Factors Impacting on Income Inequality in Vietnam: GMM Model Estimation*

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Abstract

This article analyzes the factors affecting income inequality in Vietnam, with data from 63 provinces and cities collected from the Vietnam Household Living Standards Survey of the General Statistics Office of Vietnam from 2010 to 2018. The article will firstly build a research model to identify factors affecting income inequality. Then, it uses the Generalized Method of Moments (GMM) method to evaluate the effect of factors on income inequality in Vietnam. The empirical estimate result shows that, in the period from 2010 to 2018, the factors such as the proportion of the working employees, income per capita, and inflation have positive effects on the Gini coefficient. That is, when these factors increase, there will be negative effects on improving income inequality in Vietnam. Conversely, when the factors such as the proportion of the literate adults, the proportion of the urban population, and population density increase they will have a positive impact on improving income inequality in Vietnam during this period. The estimated coefficients satisfied the sign expectation except the proportion of the literate adults. It means that, in Vietnam, the increase and more equilibrium in educational attainment balance the distribution of income and bring an improvement in income inequality.

1. Introduction

Income inequality refers to the phenomenon of income that is not evenly distributed among individuals or households in the economy. Increased income inequality will detract from socio-economic development and threaten the political stability of the country. Income inequality has a negative impact on development in general, harms social cohesion, causes unnecessary social and economic losses such as adversely affecting the quality of life of the people,

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increasing poverty rate, hindering access to health care and education of the poor, and increasing crime.

In Vietnam, besides the objective of promoting rapid economic growth in a sustainable manner, the State must also play a key role in realizing social progress and equity, ensuring that people are benefited from the overall economic growth of the country. In the process of reforming toward liberalization, opening up and integration with the region and the world, Vietnam's economy has achieved many milestones such as high and stable GDP growth, low unemployment rate, significant improvement in people's income, and inflation maintained at a reasonable level. However, this process has also downsides, hindering the sustainable development of the economy. In particular, there is a worrying situation in the increase in income disparities between population groups and between regions; society has appeared super-rich while many groups still have low living standards.

This article focuses on analyzing the factors that affect income inequality in Vietnam according to data from 63 provinces and cities collected from the Vietnam Household Living Standards Survey of the General Statistics Office of Vietnam from 2010 to 2018. For the purpose of this research, the article will firstly build a research model to identify factors

affecting income inequality. Then, using the Generalized Method of Moments (GMM) method, it will evaluate the effect of factors on the increase in income inequality in Vietnam.

2. Theoretical Basis and Research Model

2.1. Measuring Income Inequality

There are many measures of income inequality. Each measure has its own advantages and disadvantages. In this research, the author uses the popular measure of the Gini coefficient (g). The Gini coefficient, named after the Italian statistician (C. Gini), is calculated on the basis of Lorenz curve. This is a composite measure of income inequality.

According to the General Statistics Office of Vietnam, the Gini coefficient is calculated by the following formula:

$$G = 1 - \sum_{I=1}^{N} (F_i - F_{i-1})(Y_i - Y_{i-1}) \tag{1}$$

In which:
+ F_i : is the cumulative percentage of the population to the person i
+ Y_i : is the cumulative percentage of expenses to the person i

Based on the Gini coefficient, countries are divided into three groups of income inequality. Countries have low income inequality when Gini coefficient is < 0.4; average income inequality when it is between $0.4 \leq$ and ≤ 0.5; and high income inequality when Gini coefficient is > 0.5.

2.2. Factors Affecting Income Inequality

* Dependent population rate

Dependent population refers to the economic dependence of the population outside working age for the population in working age. The higher the dependent burden, the lower the income per capita, and it affects the household income and the country's economic growth. As the dependent population rate grows, households have to spend more on education, social security and healthcare, while investments and accumulation decrease. This means that a high dependent population rate hinders economic growth and social equity. Bornali (2007) pointed out that the dependent population rate has a negative impact on the improvement of income inequality.

In this research, the author uses the proportion of the working employees over 15 years old out of the total population (referred to as the proportion of the working employees, symbolized by "w") instead of the dependent population rate. Meanwhile, the high percentage of the working employees is expected will have a positive impact on the improvement of income inequality.

* Ratio of the urban population (ur)

This indicator is calculated by comparing the urban population with the total population. The fluctuation of the urban population is mainly due to the urbanization process. The process of rapid urbanization will increase the urban population rapidly and promote local economic growth, and increase the income and living standards of the population. The increase in the urban population is also due to the movement of labor from rural to urban areas in search of jobs. Thereby contributing to increase the income of rural workers, improving the living standards of rural households, leading to a reduction in the gap between the rich and the poor. As a result, an increase in the proportion of the urban population that will have a positive impact on the reduction of income inequality.

* Proportion of literate adults (pl)

The level of education in the population has a strong impact on the economic development of countries and the income of households. The World Bank (2012) has shown that the return to education has widened the wage and income gap of the highly educated and the less educated.

There are many measures to reflect the educational attainment of a population, of which is adult literacy (in this research, the author uses literate population over 15 years old), a factor of human capital commonly used. This is one of the metrics that reflect the results of education. Research by Eicher and Garcia-Penalosa (2000), Bouillon, Legovini and Lustig (2001) have shown that the relationship between education expansion and income inequality is an inverted U-shape. In the early stages of development, an increase in people's educational attainment often creates income inequality, because the person with a higher level of education will have a higher income. An increase and a greater balance in educational attainment balances income distribution and results in improvements in income inequality (Cornia & Kiiski, 2001).

* Population density (m)

Inequality tends to be lower in areas with a high population density than places with a low population density. However, the possibility of a stronger concentration of land still exists, leading to greater income inequality through capital income (Kaasa, 2003).

* Inflation (cpi)

High inflation will deepen inequality as it separates resources from those with fixed nominal incomes – usually from people less social insurance and part of the population poorer. Suhendra, Istikomah, Ginanjar, and Anwar (2020) find that inflation leads to a higher gap of income distribution. However, by means of a progressive tax system, inflation can reduce the share of the richer portion of the population (Gustafsson & Johansson, 1999).

* Income per capita (ip)

The relationship between income per capita and income inequality has been illustrated by Kuznets (1955) in the form of an inverted U-shape. He said that, in the initial stage of development, inequality increases with income, then, when developed to a certain extent, benefits are spread, inequality will decrease. Lewis' model (1954) also agreed with Kuznets (1955). Lewis (1954) argued that income inequality is not only a result of economic growth, but also a necessary condition of growth.

For Vietnam, as a developing country, income per capita and income inequality will have a positive relationship, meaning that income per capita increases, income inequality will also increase. Nguyen, Nguyen, Nguyen, and Nguyen (2010) also showed that the higher the growth rate of GDP, the higher the inequality income.

2.3. Research Model and Data

a. Research models

According to the theoretical basis, the research model of the impact of factors on income inequality is determined as follows:

$$g = \alpha_1 + \alpha_2 w + \alpha_3 pl + \alpha_4 ur + \alpha_5 lnip$$
$$+ \alpha_6 lnm + \alpha_7 lncpi + u \qquad (2)$$

In which:
+ The dependent variable representing income inequality used in the model is the Gini coefficient.
+ α_i is the coefficients of the model.
+ ln: is the natural logarithm.

b. Data

In this research, the author uses data of Vietnam Household Living Standards Survey (VHLSS) of the General Statistics Office of Vietnam (GSO). This is a survey to collect information as a basis for assessing living standards, assessing poverty and differentiating between the rich and the poor to serve the planning of policies, plans and

programs on national goals of the Party and State, aiming to continuously improve the living standards of the population in the country, regions and localities. Since this is a biennial survey conducted by GSO, the research processed this data set for 63 provinces and cities in even years from 2010 to 2018 (at the time of this research, GSO has no figures for 2020).

2.4. Research Methods

The article uses the generalized method of moments (GMM) proposed by Lars Peter Hansen in 1982. The use of the GMM model will allow to overcome the model defects such as cointegration, variable variance, and endogenous variables (Le & Nguyen, 2020), so the estimated results at this time will not be biased, stable and most effective. The GMM method has two alternative estimation types: differential GMM (D-GMM) and system GMM (S-GMM) estimation. Accordingly, Arellano and Bond's D-GMM (1991) estimate is suitable when the sample size is small and otherwise, S-GMM estimation of Arellano and Bover (1995), Blundell and Bond (1998) should be chosen.

For estimation results from GMM, Arellano-Bond and Hansen tests are required. Estimating GMM assumes that there is no quadratic autocorrelation of the remainder. Therefore, we need to perform autocorrelation test in the error composition through the Arellano-Bond test proposed in the research of Arellano and Bond (1991). Accordingly, Estimating GMM requires a first-order autocorrelation – AR (1) and there is no second-order autocorrelation – AR (2) of residuals. H_0 hypothesis: there is no first-order or second-order autocorrelation of residuals. Thus, we do need to reject H_0 in testing the AR (1), but want to accept H_0 in testing the AR (2). Sargan/Hansen test to determine the suitability of the instrumental variables in the GMM model. This is the over-identifying restrictions of the model with the H_0 hypothesis: the instrumental variables is exogenous, that is, does not correlate with the model error. Accordingly, we wish to accept the H_0 hypothesis with Prob value according to the theory greater than 0.05 or 0.1.

Table 1: Hypotheses about the Relationship between the Independent Variables and the Dependent Variable in the Model

Variable	Expectation sign	Explanations
w	(−)	The proportion of the working employees has an inverse relationship with the Gini Coefficient
pl	(+)	The proportion of literate adults has a positive relationship with the Gini Coefficient
ur	(−)	The ratio of the urban population has an inverse relationship with the Gini Coefficient
lnip	(+)	Income per capita e has a positive relationship with the Gini Coefficient
lnm	(−)	Population density has an inverse relationship with the Gini Coefficient
lncpi	(+)	The consumer price index has a positive relationship with the Gini coefficient

To estimate the regression model in the Stata 15.1 software, the command "xtabond2" will be used with the option "twostep" for the two-step system GMM (S_GMM) estimation result.

3. Analyzing the Impact of Factors on Income Inequality in Vietnam

3.1. Income Inequality in Vietnam

Income inequality and the rich-poor gap in the population, as shown on the theoretical basis, can be seen through the Gini coefficient. The Gini coefficient takes a value from 0 to 1 (or 0% – 100%). If the Gini coefficient is zero, there is no difference. The closer the Gini coefficient approaches 100%, the more the difference increases and equals 100% when there is absolute difference.

In the world, the Gini coefficient is quite high in some countries such as Russia, the USA, the Philippines, China... (Table 2). In Vietnam, the Gini coefficient based on income per capita in the period 2002–2018 has an average value of about 37.8%, in the low income inequality (<40%) and generally little variation throughout the period. This result shows a relatively fair economic growth model in Vietnam during this period. However, Vietnam's Gini coefficient is still higher than the Gini coefficient of many countries with much higher GDP/capita than Vietnam such as the UK, Romania...

According to Table 3, in Vietnam, in urban areas, there is a higher disparity between rich and poor than rural areas in the period 2002–2010. This is a normal phenomenon because,

normally in low-income areas, the gap between rich and poor is often smaller than in areas with higher income levels. Furthermore, large urban areas have a high rate of income inequality, since these regions have the richest households in the country and also include newly immigrants, so their incomes are low. By the period 2011–2018, the rich and poor differentiation in these two areas was quite similar. However, while the growth rate of inequality in urban areas tends to decrease, rural areas tend to increase. This can be explained by the process of migrating to find jobs from rural to urban areas. This has contributed to increased income and expenditure of rural households with migrants to urban areas compared to non-migrants.

3.2. Analysis of Factors Influencing Income Inequality in Vietnam

3.2.1. Descriptive Statistics and Correlation Matrix

Table 4 presents the descriptive statistics of the variables in the model (2). According to the statistical results, the Gini coefficient (g) has an average value of 0.36, a maximum of 0.456 and a minimum of 0.3. Thus, there is a quite large difference in the rich-poor gap between localities in Vietnam. The proportion of the working employees (w) is 58.6% on average. The proportion of literate adults (pl) is 92.6%, the difference between the locality with the highest and lowest proportion of literate adults is 38.6%. The ratio of the urban population (ur) is on average 27.5% and there is a big difference between localities. The large disparity is also reflected in indicators such as income per capita (lnip) and population density (lnm).

Table 2: Gini Coefficient in Some Countries (%)

Nation	2002	2004	2006	2008	2010	2012	2014	2016	2018
Cambodia	–	35.5	–	35.1	33.4	30.8	–	–	–
China	–	–	–	42.8	–	42.2	–	38.5	–
Laos	34.7	–	–	–	–	37.9	–	–	–
Philippines	–	–	44.2	–	–	43.0	–	–	–
Thailand	41.9	42.5	41.8	40.3	39.4	39.3	–	36.9	36.4
USA	–	40.6	–	–	40.5	–	–	41.4	–
Vietnam	37.3	37.2	37.4	38.2	42.7	38.7	37.6	35.3	35.7
England	–	36.2	34.8	34.4	34.8	32.6	–	34.8	–
Romania	30.2	30.0	30.5	36.9	35.3	34.9	–	34.4	–
Russia	37.3	40.9	41.5	41.4	40.9	41.6	–	36.8	37.5

Table 3: Gini Coefficient in Divided Income Distribution by Urban and Rural Areas (%)

	2002	2004	2006	2008	2010	2012	2014	2016	2018
Urban	37.7	37.2	37.1	37.2	36.9	34.4	36.7	36.1	35.0
Rural	33.0	34.0	34.3	35.5	36.4	37.0	36.8	37.7	37.9

Table 4: Descriptive Statistics of the Variables in the Model

Variable	Obs	Mean	Std. Dev.	Min	Max
g	315	0.36	0.028	0.30	0.456
w	315	0.586	0.039	0.473	0.713
pl	315	0.926	0.07	0.602	0.988
ur	315	0.275	0.17	0.097	0.878
lnip	315	7.60	0.485	6.34	8.83
lnm	315	5.676	0.989	3.738	8.336
lncpi	315	4.511	0.053	4.359	4.62

Table 5: Pearson Correlation Matrix

Variable	g	w	pl	ur	lnip	lnm	lncpi
g	1						
w	0.238***	1					
pl	-0.454***	-0.214***	1				
ur	0.024	-0.42***	0.75***	1			
lnip	-0.088	-0.2***	0.34***	0.48***	1		
lnm	-0.43***	-0.42***	0.38***	0.33***	0.54***	1	
lncpi	0.33***	-0.12**	0.23***	0.32***	0.39***	-0.09*	1

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

Pearson correlation matrix is presented in Table 5, which shows the relationship between the dependent variable and the independent variable in the model. Accordingly, the larger the correlation coefficient shows the closer the relationship between the variables. Based on the correlation matrix, g has a close relationship with w, pl, lm and lncpi. The relationship between g with ur and lnip was found to be quite loose, but the results were not statistically significant.

3.2.2. Results of Experimental Estimation

The results of estimating the research model of the impact of factors on income inequality in Vietnam are presented in Table 6. The endogenous variable is defined as income per capita (lnip), the remaining variables are defined as exogenous. For the cointegration test, according to Arellano and Bond (1991), the results show that H_0 hypothesis is rejected for the AR(1) test, but the AR(2) test accepts H_0 hypothesis. This means that the model has first-order auto correlation, but no second-order autocorrelation. Tests of Sargan and Hansen with Prob values greater than 0.1, respectively, show that all estimates meet the requirement of accepting H_0 hypothesis, means that the instrumental variables that selected in the model is appropriate.

Table 6: Estimated results of S_GMM model

Dependent Variable: g			
Variable	Coefficient	Std. Error	Prob.
L1.g	0.61	0.062	0.00
w	0.046	0.028	0.10
pl	-0.079	0.026	0.002
ur	-0.003	0.005	0.524
lnip	0.009	0.005	0.068
lnm	-0.005	0.002	0.014
lncpi	0.07	0.022	0.001

Arellano-Bond test for AR(1) in first differences: z = −4.84 Pr > z = 0.000
Arellano-Bond test for AR(2) in first differences: z = 0.65 Pr > z = 0.517

Sargan test of overid. restrictions: chi2(3) = 5.60 Prob > chi2 = 0.133
Hansen test of overid. restrictions: chi2(3) = 4.21 Prob > chi2 = 0.240
Hansen test excluding group: chi2(1) = 0.04 Prob > chi2 = 0.845
Difference (null H = exogenous): chi2(2) = 4.17 Prob > chi2 = 0.124

The estimated results in Table 6 show:

* The proportion of the working employees (w) has a positive effect on the Gini Coefficient at the 10% significance level. This result is contrary to the sign expectation, this means that in Vietnam, although an increase in the proportion of the working population (the proportion of the dependent population is reduced) positively contributes to economic growth, however, this factor is widening the gap between the rich and the poor.

* The proportion of the literate adults (pl) also tends to affect the Gini Coefficient, which is contrary to the sign expectation at the 1% significance level. This means that the relationship between the proportion of the literate adults and the Gini coefficient in Vietnam is on the right side of the inverted U figure. In other words, in Vietnam, the increase and more equilibrium in educational attainment balances the distribution of income and bring an improvement in income inequality.

* The ratio of the urban population (ur) has an estimated coefficient satisfy the sign expectation, that is, an increase in the urban population rate will have a positive effect on reducing income inequality. However, the results of running the model show that the estimated coefficient is not statistically significant.

* Income per capita (lnip) has a positive effect on the Gini coefficient at a significant level of 10%, indicating that the relationship between these two variables in Vietnam is on the left side of the inverted U figure. For Vietnam, which is in the early stage of development, income per capita and income inequality will have relationship in the same direction, meaning that as income per capita increases, income inequality also increases.

* Population density (lnm) has a positive impact on improving income inequality in Vietnam at a significant level of 5%. That is, income inequality in Vietnam tends to be lower in regions with high population densities compared to places with low population densities.

* Inflation (lncpi) in Vietnam has a positive relationship with the Gini coefficient at the significance level of 1%. This result meets the expectation of the sign, shows that high inflation will deepen inequality as it separates resources from whom with fixed nominal incomes and from poor populations.

4. Conclusion

Through analysis and assessment of the impact of factors on income inequality in Vietnam in the period 2002–2018, the research has shown that:

• Vietnam's Gini coefficient is at an average level in the world Gini coefficient. This result shows a relatively fair economic growth model in Vietnam during this period.

• In Vietnam, in urban areas, there is a higher disparity between rich and poor than rural areas in the period 2002–2010 and improved in the period 2012–2018. However, while the growth rate of inequality in urban areas tends to decrease, rural areas tend to increase.

• The experimental estimation results show that most of the variables impact on the fluctuation of income inequality. Contemporary, the estimated coefficients are satisfied the sign expectation except proportion of the literate adults. It means that, in Vietnam, the increase and more equilibrium in educational attainment balance the distribution of income and bring an improvement in income inequality.

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