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Abstract

Many developing countries, especially the Least Developed Countries are becoming more aid dependent. This bleak reality provokes debate on aid effectiveness. This study analyzes the effectiveness of aid on the health sector of Pakistan over the period 1973-2008. This study focuses on the health sector in the light of Millennium Development Goal; reducing child mortality. We estimate an econometric model to test the short and long run relationship between foreign aid and infant mortality rate in the health sector. For this purpose, Augmented Dickey Fuller test, Johansen Likelihood Ratio test and Vector Error Correction Methods are used. The results proved the short run and long run relationship between foreign aid and infant mortality rate in the health sector.

Key Words: Infant Mortality rate, Millennium Development Goal, Foreign Aid

JEL Classification: F35, I10, O12, O19

I. INTRODUCTION

Most of the developing countries are dependent on foreign aid to expand the productive capacity of their economies due to the lack of internal resources. In this context, the World Bank has provided a large amount of aid for projects in health, nutrition and population. It has observed that World Bank has allocated average annual commitments of 2.9 billion dollars in fiscal year 2009. This amount is a threefold increase over the previous year's commitments¹.

This paper used Official Development Assistance (ODA) that is a subcategory of foreign aid and account for all official aid in different sectors. According to the World Bank, ODA comprises flows that meet the Development Assistance Committee's (DAC) definition of ODA and are made to countries on the DAC list of aid recipients. This study contributes to the discussion on the effectiveness of foreign aid by focusing on the fourth MDG i.e. reducing child mortality. In this context, policies like National Plan of Action like "Health For All" (HFA) has been initiated to achieve these goals.

Although most of the developing economies has increased their spending in the health sector because the role of human capital is vital in the development of a nation but in Pakistan, inspite 8 per GDP growth rate in 1991-92, only 0.2 percent of GDP was spent on this sector. Even the other countries in the region like Bangladesh, Sri Lanka and Nepal spent more than 4 percent on this sector, which was higher than the spending on health in Pakistan.

Therefore, it seems that the health care system of Pakistan is inadequate and inefficient. The poor conditions in the health sector may be recognized by a number of factors like high population growth rate, inadequate allocation of resources in the health sector and poverty etc. While examining the effectiveness of foreign aid in the health sector of Pakistan, the following question arises; Does foreign aid affect infant mortality rate in Pakistan?

This paper comprises five parts. Section II reviews the literature. Section III explains the description of data and the specification of the model to be estimated. The results regarding the long run and short run relationship among variables are discussed in section IV. Section V concludes the findings of the study and policy implications emerging from the study.

II. REVIEW OF LITERATURE

Importance of aid in the health sector may be justified, as it can be helpful to increase investment in this sector of the recipient countries. In developing countries, the infrastructure is poor and it is required to enhance the budget of the government for providing resources for building hospitals, hire and train staff, free medicines etc. while reviewing literature, we find that income has significant effect on health status while the ratio to GDP of public spending on health and the share of public outlay in total health care spending has no significant effect on the variables in the health. The following studies discussed the aid effectiveness on different variables related with health sector.

Filmer and Pritchett (1997) run the cross-country regression using UNICEF data. They analyzed the relationship between child mortality and some social indicators like GDP per capita, income inequality and female education etc. They found that these indicators explained more than 90 percent of variation in child mortality. They found that public expenditure on health has very little effect on child mortality.

Gupta et al (1999) used cross sectional data for fifty developing countries. They concluded that expenditure allocation in health and education sectors has improved the attainment in these sectors. They suggested that the size and efficiency of allocation matter in social sectors and they found that this has strong effect in education sector as compare to the health sector.

Baldacci et al (2004) found a positive and significant impact of government spending on social indicators especially in the health and education sectors. According to the results, there was an immediate effect of health spending on health indicators. The study found significant role of policy interventions. They concluded that improving governance and budget deficit were also helpful for the countries to achieve Millennium Development Goals.

Thiele et al (2006) analyzed whether the donor countries has allocated aid in the line of MDGs or not. They used sectoral disaggregated aid data and discussed its impact on different variables reflecting these sectors in the recipient countries. Their results revealed that there was a considerable gap between desire of donor and actual aid allocation. It led to the conclusion that large amount of aid would not had the desired effects unless the targeting of aid is improved. They concluded that without allocating the aid in the right direction, it would be difficult to achieve the targets of MDGs.

Wolf (2007) examined the effectiveness of aid on education, health and water & sanitation. The study also included some social sectors like freedom of press and decentralization. Although the study has found a positive significant relation between health aid and its outcomes, however, it concluded that aid has mixed impact so it could not be the only solution for improved social indicators to achieve the goals set by MDGs.

Mishra and Newhouse (2007) estimated the relationship between aid for health and infant mortality rate. They performed a cross-country analysis using 118 countries. They used time series data between 1973 and 2004 and found that the relationship between these two variables was statistically significant. They concluded that by doubling per capita health aid was associated with a 2 percent decrease in infant mortality rate. Moreover, the results showed that the effect of health aid was relatively small and it was not sufficient to achieve the targets envisioned by the MDGs.

After reviewing the studies on the effectiveness of aid on the health sector, we conclude that multiple factors are responsible for infant mortality rate in Pakistan. This study will contribute in an important way that it will capture the short run and the long run behaviour of foreign aid in this sector.

III. THE EMPIRICAL MODEL AND DATA

The literature presented in section II shows that many factors are responsible for the status of health sector. The main factors that are identified for health sector are GDP per capita, foreign aid for health, adult literacy rate and health expenditure. For the purpose of selection of variables, this study followed Wolf (2007) and Mishra & David (2007). However, in addition to that, one other variable like Maternity & child health care centers is also included in the study that have significant role in this sector in the economy of Pakistan.

The study covers the period from 1973 to 2008. The choice of the period is based on the availability of data. Data for social indicators has been taken from various issues of Pakistan Economic Survey and World Development Indicators and the data on foreign aid for health and education sectors are taken form OECD's Creditor Reporting System (CRS) that contains information on the sectoral allocation of aid ². This study used the amount of aid commitments at current prices in million US Dollar. Although the data based on disbursement should be preferred but information on disbursement by sector is available only from 1990 onward so due to unavailability of data, aid commitment is used in this study.

The Model

In regression equation representing the health sector, infant mortality rate is our dependant variable. It is used to assess the progress in health sector towards achieving the goal of reduction in infant mortality rate. The functional form of the model is written as follows:

$$\text{IMR} = f(\text{GDP, FAH, PSH, ALR, MCH})$$

Or

$$Z_t = f(W_{1t}, W_{2t}, W_{3t}, W_{4t}, W_{5t})$$

And the econometric model is presented as:

$$Z_t = \beta_0 + \beta_1 W_{1t} + \beta_2 W_{2t} + \beta_3 W_{3t} + \beta_4 W_{4t} + \beta_5 W_{5t} + e_{2t}$$

Where:

- Z_t \Rightarrow IMR = Infant Mortality Rate
 W_{1t} \Rightarrow GDPpc = Gross Domestic Product per capita
 W_{2t} \Rightarrow FAH = Foreign Aid for Health
 W_{3t} \Rightarrow PSH = Public Spending on Health
 W_{4t} \Rightarrow ALR = Adult Literacy Rate
 W_{5t} \Rightarrow MCH = Maternity and Child Health centers
 e_{2t} \Rightarrow Error Term
 t \Rightarrow 1, 2, 3,

Econometric Methodology

For the estimation purposes, three steps methodology has been employed i.e. checking the stationarity of the data, estimating the long run function and estimating the parsimonious error correction model along with the stability and other diagnostic tests. First, we have applied Augmented Dickey Fuller (1979, 1981) tests to each of the variables and determine the stationarity property in their level as well as in their differences and all the variables found to be integrated of the same order. In order to find the long run relationship among variables, Maximum Eigenvalue test and Trace Statistic are used. Finally, parsimonious Vector Error Correction Model (VECM) is used to determine the short run relationship between these variables.

IV. EMPIRICAL RESULTS

In the previous section, we have developed an econometric model that gives us the determinants of health sector in Pakistan. In this section, the estimation of the model and empirical results of the study are presented. The model is estimated by using annual time series data for the period 1973 to 2008. It provides a framework to clarify mainly the effectiveness of foreign aid on infant mortality rate in the economy of Pakistan that is the objective of the study. The estimated function asserts the long run as well as short run relationship between these variables.

Testing of Unit Root

We employed Augmented Dickey Fuller (ADF) Unit Root Test to check the stationarity of the variables. The results are presented in the following table. The results show that null hypothesis of unit root is accepted for all variables in the level form. However, it is rejected for all variables in the first differenced form. Our test results show that all variables are I(1). These results are discussed in table 1. The results of ADF allow us to move to the co-integration method to estimate the long run relationship that is presented in the next section.

The Long-run Function: A Co-integration Analysis

As the objectives of the study is to analyze the long run relationship between variables of health sector in Pakistan, so we estimate the cointegrating relationship between infant mortality rate and its determinants. Before we run cointegration test we need to specify the lag structure. For this purpose, we employed Akaike Information Criterion (AIC) and Schwarz Bayesian Criterion (SBC), as suggested by Enders (1995) and Davidson (1998) to investigate the optimal lag length. It is important because an appropriate lag structure may over parameterize and it can reduce the power of cointegration test. The appropriate lag length of the VAR is two. To find the long run relationship, Johansen cointegration procedure is used. The results from the Johansen cointegrated test (both Trace test and Max Eigen value test) are presented in tables 2 and 3. All the variables included for the test have the same order of integration.

The empirical results in tables 2 and 3 show that there exists a long run relationship between infant mortality rate and its determinants. Significance of the variables confirms their validity in the model. The results of estimated function are presented in the following equation.

$$Z_t = 136.3684 - 0.021588 * W_{1t} - 0.004255 * W_{2t} - 0.0000664 * W_{3t} - 0.859730 * W_{4t} - 0.000525 W_{5t}$$

[T-Value] [16.865] [2.377] [3.495] [20.523] [0.8104]

The estimated equation indicates that infant mortality is determined by the GDP per capita, foreign aid for health, public spending on health, adult literacy rate and the numbers of maternity & child health care centers. The estimated model shows that the impacts of all the independent variables are statistically significant except MCH in the long run. The estimated co-efficient of the GDP per capita (W_{1t}) is 0.02159 ($t = 16.865$) that is also negative and significant. This result shows that due to increase in GDP per capita, the purchasing power of the people will increase and they would be able to receive the health facilities and consequently the infant mortality rate will decrease. The cointegration analysis indicates that the estimated coefficient of foreign aid for health (W_{2t}) is 0.004255 ($t = 2.377$) that is negative and significant. It shows that with one million dollar increase in foreign aid, the infant mortality rate will decrease by 0.004 units. In the long run, foreign aid in this sector can anticipate the decrease in infant mortality and therefore increase the health status of the economy. The analysis also shows that there is negative and significant long run relationship between public spending on health and infant mortality rate. The estimated coefficient of public spending (W_{3t}) is 0.0000664 ($t = 3.494$), which is significant. It indicates that public spending also plays an important role in determining the infant mortality rate in Pakistan. Increase in public spending implies that infant mortality rate will reduce in the long run. The estimated coefficient of adult literacy (W_{4t}) is 0.859 ($t = 20.523$), which shows negative relation between literacy rate and infant mortality rate and is highly significant. It implies that the importance of adult literacy in determining the infant mortality rate in Pakistan. Increase in adult literacy reduces the infant mortality that increases the health status of the people. The analysis indicates that there is negative long run relationship between infant mortality rate and the number of maternity & child care centers (MCH). The estimated coefficient of MCH (W_{5t}) is 0.000525 ($t = 0.807$) that is insignificant indicating that MCH has no significant role in determining the infant mortality rate in Pakistan. It is due to deficiency in data because there is decreasing trend in data from 1992-93 when there was exclusion of family welfare centers from MCH structure in NWFP.³

The Short-Run Dynamic Model for Health Sector

To determine the short run relationship between variables, we used VECM followed by Hendry's approach known as "general to specific." we include different lags of explanatory variables from top to low and first lag of Error Correction Term (ECT). The following Error Correction Model (ECM) is established using the two lags structure as suggested by AIC and SBC.

$$\begin{aligned} \Delta Z_t = & \beta_0 + \beta_1 \Delta Z_{t-1} + \beta_2 \Delta Z_{t-2} + \beta_3 \Delta W_{1t} + \beta_4 \Delta W_{1t-1} + \beta_5 \Delta W_{1t-2} + \beta_6 \Delta W_{2t} + \beta_7 \Delta W_{2t-1} \\ & + \beta_8 \Delta W_{2t-2} + \beta_9 \Delta W_{3t} + \beta_{10} \Delta W_{3t-1} + \beta_{11} \Delta W_{3t-2} + \beta_{12} \Delta W_{4t} + \beta_{13} \Delta W_{4t-1} + \beta_{14} \Delta W_{4t-2} \\ & + \beta_{15} \Delta W_{5t} + \beta_{16} \Delta W_{5t-1} + \beta_{17} \Delta W_{5t-2} + \lambda_2 ECT_{t-1} + e_{2t} \end{aligned}$$

After estimating the above model, we gradually eliminate the insignificant variables using the general to specific approach in order to get a parsimonious model. The results of the preferred model are presented in the following table.

The results in the following table show that the estimated value of Error Correction Term (ECT) is (-0.36) with ($t = -2.008$) which is significant with theoretically correct sign. It indicates that 36 percent of the disequilibrium in the determination of infant mortality rate is corrected immediately i.e. in the next year. It suggests a high speed of convergence to equilibrium if there appears disequilibrium in the system.

In the estimated dynamic error correction model, the coefficients of lagged changes in infant mortality rate (ΔZ_{t-1} and ΔZ_{t-2}) are negative and significant at 4% and 17% successively which show that the changes in successive previous periods in infant mortality negatively affect on short-term changes in infant mortality. It may reflect that the phenomena of infant mortality cannot be treated as the result of present period decision only.

The coefficients of foreign aid with two period lags (ΔW_{2t-1} and ΔW_{2t-2}) are significant with negative sign, which show that change in foreign aid for health in the previous periods has negative effect on, the current changes in infant mortality rate. However, the effect of foreign aid for health in the current period has no significant effect on Infant Mortality. The results of the analysis suggested that the impact of changes of foreign aid on the determination of infant mortality works through transmission lags.

Another finding of the analysis is that the previous period's changes in public spending on health (ΔW_{3t-1}) also affect the infant mortality negatively in short run. This may be due to the reason that the increase

in volume of the health spending increases the infrastructure and health facilities. So as a result of rise in health facilities, the infant mortality rate may decrease significantly.

The estimated coefficient of the MCH (ΔW_{5t}) is negative and significant in the short run; however, over the long run it has insignificant impact on infant mortality rate. These health centers are established to provide the emergency health facilities to the public so the facilities received by the peoples from these health centers in the short run are significant.

Diagnostic Tests for Short Run Model in the Health Sector

The results of standard diagnostic tests are presented in table 4. The high probability values of all the diagnostic tests mentioned in the table below show that the model specification is appropriate and parameters of the model are stable. Moreover, the high probability value of different tests for heteroskedasticity and serial correlation prove that these problems do not exist in the model. Similarly, CUSUM and CUSUM of square tests show that there is no instability in the model.⁴

V. CONCLUSION AND POLICY IMPLICATIONS

This study has been attempted to analyze the effectiveness of foreign aid on the health sector of Pakistan. In this regard, one of the MDGs; reduction in infant mortality rate is analyzed. Considering the theoretical developments and empirical evidence, an econometric model was developed for the health sector, containing the wide range of determinants. In the end, the dynamic functions were specified to analyze the short run and the long run behaviour of the determinants in the health sector of Pakistan. For estimation of the model, we applied the co integration technique. We have employed the Augmented Dickey Fuller tests to each of the series of data and determined the time series property of each variable. After confirming the order of integration of each variable, Johansen Likelihood Ratio tests were used to determine the long run equilibrium relationship among the variables. Finally ECM was estimated to study the short run dynamics. These econometric models were estimated for Pakistan over the period 1973-2008 using annual data series. The cointegration analysis in the health sector show that there was negative long run relationship exists between infant mortality rate and foreign aid in Pakistan. Increase in foreign aid creates significant affects on infant mortality rate in the opposite direction. In ECM, short run relationship has been proved and the error correction coefficients are highly significant with theoretically correct sign, which show that the economy will converge to its equilibrium within one year if there appears a dis-equilibrating situation.

In view of commitments to the achievement of MDGs, the Government of Pakistan has developed a National Plan of Action on Education For All and Health For All for the period 2001-2015. The gap in financial resources required to implement this plan is enormous and will have to be met from external assistance. The results show that with one million dollar increase in foreign aid, the infant mortality rate will decrease by 0.004 units. It has a significant effect in the health sector so it is recommended that efforts should be made to increase aid in this sector. The data shows that public spending in this sector is very low and lowering with the passage of time. It is, therefore, suggested that all efforts should be made to enhance the budgetary allocation in this sector otherwise it would not be possible to achieve the MDGs by 2015.

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Table 1: Augmented Dickey-Fuller Test Results for Unit Root

Variables At Level	With Trend	Variables At First Difference	With Trend	Results
	ADF- Statistics		ADF- Statistics	
IMR	0.236	Δ IMR	-6.135*	I(1)
GDP	2.031	Δ GDP	-3.22**	I(1)
FAH	-3.155	Δ FAH	-6.221*	I(1)
PSH	1.104	Δ PSH	-8.793*	I(1)
ALR	1.369	Δ ALR	-3.513*	I(1)
MCH	-2.014	Δ MCH	-4.976*	I(1)

Note: 1. * Denote significant at 5 percent
2. ** Denote significant at 10 percent

Table 2: Johansen Cointegration Test (Trace Test)

Null Hypothesis	Alternative Hypothesis	Test statistic	5% critical values
$r = 0$	$r \geq 1$	133.6334*	95.75366
$r \leq 1$	$r \geq 2$	87.01349*	69.81889
$r \leq 2$	$r \geq 3$	46.42804	47.85613
$r \leq 3$	$r \geq 4$	24.48473	29.79707
$r \leq 4$	$r \geq 5$	8.115871	15.49471
$r \leq 5$	$r \geq 6$	1.174702	3.841466

Note: 1. * Indicates significant at the 5 percent level.
2. Author's calculations

Table 3: Johansen Cointegration Test (Maximum Eigen Value Test)

Null Hypothesis	Alternative Hypothesis	Test Statistic	5% critical values
$r = 0$	$R = 1$	46.61990*	40.07757
$r \leq 1$	$R = 2$	40.58545*	33.87687
$r \leq 2$	$R = 3$	21.94331	27.58434
$r \leq 3$	$R = 4$	16.36886	21.13162
$r \leq 4$	$R = 5$	6.941169	14.26460
$r \leq 5$	$R = 6$	1.174702	3.841466

Note: 1. * Indicates significant at the 5 percent level.
2. Author's calculations

Table 4: Results of Short Run Dynamic Model for Health

Dependent Variable ΔZ_t			
Variable	Coefficient	t-Statistic	Prob.
C	-2.401762	-5.922053	0.0000
ΔZ_{t-1} **	-0.495292	-2.211463	0.0402
ΔZ_{t-2}	-0.260901	-1.421744	0.1722
ΔW_{1t} ***	-0.010012	-2.715950	0.0142
ΔW_{1t-1} *	-0.007217	-1.841876	0.0820
ΔW_{1t-2} ***	-0.013155	-2.946332	0.0086
ΔW_{2t}	-0.002331	-0.842015	0.4108
ΔW_{2t-1} ***	-0.008183	-3.143230	0.0056
ΔW_{2t-2} **	-0.007469	-2.217224	0.0397
ΔW_{3t-1} ***	-0.000336	-3.599840	0.0020
ΔW_{4t}	-0.432708	-1.621741	0.1222
ΔW_{5t}	-0.001686	-0.778248	0.4465
ECT _{t-1} **	-0.361735	-2.008281	0.0599
R ²	0.71		
Adjusted R ²	0.48		
F-statistics	3.139		
Prob (F-Statistics)	0.012		

Note: *, ** and *** shows rejection of the Null Hypothesis of insignificance at .10, .05 and .01 level respectively.

List of Variables and data sources

Variable	Source
Infant Mortality Rate (per 1000 live births)	WDI, 2008
Foreign Aid for Health (at current prices, million US\$)	OECD, CRS, online
Adult Literacy Rate (ages 15 and above)	WDI, 2008
GDP per capita (at current prices in US\$)	WDI, 2008
Public Spending on Health (total, million Pak Rupees)	Pakistan Economic Survey 08-09
Maternity and Child Health centers (total, in numbers)	Pakistan Economic Survey 08-09

Millennium Development Goals and Targets

<p>Goal 1: Eradicate extreme poverty and hunger</p> <p>Target 1: Halve, between 1990 and 2015, the proportion of people whose income is less than one dollar a day.</p> <p>Target 2: Halve, between 1990 and 2015, the proportion of people who suffer from hunger.</p>
<p>Goal 2: Achieve universal primary education</p> <p>Target 3: Ensure that by 2015, children everywhere, boys and girls alike, will be able to complete a full course of primary schooling.</p>
<p>Goal 3: Promote gender equality and empower women</p> <p>Target 4: Eliminate gender disparity in primary and secondary education, preferably by 2015, and in all levels of education no later than 2015.</p>
<p>Goal 4: Reduce child mortality</p> <p>Target 5: Reduce by two-thirds, between 1990 and 2015, the under-five mortality rate.</p>
<p>Goal 5: Improve maternal health</p> <p>Target 6: Reduce by three-quarters, between 1990 and 2015, the maternal mortality ratio.</p>
<p>Goal 6: Combat HIV/AIDS, malaria and other diseases</p> <p>Target 7: Have halted by 2015 and begun to reverse the spread of HIV/AIDS</p> <p>Target 8: Have halted by 2015 and begun to reverse the incidence of malaria and other major diseases.</p>
<p>Goal 7: Ensure environmental sustainability</p> <p>Target 9: Integrate the principles of sustainable development into country policies and programmes and reverse the loss of environmental resources</p> <p>Target 10: Halve, by 2015, the proportion of people without sustainable access to safe drinking water and basic sanitation.</p> <p>Target 11: By 2020, to have achieved a significant improvement in the lives of at least 100 million slum dwellers.</p>
<p>Goal 8: Develop a global partnership for development</p> <p>Target 12: Develop further an open, rule-based, predictable, non-discriminatory trading and financial system.</p> <p>Target 13: Address the special needs of the least developed countries.</p> <p>Target 14: Address the special needs of land locked developing countries and small Island developing states.</p> <p>Target 15: Deal comprehensively with the debt problems of developing countries through national and international measures in order to make debt sustainable in the long term.</p> <p>Target 16: In cooperation with developing countries, develop and implement strategies for decent and productive work for youth.</p> <p>Target 17: In cooperation with pharmaceutical companies, provide access to affordable essential drugs in developing countries.</p> <p>Target 18: In cooperation with the private sector, make available the benefits of new techniques, especially information and communications.</p>

Diagnostic Tests for Health Sector

			Probability
Model Specification Test (Ramsey RESET Test)		F-Statistics 0.536	0.473
		Log likelihood Ratio 1.025	0.311
Normality Test (Jarque-Bera Statistics)		Jerque-Bera Statistics 0.6376	0.7270
Heteroskedasticity Test (The White Test)		F-Statistics 0.246	0.989
		χ^2 -Statistics 20.893	0.829
ARCH Test (Autoregressive Conditional Heteroskedasticity Test)	First Order	F-Statistics 0.272	0.605
		χ^2 -Statistics 0.288	0.591
	Second Order	F-Statistics 0.315	0.731
		χ^2 -Statistics 0.683	0.711
	Third Order	F-Statistics 0.194	0.899
		χ^2 -Statistics 0.656	0.883
	Fourth Order	F-Statistics 0.655	0.628
		χ^2 -Statistics 2.856	0.582
Serial Correlation (Breusch-Godfrey LM Test)	First Order	F-Statistics 1.486	0.239
		χ^2 -Statistics 2.653	0.103
	Second Order	F-Statistics 0.714	0.504
		χ^2 -Statistics 2.704	0.258
	Third Order	F-Statistics 1.163	0.356
		χ^2 -Statistics 6.229	0.1009
	Fourth Order	F-Statistics 0.858	0.512
		χ^2 -Statistics 6.497	0.164

Source: Author's Calculation

¹ World Bank, World Development Report, 2009

² See Appendix-I

³ Pakistan Economic Survey 2008-09

⁴ For Detail results, see Appendix-III