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Determinants of FDI Inflows in Agriculture Sector Using Pooled Ordinary Least Square (OLS), Pooled Generalized Least Square (GLS), Augmented Dickey-Fuller (ADF) and Philips-perron Unit Root Test

Intan Maizura Abd Rashid*, Nur Azizah Abd Rahman,
Wan Ahmad Fauzi Wan Husain, Mohd Fitri Mansor,
Irza Hanie Abu Samah and Mohammad Harith Amlus

Abstract--- *This paper presents the importance of poverty reduction, technology advancement, infrastructure and inflation rate on foreign direct investment inlows in agriculture sector. The countries selected in this study which are Czech Republic, Hungary, Latvia, Poland and Slovenia that are categorized under OECD countries needs to address important challenges through determined implementation of structural reforms. This study applies the empirical analysis and focuses on some variables which are FDI in agriculture, poverty, inflation, technology advancement and infrastructure. Data from 2005 to 2014 were collected to determine the relationship among the variables. The models that were being used are Ordinary Least Square (OLS) and Generalized Least Square (GLS), Unit Root Test based on Augmented Dickey-Fuller (ADF) test and Unit Root Test based on Philips-Perron Test. Test was performed to examine the causal relationship between poverty and FDI in agriculture, inflation and FDI in agriculture, technology advancement and FDI in agriculture and infrastructure and FDI in agriculture.*

Keywords--- *Developing OECD Countries, Poverty, FDI in Agriculture Inflows, FDI Inflows in Agriculture – Poverty Framework.*

I. INTRODUCTION

Even though somehow foreign direct investment is good and give benefits to the selected OECD countries, but sometimes it can harm the countries that involve. Foreign direct investment inflows can make the economic conditions shaking in most of OECD countries including Czech Republic, Hungary, Latvia, Poland and Slovenia because it involves the economic systems of that country. Moreover, foreign investors also will cause the political and legal systems of the country to be unstable. It is because some of the investors does not want to follow the rules stated in the contracts and not bind with the property rights of a firm in that country. Poverty is happened across the world even the countries were developed. It is not only happening in poor countries. Even though developing

Intan Maizura Abd Rashid, Lecturer, School of Business Innovation & Technopreneurship, Universiti Malaysia Perlis, Malaysia. E-mail: intanmaizura@unimap.edu.my*
Nur Azizah Abd Rahman, School of Business Innovation & Technopreneurship, Universiti Malaysia Perlis, Malaysia.
Wan Ahmad Fauzi Wan Husain, School of Business Innovation & Technopreneurship, Universiti Malaysia Perlis, Malaysia.
Mohd Fitri Mansor, School of Business Innovation & Technopreneurship, Universiti Malaysia Perlis, Malaysia.
Irza Hanie Abu Samah, School of Business Innovation & Technopreneurship, Universiti Malaysia Perlis, Malaysia.
Mohammad Harith Amlus, School of Business Innovation & Technopreneurship, Universiti Malaysia Perlis, Malaysia.

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countries is moving towards the development and improving their growth, but still they cannot eliminate the poverty problems in their countries. Technology helps a lot but it still causes too much problems in enhancing to the development of a country. Growing economic make the technology needs to be improved so that a firm in a country manages to grow in the market. The development of infrastructure will affect the poor people especially in their incomes and welfare because it will cut the cost to access in new markets, increase returns on what assets that country has and also knowledge. In addition, high inflation rates can slowdown the long term of economic growth and international investment. It is because uncertainty that occurs makes the firms afraid to invest due to the high risk and low return (Rashid & Razak, 2016).

This study applies the empirical analysis and focuses on some variables which are FDI in agriculture, poverty, inflation, technology advancement and infrastructure. Data from 2005 to 2014 were collected to determine the relationship among the variables. The models that were being used are Ordinary Least Square (OLS) and Generalized Least Square (GLS), Unit Root Test based on Augmented Dickey-Fuller (ADF) test and Unit Root Test based on Philips-Perron Test. Test was performed to examine the causal relationship between poverty and FDI in agriculture, inflation and FDI in agriculture, technology advancement and FDI in agriculture and infrastructure and FDI in agriculture in selected OECD countries.

Research Objectives

The most important objectives of the research are to study the physical and intellectual factors affecting FDI inflows in the sample countries.

II. LITERATURE REVIEW

Solomon, Md. and Rosni (2015) said that foreign direct investment is contributed by the development of the market, exchange rate, inflation rate, size of the market and also the openness towards the trade in domestic market. Foreign direct investment proven to be one of factor that leads to the growth of the economy. In addition, it also act as the based in moving the countries towards high-industrialized countries. Moreover, government should intervene in helping the firms to enhance their growth and foreign direct investment.

In addition, the increment of productivity in agriculture sector can reduce the poverty level that includes the changes of real income in a country, multiplier effect from non-farm in rural areas, the effect of price of the foods and formation of employment. Other than that, the growth of agriculture sector is believed to make the farmers get high incomes. The reduction of poverty caused by the increases of employment and production can indirectly boost the investment in the education and health (Schneider and Gugerty, 2011).

III. METHODOLOGY & FINDINGS

In this study, Ordinary least square (OLS) and weighted least square will be sometimes inefficient in interpreting the data. Generalized Least Square (GLS) Method will be used to assess the unknown parameters in a linear regression model. It used to execute the linear regression and degree of correlation between the variables. Unit root test will test whether the time series variable is either non-stationary or possesses a unit root. The null hypothesis is

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normally been characterized as the existence of a unit root and the alternative hypothesis whether it will be a stationary, trend stationary or explosive root and it depends on what test that will be used.

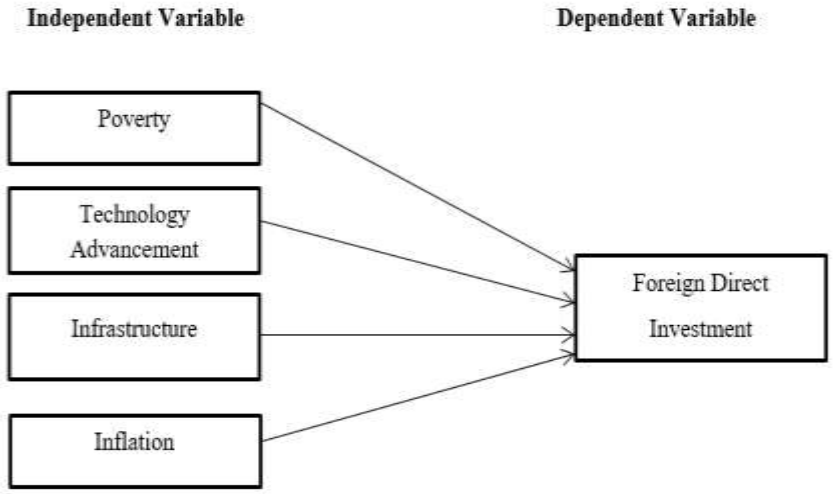

Figure 1.1: Theoretical Framework

Based on the theoretical and empirical review, the determinants of foreign direct investment in agriculture associated with poverty, technology advancement, infrastructure development and inflation can be specified as follows:

$$FDI = \alpha + \beta^{1}POV + \beta^{3}TECH + \beta^{4}INFRA + \beta^{5}INFL + \varepsilon$$

Where,

'FDI' is logarithmic value of foreign direct investment in agriculture

'POV' refers to the poverty level,

TECH' refers to technology advancement,

'INFRA' refers to the infrastructure development 'INFL' refers to inflation

Pooled Ordinary Least Square (OLS) Method

The Pooled Ordinary Least Square (OLS) Method is used to minimize the sum of the squares between the differences or errors of all the variables. Moreover, it also used to evaluate the parameter in the linear regression model. Table 1.5 explains the data that have been analyzed by using this method of study between the independent variables which are poverty, inflation, technology and infrastructure.

Table 1.1: Pooled Ordinary Least Square (OLS) Method

Variables	Coefficient	t-Statistic	P-value
Poverty	0.0811243	1.91	0.099
Inflation	0.0582766	0.96	0.34
Technology	0.2421162	0.62	0.54
Infrastructure	0.8004974	0.77	0.446
Adjusted R^2	0.1122		

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In Table 1.1, it shows the adjusted R-square of the variables is 0.1122. The t-statistic value of the poverty is the largest which is 1.91 which it can signify that the null hypothesis can be rejected as the value is not equal to zero. The P-value of technology is the highest with 0.54 where it shows that the variable is not significance.

Pooled Generalized Least Square (GLS) Method

The Pooled Generalized Least Square Method (GLS) is a method used to estimate the unknown parameters in a linear regression model. In addition, it also can be used to make the linear regression where there is correlation among the variables. The Table 1.2 below shows the estimated amount generated from all the variables which is poverty, inflation, technology and infrastructure.

Table 1.2: Pooled Generalized Least Square (GLS) Method

Variables	**Coefficient**	**t-Statistic**	**P-value**
Poverty	2.18	1.29	0.199
Inflation	0.5560664	1.02	0.31
Technology	0.22722221	0.62	0.534
Infrastructure	0.5976435	0.59	0.49
Adjusted R^2	0.0008		

Based on the Table 1.6 above, the adjusted R-square for the variables is 0.0008. The t-statistic for the infrastructure is the lowest comparing with the other variables which is 0.59. It P-value amounted 0.49 which it shown that the variable is not significant. The poverty variable t-statistic found to be 1.29 with P-value of 0.199. So, it can be simplified that the test is significant and the hypothesis can be accepted.

Unit Root Test Results

Augmented Dickey-Fuller (ADF) Test

Unit Root Test is important in determining either the data is stationary or not stationary of the time series data. The test shows the relationship between the variables, whether it is in the same order of integration. So, the analysis is done by using the Augmented Dickey-Fuller (ADF) Unit Root Test. Table 1.3 shown the results of Unit Root Test of Augmented Dickey-Fuller (ADF) in determining the properties of variables which are the FDI in agriculture, poverty, exchange rate, technology and infrastructure. The results are separated into level and first difference under intercept and intercept with trend.

Table 1.3: Augmented Dickey-Fuller (ADF) Test

Variables	ADF – Fisher Chi-Square Test			
	Intercept		Intercept + Trend	
	Level	First Difference	Level	First Difference
FDI in Agriculture	37.0913* (0.0007)	59.7735* (0)	30.6585* (-0.0062)	44.2532* (-0.0001)
Poverty	3.0096 (-0.9991)	41.0696* (-0.0002)	15.4974 (-0.345)	23.0811 (-0.059)
Inflation	46.6258* (0)	52.0358* (0)	29.2111* (-0.0098)	29.4223* (-0.0092)
Technology	44.6146* (0)	55.1408* (0)	37.0728* (-0.0007)	37.8851* (-0.0005)
Infras	4.57 (-0.9708)	35.4601* (-0.0004)	21.3584** (0.0454)	23.7609** (-0.0219)

Notes: *, and ** indicates the significant respectively to 1% and 5% significance level.

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For the first variable which is the FDI in agriculture, the results found under the intercept are non-stationary at the level and stationary at the first difference. For the level, the probability is 0.0007 and t-statistic is 37.0913 while for the first difference, the probability is 0 and t-statistic is 59.7735. Under the intercept with trend, it was obtained that the level and first difference was non-stationary. For the level, the probability is -0.0062 and t-statistic is 30.6585 while for the first difference, the probability is -0.0001 and t-statistic is 44.2532. The result showed that the first variable has significance with 1%.

The results found in second variable which poverty is shown that the results in intercept at level and at first difference are non-stationary. For the level, the probability is -0.9991 and t-statistic is 3.0096 while for the first difference, the probability is -0.0002 and t-statistic is 41.0696. Then, under the intercept with trend, it was obtained that at level and at first difference are non-stationary. For the level, the probability is -0.345 and t-statistic is 15.4974 while for the first difference, the probability is -0.059 and t-statistic is 23.0811. The result showed that the second variable has significance with 1%.

In addition, the third variable which is inflation is found under intercept and intercept with trend are stationary. For the level, the probability is 0 and t-statistic is 46.6258 while for the first difference, the probability is 0 and t-statistic is 52.0358. But, under the intercept with trend, the results found for the level and first difference was non-stationary. For the level, the probability is -0.0098 and t-statistic is 29.2111 while for the first different, the probability is -0.0092 and t-statistic is 29.4223. The result showed for the third variable shown the 1% significance.

Next, the fourth variable which is the technology shown that the results obtained under the intercept are stationary at level and first difference. For the level, the probability is 0 and t-statistic is 44.6146 while at the first difference, the probability is 0 and t-statistic is 55.1408. The results obtained for the intercept with trend shown that the results are non-stationary at level and first difference. The probability and t-statistic at level is -0.0007 and 37.0728 respectively. At the first difference, the probability is -0.0005 and t-statistic is 37.8851. The result showed that the fourth variable is significance with 1%.

For the last variable which is infrastructure, the results found under intercept are non-stationary at level and first difference. For the level, the probability is -0.9708 and t-statistic 4.57 while for the first difference, the probability is -0.0004 and t-statistic is 35.4601. It also same under the intercept with trend, the results found that it was stationary at level and non-stationary at first difference. For the level, the probability is 0.0454 and t-statistic is 21.3584 while at the first difference, the probability is -0.0219 and t-statistic is 23.7609. The result for this variable showed that it has significance with 1% and 5%.

Philips-Perron Test

Philips-Perron Test is also classified as one of the unit root test. This test was used in the time series to analyze the null hypothesis that a time series is integrated of order. Moreover, the alternative is that the variable was created by the process of stationary. Philips-Perron Test strongly made to serial correlation by using the Newey-West standard errors. Table 1.4 showed of the Philips-Perron Test in determining the properties of variables which are FDI in agriculture, poverty, technology and infrastructure. The results are separated into level and first difference under intercept and intercept with trend.

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Table 1.4: Philips-Perron Test Results

Variables	PP – Fisher Chi – Square Test			
	Intercept		Intercept + Trend	
	Level	First Difference	Level	First Difference
FDI in Agriculture	37.9554* (-0.0005)	60.2298* (0)	34.5852* (-0.0017)	72.6572* (0)
Poverty	2.22627 (-0.9998)	76.7874* (0)	32.3085* (-0.0036)	66.5223* (0)
Inflation	54.7713* (0)	118.041* (0.0000)	70.0283* (0)	94.5770* (0.0000)
Technology	39.9838* (-0.0003)	39.6706* (-0.0003)	40.5004* (-0.0002)	53.7717* (0)
Infrastructure	4.29104 (-0.9776)	46.1914* (0)	26.2414* (-0.0099)	38.3821* (0.0001)

Notes: * indicates the significant of 1% significance level.

For the first variable which is FDI in agriculture, the result showed under the intercept are non-stationary at level and at stationary at first difference. For the level, the probability is -0.0005 and t-statistic is 37.9554 while at first difference, the probability is 0 and t-statistic is 60.2298. Under the intercept with trend, the results found that it were non-stationary at level and stationary at first difference. The probability at level is -0.0017 and t-statistic is 34.5852 while at first difference, the probability is 0 and t-statistic is 72.6572. The result showed that the first variable has significance with 1%.

Then, for the next variable which is poverty, the result had shown that it was non-stationary at level and at first difference is stationary under the intercept. For the level, the probability is -0.9998 and t-statistic is 2.22627 while at the first difference, the probability is 0 and t-statistic is 76.7874. Hence, under the intercept with trend, it was found that the result was non-stationary at level and stationary at first difference. At the level, the probability is -0.0036 and t-statistic is 32.3085 while at first difference, the probability is 0 and t-statistic is 66.5223. The result for the second variable showed that it has 1% significance level.

Third variable is inflation. Under the intercept, the result showed that it was stationary at level and first difference. For the level, the probability is 0 and t-statistic is 54.7713 while for the first difference, the probability is 0.0000 and t-statistic is 118.041. For intercept with trend also showed the same results with intercept where the results was stationary. For the level, the probability is 0 and t-statistic is 70.0282 while for the first difference, the probability is 0.000 and t-statistic is 94.5770. Hence, the result for the third variable showed the 1% significance level.

In the fourth variable which is technology, the result showed for the intercept was non-stationary at level and first difference. For the level, the probability is -0.0003 and t-statistic is 39.9838 while the probability and t-statistic at first difference is -0.0003 and 39.6706 respectively. Furthermore, it also similar with intercept with trend where the results showed non-stationary at level and stationary at first difference. At the level, the probability is -0.0002 and t-statistic is 40.5004 while at first difference, the probability is 0 and t-statistic is 53.7717. The result for the fourth variable showed 1% significant level.

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The last variable which is infrastructure showed the non-stationary for level and for first difference is stationary in intercept. For the level, the probability is -0.9776 and t-statistic is 4.29104 while at first difference, the probability is 0 and t-statistic is 46.1914. In the intercept with trend, it also same with intercept where it was non-stationary at level and at first difference. At the level, the probability is -0.0099 and t-statistic is 26.2414 while at the first difference, the probability is 0.0001 and t-statistic is 38.3821. The result for the last variable also showed the 1% significance level.

IV. CONCLUSION

It shows that all variables are non-stationary in level with intercept with trend while it is stationary in the first difference test at intercept. The Augmented Dickey-Fuller (ADF) Test has been done in order to test the time series of the data either it is stationary or non-stationary. Therefore, it shows that all the variables which are FDI in agriculture, poverty, inflation, technology and infrastructure are non-stationary in level at constant trend. Moreover, during the first difference test at intercept, the result for FDI in agriculture, inflation and technology shows that they are significant, which means the variables are stationary. According to Ziotis and Papadas (2011), all the variables used in the study must be non-stationary at level and stationary at first difference. Next, the Philips-Perron Test has been carried out in order to test the null hypothesis of a time series. It makes the non-parametric correction to the t-test of statistic. Hence, it signifies that all the variables which are FDI in agriculture, poverty, inflation, technology and infrastructure in level with constant trend are stationary. So, the results were found as significant which the null hypothesis can be rejected.

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