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Original Article

Comparison the Effects of Health Indicators on Male and Female Labor Supply, Evidence from Panel Data of Eastern Mediterranean Countries 1995-2010

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Abstract

Background: Skilled labor force is very important in economic growth. Workers become skilled when they are healthy and able to be educated and work. In this study, we estimated the effects of health indicators on labor supply. We used labor force participation rate as the indicator of labor supply. We categorized this indicator into 2 indicators of female and male labor force participation rates and compared the results of each estimate with the other.

Methods: This study was done in eastern Mediterranean countries between 1995 and 2011. We used a panel cointegration approach for estimating the models. We used Pesaran cross sectional dependency, Pesaran unit root test, and Westerlund panel cointegration for this issue. At the end, after confirmation of having random effect models, we estimated them with random effects.

Results: Increasing the fertility rate decreased the female labor supply, but increased the male labor supply. However, public health expenditures increased the female labor supply, but decreased the male labor supply because of substitution effects. Similar results were found regarding urbanization. Gross domestic product had a positive relationship with female labor supply, but not with male labor supply. Besides, out of pocket health expenditures had a negative relationship with male labor supply, but no significant relationships with female labor supply.

Conclusion: The effects of the health variables were more severe in the female labor supply model compared to the male model. Countries must pay attention to women's health more and more to change the labor supply.

Keywords: Female labor supply, Male labor supply, Panel data, Eastern Mediterranean countries

Introduction

From the viewpoint of classical economists like Adam Smith, skilled workforce, like a capital instrument, will promote the efficiency of production (1). Skilled workers have more ability to produce and in the production process, they produce better than others (2). The role of labor force is highly important in the economic growth and development. Solow in his model has pointed out that improving human capital leads to economic growth. Other studies after Solow have also shown that the difference among countries regarding economic growth arises from the differences in labor supply as well as its quality and efficiency (3).

There are many indicators for micro and macro form of labor supply. For example, indicators such as the number of researchers in one million populations and the number of research centers' employees in one million populations are the symbols of having productive and professional labor

force. Unemployment index shows the ability of economy to use the labor force and it is a demand side index. One of the most important indicators for measuring the labor force is male and female labor force participation rate. It is equivalent to the proportion of male or female employees to male or female population over 15 years old. These indicators are supply side ones and comparing them with each other shows the level of gender inequality in supplying the labor force and production (4,5). Today, the role of health in increasing the labor supply is highly regarded. Health has two separate effects on labor supply. Increasing health causes the individuals to get sick less and be able to attend the labor markets more. It is specially seen in agricultural economics and hand works. On the other hand, more desirable health accompanied by more attendance to school will lead to more access to education and professional skills eventually resulting in having more productive and effective labor forces (6).

One of the health indicators which affect the labor supply is the fertility rate. It affects labor supply from a different way. Birth of the children leads the women to be excluded from the labor market. Therefore, if the number of births increases, female labor participation rate will decrease (4). For example, in Afghanistan, female labor force participation rate was low (15.5%) and fertility rate was very high (6.28). In Qatar, on the other hand, labor force participation rate was near 52% and the fertility rate was 2.271% in 2010. Studying determinants of labor supply is very important for policymakers specially health policy makers (7). One of the goals of spending in people health is having efficient workers, so it is important for health policy makers to know what health indicator effects labor supply and what is different of each indicator in male and female labor supply(3).

In this study, we tried to find these relationships and differences so the main aim of this article is to determine the effects of health on male and female labor supply in East Mediterranean (EMR) countries .

Materials and Methods

We used EMR countries panel data between 1995 and 2010. The data of 2011 and 2012 were not available; therefore, we excluded these years from the study. EMR countries are Afghanistan, Bahrain, Djibouti, Egypt, Iran, Iraq, Jordan, Kuwait, Lebanon, Libya, Morocco, Occupied Palestinian territory, Oman, Pakistan, Qatar, Saudi Arabia, Somalia, south Sudan, Sudan, Syria, Tunisia, United Arab Emirates, and Yemen. The data for Occupied Palestinian territory and Somalia were not available. In addition, the data for south Sudan were combined with those of Sudan because this country was a part of Sudan until 2010. All the data were gathered from the World Bank statistical data bank. We used two different models to determine the effects of health on male and female labor supply. We used public health expenditures, out of pocket health expenditures and fertility rate as dependent health variables. Female labor participation rate was dependent variable for model one and male labor participation was dependent for model also male labor force participation rate was independent variable for model one and female labor force participation rate was independent one for model two. These two models are shown below:

$$flfp_{it} = \alpha_i .mlfp_{it}^{\beta 1} .tfr_{it}^{\beta 2}. gdp_{it}^{\beta 3}. fedu_{it}^{\beta 4} . pub_{it}^{\beta 5}. oop_{it}^{\beta 6} . urb_{it}^{\beta 7} . . agr_{it}^{\beta 8} dum1 \quad (I)$$

$$mlfp_{it} = \alpha_i .flfp_{it}^{\beta 1} .tfr_{it}^{\beta 2}. gdp_{it}^{\beta 3}. medu_{it}^{\beta 4} . pub_{it}^{\beta 5}. oop_{it}^{\beta 6} . urb_{it}^{\beta 7} . agr_{it}^{\beta 8} . dum1 \quad (II)$$

Each of these models was in Cobb Dauglas form. Estimating these models using the OLS method was not possible because they were in nonlinear form. Thus, we had to convert them into the linear form. In doing so, we had to compute the logarithm of the two parts of the models. The new forms of the models have been shown below:

$$lmlfp_{it} = \alpha_i + \beta_1 lflfp_{it} + \beta_2 ltfr_{it} + \beta_3 lgdp_{it} + \beta_4 lmedu_{it} + \beta_5 lpub_{it} + \beta_6 loop_{it} + \beta_7 lurb_{it} + \beta_8 lagr_{it} + dum1 + u_{it} \quad (III)$$

$$lflfp_{it} = \alpha_i + \beta_1 lmlfp_{it} + \beta_2 ltfr_{it} + \beta_3 lgdp_{it} + \beta_4 lfedu_{it} + \beta_5 lpub_{it} + \beta_6 loop_{it} + \beta_7 lurb_{it} + \beta_8 lagr_{it} + dum1 + u_{it} \quad (IV)$$

Where: $lmlfp_{it}$ was the logarithm of male labor participation rate in EMR countries between 1995 and 2010

$lflfp_{it}$ was the logarithm of female labor participation rate in EMR countries between 1995 and 2010
$ltfr_{it}$ was the logarithm of fertility rate in EMR countries between 1995 and 2010
$lgdp_{it}$ was the logarithm of gross domestic product per capita in EMR countries between 1995 and 2010
$lmedu_{it}$ was the logarithm of mean years of school for men above 25 years old in EMR countries between 1995 and 2010
$lfedu_{it}$ was the logarithm of mean years of school for women above 25 years old in EMR countries between 1995 and 2010
$lpub_{it}$ was the logarithm of public health expenditures per capita in EMR countries between 1995 and 2010
$loop_{it}$ was the logarithm of out of pocket health expenditures in EMR countries between 1995 and 2010
$lurb_{it}$ was the logarithm of the proportion of people living in urban regions in EMR countries between 1995 and 2010
$lagr_{it}$ was the logarithm of the proportion of agricultural value added to the total GDP in EMR countries between 1995 and 2010
dum1 was a dummy variable for oil producing countries in EMR countries between 1995 and 2010
In this model, i indicated cross section and t indicates time series; therefore, it showed the panel data in the country of i and the year of t. β in these models represented the coefficients. We had long time series and long cross sections data in this study. Thus, for estimating the model, first we had to test cross sectional dependency and stationary. If we were sure that the models did not lead to spurious regression, estimating the models was allowed. Otherwise, we had to exclude spurious regression or show that the spurious regression did not lead to wrong estimations. For testing cross sectional dependency, we used Pesaran cross sectional dependency test (CD). The null hypothesis of this test was having cross sectional independent variables (8). For testing stationary, we utilized Pesaran CADF test. This test eliminates the effects of cross sectional dependency and gives us a true result in its presence (9). After the confirmation of having nonstationary variables, we had to prove that estimating these non-stationary variables did not give wrong results. In doing so, we had to test the presence of cointegration. Having a cointegrated model did not lead to wrong results even if the variables were non-stationary and had cross sectional dependency. In order to test co-integration, we used Westerlund panel cointegration test. This test, by using bootstrap technique, provided us with results that were not influenced by cross sectional dependency (10). At the end, after confirmation of having a cointegrated model, we used Breusch pagan and Hausman tests to select between pool or panel and fixed or random effects.

Results

As mentioned before, first we must use cross sectional dependency test. The results of this test showed that all the variables, except for the logarithm of out of pocket health expenditures (loop), were cross sectional dependent (Table 1).

Table 1: The results of Pesaran cross sectional dependency test

Variable	CD test	*P*-value
lmlfp	5.24	0.000
lflfp	25.88	0.000
Ltfr	51.14	0.000
lgdp	38.74	0.000
lpub	31.98	0.000
lmedu	54.82	0.000
lfedu	54.28	0.000
loop	0.52	0.603
lurb	42.24	0.000
lagr	23.40	0.000

In general, when the tests *P*-values are under 0.05, their null hypotheses will be accepted. For this test, the null hypothesis was accepted for all the variables, except for loop. After confirmation of having cross sectional dependent variables, we must perform the unit root test for them. We used CADF unit root test for this issue. The null hypothesis of this test is that the variable does not

have unit root. As presented in Table 2, some variables were stationary and some were not. lgdp, lmedu, lfer, lfedu, and lagr were the stationary variables. The *P*-values of these variables were above 0.05; therefore, the null hypothesis was accepted. Because of having some nonstationary variables (lflfp, lmlfp, lpub, loop, and lurb), we could not estimate the model with ordinary least square method without assurance of having a cointegration model.

Table 3 shows the results of Westerlund panel cointegration test. Because of having cross sectional variables, the results of ordinary Westerlund cointegration test must be invalid and, consequently, we had to use a cointegration test which employed bootstrap approach to eliminate cross sectional dependency effects. Table 3 also shows the results of Westerlund test with bootstrap technique.

Table 2: The results of Pesaran CADF unit root test

Variable	t statistics	*P*-value
lmlfp	-0.896	1.000
lflfp	-1.836	0.321
ltfr	-2.327	0.004
lgdp	-2.561	0.000
lpub	-1.959	0.158
lmedu	-3.799	0.000
lfedu	-2.125	0.042
loop	-1.918	0.204
lurb	-0.252	1.000
lagr	-2.870	0.000

As this table depicts, all the 4 tests for both male and female labor force participation rates confirmed having cointegrated models and estimating them did not lead to spurious regression. Now we can estimate the model without any concern.

Table 3: The results of Westerlund panel cointegration tests with the absence and presence of cross sectional dependency for male and female models

Dependent variable	Male labor participation rate		Female labor participation rate	
Test	*P*-value	Reboost *P*-value	*P*-value	Reboost *P*-value
G_a	1.000	0.734	1.000	0.550
G_t	1.000	0.863	1.000	0.675
P_a	1.000	0.453	0.472	0.247
P_t	1.000	0.841	1.000	0.638

First, we estimated the model with random effects and after that we used the fixed effects. Then, we used Breusch-pagan test to select between pooled and panel effects. The results of this test for female model showed that the model was a panel one (*P*-value: 0.00, $\chi 2$= 1877.45). After that, we used Hausman test to choose between fixed and random effects. The results of this test showed that the model had random effects in the female model ($\chi 2$=14.28, *P*-value= 0.0627). The results of these 2 tests showed us to use panel random effects for the male model, as well (Breusch pagan *P*-value: 0.00, Hausman *P*-value: 0.0907).

Table 4 presents the results of estimating male and female labor force participation rate models with random effects. The results of coefficients and *P*-values have also been shown in this table. The male model showed direct relationships with female labor participation rate and fertility rate, but a negative relationship with public health expenditures, urbanization, out of pocket health expenditures, and agriculture. However, the results were not significant regarding gross domestic product and education. On the other hand, in the female model, a positive relationship was found between male labor participation rate, gross domestic product, public health expenditures, urbanization, and agriculture and female labor force participation rate. Moreover, a negative relationship was observed between female labor force participation rate and fertility rate. Nonetheless, no significant relationship was detected for out of pocket health expenditures. According to the study results, oil dummy variable had a significant relationship with

labor supply in both male and female models; therefore, the models had refraction for oil exporter countries. The R^2 statistics was 0.5988 for the male model and 0.6871 for the female model which are both desirable for the panel data.

Table 4: The results of estimating male and female models with GLS random effects

	Male labor participation rate model		Female labor participation rate model	
Variables	**Coefficient**	***P*-value**	**Coefficient**	***P*-value**
lflfp	0.102259	0.000	-	-
lmlfp	-	-	2.645803	0.000
ltfr	0.052316	0.000	-0.4777778	0.000
lgdp	0.0041153	0.629	0.1105346	0.010
lmedu	-0.0178337	0.094	-	-
lfedu	-	-	-0.0825168	0.128
lpub	-0.0048544	0.003	0.0234336	0.005
loop	-0.0130363	0.017	0.001158	0.967
lurb	-0.114661	0.000	0.4270848	0.011
lagr	-0.0102472	0.008	0.0115657	0.560
Oil dummy	-0.1107453	0.002	0.4427975	0.012
Constant varibale	4.4992	0.000	-10.78899	0.000

R^2 =0.5988 R^2 =0. 6871

Discussion

A positive relationship was observed between male and female participation rate in the 2 models. Thus, as the male labor supply increased, the female labor supply increased, as well. This is because of the wage effects. When the wages are increased, the willingness to work also increases in the individuals eventually increasing the male and female labor supplies. In the same line, Shimer (2013) in his book confirmed the effect of wage on labor supply (11). Similar results have also been found by Bosch et al. (2012) in Germany and Fernandez (2013) for female labor force participation rate (12,13).

In the present study, fertility rate showed a negative relationship with female labor supply. This is due to the fact that fertility does not allow women to work and their participation in work force will diminish. Similar results were obtained by Bloom (2009) and Euwals et al. (2011) (6,14). The relationship between these 2 variables is bilateral; not only fertility rate reduces the female labor supply, but female labor supply will also decrease the fertility rate (15). Furthermore, the study results revealed a positive relationship between male labor supply and fertility rate. This is due to the fact that when the fertility rate increases, more mothers exclude themselves from the labor market and the jobs will be filled by men instead of women. Also, if the mother's husband did not work before, for earning the families' living costs, he is forced to work instead of his wife. This is called the substitution effect of male and female labor force supply (16). Laat found that the fertility rate of the wives of men who worked at home was significantly higher than that of the husbands who worked outside the house (17). In the current study, GDP did not have a significant relationship with male labor supply, but affected the female labor supply. This can be described by development issues. In more developed countries, women have more freedom to work. In less development countries, on the other hand, the husband is responsible for earning money and does not usually allow his wife to work outside the house. Contreras in Chile also investigated this issue and found similar results for female labor supply (18). In this study, no significant relationship was found between GDP and male labor force participation rate. This is due to the fact that in either developing or developed economy, men should work to earn money and the

male labor force supply is not related to developed or developing systems.

Public health expenditures also had similar effects on male and female labor supply. These expenditures had a negative relationship with male labor supply, but a positive relationship with female labor supply. Public health expenditures are usually spent for family planning policies, reducing infant mortality, vaccination, and public health. All these policies are much more useful for women because these policies cause the family members to get sick less, decrease the number of births, and provide more time for the mothers to go out and work. If the female labor supply increases, because of having substitution effects with male labor supply, the male labor supply will decrease (15).

The present study findings revealed a negative relationship between out of pocket health expenditures and male labor supply. Men always seek for harder works which need more physical fitness. The incidence rate of work injury in men is higher than women (19, 20). Work injuries in turn cause men not to be able to work and, as a result, the male labor supply will decrease. Ferreira et al. found that unhealthy individuals retired earlier compared to the healthy ones (21). When out of pocket expenditure increases, people cannot buy expensive medical care; therefore, they are forced to stay at home and male labor force participation rate will decrease. On the other hand, when the insurance coverage increases, the male labor force supply will increase (22). Women's works do not usually contain hard works. Therefore, they are not usually faced with severe work injuries and high levels of out of pocket expenditures do not interfere in their work. Berger et al. stated that if the husband becomes ill, the wife increases her market work in order to compensate the lost earnings (23). Moreover, Chou et al. found that reducing the out of pocket expenditures would decrease the female labor supply (24). In USA, the researchers found that health insurance would increase the willingness of older workers to work (25). Borjas et al. also showed that health insurance coverage would increase the labor supply in the immigrant population of the USA (26). Similar results were obtained by other studies (27-29). In contrast to our study, Strumpf et al. did not find any evidence that Medicaid insurance system in the United States decreased the female labor supply (30). Similarly, Cai found that health increased both male and female labor force participation rates (38). The effects of urbanization on labor supply were similar to that of fertility and public health expenditures.

Urbanization had a positive relationship with female labor supply, which is due to a cultural reason. In cities, the husbands allow their wives and daughters to work more in comparison to villages .Thus, the proportion of jobs which women can attend in cities is quite more compared to villages. Moreover, the share of services in urban regions is quite higher than rural areas (31). On the contrary to our study results, Bloom et al. revealed a negative relationship between urbanization and female labor supply (6). However, Coen-Pirani showed that husbands in urban regions allowed their wives to work more compared to those in rural regions, which is in agreement with the findings of the current study (32). This relationship was negative for male labor supply due to the substitution effects. When female labor supply increases, the wages will decrease. Consequently, the number of men who desire to work will decrease and the male labor supply will decrease, as well.

Agricultural economy has an important effect on labor supply especially in developing countries. In an agricultural economy, women work more in rural populations (33). However, our study showed no significant relationship between this variable and the female labor supply. This is because of the opposite effect of cultural effects and agricultural effects. Cultural effects lead women to work less in rural regions, while the agricultural effects lead them to work more. These contradictory effects on female labor supply resulted in the insignificant relationship between agriculture and female labor supply. Considering the male labor supply, the substitution effects were the reason for the negative relationship. In agricultural economy, female labor supply increases, while the male labor supply decreases (34).

This study had some limitations too. It was done in macro level for EMR countries. It can also be performed in micro level in other countries with more gender inequality to show if these relationships remain likewise. Some other variables might affect male or female labor supply. Because they were not as important as variables used in this study, we excluded them.

Conclusion

We analyzed the effects of some health indicators on male and female labor supply. We found that the males' income increased male and female labor supply, while substitution effects had an opposing effect. Public health expenditures had a major effect on female labor supply, but not on the male labor supply. In addition, out of pocket health expenditures reduced the male labor supply, but had no significant relationships with the female labor supply. Besides, fertility rate had a negative effect on the female labor supply because giving birth and keeping kids caused women to be at home. On the other hand, the effect of fertility rate was less significant and positive on the male labor supply. The study findings revealed a positive relationship between urbanization and female labor supply, which was because of the cultural effects. Governors must pay more attention to women's health. Change in women's health will change female labor supply more seriously than the male labor supply. This claim is confirmed by the coefficients of variables in the female model.

Ethical considerations

Ethical issues (Including plagiarism, Informed Consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc) have been completely observed by the authors.

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