

APPLICATION OF THE ECONOMETRIC APPARATUS FOR ESTIMATING SOME PARAMETERS IN THE FIELD OF GENDER EQUALITY ON THE MOLDOVAN LABOUR MARKET¹

APLICAREA APARATULUI ECONOMETRIC PENTRU ESTIMAREA UNOR PARAMETRI DIN DOMENIUL EGALITĂȚII DE GEN ÎN CÂMPUL MUNCII DIN REPUBLICII MOLDOVA

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Abstract

The main goal of this article is to evaluate the perception of gender inequality based on the selected data from the questionnaire on gender problems (latest results), elaborated by the team of the STCU project. From the twenty-eight indicators of this questionnaire there were selected five, namely: the perception of existence of inequality in the workplace, gender, age, the level of education and the sector of economic activity. Using the obtained data, gender inequality in the workplace has been estimated in the paper with the four remaining indicators. As a result, a regression function was defined. The determined regression function was estimated and analyzed.

Key words: gender inequality, gender questionnaire, labor demand and supply, least square method, regression function.

JEL: C12, J16, J7.

1. Introduction

The purpose of this paper is to apply the regression analysis of the latest results of a questionnaire about gender problems. In the frame of the research on gender equality issues within the STCU project, a questionnaire was developed, which was placed online in free access. An impressive number of people of different gender, age, level of education and economic sector activity from different countries were involved in completing this questionnaire. Based on the responses presented on 28 positions, five indicators were selected and they received binary values: one and zero.

2. The degree of scientific approach and reflection in the specialized literature

The problem of applying the apparatus of production functions with respect to the women and men contribution to Gross Domestic Product growth and estimating its coefficients is widely researched both in the work of foreign economists Gary Becker, Alan Blinder, Barry Chiswick, Jacob Mincer [Blinder, 1973][Becker & Chiswick, 1966][Chiswick, 2003][Chiswick, 1967][Chiswick, 1974][Chiswick & Mincer, 1972], as well as in the works of the economists from the Republic of Moldova.

The issues of women's involvement in the production process, the participation of women and men in the labor market, discrimination of women in the field of employment, analysis of gender problems in Moldovan SMEs are reflected in autochthonous scientific researches with the participation of the authors of this paper and are edited in scientific journals recognized in the country and in the materials of national and international conferences [Naval, 2018][Colesnicova &

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Naval,2018]] [Naval&Colesnicova&Ciobanu,2019]] [Colesnicova,2009]] [Colesnicova,2011a]] [Colesnicova,2008]] [Colesnicova, 2010]] [Colesnicova, 2011b]].

3. Data sources and used methods

Questionnaire on gender equality at employment has been evolved in the internet open access and consist twenty tow questions only four from which were selected for the purpose of this paper. The sample of 202 observations includes examined women and men from: Moldova, Romania, Russia, Ukraine, Belarus and other countries. Studies have been separated on women and men groups for all examined countries, the same approach was applied only for Moldova and other countries totally and also for women and men separately. Also, the obtained results have compared with earlier effectuated studies for 132 observation sample. The data of the elaborated questionnaire were adapted to the binary data structure (0, 1) by combining insignificant indicators, the values of which surpassed two variants of response. For example, the age indicator: under 35 years = 1; 35-50 years = 2; over 50 years = 3 was replaced by: under 35 years = 1; over 35 years = 0, given the insignificant number of those surveyed over 50 years. The gender indicator was noted as follows: female gender - 1; male gender - 0. At the level of education, the indicator of the respondents with bachelor's / master's studies was 1 and in the case of those with doctoral / postdoctoral studies - 0. The private sector was indicated by binary value 0 and state and mixed - by value 1. In the case of the dependent variable (the perception of gender inequality), the perception of its existence was denoted by the value 0, and the perception of the absence - by the value 1. In the proposed research: ordinary least squares method; multiple linear regression method; ANOVA method, Data Analysis/Regression application in Microsoft Excel[®] were applied.

4. The formulation of the problem and the obtained results

The main objective of this study consists in constructing of the behavioral function for gender problem evaluation of the women and men implications in the labor market of the Republic of Moldova. Before formulating the problem of estimating the coefficients of the regression function for the dependent variable *the existence of inequality at the workplace* (ineq_labour) in relation to *age* (age), *education level* (educ_level), *gender* (gender), *economic sector* (sector) we will make a short presentation of the gender questionnaire. First of all, it must be mentioned that about seven countries from the world including women and men of the different age, education, and activity sector have participated in this questionnaire. So taking in account these facts, different scenarios were elaborated. By total: for Republic of Moldova, all countries, other countries and only for women and men for Republic of Moldova and other countries. In continuation let's follow with behavioral function's coefficients estimations for all proposed scenarios. And let's begin with some example of the initial data presentation of the 4 independent variables for women and men encoded in the binary system are shown in Table 1.

Table 1. Example of the initial data for women and men

Order number	WOMEN				Order number	MEN			
	ineq_labour	age	educ_level	sector		ineq_labour	age	educ_level	sector
1	1	1	1	1	1	1	1	1	0
2	1	1	1	1	2	1	0	1	0
3	1	0	1	1	3	1	1	1	0
4	1	0	0	1	4	0	1	1	0
5	0	0	1	0	5	1	1	1	0

Source: Elaborated by authors based on questionnaire data

Regression obtained for the respondents of both sexes for the sample composed of 132 observations is indicated in Figure 1, earlier results [15].

Figure 1. Equation of regression for 132 respondents of both sexes

Men and women				
ineq_labour = 0.205*gender + 0.2994*age +0.358*educ_level+0.294*sector				
σ (0.0827)	(0.0766)	(0.0688)	(0.0688)	
t [2.4789]	[3.9068]	[5.2049]	[3.4028]	
$R^2=0.7479$; $R^2_{adj}=0.7342$; $F=94.943$				

Source: Elaborated by authors based on questionnaire data

The coefficients of the estimated regression function in Table 1 are significant, which is confirmed by the values of Student statistics (t -statistics), greater than 2.81 (except the first one from the **gender** variable, which shows the significance level of 0.01, therefore does not fall within the significance level of 0.005). At the same time, the standard error values - σ - are small enough.

The values of the estimated coefficients themselves determine the impact of each of the coefficients on the dependent variable, namely: about 35,8% is due to the education level, about 30% - to the age, with almost the same percentage - 29% influences the sector of activity, and on the last position with only about 20.5% is the influence of the gender variable. It should be noted that the examined sample includes both women and men.

The coefficients of determination R^2 and adjusted R^2_{adj} indicate to the fact that the selected regression function is a good one, expressing the degree of correspondence of the model of statistical dependence between the dependent variable **ineq_labour** and independent variables: **gender**, **age**, **educ_level** and the activity **sector**.

Actual results obtained the same for respondents of both sexes for the sample composed of 202 respondents are indicated in Figure 2.

Figure 2. Equation of regression for respondents of both sexes for extended sample (202 respondents)

Men and women				
ineq_labour = 0.4069*gender + 0.1802*age +0.2432*educ_level+0.4608*sector				
σ (0.0763)	(0.0714)	(0.058)	(0.0533)	
t [5.408]	[2.522]	[4.171]	[8.147]	
$R^2=0.624$; $R^2_{adj}=0.613$; $F=82.173$				

Source: Elaborated by authors based on questionnaire data

As we can see from the Figure 2 estimated coefficients for the 202 observations sample are different. It weights are twice larger for gender indicator and almost twice larger for sector indicator. While coefficients along the age and education indicators increase approximately twice. In the extended case all examined statistics: σ , t , R^2 , F , R^2_{adj} , remaining significant, are decreased. So, effectuated calculations demonstrate completely different perceptions of the implicated in study respondents.

In the second scenario (Figure 2), coefficients of the estimated regression function are significant, which is confirmed by the values of Student statistics (t -statistics), greater than 2.81 (except the second one from the **age** variable, which shows the significance level of 0.01, therefore

does not fall within the significance level of 0.005). At the same time, the standard error values - σ - are small enough.

The coefficients of determination R^2 and adjusted R_{adj}^2 are smaller than in Table 1, but hold one's ground that the selected regression function is a good one, expressing the degree of correspondence of the model of statistical dependence between the dependent variable **ineq_labour** and independent variables: **gender**, **age**, **educ_level** and the activity **sector**.

The values of the estimated coefficients themselves determine the impact of each of the coefficients on the dependent variable, namely: about 24% is due to the education level, about 18% - to the age, with 46% influences the sector of activity, and about 40.7% is the influence of the gender variable. It should be noted that the examined sample includes both women and men.

It shows interest the evaluation of the separate opinion of women and men. In order to perform this assessment, it is necessary to divide the questionnaire responses separately for women and men.

Two behavioral functions dependent on the same independent variables will be estimated. The results of the separate assessment of the gender inequality in the workplace of women and men are presented in Figure3 and Figure4; Figure 5 and Figure 6.

Figure 3. Equation of regression for male sample of 37 respondents

Men		
ineq_labour = 0.3292*age +0.3599*educ_level+0.4395*sector		
σ (0.1582)	(0.1298)	(0.1642)
t [2.0869]	[4.0917]	[1.9076]
$R^2=0.6897$; $R_{adj}^2=0.6420$; $F=25.188$		

Source: Elaborated by authors based on questionnaire data

Estimations of the coefficients of the behavioral function for men that is dependent on three factors: age, education level and sector of activity show us the influence of each factor on the issue of men's perceived inequality at work. Approximately 33% are due to age, almost 36% are the influence of the education level and approximately 44% is the impact of the activity sector. Student statistics are between the significance level 0.05 and the significance level 0.005 and standard deviations are moderate. The selected behavioral function shows a high degree of compliance to the statistical data.

Figure 4. Equation of regression for male r sample of 61respondents(extended sample)

Men		
ineq_labour = 0.3032*age +0.3076*educ_level+0.5221*sector		
σ (0.1710)	(0.1043)	(0.1387)
t [1.7733]	[2.9485]	[2.7646]
$R^2=0.5027$; $R_{adj}^2=0.4682$; $F=19.54$		

Source: Elaborated by authors based on questionnaire data

Estimations of the coefficients of the behavioral function (Figure 4) for men that is dependent on three factors: age, education level and sector of activity show us the influence of each factor on the issue of men's perceived inequality at work. Approximately 30% are due to age, almost 31% are the influence of the education level and approximately 52% is the impact of the activity sector. Student statistics are between the significance level 0.05 and the significance level 0.005 and standard deviations are moderate. The selected behavioral function shows some weakly degree of compliance to the statistical data than in the Figure 3. So calculations with extended sample till 202 respondents show much more influence of the age, education level and sector of

economy activities for men. The selected behavioral function shows a high degree of compliance to the statistical data. In the following two tables:

Figure 5. Equation of regression for female sample of 95 respondents

Women		
$\text{ineq_labour} = 0.33 \cdot \text{age} + 0.531 \cdot \text{educ_level} + 0.313 \cdot \text{sector}$		
σ (0.1582)	(0.1298)	(0.1642)
t [2.0869]	[4.0917]	[1.9076]
$R^2 = 0.7581; R_{adj}^2 = 0.7422; F = 97.176$		

Estimations of coefficients of the behavioral function (Figure 5) for women dependent on the same three factors as for men, i.e.: age, education level and sector of activity show us the influence of each factor on the issue of inequality at work, as perceived by women. About 33% is due to age, 53.1% is the influence of the education level and about 31.3% is the impact of the sector of the activity. Student statistics are between 0.05 - the significance level (for the sector) and the significance level of 0.005 for the remaining variables. Standard deviations are moderate. The selected behavioral function shows a high degree of compliance to statistical data.

Figure 6. Equation of regression for female sample of 141 respondents

Women		
$\text{ineq_labour} = 0.176 \cdot \text{age} + 0.329 \cdot \text{educ_level} + 0.481 \cdot \text{sector}$		
σ (0.0835)	(0.1298)	(0.0643)
t [2.1085]	[4.3027]	[7.4826]
$R^2 = 0.6054; R_{adj}^2 = 0.5925; F = 70.58$		

Source: Elaborated by authors based on questionnaire data

Estimations of coefficients of the behavioral function (Figure 6) for women dependent on the same three factors as for men, i.e.: age, education level and sector of activity show us the influence of each factor on the issue of inequality at work, as perceived by women (extended sample). About 17,6% is due to age, approximately 32,9% is the influence of the education level and about 48,1% is the impact of the sector of the activity. Student statistics are between 0.05 - the significance level (for the sector) and the significance level of 0.005 for the remaining variables. Standard deviations are moderate. So calculations with extended sample till 202 respondents show much more influence of the education level and sector of economy activities for women. The selected behavioral function shows some weakly degree of compliance to statistical data.

At last let's show the calculation results for women and men in the framework of the selected data for Republic of Moldova (Figure 7 and Figure 8). In the following two tables calculations for this scenario have presented.

Figure 7. Equation of regression for male sample of 28 respondents from RM

Men		
$\text{ineq_labour} = 0.2796 \cdot \text{age} + 0.5973 \cdot \text{educ_level} + 0.1834 \cdot \text{sector}$		
σ (0.2047)	(0.1665)	(0.1796)
t [1.3659]	[3.5871]	[1.0218]
$R^2 = 0.6725; R_{adj}^2 = 0.6063; F = 17.109$		

Source: Elaborated by authors based on questionnaire data

Estimations of the coefficients of the behavioral function (Figure 7) for men that is dependent on three factors: age, education level and sector of activity show us the influence of each factor on the issue of men's perceived inequality at work. Approximately 28% are due to age, almost 18% are the influence of the education level and approximately 59,7% is the impact of the activity sector. Student statistics are between the significance level 0.05 – one - in front of education and the significance level 0.005 – two in front of two other coefficients, and standard deviations are sufficiently large.

Figure 8. Equation of regression for female sample of the 92 respondents from RM

Women			
	ineq_labour = 0.2756*age +0.2692*educ_level+0.4647*sector		
σ	(0.0839)	(0.0818)	(0.064)
t	[3.2837]	[3.2899]	[6.0791]
$R^2=0.7753; R^2_{adj}=0,7591; F=102,3879$			

Estimations of the coefficients of the behavioral function (Figure 8) for women that is dependent on three factors: age, education level and sector of activity show us the influence of each factor on the issue of men's perceived inequality at work. Approximately 26,02% are due to age, almost 46,47% are the influence of the education level and approximately 31,1% is the impact of the activity sector. Student statistics are at the 0.05 level of the significance, and the standard deviations are sufficiently large.

Figure 9. Ratios based on estimated female and male coefficients of the proposed behavioral functions for the 202 respondent sample

$agewomen/men=0.1761/0,3032=0.5806$
$educ_levelwomen/men=0.2931/0.3076=1.0707$
$sector\ women/men=0.4814/0.5221=0.8578$
$synthetic\ indicator=(agewomen/men+educ_levelwomen/men+sector\ women/men)/3=0,8578$

Source: Elaborated by authors based on questionnaire data

These coefficients show that women, involved in the economic activity, are approximately twice younger than men, but women's level of education is a little higher than that of the men, and a fewer women are involved in the private and mixed (private and state) sectors. In the Figure 9 a synthetic indicator showing the ratio between women and men is calculated according to the three indicators calculated above and demonstrates that women,involved in the economic activity at the state level are same smaller than those of the men. It must be mentioned that this indicator for 202 respondents sample is smaller than,those for 141 respondents sample.

Figure 10. Ratios based on estimated female and male coefficients of the proposed behavioral functions for the 92 respondent sample for Republic of Moldova

$agewomen/men=0.2756/0.20472=0.9856$
$educ_levelwomen/men=0.2691/0.5973=0.4507$
$sector\ women/men=0.4647/0.1834=2.5335$
$synthetic\ indicator=(agewomen/men+educ_levelwomen/men+sector\ women/men)/3=1.3232$

Source: Elaborated by authors based on questionnaire data

These coefficients show that women, involved in the economic activity, are approximately the same age with men, but women's level of education is the twice smaller than that of the men, and, what is very strange, women involved in the private and mixed (private and state) sectors activity is at 2,5 times more than men. In Figure 10 the synthetic indicator showing the weighted average between women and men is calculated according to the three indicators examined earlier and demonstrates that women, involved in the economic activity are approximately at 1,3232 times than those of the men. It must be mentioned that this indicator for 202 respondents sample is equal to 0,8678 and for 141 sample is equal to 1,063. Therefore, we can conclude that in the Republic of Moldova in consequence of questionnaire results, women implication in the economic activity, especially in state sector, is better than those for total sample including all respondents., and the second reason owing to more women, involved in this process than men, and the third reason is due to the fact that those men examined in this study have higher level of education the corresponding women.

5. Conclusions

The issue of gender equality in the employment is a matter of major significance. It is in this segment where the gender disparities are the most pronounced. Research effectuated on the base of extended sample of the questionnaire respondents were done. In the framework of some scenarios, such as: all respondents in examination, women and men for two samples: initial and extended one; separately examined men and women for both samples; women and men separately for Republic of Moldova respondents only; and two figures concerning indicators calculations for both samples. Effectuated calculations for extended sample have compared with earlier doing for initial sample excluding calculations for Republic of Moldova sample. After all calculations and comparison, we can conclude that more respondents examined in extended sample in some way change obtained results in relation with number of the female and male respondents participating in corresponding study. In special for initial sample the sector of activity is a decisive one, particularly the private sector, which for many reasons offers the predilection for men. Despite the fact that men's level of education has been much below that of women, they occupy higher jobs with higher wages. Women, even with a higher level of qualification, are less requested in the private or mixed (private and state) sectors both for senior positions and for better paid positions. For both men and women, age has the same impact.

While calculation results for extended sample demonstrate some differences, especially for Republic of Moldova sample and for calculated indicators. First of all, in the extended sample for Republic of Moldova, women respondents are at approximately at 1,5 times more than men, and second almost all women are involved in economic activity in state sector, while men at most are involved in economic activity in private and mix sectors, in consequence women involved in economic activity are far greater than those of the men. This situation explains why at the sector. So, we can conclude that in the Republic of Moldova women situation from gender equality point show more implication in private and mix sectors, to be more strongly intentioned in its wishes to win in

competition with men applying for a new job when they participate in various competitions for valuable functions and positions. In turn, women have to attend interviews and contests on the same footing as men. For the future it will be a best way to include in estimated behavioral functions such a indicator human perception of the women and men professional abilities when engaging on work position.

Finally, it must be mentioned that effectuated study is very useful in elaborating policy of the women employment, demonstrate many interest results and can be successfully used in gender analyses.

References

1. Blinder, A.S. Wage Discrimination: Reduced Form and Structural Estimates. In: The Journal of Human Resources, Vol. 8, No. 4 (Autumn, 1973), pp. 436-455
2. Becker, G. Human Capital and the Personal Distribution of Income, *W.S. Woytinsky Lecture No. 1*, Ann Arbor, University of Michigan. 1967
3. Becker, G. & Chiswick, B. R. Education and the Distribution of Earnings. In: American Economic Review, 56(2), pp. 358-369. 1966
4. Chiswick, B. R. & Mincer, J. Experience and the Distribution of Earnings. University of Illinois at Chicago and IZA Bonn. Discussion Paper No. 847, pp. 1-38. 2003
5. Chiswick, B. R. Human Capital and the Distribution of Personal Income, Unpublished Ph.D. Dissertation, Columbia University. 1967
6. Chiswick, B. R. Income Inequality: Regional Analyses Within a Human Capital Framework, New York: National Bureau of Economic Research. 1974
7. Chiswick, B. R. & Mincer, J. Time Series Changes in Personal Income Inequality. In: Journal of Political Economy, 80 (3) Part 2, S34-S66. 1972
8. Naval, E. Earnings evaluation of the Moldovan budget employees. In: Proceedings of the International Symposium "Experience. Knowledge. Contemporary Challenges 3rd Edition "Romania in the Year of the Centenary. The European and Global Socio-Economic Context", December 13th-14th, 2018, Bucharest, pp. 106-115
9. Colesnicova, T. & Naval, E. Impactul diminuării discriminării de gen asupra creșterii sustenabile în Republica Moldova. In: Materialele Conferinței Internaționale "Economic Growth in Conditions of Globalization: competitiveness, innovation, sustainability. the 13th edition. Vol. II. 232-236. October 11-12, 2018 Chisinau: INCE – ISBN 978-9975-3202-9-0.
10. Колесникова Т. Гендерное вертикальное неравенство на рынке труда Молдовы. In: Economie și sociologie nr. 2 2009. Ch.: IEFS, 2009, -180 p. ISSN 1857-4130, pp. 151-159.
11. Colesnicova T. Evaluation of the human capital influence on men and women salaries in the Republic of Moldova. In: Economie și sociologie nr. 1/2011. Ch.: IEFS, 2011, - 216 p. ISSN 1857-4130, pp. 204-213.
12. Colesnicova T. Approaches to estimation of the value for working women's labor at the household in Moldova. In: Revista economică. Sibiu-Chișinău: IEFS, 2008, nr. 5-6 (42-43), vol. II, - 188 p. ISSN 1582-6260, pp. 136-145
13. Colesnicova T. Analiza problemelor de gen în IMM-urile Moldovei. In: Analele ale Institutului Umanistic Contemporan. Ch.: IUC, вып. 6-7, 2010, -226 p. ISSN 1857-1271, ISBN 978-9975-9935-6-2, p. 187-191 0,27 с.а.
14. Колесникова Т. Опыт регулирования гендерного равенства в сфере занятости в Республике Молдова. In: Analele Institutului de Economie, Finanțe și Statistică. Ch.: IEFS, 2011, -184 p. ISSN 1857-3630, ISBN 978-9975-4176-4-8, pp. 176-179