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The causal effects of education on wages: Evidence from Kyrgyzstan

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Abstract

This study uses a Mincerian earnings function to estimate the effect of education and experience on the wages of women working in developed business and trade center of Bishkek, Kyrgyztan. It employs a robust median regression and M Regression to estimate the functions for both public and private sectors. The paper also estimates the function using a least squared regression for comparison. **Findings/Originality**: The results show that returns to education for women employees in the private sector are higher than that of in the public sector. In contrast, the returns to experience for women employees in the public sector are higher than those in the private sector. The study reveals that schooling has strong causal effects on wages. Therefore, the government should give sufficient priority to education. Every Som spent in quality education generates strong positive returns for the whole economy. So that Kyrgyz government should put more efforts to enable individuals staying longer in education.

Introduction

The position of women in work-life is very important. Enhancing women's participation in economic development is not only an economic subject, but it is also a social matter. Women's participation in the work-life will provide increased income and hence an improved life quality for the family. Moreover, in addition to economic benefits, women's participation in the work-life is also very important from the perspective of eliminating discrimination, as well as women gaining freedom and self-confidence, hence, empowerment. Needless to say, from both individual and social perspectives, women's participation in the workforce and increasing employment are important factors in attaining sustainable development (Karabiyik, 2012).

Despite the fact that the female population constitutes half of the human capital of the world, female participation in the workforce lags behind male participation in every country (OECD, 2008). In industrialized countries where all the basic needs of citizens can be met, the average life expectancy of women is six years longer than men (This difference is less in many countries). In large parts of southern Asia, baby boys are believed to live longer than baby girls. Because girls are not expected to make economic contributions to the family, parents are reluctant to make investments in their girls. In many developing countries, women's education lags far behind the men, and this causes far-reaching negative outcomes for both individuals and national wealth. Increased education for girls will change this vicious cycle, and increasing of schooling will increase the incomes of women, and social benefits will be much more powerful. Education is an indispensable element of social and economic development. In many countries, the provision of access to education is the primary policy target (King & Hill, 1997).

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In the early years of transition from pre-reform times, in many of the Eastern European countries, the gender wage gap narrowed (Estonia, Hungary, Poland, Czech Republic, Slovak Republic, Slovenia, Romania, and Bulgaria). In the Commonwealth of Independent States, (Ukraine, Russia, Belarus, and Kyrgyzstan) however, an opposite situation has been observed, and gender wage gap increased dramatically (Brainerd, 2010). Among the early transition countries, the change in the gender gap in Kyrgyzstan is 0.304% between 1993-1997. This is the greatest change in the transition countries (Anderson & Pomfret, 2003). According to the Asian Development Bank's Gender Assessment Report in 2005, as of 2000, Kyrgyz women earned 67.6% of what men earned, and by 2002 the ratio declined further to 64.9%. According to the gender discrimination report, which was published in 2013 by the World Economic Forum and contained data pertaining to 136 countries, Kyrgyzstan is ranked 63rd. In other words, Kyrgyzstan is one of the countries that reveal a negative outlook on the inequality index between men and women. Most studies find that individual characteristics explain a very small portion of the gender wage differentials.

Having gained its independence after the dissolution of the USSR in 1991, Kyrgyzstan turned its back to a centralized planned economy and started to accord with the market system. During that period full and efficient utilization of production resources could not be attained because, from the perspective of gender, there is an unequal distribution in the utilization of the workforce that favors men. Moreover, one of the greatest problems the women workforce faces is equal pay for equal work. It is observed that women are paid lower wages than men in Kyrgyzstan. The fact that women concentrate more on certain professional categories or sectors is another challenge to overcome.

According to the National Statistics Committee data from 2012, women constitute 50.6% of the Kyrgyzstan population. While 35.4% of population, which is 2.810.148, live in the cities, 64.6% live in rural areas. When the population is analyzed from the perspective of age groups, it is seen that the country, where the greatest share belongs to 20-24 age group, has a young women population. The women's share inactive population is 41.3% in 2012 (men 58.6%). While the women employment rate is 46.9% (men 71.3%), the women unemployment rate has occurred at 9.5% (men 7.7%).

With 59.1%, the sector with the highest concentration of women workforce is the services sector. The shares of the women in the total employed people in the healthcare and education system has been 83.4% (men 16.6%) and 76.9% (men 23.1%), respectively. With 30%, agriculture sector follows the services sector. The women employment in industrials sector is at 9.8% whereas it is at 1.1% in construction sector. In 2012, it has been reported that 22.9% of the employed women had university degree (men 15.8%) and 25% of them (men 21.1%) were the graduates of vocational and technical schools. In other words, this situation puts forward the fact that women are better educated than men in the country. In general, women are employed with lower rates of wages. On average, it is observed that women work with 35% lower wages than men. In a word, it is evident that there is gender-based discrimination in wages across the country.

In conclusion, it can be said that an increased level of education for women will be a trigger for them to participate more actively in the work-life. The impact of better-educated women will be far-reaching, and they will add value not only to themselves but also to their families and to the societies they live in. For these important reasons, we focused particularly on the women employees while analyzing the relationship between education and wage, and we conducted our analysis specifically for Kyrgyz women employees.

The aim of this study is to determine the effects of education and experience on the wages of women employees. The working women in Bishkek, the capital city of Kyrgyzstan, constitute the target group. The effects of these returns have been analyzed by making separate studies for both the private sector and the public sector, and differences between the two sectors have been

examined. The effects of education and experience on wages have been analyzed within the scope of Mincer wage equations and by employing robust estimation methods.

Following the introduction section of the study literature review takes part, while LS, M and Median regression explanations, which are used in estimating the Mincer wage equations, have been tackled in the methodology section. The data used and the obtained descriptive statistics have been presented in the findings section. In the final section, however, discussions and conclusions have been elaborated.

In literature, there are many studies in which returns to education and experience were analyzed by utilizing Mincer equations. Some of those studies are Bargain, Bhaumik, Chakrabarty, and Zhao (2007), Fiaschi and Gabbriellini (2013), Güriş and Çağlayan (2012), Krafft, Branson, and Flak (2019), Lee and Lee (2006), Montenegro and Patrinos (2014), Psacharopoulos and Patrinos (2018), Rizk (2016), Tansel and Bircan (2004).. In these studies, different econometric models have been used. However, existence of outliers in the data has necessitated the use of robust methods. While Buchinsky (1994, 1995), Garcia, Hernandez, and Lopez-Nicolas (2001), Fersterer and Winter Ebmer (2003), Pointner and Stiglbauer (2010), Andini (2007, 2010), Bosio (2009), Pereira and Martins (2000), Changqing (2013), Denny and O'Sullivan (2007), McGuinness and Bennett (2007), Humpert (2013) use quantile regression in their studies for developed countries, and Montenegro (2001), Wang, Lv, and Qu (2013), Bishop, Luo, and Wang (2005), Guriş, Caglayan, and Sacakli (2009), Guris, Caglayan, and Saçildi (2010), Tansel and Bodur (2012) use LS and quantile, and Figueiredo and Fontainha (2013), Agrawal (2012), Badel & Peña (2010), Bishop, Chiou, and Mai (2004), Ntuli (2007), Caamal-Olvera (2013), Pham and Reilly (2007), and Staneva, Arabsheibani, and Murphy (2010) use quantile regression for developing countries.

The studies generally have found positive and significant effects of returns to education and experience on wages. Weisberg (1995) estimated Mincer's model using data collected in 1974 and 1983, respectively. The researcher found that returns to education increase over the period considered. In their study analyzing the determinants of wages in labour market in Korea, Lee and Lee (2006) found that education, age and experience variables have positive and significant effect in determination of wages. Bargain et al. (2007) estimated Mincer earnings equations for China and India and concluded that the increase in average wages in China was caused by the increase in average education levels. Similar findings have been obtained by Pereira and Martins (2000) and Fiaschi and Gabbriellini (2013) in the case of Portugal and Italy respectively.

There exist a large number of studies that used the Mincerian earnings function in order to see the changes in returns to education according to gender status. Behrman, Wolfe, and Blau (1985), Caamal-Olvera (2013), Guriş et al. (2009), and Wang et al. (2013) in their studies uncovered the fact that returns to education were higher for women compared to men. Other studies demonstrated that the returns to education had a downward tendency for women (Fersterer & Winter Ebmer, 2003; Pointner & Stiglbauer, 2010).

Many researchers adopted the Mincerian wage regression to investigate the wage differences between public and private sector employees. Smith (1976) using human capital earnings model estimated separate regressions for the federal and private-sector workers using data for 1960 and 1970 and found that returns to education were similar or higher for private workers in 1960 but higher for federal employees in 1970. The returns to experience were same or higher in favor of federal workers. In his study carried out by using Spanish data Lassibille (1998) revealed that private sector pays higher returns to human capital as compared to public sector. Similar findings have also been obtained by Psacharopoulos, Velez, & Patrinos (1994) and Al-Qudsi (1989) in the case of Paraguay and Kuwait. Using the data for Turkey, Guris et al. (2010) found that there were not considerable wage differences for women and men working at the same position in the public sector. Also, it was indicated that the returns to experience both in private and public sectors

are higher for men than for women and that the returns to education are higher for private sector than public sector.

The contribution of this work is twofold: First, mincer equations have been estimated by median and M regressions, and their results have been compared with LS. Second to the best of our knowledge this is the first econometric study in this field carried out using the data of Kyrgyzstan.

Methods

In the Mincer wage equation setting, the linear regression model can be written as:

$$lnW_i = \beta_0 + \beta_1 S_i + \beta_2 X_i + \beta_3 X_i^2 + \varepsilon_i$$

where $ln\, W_i$ is natural logarithm of individual's wage, S_i is number of schooling years, X_i is experience of individual, X_i^2 is square of experience. Coefficient β_1 denotes the return of each additional year spent on education, namely returns to education; Coefficient β_2 denotes the return of each additional year spent during working life, namely returns to experience; and ε_i denotes the error term.

When the literature is reviewed, it is seen that the Mincer equation is prevalently estimated with the LS method. The equation will be estimated with the LS method in our study, as well. The LS estimators are obtained as follows:

$$\hat{\beta}_{LS} = argmin_\beta \sum_{i=1}^{n} \hat{u}_i^2$$

In this method, the coefficients are estimated by minimizing the sum square of residuals. For the LS estimators to have the desired characteristics the commonly used assumptions should be satisfied such as the residuals should have constant variance and be free of autocorrelations, and there should not be multi-linear dependency between independent variables. Particularly when there are outliers the Least Squares estimators are affected by this situation, and they provide unreliable results. Therefore, to be able to eliminate the problems that may arise with the LS estimators, the robust regression methods and estimators arise as important alternative instruments. The median regression gives much fewer weights to outliers than the LS, and this situation yields to having more robust estimators against outliers.

Median regression estimators are obtained as follows:

$$\hat{\beta}_{MEDIAN} = argmin_\beta \sum_{i=1}^{n} |\hat{u}_i|$$

In median regression, the coefficients are estimated by minimizing the absolute values of residuals. The median regression is also called L1 regression. The median regression is known to be robust against the outliers that occur in the dependent variable. The M estimators, which are the other robust estimators, have robust location estimators. And by using a ρ function, sensitivity has been lessened. M estimators are obtained as follows;

$$\hat{\beta}_M = argmin_\beta \sum_{i=1}^{n} \rho(\hat{u}_i)$$

where $\rho(\hat{u}_i)$ is the sum function of residuals and it denotes the contribution of each error term to the objective function. When compared with the sum square of residuals and the sum of absolute value of residuals, the M estimators minimize the divergence function of observation values obtained from a more general estimate.

Results and Discussion

Data and Descriptive Statistics

In this study, to analyze the effects of education and experience on wages of working women in Bishkek, the capital city of Kyrgyzstan, surveys have been conducted. The reason for choosing the capital of Kyrgyzstan, to apply the survey questions in the framework of this study is that this city is not only a developed business and trade center, but it is also a historical and touristic city favored for education. Moreover, Bishkek City is a city where individuals with different socio-economic and socio-cultural characteristics from around Kyrgyzstan that has approximate population of 5.5 million, have settled with different economic goals. And it has great representational power concerning showing Kyrgyz people's wage differentials (Caglayan, Saçildi, & Oskonbayeva, 2014).

According to official reports of the National Statistical Committee of the Kyrgyz Republic in 2012, the number of working people in Kyrgyzstan is 2.286.400. The population of Bishkek in 2012, however, is 1.420.783. Because it was not possible to find the number of employees concerning sectors and genders, the number of surveys has been determined by taking the population into consideration and by using statistical methods[1]. According to the $\pm$ 0,05 error margin for P=0,5; P=0,4 and P=0,3 the sample size was respectively calculated as n_1=384, n_2=369, n_3=323. The number of surveys to be used in the study was determined as 384, and the sample was drawn randomly. However, by employing a higher number of surveys, applications have been made with 675 women employees, and the models have been estimated. The survey was conducted in 2012 and the descriptive statistics, which show the demographic structure, age, marital status, educational level and employment status of 675 women employees that joined the survey, are presented in Table 1.

Table 1. Descriptive Statistics of Women Employees

		Total (%)	Private Sector (%)	Public Sector (%)
Age Distribution	16-20	0.3	0.6	0.0
	21-30	33.8	41.0	27.4
	31-40	30.4	32.2	28.8
	41-50	26.1	19.6	31.8
	51 and more	9.5	6.6	12.0
Marital Status	Married	56.9	53.9	59.5
	Single	26.8	34.1	20.4
	Divorced	11.3	7.6	14.5
	Widow	5.0	4.4	5.6
Children Status	Childless	30.7	39.1	23.2
	Have child	69.3	60.9	76.8
Education	Vocational and high school	20.4	18.6	22.1
	University	65.2	69.1	61.7
	Master	3.3	4.4	2.2
	Doctorate	1.3	1.3	1.4
Monthly Wages	10000 and less	75.1	62.1	86.6
	10001-20000	21.9	33.8	11.5
	20001-30000	2.5	3.5	1.7
	30001 and more	0.4	0.6	0.3

[1] As for the optimal sample size of the population rate, the number of survey was determined by the following formula: $= \frac{Z_{\frac{\alpha}{2}}^2 P(1-P)}{d^2}$; where, $Z_{\frac{\alpha}{2}}$ is confidence coefficient, d is error margin and P is population rate. After calculating the formula its control was made by the n/N ratio. 0.05 significance level is used in the study.

The table shows that 41 % of the surveyed women working in the private sector are in the age bracket of 21-30, while in the public sector 31.8 % of female workers are in the age bracket of 41-50. Participants are comprised of 56.9 % married, 26.8 % single, 11.3 % divorced, and 5 % widowed individuals. The great percentage of working women in both sectors is married. According to the marital status of the survey participants, 53.9% of female workers in private sector and 59.5% of working women in public sector are married. According to the children status, 69.3 % of female workers have, and 30.7 % do not have children. According to the education status, 65.2 % of the participants are university graduates, 20.4 % high school and vocational high school graduates, 3.3 % Master graduates, 1.3 % Ph.D. graduates. When education status is analyzed, the great percentage of both the public (61.7%) and private (69.1%) sector is university graduate and their wages are less than 10,000 soms. The monthly salary of 75.1 % of the participants is less than 10000 som, monthly salary of 21.9 % of participants is in the interval of 10001-20000 som, 2.5% in the interval of 20001-30000 som, 0.4 % above 30001 som.

Estimation Results

Firstly, we estimate the standard Mincer equation by employing LS to the data obtained from the surveys about all the women employees and then analyze subsequently by separating the data between public and private sector workers. To check the validity of LS assumptions, some diagnostic tests have been conducted. Particularly, when the cross-sectional data were used, the presence of heteroscedasticity in the data is tested by Breusch-Pagan-Godfrey and White tests. For the specification error Ramsey's Reset Test has been applied. To determine whether there are outlier problems, standardized residuals and studentized residuals have been calculated. The results of these residuals give strong evidence that there are outlier problems. Having determined that outliers exist, Mincer equations have been estimated with median and M-regression. The LS, Median and M Regression estimate results have been summarized in Table 2.

Table 2. The Estimation Results of Mincer Earnings Equation of Women Employees

Dependent Variable: log(Wages) n=675			
Independent Variables	LS	MEDIAN	M
Constant	6.957*	6.617*	6.936*
NS_i	0.113*	0.136*	0.116*
EXP_i	0.031*	0.028*	0.027*
EXP_i^2	-0.001*	-0.000*	-0.000*
Diagnostic Tests			
R^2	0.21		
Pseudo-R^2		0.10	
F	62.82		57.05
Reset	0.48		
Breusch-Pagan-Godfrey	8.19		
White	22.61		

Notes: NS_i =number of years of schooling, EXP_i =work experience, EXP_i^2 =the square of the work experience; * indicates $p < 0.01$

According to Table 2, LS estimation results of standard Mincer earnings equation for all women employees, all of the coefficients are statistically significant. The coefficient signs of all the variables come out as expected. It is seen that increases in the number of schooling years and experience have an increasing effect on wages. However, the coefficient of the square of experience has a decreasing negative effect. According to the result of the RESET test, null hypothesis that

"there is no functional specification error", cannot be rejected at any reasonable level. The results of both Breusch-Pagan/Godfrey and White tests for heteroscedasticity indicate that the null hypothesis of a constant variance has been rejected at the 5% level. Additionally, the presence of outliers has been calculated by standardized residuals, and studentized residuals and the existence of "28" and "31" outliers have been found concerning these two measures, respectively. When the outliers were detected the standard Mincer equation has been estimated with median and M-regression, which are more robust models than LS.

The signs of the coefficients that were estimated with the Median and M-regression are the same as the LS estimate results. In the coefficient magnitudes, however, some small differences are observed. Concerning Median and M- regression, the effect of returns to education on the wages has been estimated as 13% and 11%, respectively, whereas the effect of returns to experience has been estimated as 2%. In our study, the 675 women's data obtained from survey results have been separated into two, the private sector and the public sector. The reason for this is to examine the differences in wage distributions among the sectors. The descriptive statistics of the variables pertaining to survey participants are shown in Table 3.

Table 3. Descriptive Statistics of the Variables with Respect to Public-Private Sector Difference

Statistics	Log (Wages)		Number of schooling		Experience	
	Public	Private	Public	Private	Public	Private
Mean	9.14	8.73	15.29	14.87	11.21	14.50
Median	9.21	8.69	16.00	16.00	8.00	14.00
Standard deviation	0.50	0.51	1.78	2.06	10.12	9.64
Skewness	0.25	0.43	-0.62	-0.33	1.34	0.56
Kurtosis	3.00	3.94	4.13	3.16	4.48	2.85
Jargue-Bera	3.45	24.49	3.45	7.01	124.17	19.59

The table shows that 358 survey participants worked in the public sector with an average logarithmic monthly wage of 8,72, and 317 survey participants worked in the private sector with an average logarithmic monthly wage of 9.14. When the standard deviations are analyzed it is observed that wage variations are close but higher in the public sector. When the descriptive statistics are analyzed it is seen that according to Jargue-Bera normality test results of the logarithmic wage variable for the public sector, the H_0 hypothesis for public sector is rejected and series do not have normal distribution, but do have normal distribution for the private sector. When the number of schooling years is analyzed it is seen that in public sector, average schooling year number of employees is approximately same as that of the private sector employees, however, on average they have more experience. When we look at their standard deviations, and when the number of schooling years is taken into consideration, it is seen that the differentials for women employees in the public sector is higher than the private sector. However, when experience is taken into consideration, the differentials for women employees in the private sector seems higher than public sector. By utilizing the descriptive statistic information above, the education rate *(EDR)* and the experience rate *(EXR)* can be calculated as follows, respectively:

$$EDR = \frac{\overline{NS}_{pu}}{\overline{NS}_{pr}} x100 = \frac{14.8715}{15.2933} x100 = \%97.24 \text{ and } EXR = \frac{\overline{EXP}_{pu}}{\overline{EXP}_{pr}} x100 = \frac{14.5075}{11.2129} x100 = \%129.38$$

Accordingly, it is seen that those working in the public sector are less educated than those in the private sector, but are more experienced. To be able to see the differences in public and private sector for women, firstly the Mincer equation has been estimated with the LS method. All

the results of the estimates that were conducted with respect to public-private sector difference have been summarized in Table 4.

Table 4. The Estimation Results of LS, Median and M-Regression for Public and Private Sector

Dependent Variable: log(Wages)						
Independent Variables	PRIVATE SECTOR (n=317)			PUBLIC SECTOR (n=358)		
	LS	MEDIAN	M	LS	MEDIAN	M
Constant	7.483*	7.356*	7.443*	6.709*	6.931*	6.971*
NS_i	0.089*	0.097*	0.092*	0.108*	0.090*	0.084*
EXP_i	0.046*	0.043*	0.043*	0.041*	0.046*	0.058*
EXP_i^2	-0.001*	-0.001*	-0.001*	-0.001*	-0.001*	-0.001*
Diagnostic Tests						
R^2	0.20			0.35		
Pseudo-R^2		0.11			0.17	
F	27.68		25.93	64.04		51.76
Reset	0.15			1.60		
Breusch-Pagan-Godfrey	16.96			26.10		
White	24.02			44.14		

Notes: NS_i =number of years of schooling, EXP_i =work experience, EXP_i^2 =the square of the work experience;
* indicates $p < 0.01$

In order to examine the wage differential between the public and private sectors, the standard Mincer earnings equation has been estimated separately with the LS method. When we look at the estimation results it is seen that all the coefficients are statistically significant and all the coefficient signs of the variables are in line with expectations. It is seen that increases in the number of schooling years and experience have increasing effect on the wages and the coefficient of square of experience variable has a decreasing negative effect. According to LS estimation results, it is seen that returns to education has an 8% increasing effect on wages while experience has a 4% increasing effect on wages for the private sector. Likewise, it is seen that returns to education has a 10% increasing effect on wages while experience has a 4% increasing effect on wages in the public sector. For the models estimated with the LS, specification tests have been conducted. According to specification test results, RESET test, null hypothesis of there is no specification error, cannot be rejected at any reasonable level. At 1% significance level, the null hypothesis of constant variance has been rejected with respect to both the Breush-Pagan-Godfrey and White tests. Besides, existence of outliers has been calculated with standardized residuals and studentized residuals for the model. When the standardized and studentized residuals are observed it has been found that there are 15 and 16 outliers, respectively, for the private sector and there are 19 outliers for the public sector with respect to both standardized and studentized residuals. In case outliers were detected, the standard Mincer equation has been estimated with M-regression, which is a more robust method.

When the estimate results for both sectors were looked at, it has been seen that both Median and M-regression estimate results are statistically significant and their coefficient signs were estimated in line with expectations. When the private and public sectors have been considered and holding constant other variables, while one year increasing in the number of schooling will increase wages by 9% and while one year increasing experience will increases wages by 4% for women employees. When it comes to the public sector estimates, however, it has been found that returns

to education has an 8% increasing effect on wages while experience has a 4-5% increasing effect. When the obtained results are assessed it can be said that the effect of returns to education on wages is higher in the private sector, but the effect of returns to experience on wages is slightly higher in the public sector.

Conclusions

This paper examines the effects of returns to education and returns to experience on wages of women employees in Bishkek for both public and private sectors, separately. We adopt Mincer wage equations where the log of wages is regressed on a set of education and experience and experience squared. Since the LS suffers from heteroscedasticity, non-normality, and outliers, robust regressions are used to get rid of the problems of LS. Therefore, mincer equations have been estimated by median and M regressions, and their results have been compared with LS.

The findings of this study show that returns to education for women employees in the private sector is higher than in the public sector. Although the education level of the public sector employees increases, not differing general level of wages confirm this consequence. When the returns to experience are examined, it is seen that employees in public sector have higher returns than women employees in the private sector. In response to be dismissed of elder employees in private sector, keeping at working of the most public sector employees until retirement make us thinking this result.

Results revealed that schooling has strong causal effects on wages. So governments should give enough priority to education. Every som spent in quality education generates strong positive returns for the whole economy. In other words Kyrgyz government should make more effort to enable individuals to stay longer in education.

We think that the findings of this study, which is a continuation of Caglayan et al. (2014) that analyzes women-men wage structures in detail, will provide at least partial information to researchers focusing on wage profiles of Kyrgyz women.

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