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Article

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GENERAL & APPLIED ECONOMICS | GENERAL & APPLIED ECONOMICS

The impact of urbanization on poverty reduction: An evidence from Vietnam

Nguyen Minh Ha^{1,2,3*}, Nguyen Dang Le⁴ and Pham Trung-Kien⁵

Abstract: Poverty is a global socio-economic phenomenon. It is always a problem in all countries include developing countries and developed countries. In Vietnam, the poverty rate has been decreasing while the urbanization has happened rapidly over the past 20 years. Handling the dual problems of urbanization and poverty is important to be able to attain sustainable development. Therefore, this study is to analyze the impact of urbanization on poverty reduction in Vietnam. Using Driscoll and Kraay's method and D-GMM method to estimate the provinces' panel data in the period 2006–2016, we confirm that there exists a U-shape relationship between the level of urbanization and the poverty level in Vietnam. Moreover, the estimated thresholds of urbanization from the perspective of poverty reduction are 40.19% and 43.68% in the static and dynamic model, respectively. In addition, our results exhibit that the gross regional domestic product, human capital, and agricultural value have the effect of reducing poverty, but government spending and export value increases the poverty rate in Vietnam. The paper has relevant implications for policymakers.

Subjects: Urban Studies; Cities & Infrastructure; Urban Studies; Urban Economics; Urban Sociology - Urban Studies;

Keywords: urbanization; poverty reduction

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PUBLIC INTEREST STATEMENT

Reducing poverty is important for overall development. So, it is always the goal of nations. In Vietnam, urbanization has happened rapidly over the past 20 years, and it affects poverty in this nation. The result of this study showed that urbanization clearly impacts reducing poverty in Vietnam, however, the best level of urbanization (the ratio of urban population) for poverty reduction is about 40%, if the level of urbanization is over this then urbanization increases poverty. In addition, promoting economic growth, improving education, and appropriate agricultural development policies also help reduce poverty in Vietnam.

1. Introduction

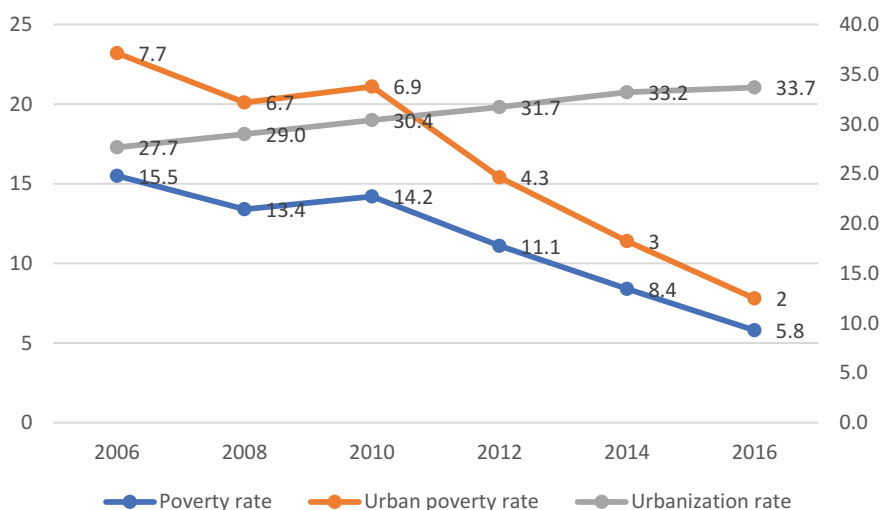
Poverty is a global socio-economic phenomenon. It is always a problem in all countries include developing countries and developed countries, but there is no overall concept of poverty because this concept relates to the socio-economic development situation of each specific country. Furthermore, it is complex to determine the causes of poverty and what helps reduce poverty. Considering the relationship between GDP and poverty has been made with the widespread belief that income growth is a critical precondition for reducing poverty. We all recognize that faster economic growth results in increased faster poverty reduction. However, this depends on the corresponding elasticity. If it is low, combining both economic growth and some policy redistribution may be required for poverty reduction (Bourguignon, 2002). In addition, poverty is affected by many other important factors such as the distribution of income among different population classes, institutions, and governance (Ravallion et al., 2007).

The world urbanization has a level of over 50% (Liddle, 2017). People recognize that economic growth and urbanization are mutually reinforcing. Economic and other activities transform and shift from rural to urban sectors while urbanization is occurring. The urbanization trend is associated with the concentration of economic activities, production, and productivity. The progressed to high income with urbanization happen in almost country (Turok & McGranahan, 2013). Therefore, urbanization is a positive factor, not only economic growth but also poverty reduction. The experiences of the countries are generally consistent with the notion that a greater proportion of the particular urban population performs a good role in poverty reduction, by simply giving new chances for migrants to go out of rural areas and from poverty. (UN-HABITAT, 2012). However, the increase in the level of urbanization contributes at first to the reduction of poverty, but later the increase comes back again (Liddle, 2017; Martinez-Vazquez et al., 2009).

According to the World Bank (2012), in Vietnam, the level of poverty decreases with the size of the city. In the smallest towns, the poverty rate is 11.2 percent, while it is only 1.9 percent in the largest cities. The depth of poverty and poverty intensity also decreases with city size, the urban poor is concentrated in small cities and towns. Small and very small cities account for 43 percent of the urban population but there are over 70 percent of urban poverty living here. In contrast, the urban population lives in two big cities in Vietnam, Hanoi and Ho Chi Minh City account for 32 percent but only 11 percent of the urban poor live there. Additionally, according to the General Statistics Office in Vietnam (GSO), the poverty rate was decreasing while the level of

Figure 1. Poverty rate and urbanization rate in Vietnam.

Source: GSO (2021)



urbanization was increasing: the poverty rate is 15.5% (this is 7.7% in urban area) and the urbanization rate is 27.7% in 2006 but these rates are 5.8% (this is 2% in urban area) and 33.7%, respectively, in 2016. The detail is showed in [Figure 1](#).

To our best knowledge, in Vietnam, most research related to poverty is to explore the factors that affect poverty such as demographic, geographic, natural, and socio-economic. The studies the impact of urbanization on poverty are lack except for the study of Arouri et al. (2017) but this study only focuses on rural poverty. So, how does urbanization affect the overall reduction of poverty in Vietnam?

In this study, we investigate the impact of urbanization on overall poverty reduction in Vietnam. Using regression on panel data from 2006 to 2016, our results confirm the hypothesis that there exists a U-shape relationship between the level of urbanization and the poverty level and estimate the threshold of urbanization from the aspect of poverty reduction.

The rest of the paper is organized as follows. In Section 2 we review how to urbanization processes affect on poverty and we also review the previous related studies. In Section 3 we mention empirical model, methodology research and the data sources. In Section 4 we give our empirical results. In Section 5 we discuss results of regression empirical model. In Section 6 we conclude and propose policy implications.

2. Literature review

Poverty can be understood as a state in which a part of the population cannot meet the minimum basic needs such as food, clothing, health, ... This concept mentions the absolute economic well-being of the poor without the welfare distribution of society. In another approach, poverty is defined as the lack of resources of individuals compared to the situation of other individuals in society. This concept of poverty considers the relationship between groups and social classes, so it is associated with inequality in the distribution of wealth and welfare among classes in a locality. There are different ways to measure poverty, we may compare the income of a person or family with a defined poverty threshold (income or consumption needed) to cover basic needs. People considered poor are those whose income (or consumption) falls below the threshold (Foster et al., 1984; Watts, 1968). Sahn and Stifel (2000); Sahn & Stifel (2003) supposed that the individual's ability to accumulate productive assets plays an important role in reducing poverty. So, the asset index was proposed as an asset-based alternative to the standard use of expenditures in defining well-being and poverty. The asset index is estimated base on data individual or household. This method was used by Arif et al. (2019) to examine the spatial and socio-economic transformation of the peri-urban Burdwan. The result showed that there is a marked influence of city life on living style and quality of life within the peri-urban villages. This improvement is evident from their housing condition and household assets. However, not all human needs bases can adequately measure information solely by income or expenditure, such as habitat, overall level, education, health, intellectual rights, political rights, civil rights, ... Therefore, poverty is also considered in many different aspects of life, known as multidimensional poverty (Alkire & Santos, 2014; Sen, 1976). The approach introduced by Sen (1976) paved the way for a greater understanding of all prior and subsequent poverty metrics. However, belonging to the social, political regime, natural and economic conditions of each country that the nature and level of poverty are different from each country. Therefore, there is no unified measure of poverty yet, which Ravallion et al. (2007) tried to do this. Poverty is associated with a host of health risks, poverty also places enormous economic, social, and psychological costs on the nonpoor as well. These costs affect both individually and as a nation. Therefore, reducing poverty is important for overall development.

Basically, there are three main causes of urbanization: a natural increase in urban population; the reclassification from rural to urban areas due to a natural increase of population; and rural-urban migration. A natural increase of population and the reclassification from rural to urban areas have few significant impacts on the economy. The key factor is rural-urban migration that can be observed in developing countries. The relationship between urbanization and economic growth is mentioned in many studies. But there is little literature about the impact of urbanization on poverty. Overall, because urbanization can impact economic growth, then it can also impact poverty. Urbanization affects poverty through many different channels, for example, migration from rural to urban. This migration comes from the wage gap between urban and rural areas. In addition to rising wages of migrants to cities, remittances from migrants are a factor that alters income and influences rural household consumption, saving, and investment behavior (Harris & Todaro, 1970; Lewis, 1954; Todaro, 1969). Therefore, migration directly affects household poverty (McKenzie & Sasin, 2007). Remittances can help households afford education and health costs for members, to spend on improving living conditions such as housing and sanitation; At the same time, it can help households to invest in rural production, equipment, and machinery to increase productivity, thereby increasing household income. Non-migrants' income may also increase as agricultural wages increase due to a decrease in the supply of labor. On the other hand, migrant workers contribute significantly to the development of the non-agricultural sector, especially in developing countries that often begin to industrialize with labor-intensive industries. The growth of economic sectors promotes overall economic growth, thereby increasing resources for poverty reduction (Ravallion et al., 2007).

Ravallion (2002) has developed a theoretical model of poverty urbanization in which the incidence of poverty is related to the degree of urbanization. The model applied to developing countries reflects an increasing convex function of the share of the poor who live in urban areas. He concludes that under certain circumstances, a higher level of urbanization does affect the increase of the urban share of poverty. Although urbanization may soothe national poverty conditions in both urban and rural areas, poverty becomes more urbanized in urban areas with a given increment of the urban population as well as those reflected in Ravallion et al. (2007). And Bertnelli and Duncan (2004) argued that urbanization conducive to the accumulation of human capital in urban areas which creates advancement in knowledge and technology. This directly drives economic growth, thus affecting poverty reduction.

Martinez-Vazquez et al. (2009) proposed a U-shaped urbanization-poverty relationship. And base on this theoretical model, the study investigated the effects of urbanization on poverty reduction by using regression panel data for a sample of 143 countries over the period 1965–2005. The empirical results confirmed the U-shaped relationship between urbanization and poverty. According to the estimate, the optimal level of urbanization in terms of poverty reduction ranges from 47.3% to 78.7% of the national population, depending on the poverty specific dimension. In addition, the study also found that urbanization's effect on reducing poverty differs across regions of the world.

Oyvatt (2016) used a dataset of 98 countries to study the empirical relationship between land inequality, urbanization, and income inequality. The results showed that the level of land inequality has a significant influence on the level of urbanization, the urban inequality income, and overall inequality income. Furthermore, the study found that excessive urbanization raises income inequality. The findings suggest that policymakers need to appreciate the importance of agricultural policies. In the long-term, progressive land reform policies and subsidies for the protection of farmers can also reduce income inequality and poverty in the urban areas.

Datt et al. (2016) studied growth, urbanization, and poverty reduction long-term in India using the 60-year data set including 20 years after the serious reform since 1991. The results showed that poverty reduction tends to decrease since 1970, however, there was a faster increase in spite of increasing inequality after 1991. Faster poverty reduction was associated with both higher growth and a more pro-poor growth pattern. Post-1991 data showed the strong inter-sectoral linkages: growth in urban consumption benefits rural poor as well as the urban poor. Before 1991, poverty reduction was almost entirely due to rural growth while the contribution of urban growth was negligible. After 1991, although rural growth was still important, it was replaced by urban growth for a more important contribution of urban growth to poverty reduction. Even though urban growth had a negative effect on distribution. In addition, growth in all three sectors of the economy, which are agriculture, industry, and services, contributed to poverty reduction. After 1991, the service sector contributed more than 60% to poverty reduction and the growth of the industry sector contributed about one fourth. The construction boom since 2000 in India has clearly enhanced ensure growth industrial sector process pro-poor. The contribution of agricultural growth rapidly decreased from 2/5 of total poverty reduction before 1991 to less than 10% of total poverty reduction after 1991.

Khan et al. (2016) studied the urbanization of multidimensional poverty in Pakistan. The study estimated the regional multidimensional poverty level in urban Pakistan with the percentages of each group in the poverty index adjusted on five data sets of the basis of the household economic survey (1998–1999, 2001–2002, 2004–2005, 2005–2006 and 2007–2008). The overall national poverty rate in Pakistan was estimated at 29, 32, 25, 29, and 28 percent, respectively, during the study period. The average multidimensional poverty rate decreased slightly in regions over about 10 years, while the dilemma of urbanization of multidimensional poverty was through an increase in regional proportions. From the core ideology of the Millennium Development Goals, research proposes input policies for poverty reduction and urban curbing poor urbanization.

Liddle (2017) studied the relationship between urbanization and poverty and inequality based on Kuznets with cross-country data set containing 133 countries. The results showed that increasing GDP per capita clearly reduces poverty and narrows the rural-urban gap. In contrast, the degree of urbanization has a nonlinear effect on poverty and the rural-urban gap. Initially, the increase in urbanization also leads to improvement in poverty in those areas, but at a higher level of urbanization, an increase in urbanization aggravates poverty and the rural-urban gap.

To study the impact of urbanization on rural poverty in Vietnam, Arouri et al. (2017) used panel data from Vietnam Household Living Standard Surveys in 2002, 2004, 2006, and 2008, the main finding of the study showed that urbanization has a tendency to decrease the agricultural land of rural households. Many households did not even without land in the process of urbanization and industrialization. So, urbanization reduces their farm income. However, urbanization makes a transition from agricultural to non-agricultural activities in rural. Rural households in higher urbanized provinces have higher wages and non-farm incomes even though lower incomes from farming. This suggests that urbanization increases the total income of rural households thus reducing poverty rural in Vietnam.

3. Methodology

3.1. Econometric model

Based on Todaro's Theory on Rural-Urban Migration and the theoretical model of the urbanization of poverty was proposed by Ravallion (2002), and the empirical framework of Martinez-Vazquez et al. (2009) and related studies, we offer the quantitative model that examines the effect of urbanization on poverty reduction as follows.

Static model:

$$POVERTY_{it} = \beta_0 + \beta_1 URB_{it} + \beta_2 URBsq_{it} + \beta_3 LnGRDP_{it} + \beta_4 LnGOV_{it} + \beta_5 EXP_{it} + \beta_6 EDU_{it} + \beta_7 AGR_{it} + \mu_i + \varepsilon_{it} \quad (1)$$

Dynamic model:

$$POVERTY_{it} = \beta_0 POVERTY_{it-1} + \beta_1 URB_{it} + \beta_2 URBsq_{it} + \beta_3 LnGRDP_{it} + \beta_4 LnGOV_{it} + \beta_5 EXP_{it} + \beta_6 EDU_{it} + \beta_7 AGR_{it} + \mu_i + \varepsilon_{it} \quad (2)$$

where $\beta_{i(i \in \{1,2,3,4,5,6,7\})}$ are the regression coefficients for each explanatory variables; *URB* is urbanization which is proxied by the ratio poverty population in the province. This measurement is commonly used in previous studies related to urbanization (Nguyen & Nguyen, 2018); *URBsqr* is the square form of urbanization, *LnGRDP* is logarithm of gross regional domestic product, *LnGOV* is logarithm of value of public expenditure; *EXP* is export value as a share of GRDP of the province; *EDU* is a proxy for the human capital of the province, which is measured by the secondary school enrollment rate; *AGR* is agricultural value of the province; μ_i is unobserved time-invariant country characteristics; ε_{it} is the random error term in country $i \in (1, \dots, 63)$ at time $t \in (2006, \dots, 2016)$. Definition of variables are summarized in Table 1.

Table 1. Definition of variables in research model

Variable Label	Definition	Expected Sign	Sources
<i>Dependent variable</i>			
POVERTY	The ratio poverty population in the province		Martinez-Vazquez et al. (2009)
<i>Independent variables</i>			
URB	The ratio urban population in the province	-	Martinez-Vazquez et al. (2009); - Arouri et al., (2017)
URBsqr	Square of URB	+	Martinez-Vazquez et al. (2009)
LnGRDP	The logarithm of gross regional domestic product of the province	-	Martinez-Vazquez et al. (2009)
LnGOV	The logarithm of value of public expenditure of the province	-	Martinez-Vazquez et al. (2009)
EXP	Export value as a share of GRDP of the province	-	Martinez-Vazquez et al. (2009)
EDU	The secondary school enrollment rate of the province	-	Martinez-Vazquez et al. (2009)
AGR	Agricultural value as a share of GRDP of the province	-	Martinez-Vazquez et al. (2009)

3.2. Data and descriptive statistics

We use panel data of 63 provinces in Vietnam from 2006 to 2016, which were collected from the annual statistical yearbook of the General Statistics Office and the Provincial Statistics Office in Vietnam. The number of observations is $11 \times 63 = 693$.

The descriptive statistics of all the variables is summarized in Table 2. The mean value of *POVERTY* is 0.1462, its standard deviation is 0.1050, its minimum is 0.0000, and its maximum is 0.5820. For *URB*, the mean is 0.2598, the standard deviation is 0.1640, the minimum is 0.0736, and the maximum is 0.8746.

4. Empirical results

4.1. Correlation matrix and multicollinearity

In the regression model, the correlation between independent variables implies the existence of multicollinearity that can influence the accuracy of the results. The coefficient correlation matrix in Table 3 shows that the pairs of independent variables are not correlated significantly. We do, however, perform a test on the multicollinearity phenomenon between variables in Table 4 to ensure accurate estimation results.

The results in Table 4 show that the coefficient VIF of all variables is quite small (<4), except the *LnGRDPpc* variable ($VIF = 5.82$). So, the multicollinearity in the model should be considered. However, by using regression on panel data, data is restructured in processing analysis. And the coefficient VIF of the *LnGRDPpc* variable is not too large. So, we can ignore this problem.

4.2. Assessing the impact of urbanization on poverty reduction

First of all, classical methods, including fixed effect estimators (FE) and random effect estimators (RE), are used to analyze the model (1) and the results are presented in Table 5. Hausman (1978) is used to test the hypothesis “ H_0 : difference in coefficients is not systematic” in order to determine which estimator is suitable. The results of the Hausman test give $\chi^2 = 83.24$ ($\text{Prob} > \chi^2 = 0.000$), rejecting the H_0 hypothesis at the 1 percent significance level, which means that the FE should be selected.

Based on the results of the estimated FE regression, the statistical value $F = 75.63$ ($\text{Prob} > F = 0.000$) for the model (1) is 1% significant which indicates that the models are statistically significant. However, do other tests, the FE regression model has violations as follows: Firstly, the Modified Wald test for the model (1) with the hypothesis “ H_0 : homoscedasticity” gives a result of

Table 2. Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
<i>POVERTY</i>	693	0.1462	0.1050	0.0000	0.5820
<i>URB</i>	693	0.2598	0.1640	0.0736	0.8746
<i>LnGRDP</i>	693	3.2326	1.0515	0.2110	6.8777
<i>LnGOV</i>	693	1.9888	0.8330	0.0988	4.8720
<i>EXP</i>	693	34.4476	89.8888	0.0009	643.3798
<i>EDU</i>	693	43.2391	35.8444	5.0600	234.9120
<i>AGR</i>	693	8.0588	6.4491	0.5004	41.9601

Table 3. Correlation matrix

Variable	URB	LnGRDPpc	LnGOV	EXP	EDU	AGR	y2009
URB	1.0000						
LnGRDPpc	0.4049*	1.0000					
LnGOV	0.2720*	0.7966*	1.0000				
EXP	0.4290*	0.8705*	0.5606*	1.0000			
EDU	0.0814*	0.4851*	0.2860*	0.4105*	1.0000		
AGR	0.0724*	0.7062*	0.5232*	0.5726*	0.3652*	1.0000	
y2009	-0.0297	-0.1198*	-0.1842*	-0.1068*	0.0224	-0.0919*	1.0000

The symbols ***, **, *, indicate the statistical significance at the 1%, 5%, and 10% levels, respectively

Table 4. Checking multicollinearity

Variable	VIF	SQRT VIF	Tolerance	R-Squared
URB	1.68	1.29	0.5965	0.4035
LnGRDPpc	5.82	2.41	0.1717	0.8283
LnGOV	2.96	1.72	0.3384	0.6616
EXP	2.08	1.44	0.4817	0.5183
EDU	1.53	1.24	0.6519	0.3481
AGR	1.94	1.39	0.5154	0.4846
y2009	1.04	1.02	0.9598	0.0402
Mean VIF	2.44			

Table 5. Results of regression for static models

Variable	FE	RE	Driscoll & Kraay
URB	−0.389*** (0.133)	−0.366*** (0.0961)	−0.389** (0.138)
URBsqr	0.484*** (0.130)	0.367*** (0.101)	0.484*** (0.135)
LnGRDP	−0.0538*** (0.00713)	−0.0781*** (0.00650)	−0.0538** (0.0180)
LnGOV	0.00186 (0.00587)	0.0213*** (0.00531)	0.00186 (0.0106)
EXP	0.000128*** (3.00e-05)	0.000163*** (2.98e-05)	0.000128** (4.86e-05)
EDU	0.000502** (0.000236)	0.000194 (0.000139)	0.000502** (0.000198)
AGR	−0.000387 (0.000403)	−0.000328 (0.000403)	−0.000387 (0.000532)
y2009	0.0127*** (0.00399)	0.0133*** (0.00418)	0.0127 (0.00776)
Constant	0.348*** (0.0272)	0.404*** (0.0184)	0.348*** (0.0630)
Observations	693	693	693
R-squared	0.584		
Number of Id	63	63	

Dependent variable: POVERTY

Standard errors are given in the parentheses.

The symbols ***, **, * indicate the statistical significance at the 1%, 5%, and 10% levels, respectively

$\chi^2 = 53,329.86$ ($\text{Prob} > \chi^2 = 0.000$) with 1% the significance level, rejecting the null hypothesis, which implies that heteroscedasticity occurs in the model. Secondly, the Wooldridge (2002) serial correlation test for the model (1) with the hypothesis “H0: no first-order autocorrelation” provides the statistical result $F(1,6) = 332.196$ ($\text{Prob} > F = 0000$) with 1% the significance level. This finding rejects the null hypothesis and suggests that autocorrelation occurs. Finally, the Pesaran (2004) cross-sectional dependency test for the model (1) with the hypothesis “H0: cross-sectional independence” is conducted. The test provides the statistical result Pesaran = -1.676 ($\text{Pr} = 0.0936$) which suggests that at 5% of the significance level, the null hypothesis can not be rejected. This implies that the model has cross-sectional independence. To resolve violations of the FE model, the method estimation proposed by Driscoll and Kraay (1998) is used. The result is presented in Table 5.

Next, to estimate the dynamic panel data model (2), the D-GMM method introduced by Arellano and Bond (1991) is used. The coefficients of the D-GMM regression are listed in Table 6.

Table 6. Result of D-GMM regression

VARIABLES	D-GMM
URB	−1.203*** (0.0510)
URBsqr	1.377*** (0.0521)
LnGRDP	−0.0588*** (0.000834)
LnGOV	0.0218*** (0.000563)
EXP	0.000149*** (5.27e-06)
EDU	−0.00118*** (1.70e-05)
AGR	−0.00113*** (0.000127)
y2009	0.00823*** (0.000192)
L.POVERTY	0.640*** (0.00891)
Observations	504
Number of groups	63
Hansen test	0.558
AR(2) test	0.627

Dependent variable: POVERTY

Standard errors are given in the parentheses.

The symbols ***, **, *: indicate the statistical significance at the 1%, 5%, and 10% levels, respectively

According to the results presented in Table 6, the statistical value Wald test for the D-GMM method is $\chi^2 = 176,336.89$ ($\text{Prob} > \chi^2 = 0.000$) which indicates the model is statistically significant at a 1 percent significance level.

To test the validity of over-identifying restrictions of the model, The Hansen test is inspected with the hypothesis “H0: model is determined to be true and a fair representation of variables (the instrument variables, as a group, are exogenous)”. This suggests the statistical result $\chi^2 = 61.70$ ($\text{Prob} > \chi^2 = 0.558$), which accepts the H0 hypothesis. So the model and variables represented are reasonable (Arellano and Bond, 1991).

The results of the Arellano-Bond test for autocorrelation with the null hypothesis “H0: no autocorrelation” are reported. The statistical result AR(1) is $z = -3.25$ ($\text{Pr} > z = 0.001$), which rejects the null hypothesis. And, the statistical result AR(2) is $z = 0.49$ ($\text{Pr} > z = 0.627$), which cannot be rejected as the null hypothesis. There are existent first-order autocorrelation and non-existent second-order autocorrelation in the residual. This indicates the consistency of the D-GMM estimators (Arellano and Bond, 1991).

The Difference-in-Hansen test with the null hypothesis “H0: the difference of the variables is the variable delay appropriate representation” is used to whether valid subsets of instruments. The test statistics gives statistical Hansen $\chi^2 = 60.58$ ($\text{Prob} > \chi^2 = 0.419$) and Difference $\chi^2 = 1.12$ ($\text{Prob} > \chi^2 = 0.952$) which cannot be rejected as the null hypothesis. This means that the instrument subsets are exogenous (Roodman, 2009).

The estimated coefficient of the lagged dependent variable in the model has a value of 0.64 (<1 and close to 1), showing the stability of the estimated coefficient proving that GMM is a reasonable estimate. The number of instrument variables (73) is smaller than the number of observations (504) and the Hansen statistical value = 0.558 indicates that there are no weak instruments in the model (Roodman, 2009).

In short, after performing the necessary statistical tests, the D-GMM estimation results are consistent and can be used for analysis.

5. Discussion of results

The findings of the econometric models clearly show the effect of urbanization on the reduction of poverty. Both the results of the static model (1) and the dynamic model (2) indicate that the effect of the *URB* variable through the regression coefficient on the dependent variable *POVERTY* is negative at the significance level of 5% for the static model and at the significance level of 1% for the dynamic model, alternately. This result is consistent with previous studies of Martinez-Vazquez et al. (2009), Datt et al. (2016), and Arouri et al. (2017). In fact, the current level of urbanization is encouraging poverty reduction in Vietnam, where the poverty rate has been low in big cities.

However, the effect of urbanization on poverty may be nonlinear, so the square form of urbanization (*URBsqr*) is included in the model to take this nonlinearity into account. The results of regression estimation indicate that the effect of the *URBsqr* variable on the variable *POVERTY* is positive and statistically significant (at the 1 percent significance level for both the static model and the dynamic model). This means the existing a non-linear relation between urbanization and poverty. This finding is in line with studies of Martinez-Vazquez et al. (2009) and Liddle (2017).

More precisely, this is a parabolic relationship, i.e. the rise in the level of urbanization contributes to a drop in the rate of poverty at first, but it can raise the rate of poverty when urbanization exceeds the threshold level. By calculating the extreme of the regression equations (1) and (2) above according to the *URB* urbanization variable, this threshold level can be determined

In Model (1), the *URB*'s coefficient is -0.389 and the *URBsq*'s coefficient is 0.484 . Assume other factors remain constant, the equation in squared form is as follows:

$$POVERTY = 0.484URB^2 - 0.389URB$$

The maximum value is $0.389/(2 \times 0.484) = 0.4019$ or 40.19% , the function changes direction at this point. The poverty rate would steadily decrease at urbanization levels before reaching 40.19% . When the level of urbanization has crossed this threshold, the rate of poverty rises.

In Model (2), the *URB*'s coefficient is -1.203 and the *URBsq*'s coefficient is 1.377 . Assume other factors remain constant, the equation in squared form is as follows:

$$POVERTY = 1.377URB^2 - 1.203URB$$

The maximum value is $1.203/(2 \times 1.377) = 0.4368$ or 43.68 or 43.68% , the function changes direction at this point. The poverty rate would steadily decrease at urbanization levels before reaching 43.68% . When the level of urbanization has crossed this threshold, the rate of poverty rises.

For the control variables, the results of static and dynamic models are consistent with the expectations referred to in the preceding section, in Table 1.

The effect of the variable *LnGRDP* on the dependent variable *POVERTY* is negative and statistically significant in both two models (at 5% significance level for Model (1) and 1% significance level for Model (2)). This result implicates the role of the gross regional domestic product on poverty reduction. This finding is consistent with studies by Arouri et al. (2017) and Liddle (2017).

The effect of the variable *LnGOV* on the dependent variable *POVERTY* for the dynamic model is positive and statistically significant at 1% level. This result implies that government spending increases the poverty rate. This may be the result of an inconsequential structure of government spending in Vietnam. Or by other reasons, the poor have not fully accessed goods or services provided by the government yet.

The effect of the variable *EXP* on the dependent variable *POVERTY* is positive and statistically significant in both static and dynamic models showing trade openness, which is represented by export value, increases poverty in Vietnam.

Both the secondary school enrollment rate variable (*EDU*—represents human capital) and the agricultural value variable (*AGR*) have a negative significant effect on the dependent variable *POVERTY* at the statistically significant 1% level for the dynamic model. This shows that education and agriculture play the important role in poverty reduction in Vietnam.

6. Conclusion

This paper examined the impact of urbanization on poverty reduction in Vietnam using the provinces' panel data in the period 2006–2016. Using Driscoll and Kraay's method resolve heteroscedasticity, autocorrelation, and cross-sectional dependence for the static model. In addition, the study uses the D-GMM method to estimate the dynamic model. Our main findings are as follows. First, urbanization clearly impacts reducing poverty in Vietnam. Moreover, the results confirm that there is a U-shape relation between urbanization level and the level of poverty. And the estimated thresholds of urbanization from the perspective of poverty reduction are 40.19% and 43.68% in the static and dynamic model, respectively. Second, economic growth and human capital have the effect of reducing poverty in Vietnam. Third, agricultural value help to reduce the poverty rate in Vietnam. This consistent with the real state in Vietnam, most of the poor work in the agricultural sector. When the share of agriculture in GDP increases, there is a possibility that the poor will

improve their income. Last, government spending and export value increases the poverty rate in Vietnam.

From our results, Vietnam should keep the level of urbanization close threshold level from the perspective of poverty reduction, about 40%. This helps to decrease the poverty rate. In addition, improving human capital and issuing appropriate agricultural development and support policies also help reduce poverty. Especially, the poor must fully access goods or services provided by the government as well as the structure of government spending must focus on poverty reduction.

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