

The Role of Agriculture and Foreign Remittances in Mitigating Rural Poverty: Empirical Evidence from Pakistan

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Background: This study examines the role of the agriculture and foreign remittances in mitigating rural poverty in Pakistan.

Methods: The data used relate to the period 1980–2017 and are sourced from the World Bank and the Economic Survey of Pakistan produced annually by the Ministry of Finance. The ARDL technique was used to calculate the effects of agriculture and foreign remittances on rural poverty.

Results: The results of this study indicate that agriculture helps to mitigate rural poverty in the long run, but that foreign remittances are more effective in reducing rural poverty in the short run. In this paper, results confirm the existence of correlations between agriculture, foreign remittances and rural poverty.

Conclusion: The outcomes of this study support the call for the government to introduce agricultural credit schemes for the rural population of Pakistan. Moreover, the government should take steps to enhance diplomatic relations with other countries and simplify policies and visa application procedures for Pakistani workers. Finally, this study suggests the government should simplify procedures for the transfer of foreign remittances to Pakistan.

Keywords: foreign remittances, rural poverty, agriculture, Pakistan

Introduction

World agriculture's main concern is to be able to feed a total population of around 9bn by 2050, and it is gaining the attention of the new world but how agriculture would boost the world economy is still much debated. Lewis'¹ dual economy models and widespread economic development in the 1960s and 1970s generally interpreted agriculture as a retrograde unproductive sector, and agricultural resources and labor shifted to the industrial sector and boosted its productivity. Earlier economic development literature fueled the subsidizing of industrialization strategy. This led to biased urban planning development,² and trade and fiscal systems which overwhelmed the agriculture taxation system.³ Whereas another view of the contribution of agriculture as the primary sector, specifically in the earlier developmental stages of a nation's economy, also emerged and made an influential contribution.^{4,5} The crucial role of agriculture in the prosperity of other sectors was recognized, and agricultural investment policy reforms instituted to enhance economic growth, even though agriculture itself has a slow growth rate as compared to non-agricultural sectors. Various previous studies have documented multiple significant effects of the agricultural sector on the other sectors, substantially in Asia and Africa.⁶

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In the 1970s and 1980s, scientific-technological adoption in Asia led to a Green Revolution that transformed traditional agriculture into a rapid-growth modern-day sector so increasing confidence in the agricultural sector as a locomotive for economic growth. However, after that due to a lack of focus on numerous agricultural projects this belief gradually decreased. This resulted in increased demand for food leading to price rises for basic food commodities and this opportunity became a manufacturing growth miracle for East Asian exports.⁷ The UN members adopted the Millennium Development Goals (MDGs) and so began a new debate. Rapid economic growth shifted the focus to reducing poverty. Nevertheless, it would also depend on poor people's participation in economic growth and would require heightened interest and aptitude towards agriculture to participate effectively in the developmental process.

Mainly in developing countries, poor people were relying on agriculture for their income and it was also claimed that the majority of the poor needed to get more from GDP which comes from agriculture than GDP generated from other sectors. Investment policy reforms would support agricultural development and be helpful in poverty reduction by paying higher wages termed as "shared growth or pro-poor strategy".^{8,9}

The participation of each sector in growth and the contribution of poor people still require debate.

In 2008 World Development Report Agriculture issued by World Bank stated that in agriculture-based economies, agriculture is the key factor in economic growth and crucial for determining food pricing.

However, given the classical intersectoral connection, the same strategy cannot be applied to agriculture-based policies which are often unable to deliver the overall growth needed for fast poverty reduction, particularly in Asia and Africa.^{10,11} The majority of the rural poor depend on agriculture and would need to get more benefits from growth originating from the agricultural sector.⁷ However, most smallholder farmers remain poor because only the large farmers been successful in obtaining benefits, predominantly in Asia and Africa.¹²⁻¹⁴

It is still questionable how much poor people stand to gain from pro-agriculture strategy directly or indirectly through the labor market and non-traditional sectors employment.^{15,16} To date, no country has successfully achieved its targets of reducing poverty through agriculture. This, despite the fact that in developing countries most of the poor depend on agriculture for their livelihoods and agriculture's contribution to GDP, is greater

than that of other sectors, such as industry, and construction.¹⁷ Also, the agriculture sector in Pakistan is the largest in terms of numbers of people employed, employing 43.3% of the nation's workforce. In the light of these facts, the paper aims to examine whether income generated in the agriculture sector in Pakistan is proving more effective in poverty reduction compared with income from other sectors.

Based on the above-mentioned potential research impetus, the objective of this study is to investigate the relationship between agriculture development and rural poverty reduction. Moreover, this study emphasizes the role of foreign remittances in rural poverty reduction in the vicinity of Pakistan. Furthermore, with the developed research framework, the study addresses the following research questions:

RQ1. How does the agriculture industry bring about rural poverty reduction in Pakistan?

RQ2. How do foreign remittances bring about the rural poverty reduction in Pakistan?

This paper has three further sections. In the next part, we discuss the existing literature. Section three presents the methodology of the study, and section four describes the empirical results obtained. The study concludes with a summary of the findings and presents policy recommendations.

Literature Review

Regarding the role of agriculture in the economy and its potential in poverty reduction, few issues seem to have attracted researchers published in the economic journals and other empirical literature. Most of the literature concentrates on structural transformation of economies, whether in the least developed countries where most of the economy is based on agriculture, or in developed countries where the economy comprises mainly industry and the service sectors.

Agriculture's declining share in GDP and employment is inevitable as economies develop.^{18,19} The cause is the high elasticity of demand for non-agricultural goods. As incomes rise, consumers increase their consumption of service goods rather than food items. Ironically, this process usually leads to higher incomes for people affiliated with service industries, and worsening poverty among those whose livelihood entirely depends on agriculture.²⁰

Several studies concentrate on determining the relationship that exists between agriculture and poverty reduction. Bresciani F Valdés examined the agriculture and

poverty links in three areas: the labor market, farming income and food prices.²¹ Furthermore, these channels are important in providing a theoretical framework, and research has concluded, considering both direct and indirect agriculture growth, that non-agriculture sectors have less poverty reduction ability than other sectors. They emphasized that the agriculture sector has relatively more potential to reduce poverty given its share of GDP. In the countries analyzed in their study, agriculture's contribution chiefly came from the agriculture labor market. However, they cautioned that such an outcome-based development strategy might not be suitable in situations where mixed agricultural production lacks labor-intensive crop and livestock production. Equally disruptive to such strategies is the fact that historically, as agriculture has progressed, labor-saving technological changes have been introduced.

The findings of Ligon, Sadoulet²² suggest that agriculture growth is more significant than that of the non-agriculture sector. This is consistent with the claim that the development of agriculture is more significant than that of the non-agricultural sector for the lower decile of household expenditure. These results are the opposite of those for wealthy households, where non-agriculture expenditure elasticity is higher than agriculture growth. Their findings confirm that agriculture growth is pro-poor.

Christiaensen, Demery²³ raise the point that agriculture's contribution to poverty reduction is different because of the benefit of growth, which might be easier for pro-poor populations to obtain, but it depends on where they are located – politically, geographically and marketwise. Agriculture growth is more effective in poverty reduction than in other sectors. Montalvo, Ravallion's²⁴ findings are the same in the agricultural sector compared with other sectors, as the driving force in poverty reduction in China. It is debatable in terms of overall poverty reduction in China; they also found little evidence in non-agricultural sectors' growth. Most of the studies emphasized that agriculture growth is comparatively more important than growth in other sectors because of the sector's potential, but that it varies according to the institutional organizations and the economy in question.²⁵ Christiaensen, Demery²³ point out that poverty damages the power of the role of agriculture in fueling national economic growth.²² Rural poverty declined in the USA in the 1960s because of non-agricultural sources.²⁶

Warr²⁷ analyses time series data by using an econometric model from Indonesia, Thailand and Philippines. His result shows that the service sector also has potential in poverty reduction. Similarly, Warr, Wen-Thuen²⁸ used

time series methods to analyze Taiwan data and found that industrial growth is also crucial for poverty reduction. Simultaneously, Ravallion and Datt^{29,30} found that poverty in India's rural areas with evidence of agriculture growth was less than half that in non-agriculture sectors. Moreover, they suppose that the latter may be the case in India because of fast growth in the grey economy. Using similar methods, Chen, Ravallion³¹ evaluate that growth in China's agricultural sector is four-times higher than in non-agriculture sectors.

Former research suggested that agriculture growth is more effective in poverty reduction than growth in any other sector because rural poverty is higher and depends on agriculture.^{23,31} However, where the occurrence of poverty is low among non-agricultural people, non-farm income growth is more effective at poverty reduction. It may be the same for poor farming families; income from non-agricultural sources is more important than farming income.²⁰ Growth in the agriculture sector is more important than all other sectors' growth, where agriculture is responsible for a large share of GDP. Most researchers agree that agriculture growth is more productive than any other sector.

Few countries achieve the target of rapid poverty reduction without it. National income growth is not essential for poverty reduction, as poverty is defined by the amount spent on goods and services, how much is earned from work, how much money poor people spend, and what are the most important sources of money.²⁰ Ravallion³² defines an increase in income of \$1.25 per day is the indicator of poverty reduction that is theoretically possible through financial transfer from developed to underdeveloped countries. Foreign remittances are another source of poverty reduction for developing countries where their citizens work overseas.³³

Regarding the impact of remittances and their implication for economic growth and poverty reduction in Pakistan from 1973 to 2010, Javid, Arif, Qayyum³⁴ also observed that remittances have a healthy and positive effect on economic growth as well as poverty reduction, and that moreover, remittances have a positive effect on education, skill levels, debt levels and investment in Pakistan's economy³⁵. Labor migration is a useful means of earning foreign exchange and impacting poverty in Pakistan.³⁶ Other research confirms that remittances increase investment, human development and education, and positively impact health.^{37–39} In the nineties, a decline in remittances was primarily responsible for exacerbating

poverty and damaging consumption, income levels, and capital stock.⁴⁰ With decreasing numbers of children in the workforce, and increases in school enrolments, households are facing financial difficulties making remittances all the more important in reducing poverty and inequality.^{38,41}

The study will underpin the relationship between mitigating rural poverty through agriculture, labor, remittance, government expenditure, and education help to reduce rural poverty in Pakistan. The contribution of this study will help the policymakers and government of Pakistan to make optimal managerial recommendations for improving the agricultural credit schemes for the rural population. Moreover, this study will suggest the government should simplify procedures for the transfer of foreign remittances to Pakistan.

Data Specification and Methodology

Data Overview

For empirical analysis, annual variables data were collected from several sources for the period 1980 to 2017. Data related to agriculture as obtained from the 2017 Handbook of Statistics for the Pakistan Economy published by the State Bank of Pakistan (<http://www.sbp.org.pk/>). Poverty data were gathered from various editions of the annual, government Pakistan Economic Survey. Remittances, government spending figures, and education data were gleaned from World Development Indicators (WDI, 2018). Variable specifications are reported in Table 1.

Research Framework

Conceptual framework constructs on research contribution, data fetched from different sources, for agriculture variable data obtained from the Handbook of Statistics for the Pakistan Economy. Rural poverty data congregated from

various published research papers, economic surveys, and the World Bank. In this research, rural poverty is a dependent variable and took in to account more important agriculture, labor, remittance, government expenditures, and education expenditures percentage of GDP to understand the role of agriculture and remittances for rural poverty reduction in Pakistan. The estimated research framework used policy and approaches for the development of agriculture and mitigating rural poverty. Under the study, these variables are connected to rural poverty and agriculture development.

Model Specification

The purpose of this model is to examine the affiliation between the dependent variable (Rural poverty) and independent variables (agriculture, labor, remittances, government expenditures, and education) for Pakistan. Based on existing literature, remittances are helping to reduce poverty, as confirmed by Vargas-Silva, Jha, Sugiyarto⁴² and Christiaensen, Demery, Kuhl.¹⁷ The model can be presented as:

$$Rpov_t = f(Agr_t, Lab_t, Rem_t, Govex_t, Edu_t) \quad (1)$$

In linear regression form, Eq (1) can be written as;

$$Rpov_t = \alpha_0 + \alpha_1 Agr_t + \alpha_2 Lab_t + \alpha_3 Rem_t + \alpha_4 Govex_t + \alpha_5 Edu_t + \varepsilon_t \quad (2)$$

where ε is a residual error in measuring poverty and is denoted for the period. The natural logarithm is used. α_i ($i = 1, 2, 3, 4, 5$) in long-run relationship.

Estimation Strategy

Stationary Tests

We applied the Augmented Dickey–Fuller (ADF) (Dickey, Fuller)⁴³ and Phillips–Perron (Phillips, Perron)⁴⁴ stationarity tests to test stationary of time series data on the level and first difference. ADF and PP unit root tests the null hypothesis and confirms that there is no unit root. A structural break exists in the series; these traditional unit root tests are not reliable. To solve this problem, the unit root test was applied to the breakpoint at the level.⁴⁵

Autoregressive Distributed Lag Test

Pesaran, Shin, Smith⁴⁶ present the ARDL bound test model and apply single cointegration analysis; this method has various advantages over single co-integration approaches. Firstly, it shows flexible stationary properties of the variables; the ARDL model can be used for variables $I(0)$, $I(1)$. Secondly, more reliable and consistent results were found with the small sample by using the ARDL model approach.

Table 1 Description and Source of Variables

Variables	Symbol	Measurement Unit of Variable
Rural Poverty	Rpov _t	Percentage of the rural population living below the poverty line
Agriculture	Agri _t	Agriculture share in total GDP
Labor	Lab _t	The share of agriculture labor in total labor
Remittance	Rem _t	Personal remittances received (% of GDP)
Government Expenditure	Govex _t	General government final expenditure consumption expenditure (current US\$)
Education	Eduex _t	Education expenditure (%GDP)

Thirdly, ARDL model also simultaneously measures one variable against another variable in both the short-run and long-run. Fourthly, it is unable to examine the hypothesis on the estimated long-run approaches because of the modified endogeneity bias of the repressors. ARDL model is present as under Eq 3;

$$\begin{aligned} \Delta Rpvot = & \beta_0 + \sum_{i=0}^p \beta_{1i} \Delta Rpvot - i + \sum_{i=0}^p \beta_{2i} \Delta Agrt - i \\ & + \sum_{i=0}^p \beta_{3i} \Delta Labt - i + \sum_{i=0}^p \beta_{4i} \Delta Remt - i \\ & + \sum_{i=0}^p \beta_{5i} \Delta Govext - i + \sum_{i=0}^p \beta_{6i} \Delta Edut - i \quad (3) \\ & + \beta_7 Rpvot - i + \beta_8 Agrt - i + \beta_9 Labt - i \\ & + \beta_{10} Remt - i + \beta_{11} Govext - i \\ & + \beta_{12} Edut - i + \varepsilon t \end{aligned}$$

where Δ is denotes to the difference operator and ε presents the residual term. The sign of summation is denoted the error correction dynamics the F-statistic test evaluates the Long-run relationship of presented time series data and joint significance that evaluate the lagged level of time series data.⁴⁶

So, there is no long-run relationship between variables of the null hypothesis, $H_0: \beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = \beta_6 = 0$, the alternative hypothesis is that $H_1: \beta_1 \neq \beta_2 \neq \beta_3 \neq \beta_4 \neq \beta_5 \neq \beta_6 \neq 0$. Two terminal critical values are compared with the calculated values for the significance level, one for upper bound 1(0) whereas, the other for upper bound 1(1). If the computed F-statistic value 1(1), the null hypothesis will be rejected of no co-integration, if the value falls below 1(0) null hypotheses are accepted, and if F-statistic value lies between the band and critical value the test result is unconvincing.

Diagnostic Testing

The ARDL model stability was checked by applying the Cumulative Sum (CUSUM), and Cumulative Sum of

Squares (CUSUMSQ) methods are presented by.⁴⁷ Recursive regression residuals based on these tests and integrate the short to long-run dynamic through residual. If the results of these two tests critical bound values drop the 5% significance level and then estimated models are stationary. The paper also checked the normality of data by Jarque-Bera and its hypothesis were present as Null hypothesis: Residuals are normal, while the proposed standard value of Jarque-Bera is that the probability value should be more than 5%. If estimated at more than 5%, the considered as normal.

Empirical Results and Discussion

Descriptive Statistics

Table 2 presents the summary statistics of all studied variables. It defines the series of rural poverty, agriculture GDP, agriculture labor, remittances, government expenditure, and education expenditures are normally distributed by Skewness, Kurtosis, and Jarque-Bera statistics. We find no outliers and discrepancy in the data and all variables have a normal distribution.

Unit Root Testing

The main reason for the applying ARDL bound test is this, none of the variables is stationary at 1(2) in Tables 3 and 4. The ARDL results are invalid if any of the variables are stationary at 1(2).⁴⁸ In this study, Augmented Dickey-Fuller (ADF) and Phillips and Perron⁴⁶ two-unit root tests were applied and the Zivot-Andrew structural break unit root test to check the stationarity of variables and the empirics are presented in Table 3 to find the integration of the variables in question. For the stationary check, whether it is stationary at level 1(0) or first difference 1(1). The empirical results of the ADF unit root test demonstrated that labor and education are stationary at 1(0) and all other variables are non-stationary at the level, at first difference 1(1) all variables are stationary.

Table 2 Summary Statistics

Variables	Rpov	Agri	Lab	Rem	Govex	Eduex
Mean	29.7287	23.7224	45.6508	5.0971	22.8636	2.4214
Median	33.2375	23.4257	46.7900	4.9648	22.6511	2.4926
Maximum	49.3000	28.4478	54.0100	10.2476	24.2595	3.0223
Minimum	4.1000	20.2197	5.7300	1.4536	21.5892	1.8378
Std. Dev.	12.0634	1.7891	7.4607	2.2524	0.7316	0.3402
Skewness	-0.6371	0.6300	-4.0613	0.2308	0.3960	-0.1772
Kurtosis	2.3798	3.4232	22.8950	2.2017	2.1559	1.9823
Jarque- Bera	3.1795	2.7971	731.1590	1.3465	2.1212	1.8387
Observation	38	38	38	38	38	38

Notes: Govex presents a log of government expenditure in (current US \$). Jarque-Bera is the normality test to check that there are no outliers in the variables.

Table 3 Unit Root Tests

Variables	ADF Test Statistic		P-P Test Statistic	
	Level	First Difference	Level	First Difference
Rpov	0.914	-3.848***	0.51	-3.647***
Agri	-1.997	-5.551***	-2.012	-33.952***
Lab	-6.545***	-10.206***	-6.556***	-33.952***
Rem	-1.710	-5.741***	-5.746***	-5.746***
Govex	-0.133	-5.396***	-5.406***	-5.406***
Eduex	-3.275**	-4.489***	-2.525	-4.281***

Notes: Govex presents a log of government expenditure in (current US \$). Superscripts **, *** denote statistical significance at the 1% and 5% levels, respectively.

Table 4 Zivot–Andrews Structural Break Test

Variables	At Level		At First Difference	
	t-Statistic	Time Break	t-Statistic	Time Break
Rpov	-5.244**	1997	-6.194***	1993
Agri	-2.880	1986	-6.136***	2006
Lab	-18.354	2002	-9.257***	2004
Rem	-3.896	1995	-6.908***	1989
Govex	-3.521	1997	-6.931***	2002
Eduex	-4.707	1999	-4.857*	1988

Notes: Govex presents a log of government expenditure in (current US \$). Superscripts ***, **, * denote statistical significance at the 1 and 5% and 10% levels, respectively.

PP unit root test indicates that agriculture labor, remittance, and government expenditures are stationary at 1(0) and other variables are non-stationary at level 1(0), and all variables are stationary at the first difference 1(1). In the presence of structural breaks, the ADF test is not robust.⁴⁹

Furthermore, we use Zivot, Andrews, statistics⁴⁵ structural break unit root test to control that limitation and results are presented in Table 4. The empirical results show that rural poverty is stationary at a level all other variables are non-stationary at 1(0), but all variables are stationary at first difference 1(1) in the Zivot–Andrew structural break unit root test. It was confirmed that we could run the ARDL bounding test approach as none of the variables is stationary at 1(2). The ARDL model is sensitive for choosing a lag order of 2 on the basis of AIC information criteria. The long-run relationship depends on lag order. Bahmani-Oskooee, Bohl⁵⁰ state that this may create invalid information by using few or too many lags that can skip the most important data.⁵¹ The F-statistic value is reported in Table 5, which is more the upper bound value at a 5% significance level. It confirms that asymmetric co-integration, so we can use the ARDL model.

Table 5 Diagnostic Tests

Test	Statistic Value
R2	0.9975
F-bound test	7.4391 0.0000
LM test	0.9180 -0.4337
Normality test (Jarque Bera)	0.3379 -0.8445
Harvey test	0.7865 -0.6973
Glejser test	1.4779 -0.2545
Stability test (CUSUM and CUSUMSQ)	Normal

Notes: F bound test is more than lower and upper bound values of 1% in both cases. Heteroscedasticity, homoscedasticity tests are also proved as normal, as p-value of each is more than 5%.

ARDL Long-Run Estimations

The results of the long-run ARDL model with relevant variables are presented in Table 6, the model of rural poverty and agriculture has been reviewed in the present section. The long-run results confirm that agriculture has a positive, significant correlation with rural headcount. Previous research by Ali, Malik⁵² found that agriculture growth has a more significant impact on rural poverty in a long-run relationship in Pakistan. Mitigating rural poverty is the main focus of developing countries, which have the highest numbers of people living below the poverty line, in rural areas, where people depend on agriculture. Between 80% and 90% of the populations of Africa and Asia are located in rural areas.⁵³ Floods are also a continuing cause of great damage to Pakistan agriculture and also increase poverty: in July 2010 almost one-fifth of the country was underwater because of flooding, which

Table 6 ARDL Test for Long-Run Estimations

Variable	Coefficient	Std. Error	t-Statistic	p-value
Agri	2.721	0.635	4.290	0.005
Lab	-0.953	0.310	-3.070	0.022
Rem	-1.460	0.530	-2.750	0.033
Govex	-20.782	1.339	-15.520	0.000
Eduex	8.164	2.767	2.950	0.026
ECT	-1.117	0.370	-3.020	0.023

Notes: Govex presents log of government expenditure in (current US \$), Edu indicates % of expenditure in GDP.

caused approximately \$43bn of damage to the infrastructure affecting the homes and farms of around 20 million people.^{54,55} Their primary source of income is agriculture; most of the population of Pakistan is in rural areas which are directly or indirectly given over to agriculture. Pakistan agriculture contributed 22.8% to GDP and employed 43.3% of the labor force.⁵⁶ The contribution of agriculture to GDP is, per head of population, proportionally greater than that of non-agricultural workers. Pakistan agriculture has declined over time because of reductions in crop production and seed quality, the lack of new technology, political instability, and most importantly, insufficient irrigation infrastructure.^{57–59}

In Asia in the 1970s and 1980s, the Green revolution in agriculture made an energetic entrance into the modern era on the back of modern technology.⁶⁰ Concentrating on agriculture could be more fruitful for Pakistan's development and poverty reduction because a large percentage of the population is engaged with the agriculture sector. It has the potential to absorb more labor and so create many more employment opportunities. Agriculture is significant for poverty reduction in rural areas; the current finding is the same as that of previous researchers.^{61,62} This study demonstrated that agricultural labor has a significant negative impact on rural poverty. Migration decreases poverty, especially in rural areas. Previous literature has concluded that migration and poverty have an inverse relationship. The labor force of developing countries migrates to developed countries and their incomes increase because of the richer economy and higher wages compared with their home countries. During the 1970s, remittance inflow was very high at about \$37 billion. It peaked in 1983, with remittances' share of GDP reaching 10.06%. Subsequently, remittances went into decline from \$2.9bn in 1983 to \$1.060bn in 1999.^{34,63} Remittance income is typically used for everyday consumption and housing⁶⁴ and has a significant negative effect on rural poverty.^{65–67} By migrating from a developing country to rich countries migrant workers generate remittances for their home countries, improving both the national economy and their family's economic circumstances. As more poor people migrate from poor to rich countries, remittances sent back to their homelands will enable investment in different sectors, and the creation of job opportunities.⁶⁸

In addition, this study has shown that government expenditure also has a significant negative effect on rural poverty, confirming the results of previous research.^{69,70} Obi⁷¹ explored the role of government expenditure in

poverty reduction. The government of Pakistan has many programs for poverty reduction, including Pakistan Poverty Alleviation Fund (PPAF), Poverty Reduction Strategy Paper (PRSP), the National Rural Support Program (NRSP), and the Benazir Income Support Program (BISP). But unfortunately, these programs have not contributed positively to the eradication of poverty due to poor governance, corruption, and the weak institutional environment.⁷² Another important contributing factor to their failure is that a large proportion of government expenditure gets allocated to urban areas, for communications and technological development purposes.

By contrast, rural areas are neglected and as a result, there is a little visible impact on poverty reduction at a local level. Government economic policies and expenditure on public services have failed to raise the standard of living of the majority of Pakistanis. A study by Nwosa⁷³ in Nigeria also found that government expenditure has a positive but insignificant effect on poverty reduction. Ahmad, Batul⁷⁴ also concluded similar findings regarding poverty and government spending in Pakistan.

However, we reported education expenditure to have a significant positive correlation with rural poverty. These results indicate that agricultural labor remittances and government expenditure are reducing poverty, while agriculture and education, in the long run, are exacerbating poverty in rural areas of Pakistan. ECT -1.117 results indicate that rural poverty deviation from short to long-run equilibrium is adjusting by 11.1% per year.

ARDL Short-Run Estimations

The estimation of the ARDL short-run model with relevant variables is presented in Table 7, the estimated coefficient of the first difference variables showing that agriculture has a negative but significant impact on rural poverty in Pakistan in short-run estimation. In the short run, agriculture is decreasing poverty in Pakistan aided by government

Table 7 ARDL Test for Short-Run Estimations

Variable	Coefficient	Std. Error	t-Statistic	p-value
Agri	-3.412	0.931	-3.670	0.010
Lab	0.693	0.407	1.700	0.140
Rem	2.485	0.560	4.440	0.004
Govex	13.933	5.946	2.340	0.058
Eduex	-7.978	2.931	-2.720	0.035
Constant	524.032	195.175	2.680	0.036

Notes: Govex presents a log of government expenditure in (current US \$), Edu indicates % of expenditure in GDP.

policies. In different ways, the government can adversely affect agriculture, firstly by bad governance and secondly by excessive taxation of production activities.⁷⁵ Corruption and excessive taxation can compromise the efficiency of agricultural production.⁷⁶ Government policies that reduce corruption, in turn, increase agricultural production and decrease poverty.⁷⁷ As yet, the government has no long-term policy for the agriculture sector.

However, the effect of agricultural labor on rural poverty is insignificant. Almost 60% of Pakistan's population is in rural areas and their primary source of income is agriculture.⁵⁶ Their production is low and they often fail to cover the costs of production. If their production were to increase, if they were to get higher prices for their produce, and the cost of production were lower, they would get out of poverty. Agriculture contributed to 22.8% GDP in Pakistan, lower than previous years. The main reason for this is a lack of interest on the part of the Pakistani government, despite agriculture employing almost 43.3% of the labor force.⁵⁶

The Pakistan government would benefit from investing in the agriculture sector in order to increase economic development and reduce poverty. Furthermore, education expenditure has a positive significant impact on rural poverty. Education is a significant remedy for a range of problems in many developed and developing countries. Education plays a very significant role in the development of any country and of its economic development in particular. Education increases job opportunities and creates a skilled labor force able to financially support itself, ultimately reducing national poverty levels. Better education is not the only goal, but better overall life chances positively influence the economic development of the country.^{78,79} Remittances and government expenditure both have significant positive effects on short-run estimation on rural poverty. Remittances from middle and upper-class migrants directly benefit the economy; however, when money is transferred directly to poor people – mainly in rural areas – they see immediate improvements in their living standard and can exit poverty. The only other way to get out of poverty is to move abroad to work but the cost of migration is too high for most of them.⁶⁶

Diagnostic Test

As shown in Table 5, several diagnostic tests were applied, the empirical model passed leading tests according to the figures. These tests are: R^2 , Jarque–Bera normality, and Harvey. The value of R^2 is reasonably high, which

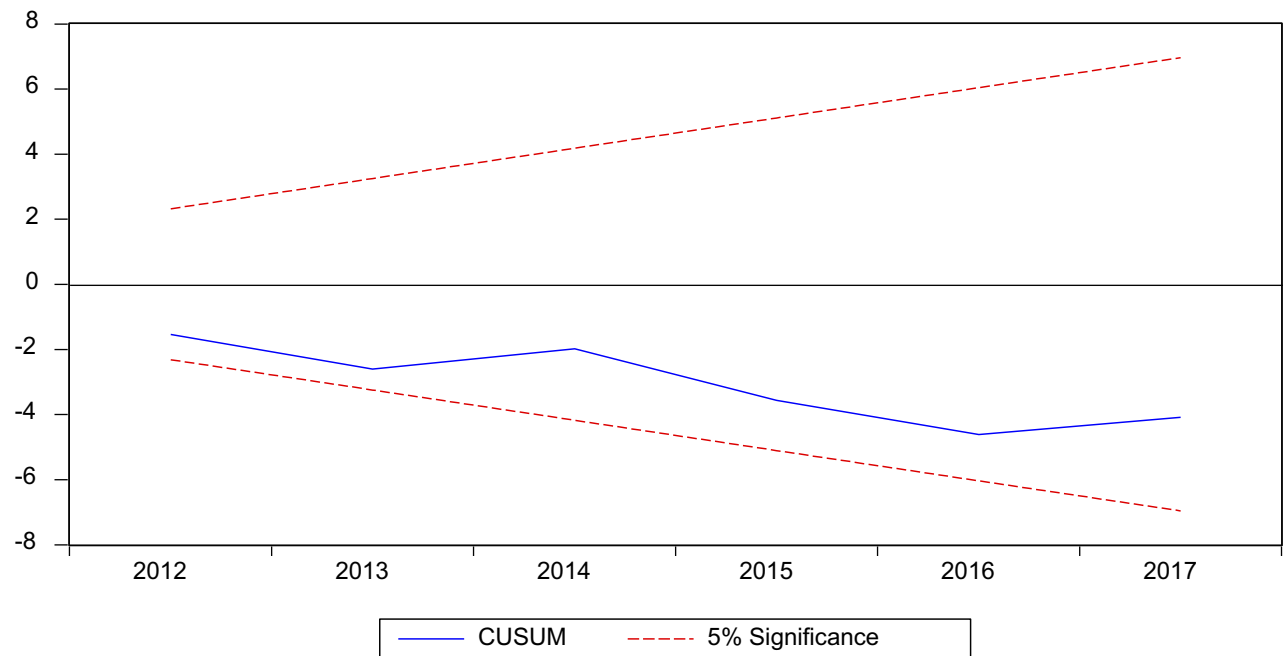
indicates that explanatory variables 99.7% variation independent variable RPOV, F value is highly significant that indicates that the model is fit for that data. The value of the normality Jarque–Bera test is statistically insignificant, which means that data are standard. Serial correlation LM test is the statistically insignificant value of the LM test illustrate that serial correlation problem is not present in the model. Harvey and Glejser tests were applied to diagnose the heteroscedasticity issue in this model; statistically, these values are insignificant which chose the level of significance which indicates that heteroscedasticity problem does not exist in the model. ARDL validity is checked through the CUSUM and CUSUMSQ tests.⁴⁷ Results of CUSUM and CUSUMSQ tests are shown in Figure 1A and B. All the estimated variables are stable over the sample period.

Robust Analysis

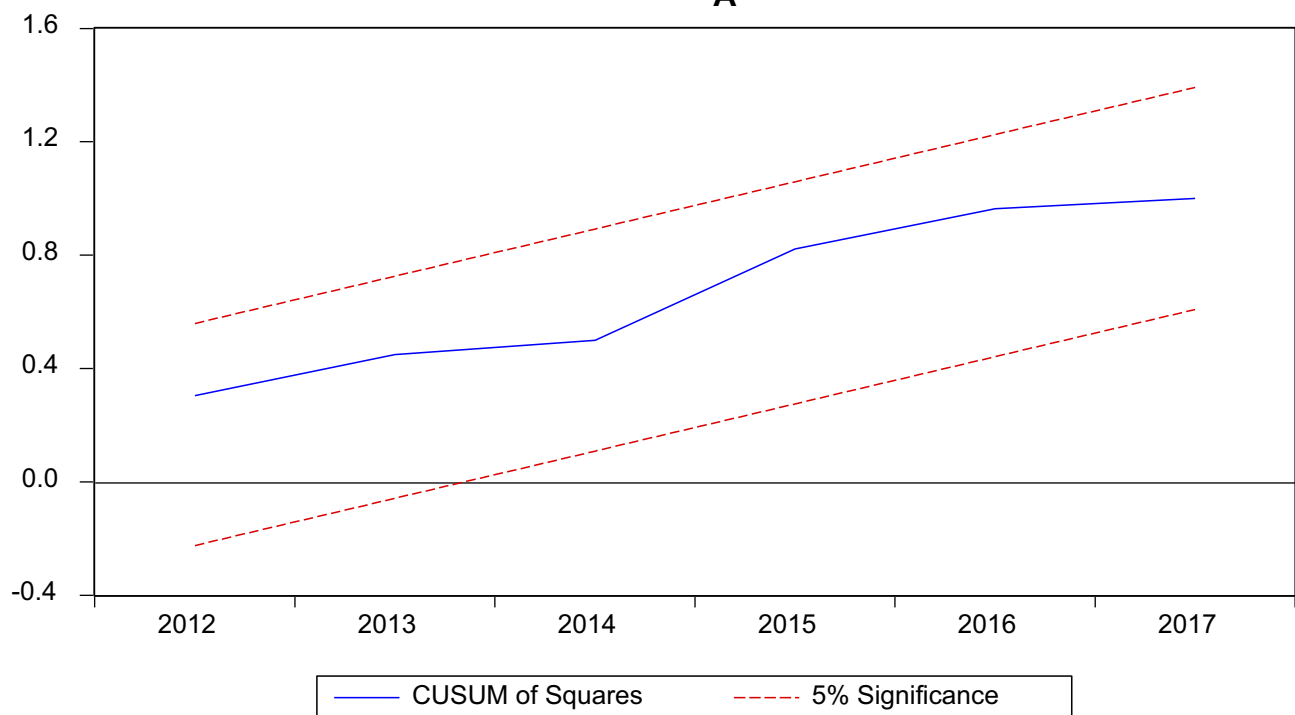
The study employed Dynamic Ordinary Least Squared Model (DOLS), Fully Modified Ordinary Least Squared Model (FMOLS) and Generalized Method of Moment (GMM) to further check the robustness effects of agriculture and remittances on poverty mitigation. The robust analysis results are provided in Table 8. The DOLS technique was applied to find the order combination of variables in the co-integrated framework, along with mixed orders of integration. The DOLS test of regresses I(1) variables against the other I(1) variables, applied leads (p) and lag of first difference ($_p$) and the other variables have integration on the I(0). The FMOLS is free from endogeneity issue and provide impartial results in the small sample.^{80,81} With the introduction of lags in model GMM endogeneity, the issue was overcome by making the model dynamic. The DOLS, FMOLS and GMM methods evaluate the actual co-integrating and are reliable for long-run estimation of the ARDL method. The estimation is significant, and coefficients are the same as ARDL long-run estimates.

Results of Granger Causality Test

The present empirical study employed the Granger causality test to determine the direction of the studied variables. The responses of the Granger causality test are illustrated in Table 9 bi-directional associations were found between the agricultural valued added and rural poverty while a unidirectional association was seen present as rural poverty cause agricultural value-added. Moreover, there is no relationship found between the agricultural labor force and rural poverty, but it was seen a unidirectional relation exists



A



B

Figure 1 (A) CUSUM stability test. (B) CUSUM of squares stability test.

between the rural poverty and agricultural labor force. Foreign remittance has no relationship with rural poverty. In addition, there is no relationship found between the rural poverty and government final consumption expenditure but

it was seen a unidirectional relation exists between government final consumption expenditure and the rural poverty. Therefore, the outcomes show a short-term association between the agricultural value-added and rural poverty,

Table 8 Robust Analysis

Variables	DOLS	FMOLS	GMM
Agri	3.019	5.219***	-0.550*
Lab	3.124***	0.619**	0.015
Rem	-3.325***	-3.092**	-0.434**
Govex	-5.737***	-3.850***	-16.124***
Eduex	-16.649	-8.197	0.980
Constant			410.584

Notes: Govex presents a log of government expenditure in (current US \$), Edu indicates % of education expenditure in GDP. Superscripts ***, **, *Denote statistical significance at the 1 and 5% and 10% levels, respectively.

Table 9 Pairwise Granger Causality Test

Null Hypothesis	F-Statistic	Prob.	Decision
Agri does not Granger Cause Rpv	2.186	0.129	Accept
Rpv does not Granger Cause Agri	2.790*	0.077	Reject
Lab does not Granger Cause Rpv	0.801	0.458	Accept
Rpv does not Granger Cause Lab	2.495*	0.099	Reject
Rem does not Granger Cause Rpv	0.477	0.625	Accept
Rpv does not Granger Cause Rem	2.221	0.126	Accept
Govex does not Granger Cause Rpv	9.990***	0.000	Reject
Rpv does not Granger Cause Govex	1.534	0.232	Accept
Eduex does not Granger Cause Rpv	1.164	0.326	Accept
Rpv does not Granger Cause Eduex	0.172	0.843	Accept

Notes: ***Indicates significant at 1% level and *Indicates significant at 10% level.

agricultural labor force and rural poverty, and government final consumption expenditure and the rural poverty.

Variance Decomposition Approach

In addition, this study also applied the forecast error variance decomposition method (VDM) under the vector autoregression (VAR) to check the validity of the outcomes. ARDL method was suitable to estimate the outcome of the dependent variable, but it is unable to provide an explanation of other independent variables in long and short-run estimation. It is unable to explain the granger causality out of the sample, only explain the co-integration of the sample.⁸² The results of the VDM are provided in Table 10. From the first period decomposition for the rural poverty in the VAR, ordering is completely due to its own innovation. In the second horizon shock, the rural poverty accounts for 92.093% change of the fluctuation due to its own shock. Furthermore, the shocks to agricultural value-added, agricultural labor force, foreign remittance, government final consumption expenditure, and education can cause 0.173%, 0.013%, 1.296%, 6.408%, 0.014% fluctuation in rural poverty, respectively. In addition, the estimated values indicate that foreign remittance, government final consumption expenditure, and education have

Table 10 Variance Decomposition Approach

Period	S.E.	Rpov	Agri	Lab	REM	Govex	Eduex
1	1.745	100.000	0.000	0.000	0.000	0.000	0.000
2	2.158	92.093	0.173	0.013	1.297	6.409	0.015
3	2.709	58.872	6.102	0.349	6.613	26.783	1.282
4	3.584	33.629	8.955	1.550	10.670	41.788	3.408
5	4.630	20.183	6.851	3.092	12.553	50.743	6.578
6	5.685	13.539	5.136	3.615	12.640	53.652	11.417
7	6.728	10.138	3.992	3.841	11.964	53.576	16.489
8	7.694	8.468	3.176	4.049	11.119	53.008	20.181
9	8.515	7.581	2.650	4.096	10.394	52.810	22.469
10	9.184	7.075	2.346	4.073	9.834	52.891	23.780

a close connection than agricultural labor force and agricultural value-added with rural poverty in the long-run. In conclusion, change in rural poverty is significantly being explained by its own shocks and also by four explanatory studied variables.

Impulse Response Analysis

In this present study applied the impulse response analysis, to what extent dependent variable reacts to shock stemming and how long with independent variables. Because of ARDL approach is best to check the co-integration of variables but it is unable to check the reaction of one variable to another variable. So to check the response of variables applied, the Cholesky impulse response function.⁸³ Impulse response results in Figure 2 and the solid line illustrate the retorts of estimations. Error bands calculated by adding and deducting one-time standard errors of the point of estimators. On the horizontal axis took the quarterly time period, and on the vertical axis is given that length of response, the response is plotted 10 quarterly.

Conclusion and Policy Implications

Conclusion

The present study analyses the role of the agriculture sector in mitigating rural poverty in Pakistan for the period 1985 to 2017. The variables examined in this study are; rural poverty headcount ratio, agriculture ratio share of GDP, the ratio of agriculture labor, remittance ratio of GDP, government final consumption expenditure, and the ratio of educational expenditure. An augmented Dickey–Fuller test was applied along with a structural break unit root test to investigate the integration of variables. To examine the long-run and short-run relationship, the ARDL bound test was applied.

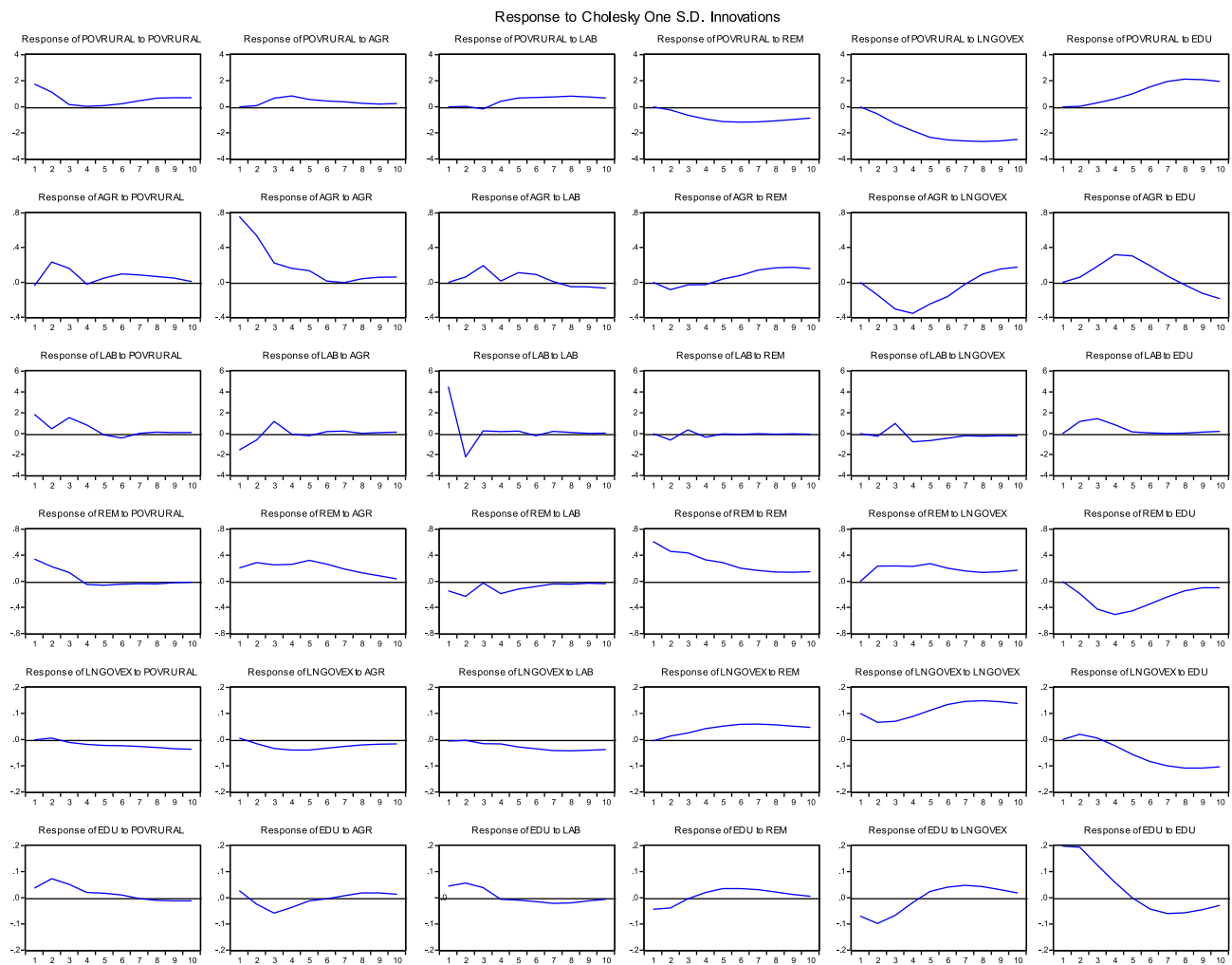


Figure 2 Impulse response function.

These results indicate that there is a significant positive correlation between agriculture and rural poverty. Labor, remittances, and government expenditure have a significant negative correlation with rural poverty. Moreover, education has a significant positive impact on rural poverty. Results indicate that labor, remittances, and government expenditure are decreasing rural poverty in the long run, whereas agriculture and education are increasing Pakistan's rural poverty in the long-run. The ARDL short-run results indicated that agriculture and education have a significant negative relationship with rural poverty. Labor has a positive insignificant relationship with rural poverty. Remittances and government expenditure have a significant positive relationship with rural poverty in the short-run in Pakistan. Moreover, diagnostic tests are performed to check the robustness of model and model are free from endogeneity issues, DOLS, FMOLS and GMM results are consistent with ARDL outcomes in terms of sign and significance. Furthermore, Granger causality test is applied to check

the direction of causality between studied variables. The responses of the Granger causality test found a bi-directional association between the agricultural valued added and rural poverty while a unidirectional association was seen present as rural poverty cause agricultural value-added.

The findings of this study suggest that remittances also provide some needed support at a national level, increasing overall GDP and contributing to poverty reduction, and they have immense potential and benefits for developing countries like Pakistan. Labor from developing countries is of great value to its host nations, making migration beneficial for both developed and developing countries. The government of Pakistan would do well to persuade the World Trade Organization (WTO) to introduce flexible visa schemes for developing countries' skilled and unskilled labor. Policymakers should focus on developing an international migration policy that helps poor people to go abroad and so support both the economic development and poverty

reduction of their home country. The international community needs to support labor-exporting countries by reducing current high transaction charges for sending money overseas. High transaction costs increase poverty, while high migration taxes, lack of competition, and low-level performance of the financial sector affect the labor-exporting countries. Moreover, it needs to cut taxation on agriculture-related products. Agriculture has always played a vital role in Pakistan's economy, continuing to generate around 23% share of GDP and employing over 43% of the population. Agriculture has the potential to reduce poverty in Pakistan. For poverty reduction, it is necessary to focus on improving agricultural productivity.⁸⁴ Increasing agriculture growth in Pakistan not only involves increasing the income of farmers but also stimulating the growth of non-agricultural activities, with the ultimate goal of reducing poverty nationwide.

Policy Implications

The Pakistan government needs to ensure that its spending is properly managed and this will help raise productivity to enhance economic growth and help to reduce rural poverty. In recent years the government has increased expenditure on roads, electricity, power, and communications all of which will lead to reductions in the cost of doing business, boost economic growth and help to decrease rural poverty. It is increasing expenditure on education and health to ensure that resources are properly used in the fight against rural poverty. But, the financial authorities should not only carefully and correctly monitor its expenditure on education but increasing spending in this sector will lead to increases in per capita income and so help reduce poverty.

The Government should introduce new schemes for the rural population in the form of grants for agriculture needs, subsidies, and crop insurance schemes. Small farmers also need good quality seed and technical assistance. In China, a major reduction in rural poverty occurred between 1978 and 1983 following land redistribution in the 1970s.⁵⁷ In Pakistan, there is an unequal distribution of land as most are owned by large landlords. Three land reforms were attempted in 1959, 1972, and 1977 but all three failed. In Pakistan, agricultural policy is currently the same whether farmers are small or large, whereas policies for small farmers could take into account both their differing needs and their geographical area, as happens in China. Pakistan would do well to adopt such a model for poverty reduction in rural areas. Greater investment is needed in the latest technologies and tunnel farming technologies to produce more fruit and vegetables. New irrigation techniques should be introduced,

and farmers are given access to such facilities to increase production. In India electricity is free for agriculture, and also fertilizers are heavily subsidized, but in Pakistan, the opposite is the case. Pakistan needs to follow the agriculture model of neighboring countries like China and India. Pakistan should provide a range of new subsidies to people engaged in agriculture, for example, free electricity and advanced and hybrid seeds, and subsidies for the installment of solar panels to power irrigation systems.

The Pakistan governments should develop new strategies regarding foreign remittance, encouraging senders to use the proper channels, incentivizing them to increase the amounts sent home. As well as reducing transfer costs, technological improvements are needed in Pakistan's banking sector, and importantly more banks are needed in rural areas. In the interests of mitigating poverty, policymakers should develop policies favorable for migrants and national development including policies that encourage workers to go abroad and send money back via the proper channels rather than illegally. This would not only help poor families but would also help the government boost the foreign reserve.

Ethics Statement

The research ethics committee of Guangxi University, Guangzhou University and Nanjing University of Aeronautics and Astronautics approved this study. The World Bank and Economic Survey of Pakistan custodians gave consent over the email.

Author Contributions

All authors have equally contributed to drafting the manuscript, data collection, analysis, and interpretation of data, reading, and approving the final version to be published. Moreover, all authors are confirming that the agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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Disclosure

The authors declare that they have no conflicts of interest in this work.

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