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ACCOUNTING FOR THE CONTRIBUTION OF FOREIGN DIRECT INVESTMENT IN POPULATION HEALTH: A CASE STUDY OF PAKISTAN

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Abstract

This paper examines the impact of foreign direct investment (FDI) on life expectancy and infant mortality rate under-5 using time series data over the period of 1980–2017. We have applied unit root as well as co-integration tests to examine integrating properties of the variables and co-integration among the variables. Moreover, we apply the ARDL approach to measure the long-run and short-run impact of FDI on life expectancy and the infant mortality rate under-5. The empirical evidence confirms the presence of co-integration amid the variables. FDI increase population health measured by life expectancy and to reduce the infant mortality rate under-5 in the long-run.

Keywords: FDI, life expectancy, infant mortality rate under-5, Pakistan.

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1. Introduction

The progress of health sector in Pakistan could not be ignored since the time of independence. The health sector plays a important role in human well being, especially in developing countries, by increasing productivity of labor force, reducing the poverty, and optimizing the return on investment in order social sector such as education (State Bank of Pakistan, annual report 2015).In Pakistan investment in health sector are viewed as an integral of the government's poverty alleviation Endeavour. There has been noticeable improvement in some health sector indicators over the years, on the whole, Pakistan ranks poorly on this account. Overall life expectancy in Pakistan remains lower than many in its peer group, while infant as well as maternal mortality rates are amongst the highest(Pakistan's economic survey, 2009).

Pakistan's health sector is still not very efficient. There are numerous weaknesses like poor governance, lack of access and unequal resources, poor quality of Health Information Management System, corruption in health system, lack of monitoring in health policy and health planning and lack of trained staff. But mainly, I will talk about lack of governance as because of this, the healthcare system is inefficient. In addition, there is a lot of corruption in health care system due to bureaucrat power of the people involved in policy making. As a result, all people do not have equal access to healthcare services and healthcare resources are not divided with equity (Kurji,et.al, 2016).

So, Pakistan is improving very slowly in the health sector for the last five decades as is evident above mentioned weaknesses. Therefore, the Government needs to take strong initiatives to change the current health care system. One important macroeconomic determinant of health could be foreign direct investment (FDI), defined by World Bank (2014) as cross-border investment to establish a lasting interest. FDI is widely acknowledged to promote economic growth, increases in wages and generally improved working conditions in low and middle income countries (LMICs) (Blouin et al., 2009; Feenstra, 1997; Moran, 2004). As these factors could affect access to healthcare, especially in LMICs where access to care is strongly dependent on ability to pay, it may the case that FDI is beneficially associated with population health. Moreover, FDI could help to improve health conditions in the host economies if foreign firms

not only paid higher wages than the domestic firms but also provided their employees with better social services and safe workplaces (Dierk & Peter, 2012).

"Health as an integral part of development" (United Nations, 1980), however, has been largely ignored in the literature on the effects of FDI. This paper will attempt to present the importance and need of FDI in population health by using two very important indicators of health sector such as, life expectancy and Infant mortality rate under 5 which is very less discussed especially in case of Pakistan. This paper is organized as follows. In section 2, we discuss the issues of health sector in Pakistan, section 3 presents potential links between FDI and population health, section 4 presents the empirical analysis and section 5 concludes.

2 Health sector issues in Pakistan

Since the last couple of decades, the situation of the health sector and related indicators in Pakistan has shown a mixed trend. From the context of South Asian economies, Pakistan has shown a low life expectancy ratio, with a higher level of mortality as well. Life expectancy at birth has been recorded from 56 to 66 years which is very low as compared to other developing and developed economies in contemporary world. In addition, the ratio of mortality rate under five is in range of 78-112 since last 1.5 decades. This figure explains that the stated rate of 78 is very high, relatively to the set targets of UNICEF by the end of 2017 which is 25 deaths per 1000 (UNCEF, 2017). It means that Pakistan is facing a challenging situation regarding present mortality rate which is 3 times higher than the south Asian region. The situation of infant mortality in Pakistan is also not very much good. Since 2000 to 2015, infant mortality rate (IMR) has also experienced with rate of 65.7 in 2017 which is still at questionable position. In other neighboring countries like India, Bangladesh, Nepal, Bhutan, Maldives and Sri Lanka, this rate is recorded as 41,33,32,30,9 and 8 respectively(Statista, 2018). So as compare to these countries, Pakistan is still facing a highest ratio of IMR in South Asia.

In addition, it is also facing the health issues like endemic polio, and burden of tuberculosis, the occurrence of neonatal, malnutrition, diarrhoea and acute respiratory illness. Additionally, as per the findings of UNICEF Pakistan, 44% of the children under the age of five are stunted, which is considered as third highest % in the world economy(UNICEF, 2016). It is also explained in the

report that the issue in the feeding of the children is still an ongoing problem as only 38 % children are breastfed for the very first sixth month of their birth. While under the age of five, 54 % of the children are facing the deficiency in Vitamin A(UNICEF, 2016). Besides, only 54% of the children are getting the vaccinations during 12-23 months of their age, while 89 out of 1000, born alive and die before reaching their fifth birth year. Almost 27.2 % of the population have HIV-positive who uses the drugs and life of their spouse and children is at high risk (UNICEF, 2016) .

The role of drinking water is very much significant in health. However, in country like Pakistan, countless health issues are recorded in last couple of years due to arsenic drinking specifically in the most populated province of Punjab and other regions (Azizullah, Khattak, Richter, & Häder, 2011; Bhowmik et al., 2015; Daud et al., 2017; K. Khan et al., 2017; S. Khan et al., 2013). In the study of Daud et al. (2017), it is explained that only 20 % of the total population of Pakistan has a clean drinking water facility and rest of 80 % are forced to drink contaminated and unhealthy water.

Additionally, medicines and medical equipment are not restockedon a regular basis(PBS, 2016). The reason is that number of non-professional medical practitioners is working without any formal degree or a license. Besides, the situation of woman healthcare in the country like Pakistan is also under severe condition specifically in the rural areas. The problem is that women havea very low access to health care facilities and mainly they dependon their men. Culture factor is also playing its role as women are not allowed to move out without the permission of men or alone. It is also found that in different rural areas, 43 % of the medical centres have no female medical advisor, while rest of the centres have only one female doctor or medical expert. In-depth analysis of tehsil headquarters explains the fact that out of 280 total hospitals, 206 are without any medical expert, especially a gynaecologist(DHS, 2013).

Although the health and related issues are targeting the overall economy, some efforts are made by the Government. It is a common phenomenon that Government of the country is directly responsible for providing health and relevant facilities to the public. In Pakistan, the healthcare facilities are expanding with the passage of time with again the pace is slow. At present, there are

1167 public hospitals and care centres, 5695 health units in the form of dispensaries with 5464 health units, 733 mother and baby care centres having medical professionals in the form of doctors, pharmacists and nurses (PBS, 2016). By the end of 2016, as per the findings of PBS one doctor per 1038 individuals, one bed per 1613 patients and one dentist per 11513 individuals is clearly providing the evidence that there are inadequate facilities in the health sector which need serious attention from the Government. Most importantly, the Government is spending only 0.7 percent of GDP on healthcare which is very low as compared to the World Health Organization's recommendation of 5%. The private sector has contributed in the form of provision of health services. It is found that almost 70 % population of the country depends upon the private sector while getting the healthcare facilities with only 20% relying on the public services, means that 61% of expenditures on healthcare is being met via private funding. Households are forced to use their own resources to pay for healthcare. These so called out of pocket expenditures. In addition, the private facilities related to healthcare are mostly provided in urban areas and thus creating a gap in such services for those who are living in rural areas (PSLM, Pakistan Bureau of Statistics 2015).

3. Potential links between Foreign Direct Investment and population health (A Review)

The empirical literature on the effects of foreign direct investment (FDI) has focused almost exclusively on the benefits that host economies may reap in terms of higher growth and wages. While this literature "seems to have run out of steam," the effects of FDI on important dimensions of the quality of life such as health conditions are among the wide array of neglected issues (Blonigen and O'Fallon 2011: 4). If at all, the link between FDI and health is addressed by listing a healthy workforce among the determinants of the location choices of foreign investors (Alsan et al. 2006; Azémar and Desbordes 2009).

There are only a few studies available that examine the role of FDI on the improvement of public health. Rodrik et al. (2002) is one of the earlier studies which claimed that FDI increases employment opportunities and improves working conditions that positively affect life expectancy of employees. Hawkes (2005) examined the role of FDI in nutrition transition particularly focusing on highly processed foods. Considering transnational food companies (TFCs) in developed countries as a sample, the study concludes that FDI plays a crucial role in nutrition

transition by enabling and promoting the consumption of nutritional foods in developing countries. Outreville (2007) argues that FDI has a significant contribution to population health through improving health care sectors of developing countries.

Theoretically, it can be argued that there are numerous channels by which and FDI may affect health. First, there is a wide range of literature (Borensztein et al.1998; Yanikkaya2003) which argues that trade openness and FDI increase economic growth significantly. If trade openness and FDI are positively related to GDP per capita, it will be beneficial for life expectancy as higher income helps to afford better food and nutrition, housing, health care treatment and investment in better living and working conditions that significantly increase life expectancy. Second, trade openness and FDI positively affect education levels, including literacy level of household which in turn positively influences health and life expectancy. The third channel is the technology transfer (Papageorgiou et al. 2007). As many studies (e.g. Xu and Wang2000; Ciruelos and Wang 2005) have found that trade openness and FDI are the means of technology diffusion, public health in a developing country can be improved through the increased access to new technologies for water sanitation, medical treatment and pharmaceuticals.

If FDI raises income and an increase in income leads to an increase in expenditures (both public and private) on goods that improve population health, such as food, clean water and sanitation, education, and medical care, then an increase in FDI should improve population health. The growth enhancing effects of FDI is stronger in poorer than in richer countries (Blonigen and Wang, 2005). However, that an increasing share of income is often spent on health care and healthy foods (such as lean meat, fish, vegetables, and fruits) as income rises, the health function does not necessarily have diminishing returns (Herzer and Nunnenkamp, 2014). Waldmann (1992) explicitly notes that “health care is plausibly a superior good.”

There is an enormous body of research on the impact of environmental pollution on health. The alternative view is that FDI will raise local environmental standards (driven by technological improvements) and create a so-called pollution halo effect; that is, a transfer of environmentally friendly technology and expertise abroad (Zarsky, 1999). The assumption behind this view is that FDI from developed countries is inherently cleaner than domestic firm production. Accordingly,

a higher level of FDI could lead to higher government spending on health and social services and thus lead to better health. In the words of Rodrik (1998), "government expenditures are used to provide social insurance against external risk."

Moreover FDI can improve health outcomes if FDI is in the form of horizontal or market seeking FDI in the health sector and makes more medical goods and services (such as pharmaceuticals and medical equipment) available at lower prices than before. While the presence of foreign firms producing medical or health-promoting products can contribute to better health, FDI can damage health if FDI is in sectors producing health-damaging products such as alcohol, tobacco, and unhealthy foods..

It is also found that FDI is a motivational factor to promote economic growth; improving working condition in domestic market, providing better wages in low and middle income states. Such factors can directly influence the access to health care indicators, more specifically in low and middle-income countries where health care is totally depending upon the paying capacities of the individuals. In case, where foreign firms will not pay higher wages to their employees in the local market, then the role of domestic firms is very much significant to study. Under such situation, domestic firms will provide better social and health care facilities to their employees. (Feenstra & Hanson, 1997a, 1997b; Lai & Sarkar, 2017; Moran, 2005; Xu & Sylwester, 2016)

The study of Alsan, Bloom, and Canning (2006). Under the methodological implication, the control of country level fixed effect, correlation among the variables and endogeneity is also applied. They explained that FDI is very much beneficial to the overall level of health, and life expectancy. While examining the age mortality effect for overall health, their findings predict significant and strong effect for FDI, while no association for the child mortality is found. In all the applied models, the effect of FDI on the health untouched which have no control over endogeneity as well. Their evidence explains that FDI has provided an overall benefit to the health of population in LMIC, specifically in the adult population. Meanwhile, for the secondary sector like manufacturing and FDI, this link is inverse with the life expectancy ratio. Their findings also explain that FDI has provided a good benefit to the overall health in LMICs.

In their study,Chintrakarn, Herzer, and Nunnenkamp (2012) have explained the long-term effect of foreign investment for the health of population in the developed economies. By applying the panel regression models, it is found that FDI has a negative impact on the health factor of developed states.

Herzer and Nagel (2015) have studied the impact of FDI for the population health with the use of panel data approach from 1980 to 2011 for 179 countries. The finding of the study indicates that the association between FDI and economic growth seems to be nonlinear with the income level. Additionally, there is a positive effect of FDI on the health factor of low income states. But this effect seems to be declining with the increase in the real income of the economy.

Alam (2015) explored the dynamic relationships between trade openness, FDI and life expectancy in the case of Pakistan for the period 1972–2013. The combined cointegration approach of Bayer and Hanck (2013) has been used to examine the long-run equilibrium relationship among the variables. Moreover, they apply the ARDL approach to measure the long-run and short-run impact of trade openness and FDI on life expectancy. The empirical evidence confirmed trade openness increases population health measured by life expectancy. FDI has also a positive impact on life expectancy.

4. Methodology, Variables and Data Description

4.1 Variables and Data description

The present research has used time series data on population health, FDI and other control variables government expenditures on health, secondary school enrolment and trade openness for the time span of 1980 to 2017 in case of Pakistan. The data of this study is collected from WDI (World Development Indicators) by World Bank and Economic Survey of Pakistan.

4.2 Methodology

In this section we will also discuss some of the econometric issues like examining the stationary of data, bound test approach to check the existence of the long run relationship between variables and the estimation of the short run and long run coefficients. These steps are taken in a specific order and are discussed below:

4.2.1 Model Specification

Time series data of variables, theory and ARDL method specify an equation which models FLFP as follows

LIFEX = f (FDI, GOVEX, TOPN, SSE)……..(1)

IMR = f (FDI, GOVEX, TOPN, SSE)……..(2)

Where,

LIFEX- life expectancy, at birth (Per 1000 people)

IMR- Infant mortality rate under-5

FDI- Foreign direct investment, (inflow US million dollar)

EXPEN- Government expenditures on health, (as a % of GDP)

TOPN-Trade openness, (import+export/GDP)

SSE- Secondary school enrolment

The data will be transformed into logarithms in order to spread the data points more uniformly given that the data have different scales of measurement. For simplicity logarithms will be represented by the letter L such that the abbreviation "log" on each variable will be represented by the prefix L. For the above functional relationship following econometric equation can be written:

$$L(LIFEX) = \beta o + \beta_1 L(FDI) + \beta_2 L(GOVEX) + \beta_3 L(SSE) + \beta_4 L(TOPN) + \beta_5 L(SSE) + \mu_1 \_\_\_\_\_ (3)$$

$$L(IMR) = \beta o + \beta_1 L(FDI) + \beta_2 L(GOVEX) + \beta_3 L(SSE) + \beta_4 L(TOPN) + \beta_5 L(SSE) + \mu_1 \_\_\_\_\_ (4)$$

4.2.2 Unit root test

The first step in determining a potentially co-integrated relationship is to test whether the variables involved are stationary or non-stationary. For this purpose, the present study uses ADF Augmented Dicky-Fuller (1981). ADF unit root tests to check the robustness of the results is considered most suitable for the small set of data compare to other tests. This test does not over reject the null hypothesis of unit root (Omisakin, 2008; Sinha, 2007; Ng-Perron 2001).

4.2.3 Autoregressive Distributive Lag (ARDL) Model

The Autoregressive Distributive Lag (ARDL) Model was developed by Pesaran and Shin (1999) and Pesaran et al (2001). The ARDL technique of integration has advantages in that it can be applied when series are integrated of different orders. The ARDL approach involves two steps for estimating the long run relationship (Pesaran et. al., 2001), first step is to investigate the long run relationship among the variables specified in the equations.

$$\Delta\, In(LIFEX) = \gamma_0 + \sum_{i=1}^{a} \gamma_1 \Delta\, In(FDI)_{t-i} + \sum_{i=0}^{b} \gamma_2 \Delta\, In(GOVEX)_{t-i} + \sum_{i=0}^{c} \gamma_3 \Delta\, In(SSE)_{t-i} + \sum_{i=0}^{d} \gamma_4 \Delta\, In(TOPN)_{t-i} + \gamma_5 In(LIFEX)_{t-1} + \gamma_6 In(FDI)_{t-1} + \gamma_7 In(GOVEX)_{t-1} + \gamma_8 In(SSE)_{t-1} + \gamma_9 In(TOPN)_{t-1} + \gamma_{10} In(SSE)_{t-1} + \mu_t \quad (5)$$

$$\Delta\, In(IMR) = \gamma_0 + \sum_{i=1}^{a} \gamma_1 \Delta\, In(FDI)_{t-i} + \sum_{i=0}^{b} \gamma_2 \Delta\, In(GOVEX)_{t-i} + \sum_{i=0}^{c} \gamma_3 \Delta\, In(SSE)_{t-i} + \sum_{i=0}^{d} \gamma_4 \Delta\, In(TOPN)_{t-i} + \gamma_5 In(LIFEX)_{t-1} + \gamma_6 In(FDI)_{t-1} + \gamma_7 In(GOVEX)_{t-1} + \gamma_8 In(SSE)_{t-1} + \gamma_9 In(TOPN)_{t-1} + \gamma_{10} In(SSE)_{t-1} + \mu_t \quad (6)$$

In equation (5) and (6) short-run and long-run relationship is depicted. $\gamma_0$is the intercept whereas γ_1 , $\gamma_2, \gamma_3, \gamma_4,$ are the short-run coefficients whereas $\gamma_5, \gamma_6, \gamma_7 \gamma_8, \gamma_9, \gamma_{10},$ are the long run coefficients of the variables. Δ shows the first difference operator and $\mu_t$is the error term. Wald test is used for the examining the existence of long run relationship between the dependent and independent variables under the null hypothesis that no long-run relationship exists. If we find the evidences of long run relation then in the 2rd step we utilize the following equation to estimate the short run coefficients: For the present study the short-run error correction model is given below:

$$\Delta In(LIFEX) = \beta_0 + \sum_{i=1}^{k_1} \beta_1 \, \Delta \mathrm{In(LIFEX)}_{t-i} + \sum_{i=0}^{k_2} \beta_2 \, \Delta \mathrm{In(FDI)}_{t-i} + \sum_{i=0}^{k_3} \beta_3 \, \Delta \mathrm{In(GOVEX)}_{t-i} + \sum_{i=0}^{k_4} \beta_4 \, \Delta \mathrm{In(SSE)} + \sum_{i=0}^{k_5} \beta_5 \, \Delta \mathrm{In(TOPN)}_{t-i} + \lambda(ECM)_{t-1} + \mu_t \quad \text{(7)}$$

$$\Delta In(IMR) = \beta_0 + \sum_{i=1}^{k_1} \beta_1 \, \Delta \mathrm{In(LIFEX)}_{t-i} + \sum_{i=0}^{k_2} \beta_2 \, \Delta \mathrm{In(FDI)}_{t-i} + \sum_{i=0}^{k_3} \beta_3 \, \Delta \mathrm{In(GOVEX)}_{t-i} + \sum_{i=0}^{k_4} \beta_4 \, \Delta \mathrm{In(SSE)} + \sum_{i=0}^{k_5} \beta_5 \, \Delta \mathrm{In(TOPN)}_{t-i} + \lambda(ECM)_{t-1} + \mu_t \quad \text{(8)}$$

Equation (7) & (8) shows the short-run relationship between the dependent and independent variables, the error correction term $(\mathrm{ECM})_{t-1}$ is add in the equation for the adjustment of the results. The coefficient of ECM should have a negative and significant value. If the co-efficient is negative and significant it will show the existence of relationship between the variables.

5. Empirical Results of the Study

5.1 Unit Root Test

Table 1: Results of the Unit Root Tests

Augmented Dickey-Fuller test for Unit Root

VARIABLES	AT LEVEL		FIRST DIFFERENCE		CONCLUSION
	INTERCEPT	TREND & INTERCEPT	INTERCEPT	TREND & INTERCEPT	
LLIFEX	-3.9258	1.1369	1.80406	-4.2020	1(1)**
LIMR	3.2431	-3.2033	-1.3924	-4.0127	1(1)**
LFDI	-1.9818	-2.1062	-5.4518	-	1(1)*
LGOVEX	-0.8832	-4.2081	-	-	1(0)**
LSSE	-0.6416	-2.0606	-4.1492	-	1(1)*
LTOPN	-1.5056	-2.2679	-7.5187	-	1(1)*

*, ** and *** shows 1%, 5% and 10% level of significance respectively

Table 1 presents the results of units root tests. As discussed before, we used Augmented Dickey Fuller test to do the unit root analysis. The results suggest that most of the variables are not stationary at level therefore we cannot apply traditional OLS techniques for our estimation. The results of ARDL estimation are given in next section.

5.2 Bound Test for Co-integration

To estimate the long-run relationship between variables the Bound test or Wald test is conducted. The coefficients are restricted to equal to zero for our null hypothesis. We then compare the computed value of F-statistics with the critical values of the two bounds, that is, upper bound, 1(1) and lower bound 1(0). We accept the existence of co-integration if the estimated F-statistics is more than the critical value of upper bound and conversely, we reject the existence of co-integration if F-statistics is below the critical value for lower bound. The finding will remain inconclusive when F-statistics is between the critical values of upper bound and lower bound. The null hypothesis of F-statistics is that co-integration does not exist among variables. Table 2 shows the results for Bound-testing for co-integration

Table: 3 Results for Bound-testing for co-integration

Equations	F-statistics	Critical value		Conclusion
		1(0)	1(1)	
(1) LLIFEX/LFDI LGOVEX LSSE LTOPN	8.019351	3.74	5.06	Co-integration exists
(2)LIMR/LFDI LGOVEX LSSE LTOPN	6.839442	2.45	3.52	Co-integration exists

In ARDL Model, for equation (1) when the dependant variable is LLIFEX life expectancy the bound test shows the value of F-statistics is more than the critical value for upper bound at 1% significance level. For equation (2) when the dependant variable is LIMR infant mortality rate under 5, the bound test shows the value of F-statistics is more than the critical value for upper bound at 1% significance level. In case of Pakistan, this suggests the existence of co-integration among variables. That is LLIFEX and LIMR has long run relationship with the explanatory variables (LFDI LGOVEX LSSE LTOPN). On the basis of the bound test results, we move forward to conduct the long run estimates of the model.

5.3 ARDL long run and short run estimated Coefficients

5.3.1 ARDL long run results (Dependant variable, LLIFEX)

The long-run results of life expectancy (LIFEX) equation are presented in Table 3. Based on ARDL model most of the results of variables are significant which shows that our model is a good fit. In case of Pakistan, foreign direct investment (LFDI), Secondary school enrolment (LSSE) and trade openness (LTOPN) have positive and significant relations with life expectancy (LLIFEX). This implies that an increase in FDI, SSE and TOPN lead to higher life expectancy in Pakistan.

Table 4 - Estimated LR Coefficients of ARDL (2, 2, 2, 0, 1) Model, Using the ARDL Approach and (Dependent Variable = lnLIFEX)

Regressor	ARDL (2, 2, 2, 0,1)	
	Coefficient	t-value (P-value)
LFDI	0.718907	3.042985 (0.0056)
LGOVEX	0.019805	0.683949 (0.5003)
LSSE	0.132828	5.217175 (0.0000)
LTOPN	0.151520	1.746372 (0.0930)
C	4.393422	17.515560 (0.0000)

For the independent variable FDI as a whole, it is found that in long-run one percent increase in foreign inflows bring about 0.71% increase in life expectancy while a one percent increase in trade openness results in increase 0.15% in life expectancy. In case of Pakistan, the results supports theoretical arguments the relationship between trade openness, FDI and life expectancy, which argues that trade openness and FDI increases economic growth significantly. If trade openness and FDI are positively related to the GDP per capita, it will beneficial for life expectancy as higher income helps to afford better food and nutrition, housing, health care treatment and investment in better living and working conditions that significantly increases the life expectancy (Borensztein et.al 1998; Yanikkaya, 2003). The findings for Foreign direct investment FDI and trade openness is also in line with those obtained in other countries as pointed out in the literature (Papageorgiou et al. 2007; Xu and Wang2000; Ciruelos and Wang 2005; Romer, 1989; Stark, 2004; Deaton, 2004; Blouin et al, 2009; Bussmann, 2009; Rodrik et al.

2002; Hawkes, 2005). Secondary school is also significant in influencing the life expectancy in Pakistan. Results show that one percent increase in SSE leads to about 0.13% increase in life expectancy. The results obtained for the impact of SSE on life expectancy is also in line with the finding of previous study (Burns et.al, 2017). However, the coefficient government expenditure on health (GOVEX) is found positive but insignificant impact on life expectancy in case of Pakistan. The impact could be because of improper allocation of resources or inability of these finances to reach the critical geographic areas (Ali, 2008).

5.3.2 The ECM and short run relationship

Table 5 - ECM Representation for Selected ARDL (2, 2, 2, 0, 1) Model Based on (Dependent Variable = LLIFEX)

Regressor	ARDL (2, 2, 2, 0,1)	
	Coefficient	t-value (P-value)
D (LFDI)	0.000290	2.203300 (0.0370)
D (LGOVEX)	-0.000277	-0.784296 (0.4402)
D (LSSE)	0.000099	0.114793 (0.9095)
D (LSSE (-1))	0.001523	1.456447 (0.1577)
D (LTOPN)	-0.000902	-1.067838 (0.2958)
D (TOPN (-1))	-0.001574	-1.819572 (0.0808)
ECM (-1)	-0.13972	3.125959(0.0045)
ECM = LLIFEX-(0.0207*LFDI + 0.0198*LGOVEX + 0.1328*LSSE – 0.1515*LTOPN+ 4.3934		
Diagnostic test statistics: R Squared = 99%, F-value = 9.5238(0.000), DW-Statistic = 1.9882		

The one period lag Error Correction term (ECM (-1)) captures the adjustment towards the long-run equilibrium. ECM (-1) is highly significant with negative sign, indicating the establishment of co-integration and long run relationship among LLIFEX, LFDI, LGOVEX, LSSE and LTOPN. The short run empirical results are indicated in table 4. The lagged error term value is 0.13972 which means 13.9 percent of disequilibrium is adjusted in each year in short run. It shows the process of adjustment towards equilibrium in short-run. Here we have found the value of error correction term (ECM) -0.13972 so the adjustment time required for Pakistan to correct the disequilibrium is 1/0.13972 = 7.16. It means the disequilibrium in economy will correct or adjust to equilibrium in seven years in Pakistan.

5.3.3 ARDL long run results (Dependant variable, LIMR)

The long-run results for the dependant variable mortality rate under-5(LIMR) are presented in Table 5. In our long run analysis independent variables FDI and SSE shows the relationship with IMR with their expected signs. The variables, FDI and SSE found to be contributing to reduce the infant mortality rate under-5 (IMR) in long-run except the trade openness variable. The study find that trade does not help to reduce child mortality. The findings for the trade openness in the current study are in accordance with the previous results of the studies (Lin et al. 2015) , study reports that tarde could even increase child mortality through raising environmental pollution.

Table 6 - Estimated LR Coefficients of ARDL (2, 2, 2, 0, 1) Model, Using the ARDL Approach and (Dependent Variable = lnLIMR)

Regressor	ARDL (2, 2, 2, 0,1)	
	Coefficient	t-value (P-value)
LFDI	-0.216513	-1.987656 (0.0575)
LGOVEX	-0.078198	-0.446887 (0.6587)
LSSE	-0.150975	-0.067993 (0.0463)
LTOPN	2.348612	1.768034 (0.0888)
C	3.278145	0.616050 (0.05432)

Results shows that both FDI and SSE has negative and significant impact on infant mortality rate under-5 in long-run suggesting that with increased magnitude of inflows, IMR will decrease. For the independent variable FDI as a whole, it is found that in long-run one percent increase in foreign inflows bring about 0.21% decrease in infant mortality rate under-5 while a one percent increase in secondary school enrolment results in decrease 0.15% in infant mortality rate under-5. Our results are in line with those obtained in other countries as pointed out in the literature (Burns et.al, 2017; Herzaer & Negal, 2011). We also found that, in long-run government health expenditures has no impact on infant mortality under-5 (IMR) suggesting that the crucial component of public spending is either misallocated or being a victim of poor governance, it is not fully allocated at all(Ali,2008).

5.3.4 The ECM and short run relationship

Table 7 - ECM Representation for Selected ARDL (2, 2, 2, 0, 1) Model Based on (Dependent Variable = LIMR)

Regressor	ARDL (2, 2, 2, 0,1)	
	Coefficient	t-value (P-value)
D (LFDI)	0.000245	0.734247(0.4694)
D (LGOVEX)	0.000390	0.066148(0.9478)
D (LSSE)	0.000080	0.066148 (0.9478)
D (LTOPN)	-0.003610	-1.588759 (0.1242)
D (TOPN (-1))	0.005190	2.295119 (0.0300)
ECM(-1)	- 0.498900	1.647094(0.0116)
ECM = LIMR- (-0.0207*LFDI - 0.0782*LGOVEX - 0.0160*LSSE + 2.3486*LTOPN - 3.2781		
Diagnostic test statistics:R Squared = 97%, F-value = 122.4768(0.000), DW-Statistic = 2.366110		

The one period lag Error Correction term (ECM (-1)) captures the adjustment towards the long-run equilibrium. ECM (-1) is highly significant with negative sign, indicating the establishment of co-integration and long run relationship among LIMR, LFDI, LGOVEX, LSSE and LTOPN. The short run empirical results are indicated in table 4. The lagged error term value is 0.498900 which means 49.9 percent of disequilibrium is adjusted in each year in short run. It shows the process of adjustment towards equilibrium in short-run. Here we have found the value of error correction term (ECM) -0.498900 so the adjustment time required for Pakistan to correct the disequilibrium is 1/0.498900 = 2.00. It means the disequilibrium in economy will correct or adjust to equilibrium in two years in Pakistan.

6. Sensitivity Analysis and Stability Test

6.1 Stability test (Model 1)

The straight lines in Figure 1and Figure 2 show the 5 percent critical bounds for the cumulative sum (CUSUM) and cumulative sum of squares (CUSUMsq) used to check for parameter stability for Model 1 of the study (Where the dependant variable is life expectancy). The graph of CUMSUM and CUSUMsq is significant at 5 percent significance levels (plots lies between the critical bounds) indicating the stability of the parameters in model.

Figure 1: Plot of Cumulative sum of Recursive Residuals (CUSUM)

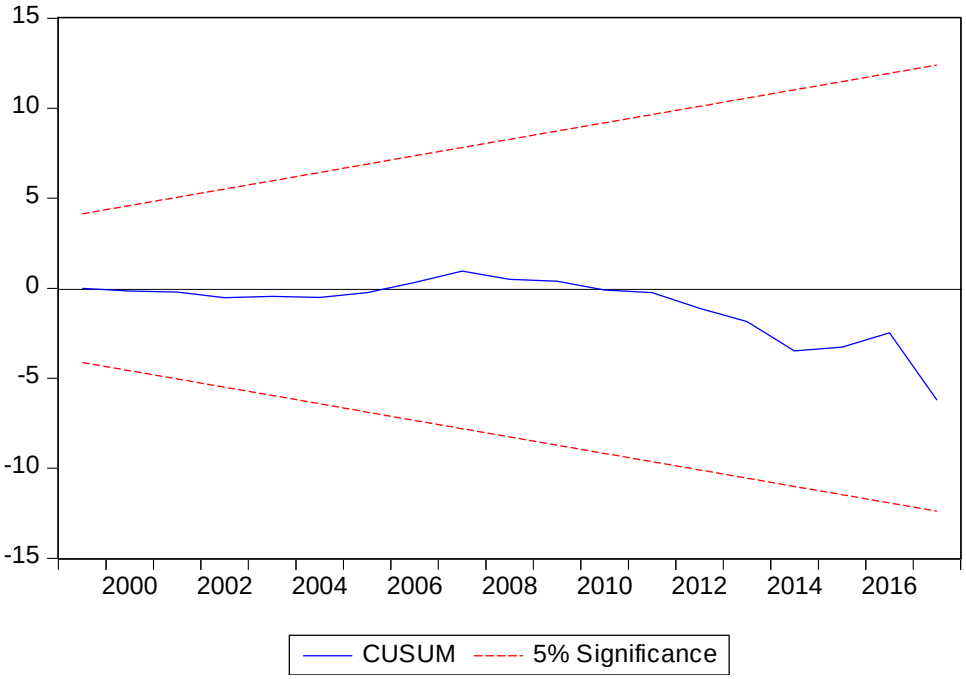
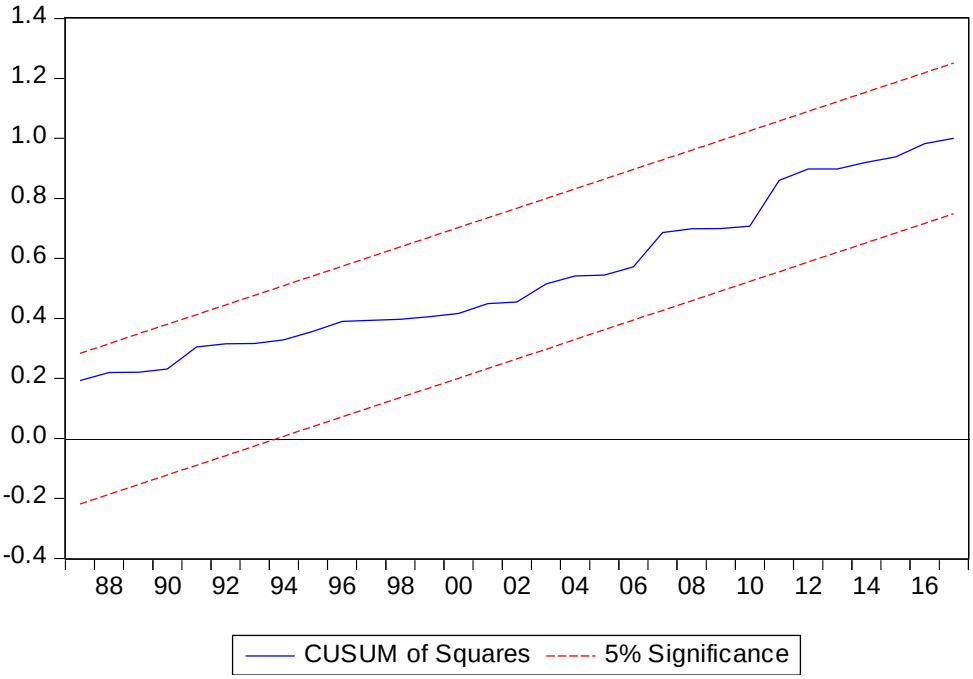


Figure 2: Plot of Cumulative sum of Squares of Recursive Residuals (CUSUMq)



6.2 Stability test (Model 2)

The straight lines in Figure 3 and Figure 4 also show the 5 percent critical bounds for the cumulative sum (CUSUM) and cumulative sum of squares (CUSUMsq) used to check for parameter stability for Model 2 of the study (Where the dependant variable is Mortality rate

under-5). The graph of CUMSUM and CUSUMsq is significant at 5 percent significance levels (plots lies between the critical bounds) indicating the stability of the parameters in model.

Figure 3: Plot of Cumulative sum of Recursive Residuals (CUSUM)

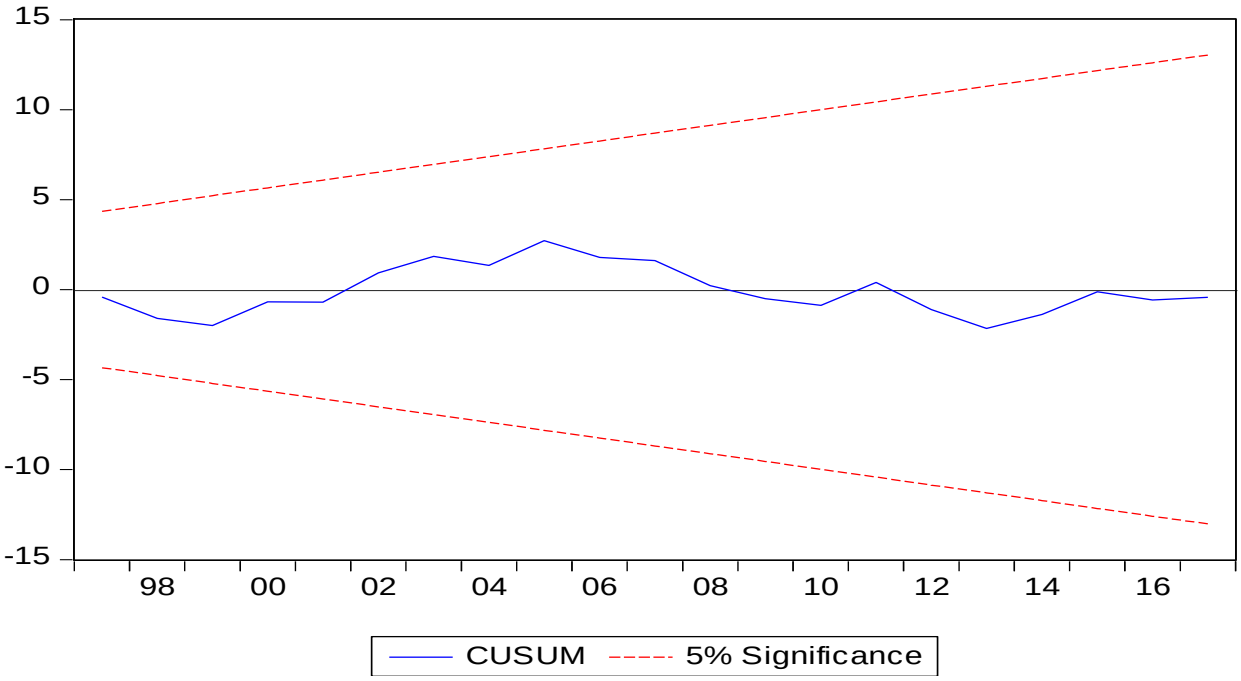
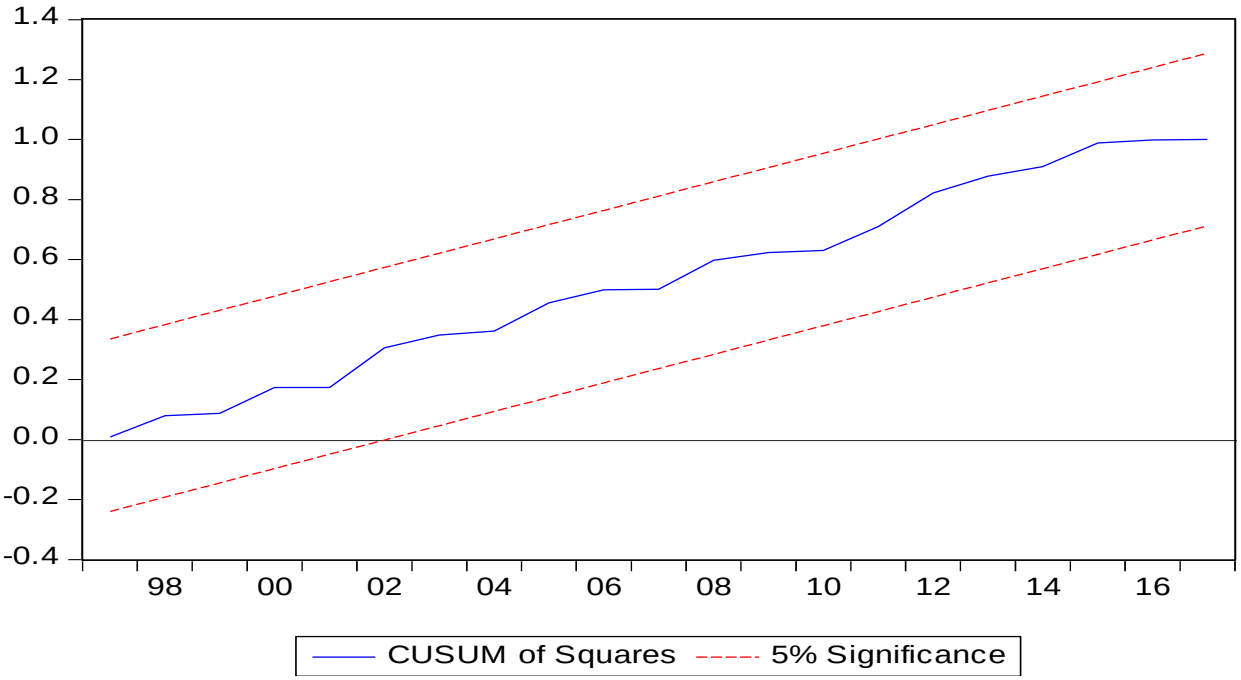


Figure 4: Plot of Cumulative sum of Squares of Recursive Residuals (CUSUMq)



7. Conclusion and policy recommendation

In case of Pakistan, we examined the relationship between FDI and population health over the period from 1980 to 2011, a relationship that has received little empirical attention. Moreover, we apply the ARDL approach to measure the long-run and short-run impact of FDI on life expectancy and infant mortality under-5 In case of Pakistan, foreign direct investment (LFDI), Secondary school enrolment (LSSE) and trade openness (LTOPN) have positive and significant relations with life expectancy (LLIFEX). The variables, FDI and SSE found to be contributing to reduce the infant mortality rate under-5 (IMR) while the government expenditure on health found to have insignificant impact on both life expectancy and infant mortality rate under-5, because Pakistan's Government has been one of the low spenders on the health sectors. More than four decades after independence (1947), Total public sector expenditure on health, for both the federal as well as provincial governments combined, in the current fiscal year is projected to be 0.3 percent of GDP, , which is strikingly low compared to the World Health Organization's recommendation of 5 percent (WHO, 2016).

The results derived from this study have some important policy implications. The key findings suggest that FDI contribute to life expectancy significantly and to reduce the infant mortality rate under-5 in Pakistan. Hence, the government of Pakistan should use FDI as economic tools not only for enhancing domestic production but also for improving health of its massive population. Therefore, we recommend that policy makers should introduce more foreign investment friendly policies that will ensure the maximum economic and population health benefits. We also suggest that the social benefits of FDI will be more potent if the policy makers can ensure greater foreign investment particularly in the health sector. Hence, Moreover, foreign affiliates should largely invest in hospital and pharmaceutical sectors by bringing modern know-how and technology from their host countries which will directly benefit to the public health of the host countries like Pakistan.

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