The Relationship Between Female Labor Force Participation and Labor Productivity: Panel Data Analysis

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Kadınların İşgücüne Katılımı ile Emek Verimliliği Arasındaki İlişki: Panel Veri Analizi

Özet

Çalışmada kadınların işgücüne katılımını temsil eden çeşitli göstergeler ile emek verimliliği arasındaki ilişki incelenmiştir. Kadınların istihdamı ile birlikte emek verimliliğinin artacağı hipotezi 1985-2010 yıllarını ve 110 ülkeyi kapsayan panel veri seti yardımıyla analiz edilmiştir. Kadınların iş gücüne katılımı göstergeleri ile emek verimliliği arasında pozitif bir ilişki tespit edilmiştir. İstatistiksel olarak anlamlı bu bulgu üç ayrı emek verimliliği göstergesi ve üç ayrı kadınların işgücüne katılımı göstergesi için de geçerlidir. Böylece, araştırma sonuçları, diğer koşullar sabit kalmak koşuluyla, kadın işgücü katılımının emek verimliliğini artırdığına işaret etmektedir.

Anahtar Kelimeler: Cinsiyet, Kadınların İşgücüne Katılımı, Verimlilik, Panel Çalışma.

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Abstract

We examine the relationship between various indicators of female labor force participation and labor productivity. We test the hypothesis that labor productivity boosts as the female employment increases by exploiting a panel data set including the period 1985 to 2010 and 111 countries and using three labor productivity indicators and three female labor force participation indicators. We identified a positive correlation between female labor force participation indicators and labor productivity. This finding is statistically significant and valid for three different productivity indicators and three different female labor force participation indicators. Thus, the results suggest that female labor force participation increases labor productivity, controlling for other factors that may contribute to labor productivity.

Keywords: *Gender, Women Participation, Productivity, Panel Study*

Kabul Tarihi / Accepted: 27.05.2016

1. Introduction

The problem of male-female wage gap has been the subject of a number of studies in application to both single countries and many countries. The wage gap may arise from productivity differences or discrimination.

There are two main theories explaining productivity differences between men and women: overcrowding hypothesis and human capital theory. According to overcrowding hypothesis, lower productivity of women is due to women's choice of occupation. Women's occupational choices are influenced by certain characteristics of jobs. It is argued that anticipation of child-related work interruptions, the need to coordinate home responsibilities with market work, the expectation of withdrawals from the labor force, the need to work fewer hours during the week, the level of stress at work, and the ability to take unplanned time off for family emergencies are likely to affect the choice of occupation, work place, and type of firm (O'Neil, 2003). Thus, women have been tend to prefer and employed in a fairly small number of relatively low-paying, traditionally female professions compatible with their home responsibilities like nurse, librarian, and teacher for many decades (Blau, Simpson and Anderson, 1998). However, women's choice of occupation can result in an excess supply of labor in female occupations which are in small numbers and have relatively low capital-labor ratio. Thus women have a lower productivity than men and their wages are depressed.

According to human capital hypothesis, lower productivity of women is due to women's lower stocks of accumulated human capital than men (Blau and Jusenius, 1976). Women tend to accumulate less labor market experience, invest less in market-oriented formal education and on-the-job training, and commit fewer amounts of time and energy than men as a result of the division of household work by gender in the family. Hence women's smaller human capital investments reduce their productivity and wages compared to men.

On the other hand, the source of wage gap may be discrimination against women in the labor market. According to discrimination theory, man and women are equally productive workers however exclusion of women from "male" jobs by the exclusionary behavior of employers, co-workers, or customers affects women's wages and occupations. Women will be hired by employers having a taste for discrimination against women when the wage difference between male and female labor is large enough to compensate for the disutility they incur by hiring women (Becker, 1957; Blau and Jusenius, 1976).

Gender wage gap have also been the subject of a number of empirical studies on single country or cross-country. In empirical studies, wage decomposition techniques are used to estimate the proportion of wage differential between men and women due to human capital differences (measured characteristics) and gender discrimination (unexplained). Such empirical studies indicate that both human capital differences and labor market discrimination are responsible for the gender wage gap. The male-female wage differentials are estimated to be between 25 to 30 percent for most industrialized countries (Kunze, 2003). These studies show that the gender wage gap remain unexplained even after taking into account differences in productivity-related characteristics between males and females such as education, age or work experience and work place characteristics (O'Neill and Polachek, 1993; Blau and Khan, 1992 and 1997; Kunze, 2003).

However, labor market in US and other countries (in most OECD countries) have experienced some dramatic changes over the past forty years. Firstly, female labor force participation has increased substantially in last decades. For example, in the USA while 33 percent of women were in the labor force in 1950, this percentage increased to 58 percent in 2013 (Federal Reserve Bank of St. Louis Economic Data, 2014). Driving force behind in this change was the increased participation of married women with children. Labor force participation of married women with children under age of 18 rose from 18 percent in 1950 to 70 percent in 2013 (O'Neil, 2003; U.S. Department of Labor Bureau of Labor Statistics, 2014). Lim (2014) reports that labor force growth was substantially higher for women than for men for every region of the world except Africa especially in the 1980s and early 1990s.

At the same time, the wage gap between men and women has narrowed in last decades (Monk-Turner and Turner, 2008; Petersen, Becken and Snartland, 2010). Decrease in earning differentials between male and female implies increased productivity of female or reduce of discrimination (or choice), or some combination of the two. From the economic policy side, the source of decrease in the wage gap is important. For example, if the source of wage gap is discrimination against women labor force, then this means inefficient allocation of resources. Under this condition, the gender wage gap should close over time with the introduction of equal pay laws. Efforts to decrease the male-female wage gap with such policies would improve economic efficiency. On the other hand if the source of wage gap is productivity differences, efforts to decrease the male-female wage gap with wage setting mechanisms would harm economic efficiency.

Researches on the source of decrease in wage gap between men and women in last decades indicate that women's higher human capital investments, socioeconomic and legislative changes have lead to reductions in wage gap:

In last decades, labor market attachment of women has increased due to increase in marriage mean age, reductions in fertility, and decrease in home responsibilities. As women's work attachment decreased, more female have pursued their market objectives and continued on-job training. Women have also increased their human capital investment as employment shift away from manufacturing towards services. More women have achieved college degrees and pursued degrees with greater market returns like business, law, and medicine (Mulligan and Rubinstein, 2005). As women increased their human capital investment, significant numbers of women have moved into a variety of traditionally male jobs. Consequently, women's productivity and hence their wage increased.

The introduction of equal pay laws and wage-setting mechanisms such as encompassing collective bargaining agreements may also have reduced the gender wage gap (Blau and Khan, 2001). Kanellopoulos and Mavromaras (1999) report that the wage gap reduced by 22 percent within three years after the introduction of national minimum wage in Greece. Using micro-data for 22 countries over the 1985-94 period, Blau and Khan (2001) find that the extent of collective bargaining coverage in each country is significantly negatively associated with its gender wage gap.

Increased competition may also have reduced the gender wage gap. The cost of discrimination will increase under competitive environment whereby firms discriminating against women will be forced to exit an industry. This argument was supported by some empirical studies for the US (Böheim, Hofer and Zulehner, 2007).

The literature review above reveals two stylized facts: female labor force participation has increased and gender wage gap has decreased recently. Hence, female labor force participation may lead to decrease in gender wage gap through increased labor productivity of women.[1] Thus, the literature review above leads us to ask whether labor productivity rises with women's labor force participation. In this study, we test our hypothesis by exploiting a panel data set covering the period 1985 to 2010 and 111 countries and using three labor productivity indicators and three female labor force participation indicators. We identified a positive correlation between female labor force participation indicators and labor productivity indicators. This finding is statistically significant and valid for three

[1] Thus, we argue that women's wages rise with labor productivity of women, and labor productivity rises with women's labor force participation.

different productivity indicators and three different female labor force participation indicators. To our knowledge, this is the first panel study on the relationship between female labor force participation and labor productivity.

This article proceeds as follows. In the following section we introduce our data, model, and our empirical strategy. Estimation results are given in section 3. We offer concluding thoughts in the final section.

2. Empirical Framework

We investigated the impact of female on labor productivity by using three labor productivity indicators and three female indicators. The period under study is between 1985 and 2010. Our largest sample includes 111countries.[2]

By using unbalanced panel data, we estimate the following one-way bivariate and multivariate fixed effect models (FEM);

$$PRD_{it} = \beta_{1i} + \beta_2 FEMALE_{it} + u_{it} \quad (1)$$

$$PRD_{it} = \beta_{1i} + \beta_2 FEMALE_{it} + \beta_3 DOMCREDIT_{it} + \beta_4 GROS_{it} + \beta_5 OPENNESS_{it} + \beta_6 AWWH_{it} + \beta_7 AWWH \wedge 2_{it} + u_{it} \quad (2)$$

and the following one-way bivariate and multivariate random effect models (REM);

$$PRD_{it} = \beta_1 + \beta_2 FEMALE_{it} + \varepsilon_i + u_{it} \quad (3)$$

$$PRD_{it} = \beta_1 + \beta_2 FEMALE_{it} + \beta_3 DOMCREDIT_{it} + \beta_4 GROS_{it} + \beta_5 OPENNESS_{it} + \beta_6 AWWH_{it} + \beta_7 AWWH \wedge 2_{it} + \varepsilon_i + u_{it} \quad (4)$$

[2] The sample for bivariate model includes the following countries: Albania, Algeria, Angola, Argentina, Armenia, Australia, Austria, Bahrain, Bangladesh, Barbados, Belarus, Belgium, Bolivia, Bosnia and Herzegovina, Brazil, Bulgaria, Cambodia, Cameroon, Canada, Chile, China, Colombia, Costa Rica, Croatia, Cyprus, Czech Republic, Denmark, Dominican Republic, Ecuador, Egypt, Estonia, Ethiopia, Finland, France, Georgia, Germany, Greece, Guatemala, Hong Kong, Hungary, Iceland, India, Indonesia, Iran, Iraq, Ireland, Israel, Italy, Jamaica, Japan, Kazakhstan, Kenya, Korea Republic, Kuwait, Kyrgyzstan, Latvia, Luxembourg, Macedonia, Madagascar, Malawi, Malaysia, Mali, Malta, Mexico, Moldova, Morocco, Mozambique, Netherlands, New Zealand, Niger, Nigeria, Norway, Oman, Pakistan, Peru, Philippines, Poland, Portugal, Qatar, Romania, Russian Federation, Saint Lucia, Saudi Arabia, Senegal, Singapore, Slovakia, Slovenia, South Africa, Spain, Sri Lanka, Sudan Republic, Sweden, Switzerland, Syrian Arab Republic, Taiwan China, Tajikistan, Thailand, Trinidad and Tobago, Tunisia, Turkey, Turkmenistan, Uganda, Ukraine, United Arab Emirates, United Kingdom, United States, Uruguay, Uzbekistan, Venezuela, Viet Nam, Yemen, Zambia, Zimbabwe.

where *it* subscript stands for the *i-th* country's observation value at time *t* for the particular variable. All variables are in logarithmic forms. β_{1i} represents country specific factors not considered in the regression, which may differ across countries but not within the country and is time invariant. ε_i is a stochastic term, which is constant through the time and characterizes the country specific factors not considered in the regression. u_{it} is error term of the regression.

Our dependent variable is labor productivity. We used labor productivity measures of The Conference Board. Total Economy Database of The Conference Board reports two labor productivity indicators, namely, GDP per hour and GDP per person employed. GDP per person engaged is obtained by dividing GDP by employment while GDP per hour is obtained by dividing GDP by total hours worked. Compared to GDP per person engaged, GDP per hour is the preferred measure of labor productivity because it measures labor intensity more adequately. However, the availability of this variable is restricted by the annual working hours data, which are currently available for 53 countries in the database. We also used labor productivity indicator of World Bank: gross value added at factor cost (current US$). Thus three different indicators of labor productivity are used to evaluate the sensitivity of our empirical results: logarithmic value of GDP per hour (in 2012 EKS $), logarithmic value of GDP per person employed (in 2012 EKS $), and logarithmic value of gross value added at factor cost (current US$) divided by total employment. The data regarding of GDP per hour (in 2012 EKS $) and GDP per person employed (in 2012 EKS $) come from Total Economy Database of The Conference Board while gross value added at factor cost (current US$) is obtained from World Development Indicators of the World Bank. Results may vary depending on which productivity indicator is used. If the results hold across different productivity indicators, it will be an indication of their robustness.

The variables used in our analysis were chosen in the light of previous studies found in the literature and our main hypothesis. Explanatory variables are defined below.

Female labor force participation (FEMALE) in above models is represented by three variables: FEMALEMALE is the logarithmic value of the ratio of total female employment to total male employment, FEMALETOT is the logarithmic value of the ratio of total female employment to total employment, and MALETOT is the logarithmic value of the ratio of total male employment to total employment. The data for the variables FEMALEMALE, FEMALETOT, and MALETOT come from ILO.

We also introduced four more determinants of productivity into our analysis to see how robust our finding is:

GROS refers to the logarithmic value of gross capital formation (current US$) divided by one year lag of gross capital formation (current US$) of the relevant country. The data come from World Development Indicators of the World Bank. The coefficient on the GROS is expected to be positive since investment in both human and fixed capital improves the labor productivity.

AWWH refers to the logarithmic value of annual hours worked in the relevant country. The data are from The Conference Board Total Economy Database. Theoretically, an increase in the average weekly working hours increases the productivity of a worker; however, it decreases the productivity of a worker after a threshold level. Thus, we employed AWWH and square term of AWWH (AWWH^2) to test the above hypothesis. Thus, the coefficient on AWWH is expected to be positive while the coefficient on AWWH^2 is expected to be negative.

OPENNESS refers to the logarithmic value of openness (i.e., the ratio of imports of goods and services (current USD) plus exports of goods and services (current USD) to GDP (current USD)) of the relevant country. The data come from World Development Indicators of the World Bank.

We expect a positive relationship between OPENNESS and the labor productivity. Increased openness to trade may boost the labor productivity through improving investment in human capital, market size, and diffusion of more efficient production techniques.

DOMCREDIT refers to the logarithmic value of domestic credit to private sector (% of GDP) of the relevant country. The data are from World Development Indicators of the World Bank.

Financial depth represented by GDP share of domestic credit to the private sector plays an important role in the determination of labor productivity. When banks provide funds for investment projects, they try to allocate resources efficiently and to select the most productive and innovative ones as far as they deal with imperfect information and adverse selection problems. Thus, the coefficient on the DOMCREDIT is expected to be positive in our model.

3. Estimation Results

Estimation results are reported in Table 1, 2, and 3 below for three different labor productivity indicators.[3] Each Table has 3 models for 3 different female labor force

[3] To save space, estimation results for bivariate models are not reported. The results are strong and robust and they are available upon request.

participation indicators. Tables also present Hausman test statistics for choosing between Fixed Effect and Random Effect models at the 5% significance level and proposed models by Hausman Test Statistics.

Table 1: Multivariate Model Estimation Results Using GDP per Person Employed in 2012 EKS$ as Dependent Variable

	1	2	3
Constant	-6.613861	-6.340243	-6.687908
Standard Error	1.831846	1.824875	1.847487
P-value	0.0003	0.0005	0.0003
FEMALEMALE	0.084939		
Standard Error	0.034394		
P-value	0.0137		
FEMALETOT		0.115426	
Standard Error		0.049105	
P-value		0.0189	
MALETOT			-0.138307
Standard Error			0.076153
P-value			0.0696
DOMCREDIT	0.164838	0.165726	0.166371
Standard Error	0.008930	0.008878	0.008905
P-value	0.0000	0.0000	0.0000
OPENNESS	0.409444	0.412353	0.413331
Standard Error	0.019083	0.018843	0.019036
P-value	0.0000	0.0000	0.0000
AWWH	2.045293	1.976435	2.063001
Standard Error	4.836676	4.819717	4.874705
P-value	0.0000	0.0000	0.0000
AWWH2	-1.369352	-1.324931	-1.381733
Standard Error	0.319227	0.318197	0.321647
P-value	0.0000	0.0000	0.0000
GROSFIXCAP	0.024507	0.024468	0.024041
Standard Error	0.014375	0.014379	0.014390
P-value	0.0885	0.0891	0.0951
Number of Observations	1186	1186	1186
Number of Countries	60	60	60
R-squared	0.975033	0.975020	0.974970
Estimated Model	RE	RE	RE
Hausman-statistics	49.178	48.989	49.695221

Table 2: Multivariate Model Estimation Results Using GDP per Hour in 2012 EKS$ as Dependent Variable

	1	2	3
Constant	-9.424.932	-9.005035	-9.142867
Standard Error	1.757.351	1.739652	1.771432
P-value	0.0000	0.0000	0.0000
FEMALEMALE	0.130305		
Standard Error	0.042577		
P-value	0.0023		
FEMALETOT		0.188652	
Standard Error		0.062280	
P-value		0.0025	
MALETOT			-0.143605
Standard Error			0.078861
P-value			0.0689
DOMCREDIT	0.139218	0.140153	0.141927
Standard Error	0.009084	0.009035	0.009055
P-value	0.0000	0.0000	0.0000
OPENNESS	0.414077	0.419194	0.426570
Standard Error	0.020859	0.020290	0.020434
P-value	0.0000	0.0000	0.0000
AWWH	2.699237	2.593299	2.624355
Standard Error	4.643778	4.599850	4.677941
P-value	0.0000	0.0000	0.0000
AWWH2	-1.870348	-1.801608	-1.822931
Standard Error	0.306717	0.303961	0.308961
P-value	0.0000	0.0000	0.0000
GROSFIXCAP	0.027665	0.027614	0.025541
Standard Error	0.014655	0.014656	0.014675
P-value	0.0594	0.0598	0.0821
Number of Observations	1026	1026	1026
Number of Countries	51	51	51
R-squared	0.974145	0.974140	0.973984
Estimated Model	RE	RE	RE
Hausman-statistics	65.215	64.762623	64.226522

Table 3: Multivariate Model Estimation Results Using Gross Value Added at Factor Cost (current US$) Divided by Total Employment as Dependent Variable

	1	2	3
Constant	5.455189	7.761412	4.257605
Standard Error	5.444205	5.446647	5.516499
P-value	0.3166	0.1545	0.4404
FEMALEMALE	0.671416		
Standard Error	0.107929		
P-value	0.0000		
FEMALETOT		0.807319	
Standard Error		0.151662	
P-value		0.0000	
MALETOT			-1.243898
Standard Error			0.237979
P-value			0.0000
DOMCREDIT	0.478186	0.487509	0.486447
Standard Error	0.026791	0.026761	0.026822
P-value	0.0000	0.0000	0.0000
OPENNESS	0.275456	0.312128	0.298480
Standard Error	0.061277	0.060519	0.061316
P-value	0.0000	0.0000	0.0000
AWWH	-1.037859	-1.619082	-7.419728
Standard Error	1.438085	1.439224	1.456105
P-value	0.4706	0.2609	0.6105
AWWH2	0.565674	0.938839	0.367558
Standard Error	0.949601	0.950665	0.961201
P-value	0.5515	0.3236	0.7022
GROSFIXCAP	0.169309	0.168853	0.166371
Standard Error	0.044362	0.044578	0.044593
P-value	0.0001	0.0002	0.0002
Number of Observations	1101	1101	1101
Number of Countries	58	58	58
R-squared	0.909692	0.908813	0.908726
Estimated Model	RE	RE	RE
Hausman-statistics	19.332099	16.189722	20.056024

Estimation results indicate the following. All coefficients of female labor force participation indicators are statistically significant take the expected signs in all models in all Tables. FEMALEMALE and FEMALETOT variables have consistently positive and significant coefficients, indicating that as the ratio of total female employment to total male employment and the ratio of total female employment in total employment increases, labor productivity increases. MALETOT variable has a negative and significant coefficient, indicating that labor productivity decreases as the ratio of total male employment in total employment increases.

In regard to other variables in the model, the coefficient of the GROS variable is positive and statistically significant in all models in all Tables. Thus, investment seems to increase labor productivity in transition countries. The estimated coefficient of OPENNESS variable takes the expected positive sign and is statistically significant in all models in all Tables. The results support the proposition that trade openness is positively correlated with productivity. The coefficients on AWWH and AWWH^2 are significant at the 1% significance level in all models in Table 1 and 2. It shows that annual hours worked is positively correlated with the productivity of a worker until a threshold level. The coefficients on DOMCREDIT are significant and have expected positive sign in all models in all Tables. This result indicates that domestic credit has a positive and significant effect on labor productivity.

Overall, our results indicate that female labor force participation contributes to increase in labor productivity in over the period 1985 to 2010.

4. Conclusion

In addition to other determinants of labor productivity, this study examines the explanatory power of female labor force participation. By using three labor productivity indicators and three female labor force participation indicators, we test the hypothesis that female labor force participation indicators contribute to increase in labor productivity over the period 1985 to 2010. The sample includes 111 countries. We identified a positive correlation between female labor force participation and labor productivity. This finding is statistically significant and valid for three different productivity indicators and three distinct female labor force participation indicators. Thus, the results suggest that female labor force participation has a positive and significant effect on labor productivity, controlling for other factors that may contribute to labor productivity.

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