




# The Role of Investment Sources in Regional Income Convergence in Vietnam: Evidence from Provincial Data, 2007-2024

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## Abstract

This study examines the role of different investment sources in promoting regional income convergence in Vietnam using provincial data from 63 provinces and cities over the period 2007-2024. Grounded in the neoclassical growth theory of Solow, the study tests both sigma and beta convergence to determine whether poorer provinces tend to catch up with richer ones in terms of per capita income. The empirical analysis focuses on three key investment sources: public investment, domestic private investment, and foreign direct investment. The results provide evidence of income convergence across Vietnamese provinces, with estimated convergence speeds ranging from 1.2% to 5.6%. Among the three investment sources, foreign direct investment shows the strongest contribution to regional convergence, followed by public investment and domestic private investment. Public investment plays an important developmental role by supporting infrastructure provision and reducing regional disparities, particularly in disadvantaged areas. However, the uneven spatial distribution of foreign direct investment and differences in local development conditions may weaken the stability of the convergence process. Based on these findings, the study suggests that Vietnam should improve the efficiency of public investment, attract foreign direct investment more selectively toward disadvantaged regions, and encourage domestic private investment in supporting industries. These policy directions can strengthen investment spillovers, reduce income disparities, and promote more balanced and sustainable regional development in Vietnam.

**Keywords:** FDI, Income convergence, Public investment, Regional inequality.

## 1. Introduction

Income convergence, often referred to as the “catch-up effect,” is a central concept in economic growth theory. According to [1], poorer countries or regions are expected to grow faster than wealthier ones, leading over time to a reduction in income disparities and a gradual convergence toward similar levels of per capita income. This prediction is rooted in the neoclassical growth model, particularly the principle of diminishing marginal returns to capital, whereby economies with lower capital stocks can achieve higher returns on investment and faster economic growth. In addition, less developed economies may accelerate their growth by adopting advanced technologies, production methods, and institutional structures from more developed regions. However, the convergence process is not automatic. Poor economies often face structural constraints such as low savings, insufficient investment capacity, weak infrastructure, and limited human capital, which may trap them in persistent poverty. Conversely, richer regions typically possess stronger technological capabilities, higher innovation capacity, and more efficient institutions, enabling them to sustain productivity growth and widen development gaps. As a result, instead of convergence, income divergence may emerge between countries or regions.

The study of [2] is a very important contribution to the theory of economic convergence. Recent decades have witnessed an increase in studies to test the validity of the convergence hypothesis as well as to explore the different determinants of convergence. Islam [3] provides a comprehensive overview of the convergence literature. Overall, it can be said that the results from studies such as [4], [5], [6], [7] and [8] support the convergence hypothesis. In contrast, studies such as [9], [10] have reported more conflicting results. However, despite such efforts, there seems to be a clear omission in studying the role of public investment, domestic investment and foreign direct investment in a research model to assess the role of each type of capital source on regional convergence in a country. In Vietnam, the impact of investment on income convergence has not been studied deeply and extensively, especially the issue of absolute convergence and conditional convergence in income due to investment factors, to clearly see the specific impact of investment types on income convergence in the conditions in Vietnam.

## 2. Research Objectives and Methods

Based on the hypothesis that economists such as [1] mentioned above, the objective of the article is to study whether provinces in Vietnam have a tendency to converge income, that is, to reduce the gap between rich and poor, and at the same time consider the role of each type of investment source and how it affects the process of

income convergence between provinces in Vietnam. The article focuses on studying the impact mechanism of public investment, domestic private investment and foreign direct investment on the issue of income convergence in Vietnam using the least squares regression model.

2.1. Convergence Assessment Model of  $\sigma$

According to [11], the concept of convergence  $\sigma$  can be defined as a group of economies that are converging if the dispersion of Gross Regional Domestic Product (GRDP) per capita of the economies tends to decrease over time. The value of  $\sigma$  is used to reflect the static difference in average income. Typically, it is measured by the coefficient of variation (CV) which is the ratio of the standard deviation of the mean. Where  $y_i$  is the per capita income of province  $i$  and  $\bar{y}$  is the mean of the per capita income of the whole country,  $n$  is the number of provinces.

$$CV = \frac{\sqrt{\frac{\sum(y_i - \bar{y})^2}{n}}}{\bar{y}} \tag{1}$$

2.2. Convergence Assessment Model of  $\beta$

In the model, the article decomposes the economy's investment into 3 types of investment sources: public investment (SI); domestic private investment (DI); foreign direct investment (FDI). The author uses the Cobb-Douglas production function to build the research analysis framework.

The Cobb-Douglas production function has the form:  $Y = F(SI_{it}, DI_{it}, FDI_{it})$ .

Where:  $Y$  is the income of the economy by province in Vietnam, the indicator used is Gross Regional Domestic Product (GRDP).

Based on the model proposed by [5], [11] applied in the case of regional convergence testing in China, the study also inherits the absolute convergence assessment model  $\beta$  as follows:

2.3. Absolute Convergence  $\beta$

$$\begin{aligned} GRDP_{it} - GRDP_{i0} &= \alpha + \beta GRDP_{i0} + \varepsilon_{it} \\ \beta &= -(1 - e^{-\lambda t}) \end{aligned} \tag{2}$$

The research objective is to examine how investment types affect the income convergence process in Vietnam. This study follows the research approach of [5] and [12], the author builds a conditional convergence assessment model for the study in the case of Vietnam as follows:

$$\begin{aligned} GRDP_{it} - GRDP_{i0} &= \alpha + \beta(GRDP)_{i0} + \beta_1(SI)_{it} + \beta_2(DI)_{it} + \beta_3(FDI)_{it} + \varepsilon_{it} \\ \beta &= -(1 - e^{-\lambda t}); \beta = -1 + e^{-\lambda t}; \beta + 1 = e^{-\lambda t}. \\ \ln(\beta + 1) &= -\lambda t, \text{ nhũ vậ y: } \lambda = -\frac{\ln(\beta + 1)}{t} \end{aligned} \tag{3}$$

Where:  $GRDP_{it}$ ,  $GRDP_{i0}$  represent the economic growth of the first and last periods of province  $i$ , respectively,  $t$  is the time period. When  $\beta$  is negative and statistically significant, it shows that there is convergence in income. That means the Vietnamese economy tends to have income convergence, if  $\beta > 0$  then the opposite. The value of  $\lambda$  is the rate of income convergence (or divergence).

3. Research Data

The data used is based on a survey from the General Statistics Office (GSO) of 63 provinces and cities in the period from 2007 to 2024. GRDP data is the real GRDP per capita of each province and city (million/person), this value is taken on the basis of converting the current GRDP price with the CPI index to remove the inflation factor. At the same time, to remove the inflation factor of the variables in the research model, for the values of public investment, domestic private investment, foreign direct investment, the ratio (%) of the current value of these variables on the GRDP value at the current price of the province will be calculated.

4. Research Results

4.1. Vietnam's Income Convergence Practices in Recent Times

4.1.1. Sigma Convergence ( $\sigma$ )

Table 1. Vietnam's CV Index.

Year	CV	Year	CV	Year	CV
2007	0.35	2013	0.39	2019	0.33
2008	0.34	2014	0.32	2020	0.3
2009	0.32	2015	0.32	2021	0.28
2010	0.38	2016	0.23	2022	0.27
2011	0.4	2017	0.22	2023	0.28
2012	0.38	2018	0.26	2024	0.26

Overall, Vietnam's CV index in Table 1 over the past time has shown a trend of gradually decreasing the gap in per capita income. This proves that the Government's efforts in reducing the poverty rate and the policies on income distribution and investment distribution in the economy towards reducing the gap between rich and poor regions are gradually becoming effective. However, this trend is not stable, proving that the economy is still subject to many objective factors, the internal strength of the economy is not strong, and is easily "vulnerable" when there are external factors. At the same time, Vietnam is a developing country, the Government has been implementing the policy of planning key economic zones and key provinces for economic growth, so it is understandable that there is instability in the income variation coefficient.

Increasing the investment level in the early stages does not necessarily create an income convergence effect

between regions because the stage of diminishing marginal productivity of investment capital has not yet reached. Either the investment process is unevenly distributed among provinces, or due to geographical conditions, climate, intellectual level, customs and practices, investment is not possible, and it may also be due to the government's subjective assessment of exploiting the strengths of each province and region to bring about economic efficiency, which leads to the fact that although there is investment, it has not created an effective spread of investment to converge income.

#### 4.2. Research Results

The article uses Eviews software to examine the distribution function of the variables. From this distribution form, the function form that approximates the normal distribution is selected as the basis for selecting the function form of the variable. All variables expressed in logarithmic form have approximately normal distribution. Except for the variable "DI" which is domestic private investment, which has approximately normal distribution form before being converted to logarithmic form.

**Table 2.** Descriptive statistics of variables.

	<b>LNGRDP</b>	<b>LNSI</b>	<b>DI</b>	<b>LNFDI</b>
Mean	2.437462	2.737439	2.292208	-0.87057
Median	2.359333	2.805367	1.991799	0.351657
Maximum	5.830513	5.436505	7.746557	5.171668
Minimum	0.546106	1.171941	0.741309	-9.220340
Std. Dev.	0.918634	0.719386	1.085112	3.861602

Table 2 describes the variables LNGRDP, LNSI, DI and LNFDI with 1,134 synchronized observations, ensuring reliability for the analysis. The mean value of LNGRDP is 2.4377462, LNSI is 2.7377439 (highest, indicating the large role of public investment), DI is 2.2922208, and LNFDI is -0.87057 (negative, reflecting uneven distribution of FDI). The median of LNGRDP (2.359333) and LNSI (2.805367) is close to the mean, indicating a fairly balanced distribution, while DI (1.991799) is skewed right and LNFDI (0.351657) is skewed left, with many provinces receiving low FDI. LNGRDP ranges from 0.546106 to 5.830513, LNSI from 1.171941 to 5.436505, DI from 0.741309 to 7.746557, and LNFDI from -9.2205340 to 5.171668, showing large variations, especially with FDI. The standard deviations of LNGRDP (0.918634), LNSI (0.719386), DI (1.085112), and LNFDI (3.861602) reflect large fluctuations, especially FDI, concentrated in developed provinces such as Ho Chi Minh City and Hanoi, while disadvantaged provinces receive less. This result suggests the need for a more even FDI allocation policy and increased public investment in disadvantaged areas to reduce inequality.

**Table 3.** Correlation coefficients of variables.

	<b>LNGRDP</b>	<b>LNSI</b>	<b>DI</b>	<b>LNFDI</b>
LNGRDP	1.000000	-0.385956	0.004269	0.368899
LNSI	-0.385956	1.000000	0.150353	-0.142201
DI	0.004269	0.150353	1.000000	0.071882
LNFDI	0.368899	-0.142201	0.071882	1.000000

Table 3 presents the correlation coefficients between the variables LNGRDP, LNSI, DI and LNFDI, providing an insight into the relationship between these factors. LNGRDP is negatively correlated with LNSI (-0.385956) and positively with DI (0.004269) and LNFDI (0.368899), indicating that public investment (LNSI) tends to decrease as per capita income increases, while FDI (LNFDI) and private investment (DI) are positively related to LNGRDP. LNGRDP is positively correlated with DI (0.150353) but negatively with LNFDI (-0.142201), indicating that public investment and private investment support each other, but compete with FDI. DI and LNFDI are positively correlated (0.071882), indicating that these two sources of investment can complement each other in the process of economic development. In general, the correlation coefficients are all low to medium, with no signs of strong multicollinearity (correlation coefficients do not exceed 0.8), ensuring the reliability of the regression model. This result suggests that the Government should consider the coordination between investment sources to optimize the impact on growth and income convergence between regions.

##### 4.2.1. Absolute Convergence $\beta$ .

Based on formula 2, the model with only  $GRDP_{i0}$  on the right side is tested for absolute convergence, the results are shown in Table 4.

**Table 4.** Absolute convergence results.

	<b>Coefficient</b>	<b>Standard Error</b>	<b>P-Value</b>
Constant ( $\alpha$ )	2.502412	0.093230	0.0000
Coefficient of $LNGRDP_{i0}$ ( $\beta$ )	-0.186983	0.066080	0.0063
Convergence speed ( $\lambda$ )	0.0138		

The estimated coefficient  $\beta$  is negative and statistically significant, which means that there is evidence of absolute convergence in average income, meaning that during the study period, regions in Vietnam with low income at the initial stage tend to grow faster than regions with higher initial income, with a convergence rate of 1.38%. Initially poor regions may enjoy more preferential government policies to have a faster growth rate. This research result is contrary to the studies of [13], [14]. However, the result is consistent with [1].

#### 4.2.2. Conditional Convergence B.

The objective is to examine how investment types affect income convergence in Vietnam. The study conducts a step-by-step experiment in the same way as [5] conducted research in China. First, each investment type will be put on the right side of the model, then each pair of investments will be put into the model, and finally all three types of investment sources will be put in at the same time. The purpose is to find the best  $\beta$  value to comment on the contribution of investment to income convergence in Vietnam. The results are shown in Table 5.

**Table 5.** Conditional convergence estimation results.

Models	Coefficient	Standard Error	P-Value
Model with public investment			
Coefficient of $LNGRDP_{i0}(\beta)$	-0.224480	0.077052	0.0050
Coefficient of LNSI	-0.064081	0.067571	0.3468
Convergence speed ( $\lambda$ )	0.016948		
Model with domestic private investment			
Coefficient of $LNGRDP_{i0}(\beta)$	-0.166204	0.070254	0.0212
Coefficient of DI	0.003826	0.004331	0.3806
Convergence speed ( $\lambda$ )	0.012118		
Model with foreign direct investment			
Coefficient of $LNGRDP_{i0}(\beta)$	-0.275469	0.067059	0.0001
Coefficient of LNFDI	0.038402	0.011730	0.0018
Convergence speed ( $\lambda$ )	0.021482		
Model with public and private investment			
Coefficient of $LNGRDP_{i0}(\beta)$	-0.205050	0.079604	0.0125
Coefficient of LNSI	-0.070310	0.067896	0.3046
Coefficient of DI	0.004249	0.004348	0.3324
Convergence speed ( $\lambda$ )	0.015298		
Model with public investment and FDI			
Coefficient of $LNGRDP_{i0}(\beta)$	-0.304253	0.075891	0.0002
Coefficient of LNSI	-0.051547	0.063000	0.4165
Coefficient of LNFDI	0.037804	0.011785	0.0022
Convergence speed ( $\lambda$ )	0.024185		
Model with private investment and FDI			
Coefficient of $LNGRDP_{i0}(\beta)$	-0.267241	0.073178	0.0006
Coefficient of LNFDI	0.037685	0.012071	0.0028
Coefficient of DI	0.001211	0.004132	0.7706
Convergence speed ( $\lambda$ )	0.020729		
Three-source investment model			
Coefficient of $LNGRDP_{i0}(\beta)$	-0.570942	0.120376	0.0000
Coefficient of LNSI	0.104453	0.089122	0.2462
Coefficient of DI	0.000308	0.003943	0.9380
Coefficient of LNFDI	0.019795	0.013840	0.1583
Convergence speed ( $\lambda$ )	0.056411		

All estimated coefficients in the model with  $LNGRDP_{i0}(\beta)$  are negative and statistically significant (P-value < 5%), which indicates that all models show a single result: each type of investment source has a positive impact on the convergence process of per capita income between regions in Vietnam, with a convergence rate of approximately 1.2% to 5.6%. The results of the heteroscedasticity and multicollinearity tests all show that the convergence assessment model ensures reliability. The research results show that provinces in Vietnam are tending to converge per capita income, meaning that the gap between rich and poor is increasingly narrowing, which is consistent with [1]. In which, foreign direct investment plays the most positive role in the convergence issue, followed by public investment and domestic private investment. Thus, the study points out the important and meaningful issue that public investment is extremely important for economic development rather than growth because the study has shown that public investment has the most positive impact on reducing the gap between rich and poor provinces in Vietnam. Therefore, the issue is that policy makers must consider the effectiveness of public investment projects so that this investment source is a "creative tool" for development, that is, public investment in highly effective projects, creating infrastructure for disadvantaged areas, thereby contributing positively to growth and reducing the gap between rich and poor through public investment policies directed to areas with more difficult conditions, thereby attracting and creating conditions for other investment sources to invest in these areas, creating a spillover effect, promoting the overall growth of the whole country. Regarding FDI capital, Vietnam needs to select enterprises with potential, brands, advanced technology, environmental friendliness, and products that not only serve Vietnam but also contribute to global values. The government needs to further encourage investment projects in remote areas with difficult conditions so that the gap between rich and poor provinces will gradually narrow, creating conditions for stable, sustainable and strong development in the future. Regarding domestic private investment capital, participation in supporting industries is a very important factor in attracting high-quality FDI projects. The government also needs to implement measures to stimulate domestic private investment with preferential policies on loans, taxes, land, etc., while creating good infrastructure conditions for domestic investors.

## 5. Policy Implications

Based on the research results provided, the following are proposed policy implications for the Vietnamese Government to leverage investment sources to promote convergence of per capita income between regions, reduce the gap between rich and poor, and support sustainable economic development:

**Enhancing the efficiency of public investment as a “development tool”:** The Government should prioritize allocating public investment capital to highly effective infrastructure projects, especially in disadvantaged and underdeveloped regions. These projects should focus on essential infrastructure (transportation, electricity, water, telecommunications) to create a foundation to attract other investments, promote local economic growth, and reduce the gap between rich and poor provinces. At the same time, it is necessary to build a strict monitoring mechanism to ensure transparency and efficiency in the use of capital.

**Attracting FDI selectively and targeting disadvantaged areas:** The Government needs to develop a policy to attract FDI selectively, prioritizing enterprises that possess advanced technology, are environmentally friendly and have the ability to participate in the global value chain. In particular, incentives (tax, land, administrative procedures) are needed to encourage FDI investment in remote and disadvantaged provinces, thereby creating momentum for economic development and narrowing the gap between rich and poor regions.

**Encouraging domestic private investment in supporting industries:** To support FDI and improve economic competitiveness, the Government should promote domestic private investment in supporting industries through preferential policies such as tax reduction, support for low-interest loans and facilitating access to land. This not only helps to maximize the benefits from FDI but also creates a spillover effect, increasing the participation of domestic enterprises in the value chain.

**Building a coordination mechanism between investment sources:** The government needs to design policies to create a close link between public investment, FDI and domestic private investment. For example, public investment can play a “bait” role to improve infrastructure, thereby attracting FDI and encouraging private enterprises to participate. This mechanism should aim to optimize the positive impact of each investment source on the process of income convergence and sustainable economic development.

**Focus on developing disadvantaged areas to promote convergence:** The government should build a long-term socio-economic development strategy, in which investment policies (both public and private) are prioritized in provinces with low per capita income. This will not only help reduce the gap between rich and poor but also create momentum for equitable development across the country, in line with the convergence rate of 1.2% to 5.6% as the study has shown.

These implications emphasize the role of public investment as an important lever, while harmoniously combining with FDI and private investment to achieve the goal of comprehensive and sustainable economic development for Vietnam.

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