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Macro Determinants of Infant Mortality in ECO Countries:Evidence from Panel Data Analysis

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Abstract

Introduction

Infant Mortality Rate (IMR) is widely used to assessing the health status of population in both developing and developed countries. The aim of this study was to identify the main factors affect infant mortality in the Economic Cooperation Organization (ECO) countries for the years 2005 to 2012.

Materials and Methods

A panel data model from ECO countries between 2005 and 2012 was used to identify the effect of some of key explanatory variables [Gross Domestic Product (GDP) per capita, Female Labour Participation Rate, Public expenditure as percentage of Total health expenditure and Total Fertility Rate] on infant mortality. The data was obtained from World Bank and World Health Organization. Also, the data analyzed by STATA version_12.

Results

This study indicated the GDP per capita and public spending had a negative and significant effect on infant mortality in studied countries. A higher total fertility rate is also associated with higher infant mortality. In addition, our analysis showed there is not association significant between female labour participation rate and infant mortality.

Conclusion

GDP per capita, public expenditure as % of total health expenditure and total fertility rate were identified as the main determinant of infant mortality in ECO countries between 2005 and 2012. We hope the results of current study provide useful information for health policy- makers to better understand the main factors affecting on infant mortality.

***Key Words*:** Determinants, ECO countries, Infant mortality, Panel data.

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Introduction

Infant mortality generally is defined as deaths before the reaching the first year of life. Usually one of the main indicators and most widely used for assessing health status of a population is infant mortality rate per 1000 live births. It is believed that the infant mortality is reflected an improper children care and is also closely associated with well-being in a given regions or country (1-4). This is demonstrated that factors affecting on health status in a given country could be impact on infant mortality in its community. Most of studies both in developed and developing countries have been evaluated the main factors affecting on infant mortality rate (5-9). In these studies, the GDP per capita, health expenditures, female labour participation rate, fertility rate and etc. were identified as the main explanatory variables affecting on infant mortality rate.

Rezaei et al. investigated the main determinant of infant mortality in Iran from 1967 to 2012 years by time series approaches. They concluded the total fertility rate, percentage of people living in rural regions, number of physicians and mean years of schooling were the main factors affecting on infant mortality rate (8). Also, there is high level of infant mortality rate in regions which have suffered from unsuitable live conditions, inappropriate socioeconomic status and inequalities of health. According to a report by UNICEF, published in 2011, annually 11 million infant die throughout the world which about 90 % of them occur in Low and Middle Countries (LMICs) (10); Or a report published in 2009 by United Nation demonstrated there is a huge gap between developed and developing countries in terms of infant mortality rate. The infant mortality rate per 1000 live births varied from 5 in developed countries to 51 for the developing countries.

Understanding of main factors of infant mortality and its relative importance for health policy making and health planning is essential tool to implementation of effective programme in order to reduce infant mortality in each country or regions. Therefore this study aimed to investigate the effect some of main factors and its severity on infant mortality over an eight-year span from 2005 to 2012 by unbalanced panel data approach in Economic Cooperation Organization (ECO[1]) countries (Figure.1). We hope our study provides useful information and valuable for health planning and enable health policy-makers to better understand the factors affecting infant mortality in studied countries.

Fig. 1: Map of ECO Member States

[1] Azerbaijan, Iran, Kazakhstan, Pakistan, Turkmenistan, Tajikistan, Turkey, Uzbekistan, Afghanistan , Kyrgyz Republic.

Materials and Methods

This was a cross sectional descriptive study. We used unbalanced panel data of ECO countries (10 countries) between 2005 and 2012. The reason why we used ECO countries is that these countries are similar regarding to the some of the socioeconomic and social indicators. The data on infant mortality rate per 1000 live births, total fertility rate per women, GDP per capita (current US$), public health expenditure as % of total health expenditure and female labor force participation rate (% of female population ages 15 and above) were obtained from World Bank and World Health Organization data bank.

The primary model was used as:

IMR= F (gdp, tfr, pexp, flp)

These variables were extracted through literature review and their availability. Finally, we used log-log model (Cobb Douglas) to determine the main factors affecting on infant mortality in ECO countries. In this model, the coefficient shows how percentages the infant mortality rate is changed by per 1 % changes in explanatory variables. So, the β_1 to β_4 indicate the elasticity of infant mortality rate with regard to the explanatory variables.

$$\mathbf{Limr= \beta_0 + \beta_1 Ltfr_{it} + \beta_2 Lgdp_{it} + \beta_3 Lpexp_{it} + \beta_4 Lflp_{it} + \varepsilon_{it}}$$

Where:

i indicates countries and **t** indicates time period; **Limr**: the logarithm of infant mortality rate per 1000 live births;

Ltfr: the logarithm of total fertility rate per women;

Lgdp: the logarithm of GDP per capita based on current $US;

Lpexp: the logarithm of public health expenditure as % of total health expenditure;

Llfp: the logarithm of the logarithm of female labor force Participation rate.

In addition, we used the F- Limer test (for choosing panel or pool data). If the null hypothesis is rejected, the panel data is preferred. In the panel data, we used Hausman test to determine whether to choose random effects or fixed effects models for analysis. In the Hausman test: $\mathbf{H_0}$: random effects would be consistent and efficient;

$\mathbf{H_1}$: random effects would be inconsistent. If the null hypothesis is rejected, the fixed effect estimator is consistence. Also, the Modified Wald test for heteroscedasticity in panel data is performed. The data analysis was done by Stata version_12.

Results

During the study period, Iran (18) and Afghanistan (77.8) countries had a highest and lowest average of infant mortality rate, respectively. The average of IMR per 1000 live births was 42.3 (range: from 84 to 15) in ECO countries. The descriptive statistics of variables used in the study are presented in (Table.1).

The average of highest and lowest total fertility rate was related to the Afghanistan (6.05) and Iran (1.9) countries, respectively.

Table 1: Descriptive statistics of variables used in the study in ECO countries, 2005-2012

Variables		Mean	SD	Min	Max	Observations
imr	overall	42.37	20.8	15	84	N= 80
	between		21.5	18	77.8	n=10
	within		3.5	36	49.7	T=10
tfr	overall	2.96	1.2	1.8	6.9	N= 80
	between		1.24	1.9	6.05	n=10
	within		0.21	2.05	3.8	T=10
flp	overall	41.6	18.7	14	68	N= 80
	between		19.6	14.8	66.4	n=10
	within		1.16	38	44.6	T=10
gdp	overall	4369.6	3657	252	12120	N= 80
	between		3540	449	9323	n=10
	within		1396	132	8481	T=10
pexp	overall	42.37	18.9	9.2	75	N= 80
	between		19.2	16.7	71.8	n=10
	within		4.2	30.3	51.2	T=10

The trend of infant mortality rate between 2006 and 2011 in ECO countries is shown in (Figure.2). As can be seen, the IMR decreased in all countries during the study period. For example, the IMR per 1000 live births in Iran was decreased from 22 in 2007 to 15 in 2012; or the IMR per 1000 live births in Pakistan decreased from 80 in 2007 to 71 in 2012. Overall the average of IMR per 1000 live births in ECO countries decreased from 47.8 at the beginning of the study to 37.3 at the end of the study.

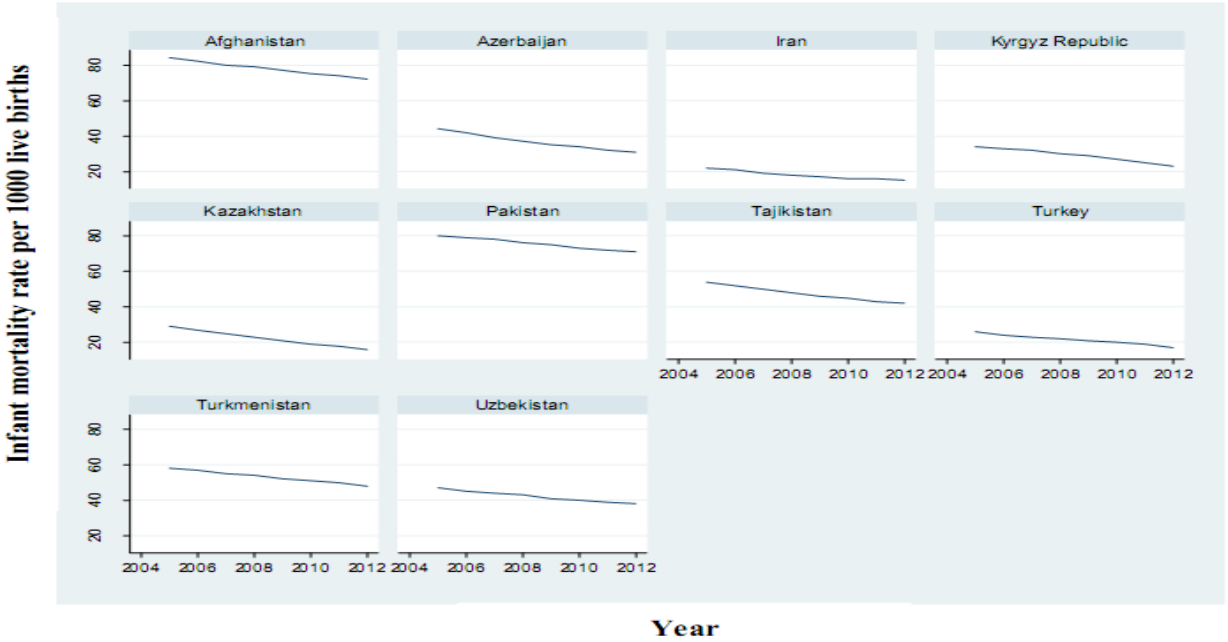

Fig.2: Infant mortality rate per 1000 live births in ECO countries, 2005-2012

The results of F-Limer, Hausman and modified Wald tests are depicted in (Table. 2). The results indicated that the panel data in against pool data is appropriated. Also, the results of Hausman and modified Wald revealed that the random effect is preferred and there are heteroscedasticity among the residuals of the model. Because of having a heteroskedasticiy, estimating the model with ordinary least square estimator will results in wrong t statistics, so we employed the Generalized least squares (GLS) random effects model which deletes the effects of heteroskedasticiy.

Table 2: Results of F limer, Hausman and modified Wald tests

Tests	Statistics	P-value
F Limer	F(9,66)= 381	<0.001
Hausman test	Chi^2 = 0.86	0.93
Modified Wald	Chi^2 = 93	<0.001

The estimate of GLS random effect model is presented in (Table.3). The results showed that Total Fertility Rate (TFR) had a positive and significant impact on infant mortality rate in Eco countries during the study period. The coefficient of TFR was 3.12 that this indicates a 10 % increases in TFR will leads to approximately 3 % increase in infant mortality rate.

The current study indicated there are significant and negative associations between GDP per capita and public health expenditure as % of total health expenditure with infant mortality. Also, there is not significant relationship between female labour participation rate and infant mortality rate.

Table 3: Econometric results of determinants of infant mortality rate in ECO countries (2005-2012) by GLS-random effect model

Variables	Coefficients	SD	p>|z|	95% Conf. Interval	
				Lower limit	Upper limit
Ltfr	3.12	0.88	<0.001	1.39	4.85
Llfp	-0.15	0.16	0.35	-0.47	0.16
Lgdp	-0.001	0.00014	<0.001	-0.0021	-0.0015
Lpexp	-0.29	0.05	<0.001	-0.39	-0.19
c	59	8.7	<0.001	42	77
R-square	Within = 0.80 Between = 0.63 Overall = 0.63				

Discussion

Infant mortality rate is one of the main indicators used to measuring health status of population in a given country thought out the world. In this paper we attempted to identify effect some of key variables such as total fertility rate, GDP per capita, public spending as % of total health expenditure and female labour participation rate on infant mortality using GLS random effect for the eight-year span 2005 to 2012 in ECO countries. The results of current study are useful for health policy- makers that how the infant mortality can be prevented in studied countries.

The descriptive analysis in our study showed Afghanistan had the highest average of infant mortality rate (78.7 per 1000 live births) and total fertility rate (6.05 per women) in the study period. In addition, the lowest average of infant mortality rate (78.7 per 1000 live births) and total fertility rate (1.9 per women) was belonged to the Iran. Our empirical analysis indicated the total fertility rate had an effect positive and significantly on infant mortality rate. This finding is consistence with studies conducted in Iran using time series analysis by Rezaei et al. (8), cross sectional data for 117 countries by Zakir et al. (5), an ecological study using data from 192 countries by Sartorius et al (11). In these studies similar to current study, TFR is identified as one of the main factors impact on infant mortality rate. Zakir et al. (5) found 10 % increases in total fertility rate will leads to increase in infant mortality rate by 8.2 % which the coefficient of this covariate in the current study was 3.21.

Our study also showed higher level of GDP per capita is associated with lower infant mortality rate. On the other hands, the GDP per capita had a negative and significant effect on infant mortality in studied countries. Jiménez -Rubio in his study using a panel data of 20 Organization for Economic Co-operation and Development (OECD) countries from 1970 to 2001 showed that there were negative and significant association between GDP per capita and infant mortality rate. In his study the coefficient of GDP per capita was -0.1 which this finding implies that if GDP per capita 10 % increases, the infant mortality rate will decrease by 1 % (12). It should be noted that in some of studies (7, 8) there were not association between income and infant mortality.

One of the other variables which in present study are considered was public spending as % of total health expenditure. Our results indicated that public spending as % of total health expenditure had an effect negative and significant relationship with infant mortality rate which in consistence with other studies (6, 9). The coefficient of this covariate was -0.29 which indicating if the GDP per capita 10 % increases, the infant mortality will decrease by 2.9 %. Shetty et al. investigated the correlation between health expenditures and infant mortality rate in 34 Asia countries. They concluded that the health expenditures is one of the most of determinant of infant mortality rate in Asia countries (13). Female labour participation rate was also considered in our study. Results revealed there was not a significant association between female labour participation rate and infant mortality rate

which in consistence with Rezaei et al. study in Iran (8).

Conclusion

In this study we attempted to identify the main factors affecting infant mortality rate in ECO countries for the eight-year span from 2005 to 2012. Our finding indicated the GDP per capita, total fertility rate and public health expenditure as % of health expenditures were the main determinant on infant mortality rate in studied countries. We hope the results of this study enable health policy makers to better understand about main factors impact on infant mortality and help to designing and implementing of effectiveness programme in order to reduce infant mortality rate.

Conflict of interests: None.

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