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KEYWORDS	ABSTRACT
Rural Prosperity, Spatial Econometric Analysis, Remittance-Driven Agricultural Modernization, Pakistan	This study examines impact of remittances on agricultural modernization and sustainability in Pakistan. Agriculture is a crucial sector for country's economy, yet it faces significant challenges like outdated farming methods, limited access to modern technology, and environmental degradation. The remittances from Pakistanis working abroad represent a substantial source of the income for many rural households and have the potential to finance necessary agricultural advancements. This research explores that how these funds are allocated, the factors influencing investment decisions, and their effect on the adoption of modern agricultural technologies and sustainable practices. Moreover, study assesses the short run and long run relationship between agricultural productivity and foreign remittances using the ARDL approach to cointegration. The findings suggest that while remittances can enhance agricultural productivity & sustainability, their actual utilization depends on a supportive policy environment, improved financial services, & capacity-building initiatives. By addressing these factors, the remittances can be a powerful tool for promoting the rural development and economic growth in Pakistan.
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## INTRODUCTION

Agriculture is crucial to economic development and growth in Pakistan. It offers unrefined material to the Agro-based industry, a mainly cotton textile sector that is the most significant subsector of the industrialized field. 23.37 % is contributed by agriculture to the country's Gross Domestic Product (GDP) and features 37.4 % work in the nationwide labor force (Statista, 2023). However, it is still a backward segment of the nation. Over the last decade, the agriculture market's demonstration has

fallen short of excellent fitness level, primarily due to the inactive output of all the essential crops (PIDE, 2022). Climate change also poses a major confront to Pakistan's farming and threatens the country's drinking water accessibility. The government is trying best for the farmers by providing agriculture inputs at reasonable prices. For assurance food security, it is necessary to boost domestic agricultural production over increased efficiency. Although Pakistan has rich production possible in agriculture, livestock, and fisheries, yet sustainable economic growth and wealth, the development of these sectors on long-term basis are of essential importance for the country's growth and affluence (FAO, 2023).

This calls for efficient production capital by adopting up to date technologies and establishing a profitable marketing system. (Pakistan Economic Survey, 2018). Individuals are on the action since human life began. Migration is neither a replacement phenomenon, neither a disappointment nor maybe replacement for development. Individuals go in strategy to enhance lives and, consequently, the lives of families to discover new abilities, build up fresh experiences to look for work, or even try to escape harmful circumstances like insecurity, famine, and disaster (Ahmad & Yasmeen, 2023). Migration is an economic, social, and political process that impacts those that move, the ones that remain behind, and the locations where they live. There is a thorough linkage between agriculture, immigration, and rural development. Human migration would be the motion of people from a single spot within the planet to a different site of the goal of taking over the semi-permanent or permanent residence, usually political and geographical boundaries (Chandio, Jiang, Rauf, Ahmad, Amin & Shehzad, 2020). The remittances and migration are the process that is supported by unobservable characteristics and they are not randomly allocated. The agricultural outcomes like crop failures generate a more significant inflow of remittances and also, they these outcomes induce migration outflows from abroad.

Also, reverse causality is a huge concern. Isolating the independent effects may be challenging when there is a close relation between remittances and immigration. Still there is a problem that we don't have enough instruments that will measure the scale of migration outflows and also the number of remittances coming from different regions of world separately (Ahmad & Yasmeen, 2023). Poverty, society's welfare and economic growth have been affected by foreign remittances, but it is still a debate that how much these factors are affected. Among the world's highest five countries, Pakistan is one of them whose exchange earnings include great number of remittances. We can see importance of these payments by analyzing that we do not have to pay them back like we pay the other exchange receipts and the official development support. in this regard, due to the addition of these remittances, we can maximize the benefits and develop the economy in a better way. If remittances are used as insurance for farmers; we will substitute risk-mitigating policies for those who left behind (Velosa, 2011). Over the last few years, in emerging countries like Pakistan the number of remittances has been growing significantly. "In 2023, payments flow to developing countries totaled US \$221 billion, an amount that was twice Official Development Assistance (ODA) towards the developing countries therein year.

The International Fund for Agriculture Development (IFAD) asserted that in 2023, the cumulative remittances for developing countries exceeded the US \$1.5 trillion (World Bank, 2023). Despite the

increasing inflow of remittances in rural areas, there is limited empirical evidence on how these funds impact agricultural modernization and sustainability. The potential benefits of remittances for the agricultural development may include the adoption of new technologies, investment in sustainable farming practices, and overall improvement in productivity and income levels. Nevertheless, the allocation of remittances is influenced by various factors such as household priorities, local economic conditions, and the availability of supportive infrastructure and policies. The relationship between remittances and agricultural development in Pakistan is complex and influenced by various socio-economic factors. While remittances can offer much-needed capital for investment, actual impact on agricultural modernization and sustainability depends on how these funds are allocated and utilized by the recipient.

### Research Objectives

1. To assess contribution of remittances to sustainable agricultural practices and environmental conservation in Pakistan.
2. To measure economic & environmental aids of remittance-driven agricultural modernization for rural communities in Pakistan.
3. To recommend policy measures that can boost positive impact of remittances on agricultural sustainability and modernization in Pakistan.

### LITERATURE REVIEW

Nishat and Bilgrami (1991) analyzed the hookup in between workers' remittance, consequently, the farming economic climate in Pakistan. They made use of a simple Keynesian style. Consistent with the 2 Gap design, the absence of exchange and investment decision capital has been a significant restriction to occasion. The affluence of remittances can supply the essential international capital required instead of utilizing foreign aid and loans that have the inherent problems of theirs. Workers' remittances have been more accessible and have been discovered, possessing essential and positive impact on agricultural growth. Adams and Richards (1998) in their newspaper evidenced that in rural Pakistan. International remittance has a substantial useful impact on the buildup of rain-fed and irrigated land. The authors attributed the consequence to habit of investing remittance ashore that provided a much better speed of return. Nevertheless, neither the international nor the inward remittance encountered a statistically massive effect upon the buildup of livestock assets (a crucial advantage for countryside households), it reduces the fees of labor who are working on farming. Ali (2018) examined effect of international remittance on farming development in Pakistan and various areas of the world.

The segregated statistic information of remittance, farming GDP, elementary school enrollment, and gross fixed capital development within agriculture market was considered because of the amount 1972 to 2012. The co-integration technique was used to study the conclusion of the day products those variables on farming gross domestic product. The coefficients of remittance from the UK, the United Arab Emirates, or the European countries have been discovered to be significant and positive in the long run. However, it had been absolutely no substantial within the fairly short term. The result of remittance from 1st world nations as the USA, Australia, and Canada exhibited the significant and negative impact on agricultural GDP within the long run. However, it had been no significant inside

the short term. The outcome shows that remittance plays a major role to fulfill the requirements of the farming industry. This study implies that this federal government should create a policy to advertise migrant households to come down with non-urban Pakistan, make use of remittance in productive pursuits. The outcomes also claim that systems must be invented to promote primary training and boost fixed capital formation within the agriculture market. [Fayissa and Nsiah \(2005\)](#) learned the options that agricultural market development had been the best topics mentioned by recapitalizes in developing places.

The human and physical capital, technical development, official financial assistance, and flux of international capital inflows have been acknowledged as the primary elements for the endorsement of farming financial processes. The study investigated combination effect of remittance on farming, utilizing panel information from Latin American nations because of quantity of 1980 to 2005. It was discovered that remittance had a significant effect upon nations' agriculture wherever the monetary method was lot less progressed. The policy inference of analysis suggested that developing countries can improve expansion effectiveness by tying remittance with other standard development capital energy sources such as human and physical capital. [Giuliano and Arranz \(2005\)](#) mentioned the connection between remittance, non- agricultural, and farming development. This study shows that remittance advertised both the farming and non-agricultural economic capital within less evolved nations through the capital and allocating it in more effective ways. The GMM method was used to conduct the results. The research outcome suggested that remittance encourages financial practice through funding routes in lands in which the financial industry cannot fulfill the credit requirements of its public sector.

[Mahmood \(2010\)](#) assess that farming is the primary key to rural development, which resulted in the expansion of human civilization. There is a thorough linkage between agricultural development and migration; consequently, probably the most goals of this particular newspaper were looking at the design of expending remittances in farming and, therefore, the effect of payments on the livelihood of the farmer. The analysis was done within the countryside areas of District Toba Tek Singh. District Toba Tek Singh was selected through an easy sampling technique. One hundred twenty respondents were chosen over the handy sampling technique. An outstanding relationship between agricultural development and migration was found. There is thorough linkage between agriculture, immigration, and rural development. The majority of migrants invested income of theirs within the farming sectors, such as purchase of farmland, farm, and livestock machinery. [Latif and Ashfaq \(2013\)](#) calculated the economic effect of transfer of funds on rural economic climate located in district of Pakistan (Sialkot), by gathering information of eighty-eight households and also conducted an analysis utilizing the regression model. The study discovered that Italy, Oman, UAE, Greece, and Kuwait have a significant number of migrants.

The variables bundled in the unit were significant. The results revealed that migrants' households make use of a significant proportion of remittance on households' consumption and, consequently, the productive purchase, like agriculture and livestock sectors. [Akpan \(2014\)](#) analyzed the association between remittances and indicators of agricultural productivity. They measured productivity using agricultural to GDP ratio, crop production index and agricultural productivity index. Result reflects

co-integration exists between variable. It shows agricultural productivity and crop production index are related to remittances in short run. By using bilateral Granger causality, it depicts unilateral relation association with nominal agricultural GDP and remittances. It revealed specified variables had commendable growth rate. [Tuladhar \(2014\)](#) examined the impact of remittance on agricultural production as remittances contribute to dynamics of economy. Study used primary cross-sectional data to explain the outcomes. Results indicated migration had negative impact on agriculture sector. It is as labor shrinks reduces agricultural output. The finding is household receiving remittances in agriculture sector donor invests further in the agricultural production to improve productivity of the capital and labor.

Hence it is essential for countries like Nepal to encourage productivity in agriculture sector to offset losses due to migration. [Debski \(2018\)](#) during this paper analyzed the significance of remittances in developing countries like Ghana. The household data is used to find the outcome of remittances on farming efficiency. As a result, there is a positive and strong effect of remittances on people having lower and medium income. This study estimates that the expenses spent on crop inputs and payments from different regions of world together shows monetary flux across income classes. In lower income people remittances are one the most important way to control the expenditure spent on crop, shows by the previous results. The findings of this study demonstrate that within the agriculture sector in order to assess the impact of payments in an appropriate way, inclusive steps are required. [Kousar, Rehman and Masheed \(2023\)](#) analyzed the effect of agriculture output on economic development in case of Pakistan. The researchers used secondary data 1973-2020. The observers apply the technique of ARDL for estimation. The FDI was found the researchers to gross fixed capital formation (GFCF) and inflow, the agricultural output (later on AGRI), and human capital and labor force participation are significant and positive.

In Pakistan, the observers analyzed that inflation rate, on other hand, has a negative and significant impact on economic growth over the long term. In contrast, Pakistan's economy is unaffected by the inflation rate. In addition, the analyzers found that the variables had a long-term term cointegration and a level of adjustment that is 51%. The study concludes by the researchers that Pakistan's public and economic development have been significantly influenced by agricultural output. In this drive, the researchers suggests that the government make sure that policymakers pay more attention to implementing long-term strategies to increase Pakistan's agricultural productivity and expansion and progress in the economy. Thus, [Chandio \(2023\)](#) analyzed the effect of remittances inflow on the agricultural productivity in Asian economies from 2000-2018. The other variable temperature the negatively related to and agricultural GDP cultivated area fertilizers credit shoes positive results. According to the findings of this study, the researchers revealed that policymakers in the emerging Asian economies should create a unique system for receiving the remittances and offer remittance investment products to make effective use of foreign funds to reduce the risks associated with the agricultural production.

### RESEARCH METHODOLOGY

In this study, secondary source of data has been used. World Bank is used to take data for dependent variables, that is Agriculture gross domestic product and independent variables that are remittances,

crop production index, inflation and water availability. In this connection, this study's time horizon is 38 years, from 1986 to 2023 for all the variables of current study, including dependent as well the independent variables.

### Model Specification

To measure the short run and long run relationship between foreign remittances and agricultural modernization in Pakistan is the basic purpose of this study. For this purpose, a model has been formed where agricultural gross domestic product is depending on foreign remittances, crop production index, inflation, and water scarcity. A following model has been formed to describe functional form these variables:

$$AGDP = f(0FR, CPI, INF, WA) \quad (1.1)$$

Where AGDP is agricultural gross domestic product as a proxy of agriculture modernization, FR is foreign remittances, CPI is crop production index, INF is the inflation, and WA is water availability. Therefore, the best functional form of the above model has been given below after applying various econometrics tests.

$$\ln AGDP_t = \beta_0 + \ln \beta_1 FR_t + \ln \beta_2 CPI_t + \ln \beta_3 INF_t + \ln \beta_4 WA_t + \mu_t \quad (1.2)$$

Where,

- ✓  $\beta_0$  is the coefficient that represents the intercepts of the error term used in the current study.
- ✓  $\beta_1$  is the slope coefficient of foreign remittances, and it shows one percent change in foreign remittances caused  $\beta_1$  percent change in agricultural GDP, keeping other variables constant.
- ✓  $\beta_2$  is the slope coefficient of the Crop production index, and it shows one percent change in CPI originated  $\beta_2$  percent changes in the agriculture GDP holding other variables constant.
- ✓  $\beta_3$  is the slope coefficient of the inflation in results and it shows 1 percent change in inflation caused by  $\beta_3$  percent change in the agriculture GDP when other variables are kept constant.
- ✓  $\beta_4$  is the slope coefficient of water availability and it shows 1 percent change in the water availability caused by  $\beta_4$  percent change in agriculture GDP and other variables kept constant.
- ✓  $\mu_t$  = error term

In order to determine the econometric model for the estimation of study, the unit root test, along with the normality test and autocorrelation, heteroscedasticity test has been applied. Since the variables are of mixed integration so the Autoregressive Distributed Lag (ARDL) model has been chosen to determine short and long run relationship of the variables. The general form of ARDL model for the study is as follow:

$$\ln AGDP_t = \alpha_0 + \sum_{i=1}^p a_1^i \ln AGDP_{t-i} + \sum_{j=0}^{q_1} \beta_1^j \ln FR_{t-j} + \sum_{k=0}^{q_2} \beta_2^k \ln CPI_{t-k} + \sum_{l=0}^{q_3} \beta_3^l \ln INF_{t-l} + \sum_{m=0}^{q_4} \beta_4^m \ln WA_{t-m} + \mu_t \quad (1.3)$$

Where,

$\alpha_0$  = constant term

$a_1^i$  = lag of dependent variable

$\beta_1^j, \beta_2^k, \beta_3^l, \beta_4^m$  = lags of independent variables

$\mu_t$  = error term



The Error Correction Model form when assuming that model has cointegration after applying bound test is given below:

$$\Delta \ln AGDP_t = \alpha_0 + \sum_{i=1}^{p-1} \alpha_1^i \Delta \ln AGDP_{t-i} + \sum_{j=0}^{q_1-1} \beta_1^j \Delta \ln FR_{t-j} + \sum_{k=0}^{q_2-1} \beta_2^k \Delta \ln CPI_{t-k} + \sum_{l=0}^{q_3-1} \beta_3^l \Delta \ln INF_{t-l} + \sum_{m=0}^{q_4-1} \beta_4^m \Delta \ln WA_{t-m} + \phi ECM_{t-1} \mu_t \quad (1.4)$$

On the basis of the above model specification the estimation, results and discussion of the current study are as follow:

## RESULTS OF STUDY

Table 1 Unit Root Tests Results

Variables	ADF Test at the level I (0)	ADF Test at First Difference I (1)	PPTest in level I (0)	PPTest in First difference I (1)
lnAGDP	-1.2379	-6.7778***	-1.1067	-7.2334***
lnWA	-2.045	-11.426***	-2.2445***	-14.846***
lnINF	-4.6803***	-6.3241***	-2.6222*	-6.3138***
lnFR	0.2293	-4.7177***	0.1103	-4.7177***
lnCPI	-1.8749	-6.2078***	-1.8575	-10.2196***

Note: \*\*\* p < 0.01, \*\* p < 0.05, \* p < 0.1.

Table 1 shows that variable lnINF is significant which shows that there is no unit root in data, variable lnAGDP, lnWA, lnFR, and lnCPI significant at 1st difference at 1% level of the significant which is integrated of order I (1).

## Residual Diagnostic

The model of study is tested for normality. The histogram graph shows the normality and normal trend of data. The goodness of fit and normal distribution of the residuals is shown by (JB) test. If the probability value of JB is greater than the 0.05 level of significance then we can conclude that the residuals are normally distributed. In this connection, in our analysis the JB test probability value is 2.1786 which is greater than 0.05 hence, it is concluded that data are normally distributed as evident in current study.

Table 2 Breusch-Godfrey and Breush-pagan-Godfrey Tests

Breusch-Godfrey Serial Correlation LM test		Heteroscedasticity Test Breusch-Pagan-Godfrey	
F Statistics	0.1143	F Statistics	0.7716
P value	0.8929	P value	0.7043

The model is tested for the problem of autocorrelation and heteroscedasticity test under the BG and BPG test and found that there is no problem of autocorrelation and heteroscedasticity as the p value is more than critical.

Table 3 Bound Test

Model	F-statistics	Critical Values	Significance
ln (AGDP) = ln (WA, INF, CPI, FR)	7.5898	181-293 214-334	10% 5%

	2.44-3.71	2.5%
	2.82-4.21	1%

The F bound test is run to check the long run association. The calculated FS is 7.5898 which is greater than the upper bound in 1, 2.5, 5, and 10 percent levels of significance. Thus, we conclude that there is a long-run relationship between the variables.

Table 4 Long Run Coefficients of ARDL Model

Variables	Coefficients	Std. Error	t statistics
lnWA	0.3395	0.0185	18.333**
lnINF	-0.0658	0.0441	-1.4904
lnFR	0.1724	0.0565	3.0489**
lnCPI	2.6481	0.3153	8.3968**

Note: \*\* p < 0.01, \* p < 0.05, p < 0.1.

Table 4 shows the long run relationship amid variables. All variable shows a positive and significant relationship with agricultural GDP except one variable inflation. 1% increase in water availability caused a 0.33% increase in agricultural GDP assuming all other variables constant. One percent increase in foreign remittances caused a 0.17% increase in agricultural GDP assuming other variables constant. 1% increase in crop production caused 2.64% increase in agriculture GDP assuming all other variables constant.

Table 5 ECM

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D (LNAGDP (-1))	0.232795	0.096613	2.409563	0.0303
D (LNCPI)	1.198939	0.254096	4.718441	0.0003
D (LNFR)	0.213209	0.063932	3.334941	0.0049
D (LNFR (-1))	0.088388	0.067244	1.314442	0.2098
D (LNFR (-2))	-0.090673	0.061087	-1.484314	0.1599
D (LNFR (-3))	0.183713	0.058112	3.161375	0.0069
D (LNINFLATION)	-0.016189	0.029150	-0.555366	0.5874
D (LNINFLATION (1))	-0.049453	0.030529	-1.619847	0.1276
D (LNINFLATION (2))	-0.056519	0.035351	-1.598783	0.1322
D (LNWA)	0.012652	0.088804	0.142466	0.8887
D (LNWA (-1))	-0.158779	0.099132	-1.601700	0.1315
D (LNWA (-2))	-0.212400	0.095240	-2.230152	0.0426
D (LNWA (-3))	-0.222871	0.100072	-2.227104	0.0429
D (LNWA (-4))	-0.222384	0.074135	-2.999709	0.0096
CointEq (-1)*	-0.764220	0.109407	-6.985120	0.0000
R-squared	0.822689	Mean dependent var		0.065176
Adjusted R-squared	0.684781	S.D. dependent var		0.104417
S.E. of regression	0.058624	Akaike info criterion		-2.532380
Sum squared resid	0.061863	Schwarz criterion		-1.852149
Log likelihood	56.78426	Hannan-Quinn criter.		-2.303503
Durbin-Watson stat	2.032404			



The ECM is significant at 1 percent significance level. However, negative value of ECM strengthens the presence of the LR relationship between the variables. The value of ECM shows the speed of adjustments from the equilibrium in AGDP of Pakistan of the previous year to equilibrium in the current year is 76 percent. R-squared is 0.82, which shows 82% variation in the AGDP is clarified through the explanatory variables which are Remittances, Crop production index, water availability and inflation.

## DISCUSSION

All the results and the findings of this present study shows us that when remittance is spent on a specific sector or inflows for a specific reason it can have much more considerable effect. This paper analyzed that in our case the government should make such policies to encourage people that they should invest in agriculture sector and also use those remittances in productive way send by the migrant's household members. Our analysis considers the fact that an increase in foreign remittances received by Pakistan has significant and positive impact on AGDP rate as shown by this study as well ([World Bank, 2022](#)). The long run elasticity of international remittance was 0.177 % with a good sign, substantial at one per cent degree of significance. It was realized that 1% increase in the overseas remittance boost AGDP by 0.177% in the long run. A general good connection between agricultural output and remittances is confirmed by the findings ([OECD, 2020](#)). Thus, no research emerges for bad behavioral modifications that negatively affect farming productivity. Thus, we are able to conclude that remittances help us to raise general harvest output and may be ideal for Pakistan's goal to boost the community food safety. This is of great value thinking about the growing level of basic foods the nation is importing.

The researchers used panel data techniques for estimation to check long-term effect of remittances on agriculture along with the other variable such as temperature, cultivated area, credit, fertilizers, and labor force. The findings by researchers revealed that remittances inflow increase agricultural output. According to study, remittances stimulate farming development in Pakistan as households who migrated to various areas of globe spent on purchase of farming land, latest farming equipment, raw material like fertilizers and seeds, for farming ([IFAD, 2021](#)). Results of this analysis discovered that families generated many kinds of financial tasks, like small scale company, purchasing property, and purchase of business acreage. The previous researcher shows positive significance of remittances ([Jawaid, 2012](#)). The suppleness of crop production index was 2.648 % with a good sign, significant at one per cent degree of significance. It was realized that 1% increase in CPI boost AGDP by 2.648% in long run. Based on study when the harvest production boosts it boosts exports that produce revenue that revenue once again purchase agriculture area results to increased agriculture GDP ([FAO, 2022](#)). If we encourage the domestic industry, it means there is an increase in exports which leads to the decrease in imports.

So basically, rise in crop production index will raise the economy in a healthy way. The long run effect of water availability is 0.339% at one percent level of significance. It was realized that 1% increase in the WA boost AGDP by 0.339% in long run. Water is the main need for agriculture so it influences agricultural GDP. The investigation's essential goal was to study the impact of foreign remittance on Pakistan's agricultural development. The empirical results reveal that the transfer of funds plays a

vital role in meeting the agricultural sector's needs. In developing countries like Pakistan, overseas payments will lead to an increase in country's economic growth and prosperity. The study concludes that sustainable inflows of remittance in the economy will reduce borrowing from the world market. Hence, the country will achieve economic growth in the future. To harness the benefits of remittances for agricultural development, targeted policy interventions, improved access to financial services, capacity building, and infrastructure development are crucial (World Bank, 2022; UNCTAD, 2023). By creating an enabling environment, Pakistan can ensure that remittances contribute effectively to agricultural productivity, sustainability, and rural development, leading to enhanced livelihoods and economic growth.

## CONCLUSION

The investigation's essential goal was to examine the impact of foreign remittance on the Pakistan's agricultural development. The empirical results reveal that the transfer of funds plays a vital role in meeting the agricultural sector's needs. In developing countries like Pakistan, overseas payments will lead to an increase in the country's economic growth and prosperity. Most of findings are inflationist earlier studies; foreign remittances, inflation, and crop production index have positive and significant results. The study concludes that sustainable inflows of remittance in economy will reduce borrowing from the world market. Hence, the country will achieve economic growth in the future. To harness the benefits of remittances for agricultural development, targeted policy interventions, improved access to financial services, capacity building, and infrastructure development are essential. By creating an enabling environment, Pakistan can ensure that remittances contribute effectively to agricultural productivity, sustainability, and overall rural development, leading to enhanced livelihoods and economic growth.

## Recommendations

1. The policymakers should devise policies to provide the migrant households with promising investment chances and incentives in agriculture that will further contribute to productive and sustainable agricultural development.
2. This study recommends that government and other bodies need to inspire recipient families, to use remittance in agricultural productive activities to facilitate migrants and their families to redirect remittance to agricultural sector.

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