

INVESTMENT AND INCOME CONVERGENCE: AN EMPIRICAL STUDY IN VIETNAM

NGUYEN THE KHANG

University of Finance - Marketing, Ho Chi Minh City, Vietnam. Email: nguyenthekhang@ufm.edu.vn

Abstract

This study analyzes the impact of investment types on income convergence between regions in Vietnam in the period 2007-2024, using data from 63 provinces provided by the General Statistics Office. Based on Solow (1956) neoclassical growth theory, the article tests the income convergence hypothesis, focusing on the roles of public investment, domestic private investment and foreign direct investment. The results show that provinces in Vietnam tend to converge in per capita income, with the gap between rich and poor gradually narrowing, consistent with Solow theory, achieving a convergence rate of 1.2% to 5.6%. In particular, foreign direct investment has the most positive impact on convergence, followed by public investment and private investment. Public investment is identified as an important factor in reducing regional inequality, playing the role of a "development tool". However, the uneven distribution of foreign direct investment and objective factors make the convergence process unstable. The study recommends that the Government should increase the efficiency of public investment in infrastructure in disadvantaged areas, selectively attract foreign direct investment in remote provinces, and encourage private investment in supporting industries through tax and loan incentives. These policies will create a spillover effect, promote sustainable economic development and reduce income disparities between regions in Vietnam.

Keywords: Income Convergence; Public Investment; FDI; Regional Inequality.

JEL Classification Code: O47; E22; R11; F21; O53.

1. INTRODUCTION

Income convergence in economics, also sometimes referred to as the catch-up effect, is the hypothesis that economists such as Solow (1956) postulated that per capita income in poor countries or provinces will tend to grow faster than in richer countries or provinces. As a result, all economies eventually converge to a common level of per capita income.

Developing countries have the potential to grow at a faster rate than developed countries because of the diminishing marginal returns to capital characteristic of neoclassical growth models.

Furthermore, poor countries can copy the production methods, technology, and organizational structures of developing countries to have a chance to catch up. In fact, poor countries are not sure to achieve high economic growth, because if income is too low, people may have to use up everything they make and therefore cannot save to invest to ensure the level of capital per worker when the population increases, leading to poverty.

At the same time, richer countries or regions have the conditions to develop science and technology, from which the marginal benefits of capital will increase more strongly and faster than poor countries or regions. This leads to the phenomenon of income dispersion among countries or regions.

The study of Barro and Sala-i-Martin (1992) 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 (2003) provides a comprehensive overview of the convergence literature. Overall, it can be said that the results from studies such as Kim (2001), Wei (2008), Rodriguez-Pose et al. (2012), McCoskey (2002), Weeks and Yao (2003) and Lei and Tam (2010) support the convergence hypothesis.

In contrast, studies such as Carlino and Mills (1993), Aubyn (1999), Cellini and Scorcu (2000) and Habibullah et al. (2012) 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 Solow (1956) 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.

Convergence assessment model of σ

According to Sala-i-Martin (1996a), the concept of convergence σ 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 σ 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.

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

Convergence Assessment Model of β

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 Sala-i-Martin (1996a, b), Wei (2008) applied in the case of regional convergence testing in China, the study also inherits the absolute convergence assessment model β as follows:

Absolute convergence β

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

The research objective is to examine how investment types affect the income convergence process in Vietnam. This study follows the research approach of Wei (2008) and Normaz (2008), the author builds a conditional convergence assessment model for the study in the case of Vietnam as follows:

$$\begin{aligned} GRDP_{it} - GRDP_{i0} &= \alpha + \beta(GRDP)_{i0} + \beta_1(SI)_{it} + \beta_2(DI)_{it} + \beta_3(FDI)_{it} + \varepsilon_{it} \\ \beta &= -(1 - e^{-\lambda t}); \beta = -1 + e^{-\lambda t}; \beta + 1 = e^{-\lambda t}. \end{aligned} \quad (3)$$

$$\text{Ln}(\beta + 1) = -\lambda t, \text{ như vậy: } \lambda = -\frac{\text{Ln}(\beta+1)}{t}$$

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 β 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 λ 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

Sigma convergence (σ)

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

Source: Author's own calculation

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

	LNGRDP	LNSI	DI	LNFDI
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
Observations	1.134	1.134	1.134	1.134

Source: Author's own calculation

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

	LNGRDP	LNSI	DI	LNFDI
LNGDP	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

Source: Author's own calculation

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.

Absolute convergence β .

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

	Coefficient	Standard Error	P-Value
Constant (α)	2.502412	0.093230	0.0000
Coefficient of $LNGRDP_{i0}$ (β)	-0.186983	0.066080	0.0063
Convergence speed (λ)	0.0138		

Source: Author's own calculation

The estimated coefficient β 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 Pham The Anh (2009), Hoang Thuy Yen (2015). However, the result is consistent with Solow (1956).

Conditional convergence β .

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 Wei (2008) 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 β 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 $LNGRDP_{i0}$ (β)	-0.224480	0.077052	0.0050
Coefficient of LNSI	-0.064081	0.067571	0.3468
Convergence speed (λ)	0.016948		
Model with domestic private investment			
Coefficient of $LNGRDP_{i0}$ (β)	-0.166204	0.070254	0.0212
Coefficient of DI	0.003826	0.004331	0.3806
Convergence speed (λ)	0.012118		

Models	Coefficient	Standard Error	P-Value
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 (λ)	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 (λ)	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 (λ)	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 (λ)	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 (λ)	0.056411		

Source: Author's own calculation

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 Solow (1956). 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.

Acknowledgement: This research is funded by University of Finance - Marketing.

References

- 1) Aubyn, M.S. (1999). Convergence across industrialised countries (1890–1989): New results using time series methods. *Empirical Economics*, 24(1), 23-44.
- 2) Barro, R.J. & Sala-I-Martin, X (1992). Convergence. *Journal Political Economic*, 100, 223-251.
- 3) Carlino, G.A. & Mills, L.O. (1993). Are US regional incomes converging? A time series analysis. *Journal of Monetary Economics*, 32(2), 335-346.
- 4) Cellini, R. & Scorcu, A.E. (2000). Segmented stochastic convergence across the G-7 countries. *Empirical Economics*, 25(3), 463-474.
- 5) GSO, General Statistics Office. *Statistical Yearbook 2007-2024*. Statistics Publishing House
- 6) Habibullah, M.S., Dayang-Affizzah, A.M. & Puah, C.H. (2012). Regional income disparities in Malaysia: A stochastic convergence analysis. *Malaysian Journal of Society and Space*, 8(5), 100-111
- 7) Hoang Thuy Yen (2015). *The Impact of Income Inequality on Economic Growth in Vietnam*. Doctoral dissertation, National Economics University.
- 8) Islam, N. (2003). What have we learnt from the convergence debate? *Journal of Economic Surveys*, 17(3), 309-362
- 9) Kim Ji Uk (2001). Empirics for Economic Growth and Convergence in Asian Economies: A Panel Data Approach. *Journal of Economic Development*, 26 (2), 49-59.
- 10) Lei, C.K. & Tam, P.S. (2010). A panel data approach to the income convergence among Mainland China, Hong Kong and Macao. *Journal of the Asia Pacific Economy*, 15(4), 420-435.
- 11) McCoskey, S.K. (2002). Convergence in Sub-Saharan Africa: A nonstationary panel data approach. *Applied Economics*, 34(7), 819-829

- 12) Normaz Wana Ismail (2008). Growth and Convergence in ASEAN: A Dynamic Panel Approach, Growth and Convergence in ASEAN: A Dynamic Panel Approach. *Journal of Economics and Management*, 2(1), 127-140.
- 13) Pham The Anh (2009). Economic Growth and Income Convergence Across Vietnam's Regions. *Journal of Economic Research*, 368, 34-41.
- 14) Rodríguez-Pose, A., Psycharis, Y. & Tselios, V. (2012). Public investment and regional growth and convergence: Evidence from Greece. *Papers in Regional Science*, 91(3), 543-568
- 15) Sala-i-Martin (1996a). The Classical Approach to Convergence Analysis. *The Economic Journal*, 106 (437), 1019-1036.
- 16) Sala-i-Martin (1996b). Regional Cohesion: Evidence and Theories of Regional Growth and Convergence. *European Economic Review*, 40, 1325-1352.
- 17) Solow, R.M. (1956). A contribution of the theory of economic growth. *Quarterly Journal of Economics*, 70, 65-94
- 18) Weeks, M. & Yao, J.Y. (2003). Provincial conditional income convergence in China, 1953–1997: A panel data approach. *Econometric Reviews*, 22(1), 59-77.
- 19) Wei, Kaile (2008). *Foreign Direct Investment and Economic Growth in china's Regions, 1979-2003*, PhD thesis, Middlesex University, London, UK