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EDUCATIONAL ATTAINMENTS AND LABOR PARTICIPATION OF FEMALES ACROSS THE TURKISH REGIONS: A PANEL DATA APPROACH

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Abstract

This paper aims at testing whether educational attainments of females beside other primary determinants have significant impacts on their participation in the labor markets across the regions of Turkey during the years 2004-2016. Even though there are certain number of empirical studies on this fact, they mostly employ time series data or micro data sets. However, very few of them stick with the regional data analysis and also do not take care of the recent developments in the empirical literature. So, the existing empirical findings do not suggest a clear evidence about the matter, particularly about the Turkish regional differences, yet. Therefore, this work exploits a panel data technique that pays attention to the recent empirical considerations. The findings suggest that, in contrary to most of the current empirical results, both the high school and the higher education graduations of females beyond the other determinants do not have significant impacts on their participation rates in the labor market across the Turkish regions in the relevant span.

Keywords: Turkish Labor Market, Female Labor Participation, Female Educational Attainments, Regional Differences

JEL Classifications: J21, J24, J82, R12, R23

1. Introduction

The disparities between males and females in terms of education and welfare standards have still lasted in both Turkey and the European Union countries (EU), whereas they have been at significantly worse extents in Turkey in comparison with the EU (Karaca and Kocabas, 2011). Female participation and employment in the labor market of Turkey have stagnated at the lowest rates for a long period compared to those in the EU, which have increased slightly only in the last decade. Overall, these low rates in major part are accepted to result from the restricted norms against females in the Turkish society and from the behavior of females in the labor market for certain reasons which are related especially to cultural, traditional, institutional, demographic, social, educational, and economic factors. In addition, they are quite likely to be related to the types of created restricted number of jobs that do not match well to the demands of females in

the labor market. The gaps in the participation and employment rates between Turkey and EU present a particular challenge to Turkey on the road towards the EU accession.

On the other hand, female labor participation and employment rates are distributed very unevenly across the regions in Turkey as the case in majority of the world nations. Unequal distributions of both the labor participation and employment rates across the regions seem not to diminish significantly at least in the medium term. Consequently, those low rates and their unequal distributions across the regions have been an obstacle to the development in Turkey.

The cross-regional discrepancies in the labor market indicators beside those in other socio-economic factors have remained at large extents yet for a long period in Turkey even though the government has engaged in diminishing them through various policy tools. Specifically, Turkish government has enlarged the educational attainments significantly at high schools level and especially at higher education in the last two decades. Number of universities and excess to higher education are surged and universities are spread across all the provinces by government interference, whereas educational levels are still comparatively low in Turkey with respect to the EU standards.

With regard to Eurostat (2017a; 2017b; 2017c) data for the year 2016, the highest and lowest rates of female labor participation, female employment, female graduates from secondary education, and female graduates from tertiary education in the level-2 regions (NUTS-2) of the EU are respectively 83.1% in Aland (Finland) in contrast to 37.6% in Campania (Italy); 80.1% in Aland (Finland) in contrast to 28.7% in Campania (Italy); 71.8% in Chemnitz (Germany) in contrast to 18.0% in Açores (Portugal); and 57.6% in Helsinki (Finland) in contrast to 12.3% in Nord-Est (Romania). On the other hand, the corresponding highest and lowest rates observed in the NUTS-2 of Turkey are respectively 52.2% in the region TR82 compared to 16.2% in TRC3; 48.4% in TR82 compared to 10.8% in TRC3; 18.1% in TR21 compared to 4.5% in TRB2; and 26.8% in Ankara compared to 4.5% in TRB2.

The share of overall high school graduates in the labor force has increased only slightly from 12.1% to 14.0%, whereas the share of higher education graduates has displayed a sharp gradual surge from 7.4% to 15.5% in Turkey between 2006 and 2016. However, they are distributed fairly uneven across the regions. The least developed east and southeast regions of Turkey, in general, have the lowest average rates in both categories of educational attainments.

Furthermore, the regions with less intensive educational attainments of females appear mostly to have somewhat less labor participation rates of females relatively, but the reverse in general looks not likely. On the other hand, some other factors beyond the educational attainments are most likely to have impact on the regional labor participation, as well. So, we should properly isolate the impacts of educational attainments of females on their participation in the labor market from the other determinants.

A large number of studies on the regional labor market disparities in Turkey have been accumulated in the literature, so far. However, there is limited empirical evidence regarding the regional differentials of (especially female) labor participation in Turkey. More specifically, a few number of empirical studies have attempted to properly measure the impacts of educational levels of females on their participation rates across the Turkish regions.

Therefore, the main objective of this paper is to empirically estimate and test the impact of educational attainments of females on their labor participation in Turkey. We employ the most recent panel data set that contain the 26 NUTS-2 over the years between 2004 and 2016. Following the existing empirical literature, the variables are chosen based on the available data and the restricted number of observations on which in this work, thus they are not exhaustive.

The findings suggest that neither graduation from high school nor graduation from higher education of females appear to significantly increase their participation in the labor markets of the Turkish regions over the years between 2004 and 2016.

2. Review of the Empirical Literature

Abundant number of studies have directly or indirectly investigated what factors affect the participation of females in labor markets so far. However, with regard to our purpose from this work, first, we touch only on some examples of the empirical studies that examined how

educational attainments of females influence their labor participation particularly in developing countries; and next, we evaluate the empirical studies that examined the issue in Turkey. Besides, Kose and Gunes (2013) have already presented a short review of the theory of regional economic disparities, and an earlier more extensive review of empirical studies about the regional labor market disparities.

Some empirical studies in question have reached certain evidence that educational attainment level of females has a significant positive impact on their participation in the labor markets, for instance, in India and Thailand (Mammen and Paxson, 2000); in the Ghana (Sackey, 2005); in Nigeria (Aromolaran, 2004); in Pakistan (Fatima and Sultana, 2009; Mujahid and uz Zafar, 2012). On the contrary, Kottis (1990) has reached the result that education level of females has a negative impact on their labor force participation in Greece.

Most of the empirical studies related to Turkey have found some evidence of supporting that higher the educational attainment level of females is higher, the labor force participation of them (Akin, 2002; Tansel, 2002; Tansel, 2004; Gurler and Ucdogruk, 2007; Tasci and Darici, 2009; Ince, 2010; Taymaz, 2010; Yamak *et al*. 2012; Kizilgol, 2012; Inan and Asik, 2014; Goksel, 2013; Bozkaya, 2013; Cetin and Sevuktekin, 2014; Limanli, 2017).

On the other hand, Patterson (2013) observes that education alone is not sufficient for female labor market participation in either Saudi Arabia or Turkey, as other factors act as barriers to women's economic participation. In particular, limited economic opportunities for women and persistent cultural and traditional social norms discourage women from participation in the workforce in developing countries. Goksel (2013) reaches similar findings for Turkey, which also differ deeply by its regions (Inan and Asik, 2014; Gunduz-Hosgor and Smits, 2006; Gedikli, 2014).

However, small number of empirical studies have investigated the issue properly considering the regional dimension. Er (2013) investigates the factors that affect participation of females in the labor market across the 26 NUTS-2 of Turkey in 2010. He finds that education level of females has a significant positive impact on their labor force participation as the share of females employed in agriculture and some other factors do.

Catalbas (2015) examines the factors that affect participation of females in the labor market across the 12 level-1 regions (NUTS-1) of Turkey between the years 2008-2013. He finds that education level of females has a significant positive impact on their labor force participation.

Korkmaz (2016), exploiting the Turkish household labor force survey data across the 12 NUTS-1 for the year 2014, finds that the strongest factor that positively affects the female labor force participation in whole Turkey is the high school graduation rather than higher education graduation of them. She also observes that education levels of females have significant positive influences on their labor force participation at about the same extents in the relatively developed 7 NUTS-1 of Turkey. Limanli (2017), also using the household labor force survey for the years 2000-2014, finds that education has a positive significant effect on female labor participation in Turkey.

It appears that there are a lot of empirical studies that attempt to determine the situation of women in the Turkish labor market in the literature. However, there are scarce number of empirical studies that consider the regional aspects of the matter yet. Regional disparities in region-specific factors have different influences on female labor participation, and also a potential variable may affect female labor participation differently across the regions. Thus, this empirical work estimates and tests the parameters in more confident way by exploiting panel data techniques and taking care of the recent empirical considerations.

3. Data, Model Specification, and Estimation Method

The main objective of this study is to empirically estimate and test the impacts of female educational attainments on their labor participation across the Turkish regions. The study uses the most recent panel data set that contain the 26 NUTS-2 regions over the years between 2004 and 2016, which are provided by Turkstat (2017). Except three biggest metro poles, each one of the 26 NUTS-2 regions are consisted of a collaboration of contagious several provinces among the 81 provinces in Turkey.

According to the empirical literature, various factors may affect the female labor participation of regions but differently, and the impacts of them may also change over time in the same location. Empirical studies in general focus on several candidate variables to explain the disparities in the regional labor markets. Majority of the empirical studies in various specifications, as mentioned about some of which above, have employed commonly such variables as sectorial mix, educational attainments, and demographic factors as the determinants of the interregional labor market disparities. Besides, some empirical studies have also added other economic, geographic, and regional amenity indicators into their empirical models, and hence used exhaustive numbers of control variables based on large numbers of observations (Kose and Gunes, 2013).

On the other hand, there are several inter-connected factors that affect the inter-regional dynamics of the Turkish labor market in a dominant way. Demographic structure, education attainments, industrial transformation, and shrinking of agriculture are observed as some major ones among them in Turkey during the last couple of decades (Aydemir, 2013). These factors are distributed rather unevenly across the regions. We are aware that cultural, traditional, institutional, and social norms are important factors working against female labor participation in the Turkish society. However, since we could not measure them, we may assume that they do not change significantly by the region.

Considering these facts, the variables are chosen according to availability of the data; and also restricted number of observations on the time series part of the panel data urges us to select a minimum number of primary explanatory variables in the model, hence they are not exhaustive in this work. On the other hand, demographic factors, sectorial mix, educational attainments of regions are found significant determinants of regional labor market differentials in some empirical studies, so that we stick with those variables in this work as well.

In this regard, specifying a simple model we assume that the rate of female population at age between 15 and 54 in total female population over age 15 (L_FPOP1454), the ratio of employment in both industry and service sectors into employment in agriculture sector (L_IND&SER/AGR), the share of the labor force with high school graduation (L_SECONDARY), and the share of the labor force with at least 4 year equivalent of higher education degree (L_TERTIARY) determine the female labor participation rates (L_FLP) across the regions. Prefix L_ is used to denote the natural logarithms of the existing variables (see Table A1 in the Appendix for the definition of the variables).

Thereby, we estimate the following regression equation, which is linear in its parameters and considers the panel data techniques:

$$L\_FLP_{r,t} = \beta 0 + \beta 1 * L\_FPOP1554_{r,t} + \beta 2 * L\_IND\&SER/AGR_{r,t} + \beta 3 * L\_SECONDARY_{r,t} + \beta 4 * L\_TERTIARY_{r,t} + U_r + V_t + \varepsilon_{r,t} \qquad (1)$$

where β_0 is an intercept and β_1, β_2, β_3, and β_4, represent the slope parameters of the considered explanatory variables. The subscripts *r* and *t* stand for the regions (r = 1, 2, …, 26) and the years (t = 2004, 2005, …, 2016) in the equation. u_r implies unobserved possible region-specific effects and v_t implies unobserved possible year-specific effects. We try to estimate the model with the most proper methods after exploiting various commonly used tests, so that at least we may assume the residual-error terms across regions and years ($\varepsilon_{r,t}$) are distributed randomly with mean zero and well-known statistical attributes. Major part of the variation in the employed variables comes from cross-regions (between) rather than over years (within) in the panel data. No one of the variables has a high multi-co-linearity problem as checked by variance inflation factors (VIFs). The highest VIF is 4.77 for L_TERTIARY and 3.42 for the mean in the equation (Table A2 in the Appendix).

Firstly, we use Pesaran's (2007) covariate-augmented Dickey-Fuller (CADF) statistic as a second generation unit root test of the variables because there is high plausibility of cross-section dependency problem in the data. According to Pesaran's (2004) lagrange multiplier type cross-sectional dependency (CD_LM) test, all the variables seperately have a cross-sectional dependency problem at 1% significance level, whereas there is a cross-sectional dependency problem by the statistic of Frees (1995) but not by the statistics of Pesaran (2004) and Friedman

(1937) based on cross-sectional residuals estimated from fixed effects regression at 5% significance level (see Table A3 in the Appendix). All the variables are stationary at their levels with logs at 1% level of significance with constant-deterministic except L_IND&SER/AGR with constant- and trend-deterministics (see Table A4 in the Appendix). It is also plausible that we could not test the unit roots of the variables properly, especially the unit roots of the ones that their first differences are taken, because the time series part of the panel is quite short. On the other hand, Westerlund (2007) panel co-integration tests with error correction model confirm that all the independent variables separately are co-integrated with the dependent variable L_FLP at 1% level of significance (see Table A5 in the Appendix).

On the other hand, we exploit commonly used various test statistics in order to make a decision about the estimation method of the panel data model. The test results suggest that the parameters are not the same across the regions, so that at least pooled ordinary least squares (POLS) estimation is not a valid method. There are unit-effects, which are fixed at 5% level of significance or random at 6% level of significance with Hausman test statistic (see Table 1). There are the problems of first-order autocorrelation, heteroskedasticity (see Table A6 in the Appendix), and cross-sectional dependency (see Table A3 in the Appendix) in our panel data model.

Recently, some empirical estimators are developed to consider these facts in order to reach consistent estimates and valid test statistics. The two estimators among which with regard to panel data are the Pesaran's (2006) common correlated effects mean group (CCEMG) estimator, and the Eberhardt and Teal's (2010) augmented mean group (AMG) estimator. Both emphasize variable nonstationarity, cross-section dependence, and heterogeneity in the slope parameters (see Eberhardt *et al.* 2013; Kapetanios *et al.* 2011; Eberhardt and Teal, 2010; Eberhardt and Teal, 2011; Moscone and Tosetti, 2010; Roodman, 2009). The presence of those problems induces endogeneity in the estimation equation (see Eberhardt and Teal, 2011), as well. The two estimators allow for the empirical set up that deals with cross-section dependence, heterogeneity in the parameters, and problems of identification. The focus of the estimators are to obtain consistent estimates of the parameters related to the observable variables when there is no autoregressive endogeneity and the regressors are strictly exogenous. These approaches are robust to the presence of a limited number of strong factors/global shocks and an infinite number of weak factors/local spillover effects (see Pesaran and Tosetti, 2011; Eberhardt and Teal, 2010).

Both CCEMG and AMG procedures perform similarly well in terms of bias or root mean squared error in panels with nonstationary variables and cross-section dependence in Monte Carlo simulations (see Eberhardt and Bond, 2009). In addition, these various estimators are designed for moderate sizes of time series/cross-section macro panels (see Roodman, 2009). Therefore, we employ these estimators in order to estimate the parameter consistently and reach valid test statistics in our model. The existing empirical studies on this issue did not consider these facts yet.

On the other hand, we also provide additional estimates from the system GMM, and the error correction forms of mean group (MG), pooled mean group (PMG), and dynamic fixed effects (DFE) regressions (Pesaran and Smith, 1995; Pesaran *et al.* 1999) as a consistency check of the results. GMM estimator takes into account the problems caused by unobserved region specific effects and joint endogeneity in lagged dependent variable models, and provides control for simultaneity and omitted variable biases. Moreover, because there is a panel cointegration among the variables, both long-run and short-run estimates of the parameters could be reached separately by the estimation methods of MG, PMG and DFE.

4. Empirical Results from the Estimations

For only a comparison, if we omit the recent empirical considerations and estimate the model by the methods of fixed effects (FE) or random effects (RE), we reach the inconsistent results in Table 1. According to F statistic and t statistics, all the estimated parameters beyond L_TERTIARY are jointly and separetly significant at the 1% or 5% level in both equations. The variation in the independent variables explains about 99% (by an overall R^2) of the variation in the dependent variable in both estimations. However, when the econometric matters as

mentioned above are considered, these results are baised and inconsistent, so that we cannot trust them.

Table 1. Estimates from FE and RE Regressions

Independent Variables	FE Coefficients	t	RE Coefficients	t
L_FPOP1554	1.0272**	127.21 (0.000)	1.0323**	143.21 (0.000)
L_IND&SER/AGR	-0.0302**	-4.37 (0.000)	-0.0298**	-6.02 (0.000)
L_SECONDARY	-0.0367**	-2.69 (0.008)	-0.0261*	-2.10 (0.036)
L_TERTIARY	0.0075	1.37 (0.171)	0.0050	1.02 (0.309)
Constant	0.1321**	3.60 (0.000)	0.0936**	2.89 (0.004)
	$F(4, 308) = 10743.95^{**}$ (0.000) $R^2 = 0.9932$ F test that all u_i=0: $F(25, 308) = 29.13^{**}$ (0.000)		Wald $chi2(4) = 46101.33^{**}$ (0.000) $R^2 = 0.9933$ Hausman test for H_0: $\beta_{RE} = \beta_{FE}$ $chi2(4) = 9.43$ (0.051)	

Notes: (**) and (*) indicate that the results are significant respectively at 1% and 5% levels. Within parentheses are significance levels of test statistics. Dependent variable is L_FLP.

Table 2 presents the parameter estimates from the common correlated effects methods of mean group (CCEMG), GMM weighted mean group-ordinary least squares (MG-OLS), and augmented mean group (AMG). According to the Wald *Chi2* statistics, the estimated parameters are jointly significant at the 1% level in all the three estimations. However, only the coefficients of the two variables L_FPOP1554 and L_IND&SER/AGR are significant at 1% level, whereas coefficient estimates of the other two variables L_SECONDARY and L_TERTIARY are not significant even at 10% level in the three estimation procedures by separate *Z* statistics.

Table 2. Estimates from CCEMG, MG-OLS and AMG Regressions

	CCEMG Coefficients	Z	MG-OLS Coefficients	Z	AMG Coefficients	Z
L_FPOP1554	0.9809**	32.75 (0.000)	0.9813**	32.16 (0.000)	0.9697**	46.77 (0.000)
L_IND&SER/AGR	-0.0811**	-4.79 (0.000)	-0.0625**	-3.15 (0.002)	-0.0838**	-5.97 (0.000)
L_SECONDARY	0.0222	0.52 (0.605)	0.0277	0.63 (0.529)	-0.0146	-0.61 (0.545)
L_TERTIARY	-0.0059	-0.25 (0.805)	-0.0128	-0.57 (0.569)	0.0101	1.32 (0.186)
Constant	0.5127	1.29 (0.196)	0.4681	1.16 (0.247)	0.2746**	3.40 (0.001)
Wald *Chi2* (4)	1096.04**	(0.000)	2122.06**	(0.000)	5801.60**	(0.000)

Notes: (**) and (*) indicate that the results are significant respectively at 1% and 5% levels. Within parentheses are significance levels of test statistics. CCEMG (Pesaran, 2006): All coefficients represent averages across groups. Coefficient averages are computed as outlier-robust means (using rreg). Estimates of the added cross-section averaged regressors are not presented in the table since they do not have specific meanings. Dependent variable is L_FLP. MG-OLS: The mean group estimates are (GMM-) weighted by the standard errors of the individual coefficients. Estimates of the added cross-section averaged regressors are not presented in the table because they do not have specific meanings. Dependent variable is L_FLP. AMG (Eberhardt and Bond, 2009; Eberhardt and Teal, 2010): Common dynamic process is imposed with unit coefficient. All coefficients represent averages across groups. Coefficient averages computed as unweighted means. Dependent variable is adjusted of L_FLP rate (adjL_FLP).

Moreover, we also provide the parameter estimates from the system GMM estimator and the error correction forms as a consistency check in the following two tables. The results from the system GMM procedure are presented in Table 3. The parameter estimates are jointly significant at 1% level in the model by Wald *Chi2* statistic. There are no significant autoregressive errors in the estimated equation with regard to Arellano-Bond test. Hansen test does not reject the overidentified restrictions at 1% level of significance even though Sargan test rejects it. Also, difference-in-Hansen tests do not reject that instrument subsets are exogeneous at 1% level of significance. As observed above in Table 2, the coefficients of the two variables L_FPOP1554 and L_IND&SER/AGR are significant at 1% level, whereas coefficient estimates of the other two variables L_SECONDARY and L_TERTIARY are not significant even at 10% level in the system GMM regrerssion by separate *t* statistics.

Table 3. Estimates from GMM Regression

Independent Variables	Coefficient Estimates	Z
L_FLP.L1	0.0847*	2.25 (0.025)
L_FPOP1554	0.9888**	40.82 (0.000)
L_IND&SER/AGR	-0.0224**	-2.63 (0.009)
L_SECONDARY	-0.0369	-1.47 (0.140)
L_TERTIARY	-0.0078	-0.66 (0.508)
		Z
Arellano-Bond test for AR(1) in first differences		-1.01 (0.311)
Arellano-Bond test for AR(2) in first differences		0.45 (0.649)
		Chi2
Sargan test of overid. restrictions (d.f. = 76)		238.54** (0.000)
Hansen test of overid. restrictions (d.f. = 76)		20.22 (1.000)
Difference-in-Hansen tests of exogeneity of instrument subsets GMM instruments for levels		*Chi2*
Hansen test excluding group (d.f. = 65)		22.68 (1.000)
Difference (H$_0$: exogenous) (d.f. = 11)		-2.46 (1.000)
IV (L_FPOP1454, L_IND&SER/AGR, L_SECONDARY, L_TERTIARY)		*Chi2*
Hansen test excluding group (d.f. = 72)		22.98 (1.000)
Difference (H$_0$: exogenous) (d.f. = 4)		-2.76 (1.000)
Number of Instruments = 81		
Wald *Chi2* (5) = 477310.25** (0.000)		

Notes: (**) and (*) indicate that the results are significant respectively at 1% and 5% levels. Within parentheses are significance levels of test statistics. Dependent variable is L_FLP. Dynamic panel-data estimation, one-step system GMM with robust standart errors (Arellano and Bover, 1995 / Blundell and Bond, 1998). L_FLP.L1 is one year lagging of the dependent variable.

On the other hand, the results from error correction procedures are exhibited in Table 4. According to Hausman test statistic, PMG estimates are more efficient than MG estimates at 1% level of significance, and also the estimates of error correction terms are negative and significant at 1% level in all the three procedures by separate *Z* statistics. Thus, it suggests that long term

parameters are homogenous and DFE estimates could be confident as well. The long run parameter estimates of the three variables L_FPOP1554, L_IND&SER/AGR and L_TERTIARY are significant at 1% level in PMG procedure, whereas that of the variable L_FPOP1554 is significant at 1% level as that of the variable L_IND&SER/AGR is significant at 5% level in DFE procedure. However, the short run parameter estimates of the two variables L_FPOP1554 and L_IND&SER/AGR are significant respectively at 1% and 5% levels in PMG procedure, whereas which of only variable L_FPOP1554 is significant at 1% level in DFE procedure by separate *Z* statistics.

Table 4. Estimates from Error Correction (ec) Forms – MG, PMG and DFE Regressions

	MG Coefficients	*Z*	PMG Coefficients	*Z*	DFE Coefficients	*Z*
Independent Variables	Error Corrected-Long Run Results					
L_FPOP1554	0.9431**	10.18 (0.000)	1.0249**	192.58 (0.000)	1.0267**	51.07 (0.000)
L_IND&SER/AGR	-0.1295	-1.81 (0.070)	-0.0538**	-8.75 (0.000)	-0.0384*	-2.37 (0.018)
L_SECONDARY	0.0831	0.56 (0.576)	-0.0059	-0.54 (0.591)	-0.0057	-0.16 (0.875)
L_TERTIARY	0.0737	1.39 (0.164)	0.0287**	5.52 (0.000)	0.0106	0.73 (0.463)
	Short Run Results					
ec	-0.8313**	-7.09 (0.000)	-0.5554**	-7.19 (0.000)	-0.5891**	-8.76 (0.000)
L_FPOP1554 .D1	0.1424	1.17 (0.240)	0.4271**	5.68 (0.000)	0.4170**	6.86 (0.000)
L_IND&SER/AGR .D1	-0.0289	-1.27 (0.202)	-0.0319*	-2.11 (0.035)	-0.0114	-0.98 (0.329)
L_SECONDARY .D1	0.0183	0.42 (0.677)	-0.0022	-0.11 (0.909)	-0.0178	-0.81 (0.417)
L_TERTIARY .D1	0.0025	0.10 (0.920)	-0.0111	-0.84 (0.402)	-0.0065	-0.73 (0.462)
Constant	0.1539	0.69 (0491)	0.0244**	5.42 (0.000)	0.0363	0.60 (0.551)

Hausman Test: H$_0$: Difference in coefficients not systematic (MG Estimates vs. PMG Estimates) → *Chi2* (4) = 0.11 (0.998)

Notes: (**) and (*) indicate that the results are significant respectively at 1% and 5% levels. Within parentheses are significance levels of test statistics. Dependent variable is L_FLP. .D1: first difference of the variable.

Except from those in Table 1, we have reached expected signs of the significant coefficient estimates from all the procedures in Tables 2, 3 and 4. Coefficient estimate of L_FPOP1554 has positive sign as that of the variable L_IND&SER/AGR has a negative one. In addition, coefficient estimate of L_TERTIARY has positive sign but only from PMG procedure in Table 4.

The estimates from the procedures of common correlated effects, system GMM and error correction forms reveal that the higher the females at working age category between 15 and 54 years (potantial female labor force) the higher is their participation in labor force of the regions, whereas the transformation of labor from agriculture to industry and services sectors has declined female participation in the labor markets of the regions. Beyond the above estimated significant factors (L_FPOP1554 and L_IND&SER/AGR), it is quite weak possibility that disparities of female graduates from higher education (L_TERTIARY) have contributed significantly into their participation disparities, whereas which from high schools (L_SECONDARY) have not contributed significantly into their participation disparities in the labor forces across the Turkish regions. In

brief, major part of the regional disparities in female labor participation is explained by the regional disparities in potantial female labor force (L_FPOP1554) in Turkey.

5. Concluding Remarks

Having relied on the results obtained from the estimation procedures which consider the recent developments in the empirical literature, we observe that major part of the regional disparities in female labor participation is explained by the regional disparities in potantial female labor force at working age category between 15 and 54 years in Turkey. Next, the transformation of employment from agriculture to industry and services has declined female participation in the labor markets of the regions. In contrary to most of the current empirical results, either graduations of females from high schools or graduations of them from higher education institutions, beyond the other determinants, have not significantly increased their participation in the labor markets of the Turkish regions over the years between 2004 and 2016.

In fact, the primary problem appears to be the persistent low employment rates of females in the Turkish labor market, which might result in low labor participation rates of them. This issue could be worth to do research on as a future inquiry. In this point of view, in order to break this vicious circle, the regions have to create further sustainable jobs out of agriculture for women. In addition, they could educate and denote their female labor forces with the required skills for those jobs. Inactive female labor force is a significant obstacle to the further development of the regions and Turkey.

Therefore, Turkish government should upgrade the education system in both high schools and universities together in terms of resources and quality. Moreover, it should adapt the system into the plausible occupations of the future, as well. So, it should pay serious attention into the current demands and future expectations of business community for the labor types and skills by modifying the whole education system.

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Appendix

Table A1. Definitions of the Variables Employed in the Study

Variable Name	Definition of Variable
L_FLP	Natural log of the participation rate of female labor force
L_FPOP1554	Natural log of the rate of female population at age between 15 and 54 in total female population over age 15
L_IND&SER/AGR	Natural log of the ratio of total employment in industry plus services into total employment in agriculture
L_SECONDARY	Natural log of the rate of female high school (general and vocational/technical) graduates in total female population over age 15
L_TERTIARY	Natural log of the rate of female higher education graduates in total female population over age 15

Notes: All of the data have been collected from TURKSTAT (the Turkish-Governmental Statistical Institution) web page (http://www.turkstat.gov.tr).

Table A2. Descriptive Statistics and VIFs of Variables in Panel Data Set; N = 338 (CS=26 & TS=13)

Variables	Mean	Stand. Dev.	Min.	Max.	VIF
L_FLP	3.24	0.45	1.14	3.99	mean = 3.42
(FLPr)	(27.64)	(9.50)	(3.12)	(54.04)	
L_FPOP1554	3.13	0.42	1.14	3.74	2.70
(FPOP1554r)	(24.55)	(7.79)	(3.12)	(42.09)	
L_IND&SER/AGR	1.02	1.19	-0.86	5.82	2.45
(IND&SER/AGRr)	(12.14)	(44.37)	(0.42)	(337.73)	
L_SECONDARY	2.49	0.33	1.46	3.15	3.75
(SECONDARYr)	(12.70)	(3.95)	(4.31)	(23.32)	
L_TERTIARY	1.74	0.62	-0.44	3.12	4.77
(TERTIARYr)	(6.81)	(4.00)	(0.64)	(22.54)	

Notes: The rates of the variables before taking the natural logs of the numbers are within the parantheses. The rates of those variables in overall Turkey are respectively 32.46%, 29.60%, 4.13 times, 14.93% and 13.00% in 2016.

Table A3. Pesaran (2004) Lagrange Multiplier Type Cross-Sectional Dependency (CD_{LM}) Test

H$_0$: cross-sectional independence

Variables	CD_{LM}-test statistic
L_FLP	22.64[**] (0.000)
L_FPOP1554	24.04[**] (0.000)
L_IND&SER/AGR	9.76[**] (0.000)
L_SECONDARY	4.97[**] (0.000)
L_TERTIARY	55.36[**] (0.000)

Based on cross-sectional residuals estimated from FE (within) regression

	Test statistics
Pesaran	1.01 (0.314)
Friedman	17.73 (0.854)
Frees	1.12[**]

Notes: (**) and (*) indicate levels of significance respectively at 1% and 5%. Within parentheses are significance levels of test statistics. Critical values from Frees' Q distribution are 0.390 and 0.262 respectively at 1% and 5% levels of significance.

Table A4. Pesaran's (2007) CADF Test (Augmented by 1 lag) for H_0 : Unit Roots

	Deterministics: Constant		Deterministics: Constant&Trend	
	t-bar	**Z (t-bar)**	**t-bar**	**Z (t-bar)**
L_FLP	-2.584**	-4.007**	-2.185	0.342
		(0.000)		(0.634)
L_FPOP1454	-2.541**	-3.806**	-2.208	0.238
		(0.000)		(0.594)
L_IND&SER/AGR	-2.013	-1.360	-3.056**	-3.624**
		(0.087)		(0.000)
L_SECONDARY	-2.267*	-2.536**	-2.318	-0.262
		(0.006)		(0.397)
L_TERTIARY	-2.683**	-4.464**	-2.792*	-2.420**
		(0.000)		(0.008)

Notes: (**) and (*) indicate levels of significance respectively at 1% and 5%. Within parentheses are significance levels of test statistics.

Table A5. Westerlund ECM Panel Co-integration Tests

Models with constant Independent Variables	Statistic	Ho: no cointegration Z-values	
L_FPOP1554	Gt	-15.905**	(0.000)
	Ga	-5.639**	(0.000)
	Pt	-10.203**	(0.000)
	Pa	-6.509**	(0.000)
L_IND&SER/AGR	Gt	-6.308**	(0.000)
	Ga	1.214	(0.888)
	Pt	-4.946**	(0.000)
	Pa	-2.689**	(0.004)
L_SECONDARY	Gt	-6.250**	(0.000)
	Ga	0.729	(0.767)
	Pt	-5.927**	(0.000)
	Pa	-3.089**	(0.001)
L_TERTIARY	Gt	-7.357**	(0.000)
	Ga	-2.521**	(0.006)
	Pt	-8.301**	(0.000)
	Pa	-8.887**	(0.000)

Notes: (**) and (*) indicate levels of significance respectively at 1% and 5%. Within parentheses are significance levels of test statistics. Dep. Var.: L_*FLP*.

Table A6. Common Test Results in Deciding the Estimation Method of the Panel Data Model

Tests for poolability of the panel data (H_0: same parameters across units)		
Chow test: $F(125, 208)$	11.91**	(0.000)
Test of parameter constancy: $Chi2(125)$	1994.90**	(0.000)
(derived from Random Coefficients regression)		
ALM and LM tests for autocorrelation and poolability of the panel data based on RE estimation		
two-sided - $ALM\_Chi2(1)$	582.66**	(0.000)
(H_0: var(u)=0)		
one-sided - $ALM\_Z/N(0, 1)$	24.14**	(0.000)
(H_0: var(u)=0)		
serial correlation $\_Chi2(1)$	24.82**	(0.000)
ALM (H_0: lambda=0)		
joint test $\_Chi2(1)$	829.42**	(0.000)
LM (H_0: Var(u)=0, lambda=0)		
F test for panel joint unit effects (H_0: all u_i=0)		
$F(25, 308)$	29.13**	(0.000)
LR test for panel unit effects (H_0: sigma_u=0)		
$Chibar2(01)$	290.22**	(0.000)
Breusch & Pagan LM test for decicion between POLS and random effects (H_0: var(u)=0)		
$Chibar2(01)$	804.60**	(0.000)
Hausman test for the hypothesis that difference in the coefficients not systematic (H_0: $\beta_{RE}= \beta_{FE}$)		
$chi2(4)$	9.43	(0.051)
Modified Wald test for groupwise heteroskedasticity in FE regression model		
$chi2(26)$	2042.86**	(0.000)
Levene-Brown-Forsythe tests for groupwise heteroskedasticity in RE regression model		
$W0$ (df: 25, 312)	4.240**	(0.000)
$W50$ (df: 25, 312)	3.684**	(0.000)
$W10$ (df: 25, 312)	4.192**	(0.000)
Bhargava et al. (1982) modified Durbin-Watson and Baltagi-Wu LBI tests for the first order autocorrelation in FE/RE regression models		
$modified Bhargava et al. D-W$	1.021	
$Baltagi-Wu LBI$	1.268	

Notes: (**) and (*) indicate levels of significance respectively at 1% and 5%. Within parentheses are significance levels of test statistics. Dep. Var.: L_FLP.