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Is Poverty a Product of Environmental Degradation in Developing Economies? A Case of Pakistan

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Abstract

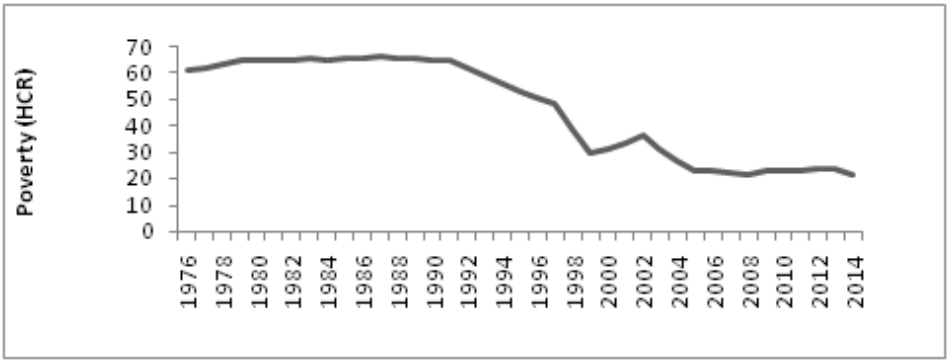
Amid increasing significance of the relationship between poverty and environment across nations, the study aims to scrutinize the impact of environmental pollution proxied by CO_2 emission on poverty in Pakistan. It is analyzed by applying Auto Regressive Distributed Lag (ARDL) and Bounds Testing approach to time series data for the years 1976 to 2014. Findings have professed that environmental pollution has positive impact on poverty both in short-run and long-run. In control variables, GDP growth rate, education and health status in the economy have shown negative impacts on poverty. The study suggests that environmental protection policies should be applied to prevent poverty prevalence. Spread of education and health facilities are also proposed for poverty alleviation.

Keywords: poverty, environment, ARDL, ECM, Pakistan.

1. Introduction

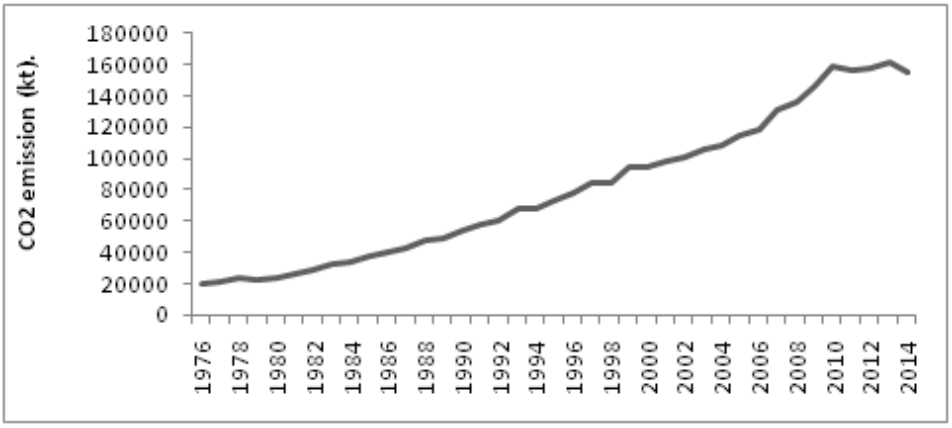
Poverty-environment nexus is one of the major challenges in developing economies, and it needs timely intervention through appropriate policy to alleviate poverty. International poverty eradication programs have established the link between environment protection and poverty alleviation. However, the literature has mixed empirical evidences about interdependence of poverty and environment. For instance, Fisher et al. (2013) explained that communities in which basic facilities are scarce and restrained to ecological services are caught by poverty-trap. On the other hand affluent people of industrial countries do not exhibit their dependence on environment. Fisher (2004) narrated that the poor who cannot access their fundamental needs and constrained to depend upon the environmental factors are usually trapped in poverty. Sarkar (2010) suggested that poverty and deterioration of environment are very strongly connected and causally interdependent (see also, Dasgupta, et. al. 2005). Similarly, the poor in developing economies habitually depend upon environment for livelihood which results in environmental deterioration (Gray and Moseley, 2005). Chu and Yu (2002) opined that poor environment creates human poverty (Yusuf 2004; Khan 2008). Walker (2004) concluded that poverty devastate the environment (Moral 2009). These mixed evidences may be due to varying socioeconomic and ecological situations of the economies.

The situation of poverty and environmental pollution in Pakistan is not good. Pakistan ranks among the top few countries which are environmentally vulnerable. In the country 40% of the people do not meet the facility of portable water, only 64% are using sewerage facility and 48% of the households are using improved sanitation facilities. Air quality data indicates the presence of high concentration of suspended particulate matters (PM10) in air that is 2.0-3.5 times higher than the safe limit. Solid waste in the country remained 27 million tons for the year 2015. The CO_2 emission in the country is 150 thousand kt. The trend of poverty and environmental pollution are given in figure 1 and 2.



Source: World Bank (2014)

Figure 1: Poverty (HCR) in Pakistan



Source: World Bank (2014)

Figure 2: Environment (CO_2 emissions) in Pakistan

Pakistan may be a good case study in the developing economies to explore the impact of environment on poverty. The current study aims to see the impact of environment on poverty in Pakistan.

2. Literature Review

The existing literature indicates that environmental demolition affects poor people rigorously because the poor are not able to manage the effects of environmental degradation (e.g. Renkow 2000; Sarkar 2010; Yang et al. 2015). Contrary to these ideas,

most of the studies have claimed that poverty leads to environmental degradation (Fisher et al. 2013).

There exist a number of studies which professed that environmental degradation affects the poverty and poverty affects environment. For example, the relationship between poverty and environment was investigated by Sunderlin et al. (2008) for Malawi, Uganda, Mozambique, Indonesia, Vietnam, Honduras and Brazil. By applying the spatial autocorrelation technique, two-way relationship between poverty and environment was established. Similar results have been shown by Zhou et al. (2008 for China) Shah and Guru (2004 for India).

Such types of other studies have also claimed that poverty and environment are correlated to each other. Poverty causes environmental degradation and causality exists between environmental degradation to poverty. Sometimes, the poor cause environmental dreadful conditions, and in some situations, they are simply victimized by socioeconomic proceedings of the other's through environmental degradation (Ghani et al. 2014).

Review of literature implies that prevailing wisdom on poverty and environmental relations have confused the standard assumptions of the issue across developing and advance economies. The variation in results may be due to application of different econometric techniques and capturing of environment by different indicators. For example, Ozcan (2013) has applied Panel Data Analysis for Middle East Countries and used CO_2 emissions as an indicator of environment. Lau et al. (2014) applied ARDL approach and Granger Causality technique in which environment was measured by CO_2 emissions. Cowan, et. al. (2014) also used CO_2 emissions as environment proxy and applied Panel Causality analysis for BRICS (Brazil, Russia, India, China, and South Africa). Similarly, poverty has been captured by poverty headcount ratio (Cheema and Sial 2010). Existing development literature blames the poor for environmental degradation and ignores the role of other actions at different scales to influence the ecological dreadful condition. The present study is worth contributing to the literature of economics in providing an econometric analysis of role of environment in poverty as a case study of Pakistan.

3. Methodology

3.1 Specification of the Model

To investigate the impact of environment on poverty this study has specified the following model:

$$POV = f (ENV, GDP, HLTH, EDU) \text{ …….. } (1)$$

Where

POV = Poverty, measured by headcount ratio

ENV = Environment, measured by CO_2 emissions (kt).

GDP = GDP growth (% annual).

HLTH = Health, measured by life expectancy at birth

EDU = Education, measured by primary enrollment.

The study uses annual time series data for the years 1976 to 2014, taken from the World Bank (2014) and the Economic Surveys (various issues) by the Government of Pakistan. This study uses poverty headcount ratio (HCR) for poverty and CO_2 emissions (kilo ton)

as environmental proxy to explore the effect of environment on poverty in Pakistan. In control variables GDP growth, health and education are included in the model.

Econometrics transformation of the model given in equation (1) is as under:

$$POV = \alpha_0 + \alpha_1 ENV + \alpha_2 GDP + \alpha_3 HLTH + \alpha_4 EDU + \varepsilon_t \ldots\ldots\ldots (2)$$

Equation (2) shows the environmental effect on poverty, ε_t is error term which captures the impact of all those variables which are not included in the model, α_0 is intercept of the model, α_1, α_2, α_3 and α_4 capture the effects of environment, GDP growth rate, health and educational status of the people on poverty respectively.

3.3 Bounds Testing Estimation

Autoregressive distributed lag technique presented by Pesaran et al. (2001) is applied to estimate the effect of environment on poverty in Pakistan. An autoregressive distributed lag technique is more appropriate for studies with small number of observations. Bounds test approach is considered as more superior as compared to other approaches to cointegration. The problem concerning the robustness of the cointegration tests can be minimized with the application of the bounds test in case of dealing with small number of the observations. The unrestricted error correction model of general approach for equation (2) is as under:

$$\Delta(POV)_t = \gamma_0 + \sum_{i=1}^{n} \gamma_{1i} \Delta(POV)_{t-i} + \sum_{i=0}^{n} \gamma_{2i} \Delta(ENV)_{t-i} + \sum_{i=0}^{n} \lambda_{3i} \Delta(GDP)_{t-i} + \sum_{i=0}^{n} \gamma_{4i} \Delta(HLTH)_{t-i} +$$

$$\sum_{i=0}^{n} \gamma_{5i} \Delta(EDU)_{t-i} + \beta_1 (POV)_{t-i} + \beta_2 (ENV)_{t-i} + \beta_3 (GDP)_{t-i} + \beta_4 (HLTH)_{t-i} + \beta_5 (EDU)_{t-i} + \varepsilon_t \ldots\ldots\ldots (3)$$

In equation (3), 'Δ' represents the first difference operator *'ε_t'* is stochastic disturbance term and is assumed to be normally distributed. In this model, first difference lagged value of dependent variable shows short run and first lagged level values show long run estimates. Wald coefficient test is used on all lagged explanatory variables in the model given in equation (3). Lagged coefficients of independent variables are assumed zero under Null hypothesis. If we accept the null hypothesis, it means that cointegration between poverty and environment is not found.

Construction of hypothesis for environment to poverty will be as under:

H_0: $\beta_1=\beta_2=\beta_3=\beta_4=\beta_5=0$ (Cointegration does not exist)

H_1: $\beta_1\neq\beta_2\neq\beta_3\neq\beta_4\neq\beta_5\neq0$ (Cointegration does exist)

For estimating the coefficients of independent variables, model given in equation (3) is solved by Ordinary Least Square technique. Autoregressive Distributed Lag model for long run coefficients ($\beta_1, \beta_2, \beta_3, \beta_4, \beta_5$) of general approach to the model is as under:

$$\Delta POV_t = \delta_0 + \sum_{i=1}^{n} \delta_{1i} (POV)_{t-i} + \sum_{i=0}^{n} \delta_{2i} (ENV)_{t-i} + \sum_{i=0}^{n} \delta_{3i} (GDP)_{t-i} + \sum_{i=0}^{n} \delta_{4i} (HLTH)_{t-i} +$$

$$\sum_{i=0}^{n} \delta_{5i} (EDU)_{t-i} + \varepsilon_t \ldots\ldots\ldots\ldots (4)$$

After estimation of above model, short run coefficients of the model with error correction term is estimated. For this purpose, we have used the short run error correction estimates of above model. If the value of error term is negative and significant, it means that short

run association between variables is present. Error correction model of general approach for environment to poverty for short run is as follows:

$$\Delta POV_t = \sigma_0 + \lambda(ECM)_{t-1} + \sum_{i=1}^{n}\sigma_{1i}(POV)_{t-i} + \sum_{i=0}^{n}\sigma_{2i}(ENV)_{t-i} + \sum_{i=0}^{n}\sigma_{3i}(GDP)_{t-i} + \sum_{i=0}^{n}\sigma_{4i}(HLTH)_{t-i} + \sum_{i=0}^{n}\sigma_{5i}(EDU)_{t-i} + \varepsilon_t \text{.....(5)}$$

In the model given in equation (5), ECM_{t-1} is lagged error correction term of the model.

4. Results and Discussion

The descriptive estimates of the variables used in the study are given here.

4.1 Bounds Test

We have conducted the Bounds test to find out cointegration among variables. By following the Bounds testing procedure, we considered all long run estimates to become zero under Null Hypothesis as:

Null-Hypothesis (H_0): $\beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = 0$

Alternative Hypothesis (H_1): $\beta_1 \neq \beta_2 \neq \beta_3 \neq \beta_4 \neq \beta_5 \neq 0$

Table 1: Results of Bounds Test

F-Value	Critical Bounds	Prob.	Conclusion
12.37	I(0) = 3.74 I(1) = 5.06	0.000	Cointegration exists

The value of F-statistics is 12.37, which is greater than the upper bound value (5.06) and implies to reject null hypothesis, hence we can conclude that long-run relationship between poverty and environment exists in Pakistan.

4.2 Coefficients of Model in Long-run

For estimating the coefficients in the long-run, normalization process is used. For that, lagged coefficients of independent variables are divided by the cointegration vector after multiplying with (-1). The results are noted in table 2.

Table 2: Long-run Estimates of ARDL Model

Variables	Coefficient	t-ratio	Prob
ENV	4.21*	0.99	0.000
GDP	-0.16*	-0.64	0.010
HLTH	-0.18**	-1.83	0.104
EDU	-0.21**	-0.87	0.101

*and** show 5% and 10% level of significance respectively.

The long run coefficients show that environment has positive impact on poverty in Pakistan. It reveals that environment creates poverty in Pakistan.

4.3 Short-run Coefficients of ARDL Model

The short-run estimates of model are given in table 3.

Table 3: Short-run Estimates of ARDL Model

Variables	Estimates	t-value	Prob.
ΔPOV	0.247*	1.979	.000
ΔENV	0.141*	1.695	.000
ΔGDP	-0.469*	-3.071	.031
ΔHLTH	-0.195**	-6.870	.102
ΔEDU	-0.271**	-0.863	.104
ECM(-1)	-0.196*	-3.905	.001
$R^2 = 0.75$	Adjusted $R^2 = 0.69$	D.W-statistics = 1.89	

* and ** indicate 5% and 10% level of significance

The results indicate that environment has positive impact on poverty which means that increase in environmental degradation leads to increase in poverty. Environment has multidimensional effects on the country and the poor are more vulnerable to environmental changes than the rich. Environmental degradation exerts ill effects on the poor and most of the diseases such as asthma, eye diseases, skin infection, joint pain, respiratory diseases, diarrhea and malaria are spread due to polluted air and polluted water. The poor do not have financial capacity to manage risks associated with environmental degradation. It means that environmental degradation may exert unenthusiastic impacts towards the productive capacities of the people by producing the health hazards. It results into reduction in overall output of the economy which leads to low per capita income, low savings and low capacity to invest which results into economic backwardness and final product emerged in the form of poverty.

GDP growth has shown negative impact on poverty which indicates that increased GDP growth rate distributes the fruits of growth to the poor community. This result is supported by the studies which narrate that economic growth is considered as the key factor to alleviate poverty (Collier 2007; Kates and Dasgupata 2007; Chen and Ravallian 2007). Economic growth enhances availability of irrigation and road and rail infrastructure which plays a critical role in growth of agriculture and industrial sector respectively. As economic growth takes place, the backward areas might have experienced some improvements in indicators like literacy, life expectancy, agricultural productivity, transport and mobility. The impact of economic growth pulls these areas out of poverty. This result is analogous to the Keynesians growth theory which asserts that growth can promote economic development and thus relieves poverty.

Health and education have shown negative effect on poverty revealing that improved health standards and educational level cause to increase human capabilities for production and income which leads to reduction in poverty. It is analogous to the results by many studies (see for instance, Walker 2004). The explanation may be that improved health and education may lead to improved skill and adaptation of technologies which accelerate the growth of economy and reduce poverty. The results reflect the relevance of Neo Classical growth theories and exogenous growth theories which indicate that an increased level of income cannot be achieved by economies with increasing returns to scale without improving the human capital. In developing economies, possibly the high rates of return on investment are very much reduced by lower levels of complementary investments in human capital, infrastructure, and research and development. Endogenous growth theories consider the knowledge as an important part of the production in which there is no diminishing returns.

The value of error correction term (ECM) is negative which implies that 20 percent adjustment from short run disequilibrium to long run equilibrium takes place. Moreover, the estimated values of R^2 and adjusted R^2 of ARDL model are 0.75 and 0.69 respectively indicating that 75% variation in poverty is explained by the explanatory variables. Durbin-Watson statistics is 1.89, which confirms the absence of autocorrelation in the model. Consequently, overall performance of the ARDL model is found to be good.

4.4 Diagnostic Tests

All the diagnostic tests are applied to verify the authenticity of model. The results of diagnostic test are given in table 4.

Table 4: Results of Diagnostic Tests

Test statistics	Null Hypothesis (H_0)	Prob.	Decision
Bruesh-Godfrey Serial Correlation Test	H_0: No Autocorrelation.	0.29	Do not reject H_0.
Ramsey's RESET Test	H_0: Proper functional form.	0.86	Do not reject H_0.
J-B Normality Test	H_0: Normality of error term.	0.08	Do not reject H_0.
Hetroskedasticity	H_0: No Hetroskedasticity	0.11	Do not reject H_0.

The study has conducted Jarque-Bera normality test for residual in order to see whether the residuals are normally distributed or not. In our ARDL model, the results of Jarque-Bera test designate that residuals are normally distributed. Ramsey's RESET Test is conducted to ensure the correct functional form of the model and probability value of Ramsey's RESET TEST becomes 0.86 which implies that model is correctly specified. Breusch-Godfrey LM test is applied to detect the residual serial correlation. Results of Breusch-Godfrey test imply that there is no serial autocorrelation. Autoregressive Conditional Hetroskedasticity (ARCH) test is applied to detect the autocorrelation which entails that there is no ARCH effect in our ARDL model.

CUSUM and CUSUMSQ are plotted to check stability of parameters in short and long run. Graphs of recursive coefficients and graphs of leverage have also been constructed to analyze the stability of parameters. The findings advocate that the parameters are stable, because variation lies between critical bounds as it is proved by the bounds testing results. The divergence between CUSUM and CUSUMSQ graphs is not present which authenticates the stability of short and long run estimates.

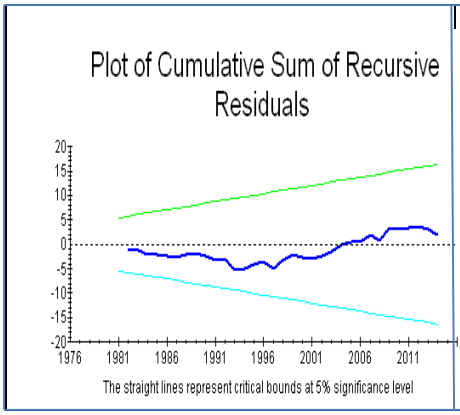


Figure 3: Plot of CUSUM

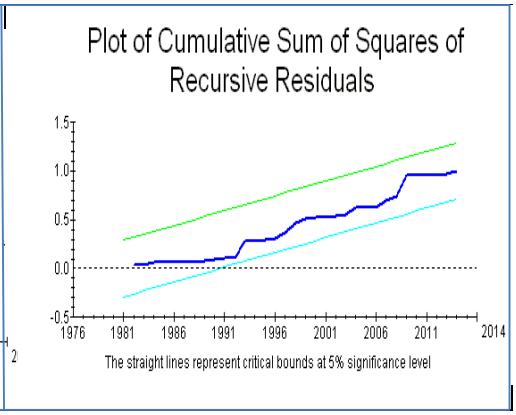


Figure 4: Plot of CUSUMSQ

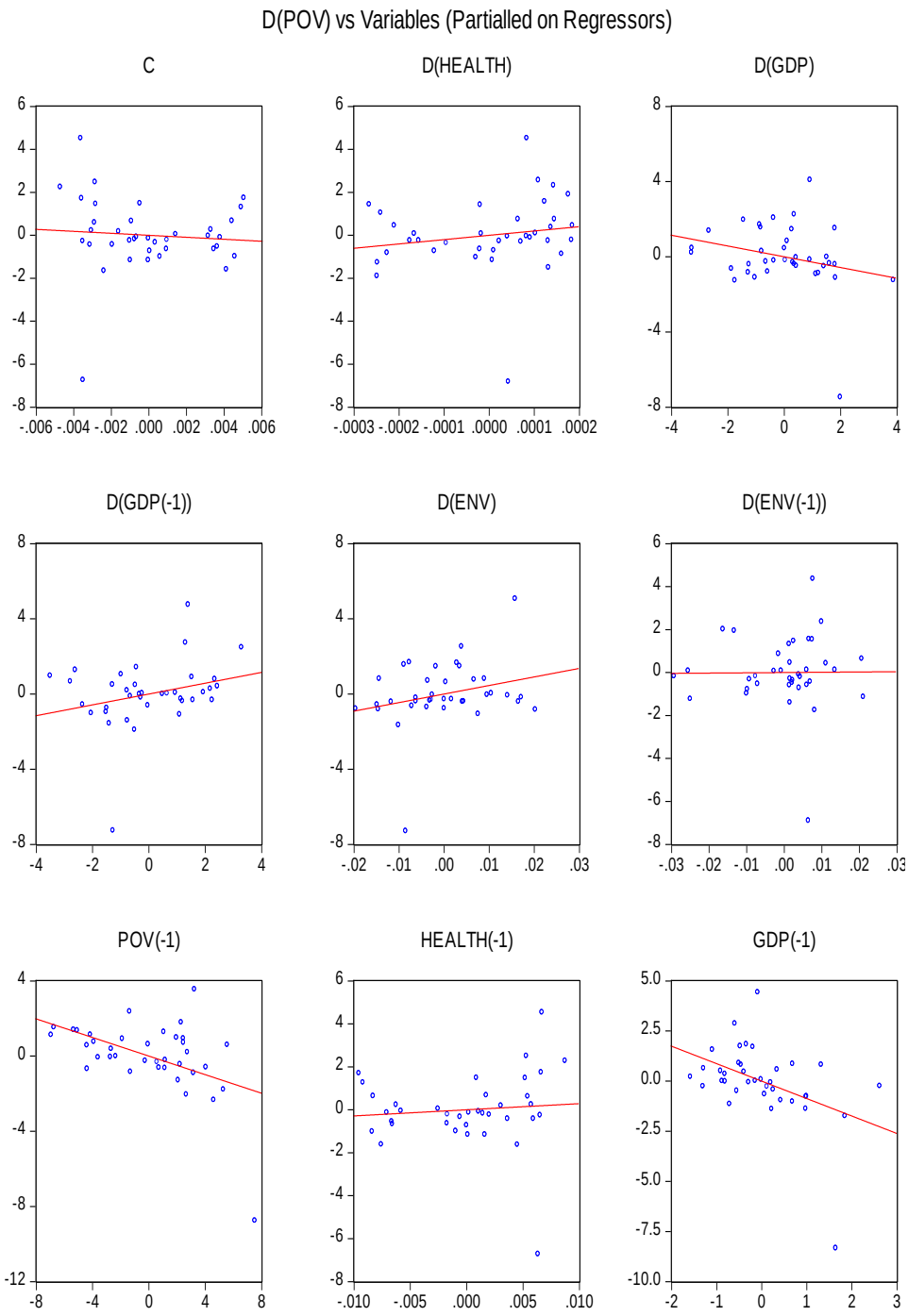


Figure 5: Leverage Plots

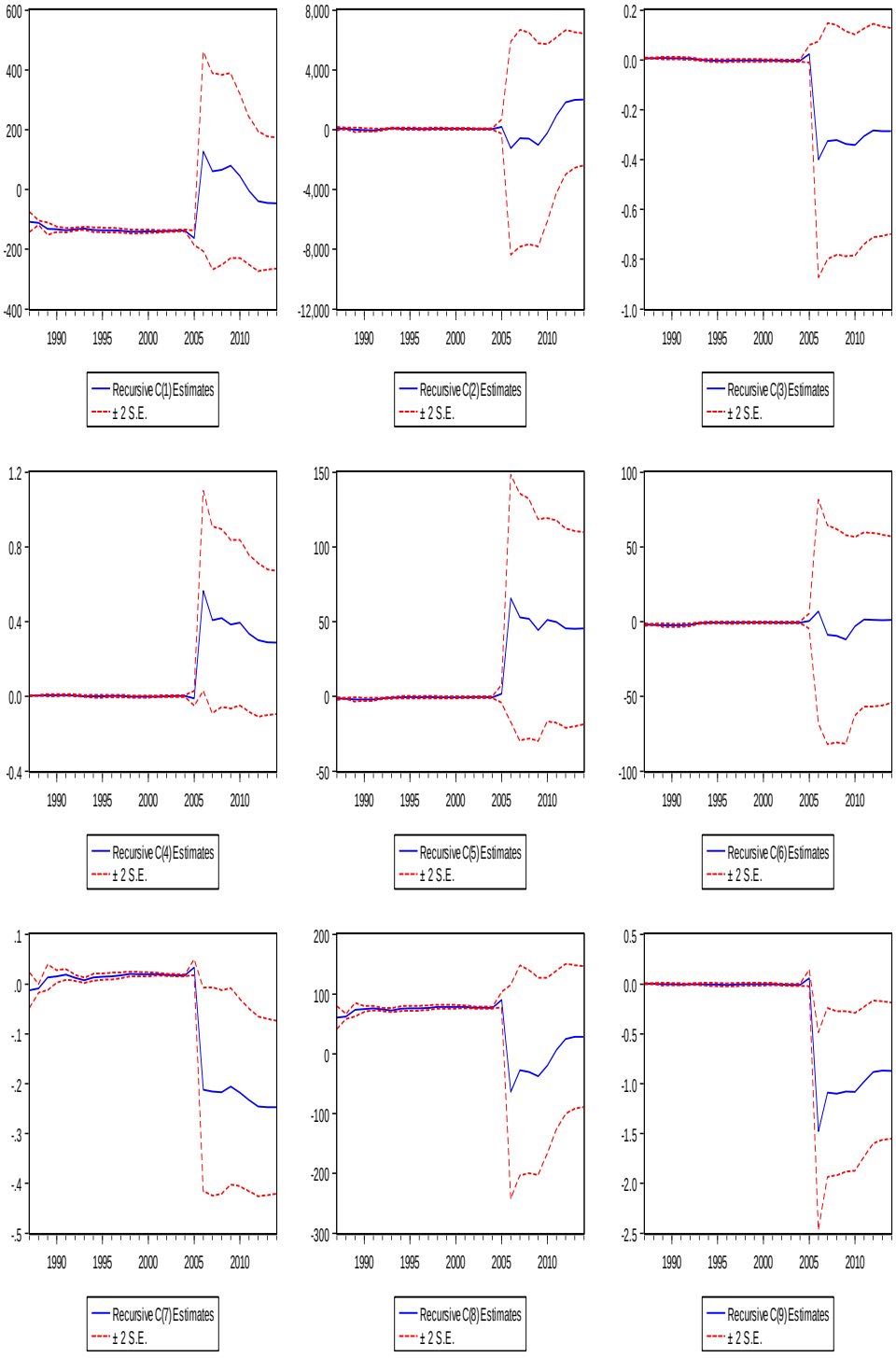


Figure 6: Recursive Coefficients

The results of all the diagnostic tests designate that our ARDL model is adequate as it passes all tests e.g. serial correlation test, hetroscedasticity test, misspecification test, and normality test. Furthermore, plots of CUSUM and CUSUMSQ, leverage plots, and the graphs of recursive coefficients show that all the estimators are stable as presented in graphs 3, 4, 5 and 6 respectively.

5. Conclusion and Recommendations

The study aims to investigate impact of environment on poverty in Pakistan by applying ARDL bounds testing approach to annual data for the years 1976 to 2014. Findings have provided a strong evidence of impact of environment on poverty in Pakistan.

It is concluded that environmental degradation is one of the major culprits for poverty in Pakistan. It must be tackled for poverty alleviation. The results advocate that, it is sagacious to take into account the relationship between the two series, while designing poverty alleviation policies in Pakistan. In terms of policy implications, nevertheless, it would be worthwhile for policy makers and poverty alleviation authorities to have regulatory measures regarding environmental pollution. Study also suggests that spread of education and health facilities may lead to poverty alleviation Pakistan. So along with control of environment, health and education policies are needed.

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