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ARE ENVIRONMENT, INFORMAL SECTOR AND POVERTY INTERRELATED?

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ABSTRACT

In developing countries, the informal sector plays a diverse role, from eradicating poverty to polluting the environment. Perhaps, due to inadequate awareness and scanty literature, the aspect remained ignored. This study was an attempt to determine the simultaneous relationship between environment, informal sector, and poverty. This study was based on panel data study of three countries, Pakistan, Bangladesh, and India. ARDL approach was used to measure the size of the informal sector economy of Pakistan, India, and Bangladesh. The generalized momentum (GMM) method was applied to determine the environment's simultaneous effects, on poverty, and the informal sector economy. The outcomes unveiled that informal sector employment and poverty expedited the carbon dioxide emission in three countries such as India, Pakistan and Sri Lanka. Secondly, poverty and CO_2 emissions had a positive association with the informal sector whereas thirdly, there was a negative impact of the informal sector economy and CO_2 emissions on the poverty. This study urges to channelize the informal sector because it can contribute towards poverty reduction in a better way once its channelized and provision of adequate awareness among the people regarding judicious use of natural resources. For instance, climate smart agriculture, sustainable farming and Good Agricultural Practices have been implemented to curtail the CO_2 emissions from agriculture sector. The needs are to provoke other sectors as well followed by the initiation of legal restrictions on CO_2 emissions.

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INTRODUCTION

Poverty is one of the great challenges the world is confronting with. Poverty has become a consistent and a severe global issue even in the new era. According to the data of World Bank, reported by Roser and Ortiz-Ospina (2019), 10.7% of the total population (767 million people) was extremely poor as they lived under 1.90 US dollar per day. Taking the severity of the poverty into account, numerous efforts are being undertaken in the world to alleviate this menace. More importantly, number of nations have come closer to work mutually against this plight and welfare of the society. Despite of abundant efforts, still more than 1.4 billion people on the planet are poor with a per day earning of under 1.25 USD. Of these poor, 1.4 billion people are suffering from hunger and Asian and Sub-Saharan Africa countries hosted the lion's share (Chaudhuri, 2017).

Globally, numerous strategies are on board in order to curtail the persistence of the poverty. Aoun (2004) has suggested that (i) investment in human capacity, (ii) capital formation (iii) entrepreneurship (iv) international trade (v) rural development and (vi) equity and environmental quality were the critical aspects to consider while targeting poverty alleviation. These

aspects could potentially elevate the economic growth which is regarded as one of the principal attributes for poverty eradication and pulling the deprived and poor out of vivacious circle of the poverty (Gopalan, 2014). Empirical evidences from Brazil, Africa, China, Costa Rice and Indonesia reflect that lucid economic growth tool a hefty number of people out of poverty circle during 1970 to 2000 (World Bank, 2001). Micro-finance, another poverty alleviating strategy currently operational in number of developing countries (Lashley, 2004; Banerjee and Jackson, 2017) fostered the income generating activities for the poor and encouraged them toward entrepreneurship (Das and Bhowal, 2013). Different social safety nets program had positive impacts on poverty alleviation, lowering the vulnerabilities and shrinking social inequalities in developing countries (Khan, 2013). Mumtaz and Whiteford (2017) augmented social safety nets effective particularly for lower income countries like Pakistan in order to alleviating poverty and boosting health and educational standards.

Agriculture is the largest potential sector helping poverty alleviation. Agriculture helps in mitigating the rural poverty in long run (Liu *et al.*, 2020). No country has been able to record rapid escalation from the poverty without investing and promoting agricultural growth (Timmer, 2005). Christiaensen *et al.* (2011) inferred that developed agricultural growth assisted in devising the effective poverty alleviation programs. This indicates that the development in agriculture sector is directly associated with the decrease in poverty level. With the passage of time, the paradigm of agriculture also changed. The researchers shifted their focus to livelihood diversifications (Nawaz, 2010; Montgomery and Weiss, 2011) and urged promotion of non-farm livelihoods along with the farm led activities for the economic development (Loison, 2015; Martin and Lorenzen, 2016). During the early 2000s, the establishment of inclusive value chains and market mechanisms incepted as an alternative for poverty alleviation in developing countries (Stoian *et al.*, 2012). Agriculture is the sector which engages a major chunk of population. According to Roser (2013) three quarters of the labor force in a poor country Madagascar was engaged in agriculture whereas in rich country like Germany or the UK in 100 is employed in agriculture. For the period between 1991-2020, average labor force engagement in agriculture for Pakistan, India and Bangladesh was 42.74, 53.98 and 53.72% respectively.

Pakistan is central in terms of informal economy as the workers have restricted access to labour welfare services, despite agriculture sector is labor intensive business. The labor Force Survey 2017-18 briefs that informal sector absorbs 71.7% of the employments other than agriculture, especially in rural areas (75.6%) as compared to urban areas (68.1%). Khuong *et al.* (2020) estimated 56% of informal economy of GDP in Pakistan. Informal economy is referred as in many ways in the literature such as shadow, irregular, unofficial, unobserved, black, underground and grey economy (Gylys, 2005). It encompasses of those economic activities, jobs, workers and enterprises that are not regulated formally by the states. Though, these activities have significant role in economy building and livelihood support to the families. Gulzar *et al.* (2010) corroborated that informal economy had tendency to play positive role for the growth of formal sector economy. This could be deducted that, informal economy in Pakistan would be having significant support to formal sectors. Nevertheless, the informal sector is growing more as compared to formal sector in Pakistan. During 2008 the size of informal economy was 74% as compared to 91% of formal economy. It is key to note that 73.3% of people got their employment outside of agriculture sector in rural areas than urban regions (Kemal and Qasim, 2012).

In most urban and rural informal economic sectors, activities are running with many problems associated with waste generated from the informal sector, resulting in environmental degradation. The informal sector economy is a significant contributor to GDP and highlighted the direct positive relationship between the informal sector and employment in Nigeria (Malaolu and Ogbuabor, 2013). Besides it, the informal sector economy and CO2 emission have a strong relationship in the absence of stringent environmental regulation (Elgin and Mazhar, 2013). Both the environment and poverty are directly related to change, human behaviour, and the goal of changing the natural environment (Mayer, 2008). In this context, it is imperative to explore the relationship between poverty, informal economy and the environment. Humans are manipulating the environment in need of more food and other essentials. Human impacts on the environment are occurring on an unprecedented scale, scale, and local scale. For example, Globally, there have been dramatic changes in the various human uses of the planet's ice-free surface.

However, extensive deforestation and loss of agricultural land due to population pressure have led to changes in the carbon storage in plant biomass, increasing the concentration of carbon dioxide in the atmosphere (Chen and Zhu, 2008). Due to strong population growth, industrial and deforestation increase, which mainly increases greenhouse gas CO_2 emissions. After the 1970's the concentration of greenhouse gases in the atmosphere has increased by about 25%, and even more (Khalil, 1992). Meyer and Turner (1992) and Stern *et al.* (1993) confessed that among the possible human forces that cause the land use change, population, level of affluence, technology, political and economic institutions and cultural attitudes and values are the most important. The informal sector has many aspects and consequences, but this study focused on how it is associated with the environment and poverty. All of these are essential factors and interlinked with each other. The study's main objectives are to calculate the size of the informal sector economy and find out the casual association among the informal sector economy, CO_2 Emission, and poverty. But the authors' main concern is that how Informal Sector Economy, Poverty and Environment, are interlinked with each other?

METHODOLOGY

Data for analysis was taken from the different sources, including Economic surveys, Handbooks of statistics of Pakistan, India, and Bangladesh. M1 and M2 were used for the currency in circulation, resident foreign currency account, tax revenue, bank services, GDP, GNP, inflation, and tertiary education were used as previously used by Khan *et al.* (2017). Data regarding CO_2 emission was collected from WDI.

Construction of Variables

Previous studies have used the direct and indirect approach in order to explore the size of informal sector economy. Kemal and Qasim (2012) described the details of these approaches. In this study, we used the monetary approach in the modified version ARDL model incepted by Pesaran et al. (2001) and Pesaran and Shin (1999). Discussing by Arby et al. (2010), the measurement of the informal sector economy of Pakistan has been by using the ARDL model approach, we deal with various the problems associated with the Tanzi approach (1983). In one model, using both stationary and nonstationary variables can also produce the long-run association.

ARDL Approach is formulated as follows:

$$C_{ut} = a_1 Y_{1t} + a_2 Y_{2t} + a_3 Y_{1t-1} + a_4 Y_{2t-1} + a_5 C_{t-1} + \varepsilon_t \quad \text{Eq.1}$$

Cu/Mt = money in circulations to M2 ratio

TY = total taxes (% to GDP)

BSS=Bank Services is an indicator of Financial Development

INF= Inflation Rate

TEdu= Enrolment in tertiary education

The cointegrating relationship among the variables is calculated through the upper level of the bond by F-Statistics. The long-run model is applied after the approval of the bound test in equation 2, 3 and 4.

For Pakistan;

Cu/Mt = β0 +β1 TY+ β2TEdu +β3 INF +β4BSS Eq2

For India

Cu/Mt = β0 +β1 TY+ β2TEdu +β3 INF +β4BSS Eq3

For Bangladesh

Cu/Mt= β0 +β1 TY+ β2TEdu +β3 INF++β4BSS Eq.4

β i α i = for i = 0, 2, 3, 4, 5.

The informal economy is calculated as a ratio to the economy's total size (formal plus informal) calculated as follows.

Utt=YYi/Y =βTY+βTEdu/Mt

Utt=Informal Economy

YYi=Informal Economy to GDP

Y=Formal Economy to GDP

YYi is GDP in informal Economy, Y is the total size of the economy, and Mt is the ratio of M1 definition of monetary aggregates to M2 (Arby *et al.*, 2010; Khan *et al.*, 2017).

Heterogeneous Panel Unit Root Test

In this paper, the heterogeneous panel unit root test was used to check the variables for the order of integration (stationarity). As it is recognized that the usual Augmented Dickey-Fuller (ADF)-type is utilized to check for unit root when there exists a problem of low strength in rejecting the null hypothesis, in particular for short-spanned data. For our analysis, it was necessary to check the panel unit root.

Causality and GMM

Standard two-step EG technique is historically used for trying out the causality. This study employed the panel standard estimation approach was once consequences in unpredictable parameter estimations ensuing from size errors and left out variable problems. To overcome this problem, the General Method of Moments (GMM) developed by using Holtz-Eakin and Rosen (1989) and

Arellano and Bond (1991) were used. The basic purpose of the GMM approach is to reduce the estimation bias, which frequently comes in panel statistics estimations. These issues arise due to the country-specific and time-specific effects, endogeneity in independent variables, and when we used lagged structured variables as regressors.

RESULTS AND DISCUSSION

ARDL Approach for construction of Variable

It is estimated by ARDL Approach and selected the model for k = one to four lags. It is decided after checking the minimum Akaike information criterion for India, Pakistan, and Bangladesh. The long-run association of currency ratio with other variables is formulated as follows:

For Pakistan

Cu/Mt = 1.074+ 32.97TY-1.14 LnBSS−-0.179INF+2.076TEdu Eq. 5

For India

Cu/Mt = 0.53+ 0.00103TY-0.0181LnBSS+0.0062INF-0.0064TEdu Eq.6

For Bangladesh

Cu/Mt = 0.45+ 0.1024TY-3.219306LnBS+INF+8.775356TEdu Eq. 7

The outcomes of this study show different growing trends, as described by previous studies such as Kemal (2007), Arby *et al.* (2010) and Khan *et al.* (2017). Kemal (2007) found a rising trend to the end of the 1990s, while Ahmed and Hussain (2008) had reported decreasing path. Arby *et al.* (2010) proved a decreasing path, but current results are contrary to those of Arby *et al.* (2010) but consistent with those of Khan *et al.* (2017) as they found an increasing trend after 2009.

Table 1. Measurement of Size of Informal Economy.

Informal economy percentage of total economy in India, Pakistan, and Bangladesh measured by the ARDL approach							
Years	India	Pakistan	Bangladesh	Years	India	Pakistan	Bangladesh
1971	5.0	23	26	1994	11.3	16	10
1972	5.1	29	37	1995	9.9	15	14
1973	5.2	23	33	1996	11.7	16	17
1974	5.2	17	20	1997	12.7	28	19
1975	5.2	16	21	1998	13.9	27	17
1976	5.4	15	7	1999	14.5	21	12
1977	5.3	15	6	2000	20.4	19	10
1978	7.5	16	5	2001	21.8	20	5
1979	7.9	15	6	2002	23.9	20	15
1980	7.9	15	6	2003	24.4	19	16
1981	8.6	14	6	2004	24.4	21	15
1982	8.1	15	11	2005	23.2	26	14
1983	9.4	14	4	2006	25.5	27	13
1984	9.9	15	5	2007	30.9	18	21
1985	10.1	14	13	2008	38.1	18	18
1986	10.5	19	11	2009	40.7	19	17
1987	11.3	18	8	2010	45.4	24	18
1988	10.0	18	11	2011	62.9	28	28
1989	10.2	19	8	2012	69.8	31	24
1990	10.7	19	14	2013	72.6	31	25
1991	10.5	16	11	2014	72.6	30	26
1992	11.7	16	14	2015	72.5	29	27
1993	11.7	16	16	2016	72.5	29	27

Panel Unit Root

testable 2 affirms that there was no time trend, so it checked the stationarity for a constant plus time trend, which confirmed that the null hypothesis of a panel unit root can't be rejected at a range of lag lengths. It is concluded that most of the variables are non-stationarity by using the IPS, which is also applied for the heterogeneous panel. The effects of the panel unit root tests confirm that the variables are nonstationary at the level, and they are stationarity at first-order difference.

Table 2. Panel Unit Root Test – Im, Pesaran, and Shin (IPS).

Variable	Level		First-order difference	
	Constant	Constant + Trend	Constant	Constant + Trend
POV	0.84598 (0.8012)	-0.40533 (0.3426)	-5.86743* (0.0000)	3.47851 (0.0001)
LCO2	1.25767 (0.8957)	-2.20431* (0.0138)	-10.42251*(0.0034)	-9.86181* (0.0000)
IFS	-0.91781 (0.9133)	-1.68200 (0.8706)	-3.41108* (0.0000)	-3.50588* (0.0012)
INF	-7.33129* (0.0000)	-6.29884* (0.0000)	-11.2764* (0.0000)	-7.33129* (0.0000)
TE	-052001 (0.6985)	-.23376 (0.4076)	-5.87352* (0.0000)	-4.70349* (0.0000)

Variables	Eq1. (LCO2)	Eq2. Informal Economy	Eq3. Poverty
Constant	-9.205170 [-1.031667] (0.3029)	-13.78572 [-1.426904] (0.1545)	81.34110 [2.003546] * (0.0459)
LGDP	0.225275 [1.762803] ** (0.0757)		
POV	0.225799 [1.861564] * (0.0193)	0.022688 [1.469983] ** (0.08733)	
IFSE	-0.006893 [-3.437953] * (0.0007)		-0.128700 [-0.840199] (0.4013)
LCO2		2.569985 [5.574948] * (00.0000)	-3.548955 [1.049284] (0.2947)
INF			-0.076622 [-1.975996] * (0.0489)
TE		0.490889 [2.604170]* (0.0096)	
R^2	0.996903	0.687970	0.796805
DW	1.227552	1.285209	1.068050
AR (1)	1.004725 [60.5845] (0.0000)	0.466507 [7.673525] (0.0000)	0.896356 [21.77215] (0.0000)
Sargan's J test P-value		0.999347310	

*Note: t-statistics is in parentheses p-value is in brackets ** indicate significance at 5 % * indicate significant at 1%*
CO_2 represents the CO_2 emissions, GDP represents the gross domestic product, IFS represents informal sector employment, POV is poverty, and TE represents tertiary enrollments taken as a proxy of higher education.

Table 4. Pedroni's Heterogeneous Panel Cointegration Test Results.

Test Statistics	Value
panel v-stat	0.61
panel rho-stat	-.88
panel pp-stat	-5.33*
panel adf-stat	-1.88*
group rho-stat	-0.26
group pp-stat	-5.91*
group adf-stat	-1.77*
*Significant at 1% level	**Significant at 5% level

Panel Co integration

Table 4 shows the estimation of the GMM simultaneous equation model. The tables explore the list of estimators in its first column and in the second column shows the estimates obtained from 1st equation of the model with the dependent variable log of CO_2 Emission. Third column reports the results of equation 2 with informal sector employment as a dependent variable, and the fourth column report the results of 3rd equation with poverty taken as dependent variable. The results of table are theoretically compatible and satisfactory in term of sign and significance.

The Adjusted R^2 values are also reasonably high. More specifically, the adjusted R^2 is 0.95, 0.68, and 0.79, respectively for three equations. The problem of autocorrelation was removed by applying autoregressive scheme AR (1), which was detected in the model through the Durbin Watson test. For the problem of endogeneity gross domestic product, inflation and tertiary education are used as instrumental variables.

To check the effectiveness of instruments in the estimation, Sargan's test is used to check the accuracy of the set of instrument variables used in the model. Sargan's test results did not reject the accuracy of this set of instrument variables used in the model.

Poverty has a positive impact on CO_2 emissions 'because poor are directly related to emitting CO_2 by using natural resources without taking any protective measures. Due to the low level of education, they are incapable of knowing the meaning of environmental degradation. Economic growth also increases the CO2 Emission as this found. This study also established the positive relationship between GDP and CO_2 emissions. Findings are consistent with those of Heshmati (2006) as he found the positive impact of poverty on CO_2 emissions. Cheema and Sial (2012) augmented that that GDP had positive effects on CO_2 Emission. On the other side, there is a negative association between informal sector and CO_2 emissions because informal sectors increase people's income due to which people avoid direct use of natural resources and adopt remedial measures. There are some contradicting views related to the relationship between poverty and the informal sector. In this study, we found the causal effect between poverty and informal sector. Due to poverty, people adopt informal jobs, and informal sectors provide jobs to unemployed people, eradicating poverty. But due to low wages in the informal sector, peoples are unable to improve their living standards and remain low. There is also a causal relationship between CO_2 and informal sector employment. Results indicate that poverty increases CO_2 emissions, and CO_2 Emission caused informal sector employment. There is also a causal relationship between CO_2 Emission and poverty. Due to poverty, CO_2 emissions will increase. But as an increase in CO_2 Emission is due to an increase in informal sector jobs, it will indirectly reduce poverty.

CONCLUSION AND RECOMMENDATIONS

The simultaneous relationship between poverty, informal sector employment, and environmental degradation is less investigated in literature. This study found two-way relationships among poverty, informal sector and environmental degradation. This was very contradicting because, due to poverty, peoples enter the informal sector, and after having jobs in this sector, poverty is eradicated in some context. But due to low wages, they remain poor. Similarly, CO_2 emissions and the informal sector also cause each other in different directions.

An increase in informal sector employment increases CO_2 emissions' due to the depletion of natural resources. The interrelationship between informality and poverty is self-motivated in nature. In developing countries, poverty and informal sector employment are side by side. Due to poverty and informal sector-environment

degradation, it is ubiquitous in developing countries (Devicienti *et al.*, 2009), which are now empirically tested in this study.

This is a misperception in developing countries that informal sector employment reduces poverty, but it has been empirically found in this study that informal sector employment reduces poverty to some extent, but on the other side, people in the informal sector remain poor. In developing countries, CO_2 Emission impede sustainability. The major causes of CO_2 emissions are poverty and informal sector employments. There should be some restrictions set by the government to legalize and imposing taxes on CO_2 emissions. Moreover, the need is to channelize the informal sector in order to crease formal employments for the people. Institutions should explore the palatable avenues of informal sector and the ways to control CO_2 emissions. For instance, sustainable agriculture, climate smart agriculture and adoption of Good Agricultural Practices could help reducing environmental degradation being caused through agriculture sector. In the same pattern, the other sectors need to be focused to introduce and implement environmentally friendly approaches to curtail the CO_2 emissions.

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