

Article

Spatial Impact of Foreign Direct Investment on Poverty Reduction in Vietnam

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Abstract: In this study, we analyze the spatial effect of foreign direct investment (FDI) on poverty reduction in Vietnam. This study uses the provincial-level panel data and the fixed-effects regression and the spatial econometric model to investigate empirically the impact of FDI on poverty reduction in Vietnam. The study finds that FDI has contributed to poverty reduction not only directly but also indirectly through human capital. However, FDI has indirectly worsened poverty through international trade. In addition, empirical results from the spatial econometric model show that FDI tends to decrease poverty in provinces. Finally, the study has some policy implications to decrease the negative effects of FDI on poverty reduction in Vietnam.

Keywords: foreign direct investment (FDI); poverty reduction; Vietnam

JEL Classification: F21; F23; O11; C23; I32



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1. Introduction

The ultimate goal of the economic development is to bring social progress to people, so the aim of poverty reduction is always put in the first priority in order to achieve the economic development. To achieve this goal, developing countries need to take advantage of domestic and foreign resources to boost economic growth, and increase people's income, thereby reducing poverty. FDI plays an important role in improving the well-being of the host country, which not only helps to remedy a capital shortage, but also serves as a channel for transferring new technology, new management techniques and skills, improving the qualifications of the workers, leading to economic growth, job opportunities, and increasing the state budget for host countries (Haddad and Harrison 1993; Markusen and Venables 1999).

Theoretically and empirically, most economists believe that FDI can affect poverty reduction positively through job creation, knowledge transfer, which makes contribution to economic growth (Gohou and Soumare 2012; Shamim et al. 2014; Fowowe and Shuaibu 2014; Soumare 2015). However, there are conflicting arguments on this issue. Some economists believe that economic growth (contributed by FDI) does not lead to poverty reduction. Growth can even aggravate the poverty if it is accompanied by increasing social inequality (Reuveny and Li 2003; Choi 2006; Basu and Guariglia 2007; Pham and Riedel 2019). Thus, although there has been an increase in studies on the effects of FDI on poverty reduction in the world, their results are still inconclusive. In addition, the number of studies on the effects of FDI on poverty reduction in Vietnam is still insufficient.

In recent years, Vietnam's poverty rate has decreased significantly but slowly while the rate of re-impovertment has fluctuated. In addition, there is a large disparity among

socio-economic regions regarding poverty reduction's achievements. More specifically, the poor are still mainly concentrated in rural areas and in ethnic minority communities. This fact is the difficulty in poverty reduction so it is urgent to find more effective ways to reduce poverty in the future. FDI is considered an efficient solution, which contributes a large amount of capital to the operating economy, creates job opportunities for workers, improves workers' income, disseminates technological knowledge to domestic enterprises, and increases import and export, contributing to economic growth and macroeconomic stability, expanding international investment cooperation, and ultimately promoting integration with other countries all over the world. In Vietnam, the number of studies on the relationship between FDI and poverty reduction is limited (Nguyen 2002; Hung 2006; Dat 2017). In addition, these studies have not yet shown the impact of FDI on poverty reduction under the moderating effects of the international trade and education levels. Last but not least, the impact of FDI on poverty may exhibit spatial autocorrelation and needs to be examined by adopting spatial regression models. Traditional panel data analysis neglects the impact of spatial correlation, possibly deriving biased results. To the best of our knowledge, there are not any studies focusing on the effect of FDI on poverty reduction by applying spatial regression models. Therefore, this article will focus on addressing this research gap.

In this study, we focus on analyzing the impact of FDI on poverty reduction in Vietnam. First, we present a theoretical model to describe the impact of FDI on poverty. Second, we use the fixed-effects regression and the spatial econometric model regression with panel data for 63 provinces during the period 2010–2016 to analyze the impact of FDI on poverty. In addition, we investigate the relationship between FDI and poverty reduction under the moderating effects of education and international trade. Third, by applying the fixed-effects regression and the spatial econometric model regression, the study finds that FDI tends to decrease poverty in Vietnam. The study also finds that the effects of FDI on poverty reduction are different in terms of international trade and the level of education of the host provinces in Vietnam. Apart from FDI, the study suggests that the level of economic development, openness to trade, human capital, and inflation are important determinants of poverty reduction in Vietnam.

This article is structured into five parts: (i) Introduction; (ii) Literature Review; (iii) The Vietnamese Case; (iv) Econometric Analysis; (v) Results, and; (vi) Conclusion.

2. Literature Review

Based on studies on the impact of FDI on poverty reduction, FDI could have positive or negative impact on the poverty. FDI even has no impact on poverty. The theoretical and empirical research on the impact of FDI on poverty reduction can be divided into two sides as follows:

2.1. FDI Has Positive Impact on Poverty Reduction

According to Dunning (1993)'s "OLI" theoretical framework (OLI stands for Ownership, Location and Internalization), because of the ownership advantage of multinationals, FDI brings capital, technology, and other intangible assets of the company to developing countries. Therefore, FDI not only contributes to poverty reduction through the growth and economic development but also affects poverty through the impact on employment and salary structure of developing countries. Also, FDI stimulates the growth of developing countries through job creation and capital formation, technology transfer, and diffusion of knowledge. These benefits then spread to the entire economy. Theoretically, the study also pointed out the channels through which FDI has an impact on poverty reduction.

First, FDI can help reduce poverty if FDI creates employment opportunities for a large number of unskilled workers with low incomes or the poor. In developing countries, the number of jobs created by FDI becomes important because these countries have large surpluses of labor. According to the Heckscher–Ohlin model (1991), in order to take advantage of the abundant factors of production in developing countries which have

relatively abundant unskilled labor, FDI will focus on fields mainly using the unskilled labor in those countries (Lee and Vivarelli 2006; Ucal et al. 2014). Therefore, FDI will lead to an increase in the demand for unskilled workers, which will not only offer salary for the formerly unemployed workers, but also increase the wages of unskilled workers compared to that of skilled workers in developing countries. Thus, through the direct channel, FDI can have a positive impact on poverty reduction.

Second, FDI can affect poverty reduction in the host countries through economic growth. Economic growth helps to create more jobs and increase the spending of the entire society. Without economic growth, countries cannot improve the living standards and incomes of their populations. In developing countries, FDI is the main source of capital in the total investment of the whole society when these countries do not accumulate the necessary amount of capital for their development. Both theoretical and practical research shows that FDI has a positive impact on economic growth through the provision of key resources for economies such as capital, technology, and management skills (Alfaro et al. 2006; Carkovic and Levine 2002). Next, growth is a necessary condition for poverty reduction as growth often raises incomes for the poor along with an increase in incomes in the whole economy (Dollar and Kraay 2002).

Klein et al. (2001) argues that FDI promotes economic growth in developing countries, while economic growth is the most important channel for poverty reduction. FDI contributes tax sources to the state budget, which helps government to have more resources to support poverty reduction programs. These researchers indicate that FDI is an important way to transfer knowledge, skills, and management experience from developed countries to developing countries, leading to the increased labor productivity in developing countries, which makes a great contribution to the growth and economic development in those countries. Thus, through economic growth, FDI is expected to have a positive influence on poverty reduction.

Third, FDI can have a spatially positive spillover effect on poverty reduction in host countries. Due to its ownership advantage, FDI can create positive spillovers effect of knowledge across regions in order to boost economic growth for the whole countries. First, FDI stimulates labor mobility among regions, so employees who are hired and trained by MNEs in one region can bring knowledge to local businesses in other regions (Du et al. 2005; Fosfuri et al. 2001; Holger and Strobl 2005). Second, FDI can develop forward and backward industrial linkages with firms in other regions, providing firms in other regions with opportunities to scale up and improve productivity through across links in the supply chain (Chen et al. 2013; Javorcik 2004; Kugler 2006; Liu 2008). Thus, when FDI has a positive spatial effect on economic growth, it will contribute to poverty reduction in other areas.

On the basis of the theory mentioned above, a large number of empirical studies have found positive effects of FDI on poverty reduction. There are some typical empirical studies conducted by Mirza et al. (2003); Mold (2004); Calvo and Hernandez (2006); Gohou and Soumare (2012); Mahmood and Chaudhary (2012); Israel (2014); Shamim et al. (2014); Fowowe and Shuaibu (2014); Ucal et al. (2014); Soumare (2015); Uttama (2015) and Ganic (2019).

Calvo and Hernandez (2006) using data on 15 Latin American countries in the 1990s (including Mexico) argue that FDI will affect poverty reduction not only through indirect channels (economic growth) but also through direct channel (job creation). Using data from 15 Latin American countries, the authors have shown that the lack of investment capital in the economy is an important factor affecting poverty and thereby, FDI can help reduce poverty. Instead of imposing inefficient policies to attract FDI into the country, governments should have specific policies to reduce poverty.

Mirza et al. (2003) studied the impact of regionalization and FDI on poverty in the case of ASEAN countries through an indirect channel (economic growth) and direct channel (other variables). The results of the study show that high economic growth helps to reduce poverty. Although it contributes only 40% to poverty reduction in these countries, this rate may be higher in the future. Research also shows that FDI helps to create jobs and enhance

human capital by contributing up to 60% of poverty reduction in these countries. However, the research has not shown which FDI sectors will help to create more jobs, leading to faster poverty reduction.

Mold (2004) believes that FDI plays an essential role in poverty reduction but this relationship is very complicated and multidimensional. He also argues that economic growth results in poverty eradication. Using data from 60 developing countries, Mold reaches the final conclusion that the relationship between FDI and poverty reduction is strong.

Ganic (2019) evaluates the relationship between FDI and poverty reduction in 12 European countries between 2000–2015. The researcher divides European countries into two regions based on transition and post-transition—i.e., Western Balkan region and Central European region. The researcher concludes that the relationship between FDI and poverty reduction varies in both regions. In the Western Balkans, FDI has a positive influence on poverty reduction, while in Central Europe, the effect is negative and insignificant. Furthermore, the results confirm some previous assumptions that FDI has a more significant impact on poverty reduction in emerging countries such as the Western Balkans than in richer countries such as Central Europe.

In Vietnam, numerous studies focusing on the effects of FDI on poverty reduction have shown the positive influence of FDI on poverty reduction. Nguyen (2002) pointed out that FDI affects poverty reduction directly and indirectly. The author concluded that in the short run, FDI has a positive impact on growth, leading to poverty reduction. The study also showed that FDI in labor-intensive industries will help reduce poverty in host countries. Hung (2006) also pointed out that FDI directly affects poverty alleviation through job creation and tax revenues from FDI firms strengthening the Social Security system. FDI also indirectly affects the poverty reduction process when it is the most important factor affecting growth.

2.2. FDI Has Negative or No Significant Impact on Poverty Reduction

Theoretical and empirical studies have shown mechanisms through which FDI can have a negative or no significant impact on poverty reduction. First, through job creation and wages, FDI does not always reduce poverty in host countries. In developing countries, many foreign companies have intensive capital, so they have not created many jobs for unskilled workers in their countries.

Besides, according to Feenstra and Hanson (1997)'s general trade equilibrium model theory, some jobs can be considered low-skilled in one country but considered highly skilled in others. The authors argue that FDI requires new activities with more skills compared to the existing ones in the host country, meaning that capital flows into developing countries increase the need for skilled labor instead of low-skilled unskilled labor. Consequently, unskilled workers will be unemployed while the demand for skilled workers increases. In this case, FDI does not have a positive effect on poverty reduction.

Many empirical studies have been carried out to evaluate the impact of FDI on poverty reduction. Jenkins (1986) provided some evidence in this regard by using his survey of subsidiaries of multinational corporations in South Africa in 1985. The survey shows a trend towards foreign firms in which they apply increasingly capital-intensive production methods, use technologies imported from other countries. Bhorat and Poswell (2003) also examined how new technology affects the labor market in South Africa through the role of FDI. The results show that technological change has led to an increase in the demand for skilled labor. The ability of new technologies to create jobs for unskilled workers is very low. South Africa's FDI inflows are unlikely to have a positive impact on employment. In other words, they lead to short-term unemployment. Also, the role of FDI in developing technology has worsened income inequality.

Mihaylova (2015) also suggested that although FDI may initially lead to an increase in wages in traditional sectors, it is likely accompanied by a more capital-intensive production, leading to higher unemployment rates in the traditional sectors, thereby contributing to

increasing poverty rate. Thus, in this case, instead of creating jobs for unskilled workers, FDI companies only recruit highly skilled workers, leading to a negative impact of FDI on poverty reduction.

Second, FDI accessing opportunities will affect the economic structure transformation of the host country (An and Yeh 2021). FDI enterprises often invest in profitable areas such as industry and service, taking advantage of industries benefiting investment incentives from the investment policies of the government and local authorities. This will affect income inequality among industries in the economy, possibly causing imbalances between sectors and fields of the economy. Unskilled workers in less FDI-funded industries such as agriculture may not benefit from FDI enterprises, leading to an inability to reduce poverty in host countries majoring in agriculture.

The empirical studies showing that FDI has negative effects on poverty reduction were conducted by Mohey-ud-din (2006), Huang et al. (2010), and Ali et al. (2010). The results of these studies show that FDI inflows lead to an increase in poverty. Besides, some other studies show that FDI does not have a significant impact on poverty such as Tsai and Huang (2007), Akinmulegun (2012), and Ogunniyi and Igberu (2014).

In summary, it can be seen that the results of studies on the direct effects of FDI on poverty reduction differ regarding the country/region, the proxy variable of poverty, and the method and the period of studies.

3. The Vietnamese Case

From 2010 to 2016, the total registered FDI flow was 147.1 billion USD and the total implemented FDI flow was 86.305 billion USD. Currently, there are 135 countries and territories investing in Vietnam. South Korea is the biggest partner, followed by Japan, Singapore, and Taiwan. Beside economic benefits, FDI also has a positive impact on exchanges between different cultures through the process of mutually beneficial cooperation between Vietnamese people and many ethnic groups around the world.

It can be seen from Figure 1 that from 2010 to 2016, FDI inflows into Vietnam fluctuated due to the State's policies on foreign direct investment and the world's economic and political situation. In 2011, the total registered capital decreased by 21.57% compared to 2010 due to the global economic recession and rising inflation in Vietnam, which reduced investor confidence. From 2012 to 2016, the number of FDI projects and the total registered capital increased, but the ratio of realized capital to registered capital was still low.

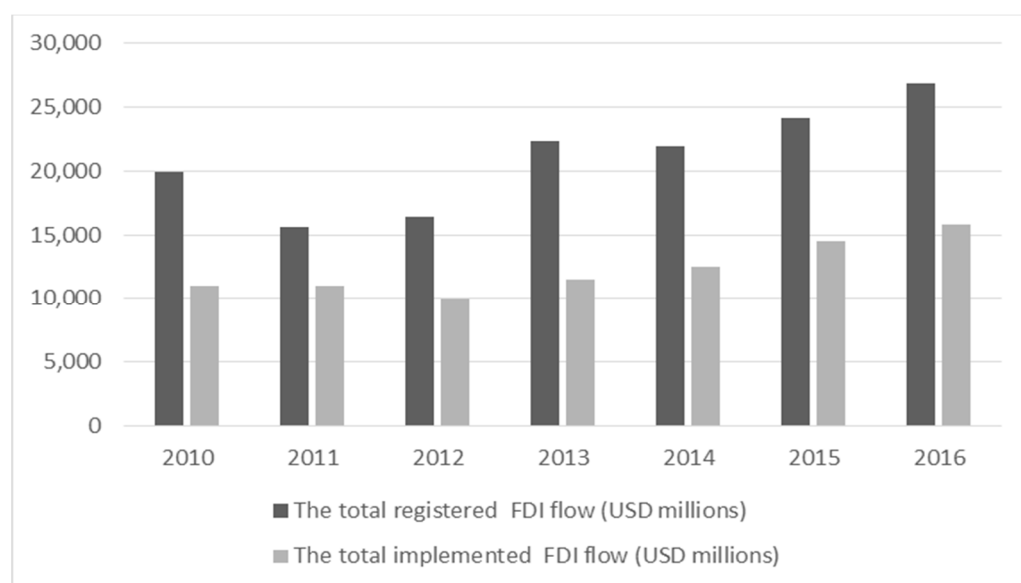


Figure 1. Foreign direct investment flow in Vietnam, from 2010 to 2016. Source: General Statistics Office of Vietnam.

In order to fulfill the commitment with WTO, the regulations on incentives for projects with high export rates have been abolished by Vietnam and FDI enterprises are not required to adopt localization rates and use domestic materials. Therefore, FDI is invested in diversified fields—including oil and gas exploration and exploitation, high-tech production, electrical products and electronics, iron and steel production, textile and garment production—which contributes to the economic growth, creating more jobs and enhancing income for residents.

Besides, one of the important features of FDI in Vietnam is the positive influence of FDI on international trade. According to the statistics of the General Department of Customs and the Ministry of Industry and Trade, the total import and export value of the whole country reached 350.743 billion USD in 2016, increasing by 193.667 billion USD compared to 2010. Noticeably, the group of FDI enterprises has import and export value reaching to 128.9 billion USD, accounting for 36.8% of the country's total import-export turnover. Particularly, in the high-tech sector such as computers, electronic products, and some traditional exported products such as textiles, footwear is currently strongly competed and dominated by the group of FDI enterprises.

Exports of FDI enterprises in leather and footwear account for nearly 80% of the industry's exports. Even in the agricultural sector, the FDI sector's export turnover of aquatic products, coffee, vegetables, and pepper has recently increased significantly with hundreds of millions of USD per each group.

According to the General Statistics Office (GSO), it can be seen from Table 1, the proportion of poor households in the country following the unidimensional approach decreased rapidly from 14.2% in 2010 to 5.8% in 2016, on average of 1.4% a year. In general, the trend of poverty reduction in rural and urban areas is quite similar. In particular, the achievement of poverty reduction in rural areas was particularly impressive in the 2010–2016 period. In 2010, nearly 17.4% of rural households were poor, but by 2016 this figure decreased to more than a half (7.5%). This decline in poverty reduction results from the fact that a significant proportion of the remaining poor households is extremely poor, and it takes more effort to support these households out of poverty.

Table 1. Proportion of poor households by urban—rural areas in the period 2010–2016.

The Rate of Poor Households According to the Poverty Standard of the Government in the Period 2010–2016				
Year	2010	2012	2014	2016
Total	14.2	11.1	8.4	5.8
Urban areas	6.9	4.3	3	2
Rural areas	17.4	14.1	10.8	7.5

Source: General Statistics Office of Vietnam.

4. Econometric Analysis

4.1. The Empirical Model

4.1.1. Baseline Model

Based on the “OLI” framework of [Dunning \(1993\)](#), and the general equilibrium trade model theory by [Feenstra and Hanson \(1997\)](#), and previous empirical studies (such as [Ogunniyi and Igberi 2014](#); [Huang et al. 2010](#); [Mahmood and Chaudhary 2012](#)), we estimate the impact of FDI on poverty reduction in Vietnam by using the following empirical model:

$$Pov_{it} = \beta_0 + \beta_1 \cdot FDI_{it} + \beta_2 \cdot \ln PGDP_{it} + \beta_3 \cdot Trade_{it} + \beta_4 \cdot HC_{it} + \beta_5 \cdot UNEM_{it} + \beta_6 \cdot CPI_{it} + c_i + \varepsilon_{it} \quad (1)$$

In which: i ($i = 1, 2, \dots, 63$) and t ($t = 2010, 2011, \dots, 2016$) denote province i and year t .

Pov_{it} is the rate of poor households according to the income of the province/city (referred as province after) i in year t . This is the most common and general indicator to assess poverty and poverty reduction. The poverty rate is the percentage of the population below the poverty line, measured by the ratio between the total number of poor people and the total population of each locality.

FDI_{it} is the ratio of FDI flows to GDP of province/city i in year t . In the studies of the impact of FDI on poverty reduction, FDI stock and FDI flow are two commonly used measurements. FDI flow could directly reflect how FDI accesses a specific region at a given time while stock data could reveal the relationship between the FDI and local characteristics, (Galan et al. 2007). On the other hand, using data on flowing instead of stock has the advantage that the high persistence in the latter raises the concern that these series contain a unit root. Moreover, using a static model is more appropriate for FDI flows and the fast response makes it a powerful measure to evaluate quick changes in covariables such as a policy change. Therefore, for this study, we use FDI annual inflow as the independent variable.

Control variables in the model related to poverty reduction, which were significantly verified in previous studies including:

(1) Regarding the level of development, the previous work of Tsai (1995) and Figini and Görg (2011) proposed to use the criterion of GDP per capita. This variable is the most common representation for level of economic growth. The expected indication of GDP per capita is positive or negative. Economic growth leads to an increase in a country's poverty if everyone cannot satisfy with its results equally. On the other hand, economic growth can lead to poverty reduction if there are labor absorbing economic growth and better policies related to the distribution of income.

The variable PGDP is the GDP per capita of the province in year t at constant 2010 prices (million VND/person). This variable is the most common representation of the level of the economic development and growth to observe the impact of economic growth and development on the poverty reduction.

(2) Both theoretical and empirical studies show that trade can affect the poor. According to Winters (2002), trade openness affects poverty through changes in commodity prices, affecting markets, and economic growth. Trade also originated from the work of Francois and Nelson (2003) and Heckscher et al. (1991), who argue that increased trade in countries with a majority of the unskilled workers reduces poverty. On the other hand, trade may increase the demand for skilled labor instead of unskilled ones, leading to no improvement in poverty (Feenstra and Hanson 1997; Te Velde 2003). The variable Trade is the percentage of total trade (both import and export) to the GDP of the province i in year t , reflecting the trade openness from a macro perspective (% of total export + import/GDP).

(3) The variable HC is human capital accumulation which is reflected through the labor quality of the province. Human capital can be defined in many different ways, the proportion of students enrolled in schools to the population, the proportion of students enrolled in secondary school to the population, the proportion of students enrolled to higher education to the number of students enrolled in secondary education, the percentage of trained workers or investment in education. Agarwal et al. (2015) used a classical linear regression model to estimate GLS, which used a variable of human capital measured by years of schooling. In this research, the variable human capital is represented by the percentage of trained workers in the total number of employees working in province i in year t .

(4) The inflation variable is measured by the consumer price index (CPI). This index is used to capture the macroeconomic stability and reflect each relationship between economic fluctuations and poverty. The studies of Datt and Ravallion (1992), Dolmas et al. (2000), Erosa and Ventura (2002), Crowe (2004) show that inflation increases income, leading to the redistribution of income among individuals in society, in a way that does not help reduce poverty. According to research conducted by Easterly and Fischer (2000), inflation will hurt the poor more than the rich because those with better financial conditions have better access to financial instruments to avoid inflation, while the poor mainly keep cash in their portfolios. Thus, inflation can reduce the disposable income of the poor. Moreover, if nominal wages increase less than the prices of goods, their real incomes will fall, leading to a higher number of poor people.

(5) The unemployment level is used in the model because current unemployment rate of young people increase the risk of poverty in the future. [Saunders \(2002\)](#) points to evidence that unemployment increases the risk of poverty. Unemployment of parents has caused considerable stress for children in the family. In such cases, children are more likely to drop out of school to join the workforce. Without completing the fundamental education, the lower level of human capital will expose these children to an unstable working environment in the future. These outcomes will tend to create poverty for the next generation. The UNEM variable represents the unemployment rate aged 15 years and over in the population of province i in the year t .

c_i : reflects local specific effects and is assumed to remain unchanged over time, geographical location, and local culture. ε_{it} : is an error term of the model.

The study continues to test whether there is an indirect effect of FDI on poverty reduction through international trade by adding the interaction variable between FDI and trade ($FDI \times TRADE$) into the model. As being analyzed above, FDI has a great influence on international trade, reflecting through the rate of FDI in import-export turnover in Vietnam. Because foreign investment in Vietnam increased the trade openness of the economy, FDI can have a negative effect on poverty reduction through its activities that dominate international trade. The hypothesis is that FDI would contribute to increase poverty rate through its role in international trade because FDI has been the major contributor to the expansion of Vietnam's international trade. We use the following empirical model to test the hypothesis

$$Pov_{it} = \beta_0 + \beta_1.FDI_{it} + \beta_2.LnPGDP_{it} + \beta_3.Trade_{it} + \beta_4.FDI_{it} * Trade_{it} + \beta_5.HC_{it} + \beta_6.UNEM_{it} + \beta_7.CPI_{it} + c_i + \varepsilon_{it} \quad (2)$$

In Equation (2), $FDI \times TRADE$ is the interaction term between FDI and trade, and other variables are defined the same as in Equation (1).

Finally, FDI inflows into the economy are often considered as a way to increase human capital including new knowledge and skills for the host country ([Todaro and Smith 2009](#)). The willingness of foreign companies to invest in knowledge and skills education depends on the level of initial education as well as the cost of further education and training in the host country. As a result, countries with a high initial level of education and low costs of further education will often be preferred ([Alfaro and Rodriguez-Clare 2004](#); [Te Velde and Zenogiani 2007](#); [Dutta and Osei-Yeboah 2013](#)). Host countries need to have an appropriate level of human capital along with other economic and political institutions to be able to benefit from FDI. In particular, [Abramovitz \(1986\)](#), [Benhabib and Spiegel \(1994\)](#), [Borensztein et al. \(1998\)](#), [Xu \(2000\)](#), [Ford et al. \(2008\)](#), and [Wang and Wong \(2009\)](#) show that FDI promotes productivity growth or economic growth only when the host country reaches the human capital threshold.

We conduct a test on the indirect effect of FDI on poverty reduction through local human capital/education by adding the interaction variable between FDI and human capital ($FDI \times HC$) into the model. The hypothesis is that FDI would contribute to decrease poverty rate under the moderating effect of human capital. We use the following empirical model to test the hypothesis

$$Pov_{it} = \beta_0 + \beta_1.FDI_{it} + \beta_2.LnPGDP_{it} + \beta_3.Trade_{it} + \beta_4.HC_{it} + \beta_5.FDI_{it} * HC_{it} + \beta_6.UNEM_{it} + \beta_7.CPI_{it} + c_i + \varepsilon_{it} \quad (3)$$

In Equation (3), $FDI \times HC$ is the interaction term between FDI and human capital, and other variables are defined the same as in Equation (1).

4.1.2. Spatial Regression Model

Theoretically, fixed-effect model and random-effect model are commonly used methods to estimate panel data, however, the problem turns out that there may be a spatial

effect that cannot be estimated by these two models. Therefore, the study uses a spatial econometric model to consider the impact of variables when considering spatial factors.

Spatial econometric models with panel data have recently gained widespread popularity and are recognized as a more accurate estimation method due to the interpretation of both spatial and temporal characteristics for studies when there is a spatial dependence between observations (Anselin et al. 2004; Elhorst 2017). Spatial panel data is a special case of panel data, where data is observed on two dimensions: spatially and temporally.

In fact, regression with spatial panel data presents many advantages over conventional cross-sectional or time-series regression. Although the common use of panel data takes into account individual characteristics between countries or between provinces within the same country, it ignores the spatial relationship between them. Meliciani and Peracchi (2006) note that there is a strong correlation in economic growth between neighboring localities as well as neighboring countries. Anderson and Van Wincoop (2003) also argue that localities in the same country often have close links with each other because they are subject to the same government policies. It is more convenient when a locality conducts commercial transactions with nearer provinces. According to Le Gallo et al. (2003), measuring economic relationships without spatial correlation can lead to biased and unreliable estimates. In fact, there are many features of neighboring provinces that we cannot observe or control in the model that can change simultaneously. In addition to government policies that are generally applied to a region, similar natural features such as climate and topography also make those neighboring provinces/cities have similar characteristics and change together, while farther provinces do not have this feature.

Types of spatial regression models include spatial autocorrelation model (SAC) spatial Durbin model (SDM), spatial autoregressive model (SAR), spatial error model (SEM), and generalized spatial panel random effects model (GSPRE). In this study, the author will use necessary tests to choose the appropriate spatial model.

We construct the spatial matrix based on taking the provinces as spatial units. In Vietnam, there are 63 provinces and cities and they are characterized by stretching and so we choose the province as the spatial unit with the administrative unit at the headquarters of the provincial People's Committee as the geographical location.

4.2. Data

This study uses provincial-level panel data containing 63 provinces over the period 2010–2016 in Vietnam. All data in this study are collected from the General Statistics Office of Vietnam. Since the main objective of this paper is to investigate the impact of FDI poverty reduction in Vietnam, the dependent variable used in this study is the poverty rate. As mentioned above, the theoretical considerations lead us to expect a positive effect of FDI on poverty reduction.

As shown in Table 2, the average poverty rate (POV) is 12.95918, the standard deviation is 9.95728. This shows that the poverty rate in Vietnam is very different among localities. The standard deviation of the ratio of FDI to GDP at each locality is also relatively large 12.02176, showing that there has been great variation in FDI capital among provinces.

Table 2. Data summary.

Descriptive Statistics							
Variables	POV	FDI	PGDP	HC	TRADE	CPI	UNEM
Observation	441	441	441	441	441	441	441
Mean	12.9592	5.2582	30.3429	15.5891	111.1991	6.9869	1.9273
Std. Dev.	9.9573	12.0218	32.0650	6.6827	213.3727	6.1777	1.1530
Min	0	0	0.0708	5.1	0.0223	−0.8	0.0284
Max	50.8	124.5034	270.0642	42.7	3902.686	30.7	6.5445

Table 2. Cont.

Correlation Matrix							
	POV	FDI	lnPGDP	HC	TRADE	CPI	UNEM
POV	1.0000						
FDI	−0.1316	1.0000					
lnPGDP	−0.6287	0.1647	1.0000				
HC	−0.3414	0.1934	0.5729	1.0000			
TRADE	−0.0875	0.1715	0.1532	0.1234	1.0000		
CPI	0.2711	−0.0188	−0.1923	−0.2022	−0.0112	1.0000	
UNEM	−0.5228	−0.0053	0.3717	0.2424	0.0120	−0.0637	1.0000

5. Empirical Results and Discussions

5.1. Estimating the Impact of FDI on Poverty Reduction by Adopting the Fixed-Effect Regression

To choose a suitable model, the study used Breusch and Pagan Lagrangian and Hausman tests. The test results show that the fixed effects model is appropriate. Theoretically, in the case of balanced panel data where all the cross-sectional data variables are constant and there are not any missing values, fixed effect method is appropriate. Furthermore, fixed effect method is also useful to control some unobserved variables (at a regional level, such as local institutions or some features that differentiate one industry from another) that do not change over time but they may generate changes in the dependent variable.

Column 1 in Table 3 shows the results of model 1 estimation—model of testing direct effects of FDI on poverty reduction. First, estimating the fixed effects data (FE) regression model shows that FDI has a positive effect on poverty reduction in Vietnam. That means attracting FDI into Vietnam contributed to reducing the poverty rate in Vietnam. The results of this study are consistent with the studies of [Nguyen \(2002\)](#), [Hung \(2006\)](#), and [Dat \(2017\)](#). The positive effect of FDI on poverty reduction in Vietnam can be explained by the following reasons. Firstly, according to World Bank analysis, FDI in Vietnam is concentrated in manufacturing, processing, and labor-intensive industries that require low skills. Therefore, FDI enterprises contribute to creating jobs and income for unskilled workers and the poor. Beside the direct impact through labor recruitment, FDI also has an indirect effect on employment through economic growth—localities also create jobs for workers due to economic growth contributed by FDI. The second is the spillover effect. When workers are hired by FDI enterprises return to their hometowns and localities and set up their own businesses, they can bring knowledge and skills from FDI enterprises. This not only promotes the dissemination of knowledge from FDI enterprises to the local economy, but also increases local people's income and contributes to poverty reduction. Thirdly, FDI contributes to local economic growth and its benefits eventually spread to the entire economy, helping to solve the problem of poverty. The findings of the study underline the importance of FDI inflows to poverty reduction at the provincial level in Vietnam.

Second, the trade openness variable (TRADE) is significant at 5% and the negative sign indicates that provinces with a large trade openness will reduce the poverty rate. Third, the variable economic growth (PGDP) is significant at 1% with a negative sign implying that economic growth in Vietnam contributes to poverty reduction and the poor benefit from economic growth. Fourth, the variable human capital (HC) has statistical significance at the 1% and the negative sign shows the trend of positive impact of human capital on poverty reduction. In other words, provinces/cities with better human capital will lead to more poverty reduction. Fifth, the inflation variable is measured by the consumer price index (CPI) significant at 5% with the positive sign. This confirms that an increase in inflation leads to an increase in poverty, and macroeconomic stability is conducive to poverty reduction. Sixth, the effects of the unemployment variable are uncertain and need more research to confirm the direction of the impact.

Table 3. Fixed-effect regression estimation results.

Independent Variable	Model 1	Model 2	Model 3
FDI	−0.210 *** (0.075)	−0.787 *** (0.135)	0.642 *** (0.272)
lnPGDP	−13.599 *** (1.038)	−16.734 *** (1.315)	−15.666 *** (1.312)
TRADE	−0.241 *** (0.057)	−0.521 *** (0.077)	−0.009 (0.096)
HC	−0.163 *** (0.045)	−0.098 * (0.056)	−0.134 * (0.079)
UNEM	0.075 (0.222)	0.264 (0.218)	0.270 (0.222)
CPI	0.181 *** (0.030)	0.137 *** (0.032)	0.142 *** (0.032)
FDI × TRADE	— —	0.004 *** (0.000)	— —
FDI × HC	— —	— —	−0.074 *** (0.022)
Constant	57.28 *** (3.24)	67.18 *** (4.031)	64.191 *** (4.034)
Mean VIF	1.26	1.42	3.24
Observations	441	441	441
Number of groups	63	63	63
Condition number	9.21	9.38	9.98
Hausman test	chi2(6) = 31.32 Prob > chi2 = 0.0000	chi2(6) = 34.20 Prob > chi2 = 0.0000	chi2(6) = 32.14 Prob > chi2 = 0.0000

Notes: Dependent variable: POV, 2010–2016. *** $p < 0.01$; * $p < 0.1$. Robust standard errors in parentheses.

Column 2 in Table 3 shows the estimated results of model 2—model of testing indirect effects of FDI on poverty reduction through international trade. The main variable to be considered in model (2) is the interaction variable between FDI and trade (FDI × TRADE). The coefficient of the interaction variable is positive and statistically significant at 1%, suggesting that FDI will have a greater impact on increasing poverty in provinces with higher level of trade openness. Therefore, this result supports our hypothesis that FDI will have a negative effect on poverty reduction through the FDI sector's extensive activities in international trade. In other words, while FDI contributes a great deal to Vietnam's international trade, its role in promoting international trade also increase poverty rate in Vietnam.

Column 3 in Table 3 shows the estimated results of model 3—Model of testing the indirect impact of FDI on poverty reduction through human capital. The variable of interest in model (3) is the interaction variable of FDI × HC that is significant at 1% and the negative sign. This shows that FDI has indirect effects on poverty reduction through human capital/educational level. FDI will have a great impact on poverty reduction in localities with higher educational level and higher quality of human capital.

5.2. Estimating the Impact of FDI on Poverty Reduction by Adopting the Spatial Regression Model

The author estimates the spatial Durbin model in the form of fixed effects and random effects and conducts Hausman test for these two models. Hausman test results show that

the fixed effect model is chosen in this case. The author conducts a time-fixed effect test and the results show that the model has a fixed effect over time.

The results of testing the selection of SAR and SDM models show that $\chi^2 = 49.75$ and $\text{Prob} > \chi^2 = 0.000$, thus rejecting the hypothesis that H_0 is the choice of the SAR model. Therefore, the SDM model is selected as the model in the analysis. Similarly, the test results of SEM and SDM model selection show that $\chi^2(5) = 80.35$ and $\text{Prob} > \chi^2 = 0.000$, thus rejecting the hypothesis that H_0 is the choice of SEM model. Finally, the SDM model was selected as the model in the analysis.

The Table 4 presents the estimation results of the spatial Durbin model (SDM) with the existence of a fixed effect over time. The obtained results are similar to those analyzed in the above fixed-effects model estimation when there is no spatial factor. First, FDI still has an impact on poverty reduction in Vietnam when spatial factors are considered in the model. Second, other variables including economic growth and trade openness both have an impact on poverty reduction in Vietnam. Meanwhile, inflation will exacerbate poverty. The coefficient of the UNEM variable is still not statistically significant, in other words, has no impact on poverty. Third, through trade, FDI still increases poverty when spatial effects are considered. Finally, under the regulation of human capital, FDI will have spatial effects to help reduce poverty.

Table 4. Spatial Durbin Model with time fixed-effects regression results.

Independent Variable	Model 1	Model 2	Model 3
FDI	−0.1908 *** (0.045)	−0.6595 *** (0.127)	−0.5452 ** (0.256)
lnPGDP	−9.9811 *** (2.603)	−10.0802 *** (2.636)	−10.0745 *** (2.622)
HC	−0.1344 (0.098)	−0.1420 (0.098)	−0.1454 (0.099)
TRADE	−0.1414 *** (0.051)	−0.3247 *** (0.075)	−0.1551 *** (0.050)
CPI	2.9904 *** (0.527)	2.9769 *** (0.528)	2.9866 *** (0.528)
UNEM	0.1552 (0.129)	0.1360 (0.130)	0.1565 (0.130)
FDI × TRADE	(−) (−)	0.0031 *** (0.001)	(−) (−)
FDI × HC	(−) (−)	(−) (−)	−0.0796 *** (0.014)
Rho	0.1306 (0.097)	0.1298 (0.098)	0.1298 (0.098)
sigma2_e	34.0977 *** (6.117)	33.7249 *** (6.103)	33.8493 *** (6.101)
Observations	441	441	441
R-squared	0.379	0.388	0.378
Number of id	63	63	63

Notes: Dependent variable: POV, 2010–2016. *** $p < 0.01$; ** $p < 0.05$. Robust standard errors in parentheses.

6. Conclusions and Policy Implications

The main purpose of this study is to investigate empirically the direct impact of FDI on poverty reduction and also the impact of FDI on poverty reduction under the moderating effects of provinces' level of education and international trade. Based on an overview of the theoretical and empirical studies on the relationship between FDI and poverty reduction, the study used panel data of 63 provinces and cities of Vietnam in the period 2010–2016 and estimated a quantitative model by applying the fixed effects and the spatial model regressions.

The study found the following main results. First, research has shown that FDI has a positive effect on poverty reduction through job creation for unskilled workers, knowledge spillover effect, and contribution to local economic growth. Second, FDI also has an indirect effect on poverty alleviation through improved local education. Third, FDI has indirectly increased poverty in provinces with high levels of trade openness. Fourth, economic growth in Vietnam leads to poverty reduction as workers benefit from economic growth. Fifth, provinces with high labor capital, a developed education system, and an increase in trained labor will help reduce poverty. Sixth, when the macroeconomy is stable, there will be better solution to poverty reduction.

The paper makes two major contributions to the literature. First, the paper adopts the spatial model regression to test the effect of spatial correlation in estimating the impact of FDI on poverty reduction, producing more consistent estimates. Second, the paper investigates not only the direct impact of FDI on poverty reduction but also the impact of FDI on poverty reduction with the moderating effect of provinces' level of education and international trade, adding new empirical evidence to the literature overview on the impact of FDI on poverty reduction in Vietnam.

From the research results, the following policy implications can be suggested. First, research shows that in addition to improving economic conditions, education and technology, Vietnam should redesign its FDI policy by shifting from promoting export-oriented FDI into industries and sectors that create more jobs to attract more FDI. Second, the development of human capital has a significant effect to reducing poverty, which implies that improving the overall quality of human resources will benefit everyone and has positive impact on poverty reduction. Vietnam has not been successful in providing good-quality and appropriate education and training. Aiming for good quality human resource development at the lower end of the labor market would also have a positive impact on the way in which FDI affects poverty reduction. Therefore, Vietnam needs to improve human capital, improve the qualifications of workers, and increase the rate of trained workers to meet the human resource requirements of FDI enterprises, this not only helps to attract modern high-tech projects, but also helps to reduce poverty in localities. To improve human capital, policies should focus on increasing investment in public education and supplying a good educational basis (at least secondary education) and an appropriate technical education. Besides, the government can encourage training in MNEs and other firms. When firms pay for training, the employees do not capture all the benefits from training; in reality, firms capture some by raising productivity more than wages. Finally, curbing inflation and stabilizing the macro-economy should be put in priority to reduce poverty and attract FDI inflows.

Nevertheless, there are some limitations in this study that should not be overlooked. At first, generalizability of the findings to other settings must be undertaken with the utmost caution because the study focuses solely on Vietnam. Replication and extension to other transition economies is a direction for future research. Second, FDI and poverty are both complex phenomena, and this study only examines part of their relationship. FDI in different sectors can have different effects on poverty. However, due to the limitation of FDI data disaggregated by sector for 63 provinces in Vietnam, the study only uses the data of total realized FDI inflow as a proxy variable. Regarding poverty, the study only used the unidimensional poverty index, which is measured by income or consumption criteria.

Therefore, the use of FDI data by sector and multidimensional poverty index will be the direction of future research.

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