Testing the Demographic - Economic Paradox for Newly Industrialized Countries: A Panel Data Analysis

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Abstract

This study examines the relationship between the total fertility rate and per capita GDP based on the Demographic-Economic Paradox in 10 Newly Industrialized Countries for the period 1980-2012. Using the Panel Ordinary Least Squares method, the results of the study support the existence of the Demographic-Economic Paradox, which is described that nations or subpopulations with higher GDP per capita are observed to have fewer children, even though a richer population can support more children. Also, this study examines the causal relationship between fertility and per capita GDP through the Granger non-causality test developed by Dumitrescu and Hurlin (2012). The panel causality test results indicate the presence of bilateral causality relationship between the two variables.

Keywords: Total Fertility Rate; Economic Growth; Panel Causality

JEL Classification: I15, O40, C23

Introduction

Family size and the number of children per woman fell substantially in many countries over the twentieth century. There are close linkages between economic indicators and total fertility rate, which is defined as the number of children that would be born to a woman as well as other demographic and social indicators. The fertility rate has important influences on population growth and dependency ratios. According to the neoclassical growth model, the fertility rate has a negative impact on the steady-state ratio of capital to effective worker. Hence, there exists the prediction for a negative effect of the fertility rate on economic growth. As it is suggested in models of endogenous fertility, higher fertility also reflects greater resources devoted to child-rearing. Consequently, higher fertility would be expected to reduce growth with this channel (Barro 2003). This proposition that the greater the wealth, the fewer the children is referred to “The demographic-economic paradox” in the literature.

For Birg (2001), the demographic-economic paradox refers to the “proposition that there is an inverse relation between the number of children that people in the developed countries, but also the in the developing and emerging countries, actually have and could afford to have in view of their constantly rising real income. In addition to the channel asserted above by Barro (2003), this phenomenon is explained with reference to the rising opportunity costs of having children under the conditions of high women’s labour force participation rates and levels of vocational qualification. Accordingly, there is a demographic price to pay for women’s prosperity,
modernity, growing labour force participation, and the increasing options available to women to shape the course of their own biographies. According to Birg (2001), the demographic decline of modern societies unfolds in keeping with a scientific logic of its own (Kröhnert and Klingholz 2008).

There are different views related with the relationship “fertility-economic development/growth” in the growth models. Neoclassical growth models suggest a negative impact of fertility on economic outcomes, while endogenous growth models rather argue in favour of a positive impact. Specially, Malthus suggests that fertility increases lead to poverty and immiseration due to the finite nature of natural resources, which is represented as “population trap”. Similarly, Solow (1956)’s growth model predicts that population growth leads to a dilution of physical capital, on the assumption that the supply of capital is fixed and returns of labour are diminishing. Intergenerational models (Galor and Weil 1996, 1999, 2000; De la Croix and Doepke 2003; Doepke 2004; Galor 2005) assume that a reduction in family size increases private savings and enables households to invest more in each of their children, which makes the labour force more productive and thus triggers growth (Luci and Thevenon 2010).

The objective of this paper is to examine the relationship between fertility and per capita GDP as part of the Demographic-Economic Paradox in 10 Newly Industrialized Countries for the period 1980-2012. The rest of this paper is structured as follows. Section 2 outlines the previous literature, Section 3 contains the data set and the methodology and presents the main findings and Section 4 concludes the study.

**Literature Review**

As stated above, there are many ways in which fertility inversely impacts economic outcomes and the growth models also shows ambivalent results for this direction of effect. In the literature, Brander and Dowrick (1994) examine the effects of population growth and fertility on economic growth for 107 countries covering 1960-1985 periods. They found that high birth rates cause the reduction of economic growth by means of investment effects and capital dilution.

Mishra et al. (2006) investigate the relationship between the female labour force participation rate and total fertility rate for the G7 countries over the period 1960-2004. Using panel cointegration and Granger causality analyses, the study found that the variables are cointegrated and there is a Granger causal link from the total fertility to the female labour force participation.

Li and Zhang (2007) investigate the impact of birth rate on economic growth using a panel data set of 28 provinces in China for the period 1978-1998. Using the generalized method of moments estimator, the empirical findings of Li and Zhang (2007)’s study showed that the birth rate has a negative effect on economic growth. Hence, this finding is interpreted by the authors in the way that it supports the view of Malthus and China’s birth control policy is indeed growth enhancing.

Catanet and Catanet (2008) examined the determinants of economic growth for more than 150 countries over the period 1961-2000. Their findings show that economic growth is negatively correlated with fertility and population growth. Similarly, investigating the relation between fertility and economic growth, Hartmann (2010) found that a one percent change in the total fertility rate leads to a -0.029 percentage point change in the GDP per capita growth rate for 114 developing countries over the period 1975-2008.

Myrskylä et al. (2009) examine the impact of human development on total fertility rate. They found a negative correlation between human development and fertility at the countries with human development index level equal to or lower than the threshold value (determined as
0.777), while they found a positive correlation between the two variables at the countries with high human development index.

Luci and Thevenon (2010) investigate whether there is a convex relationship between economic development and fertility for 30 OECD countries over the period 1960-2007. They found an inverse J-shaped pattern of fertility along the process of economic development. This finding is interpreted by the authors that there is a clear shift in the relationship between the two variables from negative to positive.

Somayeh et al. (2013) investigate the effects of total fertility rate, life expectancy at birth, mortality rate and capital stock on the economic growth in 16 developed countries and 14 developing countries using panel data analysis over the period 1990-2010. Their empirical findings showed that capital stock and life expectancy have a statistically significant positive effect on economic growth, while mortality rate has a statistically significant negative effect on economic growth in both groups of countries. The effect of fertility rate on economic growth differs for developing and developed countries. For developed countries, fertility rate has a statistically significant positive effect on economic growth, while it has a statistically significant negative effect for developing countries.

Dominiak et al. (2014) test the hypothesis based on U-shaped relationship between total fertility rate and economic growth in 18 high-income countries over the period 1970-2011. Their findings support the hypothesis between total fertility rate and economic growth.

Data and Methodology

Source of Data

In this study it is empirically investigated the relationship between fertility and per capita GDP in perspective of the Demographic - Economic Paradox. To do this, the variables considered in this study, per capita GDP, and fertility, were collected from World Bank’s World Development Indicators. All data are annual, cover the years 1980 to 2012 and extend to 10 Newly Industrialized Countries (NIC). The real per capita GDP (pgdp) is in constant 2000 US dollars, and total fertility rate (tfr) refers to number of children that a woman would give birth to, in accordance with current age-specific fertility rates.

Model and Econometric Methodology

Model

Following the Demographic - Economic Paradox framework, this study models the relationship between per capita GDP and fertility as follow in Equation 1 and Equation 2 (with subscript i denoting a country and t denoting a year):

\[ tfr_{it} = \alpha_i + \beta_1 gdp_{it-1} + \epsilon_{it} \]  
\[ gdp_{it-1} = x_{it} + \theta_1 ftr_{it} + \eta_{it} \]

We use the natural logarithm of GDP per capita (pgdp) and total fertility rate (tfr) which are standard in most macro-econometric works, as the logarithmic form reduces absolute increases in the levels of the variables and therefore captures proportional rather than absolute differences in the distribution of the variables.

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1 These countries are Philippines, South Korea, Brazil, Turkey, China, Thailand, Malaysia, Mexico, South Africa and India.
Table 1. Descriptive Statistics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Maximum</th>
<th>Minimum</th>
<th>obs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>tfr</td>
<td>2.797555</td>
<td>0.954793</td>
<td>5.183000</td>
<td>1.076000</td>
<td>330</td>
</tr>
<tr>
<td>pgdp</td>
<td>4443.867</td>
<td>4093.003</td>
<td>23303.01</td>
<td>221.6543</td>
<td>330</td>
</tr>
</tbody>
</table>

Source: made by the author through EViews 8.0

Table 1 presents descriptive statistics of data used in this paper. As a result, there is no sampling bias in the data. The means of all variables used for the empirical analysis are close neither to their minimum nor maximum value, which indicates that there is no disproportion. Moreover, the standard deviations of the variables are large and the values are widely dispersed around the mean.

Econometric Method

We apply the panel data analysis to test the presence of the Demographic - Economic Paradox. Panel data helps to detect the dynamics of changes in short time series. Moreover, it gives more informative data, more variability, less co-linearity among the variables, more degrees of freedom and so, more efficiency (Baltagi 2005).

Homogeneity and cross-sectional dependency analysis

Firstly, this study applies Pesaran and Yamagata’s (2008) homogeneity test in order to determine whether or not slope coefficients are homogenous in the empirical model. It does not allow us to capture heterogeneity due to country specific characteristics, if the slope homogeneity is assumed without any empirical evidences (Breitung 2005). An homogenous panel data model (or pooled model) is a model in which all coefficients are common while an heterogenous panel data model is defined as a model in which all parameters (constant and slope coefficient) vary across individuals (Hurlin, 2010). Pesaran and Yamagata (2008) proposed delta_tilde test for testing slope homogeneity. The small sample properties of the statistic can be improved under the normally distributed errors with bias adjusted statistic (delta_tilde_adjusted) suggested by Pesaran and Yamagata (2008).

Secondly, this study tests the presence of cross-sectional dependence across countries. Pesaran (2006) showed that ignoring cross-section dependency causes substantial bias and size distortions in estimation of the relationship between two variables. In this study, we apply the cross-section independence using the LM tests developed by Breusch and Pagan (1980) and Pesaran (2004). There are three LM tests, which are applied to check cross sectional dependency. One of them, CDLM1 was developed by Breusch Pagan (1980). Other LM tests are CDLM2 and CDLM tests that were developed by Pesaran (2004). CDLM1 test is useful when N is fixed and T goes to infinity. Thus, in this study we rely on the results of CDLM1 test statistic.

Unit root analysis

After analysing cross-section dependency, it is controlled whether there is unit root in the series in order to get unbiased estimations. Many recent studies rely on panel unit root tests in order to increase the statistical power of their empirical findings. Several different panel unit root tests are available. These tests are generally divided into two groups, namely, ‘first generation panel unit root tests’ and ‘second generation panel unit root tests. The first generation of panel unit root tests are based on the cross-sectional independency hypothesis: Levin and Lin (1992, 1993), Levin et al. (2002), Im et al. (1997, 2002, 2003), Maddala and Wu (1999), Choi (1999, 2001), Hadri (2000). The second generation tests have included the works of Bai and Ng (2004), Moon and Perron (2004), Phillips and Sul (2003), Pesaran (2003), Choi (2002), O’Connell (1998), Chang (2002, 2004). The main difference between two generations of tests lies in the cross-sectional independence assumption. First generation tests assume that all cross-sections are independent and second-generation tests relax this assumption (Hurlin 2004). In this paper, we take into account Cross-Sectionally Augmented IPS (thereafter CIPS) statistic value, which
is average of Cross-Sectionally Augmented Dickey Fuller (thereafter CADF) statistics from second generation unit root tests, allowing cross-section dependence. Pesaran (2003) proposes a test based on standard unit root statistics in a CADF regression. CADF process can be reduced with an estimation of this equation:

\[ \Delta Y_i = \alpha_i + \beta_i Y_{it} - 1 + \sum_{j=1}^{m} \delta_j \Delta Y_{it-j} + d_i \tau + c_i \tau_{it} + \sum_{j=0}^{K} \phi_j \Delta Y_{it-j} + \epsilon_{it} \]  

(3)

where \( Y_{it} = N^{-1} \sum_{j=1}^{N} Y_{jt} \), \( \Delta Y_{it} = N^{-1} \sum_{j=1}^{N} \Delta Y_{jt} \) and \( \epsilon_{it} \) is regression errors. Let CADFi be the ADF statistics for the i-th cross-sectional unit given by the t-ratio of the OLS estimate \( \hat{\beta}_i \) of \( \beta_i \) in the CADF regression. Individual CADF statistics are used to develop a modified version of IPS t-bar test (denoted CIPS for Cross-Sectionally Augmented IPS) that simultaneously take account of cross-section dependence and residual serial correlation:

\[ CIPS = N^{-1} \sum_{i=1}^{N} CADFi \]

The null hypothesis and the alternative hypothesis of CIPS are formulated as:

- \( H_0 : \beta_i = 0 \) This hypothesis implies that all the time series are non-stationary
- \( H_1 : \beta_i \neq 0 \) This hypothesis implies that all the time series are stationary process.

**Estimation**

In this study, we use a specific country group (the NIC) so fixed effect panel data analysis is useful (Baltagi 2008: 14). Also, we use a fixed effects estimation model to account for unmeasured country-specific factors. The fixed effects model performs regression in deviations from country means. This implies an elimination of unobserved country-specific variables that are constant over time and that have an impact on fertility. One might, for example, think of the country’s degree of national feeling that can be correlated with fertility levels as well as with a country’s economic development stage. The fixed effects estimator also captures norms and attitudes that do not necessarily change much over time but impact fertility, for example attitudes toward gender roles (Luci and Thevenon 2010).

Fixed effects model can be formulated as follows in Equation 4:

\[ y_{it} = \alpha_i + \beta i x_{it} + \epsilon_{it} \]

(4)

where \( \alpha_i \) denotes all the observable effects and it is group-specific constant term in the regression model. \( \alpha_i \) equals \( z_i \alpha \) in the regression (4). If \( z_i \) is unobserved, but correlated with \( x_{it} \), then the coefficient of \( \beta \) is biased and inconsistent under assumptions of \( E(u_{it}) = 0; E(u_{it} u_{it}) = 0 \) for \( s \neq 0 \) and \( i \neq j \).

Also, we examined if there exists a bilateral causality relationship between the variables through the Dumitrescu and Hurlin (2012)'s non-causality test (as a binary relationship from x to y). The test is a simple version of the Granger (1969) non-causality test for heterogeneous panel data models with fixed coefficients. For each individual \( I=1,...,N \) at time \( t=1,...,T \), we consider the following linear model (Dumitrescu and Hurlin 2012):

\[ Y_{it} = \alpha_i + \sum_{k=1}^{K} \beta^{(k)} Y_{it-k} + \sum_{k=1}^{K} \beta^{(k)} X_{it-k} + \epsilon_{it} \]

where \( X_{it} = (x_{it1},...x_{itT})' \) and \( Y_{it} = (y_{it1},...y_{iT})' \) are stationary variables in T periods. \( \beta_{it} = (\beta^{(1)}_i,...,\beta^{(K)}_i)' \).

We assume that lag orders K are identical for all cross-section units of the panel and the panel is
balanced. Besides, we allow that autoregressive parameters \( r_i^{(k)} \) and the regression coefficients slopes \( \beta_i^{(k)} \) are constant in time and they vary across groups. The hypotheses of the Dumitrescu and Hurlin (2012) test are formulated as follow:

\[
H_0: \beta_i = 0 \quad \forall i = 1, \ldots, N
\]

\[
H_1: \beta_i = 0 \quad \forall i = 1, \ldots, N_1
\]

\[
\beta_i \neq 0 \quad \forall i = N_1 + 1, \ldots, N
\]

Under the null hypothesis, we assume that there is no individual causality relationship from \( x \) to \( y \) exists. This hypothesis is denoted the Homogeneous Non Causality (HNC) hypothesis. Thus, under the null hypothesis of HNC, there is no causal relationship for any of the cross-section units of the panel. The alternative hypothesis is denoted the Heterogeneous Non Causality (HENC) hypothesis. Under the alternative hypothesis, we assume that there is a causal relationship from \( x \) to \( y \) for a subgroup of individuals and \( \beta_i \) may differ across groups. Besides, under the alternative hypothesis, we assume that there are \( N_1 \) individual processes with no causality from \( x \) to \( y \) and \( N_1 \) is unknown but provides the condition \( 0 \leq N_1 / N \leq 1 \).

We propose the average statistic \( W_{N,T}^{HNC} \) associated with the null Homogeneous Causality (HNC) hypothesis, as follows:

\[
W_{N,T}^{HNC} = 1/N \sum_{i=1}^{N} W_{i,T},
\]

where \( W_{i,T} \) denotes the individual Wald statistics for the \( i \)-th cross-section unit corresponding to the individual test \( H_0: \beta_i = 0 \).

Let denote \( Z_i \), the \((T, 2K+1)\) matrix \( Z_i = [e: Y_i: X_i] \) where \( e \) denotes a \((T, 1)\) unit vector and by \( \theta_i = (\alpha_i, \gamma_i', \beta_i')' \) the vector of parameters of the model. Let the test for the HNC hypothesis be \( r \theta_i = 0 \) where \( R \) is a \((K, 2K+1)\) matrix with \( r = [O: I_k] \). For each \( i=1, \ldots, N \), the Wald statistic \( W_{i,T} \) corresponding to the individual test \( H_0: \beta_i = 0 \) is defined as \( W_{i,T} = \hat{\theta}_i' R \left[ \hat{\sigma}_T^2 R (Z_i' Z_i)^{-1} R' \right] R \hat{\theta}_i \),

where \( \hat{\theta}_i \) is the estimate of parameter \( \theta_i \) obtained under the alternative hypothesis, and \( \hat{\sigma}_T^2 \) is the estimate of the variance of the residuals. Under the null hypothesis of non-causality, each individual Wald statistic converges to a chi-squared distribution with \( K \) degrees of freedom:

\[
W_{i,T} \xrightarrow{T \to \infty} \chi^2(K), \quad \forall i = 1, \ldots, N
\]

The standardized \( Z_{N,T}^{HNC} \) for \( T, N \to \infty \) denotes the fact that \( T \to \infty \) first and then \( N \to \infty \) is as follows:

\[
Z_{N,T}^{HNC} = \sqrt{N/2K}(W_{N,T}^{HNC} - K) \to N(0,1)
\]

The standardized average statistic \( Z_{N,T}^{HNC} \) for a fixed \( T \) dimension with \( T \geq 5 + 2K \) is as follows:

\[
Z_{N,T}^{HNC} = \left[ \frac{N}{2K} \left( \frac{T - 2K - 5}{T - K - 3} \right) \left( \frac{T - 2K - 3}{T - 2K - 1} \right) W_{N,T}^{HNC} - K \right] \to N(0,1)
\]

**Empirical Findings**

As outlined earlier, we test first the homogeneity of the Equation (1) and the Equation (2) using Pesaran and Yamagata’s (2008) homogeneity test. The results of this test are reported in Table 2. The p-values clearly fail to reject the null hypothesis of the slope homogeneity hypothesis for two models. Thus, reports support country-specific homogeneity (for both \( \delta_t^{\sim} \) and
delta_tilde_adjust). Therefore, we take into account the tests that impose homogeneity restrictions on the variable in the empirical part of the study.

Table 2. Pesaran and Yamagata (2008)’s Homogeneity Test

<table>
<thead>
<tr>
<th></th>
<th>Equation 1</th>
<th></th>
<th>Equation 2</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Test statistic</td>
<td>P-value</td>
<td>Test statistic</td>
<td>P-value</td>
</tr>
<tr>
<td>delta_tilde</td>
<td>-0.322</td>
<td>0.626</td>
<td>-0.794</td>
<td>0.786</td>
</tr>
<tr>
<td>delta_tilde_adjusted</td>
<td>-0.337</td>
<td>0.632</td>
<td>-0.832</td>
<td>0.797</td>
</tr>
</tbody>
</table>

Source: made by the author through Gauss 6.0

In order to investigate the existence of cross-sectional dependence, we carried out Pesaran’s CD test (2004). The test statistic reported in Table 3 presents the strong evidence of cross-section dependence in the variables of pgdp and tfr at 1 percent levels of significance.

Table 3. The Results of Cross Section Dependence Test for the Variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Statistic</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>tfr</td>
<td>298.936***</td>
<td>0.000</td>
</tr>
<tr>
<td>pgdp</td>
<td>114.112***</td>
<td>0.000</td>
</tr>
</tbody>
</table>

*** indicates rejection of the null hypothesis at 1 percent level of significance.

Source: made by the author through Gauss 6.0

According to Table 3, we take into account Cross-Sectionally Augmented IPS (thereafter CIPS) statistic value, which is average of Cross-Sectionally Augmented Dickey Fuller statistics from second generation unit root tests, allowing cross section dependence. Table 4 shows the panel unit root test results through CIPS test.

As illustrated in Table 4, we reject the null hypothesis of unit root for fertility at the 1 percent significance level while we fail to reject the null hypothesis of unit root for pgdp. But pgdp seemed to be stationary variable after taking its first difference. Thus, in order to avoid spurious regression problems we included tfr and dpgdp to regression model.

Table 4. The Results of Pesaran Unit Root Test

<table>
<thead>
<tr>
<th>Variable</th>
<th>CIPS stat.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CV (0.01)</td>
</tr>
<tr>
<td>tfr</td>
<td>-4.1150***</td>
</tr>
<tr>
<td>pgdp</td>
<td>-1.4923</td>
</tr>
<tr>
<td>dpgdp</td>
<td>-2.9841***</td>
</tr>
</tbody>
</table>

d is first difference operator; *** indicates rejection of null hypothesis at 1 percent level of significance. Critical values are obtained from Pesaran (2006) Table II(b). The critical values (CV) at 1, 5, and 10 percent level of significance are -2.57, -2.33, and -2.21.

Source: made by the author through Gauss 6.0

Having established the stationarity of the series, we then proceed to test the Demographic - Economic Paradox using Panel OLS estimation technique. For the equation 1 and equation 2, the results of panel estimation are summarized in Table 5 and Table 6, respectively.

The estimation results obtained by fixed effects are shown in Table 5 and Table 6. From Table 5 and Table 6, we can see that all the coefficients are statistically significant in difference from zero. The more clearly Table 5 provides that a one percent change in per capita GDP leads to a -0.471 percentage change in the total fertility rate while holding all other variables constant. Hence, a higher level of per capita GDP associates with a lower total fertility rate. So, this empirical finding from Table 5 supports the existence of the Demographic-Economic Paradox for 10 NIC over the period 1980-2012. According to Table 6, the coefficient of fertility is negative and statistically significant. A one percent change in the total fertility rate leads to a -1.201 percentage change in the level of per capita GDP while holding all other variables
constant. From this point of view, this finding stated that higher fertility associates with lower per capita GDP for 10 NIC. Also, this finding supports the view of Malthus.

Table 5. Results for Panel Least Squares Method
Dependent Variable: tfr
White Cross-Section Standard Errors and Covariance (d.f.corrected)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>4.712739</td>
<td>0.123299</td>
<td>38.22206***</td>
<td>0.0000</td>
</tr>
<tr>
<td>dpgdp</td>
<td>-0.4712739</td>
<td>0.123299</td>
<td>-30.83478***</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

*d is first difference operator and ***indicates the statistical significance at 1 percent level.*

Source: made by the author through EViews 8.0

Table 6. Results for Panel Least Squares Method
Dependent Variable: dpgdp
White Cross-Section Standard Errors and Covariance (d.f.corrected)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>9.084177</td>
<td>0.040307</td>
<td>225.3769***</td>
<td>0.0000</td>
</tr>
<tr>
<td>tfr</td>
<td>-1.201131</td>
<td>0.039946</td>
<td>-30.06891***</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

*d is first difference operator and ***indicates the statistical significance at 1 percent level.*

Source: made by the author through EViews 8.0

In this study, we also investigated if there is a causal relationship between fertility and per capita GDP. For this purpose, we applied the Granger non-causality test for heterogeneous panel data developed by Dumitrescu and Hurlin (2012). DH panel causality test results are given in Table 7. According to the empirical results in Table 7, it is observed that there is a bidirectional causality relationship between the two variables.

Table 7. The Results of Dumitrescu and Hurlin (DH) Panel Causality Test

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>$Z_{N \cdot T}^{inc}$ Statistic</th>
<th>P-Value</th>
<th>$Z_{N \cdot T}^{inc}$ Statistic</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>tfr does not Granger cause dpgdp</td>
<td>6.408</td>
<td>4.83E-10</td>
<td>5.459</td>
<td>1.34E-07</td>
</tr>
<tr>
<td>dpgdp does not Granger cause tfr</td>
<td>10.149</td>
<td>1.71E-23</td>
<td>8.734</td>
<td>1.08E-17</td>
</tr>
</tbody>
</table>

Source: made by the author through EViews 8.0

Conclusions

High fertility rates may put pressure on population over the carrying capacity of the habitat. Accordingly, high fertility will diminish the population’s resources such as available food and water supply and habitat space. Eventually, mortality due to starvation and illness rates until carrying capacity is reached will increase. Fertility is highly interconnected with macroeconomic outcomes as well as these demographic variables. A general theoretical approach put forward the co-determination of fertility and economic growth paths.

This paper aims to test the Demographic-Economic Paradox suggesting there is an inverse relation between the number of children that people in the developed countries, but also the in the developing and emerging countries, actually have and could afford to have in view of their constantly rising real income for 10 Newly Industrialized Countries over the period 1980-2012. With this aim, the paper has applied recently developed panel econometric techniques. Our investigations through econometric panel data estimation show that the level of per capita GDP is significantly affected by the total fertility rate and the total fertility rate of the selected countries is significantly influenced by the level of per capita GDP, as well. According to the results of the estimation, a one percent change in the total fertility rate leads to a -1.201 percentage change in the level of per capita GDP while holding all other variables constant. A one percent change in per capita GDP leads to a -0.471 percentage change in the total fertility rate while holding all other variables constant. Hence, the paradox is valid for the selected
countries over the period of 1980-2012. In this study, we also tested if there is a causal relationship between fertility and per capita GDP and applied the Granger non-causality test developed by Dumitrescu and Hurlin (2012). Accordingly, it is observed that there is a bidirectional causality relationship between the two variables. Thus, we can say that per capita GDP to be statistically significant predictors of prospected total fertility rate and total fertility rate to be statistically significant predictors of prospected per capita GDP.

References