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## NEXUS BETWEEN FDI, AGRICULTURE, AND RURAL DEVELOPMENT: EVIDENCE FROM ASIAN COUNTRIES

 **Sujan Chandra Paul<sup>a</sup>** †

**Nusrat Jahan<sup>b</sup>**

**Ashim Kumar Nandi<sup>c</sup>**

**Md. Asiqur Rahman<sup>d</sup>**

<sup>a,d</sup>Assistant Professor, Department of Accounting and Information Systems, University of Barishal, Bangladesh.

<sup>b</sup>Assistant Professor, Department of Marketing, University of Barishal, Bangladesh.

<sup>c</sup>Assistant Professor, Department of Sociology, University of Barishal, Bangladesh.

† ✉ [sujan9099@gmail.com](mailto:sujan9099@gmail.com) (Corresponding author)

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### ABSTRACT

The aim of this study is explore the effect of foreign direct investment on agriculture and rural development. For this, panel data of 46 countries from Asia were accumulated for the time frame 1991–2018. The models OLS, POLS, 2SLS, and GMM are employed in this study. The study reveals that there is a favorable association between foreign direct investment and agricultural land as percentage of total land using the models OLS, POLS, 2SLS. In stark contrast, value added for agriculture, forestry, and fishing has an unfavorable association with foreign direct investment in all models employed in the study. Furthermore, female employment in agriculture has a negative association with foreign direct investment in OLS, 2SLS and GMM models, whereas male employment in agriculture has a negative association with foreign direct investment in the POLS model only. Land under cereal production has a favorable association with foreign direct investment in all models except POLS, and permanent cropland has a favorable association with foreign direct investment in all models except GMM. In addition, rural population has a positive relationship with foreign direct investment in OLS, POLS and 2SLS and a negative relationship with foreign direct investment in GMM.

**Contribution/Originality:** This study contributes to providing evidence on the effects of foreign direct investment on agriculture and rural development. Different types of models were used in this study to find out the relationship between foreign direct investment and certain variables relating to the agriculture and rural development of 46 asian countries.

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## 1. INTRODUCTION

In a study conducted by [Chaudhuri and Banerjee \(2010\)](#), where a three-sector general equilibrium model with simultaneous unemployment of both skilled and unskilled labor was used to investigate the effects of foreign direct investment (FDI) in agricultural land in a developing economy. The findings of that study demonstrate unequivocally that FDI in agriculture not only boosts national welfare, but also helps to alleviate the unemployment

problem in both forms of labor. This paper, therefore, logically supports the significance of FDI inflow in agriculture in emerging countries.

A study by Onphanhdala, Suruga, Daigaku, and Kenkyūka (2013), where the researchers conducted field surveys between 2009 and 2011 in Oudomxay Province, Northern Laos, demonstrated that Chinese investment has changed the agriculture sector from subsistence to commercial farming. It is evident from that study that Chinese investment has a major impact on poverty alleviation and income inequality. Unfortunately, these benefits are not available to all households or communities. Uneven development across families and communities is essentially rooted in the first era and Chinese merchants' manufacturing choices.

Anwar, Saeed, Khan, and Ahmad (2013) identified that GDP and trade openness have a positive and considerable association with FDI inflows in the Pakistani agriculture sector, but government debt has a negative and significant relationship. The findings also showed that in Pakistan's agriculture sector there is a positive association between inflation and FDI inflows, whereas the exchange rate has a negative relationship, though both of these factors are trivial.

Moreover, Wang, Xie, Zhang, Wang, and Yu (2019) used the Slack-based Measure and Malmquist-Luenberger (SBM-ML) index method to quantify the agricultural Green Total Factor Productivity (GTFP) of 24 provinces of China in the period 2004–2016, bringing the undesirable output of agricultural carbon emissions into the agricultural Total Factor Productivity (TFP) accounting framework as a measure of GTFP. Using the two-step system generalized moment method (GMM), the influence of agricultural FDI on the rise of agricultural GTFP and other sub-items was also revealed. The average annual growth rate of agricultural GTFP was 3.1%, with a 52% contribution rate to agricultural growth. The growth of agricultural GTFP shows that, with advancement in agricultural technology accompanied by a decline in agricultural technical efficiency, agricultural GTFP rose in the Eastern, Central, and Western regions. Although agricultural FDI has a considerable enhancing influence on agricultural GTFP and sub-items, in the long run it has an inverted U-shaped pattern.

Furthermore, between 1990 and 2017, Mivumbi, Wangping, and Xiaoling (2019) examined the link between Rwandan economic development, agricultural FDI, agricultural employment, and rural population. The co-integration with the constant level relationship of variables was investigated using the autoregressive distributed lag (ARDL) "bounds" test technique. The ARDL model estimates co-integration coefficients while the ECM model estimates short-run coefficients after verifying the long run (co-integration) equilibrium connection of economic growth within variables. These workers discovered that Rwandan economic growth is now contingent on foreign direct investment, with agriculture serving as a growth engine for the country. Economic growth has a causal link with the population of rural regions, but FDI and employment in agriculture have no direct relationship with economic growth. Rwanda, according to the report, should have the ability to absorb sophisticated agricultural technologies in order to fully benefit from FDI. Rwanda's government should push macroeconomic measures to entice FDI while also encouraging agricultural economic growth.

Additionally, Chaudhary (2018) found that the agriculture sector's results are unsatisfactory for a number of reasons. More than half of the population is now food insecure as a consequence of this scenario. The agriculture industry has had bleak results as a result of inadequate policy and execution. Hence, the Nepalese government, in collaboration with other relevant authorities, should efficiently execute agriculture policies in order to diminish poverty and promote rural development. For poverty reduction and rural development, agriculture-rural accommodating policies and effective performance are pivotal.

Rashid and Razak (2016) empirically explored the key drivers of FDI in the agriculture sector using high-income emerging economies in OIC nations as a case study. Agriculture sectors respond as critical components of any economy's expansion in order to alleviate poverty. Therefore, it inspected agriculture investment experiences in a number of member countries to identify possible roles for nations seeking FDI and their development partners in fostering FDI within the OIC, particularly in agriculture fresh investment. In this study, FDI in agriculture responds as a dependent variable while economic determinants such as market size, inflation, poverty, exchange rate, and infrastructure are independent variables in chosen OIC countries (Malaysia, Oman, and Brunei).

In light of the above-mentioned studies, this paper attempts to determine the relationship between FDI, agriculture, and rural development in Asian countries. The paper comprises five parts, with the second part giving a review of the literature while section three describes the methods used in the study; part four sheds light on the findings and discussion and finally the paper concludes with some viable recommendations and conclusions.

## 2. LITERATURE REVIEW

According to Chaudhuri and Yabuuchi (2010) one of the most contentious policy problems in many emerging economies, including India, is the establishment of Special Economic Zones (SEZ) that use agricultural land to encourage industrialization. Their study gauged the policy's implications with the help of a three-sector, Harris-Todaro-type general equilibrium model that represents a typical emerging economy. It concludes that agriculture and SEZ may both flourish simultaneously if the government invest a significant portion of its resources in irrigation projects and other infrastructure development aimed at fostering land efficiency. In addition, this approach may also boost agricultural wages and aggregate employment in the economy.

Tambuman (2014) demonstrated that the presence of FDI in agriculture does not inevitably contribute a lot to the well-being of small farmers. It depends on the business strategies they use to relate their output to small farmers in the area. The most intriguing insights of this study comprises (1) contract farming, particularly the plasma and nucleus system, which is the most popular in Indonesia; (2) some partnerships failed to benefit local farmers, denoting that there are some preconditions for a successful partnership; and (3) there is no evidence to date that successful

partnerships will have positive impacts on agricultural productivity, rural income, and economic growth. Despite the paucity of data, that study indicates that the sort of business model employed has a significant impact on whether investment improves market access and, hence, the income of small farmers in the area. Given that the overall climate is favorable, any sort of commercial collaboration will benefit plasma farmers and have a good multiplier impact on rural areas.

The study by [Izuchukwu, Huang, Shehu, and Olufemi \(2012\)](#) showed that the agricultural sector plays a pivotal role in the growth of the overall economy of Nigeria. Nevertheless, despite several government initiatives, the sector is still characterized by low yields and limited areas under cultivation, particularly due to government dependence on a mono-agricultural economy based on oil. To analyze the impacts of FDI on agricultural sector growth in Nigeria between the years 1980 and 2009, a vector autoregression (VAR) model and a three-step approach were utilized. Here, the Augmented Dickey Fuller (ADF) and Philips–Parron (PP) unit root tests were also used. The multivariate cointegration test by Johansen and Juselius indicates that cointegration is present. The results of the Granger causality test demonstrate that the variables used have a bidirectional, unidirectional, and no causal connection. More FDI should not only be sourced in order to boost agricultural output and develop the sector as a whole; but the government should also impart a legal and administrative quality framework and encourage more agricultural exportation, which will enhance foreign exchange earnings and facilitate the competitiveness of Nigerian agricultural produce in the international market.

[Santangelo \(2018\)](#) analyzed the impact of FDI on land in agriculture in developing countries and found that the impact varied depending on the investor's country of origin. Due to domestic institutional pressure for human rights respect and responsible agricultural behavior, as well as positive spillovers, FDI in land by developed-country investors has a beneficial impact on food security through expansion of land used for crop production. On the contrary, FDI in land by developing-country investors has an adverse impact on food security by reducing farmland owing to domestic institutional pressure to conform to national interests and government policy objectives, as well as negative spillovers.

Foreign direct investment has been utilized as a strategy in rising nations that have created a real shift in their economies, according to [Douansouvanh, Qijun, and Kombate \(2019\)](#). However, no research has been done to determine how these changes have helped the country's poverty reduction and economic growth. Therefore, in order to fill a research vacuum, this article sought to determine how FDI's role in agriculture development, such as job creation, tax payment, and knowledge and technology transfer, contributes to poverty reduction in a nation. The Lao People's Democratic Republic was utilized as a case study, and 450 respondents were gathered using a self-administered survey questionnaire (face to face with interaction with the participant). The findings showed that FDI involvement in agriculture development through job creation and FDI tax payments have a strong short-term impact on poverty alleviation, but a weak long-term impact. However, FDI transfer of knowledge and technology has a weak short-term impact on poverty alleviation but a greater long-term impact. Transfer of knowledge and technology is a critical asset that emerging economies require from FDI in order to stimulate change and contribute to economic success.

A study by [Houjian \(2010\)](#) examined how FDI affects the urban–rural income gap, using panel data between 1992 and 2007. The results suggest that FDI influx can limit widening of the urban–rural income disparity. Moreover, FDI is an endogenous variable for closing the income gap between urban and rural areas. Fiscal expenditure is a vital element in the tendency of the income gap between urban and rural in the control variables, although economic growth and physical capital accumulation may considerably lower the income gap between urban and rural, while the accumulation of human capital and the degree of opening up have no discernible effect on the income difference between urban and rural areas.

[Chen, Hsu, and Fan \(2014\)](#) conducted a comparative review of China's and Africa's distinct development paths and current policy contexts. The authors discuss China's development lessons as well as policy recommendations for China–Africa engagement in areas such as agricultural and rural development, openness and liberalization, evidence-based policymaking, pro-poor policies, institutions, and capacity.

A study by [Lv, Wen, and Xiong \(2010\)](#) demonstrated that agricultural market size has a substantial positive influence on FDI inflow to China's agriculture while agricultural import has a negative effect. Although agricultural export has a beneficial effect, it is not statistically significant. The report states that the direction of FDI policy during China's agricultural opening process is still vague, and the reduction in the proportion of fiscal spending is evidently not favorable to attracting more FDI to China's agriculture. Additionally, the performance index indicates that inbound FDI performance in China's agriculture is growing, but not according to the satisfaction of its market size.

A research carried out by [Chun-Ying \(2010\)](#) used a vector error correction model, cointegration, and the Granger causality test to investigate the connection between foreign direct investment and the urban–rural income disparity in Jiangsu Province from 1986 to 2007. The empirical findings showed that the connection between FDI and the urban–rural income gap is constant over time. As a consequence of FDI, the income gap between urban and rural areas has widened. Between foreign direct investment and the urban–rural income divide, the Granger causality connection did not exist. Finally, the empirical findings were examined as well as the policy implications.

[Gunasekera, Cai, and Newth \(2015\)](#) utilized the dynamic Global Trade Analysis Project (GDP) model to study the possible implications of increased land productivity and foreign direct investment in Africa. Their findings showed that combining measures to improve land productivity with FDI development may boost Africa's share of global agricultural output and exports, notably in the areas of oil seeds, sugar, and cotton.

Zhuang and Chen (2008) found that FDI in the service industry had a noteworthy direct and indirect influence on the host country's industrial structure adjustment. The paper's empirical research in Guangzhou demonstrates that the impact of FDI in the service industry on economic growth and structural adjustment varies greatly depending on the stage of economic development. In this case, FDI is the driving force behind the service industry's internal reorganization. Further investigation reveals that the effect of FDI on the circulation industry in Guangzhou is greater than the effect on production service and real estate, and the effect on social services is less obvious, which is consistent with the shifting path of FDI among various sectors of the service industry since 2000. Therefore, FDI in the service sector has a significant impact on structural adjustment. Finally, strategies for improving the service industry's internal structure are proposed.

Rashida and Razaka (2019) found that poverty is an influential factor for FDI in agriculture inflows, and FDI in agriculture inflows has a negative and substantial influence on poverty reduction. Following that, the study's policy implications are explored, along with some recommendations.

The study carried out by Gorton and Guba (2002) revealed that the Hungarian dairy-processing sector underwent substantial reorganization throughout the transition period. By acquiring larger processing units, streamlining manufacturing, and cutting staff, foreign investors have spearheaded this reorganization. They have put in place more formal contracting arrangements, supporting the expansion of a limited group of medium-sized dairy farms while excluding micro-producers. The latter are unable to fulfill quality control standards and mostly produce for informal marketing channels.

Kalkidan (2017) studied the influence of FDI influx on the growth of Ethiopia's agriculture industry from 1985 to 2016. The vector error correction model was employed due to the nonstationarity of the macro variables utilized in the model and the presence of cointegration. To validate the model, it was examined for serial correlation, multicollinearity, heteroscedasticity, and omitted variables. In Ethiopia, FDI was found to have a beneficial influence on agricultural growth. According to the research, the Ethiopian government should develop policies that would generate an enabling climate for increased FDI inflows. Because an unchecked flood of foreign investors destroys native new businesses, the regulations should be implemented with prudence. Existing rules to limit excessive profit repatriation and divestments should also be reviewed by policymakers.

According to Mwijarubi (2019), Tanzania has attempted to restructure its economy in order to gain the full benefits of capitalism. The agricultural industry is one of the vital sectors it has attempted to focus on, which employs the great majority of Tanzanians. Any increase in sector productivity will assist the vast majority. The government of the United Republic of Tanzania, which is a significant stakeholder in the industry, is pushing for more foreign direct investment. Unfortunately, the FDI inflow has had little impact on agriculture, disrupting rural livelihoods and causing food insecurity among peasant communities in several situations. The solution to enlarge production in agriculture is to invest more in the existing framework of small scale farming.

Wang and Li (2011) investigated the link between FDI and the rural-urban income disparity in China from a theoretical and empirical viewpoint, and provided a theoretical synthesis. From the theoretical analysis, they first utilized the classical production function framework to investigate the inherent relationship between FDI and the rural-urban income difference. It has been shown that FDI has boosted the non-agricultural economy and is expected to widen the rural-urban economic divide. As a result, they present the industrial structure adjustment mechanism and examine the connection between FDI and the rural-urban income gap using data from 1979 to 2009. The empirical findings demonstrate that FDI expansion lowered the share of rural residents' income in total national income, whereas it had a substantial beneficial influence on urban residents' income growth. It, therefore, confirms the theoretical prophecy that FDI may widen the income disparity between urban and rural areas. As a result, the study suggests that they should promote rural society reform, free rural productive force, and reduce the negative effects of FDI on the urban-rural income gap by modifying FDI industrial locations and boosting employment.

Investigation of the function of FDI in the Indian economy's agriculture sector and examined the influence of FDI on agriculture. FDI is one of the most important vehicles for increasing job possibilities in the agriculture sector through commercialization and modernization, as the industry employs 52% of the workforce. The agriculture industry contributes around 15% to the national economy, and there is ample room for growth in food processing, farm services, and infrastructure. Agricultural and FDI growth have an inverse relationship, which indicates that a substantial percentage of FDI does not go to agriculture. The government should make agriculture a top priority in order to boost production and meet the rising need for food security, as well as to work toward the welfare of small and marginalized farmers. In the agricultural sector, a public-private partnership approach will be beneficial in filling the savings investment gap. To address the limitations of foreign investments, a robust regulatory framework should be used to safeguard customers and marginal farmers.

A study by Jiang and Shi (2014) studied China's attractiveness for foreign direct investment (FDI) and found that FDI has been rising year after year as a result of reform and opening up, as well as ongoing economic growth and development. FDI, however, is spread unevenly among the three major industrial sectors. The study discovered that the amount and scope of FDI used in agriculture lagged considerably behind the industrial and service sectors, and that it was dispersed unevenly across geographical areas as a result of our research. The problem of "agricultural, rural regions and farmers" has long been one of the most crucial and challenging in China's economic reform process. The major focus of this article is on the effects of FDI on the agricultural sector of the macro-economy and how they should fully utilize FDI to reduce China's agricultural trade deficit and improve agricultural commodities' international competitiveness.

### 3. METHODS

This paper conducted exploratory analysis by using the following data and techniques.

#### 3.1. Data

Secondary panel data of 46 countries in Asia for the period 1991–2018 were compiled from the World Bank's World Development Indicators. The data comprise information that considers nine variables. To conduct the analysis, it was first log normalized. After, the data are first degree separated to eliminate the autocorrelation problem.

#### 3.2. Methods

This paper administered a step-by-step model-based composite analysis. The Ordinary Least Squares (OLS) model was used first to define the relationship between FDI and certain variables related to agriculture and rural development among the 46 countries in Asia. Then the Pooled Ordinary Least Squares (POLS) model was used to determine the relationship between FDI and certain variables related to agriculture and rural development. After, to describe the relationship between FDI and certain variables related to agriculture and rural development, the two-stage least-squares model (2SLS) was deployed capitalizing STATA 15. Finally, the Generalized Method of Moments (GMM) was applied to classify important explanatory variables that can explain why FDI and certain variables related to agriculture and rural development are related.

#### 3.3. Variables and Description

Here, net inflow (BoP, current) is expressed in billion USD while lnFDI denotes log normal of foreign direct investment. LnALpla indicates log normal of agricultural land, this variable being expressed as percentage of land area of a country; LnAFFpgdp denotes log normal of value added for agriculture, forestry, and fishing, expressed as percentage of gross domestic product. Moreover, LnEAFpfe denotes log normal of employment in agriculture (female) and is expressed as percentage of total female employment. In addition, LnEAMpme indicates log normal of employment in agriculture (male), expressed as percentage of total male employment. LnLCPhec indicates log normal of land under cereal production, expressed as hectares; LnPCpla denotes log normal of permanent cropland, expressed as percentage of total land area. LnRPptp denotes log normal of rural population, expressed as percentage of total population; LnRP denotes log normal of rural population, expressed as absolute value.

## 4. RESULTS AND DISCUSSION

#### 4.1. Descriptive Statistics

All variables used in the descriptive statistics are listed below. For each statistic, the table depicts the number of measurements, mean value, standard deviations, and minimum and maximum values.

Table-1. Descriptive statistics.

Variable	Obs.	Mean	Std. Dev.	Min.	Max.
Year	1288	2004.5	8.081	1991	2018
FDI	1244	6.286e+09	2.396e+10	-1.018e+10	2.909e+11
ALpla	1188	35.102	23.726	0.931	83.981
AFFpgdp	1156	13.68	11.143	0.025	57.239
EAFpfe	1288	33.646	26.847	0.01	90.65
EAMpme	1288	30.793	20.404	0.08	83
LCPhec	1224	7262010.8	19785684	4	1.057e+08
PCpla	1280	3.465	4.984	0.001	26.667
RPptp	1288	45.819	24.251	0	90.82
RP	1285	50178048	1.566e+08	0	8.923e+08

Table 1 summarizes the data from the 46 countries over the 28 years based on nine variables. The prominent dependent variable, FDI, shows an average of 6.28 billion dollars for the countries surveyed, with a very high standard deviation of 2.39 billion dollars. This indicates that there is a significant deviation in FDI among the countries of the world. The average agricultural land (percentage of land area) is 35.10%, with a standard deviation of 23.72%. The mean value of value added in agriculture, forestry, and fishing (percentage of gross domestic product) is 13.68%, with 11.18% standard deviation. The average female employment in agriculture is 33.64% of total female employment, while the average male employment in agriculture is 30.79% of total male employment, with 26.84% and 20.40% standard deviation, respectively. The average land under cereal production is 7.26 million hectares, with 19.78% standard deviation. The mean value of permanent cropland is 3.46% of total land area, with standard deviation of 4.98%. The average value of rural population is 45.81% of the total population, with standard deviation of 24.25% and the mean value of the rural population is 50.17 million.

## 4.2. Pairwise Correlation Matrix

Table-2. Matrix of correlations.

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) FDI	1.000								
(2) ALpla	0.100	1.000							
(3) AFFpgdp	– 0.106	0.268	1.000						
(4) EAFpfe	– 0.050	0.271	0.792	1.000					
(5) EAMPme	0.002	0.280	0.822	0.888	1.000				
(6) LCPhec	0.550	0.259	0.102	0.248	0.272	1.000			
(7) PCpla	– 0.025	0.017	–0.071	–0.098	0.017	–0.022	1.000		
(8) RPptp	– 0.023	0.234	0.746	0.849	0.836	0.233	0.142	1.000	
(9) RP	0.515	0.222	0.103	0.247	0.263	0.983	–0.015	0.237	1.000

In order to identify the impact of FDI on agriculture and rural development (Table 2), we analyze correlations among the variables sourced from the literature. A combined correlation matrix is given below to report the variables.

## 4.3. Econometric Models

The dependent (LnFDI) and independent variables (LnALpla, LnAFFpgdp, LnEAFpfe, LnEAMPme, LnLCPhec, LnPCpla, LnRPptp, LnRP) are used in multiple regression models. The effects of such models are demonstrated and interpreted in the following section.

Table-3. OLS model.

LnFDI	Coef.	St. Err.	t-value	P-value	[95% Conf. Interval]	Sig.
LnALpla	0.417	0.082	5.09	0	0.257 0.578	***
LnAFFpgdp	-1.654	0.14	-11.79	0	-1.929 -1.378	***
LnEAFpfe	-0.249	0.087	-2.88	0.004	-0.42 -0.079	***
LnEAMPme	0.137	0.143	0.96	0.339	-0.144 0.418	
LnLCPhec	0.245	0.058	4.21	0	0.131 0.36	***
LnPCpla	0.18	0.034	5.33	0	0.114 0.247	***
LnRPptp	0.245	0.186	1.32	0.187	-0.119 0.61	
LnRP	0.489	0.074	6.61	0	0.344 0.635	***
Constant	10.975	0.643	17.08	0	9.714 12.237	***
Mean dependent var.	20.309		SD dependent var.	2.515		
R-squared	0.513		Number of obs.	935.000		
F-test	122.070		Prob > F	0.000		
Akaike crit. (AIC)	3721.955		Bayesian crit. (BIC)	3765.520		

Note: \*\*\*  $P < 0.01$ , \*\*  $P < 0.05$ , \*  $P < 0.1$ .

Table-4. POLS model.

LnFDI	Coef.	St. Err.	t-value	P-value	[95% Conf. Interval]	Sig.
LnALpla	0.693	0.241	2.88	0.004	0.222 1.165	***
LnAFFpgdp	-2.129	0.178	-11.96	0	-2.478 -1.78	***
LnEAFpfe	-0.064	0.163	-0.40	0.692	-0.383 0.254	
LnEAMPme	-0.694	0.321	-2.16	0.031	-1.323 -0.065	**
LnLCPhec	0.115	0.107	1.07	0.284	-0.095 0.325	
LnPCpla	0.376	0.098	3.82	0	0.183 0.569	***
LnRPptp	-0.188	0.341	-0.55	0.582	-0.857 0.481	
LnRP	1.024	0.154	6.65	0	0.722 1.325	***
Constant	8.089	1.611	5.02	0	4.932 11.246	***
Mean dependent var.	20.309		SD dependent var.	2.515		
Overall r-squared	0.491		Number of obs.	935.000		
Chi-square	585.179		Prob > chi2	0.000		
R-squared within	0.411		R-squared between	0.612		

Note: \*\*\*  $P < 0.01$ , \*\*  $P < 0.05$ , \*  $P < 0.1$ .

Table 4 shows the POLS model demonstrating that there is a significant positive relationship between FDI with agric The ordinary lease squares model Table 3 shows that foreign direct investment has a significant positive

relationship with agricultural land, land under cereal production, permanent cropland, and rural population. It implies that an Asian country having more agricultural land, land under cereal production, permanent cropland, and rural population can attract more FDI. On the contrary, the chart depicts that the value added of agriculture, forestry, fishing, and female employment in agriculture have a significant negative relationship with FDI. Furthermore, other variables such as male employment in agriculture and rural population as a percentage of total population have a positive relationship with FDI.

ultural land, permanent cropland, and rural population. It implies that an Asian country having more agricultural land, permanent cropland, and rural population can entice more FDI. In contrast, value added for agriculture, forestry, and fishing and male employment in agriculture depicts a significant negative relationship with FDI. Other variables, including female employment in agriculture, land under cereal production, and rural population as a percentage of total population, show a mixed relationship with FDI.

Table-5. 2SLS model.

**Instrumental variables (2SLS) regression**

LnFDI	Coef.	St. Err.	t-value	P-value	[95% Conf	Interval]	Sig.
LnALpla	0.417	0.082	5.09	0	0.257	0.578	***
LnAFFpgdp	-1.654	0.14	-11.79	0	-1.929	-1.378	***
LnEAFpfe	-0.249	0.087	-2.88	0.004	-0.42	-0.079	***
LnEAMpme	0.137	0.143	0.96	0.339	-0.144	0.418	
LnLCPhec	0.245	0.058	4.21	0	0.131	0.36	***
LnPCpla	0.18	0.034	5.33	0	0.114	0.247	***
LnRPptp	0.245	0.186	1.32	0.187	-0.119	0.61	
LnRP	0.489	0.074	6.61	0	0.344	0.635	***
Constant	10.975	0.643	17.08	0	9.714	12.237	***
Mean dependent var.	20.309		SD dependent var.		2.515		
R-squared	0.513		Number of obs.		935.000		
F-test	122.070		Prob > F		0.000		

Note: \*\*\*  $P < 0.01$ , \*\*  $P < 0.05$ , \*  $P < 0.1$ .

The results of the 2SLS model (Table 5) show that FDI has a substantial positive relationship with agricultural land, land under cereal production, permanent cropland, and rural population, which suggests that an Asian country having more agricultural land, land under cereal production, permanent cropland, and rural population can attract greater FDI. On the contrary, value added for agriculture, forestry and fishing, and female employment in agriculture has a significant negative relationship with FDI. Moreover, other variables such as male employment in agriculture and rural population as a percentage of total population have a positive relationship with FDI, but although the nature of that relationship is insignificant for FDI, the overall model is significant at the 10% level.

Table-6. GMM model.

LnFDI	Coef.	St. Err.	t-value	P-value	[95% Conf	Interval]	Sig.
L.LnFDI	0.388	0.04	9.64	0	0.309	0.467	***
LnALpla	0.65	0.841	0.77	0.439	-0.998	2.298	
LnAFFpgdp	-1.523	0.184	-8.28	0	-1.884	-1.163	***
LnEAFpfe	-0.448	0.203	-2.20	0.028	-0.847	-0.05	**
LnEAMpme	-0.676	0.43	-1.57	0.116	-1.518	0.166	
LnLCPhec	0.425	0.142	2.99	0.003	0.146	0.703	***
LnPCpla	0.327	0.244	1.34	0.18	-0.152	0.806	
LnRPptp	0.6	0.527	1.14	0.255	-0.433	1.633	
LnRP	-1.301	0.608	-2.14	0.032	-2.493	-0.109	**
Constant	29.712	9.611	3.09	0.002	10.876	48.549	***
Mean dependent var.	20.503		SD dependent var.		2.303		
Number of obs.	810.000		Chi-square		966.380		

Note: \*\*\*  $P < 0.01$ , \*\*  $P < 0.05$ , \*  $P < 0.1$ .

The GMM (Table 6) model shows a significant positive relationship for FDI with land under cereal production and rural population, which indicates that an Asian country with greater land under cereal production and rural population can attract more FDI. Conversely, value added for agriculture, forestry and fishing, and female employment in agriculture demonstrates a significant negative relationship with FDI. In addition, other variables such as agricultural land, male employment in agriculture, permanent cropland, and rural population as a percentage of total population render a mixed relationship with FDI.

## 5. CONCLUSION

This paper sought to examine the effect of FDI on agriculture and rural development with the help of panel data from 46 Asian countries during the time frame 1991–2018. The findings of this study show that there is a favorable association between FDI and agricultural land as percentage of total land using the models OLS, POLS, and 2SLS.



However, value added for agriculture, and forestry and fishing shows an unfavorable association with FDI in all the models used in the study. Female employment in agriculture has a negative association with FDI in the OLS, 2SLS, and GMM models while male employment in agriculture has a negative association with FDI in the POLS model only. Furthermore, the paper depicts a favorable association between lands under cereal production and FDI in all models except POLS. Additionally, permanent cropland has a favorable association with FDI in all models except GMM. Finally, it shows that rural population has a positive association with FDI in the OLS, POLS, and 2SLS models but a negative association in the GMM model.

Due to database constraints, this study used statistics based solely on Asian countries. Moreover, as the study takes into consideration data spanning a period of 28 years, the evidence would be more convincing if the data covered a longer period in time. Besides, for research purposes, data must be transformed, which could likely result in inconsistency; and several factors were omitted from this study. Other than the foregoing, further future research should concentrate on determining the most significant determinants of FDI.

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Appendix-1. List of Countries.

Afghanistan	Lao PDR
Armenia	Lebanon
Azerbaijan	Malaysia
Bahrain	Maldives
Bangladesh	Mongolia
Bhutan	Myanmar
Brunei Darussalam	Nepal
China	Oman
Colombia	Pakistan
Cyprus	Philippines
Egypt, Arab Rep.	Qatar
Georgia	Saudi Arabia
India	Singapore
Indonesia	Sri Lanka
Iran, Islamic Rep.	Syrian Arab Republic
Iraq	Tajikistan
Japan	Thailand
Jordan	Timor-Leste
Kazakhstan	Turkmenistan
Korea, Dem. People's Rep.	United Arab Emirates
Korea, Rep.	Uzbekistan
Kuwait	Vietnam
Kyrgyz Republic	Yemen, Rep.