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Socioeconomic and Demographic Determinants of Child Mortality: Recent Empirical Evidence

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Abstract

The purpose of this study is to contribute significantly to the empirical literature related to the determinants of child mortality in developing countries. The study examined social, economic and demographic factors using a balanced panel dataset of 10 developing countries from Africa, Asia, and Latin America for the period of 1990 to 2021. The study employed feasible generalized least square regression technique to estimate relationships. The findings show that economic growth, mobile phone usage, female labor force participation, and international remittances inflows reduce child mortality. However, higher adolescent fertility significantly increases child mortality in the sample countries. The findings highlight the importance of economic stability, women empowerment, and mobile technology in reducing child mortality. Similarly, high fertility among young women significantly worsens the situation. The results have also societal implications. While higher female labor force participation and lower adolescent fertility reduce child mortality, they also improve overall development in the society. The findings of this paper support the assertion that gender equality, economic empowerment and adoption of technology are necessary for improving child health. The study provides policymakers with empirical evidence to improve socio-economic and demographic factors through formal and informal institutional reforms.

Keywords: Child Mortality, Economic Growth, Mobile Phone Usage, Inflation, Female Labor Force Participation, Adolescent Fertility Rate, Population Growth

Introduction

The development of a country is traditionally measured by three key dimensions: standard of living, education, and health (Paliova et al., 2019). However, for developing economies, health has come to the forefront due to its interlinked connections with the other two aspects. Among various health indicators, the under-five child mortality rate (CMR) stands out as a crucial metric

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to measure a country's health profile. CMR is defined as the death of a child before the age of five. CMR is still a global challenge despite being designated a Sustainable Development Goal. Although countries have made significant progress in reducing CMR globally, disparities continue to persist across nations. For policy formulation perspective, it is crucial to recognize factors affecting CMR in developing economies. The present study examines the impact of theoretically and empirically relevant social, economic, and demographic factors which affect CMR in developing economies. The study uses a balanced panel dataset of ten developing economies from Africa, Asia, and Latin America. The choice of sample is based on data availability and literature. In addition, our sample provides a broader picture of CMR across countries with different socioeconomic and demographic structures. Moreover, CMR is a serious issue in developing countries, and already included in the sustainable development goals (SDGs).

Empirical literature identified several factors which affect CMR. For example, Hobcraft et al. (1984) found that GDP per capita, access to healthcare, drinking water and a proper sanitation system are important determinants of CMR. Similarly, other factors such as poverty incidence, female empowerment, lack of contraceptive measures may significantly increase CMR in developing economies (Katoch, 2022; Klasen et al., 2021; Suriyakala et al.,2016). Furthermore, high population growth (POP) and the adolescent fertility rate (FER) are recognized as crucial demographic determinants of CMR (Bradshaw et al.,2023; Gronvik & Sandoy, 2018). Our research paper uses three relevant and famous theories for its theoretical foundation. First, Amartya Sen capability approach (Sen, 1993) which advocates individuals' freedom in terms of their ability to do different tasks and overall happiness, rather than achieving merely economic welfare. Second, the demographic transition (DT) theory which postulates that economies tend to experience lower POP as their income levels rise and CMR reduces (Harttgen et al.,2013; Kirk, 1996). Finally, the social determinants of health (SDH) framework developed by the World Health Organization. SDH suggests that socioeconomic factors have relatively stronger effects on CMR than clinical factors (Krumeich & Meershoek, 2014).

The objective of our paper is to estimate the effect of economic, social, and demographic factors in CMR in sample countries. In particular, economic variables include economic growth (EG), which is proxied by real gross domestic product per capita, international remittances inflows (REM), and inflation rate (INF). Similarly, social factors include female labor force participation (FLFP) and the usage of mobile phone (MOB). Finally, POP and FER are used to capture the effects of demographic factors on CMR. To achieve the aforementioned objective, the study uses a balance panel data of 10 emerging economies for the period of 1990 to 2021. The data on all variables were collected from the World Bank. Furthermore, the study employs feasible generalized least square (FGLS) regression technique to obtain reliable and valid estimates. FGLS provides robust results and account for heteroscedasticity, autocorrelation and cross-dependence (Hasan et al., 2024). Moreover, the Driscoll and Kraay standard errors regression method is also used to re-validate our findings of FGLS.

This study would provide valuable insights to policymakers and governments of the diverse sample economies regarding the complex interlink of socio-economic and demographic factors influencing CRM in the sample countries. This study contributes to empirical literature by providing recent evidence on the impact of socio-economic and demographic factors on CMR in the context of developing economies. Furthermore, the study contributes by improving the understanding of the key factors responsible for high CMR in the sample emerging economies. Moreover, this study contributes to the body of literature by offering evidence-based policies for the developing economies to reduce CMR.

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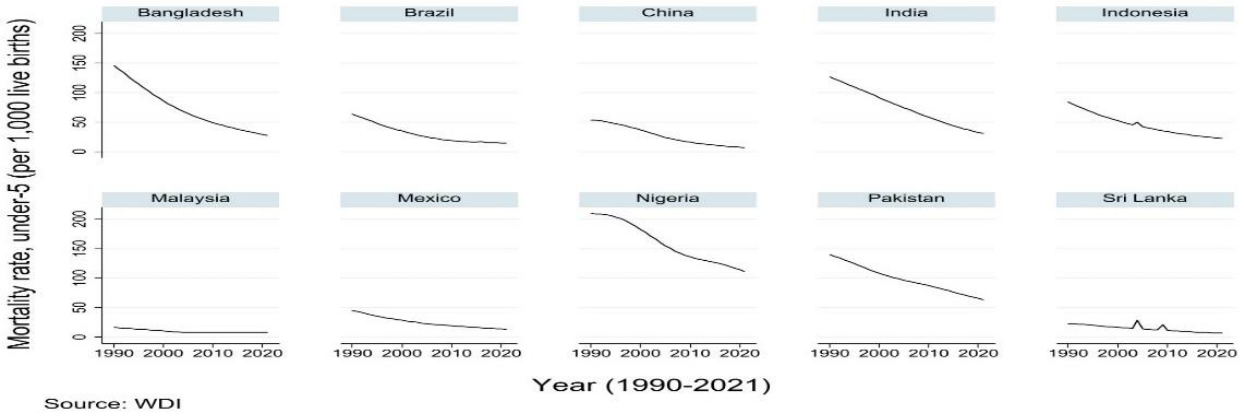
Figure 1 illustrates that the CMR has decreased across all the sample economies during the sample period. The figure shows excellent improvement in CMR particularly in Bangladesh, India, Nigeria, and Pakistan. The main reasons for this decline in CMR are higher income per capita, better access to food, nutrition, and healthcare services, and collective efforts by international organizations such as WHO, United Nations Children's Fund (UNICEF), and several non-government organizations (NGOs).

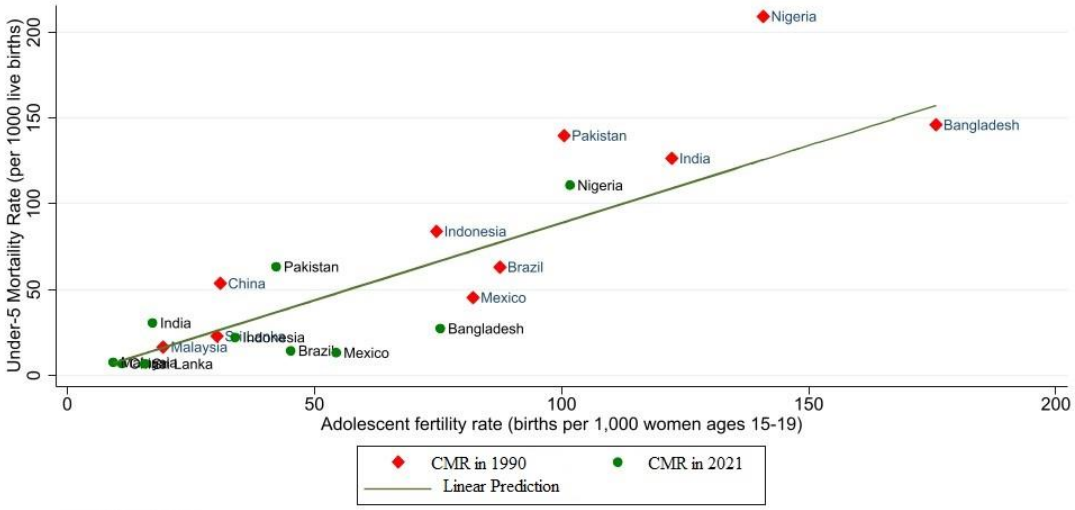
Figure 1. Under-5 Mortality Rate (per 1,000 live births)



Source: WDI

Similarly, Figure 2 shows the correlation between FER and CMR in the sample countries for 1990 and 2021. The figures illustrate a positive association between two variables, suggesting lower FER leads to decline in CMR. The majority of the sample countries have significantly reduced their FER, which contributed to the reduction of CRM. This finding is consistent with DT theory.

Figure 2. Under-5 Child Mortality and Fertility Changes from 1990 to 2021



Literature Review

In the literature of development economics, CMR is a significant indicator of human capital and social welfare in an economy (Tamura, 2006). This study has examined essential demographic, socio-economic, and institutional factors affecting CRM in developing economies. This section of

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literature review discusses empirical literature to contextualize the aforementioned determinants, with a specific focus on factors such as EG, FLFP, INF, REM, FER, MOB, and POP. The primary objective is to provide insights that emphasize strategies for policy development.

Theoretical Literature

The theoretical foundation of this study is based on three important theories: the social determinants of health (SDH) framework, the Demographic Transition (DT) Theory, and Amartya Sen's Capability Approach (ASCA). The SDH was developed by the World Health Organization (WHO), which suggests that socio-economic factors have a stronger impact on health outcomes than clinical ones (Krumeich & Meershoek, 2014). This framework emphasizes how scarcity of resources, poverty, and social disparities may increase CMR. On the other hand, DTT postulates that economies tend to have smaller family-sizes as they experience high economic development, and the quality of child is preferred over quantity (Kirk, 1996). Additionally, improvement in standard of living and healthcare services reduce CMR in the country (Harttgen et al.,2013). Finally, ASCA was developed by Amartya Kumar Sen, which stresses the freedom of individuals to obtain well-being by increasing their abilities to perform tasks and become what they want to be, instead of only on economic welfare (Sen, 1993).

Empirical Literature

Child Mortality and Economic Growth

EG is a primary determinant of CMR. Economies with larger EG tend to have lower CMR because of the greater access to healthcare services and better living conditions (Harttgen et al.,2013). Similarly, a study by Nishiyama (2011) reported that a higher EG might have weaker or mixed effects on CMR, but negative EG has a significant adverse impact on CMR. Likewise, Cardona et al. (2022) found that a 1 percent fall in income per capita caused 28,300 deaths in children under the age of 5 in 2020, during lock-down. Furthermore, the relationship between CMR and EG is more pronounced in developing economies where public investment in health is largely dependent on EG (World Bank, 2022). Thus, the study proposes the following hypothesis:
H_1: Higher Economic Growth Significantly Reduces Child Mortality in Developing Countries.

Child Mortality and Mobile Usage

The recent advancement in information and communication technologies has improved access to health care services (De & Pradhan, 2023). In their study, they found that MOB significantly improves maternal and neonatal health indicators in low- and middle-income countries. Similarly, the MOB reduces communication gap and enables prompt responses to medical emergencies, especially in remote areas (Wu et al., 2012). Moreover, the MOB improves the performance of community health workers in expanding child immunization which leads to lower CMR (Feroz et al., 2020). Thus, the study proposes the following hypothesis:
H_2: Increased Mobile Usage Significantly Reduces Child Mortality in Developing Countries.

Child Mortality and Female Labor Force Participation

FLFP has a significant effect on child health indicators. Generally, higher FLFP reduces financial constraints and increases household income in developing economies, leading to improved access to food and health care services (Siah & Lee, 2015). Similarly, Klasen et al., (2021) argue that employed mothers experience a lower CMR compared to unemployed ones. However, an

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increased FLFP reduces time for childcare which adversely impacts child health outcomes (Rashad & Sharaf, 2019). Thus, the study proposes the following hypothesis:
H_3: Higher Female Labor Force Participation Significantly Affects Child Mortality in Developing Countries.

Child Mortality and International Remittances
REM are an important factor affecting CMR by expanding income and access to food, healthcare and living conditions in developing countries (Deonanan & Ramkissoon, 2024; Ramkissoon & Deonanan, 2023; Hasan et al., 2024). However, Deonanan and Ramkissoon (2024) argue that REM reduces CMR in economies with moderate level of CMR, and they are less effective in reducing CMR in economies experiencing low or high CMR. Therefore, the study proposes the following hypothesis:
H_4: International Remittances Significantly Affect Child Mortality in Developing Countries

Child Mortality and Adolescent Fertility
Generally, high FER is associated with higher CMR in developing economies. For example, adolescents are more likely to experience preterm labor, low birth weight, and maternal and perinatal mortality (Gronvik & Sandoy, 2018). Similarly, young mothers, in developing economies, often have a lack of access to proper prenatal medical care and professional midwives, factors contributing to adverse impact on both mothers and child health outcomes (Suriyakala et al.,2016). Thus, the study proposes the following hypothesis:
H_5: Adolescent Fertility Significantly Increases Child Mortality in Developing Countries

Child Mortality and Inflation
Rising INF reduces purchasing power of households, leading to limited access to food, healthcare and other economic goods, which badly affect child health (Arintoko et al., 2023; Christian, 2010). In the study, Christian discovered that CMR significantly increases during inflationary periods due to high economic instability and decreased affordability of healthcare in South Asia and sub-Saharan Africa. A similar study conducted by Kidane and Woldemichael (2020) estimated 'food inflation elasticity of CMR' and found that an increase in food inflation by 10 percent cause an increase in CMR of 5.4 percent. Therefore, economic stability is crucial to reduce CMR in developing economies. Thus, the study proposes the following hypothesis:
H_6: Inflation significantly Increases Child Mortality in Developing Countries

Child Mortality and Population Growth
Several empirical studies have examined the relationship between CMR and POP (Bradshaw et al.,2023; Fabella, 2008; Shelton,2014). For example, developing economies with weak healthcare systems tend to have a positive association between CMR and POP as households minimize the losses by having more children (Fabella, 2008). However, a country may experience higher POP when CMR reduces until fertility rate decreases and parents substitute the quality of the child over the quantity (Shelton, 2014). Similarly, economies with lower CMR combined with access to contraceptive measures and better healthcare tend to have low POP (Bradshaw et al.,2023). Thus, the study proposes the following hypothesis:
H_7: Population Growth and Child Mortality have significant relationship in Developing Countries

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Research Gap

Although, several studies examined the determinants of CMR (Bradshaw et al.,2023; Cardona et al., 2022; Christian, 2010; Deonanan & Ramkissoon, 2024; De and Pradhan, 2023; Gronvik & Sandoy, 2018; Klasen et al., 2021), but few gaps still exist in the empirical literature. The majority of them examined the impact of social, economic and demographic factors in isolation, ignoring their joint impact on CMR. Furthermore, limited empirical evidence is documented on the effects of MOB and FLFP on CMR in developing countries. This study fills this gap by examining the impact of socioeconomic and demographic factors on CMR in developing countries. Moreover, our study provides broad insights into policy actions.

Methodology

Data and Variables

The study used a balanced panel of 10 developing economies from 3 regions i.e., Africa, Asia, and Latin America for the period of 1990 to 2021. The study chose sample and data based on literature and data availability. The data for all the variables were collected from the World Bank's World Development Indicators (WDI). The description and measurement of the variables are discussed in Table 1.

Table 1. Description of Variables

Variable	Description
CMR	Child Mortality Rate (total deaths of children under 5 per 1,000 live births)
EG	Economic Growth is proxied by real GDP per capita (measured in 2015 US$)
INF	Inflation Rate on a year-on-year basis (Consumer Price Index)
REM	International Remittances received (% of GDP)
FER	Adolescent Fertility Rate (total births per 1,000 women ages 15-19)
POP	Annual Population Growth Rate (%)
FLFP	Female Labor Force Participation (% of females in total labor force)
MOB	Number of Mobile Users (per 100 people)

Statistical Analysis and Econometric Model

This section discusses the specific econometric model and statistical analysis performed in the study. Firstly, the study performed descriptive and correlational analyses to provide useful insights about the data. Secondly, the study employs the most appropriate regression technique, feasible generalized least squares (Hasan et al.,2022), to test the hypotheses developed in the previous section. Specifically, the study estimates the following regression model:

$$CMR_{it} = \beta_0 + \beta_1 EG_{it} + \beta_2 INF_{it} + \beta_3 REM_{it} + \beta_4 FER_{it} + \beta_5 POP_{it} + \beta_6 FLFP_{it} + \beta_7 MOB_{it} + \beta_8 YRDUM + \beta_9 CDUM + \mu_{it}$$

Results and Discussion

Descriptive and Correlation Analysis

Descriptive statistics of all variables are reported in Table 2. The results show significant variation in all variables over time across countries. For example, CMR in Bangladesh reduced by 81.5% from 1990 to 2021, while it has reduced only by 47% in Nigeria during the same period. Countries like China, Malaysia, and Sri Lanka managed to reduce CMR to a single-digit figure from 1990 to 2021. The results show similar patterns for the other variables.

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Table 2. Descriptive Statistics

Country	Variable	Mean	SD	1990	2021	S-Wilk	Variable	Mean	SD	1990	2021	S-Wilk
Bangladesh	CMR	72	36	146	27	0.917[b]	FLFP	26	4	22	32	0.897[a]
Brazil	CMR	30	15	63	14	0.862[a]	FLFP	41	3	35	43	0.828[a]
China	CMR	27	16	54	7	0.895[a]	FLFP	45	0	46	45	0.923[b]
India	CMR	75	30	127	31	0.944[c]	FLFP	25	2	25	23	0.900[a]
Indonesia	CMR	45	18	84	22	0.925[b]	FLFP	38	1	38	39	0.880[a]
Malaysia	CMR	10	3	17	8	0.775[a]	FLFP	36	1	35	39	0.743[a]
Mexico	CMR	25	9	45	13	0.919[b]	FLFP	35	2	30	38	0.917[b]
Nigeria	CMR	159	34	209	111	0.898[a]	FLFP	46	1	47	44	0.738[a]
Pakistan	CMR	98	23	140	63	0.957	FLFP	18	4	11	23	0.917[b]
Sri Lanka	CMR	15	6	23	7	0.949	FLFP	34	1	37	34	0.899[a]
Bangladesh	FER	123	32	176	75	0.927[b]	MOB	35	41	0	109	0.785[a]
Brazil	FER	73	14	88	45	0.887[a]	MOB	57	50	0	102	0.862[a]
China	FER	15	4	31	11	0.725[a]	MOB	46	45	0	122	0.858[a]
India	FER	69	42	122	17	0.865[a]	MOB	33	36	0	82	0.762[a]
Indonesia	FER	50	12	75	34	0.953	MOB	55	59	0	134	0.804[a]
Malaysia	FER	14	3	19	9	0.933[b]	MOB	72	57	0	141	0.844[a]
Mexico	FER	73	7	82	54	0.891[a]	MOB	48	40	0	100	0.840[a]
Nigeria	FER	125	12	141	102	0.874[a]	MOB	34	37	0	91	0.803[a]
Pakistan	FER	66	18	101	42	0.920[b]	MOB	30	31	0	82	0.788[a]
Sri Lanka	FER	24	5	30	16	0.880[a]	MOB	51	55	0	141	0.807[a]
Bangladesh	GDP	898	359	493	1684	0.894[a]	POP	1	0	2	1	0.877[a]
Brazil	GDP	7554	1082	6086	8622	0.909[a]	POP	1	0	2	1	0.951
China	GDP	4649	3241	905	11223	0.897[a]	POP	1	0	1	0	0.944[c]
India	GDP	1091	472	534	1962	0.902[a]	POP	2	0	2	1	0.954
Indonesia	GDP	2497	767	1484	3893	0.901[a]	POP	1	0	2	1	0.969
Malaysia	GDP	7573	1970	4260	10606	0.958	POP	2	1	3	1	0.898[a]
Mexico	GDP	9387	655	8145	9760	0.934[c]	POP	1	0	2	1	0.968
Nigeria	GDP	2002	464	1609	2430	0.864[a]	POP	3	0	3	2	0.941[c]
Pakistan	GDP	1234	215	957	1651	0.897[a]	POP	2	1	3	2	0.946
Sri Lanka	GDP	2710	1081	1321	4331	0.898[a]	POP	1	0	1	1	0.951
Bangladesh	INF	6	2	6	6	0.959	REM	6	3	2	5	0.899[a]
Brazil	INF	268	707	2948	8	0.434[a]	REM	0	0	0	0	0.915[b]
China	INF	4	5	3	1	0.712[a]	REM	0	0	0	0	0.938[c]
India	INF	7	3	9	5	0.913[b]	REM	3	1	1	3	0.943[c]
Indonesia	INF	9	10	8	2	0.503[a]	REM	1	0	0	1	0.963
Malaysia	INF	3	1	3	2	0.985	REM	0	0	0	0	0.947
Mexico	INF	10	9	27	6	0.710[a]	REM	2	1	1	4	0.929[b]
Nigeria	INF	18	16	7	17	0.647[a]	REM	3	2	0	4	0.919[b]
Pakistan	INF	8	4	9	9	0.942[c]	REM	4	2	5	9	0.945
Sri Lanka	INF	9	5	21	7	0.901[a]	REM	7	1	5	6	0.930[b]

[a,b,c] indicates significance at 1, 5 and 10 percent level, respectively. SD= standard deviation, S-Wilk= Shapiro Wilk Statistics.

Moreover, Pearson's coefficient of correlation and variance inflation factor (VIF) are reported in Table 3. The results show a significant negative correlation between CMR with EG, FLFP and MOB, while a significant positive association of CMR with FER and POP. Moreover, the results confirm that there is no multicollinearity in our model as indicated by both pairwise coefficient of correlation and the value of VIF (less than 10). The study can include all variables in a regression model without concern for multicollinearity among them. However, the post-regression analysis reveals that the model is affected by heteroscedasticity and autocorrelation.

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Table 3. Pearson's Coefficient of Correlation and Variance Inflation Factor (VIF)

Variables	CMR	EG	INF	REM	FER	POP	FLFP	MOB	VIF
CMR	1								
EG	-0.582[a]	1							1.891
INF	0.019	0.067	1						1.041
REM	0.057	-0.424[a]	-0.098[b]	1					1.615
FER	0.771[a]	-0.335[a]	0.073	0.123[b]	1				1.525
POP	0.689[a]	-0.282[a]	0.031	-0.094[c]	0.508[a]	1			1.619
FLFP	-0.126[b]	0.406[a]	0.022	-0.382[a]	-0.150[a]	-0.235[a]	1		1.364
MOB	-0.476[a]	0.476[a]	-0.120[b]	0.074	-0.413[a]	-0.456[a]	0.226[a]	1	1.761

[a, b, c] indicates significance at 1%, 5%, & 10% levels, respectively.

Regression Analysis

The regression results are reported in Table 4. First of all, the value of Wald-Chi^2 indicates that the overall model is statistically significant at 1 percent level of significance. Furthermore, the findings show that the coefficient of EG is negative and statistically significant, indicating that higher economic growth reduces CMR in developing countries. Similarly, the variable of REM is also found to have a significant and negative relationship with CMR. This finding shows that economies that receive higher REM tend to experience lower CMR. In addition, the coefficient of FLFP is also negative and statistically significant. This finding reveals that economies with higher rate of FLFP experience low CMR due to access to food and child healthcare due to financial stability. Similarly, the coefficient of MOB is negative and statistically significant which shows that higher access to mobile phones reduces CMR due to prompt response to medical emergencies and low communication gap. Higher access to mobile phones also helps community health workers reach and provide their services in remote areas.

On the other hand, the results show that higher FER increases CMR in developing economies. The variables of INF and POP are found to be statistically insignificant. The reason for the insignificance of INF on CMR may be due to its diluted direct effect; its effect may be mediated through other economic variables such as through personal income and access to food and nutrition. Similarly, the insignificant impact of POP on CMR is due to its mixed effect depending on the level of development and resource distribution. Higher POP may increase CMR due to lower resource availability per person. However, in some other contexts, higher POP may increase the capability approach of a country and reduce CMR. Thus, POP may become significant in a broad panel data regression model.

Table 4. Regression Results using FGLS Method

Variables	FGLS Approach		Driscoll-Kraay Std. Error Approach	
	Coefficient	Standard Error	Coefficient	Standard Error
EG	-0.002[a]	0.000	-0.003[a]	0.001
INF	0.001	0.001	0.007[a]	0.002
REM	-0.503[b]	0.197	-4.958[a]	0.674
FER	0.439[a]	0.044	0.768[a]	0.070
POP	1.205	1.321	1.548	3.158
FLFP	-0.837[a]	0.203	-0.796[a]	0.242
MOB	-0.048[b]	0.019	-0.159[a]	0.031
Intercept	64.398[a]	9.010	62.646	23.748
Wald-Chi^2	305.756[a]		539.25[a]	
Observations	320		320	
R^2	-		0.860	

[a, b, c] indicates significance at 1%, 5%, & 10% levels, respectively.

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Conclusion

This study examined the impact of socio-economic and demographic factors on under-5 child mortality rate (CMR) in developing economies. The study uses the sample of 10 developing economies from Africa, Asia and Latin America from the period of 1990 to 2021. The findings show that economic growth (EG), international remittances inflows (REM), female labor force participation (FLFP), and access to mobile phone (MOB) have a significant and negative impact on CMR. However, the variable of adolescent fertility (FER) has a significant and positive impact of CMR in the sample countries. These results imply that higher EG, REM and FLFP reduce CMR by improving economic status of households and enabling them to access food and medical healthcare. Similarly, higher access to MOB allows households to receive medical aid in emergencies. However, the positive coefficient of FER shows that higher FER increases CMR due to risk of preterm and low weight birth. Additionally, higher FER increases CMR through various channels such as low resource availability per child and negative effects on maternal health. The variables of INF and POP are found to be statistically insignificant. Moreover, the study has some limitations. First, the study used a sample of 10 developing countries, so the findings are not applicable to developed countries. Second, the study focuses on social, economic and demographic factors affecting CMR; future studies may include other factors such as technological advancement in medical science, institutional quality, and climate change, that may affect CMR in developing countries.

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