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EDUCATION, INCOME DISTRIBUTION AND GENDER PAY GAP: THE CASE OF TURKEY*

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Abstract

This article aims to reveal the characteristics of the relationship between education and income distribution in Turkey. Additionally, it examines the role of gender pay gaps in this relationship. In the study, Heckman's two-stage estimation and quantile regression methods were applied by using the data from the Household Labor Force survey of 2017 of TURKSTAT. According to the results of the Heckman two-stage estimation method, increases in education level increase the wage income of women faster than men. According to the quantile regression method, the effect of education on wages is greater for males in low earning segments and higher for females in high earning segments. The results of the study show that increasing the education level of women is the shortest way to reach a higher level of income distribution equality.

Keywords: *Education, Income Distribution, Human Capital, Quantile Regression.*

EĞİTİM, GELİR DAĞILIMI, CİNSİYETE DAYALI ÜCRET FARKLILIKLARI: TÜRKİYE ÖRNEĞİ

Öz

Bu çalışma Türkiye'de eğitim ile gelir dağılımı arasındaki ilişkinin niteliklerini ortaya çıkarmayı hedeflemektedir. Ek olarak bu çalışma cinsiyetler arası ücret farklılıklarının gelir dağılımındaki rolünü de incelemektedir. Çalışmada eğitimin etkisi, TÜİK'in 2017 yılına ait Hanehalkı İşgücü mikro veri seti ile Heckman iki aşamalı tahmin ve dilim regresyon yöntemleri kullanılarak tahmin edilmiştir. Heckman iki aşamalı tahmin yöntemi sonuçlarına göre, eğitim seviyesinde yaşanan artışlar kadınların ücret gelirlerini erkeklere göre daha hızlı arttırmaktadır. Kantil regresyon yöntemi sonuçlarına göre ise eğitimin kazançlara etkisi düşük kazanç gruplarında erkeklerde, yüksek kazanç gruplarında ise kadınlarda daha fazladır. Çalışmanın sonuçları kadınların eğitim seviyelerinin arttırılmasının gelir dağılımında eşitlikte daha yukarı bir seviyeye çıkmak için en kestirme yol olduğunu göstermektedir.

Anahtar Kelimeler: *Eğitim, Gelir Dağılımı, Beşerî Sermaye, Kantil Regresyon.*

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1. INTRODUCTION

Fair income distribution is one of the most important requirements for countries to ensure economic and social stability. From a social perspective, negative social disorders decrease as citizens feel that there is a high level of income equality. Country-level analyses, in general, reveal that income distribution equality is higher in developed countries. Higher levels of income equality accelerate economic growth and development processes as it helps to ensure economic and social stability. In developing countries with higher levels of inequality, economic and social stability may hardly be established. Thus, convergence to the level of developed countries is prolonged.

Countries have various policy tools in order to increase income equality. The most used tools are tax systems, health, and education policies. Via tax reforms, more taxes are collected from high-income groups and less from low-income groups. The aim is to eliminate the differences between the two income groups by transferring some of the taxes collected from the high-income groups to the low-income groups. The effect of health policies on income distribution has become clear with the recent Corona Virus Pandemic. Governments should support health expenditures to ensure justice in income distribution by enabling every citizen from each socio-economic class to have access to health services**.** However, the most influential policy tool in the long run on income distribution is education. The education reforms aim to increase the education level of the citizens. Individuals can increase their knowledge and skills thanks to education, and they can move to higher income groups in the future from their current income groups. Since the national income is distributed according to the productivity of the citizens, education reforms are important steps towards a fair income distribution.

This study analyzes the impact of schooling on earning distribution in Turkey. In addition, it also aims to determine the negative effect of gender wage differences on income distribution inequality in Turkey. Then, the effect of education on wages by gender is also investigated in this study. The Heckman two-stage estimation and Quantile Regression methods were applied by using the Household Labor Force Survey data of TurkStat for the year 2017 to interpret the effect of education on income distribution in Turkey. According to the results of the Heckman two-stage estimation method, improvements in education level increase the wage income of women more than men. According to the quantile regression results, the effect of education on earnings is greater for males in low-earning segments and higher for females in higher-income segments. The results of the study indicate that quantitative increases in education should accompany qualitative increases in education in Turkey and that the education level of women should be further increased.

In the second part of the study, the concept of income distribution is defined, and various income distribution indicators of Turkey are exposed. In the third section, we provide information about the knowledge economy, human capital, and the structure of the Turkish education system. The fourth chapter presents studies on the effect of education on income distribution. The fifth chapter gives information about the econometric method and data set used in the study. The sixth chapter exposes the estimation results and their interpretations. Finally, the study ends with the concluding remarks and policy suggestions.

2. THE CONCEPT OF INCOME DISTRIBUTION AND TURKEY

Income distribution is the distribution of the income that a country has earned at the end of a certain period among all the economic factors and individuals in the society who participated in the process of generating income (Ersezer, 2006: 206). It is known that economic growth and development processes are stable in countries that distribute income more equally. If a country has high-level income inequality, there may be a serious decrease in the productivity of the country, which might stem from the social unrest due to inequality.

When there are high differences in earnings of individuals with close knowledge and skills, the desire of the citizens of the country to invest in their human capital in the future may decrease. Thus, the economic growth and development process in such a country will be prolonged, causing the country to lag behind other countries. On the other hand, if this country distributes income fairly, individuals will try to increase their human capital in order to get a larger share of the income. As the human capital of citizens increases, their income levels will increase, and the duration of the country's development process will be shortened. Through this example, it can be clearly seen that countries should focus on the concept of fair income distribution.

There are various types of income distribution. Basically, a distinction is made between primary and secondary income distribution. Primary income distribution is the division of the national income obtained in a country at the end of a certain period among the factors of production as wage, rent, profit, and interest. The most important feature of this distribution is that there is no role that belongs to the government. The market realizes this distribution within its own mechanism (Uysal, 2007).

Secondary income distribution is the distribution after the intervention of economic agents with the policy tools owned by the state in wages, rent, profit, and interest incomes. In other words, as a result of the policies implemented, economic agents earn a different final income than primary income distribution (Çalışkan, 2010: 92). Therefore, it is also called the redistribution of income as well as secondary income distribution.

When primary and secondary income distribution types are compared in terms of fairness in distribution, we can observe that secondary income distribution is superior to primary income distribution in light of studies on this subject. The reason is that the government can minimize unfairness in the primary income distribution at this stage. Thus, it is seen that the majority of countries in today's world benefit from the secondary income distribution in equalizing the income distribution. Other types of income distribution are; personal income distribution, sectoral income distribution, functional income distribution, and regional income distribution.

2.1 Personal Income Distribution

Personal or household income distribution shows the distribution of national income among individuals in a country at the end of a certain period. In this type of distribution, how individuals make their income is not important. The essential point is how much income individuals earn as a result of the distribution (Kuştepeli and Halaç, 2004: 6).

In Table 1, the first column includes income groups. Among the five income groups, the first 20% group represents the individuals at the lowest income level in society. Income levels of individuals increase as they climb from the first lowest-income group to the following higher-income groups.

In the last 10 years, Table 1 shows that the distribution of personal income in Turkey has followed approximately the same pattern for each income group. Individuals from the highest income group have a very high share of 46-47% of the national income. Individuals in the lowest income group can obtain approximately 6% of the national income. The difference between the incomes of these two income groups is very high. Thus, it can be seen that there are serious inequalities in income distribution in Turkey.

Table 1: Personal Income Distribution in Turkey (%) (2011-2020)

	YEARS									
GROUPS	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
V. 20 %	46.7	46.6	46.6	45.9	46.5	47.2	47.4	47.6	46.3	47.5
IV. 20 %	21.7	21.7	21.4	21.7	21.5	21.1	20.9	20.9	21.4	21.1
III. 20 %	15.2	15.3	15.2	15.3	15.2	15.0	14.8	14.8	15.2	14.9
II. 20 %	10.6	10.6	10.7	10.9	10.7	10.6	10.7	10.6	10.9	10.6
I. 20 %	5.8	5.9	6.1	6.2	6.1	6.2	6.3	6.1	6.2	5.9

Source: TURKSTAT (2021) (Access Date: 19.10.2021)

There are two methods that are frequently used to measure income distribution justice. These methods are the Gini coefficient and the P80/P20 ratio. The Gini coefficient calculated with the help of the Lorenz curve takes values between 0 and 1. It is interpreted that the closer the Gini coefficient in a country to 0, the more equal the distribution is. On the other hand, if it is close to 1, the income distribution is as unfair as it can be. Figure 1 shows the Gini coefficients calculated in Turkey between the years 2011-2020.

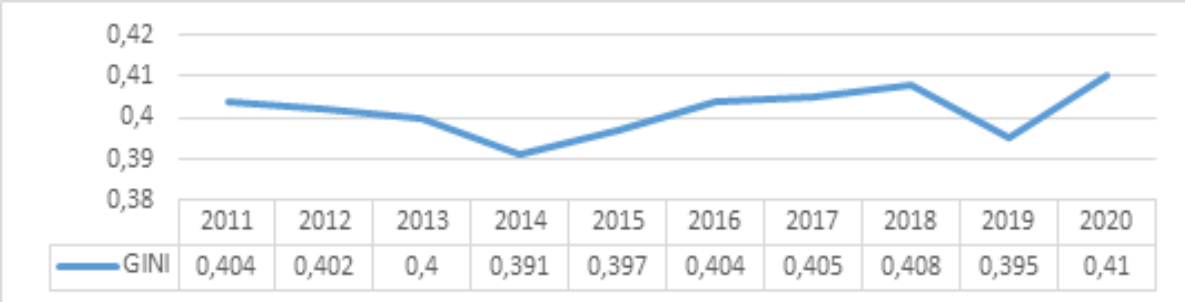

Figure 1: Gini Coefficients in Turkey (2011-2020). References: TURKSTAT (2021) (Access Date: 22.10.2021)

According to Figure 1, the Gini coefficient has fluctuated between 0.391 and 0.410 in the last 10 years in Turkey. The average of these values is 0.40. With an average of 0.40 Gini coefficient, Turkey is a country where income distribution inequality is very high, as shown by the average of Gini coefficients in developed countries, which is 0.30. In order to increase income equality in Turkey, Gini coefficients should be reduced to 0.30 and below.

P80/P20 ratio was developed by Pareto, who revealed that 80% of Italy's national income is collected by 20% of the society via this ratio. Pareto also stated that this observation for Italy is valid also the other countries in the world after a certain period of time (Öztürk, 2012: 435). Table 2 shows the P80/P20 ratios in Turkey between 2011 and 2020. Table 2 shows that the P80/P20 ratios have been around 7 in the last 10 years in Turkey. The year with the highest P80/P20 ratio was 2006 with 8.1. As of 2020, the table shows that this rate has increased to level 8 again.

Table 2: P80/P20 Ratios in Turkey (2011-2020)

Years	P80/P20
2006	8.1
2007	7.1
2008	7.1
2009	7.4
2010	6.9
2011	7.0
2012	6.9
2013	6.8
2014	6.9
2015	7.2
2016	7.4
2017	7.4
2018	7.6
2019	7.0
2020	8.0

Source: TURKSTAT (2021) (Access Date: 22.10.2021

2.2. Sectoral Income Distribution

Sectoral income distribution is a type of income distribution used to show the shares of agriculture, industry and service sectors in national income. The advantage offered by the sectoral income distribution is that it provides the opportunity to compare the development levels of countries relative to each other. It also gives a clue about which sectors should invest more in order for countries to grow and develop economically (Kuştepeli and Hallaç, 2004: 7). For example, the shares of the agricultural sector is 2% in developed countries and higher

in developing countries (Bükey, 2016: 51; Aykaç, et al., 2013: 8). In developing countries, the agricultural sector receives a higher share of national income than other sectors in the economy.

The sectoral income distribution in Turkey shows that the share of the agricultural sector in the national income in 1963 was around 63%, according to the data published by TUIK. However, as of 1980, Turkey abandoned the import substitution policy and significantly reduced the subsidies given to the agricultural sector. Thus, the share of the agricultural sector in national income decreased to 6.5% in 2019 (Bükey, 2015: 51; TUIK, 2021).

2.3. Functional Income Distribution

This type of income distribution shows the incomes obtained by the production factors at the end of the process of generating national income in a country. As a result of the division, the incomes obtained according to the factors of production are; wages for labor, interest for capital, rent for land and profit for the entrepreneur (Karataş, 2019: 61; Ensari, 1997: 18).

The functional income distribution in Turkey, according to the data for the year 2021 published by TURKSTAT, the share of wage earners in national income increased by 0.4 points compared to the previous year and became 47.1%. In developed countries, the share of wage earners in national income is above 50%. Then, to ensure a fair income distribution in Turkey, it is necessary to increase the share of the wage earners from the national income, as in the developed countries.

2.4. Regional Income Distribution

It is a type of income distribution that shows how the national income obtained in a country at the end of a certain period is shared among the regions within the country. When the reasons for the difference in national income between regions are listed; Reasons such as transportation costs, the effects of climatic conditions on economic activities, differences in education, health, and social opportunities can be given as examples.

Another indication of the regional income distribution is to show the level of development that exists among the regions within the country. In this way, it can provide important information to policymakers for the development of the country as a whole (Karataş, 2019: 59; Özbilen, 1998; 377).

The regional income distribution analysis in Turkey shows that Istanbul is the province with the highest share of national income. The reason is that Istanbul has many job opportunities and is the most developed city in Turkey. In addition, Istanbul is the province with the highest inequality in the distribution in Turkey. The reason is that Istanbul also has a high amount of unregistered employment. P80/P20 ratios of Istanbul and other regions reveal regional income distribution discrepancies across the regions in Turkey more clearly. The P80/P20 ratio was calculated as 7.4 for Turkey. The places with the highest P80/P20 ratio are Istanbul with 7.8, West Marmara with 6.6 and Southeast Anatolia with 6.5. The lowest places are in East Marmara with 4.6, West Black Sea with 5.5 and Middle East Anatolia with 5.6. Except for Istanbul, inequalities in income distribution decrease as one moves from developed regions to underdeveloped regions.

3. INFORMATION ECONOMY, HUMAN CAPITAL, AND THE STRUCTURE OF THE TURKISH EDUCATION SYSTEM

There are three important forms of societies in economic history. These forms are agriculture, industry, and information societies, respectively. The beginning of economic life started with agricultural communities. The agricultural sector, which could maintain its importance until the 18th century, left its place to the industrial sector. In the following periods, information societies started to increase technology and communication (Kocacık, 2003: 1-2).

There is no definition that explains the concept of the knowledge economy. It is known that the basic inputs in the agriculture and industry sectors are labor and capital but, in the information society, a single basic input emerges as information. Contrary to other inputs, the returns to the information input increase as it is used (Yıldırım, 2004: 109). It is important to know how goods and services are produced in industrial societies. However, in information societies, how to produce knowledge becomes more important. When we look at the

countries that have succeeded in transitioning to the information society, it is seen that they have primarily completed their industrialization processes (Kocacık, 2003: 7-8; Erkan, 1998: 214; Sadıklar, 1995: 112- 113). Thus, the prerequisite for transitioning to an information society may be interpreted as the completion of the industrialization process.

In order for countries to develop and use technology, they need individuals who are capable in this field. This requires investment in human capital. Human capital is all the knowledge and abilities of individuals (Yeri and Kibritçioğlu, 1998: 207). According to another definition, it is the investment that an individual makes in order to be more competitive in the labor market by combining his/her knowledge and skills with the new knowledge and skills (Akça, 2015: 856; Saxton, 2000). Education has the main important step in the development of human capital. The reason is that education enables individuals to increase their knowledge and skills and to become more competitive in the labor market. Individuals with higher education have the opportunity to work in better jobs in the labor market and have the opportunity to move from their current income groups to higher-income groups. Thus, education also ensures more equal distribution (Durkaya and Hüsnüoğlu, 2018: 54).

The important element of the knowledge economy is human capital. The way countries can increase their human capital is their importance to education. When developed and developing countries are compared in this regard, it is seen that developed countries give more importance to education. Thus, developed countries can adapt to the knowledge economy more quickly. In order for developing countries to catch up with the information society process, they should immediately strengthen their human capital stocks by increasing the importance they attach to education. Turkey is a developing country, and the structure of the education system should be examined before the role of education in income distribution.

3.1. Turkish Education System

Education, which plays an important role in increasing the stock of human capital, also accelerates the economic growth and development processes of countries. Countries that succeed in establishing a good education system gain an advantage over other countries by responding quickly to the needs of the age. However, countries that fail to establish a good education system lag behind. Thus, education can be a driving force for countries to move forward and a reason for fall when it is overlooked (Başkan and Çay, 2019: 176).

When the Turkish education system is examined, it is seen that different types of education models have been applied in recent decades. Until 1997, 5 years of primary school, three years of secondary school, and plus 3 years of high school (5+3+3) education system was implemented (Gündüz, 2011: 7). In 1997, the education model was changed, and 8-year compulsory uninterrupted education system was introduced. This reform expanded the average schooling years in the country substantially. As of the 2012-2013 academic year, the 4+4+4 education system has been adopted. The advantage offered by the transition to this education system is that students can be directed to vocational education at an early age.

When higher education in Turkey is concerned, an important problem that draws attention is that only the number of universities is expanded, and this quantity increase is not accompanied by quality improvement. This problem causes unemployment levels to increase further due to the inability to train the qualified personnel required by the labor market. Thus, both physical and human capital investments are wasted. In order to prevent this negative picture in Turkey, policies that will increase not only the quantity but also the quality of universities should be implemented immediately.

4. LITERATURE

The first studies investigating the effect of education on income distribution belong to Mincer (1958), Schultz (1961), and Becker (1962). They investigate the relationship between these two variables with the help of human capital theory. They indicate that education affects income distribution, but the direction of the effect is unambiguous (Gregorio and Lee, 2002: 395-396). Becker and Chiswick (1966) investigate the relationship between these two variables for different regions in America. They state that the convergence in education level among individuals living in different regions creates equal income distribution. In parallel, Chiswick (1971)

investigates the relationship between these two variables for nine countries and reaches similar results. Another study on this subject is Chenery et al. (1974) for 66 countries. They show that the increase in education level contributes to income distribution equality.

Knight and Sabot (1983) examine the association of education with earning distribution using composition methods. The study concludes that education increases income inequality in the short run but reduces it in the long run, just as in Kuznets' inverted U hypothesis. A study supporting this study by Gregorio and Lee (2002) on the relationship between education and income distribution for different countries for the period 1960-1990 using panel data methodology indicates the validity of Kuznets' inverted U hypothesis.

When the studies on the effect of education on income distribution are examined, it is observed that they generally analyze developed country cases (Tansel and Bircan, 2010: 2). However, it is known that inequalities in income distribution are a more severe problem in developing countries. Thus, the number of studies on this subject should be increased for developing countries. When the literature on Turkey is analyzed, it is seen that there are studies that examine the effect of education on income distribution from more general perspectives. There are also studies investigating the wage differences among individuals who graduated from different departments of universities and the effects of education on wages by gender.

Tansel and Bircan (2010) examine the effects of increases in education levels on wage incomes of male employees in Turkey between 1994-2002 using least squares and quantile regression methods. Their findings show that, as the level of education increases, inequalities between individuals in the same income group increase, but the distribution between different income groups becomes more equal. On the other hand, Bakış et al. (2013) examine the relationship between education and distribution by using the least-squares, quantile regression, and instrumental variable quantile regression methods of household data for the years 2006-2009 in Turkey. They reveal that the increases in the education level increase the wage income of women more. Bakış and Polat (2015) investigate the effect of education on distribution by using household data between 2002-2010 in Turkey. They demonstrate that there was no change in the ratio of educated individuals compared to uneducated individuals for the years 2002-2004. Despite the significant increase in the number of educated individuals, wage incomes changed in favor of educated individuals between the years 2004-2010. Çiftçi and Kangallı (2015) examine the effects of increases in parents' education levels on family income in Denizli province in 2012. They use least squares and quantile regression methods in their studies. Their results show that the mother's education level has no effect on income at each income level. The increase in the fathers' education level increases the family income up to the median income group, and then the power of influence decreases. Ulucan and Çiftçi (2019) examine the effects of significant increases in the number of universities in Turkey on wages using household data and least squares and quantile regression methods for the years 2007-2017. The results of the study show that the income differences between the highest income group (q90) and the lowest income group (q10) decreased between these years. Increases in the minimum wage can explain the approach of lower-income groups to higher-income groups. The increase in the number of universities has started to reduce the power of universities to determine wage rates. Tansel (2008) examines the effect of education on the wages of men and women in Turkey between 1994-2005 using least squares and the Heckman two-stage estimation methods. The findings show that, in the period, education increased women's wages by 5% more than men.

Kelly et al. (2010) revealed that the effects of people's abilities on wages are very limited, underlining the importance of education. In addition, those who graduate from education, medicine, engineering, and computer technologies departments earn higher wages than those who graduate from other departments. Chevailer (2011) examined the effects of graduated departments and education by gender using the quantile regression method in his study. As a finding of his study, he revealed that the wages differ according to both the graduated departments and the genders. Similar to this study, Walker and Zhu (2011) examined the effects of university departments and genders on wages in England using least squares and quantile regression methods. Their findings suggest that the increase in education level increased the wages of women more, and the departments they studied had no effect on wage incomes. For men, those who graduated from economics, business administration, and law earned higher wages than those who graduated from other departments. Long et al. (2015) examined the wage differences between individuals who graduated from different departments for the period between 1982

and 2012. Their findings show that wage differences were observed in the first 3 years after graduation. In the following periods, there is a decrease in the competencies gained by the individuals and the wage differences. Paolo and Tansel (2017) examined the effect of graduating from different departments on wage income in Turkey using least squares and RIF-Regression methods. The findings suggest that graduating from different departments in Turkey differentiates wages. Çiftçi and Ulucan (2021), on the other hand, investigated the effects of graduating from different departments on wages in Turkey using household data and least squares, Heckman two-stage estimation, and quantile regression methods between the years 2014-2017. As a result, it has been determined that there are wage differences between the college majors in Turkey.

5. DATA AND METHODOLOGY

In this study, TurkStat's Household Survey Data from the year 2017 is used. The number of observations for men is 183,009 and the number of observations for women is 195,682. In Table 3, descriptive statistics of the education degrees completed by men and women are given. Table 3 demonstrates that the majority of women have not graduated from any school. On the other hand, males generally have higher educational levels, so men have higher wage incomes in the labor market. Therefore, the high gender pay gap can mostly be attributed to education discrepancies between men and women.

Table 3: Distribution of Males and Females by Type of School Completed (%) (2017)

The Degree of Education	Males (%)	Females (%)
Without a diploma	21.14	78.86
Primary Sch.	49.34	50.66
Middle Sch.	56.82	43.18
High Sch.	54.85	45.15
Vocational high Sch.	60.65	39.35
Undergraduate Degrees	55.02	44.98
Postgraduate Degrees	57.26	42.74

Source: Authors' own Calculations Using Data from the Household Survey (2017) of TURKSTAT.)

In the methodology selection, we take into account that one of the essential problems in the implementation of the OLS method is sample selection bias. The sample selection bias in the established model makes the estimates biased. In order to eliminate this problem, Heckman (1979) developed the Heckman Two-Stage Estimation Method. The Heckman two-stage estimation method has one selection and one outcome equations. First of all, in the selection equation, an error term is predicted that causes sample selection bias in the model. The probit model is used to obtain this error term. Then, an inverse Mill ratio representing the predicted disturbance, Lambda (λ) is created to correct for the selection bias. Thus, the problem of sample selection bias in the model is eliminated (Miran, 2010: 400).

The probit model used in the selection equation is shown in equation 1, the final equation including (λ) is denoted in equation 2 (Çolak and Öner, 2018: 62). The most important factor to be considered in the application of the Heckman two-stage estimation method is the number of variables in the selection and outcome equation. In order to get robust results from this estimation method, the number of variables in the selection equation must be more at least by one variable than the final result equation (Çiftçi and Ulucan, 2021: 10).

$$d_i = X_i'\beta + \varepsilon_i \qquad (1)$$

$$y_i = X_i'\beta + \sigma\lambda\left(\frac{\widehat{X_i'\beta}}{\sigma}\right) + \varepsilon_i \qquad (2)$$

One of the most important assumptions of the OLS method is the normal distribution of sample error terms. However, if this assumption is violated, the reliability of the estimates decreases. Violation of normality is often the case in wage data. Under these conditions, the quantile regression method developed by Koenker and Basset

(1978) can be used (Çiftçi and Kangallı, 2015: 144). In the quantile regression method, each point in the distribution of the variables is weighted equally. In this way, it is also possible to have estimations about the variables' values at different points of the income distribution. On the other hand, in the OLS method, the problems arise that the varying variance and error terms are not normally distributed. These problems can be solved with the quantile regression method (Çiftçi and Kangallı, 2015: 144; Montenegro, 2001; Hunter and Kunneth, 2000).

The model used in applying the quantile regression method is shown in equation 3 (Çiftçi and Kangallı, 2015: 144). The value of q in the equation is between 0 and 1. Thus, it is possible to have information about the values of the dependent variable at different points of the income distribution (Ulucan and Çiftçi, 2019: 656).

$$Y_i = X_i \beta_q + \varepsilon_{qi} \text{ , Kantil}_q \ (Y_i/X_i) = X_i \beta_q \qquad (3)$$

Equation 4 denotes the minimization equation (Cameron and Trivedi, 2009: 207). Equation 4 reveals that as the value of q increases, the weight of the prediction shifts to the left, and as the value of q decreases, the weight of the prediction shifts to the right. Thus, it is interpreted that the quantile regression method makes an asymmetric estimation, as opposed to OLS (Ulucan and Çiftçi, 2019: 656; Cameron and Trivedi, 2009: 207).

$$Q(B_q) = \sum_{i=y_i>x_i'\beta}^{N} q|y_i - x_i'\beta_q| + \sum_{i=y_i<x_i'\beta}^{N} (1-q)|y_i - x_i'\beta_q| \qquad (4)$$

In our study, firstly, Heckman's two-stage estimation method was applied. One dependent and nine independent variables were used. The logarithm of the monthly wage is the dependent variable. The dependent variables are the degree of education, age, gender, region, status at the workplace, social security registration (SSR) status, whether the work is permanent or temporary, the main field of activity of the workplace, and ownership status of the workplace (public or private sector). The model used is shown in Equation 5.

$$LnW_i = \beta_0 + \beta_1 \ Education_i + \beta_2 \ Age_i + \beta_3 \ Sex_i + \beta_4 \ Region_i + \beta_5 \ Workplace_i + \beta_6 \ SSR_i + \beta_7 \ Permanency_i + \beta_8 \ Main\_field_i + \beta_9 \ Ownership_i + e_i \qquad (5)$$

6. ESTIMATION RESULTS

Table 4 shows the results of the Heckman estimation method. Before interpreting the estimation results, it should be noted that our estimated parameters show the descriptive effect between the dependent and independent variables. Our parameters did not show a purely causal effect because the method we used in the study was not experimental or quasi-experimental. According to the Heckman estimation results, men and women earn more wage income as the degree of school increases. Men and women who are graduated from primary school earn lower wages than those without diplomas in the reference category. The reason can be ability bias. Ability bias explains the fact that some talented individuals may have higher wages regardless of how much education they received, and it is not surprising that these talented individuals received high education levels (Leigh, 2008: 234). Hence, the return to their abilities can be estimated in return to education, creating a bias in the estimate. A number of studies in the literature analyze the ability bias (See, for example, Ashenfelter and Kruger, 1994; Zhang, Liu and Yung, 2007; Leigh ,2008).

Secondary school and master's or doctoral degrees increase men's wages more than women. The findings also show that the rest of the school degrees increase women's wage income more. On the other hand, when vocational or technical high school degrees are compared with general high school degrees, it is seen that vocational high school degree increases wages of both males and females more than high schools. The return to vocational school is higher than high school by 0.053 log points for males and 0.037 log points for females. The findings are consistent with the studies of Tansel (1994,1996,2005 and 2008), Ulucan and Çiftçi (2019), and Tansel and Bodur (2012), which demonstrate that vocational or technical high schools increase their wages more than general high schools.

When the effects of other variables in Heckman's estimation on wage incomes of men and women are examined, being unregistered to a security institution causes men and women to earn lower wages compared to their formal working status. Unregistered men earn 0.294 log points and women 0.610 log points lower wage

income. This variable reduces women's wage incomes more. Similarly, working temporarily reduces the wage income of men and women by 0.291 logarithmic points and 0.497 logarithmic points, respectively, as compared to working permanently. Men and women working in the public sector earn higher wages than those working in the private sector. Men working in the public sector earn 0.331 logarithmic points more wage income than men in the private sector. As for women, those working in the public sector earn 0.322 logarithmic points more than those working in the private sector. Thus, it is seen that working in the public sector has a greater effect on men's incomes compared to the private sector. Finally, when the effect of working in the non-governmental sector (foundation, association, etc.) on wage incomes compared to the private sector is examined, we observe no significant effect on men's incomes and an increase in women's wage incomes by 0.112 logarithmic points.

Table 5 shows the quantile estimation results for men. When the quantile regression results for men are evaluated, it is seen that increases in education level for all income groups lead to higher wage incomes. While the effect of primary school degrees on wages is positive only for the lowest income group (q10), it is negative for other income groups. This situation can be explained by the ability bias, which is also stated as a result of the Heckman estimation method. Secondary school's effect is the highest in the second-highest income group (q75), 0.062 logarithmic points, and lowest in the second-lowest income group, 0.037 logarithmic points. The effect of the high school degree is the highest in the highest income group (q90) and the lowest in the lowest income group (q10). It is seen that vocational or technical high school degree provides higher wage income than general high school degree. This situation supports the importance that should be given to vocational education. The premium of the vocational or technical high school degree is 0.009 logarithmic points in the lowest income group (q10), 0.012 logarithmic points in the second-lowest income group (q25), 0.020 logarithmic points in the median income group (q50), 0.014 logarithmic points in q75. However, the highest income group (q90) earns 0.017 logarithmic points lower wage income than those with general high school degrees. The premium of college and post-graduate education levels steadily increase as we move to the higher-income segments.

Men who work in an informal sector job earn lower wages than those who work in the formal sector. The negative effect of not working as a registered employee on wages is the highest in the lowest income group, with 0.531 logarithmic points (q10). The effect is the lowest in the highest income group, with 0.174 logarithmic points (q90). Similarly, temporary employment in a job has a negative effect on all income groups compared to permanent employment. This effect is highest in the lowest income group (q10) with 0.414 logarithmic points and in the highest income group (q90) with at least 0.033 logarithmic points. It is seen that men who work in the public sector earn higher wages in all income groups compared to those who work in the private sector. However, in this part, unlike other variables, the effect is the highest in the lowest income group (q10), with 0.458 logarithmic points, while in the highest income group (q90), the effect is the lowest, with 0.235 logarithmic points. When the wage incomes of the non-governmental sector workers are concerned, they earn 0.113 logarithmic points lower wage income in the lowest income group (q10). However, those employees earn 0.059 logarithmic points and 0.107 logarithmic points higher wage income in the second-highest income group (q75) and the highest income group (q90), respectively.

Table 6 shows the quantile estimation results for women. When the quantile regression results for women are analyzed, we observe that the primary school degree has no significant effect on wage incomes. The secondary school degree does not affect the wage income of the lowest income group (q10). As the degrees of school completed in women increase, wage incomes increase for each income group. The increasing effect of all school degrees on wages is highest for the highest income group (q90) and least for the lowest income group (q10). For all income groups, those with vocational or technical high school degrees earn higher wages than those with general high school degrees. Thus, the importance of vocational education is once again revealed. Compared to the reference category group, those without diplomas, it is seen that those who earn the highest wages are those with university and master's or doctoral degrees.

Those women who are not registered in a job earn lower wage income in all income groups compared to those who work formally. This variable reduced wage income by 1.002 logarithmic points in the lowest income group (q10). When the effect of not working continuously in a job on wage incomes compared to the status of permanent employment is examined, it is seen that results similar to unregistered workers. Those working

in the public sector earn higher wages in all income groups than those who do not work in the private sector. The effect of this variable, unlike other variables, is the highest in the lowest income group (q10), with 0.516 logarithmic points, and the lowest in the highest income group (q90), with 0.245 logarithmic points. The wage income of non-governmental sector (foundation, association, etc.) employees is 0.443 logarithmic points higher in the lowest income group (q10), 0.233 logarithmic points higher in the second-lowest income group (q25), and 0.043 logarithmic points greater in the median income group compared to those working in the private sector. In the highest income group (q90), this group earns 0.073 logarithmic points lower wage income than those working in the private sector.

Table 4: Heckman Two-Stage Estimation Results

	Male		**Female**	
	HECKMAN	**HECKMAN 1st stage**	**HECKMAN**	**HECKMAN 1st stage**
Primary Sch.	-0.485 (0.1000) ***	-0.081 (0.0415) **	-0.086 (0.1473)	-0.080 (0.0542)
Middle Sch.	0.325 (0.1011) ***	-0.035 (0.0419)	0.064 (0.1695) ***	0.061 (0.0638)
High Sch.	0.102 (0.1050) ***	-0.012 (0.0477)	0.149 (0.1628) ***	-0.107 (0.0672)
Vocational High Sch.	0.115 (0.1038) ***	0.033 (0.0472)	0.186 (0.1633) ***	-0.028 (0.0694)
Junior College	0.255 (0.1093) ***	0.040 (0.0574)	0.302 (0.1637) ***	-0.089 (0.0732)
College	0.453 (0.1110) ***	0.025 (0.0550)	0.497 (0.1652) ***	0.025 (0.0714)
Masters and Doc.	0.835 (0.1524) ***	-0.20 (0.0919) **	0.818 (0.2016) ***	0.072 (0.1227)
Age	YES	YES	YES	YES
Region	YES	YES	YES	YES
Work Status	YES	YES	YES	YES
Not Registered to Social Security.	-0.294 (0.0060) ***	-0.60 (0.0211) ***	-0.610 (0.1568) ***	-0.68 (0.0383) ***
Temporary worker	-0.291 (0.0074) ***	-1.154 (0.0222) ***	-0.497 (0.1414) ***	-1.055 (0.0360) ***
Activity field	YES	YES	YES	YES
Public Sector	0.331 (0.0083) ***	0.384 (0.0719) ***	0.322 (0.0098) ***	0.44 (0.0636) ***
Non-Governmental Sector	-0.007 (0.0296)	0.009 (0.1420)	0.112 (0.0174) ***	0.62 (0.1373) ***
Married	X	0.089 (0.0285) ***	X	-0.067 (0.0446)
Divorced	X	0.007 (0.0637)	X	-0.223 (0.0652) ***
Spouse dead	X	0.125 (0.1477)	X	-0.232 (0.0977) ***

(*** denotes statistical significance at 0.001, ** denotes statistical significance at 0.05, and * denotes statistical significance at 0.10. The reference category in the types of schools graduated from is without a diploma. Those who work registered in the enrollment variable, permanent employment in the continuity at work variable and private sector employees are the reference categories for public and other employee variables. Marital status variables are used only in the 1st stage Heckman estimation.)

Table 5: Male Quantile Regressions Results

Male Quantile					
Variable	**Q10**	**Q25**	**Q50**	**Q75**	**Q90**
Primary Sch.	0.016 (0.0074) **	-0.006 (0.0033) *	-0.022 (0.0070) ***	-0.024 (0.0070) ***	-0.030 (0.0088) ***
MİDDLE SCH.	0.042 (0.0074) ***	0.037 (0.0034) ***	0.055 (0.0070) ***	0.062 (0.0069) ***	0.052 (0.0087) ***
High Sch.	0.052 (0.0075) ***	0.064 (0.0038) ***	0.103 (0.0073) ***	0.137 (0.0079) ***	0.184 (0.0100) ***
Vocational High Sch.	0.061 (0.0075) ***	0.076 (0.0041) ***	0.123 (0.0072) ***	0.151 (0.0072) ***	0.167 (0.0096) ***
Junior College	0.113 (0.0078) ***	0.172 (0.0061) ***	0.242 (0.0079) ***	0.313 (0.0087) ***	0.333 (0.0109) ***
College	0.222 (0.0099) ***	0.328 (0.0048) ***	0.426 (0.0077) ***	0.511 (0.0078) ***	0.576 (0.0102) ***
Masters and Doc.	0.453 (0.0216) ***	0.602 (0.0083) ***	0.756 (0.0170) ***	0.974 (0.0191) ***	1.129 (0.0151) ***
Age	YES	YES	YES	YES	YES
Region	YES	YES	YES	YES	YES
Work Status	YES	YES	YES	YES	YES
Not Registered to Social Security.	-0.531 (0.0148) ***	-0.321 (0.0048) ***	-0.192 (0.0048) ***	-0.176 (0.0046) ***	-0.174 (0.0061) ***
Temporary worker	-0.414 (0.0029) ***	-0.271 (0.0128) ***	-0.131 (0.0065) ***	-0.071 (0.0046) ***	-0.033 (0.0073) ***
Activity field	YES	YES	YES	YES	YES
Public Sector	0.458 (0.0076) ***	0.487 (0.0049) ***	0.438 (0.0053) ***	0.347 (0.0068) ***	0.235 (0.0099) ***
Non-Governmental	-0.113 (0.0493) **	-0.031 (0.0235)	-0.001 (0.0121)	0.059 (0.0218) ***	0.107 (0.0470) **

(*** denotes statistical significance at 0.001, ** denotes statistical significance at 0.05, and * denotes statistical significance at 0.10. The reference category in the types of schools graduated from is without a diploma. Those who work registered in the enrollment variable, permanent employment in the continuity at work variable and private sector employees are the reference categories for public and other employee variables. Marital status variables are used only in the 1st stage Heckman estimation.)

When we analyze the quantile regression results for men and women together, we should first examine the effects of school degrees on wages. From the lowest income group (q10) to the second-highest income group (q75), the premiums of secondary school, general high school, vocational or technical high school, college, and university degrees are higher for men than women. However, in the second highest (q75) and highest (q90) income groups, the education premiums are higher for women than men. On the other hand, the effect of master's or doctoral degrees are the highest for women in q90. This result supports the studies of Çiftçi and Kangallı (2015) investigating the contribution of parents' education status living in Denizli to family income for 2012. In their study, similar to our results, they found that increases in the education of fathers from the lower-income group (q10) to the median income group (q90) increased the family income more, but in the high-income groups, the increases in the education of the mothers increased the family income more.

Informal work, shown by registration status, causes both men and women to earn lower wages than formal work. The negative effect of this variable on wages is seen to be higher for women than men for all income groups. Among the reasons for the negative effect of unregistered employment on wages, the higher supply of informal workers compared to the formally employed workforce plays an important role. Furthermore, women and men in the informal sector cannot benefit from most worker rights. Another reason for this adverse effect is the increase in the number of immigrants in Turkey. The migrant workforce is willing to work at lower wages than the domestic workforce. This makes immigrants more competitive in the labor market than the domestic

labor force. Şenses (2015) examines the effect of immigrants on wages. At the end of his study, he reveals that immigrants have a negative impact on wages. The effect of not working continuously in a job on wages compared to permanent working status is negative for both men and women for all income groups. On the other hand, this negative effect is lower in males, as in the variable of registration. Employees in the public sector earn higher wages for both men and women than those working in the private sector. However, women working in the public sector earn higher wages than men for all income groups. In addition, the lowest income group (q10) earns the highest wage for men and women, and the highest income group (q90) earns the lowest income. Finally, non-governmental sector employment negatively affects men's wage incomes and increases women's wage incomes in the lowest income group (q10) compared to working in the private sector. However, in the highest income group (q90), the effect of the variable on wages is negative for women and positive for men. However, women working in the public sector earn higher wages than men. Compared to those working in the private sector, non-governmental sector employees earn lower wages in the lowest income group for men (q10) and higher wage income for women in the highest income group (q90).

Table 6: Female Quantile Regression Results

Female Quantile					
Variable	**Q10**	**Q25**	**Q50**	**Q75**	**Q90**
Primary Sch.	-0.215 (0.0174)	-0.003 (0.0040)	-0.003 (0.0020) *	-0.003 (0.0057)	-0.007 (0.0062)
Middle Sch.	0.001 (0.0186)	0.011 (0.0045) **	0.041 (0.0036) ***	0.094 (0.0074) ***	0.113 (0.0086) ***
High Sch.	0.035 (0.0188) *	0.027 (0.0042) ***	0.069 (0.0035) ***	0.164 (0.0087) ***	0.237 (0.0105) ***
Vocational High Sch.	0.060 (0.0175) ***	0.036 (0.0041) ***	0.085 (0.0040) ***	0.202 (0.077) ***	0.262 (0.0092) ***
Junior College	0.105 (0.0177) ***	0.076 (0.0043) ***	0.183 (0.0070) ***	0.342 (0.0081) ***	0.429 (0.0119) ***
College	0.183 (0.0177) ***	0.187 (0.0059) ***	0.356 (0.0051) ***	0.548 (0.0081) ***	0.646 (0.0092) ***
Masters and Doc.	0.347 (0.0186) ***	0.382 (0.0089) ***	0.640 (0.0157) ***	0.962 (0.0184) ***	1.143 (0.0206) ***
Age	YES	YES	YES	YES	YES
Region	YES	YES	YES	YES	YES
Work Status	YES	YES	YES	YES	YES
Not Registered to Social Security.	-1.002 (0.0219) ***	-0.694 (0.0239) ***	-0.420 (0.0085) ***	-0.247 (0.0094) ***	-0.188 (0.0065) ***
Temporary worker	-0.920 (0.0097) ***	-0.719 (0.0218) ***	-0.489 (0.0074) ***	-0.270 (0.0158) ***	-0.184 (0.0068) ***
Activity field	YES	YES	YES	YES	YES
Public Sector	0.516 (0.0209) ***	0.567 (0.0049) ***	0.464 (0.0059) ***	0.349 (0.0078) ***	0.245 (0.0112) ***
Non-Governmental	0.443 (0.0209) ***	0.233 (0.0246) ***	0.043 (0.0071) ***	0.003 (0.0084)	-0.073 (0.0131) ***

(*** denotes statistical significance at 0.001, ** denotes statistical significance at 0.05, and * denotes statistical significance at 0.10. The reference category in the types of schools graduated from is without a diploma. Those who work registered in the enrollment variable, permanent employment in the continuity at work variable and private sector employees are the reference categories for public and other employee variables. Marital status variables are used only in the 1st stage Heckman estimation.)

7.CONCLUSION AND POLICY SUGGESTIONS

According to the 2017 household data used in the study, while the majority of women in Turkey do not have a diploma, the education level is higher for males. This situation emerges as a major reason for the gender wage differences in Turkey. According to the Heckman two-stage estimation results, an increase in education increases women's wage income faster than men in some income groups. This increase is greater for males in bottom-earning segments and bigger for women in higher-earning segments. Thus, the most basic policy recommendation that can be given to reduce the gender pay gap and to have equal distribution in Turkey is to increase the education level of women. The higher premium of vocational or technical high schools in Turkey suggests that their number should be increased. In addition, Turkey will have an advantage over other developing countries in higher education capacity serving a massive population. Individuals may have the opportunity to rise to higher income groups in the future from their current income groups due to the expansion in the coverage of university education in Turkey. However, there are serious quality problems in university education in Turkey. One of the most important problems is that quality increases do not accompany the increase in the number of universities. In Turkey, it is essential to eliminate this quality-quantity imbalance immediately and to implement policies aimed at increasing the qualifications of universities. Thus, in this way, Turkey will be able to bring the human capital stock it needs for the knowledge economy to the desired levels. It is also shown that working in the informal sector compared to being registered and the status of working temporarily have negative effects on the wage incomes of men and women compared to permanent employment. Hence, unregistered employment should be brought to minimum levels in order to ensure a more fair income distribution in Turkey.

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