.000	0.000	0.000
2015	183.37	404.67	184.45	29.19	1564.2
	0.000	0.000	0.000	0.000	0.000
2016	186.6	441.9	191.9	27.48	1477.4
	0.000	0.000	0.000	0.000	0.000
2017	318.8	590.67	352.5	51.7	1586.2
	0.000	0.000	0.000	0.000	0.000
2018	196.51	355.27	199.6	33.303	1665.3
	0.000	0.000	0.000	0.000	0.000
2019	266.2	539.75	268.29	53.957	1459.5
	0.000	0.000	0.000	0.000	0.000

Results of Mincer earnings function using three regression methods in the period of 2011 and 2019 are indicated in Table 3. OLS, semiparametric regression method and semiparametric regression method considering the endogeneity are used to estimate the results respectively in the table. According to the OLS results, rate of return to education is approximately 15% based on Mincerian earnings function. The returns to one additional schooling year range between 13% and 16%. The results also indicate that one extra year of experience increases earnings level about 10%. The rate of effect varies between 9% and 12%. The OLS results of years of schooling and years of experience affirm the Mincer earnings function assumptions. The estimation results also indicate that married individuals earn more than the unmarried individuals. According to the results estimated by Halvorsen-Palmquist approach, rate of this earning differentials varies between 15% and 28%. Semiparametric and control function approach test results also confirm that married individuals earn more and the rate changes between 11% and 25% by the years. Besides, the OLS,

semiparametric and control function estimation results reveal that males also earn more than females approximately 50%.

Table 3: Estimation results of three regression

Yıllar	2011	2012	2013	2014	2015	2016	2017	2018	2019
Intercept									
OLS	5.9	5.7	5.7	5.9	6.2	6.4	6.6	6.8	6.9
	(t-test: 111.7)	(t-test:122.9)	(t-test:120.3)	(t-test:124.2)	(t-test:145.1)	(t-test:156.4)	(t-test:155.3)	(t-test:165.3)	(t-test:159.9)
Semiparametric	8.4	8.3	8.4	8.5	8.7	8.9	8.9	9.14	9.39
	(t-test: 282.1)	(t-test: 320.6)	(t-test: 312.03)	(t-test: 318.3)	(t-test: 374.9)	(t-test: 391.8)	(t-test: 398.1)	(t-test: 431.6)	(t-test: 436.8)
Control Function	8.4	8.3	8.4	8.5	8.7	8.8	8.9	9.14	9.39
	(t-test: 281.8)	(t-test:320.4)	(t-test: 311.62)	(t-test:318.2)	(t-test:374.9)	(t-test:391.7)	(t-test:397.6)	(t-test:431.6)	(t-test:436.5)
EDU									
OLS	0.16	0.16	0.16	0.15	0.15	0.15	0.14	0.13	0.14
	(t-test: 48.71)	(t-test:56.37)	(t-test:55.04)	(t-test:53.4)	(t-test:58.5)	(t-test:59.7)	(t-test:54.3)	(t-test:53.36)	(t-test:54.66)
Semiparametric	-	-	-	-	-	-	-	-	-
	(F-test: 507.6)	(F-test:578.4)	(F-test:677.7)	(F-test:677.5)	(F-test: 413.7)	(F-test: 453.5)	(F-test:595.7)	(F-test:358.9)	(F-test:535.5)
Control Function	-	-	-	-	-	-	-	-	-
	(F-test: 212.3)	(F-test:304.1)	(F-test:275.8)	(F-test:265.5)	(F-test:300.1)	(F-test:312.2)	(F-test:270.9)	(F-test:254.9)	(F-test:273.4)
EXP									
OLS	0.1	0.12	0.12	0.1	0.1	0.09	0.1	0.09	0.09
	(t-test: 26.6)	(t-test:34.5)	(t-test:34.5)	(t-test:32.5)	(t-test:36.8)	(t-test:35.11)	(t-test:36.7)	(t-test:37.35)	(t-test:35.74)
Semiparametric	-	-	-	-	-	-	-	-	-
	(F-test:105.6)	(F-test:167.4)	(F-test:171.4)	(F-test:159)	(F-test:182)	(F-test: 177.4)	(F-test:207.1)	(F-test:195.2)	(F-test:196.2)
Control Function	-	-	-	-	-	-	-	-	-
	(F-test: 76.7)	(F-test:128.8)	(F-test:142.4)	(F-test:141.8)	(F-test:175.7)	(F-test:174.1)	(F-test:183.3)	(F-test:195.2)	(F-test:273.4)
EXP^2									
OLS	-0.002	-0.002	-0.002	-0.002	-0.001	-0.001	-0.001	-0.001	-0.001
	(t-test: -22.5)	(t-test: -31.4)	(t-test:-30.8)	(t-test:-28.8)	(t-test:-32.9)	(t-test:-31.5)	(t-test:-32.5)	(t-test:-33.6)	(t-test:-30.43)
Semiparametric	-	-	-	-	-	-	-	-	-
Control Function	-	-	-	-	-	-	-	-	-
MS									
OLS	0.25	0.21	0.18	0.23	0.14	0.25	0.21	0.2	0.21
	(t-test: 7.69)	(t-test:7.3)	(t-test:5.97)	(t-test:7.78)	(t-test:5.4)	(t-test:10.35)	(t-test:8.44)	(t-test:8.86)	(t-test:8.88)

Semiparametric	0.19 (t-test:6.13)	0.16 (t-test:5.7)	0.1 (t-test:4.2)	0.17 (t-test:5.8)	0.1 (t-test:4.04)	0.19 (t-test:8.06)	0.17 (t-test:6.8)	0.18 (t-test:8.13)	0.23 (t-test:6.64)
Control Function	0.19 (t-test: 6.02)	0.16 (t-test:5.61)	0.12 (t-test:4.09)	0.16 (t-test:5.7)	0.1 (t-test:3.9)	0.19 (t-test:7.94)	0.16 (t-test:6.61)	0.18 (t-test:8.03)	0.15 (t-test:6.53)
GEN									
OLS	0.3 (t-test:14.15)	0.5 (t-test:23.8)	0.6 (t-test:26.5)	0.5 (t-test:26.3)	0.5 (t-test:26.7)	0.4 (t-test:24.5)	0.5 (t-test:26.36)	0.5 (t-test:28.9)	0.4 (t-test:24.4)
Semiparametric	0.4 (t-test:16.37)	0.6 (t-test:26.9)	0.6 (t-test:29.7)	0.6 (t-test:29.3)	0.6 (t-test:26.1)	0.5 (t-test:26.6)	0.5 (t-test:28.73)	0.5 (t-test:30.8)	0.5 (t-test:26.7)
Control Function	0.4 (t-test:16.5)	0.6 (t-test:27.1)	0.6 (t-test:29.8)	0.6 (t-test:29.4)	0.6 (t-test:29.2)	0.5 (t-test:26.8)	0.5 (t-test:29.1)	0.5 (t-test:31.02)	0.5 (t-test:27.1)
REF									
OLS	-	-	-	-	-	-	-	-	-
Semiparametric	-	-	-	-	-	-	-	-	-
Control Function	-3.2 (t-test:-14.1)	20.37 (t-test:15.78)	31.8 (t-test:10.73)	6.69 (t-test:13.84)	-8.71 (t-test:-15.4)	-2.22 (t-test:-14.3)	-1.73 (t-test:-11.41)	-1.33 (t-test:-10.4)	-0.81 (t-test:-8.2)

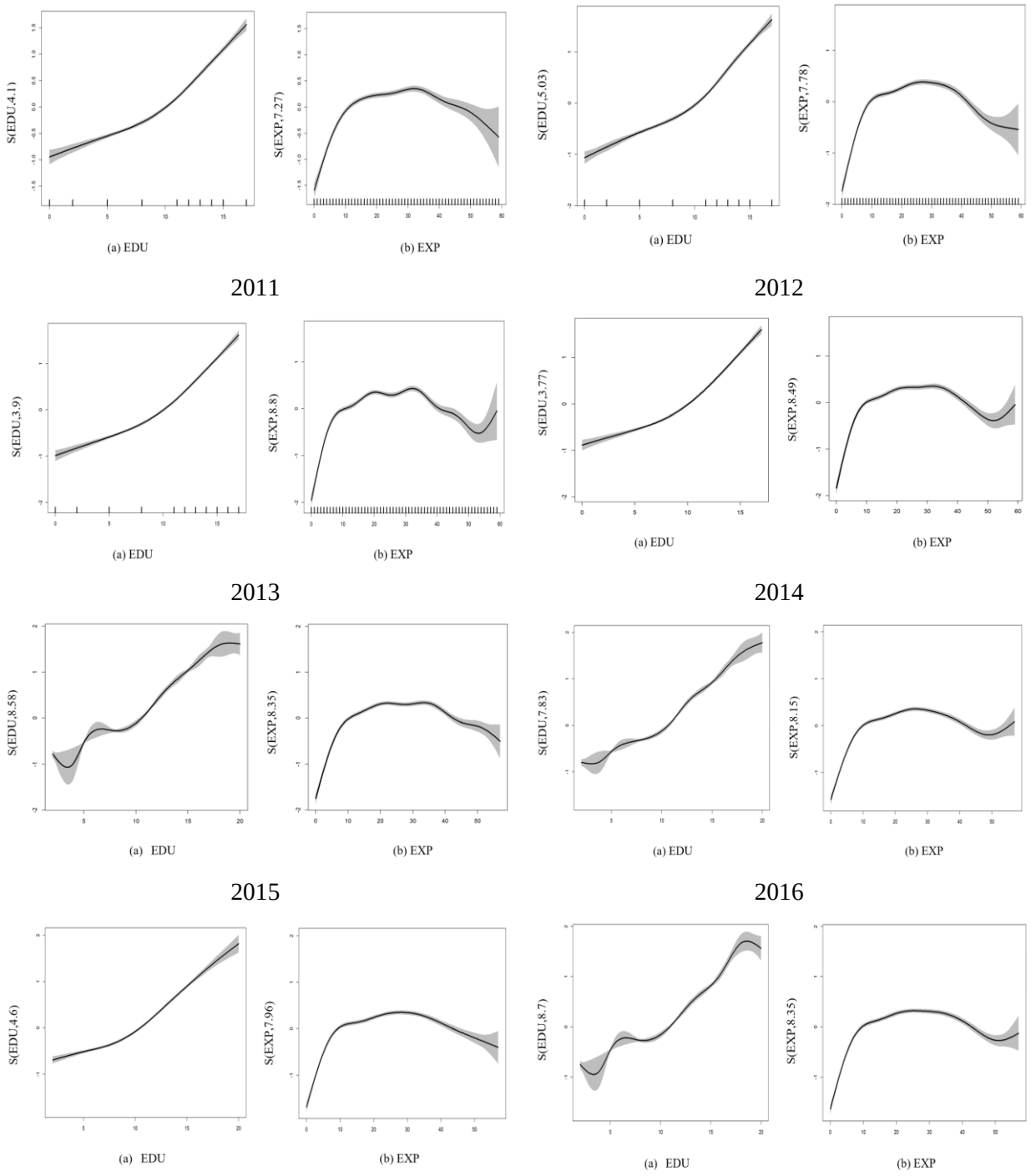
Coefficient results of nonparametric regression are obtained through graphical presentation. The number of models are estimated as the number of observations. Estimation of *f(.)* functions for the variables are revealed by curves. Main curve contains the confidence intervals that include lower and upper 95% layers on the side. The graphs in Figure 5 show the estimation results of the impact of *EDU* and *EXP* nonparametric variables on the earnings level in the semiparametric regression model for the period between 2011 and 2019 separately.

Figure 5 indicates that an increase in the years of schooling affects the earning levels positively in general. Especially, the effect of a rise in the years of schooling on the earnings level increases after eight years of schooling. Impact of high school graduation and beyond on the earnings is more than lower education level. Rate of the rise in the level of earnings is lower in the graduation levels that are less than the high school degree. According to the obtained results from the data in the years 2015 and 2018, educational degree of the individuals who didn't complete any schooling level negatively affects the earnings level.

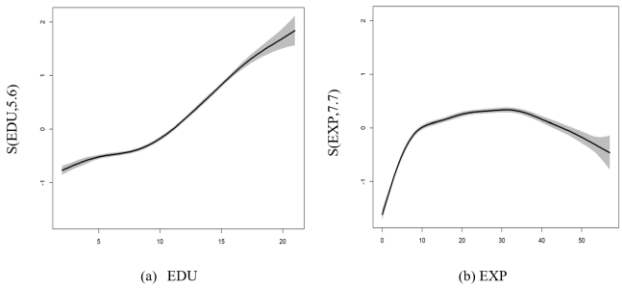
According to *EXP* graphs in the years between 2011 and 2019, in the first ten years, an increase in the years of experience affects the earnings level positively. This effect remains steady in the period between tenth and thirtieth years of experience. After the thirtieth years, an increase in the years of experience causes

decline in the earnings level in general. The graphs indicate that there is no certain agreement about the functional form of the relationship between years of experience and the earnings level. The highest level of earnings corresponding to the years of experience varies by year.

Figure 5: Estimation results of semiparametric regression



2017 2018



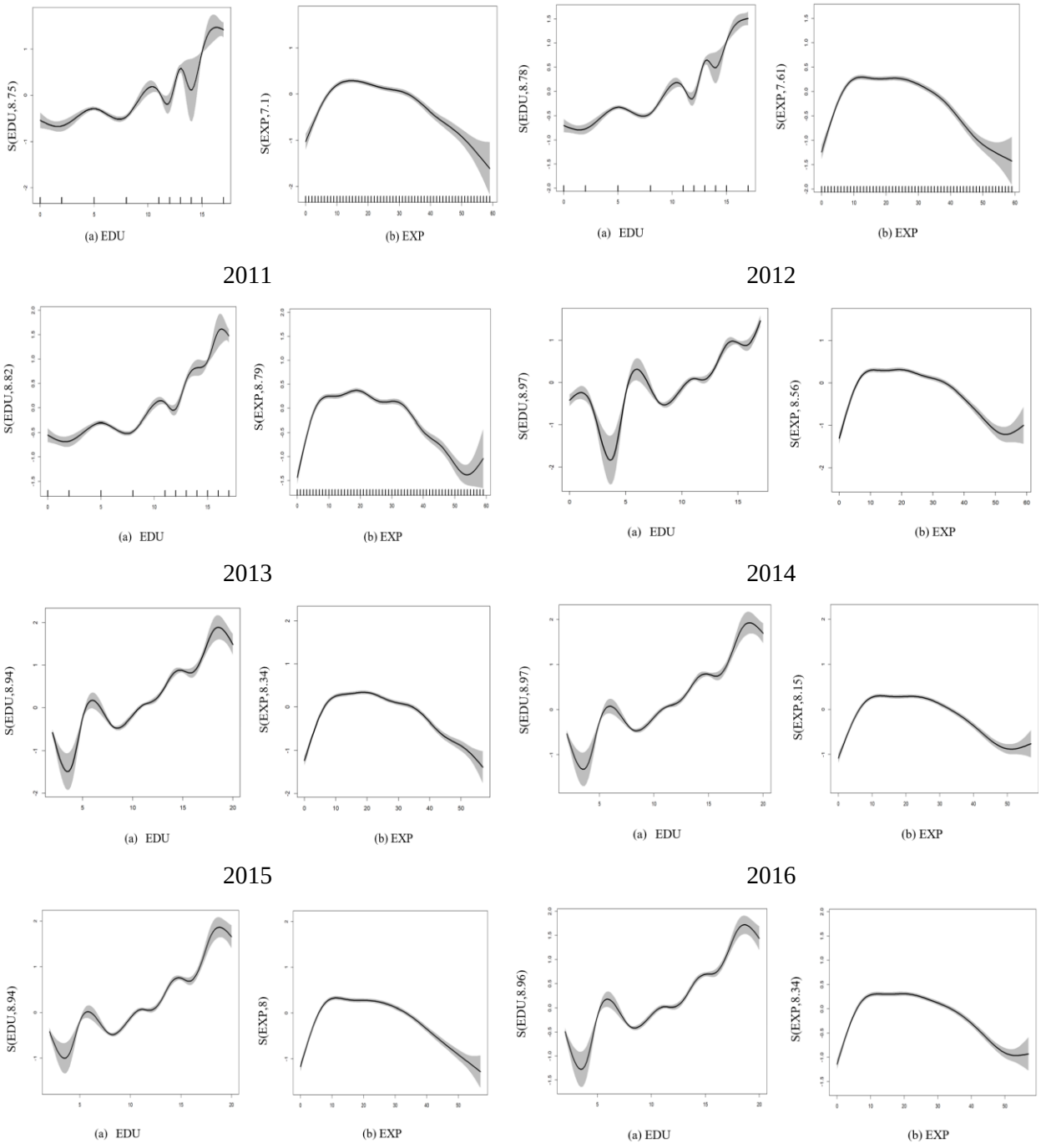
(a) EDU (b) EXP

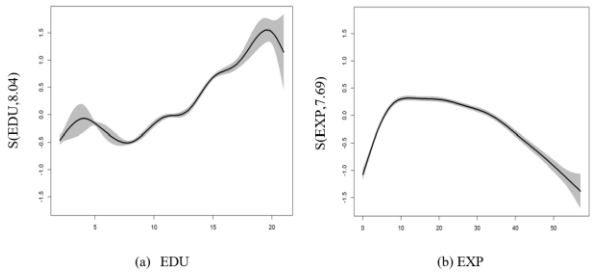
2019

In the model, *REF* variable is applied as the control function of *EDU* variable. Estimation of coefficient of *REF* is invalid, however statistical significancy of this variable is estimated to test the endogeneity. In other words, test statistics results state if the control function is valid for the model or not. According to Table 3, test results of all years represent that *REF* variable is significant statistically. Consequently, *REF* control function is exogeneous and valid. This function can be used as exogeneous variable to represent *EDU* endogenous variable in the model.

Figure 6 shows the test results of the semiparametric regression method considering the endogeneity for the years between 2011 and 2019. According to the results in the figure, there are more fluctuant progresses in the *EDU* graphs of the control function approach compared to the semiparametric test results. The effect of *EDU* on the earnings level has an increasing trend, however some completed schooling years exhibit negative impact on the earnings. Especially first two years in the education level which present the schooling level of the individuals who didn't complete any school affect the earnings level negatively for almost every year in the period. Completing the primary school education causes the impact of years of schooling on the earnings level to be positive in general. High school graduation level provides an increase in the earnings level for each year. The rate of this rise is more in the university graduation compared to high school graduation generally. The effect of postgraduate schooling degree on the earnings level is tend to decline in the period. However, this decrease only exists in the level of doctorate degree. Rate of the return to education is highest in university and master degree graduation levels.

Figure 6: Estimation results of semiparametric regression with control function approach





(a) EDU (b) EXP

2019

Figure 6 implies that the impact of *EXP* on the earnings level varies by the years. Positive effect of the years of experience remains in the first ten years as the highest rate through individuals' working life for each year. The results of control function approach are similar to semiparametric test results in this term. However, the effect of the years of experience on the earnings level changes for following years in the working life. The impact of *EXP* tends to decline in the period between tenth and thirtieth years. Stage of this impact can be stationary for some years (for example in 2012 and 2016) in the years between 2011 and 2019. In other words, an increase in the years of experience has no remarkable effect on the level of earnings in these years. The rate of negative effect of *EXP* increases after the term of thirtieth years and this impact remains as negative until end of the working life in general. Consequently, an additional year of the experience after thirty years causes a decline in level of the earnings in the working life. According to the obtained control function results, it is not possible to evaluate the relationship between years of experience and earnings level in a certain functional form. Graphical representation of relationship between *EXP* and the earnings level changes by years.

CONCLUSION AND POLICY IMPLICATION

This study empirically investigated the return to education using Mincer earnings function between 2011 and 2019 applying cross sectional data set for Türkiye. For this purpose; OLS, semiparametric regression method and semiparametric regression method with control function approach which considers the endogeneity in the model were analysed to find out the impact of education on the earnings level. The achieved results of this study reveal that the impact of years of schooling which is selected as a proxy determinant of education on the earnings level is positive for both of three estimation method results in general. In semiparametric regression estimation results, the rate of the return to education is tend to increase after 10 years in the educational attainment. The return to education of primary and middle school degree level is lower than the return to education of high school graduation and above. According to the obtained results from the data set for the years 2015 and 2018, educational degree of the individuals who didn't

complete any schooling level affects negatively the earnings level. Completing primary school degree causes a positive effect and continues in this aspect in those years.

Similarly, the semiparametric regression with the control function approach test results concludes that the return to education is positive in most of educational degree in Türkiye for the concerned period. However, the impact of educational attainment is negative in the uncompletion any educational degree and in the completion of doctorate degree level for almost all of the related years. The rate of positive effect of completion of university education on the earning level is higher than the lower education graduation. At the same time, completion of primary school degree causes the earnings level to be positive and rise dramatically.

The achieved results of this study present high returns to education in university graduation for the case of Türkiye in the concerned years. In this respect, it is very crucial to encourage the completion of university education and develop the national policies in this direction. In addition to the completion of university, the high qualification of university education is also necessary in order to increase the employment opportunities. Thus, an increase in the number of university graduates employed in the labor market is expected. Implementation of these issues affect the entire educational life of individuals and should be carefully applied in every stage of education. For this reason, the quality of education should be kept high at all levels of schooling. The qualified education will not only make an important contribution to the earning levels of the employees, but also to economic growth in macro terms in Türkiye.

AUTHOR STATEMENT / YAZAR BEYANI

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