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Fertility and Female Employment: A Panel Study on Developing Countries

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Abstract

The study analyzes the effect of female employment on fertility rate. Using panel fertility regression specification with Prais-Winsten regressions procedure, panel-corrected standard errors, and autoregressive errors on a sample of 29 developing countries over the period 1990-2011, the study estimates the effect of female labor participation on fertility rate. To pick up country-specific factors, using the principal component analysis, the study estimates a family policy index that consists of three important family policy variables including: Duration of paid leave for mothers (weeks), wage replacement of paid leave for mothers (%), and length of breast feeding coverage (years). Furthermore, to pick up fixed effects and time effects, the study includes geographic location (latitude) and time effects. The empirical results confirm the finding of Engelhardt and Prskawetz (2005) that the increase in female labor force participation rate has a negative impact on fertility and that this negative effect is decreasing over time. Also, the results suggest that more flexible policies toward family planning such as longer duration of paid leave for mothers, higher percentage of wage replacement of paid leave for mothers, and longer breast feeding coverage help in increasing fertility. Finally, in line with Pampel (2001), Kogel (2004) and Engelhardt and Prskawetz (2005) the study finds that time trend affects this negative relationship between female labor participation and fertility where the negative impact of the former on the latter decreases over time.

Keywords: Fertility, Female Employment, Panel Regression, Prais Winsten, Family Policies.

JEL classification: J13; J21; C33

1. Introduction

There is a growing literature on the relationship between female employment and fertility. Some studies argue that the causal effect travels from female labor participation to fertility and other studies argue the opposite. For the former group of studies such as Becker (1991), Cigno (1991), and Ermisch (2003), the view is based on the intuition that females labor force participation or future plans serves as a good predictive variable to their reproductive life. On the other hand, the latter group of studies argues that the effect goes from fertility to employment where that females' childbearing responsibility constrains the ability to join the labor force. The existing literature on this reverse causality includes Browning (1992), Nakamura and Nakamura, (1985), Carrasco (2001), and Michaud and Tatsiramos (2011).

The existing literature seems to concentrate more on the relationship between fertility and female labor participation in developed countries. Few studies have investigated this relationship in developing countries. For instance, Lloyd (1991), Piché, Poirier, and Neill (1989) were not able to find a clear negative statistically significant relationship between female labor participation and fertility as was the case with developed economies. The reason is in most developing countries, the live-in labor is available and cheap, nuclear family mostly live with extended family, few available paid jobs for females, plus norms and traditions at many times restrict the ability of women to leave house and work. Given these factors, the link between female labor participation and fertility in developing countries is very weak if not statistically significant. Beguy (2009) argued, however, that the relationship will highly depend on the country-specific factors such as social gender-specific role of woman. Analyzing the data of two urban cities in Sub-Saharan countries, Dakar (Senegal) and Lomé (Togo), results suggest that the relationship between female participation and fertility is more significant in Lomé than in Dakar. In line with these results, Agadanian (2000) and Yohannes et al. (2003), find that a working mother is more likely to limit the number of her child births or as Banerjee (2004) finds that working mothers tend to have lower pregnancy frequency as compared with unemployed women.

Given the above background, the purpose of the paper is to examine the causal effect of female labor force participation rate on fertility rate for a group of 29 developing countries over the period 1990-2011 while taking into consideration the country-specific factors and time effects. Furthermore to capture country's heterogeneity, using the principal component analysis, the study develops a Family Policy (FP) index that consists of three important policy variables including: Duration of paid leave for mothers (weeks), wage replacement of paid leave for mothers (%), and length of breast feeding coverage (years). The structure of the paper is as follows. In the next section we lay out empirical specification. Section 3 describes the data set. Section 4 describes the empirical results, and the last section concludes.

2. Empirical Specification

Using panel regression estimation with country-specific factors and time effects, this section estimates the fertility regression for the 29 developing countries as a function of female labor participation rate for a group of twenty nine countries. The form of the regression equation is shown in Equation (1) below.

$$Fer_{i,t} = \beta_0 + \beta_1 Femp_{i,t} + \delta_i + u_{i,t} \qquad i = 1,...N; t = 1,...T \tag{1}$$

where $Fer_{i,t}$ is the fertility rate, $Femp_{i,t}$ is the female labor participation rate, δ_i is the cross-sectional fixed effects, and $u_{i,t}$ is the residual term of the regression with zero mean and zero correlation either with itself or with regressors. Equation (1) is estimated using three procedures; the between-effects, the fixed-effects, and the random-effects. Finally, the subscript i and t refers to the country and the time period respectively.

The choice between the between-effects, the fixed-effects, and the random-effects panel regressions was made based on the results of the Hausman specification test. If the heterogeneity between cross sections and over time is related to a random process and not correlated with the regressors, then the random model would be the best fit. Otherwise, the between-effects model or the fixed-effects model is used. The results of the model selection process are discussed in next section.

Given the possibility of autocorrelation of residuals, the Baltagi and Wu (1999) test for first order autocorrelation in errors was undertaken. In case the null hypothesis which states no autocorrelation in errors is rejected, the study considers estimating equation (1) using the Prais and Winsten (1954) method with panel-correlated standard errors and AR(1) disturbances. Equation (2) below estimates the fertility regression using the Prais and Winsten method[1] and including the Family Policy (FP) index to pick up country's heterogeneity in terms of family planning policies. Equation (2) also includes the geographic locations of each country and time effects.

$$Fer_{i,t} = \beta_0 + \beta_1 Femp_{i,t} + \beta_2 FP_i + \beta_3 (Femp_{i,t} * FP_i) + \beta_4 Lat_i + \lambda_t + u_{i,t} \qquad i = 1,...N; t = 1,...T \tag{2}$$

where $Fer_{i,t}$, $Femp_{i,t}$ and $u_{i,t}$ are as defined in Equation (1). The time invariant FP_i is the family policy index created in the paper by using the principal component analysis, λ_t is the time fixed effects, and Lat_i is the latitude of each country.

3. Data

The data set consists of 29 developing countries over the period from 1990 – 2011. The data on female labor force participation rate, fertility, and countries' latitudes were collected from the World Bank Database (World Development Indicators). Female labor force participation rate is the percentage of female labor in the working age population of 15 years old and above. The fertility rate is defined as "the number of children that would be born to a woman if she were to live to the end of her childbearing years and bear children in accordance with current age-specific fertility rates."

The data on duration of paid leave for mothers (weeks), wage replacement of paid leave for mothers (%), and length of breast feeding coverage (years), are collected from the WoRLD Legal Rights Database Center. Using the principal component analysis, the three variables were used to create the FP index. It is assumed that the longer the duration of paid leave for mothers, the higher the percentage of wage replacement of paid leave for mothers and the longer the breast feeding coverage the stronger is the link between female labor participation and fertility.

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[1] More details on the Prais and Winsten method are available at Engelhardt and Prskawetz (2005).

4. Estimation Results

To estimate the empirical relationship between female employment and fertility, Equation (1) was estimated three times using panel regression estimation methodology with between-effects, fixed-effects, and random-effects. The results of the three models are reported in Table (1) below which is used as our criteria for the model selection.

As shown in Table (1), the between-effects model does not seem to be the correct model where the female labor participation is not statistically affecting the fertility rate and the model fails to reject the null hypothesis of the F-statistic. In addition, the results of the Hausman test indicate that there is a small probability that the differences in the estimated coefficients between the between-effects model and the random effects model are not systematic. In other words, the result of the Hausman test favors the between-effects model over the random-effects model.

Next, the second regression specification of Table (1), the fixed-effects model, the results are more promising. The coefficient on female participation rate is negative and statistically significant as expected. Furthermore, the model rejects the null hypothesis of both the F-statistic and the Hausman test. The results imply that, using the fixed effects regression, the model is overall statistically significant and more appropriate than the random-effects specification. Finally, the null hypothesis of the Chow test that cross-sectional dummies are equal to zero is rejected.

Table 1. Prais and Winsten Regression withPanel-correlated Standard Errors and AR(1) Disturbances

Dependent Variable: Fertility Rate	(1) Between-Effects	(2) Fixed-Effects	(3) Random-Effects
Constant	3.2 ***	4.297***	7.522***
Female Participation	0.016	-0.098***	-0.081***
R^2	0.043	0.900	0.044
F-statistic	1.230	180.40***	
Wald Test			193.14***
Chow Test		182.07***	
Breusch Pagan Test			4214.43***
Hausman Test	51.25***	60.50***	
ρ		0.980	0.980
Baltagi-Wu LBI		0.278	0.278
Wooldridge		120***	

Notes: ***, ** and * denotes statistical significance at the 1%, 5% and 10% levels respectively

The third column of Table (1) shows the random-effects specification which again shows the effect of female labor participation on fertility is negatively statistically significant where a one percent increase in female labor participation leads to an increase of about 0.1 births per woman. The null hypothesis of the Wald test (chi-squared test) which states that the coefficient on female participation is equal to zero is rejected. In addition, as shown in Table (1), the null hypothesis of the Breusch and Pagan Lagrange Multilipier test for random effects which states that the variance across entities is zero is also rejected.

The lower panel of Column (2) and (3) of Table (1) shows the estimation of the panel regression, fixed and random effects respectively, with first-order autocorrelation and where ρ is the autocorrelation coefficient. The result of the Baltagi-Wu LBI[2] (1999) test confirms the presence of positive serial correlation. Furthermore, the result of the Wooldridge test also confirms the presence of serial correlation from the regression of the first-differences variables.

To sum up, the results of Table (1) shows that the fixed-effects model is the most appropriate type of model for our regression. The coefficient on female labor participation is negative as expected and statistically significant. The regression is overall statistically significant based on the F-statistic. The model requires the addition of country-specific effects as the results of the Chow test indicates. In addition, based on Hausman test the fixed effect model is more appropriate to the random-effects model though suffers from high serial correlation either by using the Baltagi-Wu LBI test or the Wooldridge test.

To overcome the serial correlation problem, the Equation (1) was re-estimated using Prais-Winsten regressions procedure with panel-corrected standard errors and autoregressive errors. Column (1) of Table (2) shows that the female labor participation coefficient is again negative and statistically significant and the Wald test confirms that the overall regression is statistically significant as well.

[2] If the LBI is far below 1.5, the model has a positive serial correlation.

Following the Pampel (2001) and estimating Equation (1) was estimated using the one-year lagged female labor participation as the regressor. As the results of Column (2) shows, the fit of the regression has increased as compared to the one of Column (1) and the coefficient on the lagged labor participation is still negatively statistically significant as expected. Accordingly, this model is the one chosen for the coming regressions.

Table 2. Prais and Winsten Regression with Panel-correlated Standard Errors and AR(1) Disturbances

Dependent Variable: Fertility Rate	(1)	(2)
Constant	5.623***	5.411***
Female Participation	-0.035***	-0.031***
R^2	0.09	0.27
Wald Test	60.11***	214.52***

Notes: ***, ** and * denotes statistical significance at the 1%, 5% and 10% levels respectively

Worth noting that this last regression, Column (2) ot Table (2), does not pick up the countries' heterogeneity in terms of differences in family planning policies such as the duration of paid leave for mothers (weeks), wage replacement of paid leave for mothers (%), and length of breast feeding coverage (years). It is expected that the more flexible the family planning policies such as a longer duration of paid maternity leave, higher percentage of wage replacement, and longer breast feeding coverage, the smaller is the negative, if not the positive, impact of the increase in females labor participation on fertility rate. The intuition is, the less the opportunity cost of having a baby while working, the less is the negative impact of the increase in females labor participation on their willingness to have an additional child.

To take into account the cross-sectional heterogeneity, the study uses the principal component analysis to create a FP index as mentioned previously and include it in the regressions of Table (3). The first column of Table (3) below reports the results of estimation Equation (2) with the FP index and the second column shows the results after adding the FP index and its interaction term with the female participation rate variable.

As expected, Column (1) of Table (3) shows the negative statistical significant coefficient of female participation and the expected positive statistically significant coefficient of the FP index, where a one unit increase in the index implies more flexible family planning policies and increase in fertility. The coefficient on latitude also shows an expected negative statistically significant coefficient, where the farther from the equator the less the fertility rate. Additionally, the regression R^2 shows the increase of fit in the regression as compared to the regression of Column (2) of Table (2). Finally, the Wald test shows that the overall regression is statistically significant

Table 3. Prais and Winsten Regression with Panel-correlated Standard Errors and AR(1) Disturbances and FP Index

Dependent Variable: Fertility Rate	(1)	(2)
Constant	6.322***	5.877***
Female Participation	-0.032***	-0.024***
FP Index	0.106***	0.002
Interaction: Female Participation with FP Index		0.002*
Latitude	-0.051***	-0.048***
R^2	0.57	0.57
Wald Test	244.57***	181.65***

Notes: ***, ** and * denotes statistical significance at the 1%, 5% and 10% levels respectively

Adding the interaction term of female labor force participation rate with the FP index answers the question of how female participation rate affects fertility in the presence of different degrees of family planning policies. As shown in Column (2) of Table (3) once the interaction term is included in the regression, the coefficient on FP index turned statistically insignificant. This is probably because of a multicollinearity issue between the FP index and its interaction term. The coefficient on female participation though, remained statistically significant with the correct sign. The total effect of female participation on fertility is found by adding up the coefficient on female participation and the interaction term, or $\beta_1 Femp_{i,t} + \beta_3 (Femp_{i,t} * FP_i)$ of Equation (2). Based on the results, the total effect of a one unit increase in female participation rate is equal to $-0.024 + 0.002\ FP_i$. This implies, the higher the FP index the smaller is the total negative impact of female participation rate on fertility. The regression R^2 shows that the regressors explain about fifty seven percent of the fertility variable. The Wald test again confirms that the overall regression is statistically significant.

Previous studies such as Pampel (2001), Kogel (2004) and Engelhardt and Prskawetz (2005), have proven that time series trends has an effect on the negative association between female labor force participation and fertility rate which cannot be captured by the above regressions. To estimate the effect of time on the estimated impact of female participation on fertility, Table (4) shows the regression results of splitting the sample and estimating Equation (2) for two different time periods.

Table 4. Prais and Winsten Regression with Panel-correlated Standard Errors and AR(1) Disturbances and FP Index, Splitting the Sample

Dependent Variable: Fertility Rate	1990-2000 (1)	2001-2011 (2)
Constant	6.502***	4.830***
Female Participation	-0.029***	-0.010*
FP Index	-0.050	-0.005
Interaction: Female Participation with FP Index	0.003**	0.002**
Latitude	-0.056**	-0.044***
R^2	0.48	0.75
Wald Test	50.77***	250.08***

Notes: ***, ** and * denotes statistical significance at the 1%, 5% and 10% levels respectively

As shown in Column (1) of Table (4), the regression was estimated for the period 1990-2000 and the second column for the period 2001-2011. As the results shows, the impact of female participation rate on fertility decreases by more than half, from -0.029 to -0.010, from the first period to the second period. The female participation rate coefficient in both periods is still negative and statistically significant. This result confirms the hypothesis in the literature that the negative impact of female labor participation on fertility is affected by time trend. Furthermore, the coefficient of the interaction term is positive and statistically significant in both periods, though slightly smaller in the second period. The total effect of a one unit increase in female participation rate decreases from [$-0.029 + 0.003\ FP_i$] to [$-0.010 + 0.002\ FP_i$]. Again the results confirm that time trend has an impact on the negative total effect of female participation rate on fertility. The reason might be because of the modernization in the economy where new technologies such as microwave or dishwashers make it easier for a working mother to take care of her family and her work simultaneously. It could also be due to the wider availability of child care centers over time which in turn reduces the constraints on work-fertility relationship.

5. Conclusion

Using Prais-Winsten regressions procedure with panel-corrected standard errors and autoregressive errors on a sample of 29 developing countries over the period 1990-2011, the empirical results confirm the findings of Engelhardt and Prskawetz (2005) that the increase in female labor force participation rate has a negative impact on fertility rate. The study takes into consideration the country-specific factors, unobserved heterogeneity, and serial correlation in the error terms.

The study finds that countries' heterogeneity in terms of family policies affects women' choice between working and childbearing. Using the principal component analysis, the paper creates a family policy index which provides comprehensible evidence that these countries-specific factors, such as family planning policies, have a statistical significant effect on the impact of female labor force participation rate on fertility rate. In other words, the more flexible policies toward family planning such as longer duration of paid leave for mothers, higher percentage of wage replacement of paid leave for mothers, and longer breast feeding coverage the higher the fertility rate.

Furthermore, in line with Pampel (2001), Kogel (2004) and Engelhardt and Prskawetz (2005) the study finds that time trend affects this negative relationship between female labor participation and fertility. The results show that by splitting the time series dataset into two time spans, the negative impact of the former over the latter decreases over time.

Although the results of the study contribute to the relationship between female labor participation rate and fertility rate in developing countries, micoeconomic data constraints hinders that ability to account for certain aspects in this relationship. These aspects include the spouse working condition, type of the occupation, living with extended families or other type of help in the house, availability of childcare centers, mother educational background, contraceptive use, etc. Future studies on work and fertility relationship in developing countries should make use of these data, if available, to better estimate the relationship.

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