Provincial divergence and sub-group convergence in Vietnam’s GDP per capita*

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Abstract

In the Vietnamese context, this paper is the first application of Phillips & Sul’s (2007, 2009)’s approach to the examination of inequality in GDP per capita in a study of 61 Vietnamese provinces covering the period 1990-2011. The results show that provincial levels of GDP per capita diverged over the study period, and all provinces could be formed into five convergence sub-groups. However, the result of σ-convergence shows that there was a clear break in the trend around 2004 when it reversed itself. Further insights into the factors underlying the switch from divergence to convergence around 2004 were gained through an analysis of provincial-level data for foreign direct investment, public investment, and central-provincial budgetary transfers. Estimates from an ordered probit model suggest that foreign direct investment, domestic investment, and transfers from central to provincial governments have played an important role in forming the sub-groups. Based on these results, several policy implications are discussed.

Keywords: provincial divergence, sub-group convergence, foreign direct investment, domestic investment, transfers from central to provincial governments, Vietnam

JEL Classification: O11, O47

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1 Introduction

Over the last 26 years of economic reform since 1990, Vietnam has attained significant macroeconomic achievements. The GDP growth rate increased from 2.8% in 1986 to 9.5% in 1995 and 6.2% in 2016 (World Bank, 2017). The GDP per capita (PPP) increased from US$ 970 in 1990 to US$ 6,424 in 2016 (World Bank, 2017). The poverty headcount ratio at US$ 1.90 a day (2011 PPP) (% of the population) decreased from 49.2% in 1992 to 3.06% in 2014 (World Bank, 2017). However, the income inequality (Gini index) increased from 0.35 in 1992 to 0.37 in 2014 (World Bank, 2017).

Few previous studies examined regional income disparity in Vietnam using the traditional measures of income disparity (e.g., the Gini coefficient) and convergence of income growth (e.g., $\delta$- and $\beta$-convergence tests) (Liu, 2001; Walle & Gunewardena, 2001). These traditional techniques assume that all provinces follow the same growth path. However, research also shows that this assumption does not hold in the case of Vietnam due to marked differences across provinces regarding macroeconomic structures (Nguyen, 2009).

To tackle limitations of the traditional techniques, Phillips & Sul (2007, 2009) have proposed the “log(t)” test to examine the output convergence hypothesis. This alternative method takes into account heterogeneity among individual countries/regions and allows for the possibility of convergence among sub-groups of countries. The framework of Phillips & Sul (2007; 2009) has been widely applied to many regions and countries including the USA, a number of European countries (Apergis et al., 2010; Bartkowska & Riedl, 2012; Borsi & Metiu, 2015), China (Herrerias & Ordonez, 2012) and India (Ghosh et al., 2013).

The present study applies Phillips & Sul’s (2007, 2009) log(t) test to an examination of the overall convergence of GDP per capita among provinces in Vietnam. Given that the statistical significance of the convergence hypothesis is rejected, this study then empirically identifies convergence sub-groups of provinces. Sensitivity analysis is used to investigate the inequality in GDP per capita across provinces in Vietnam. In addition, factors affecting the trend and pattern of disparity in GDP per capita, and conditioning factors forming convergence sub-groups
are examined.

The present study makes several contributions to the literature. First, to the best of our knowledge, this is the first application of the \( \log(t) \) test by Phillips & Sul (2007, 2009) in examining disparity in GDP per capita at Vietnam’s provincial level. Empirical results identify five convergence sub-groups the existence of which have implications for economic policy, especially those policies that target the reduction of income inequality. Second, our empirical results show that apart from domestic and foreign investment, domestic transfers from the central government to less developed provinces remain an important factor in determining group convergence. Last, the spillover effect of transfers from economic centres to adjacent provinces needs further research attention as these effects appear to be a substantial factor in reducing income disparity.

This remainder of this paper is organized as follows. Section 2 presents a literature review of approaches to investigate income inequality. Section 3 outlines the methodology used in this study and Section 4 describes the data used. Section 5 discusses the study’s empirical results, and Section 6 concludes.

2 Literature review

The literature on inequality is extensive. We, therefore, focus this study’s approach on an identified gap in the literature relating to the measurement of output convergence. The literature on output convergence can be categorised into: (1) some traditional time-series data approaches (\( \delta \)-convergence, \( \beta \)-convergence, and the unit-root tests); (2) a new dynamic panel data approach developed by Phillips & Sul (2009).

The \( \beta \)-convergence and \( \delta \)-convergence tests have been applied to a wide range of countries and regions. Barro & Sala-i-Martin (1991) indicated that the rate of convergence between the poor and the rich states in the USA was nearly 2% per year in the 1880-1988 period. Sala-i-Martin (1996) stated a similar convergence rate across the USA (1880-1990), in Japan (1955-1990), and in five European nations (1950-1990). Neri (1998) suggested that Australia experienced \( \beta \)-convergence
during the period 1861-1992, but divergence trends were found during the periods 1976-1992 (Neri, 1998), 1966-2001 (Smith, 2004) and 1984-2005 (Nguyen et al., 2006).

Similar convergence tests were also applied to developing economies. Empirical evidence in Indonesia showed convergence in several periods, including 1975-1993 (Garcia & Soelistianingsih, 1998), 1993-2002 (Resosudarmo & Vidyattama, 2006), and 1982-2008 (Kharisma & Saleh, 2013). However, empirical studies of regions in China found that income disparity had increased and income levels across provinces were not converging (Jian et al., 1996).

A few previous studies on regional income disparities in Vietnam were undertaken and they found consistent evidence of increasing disparity. Walle & Gunewardena (2001) examined disparity between ethnic groups by using the Blinder-Oaxaca decomposition on data from Vietnam Living Standard Surveys (VLSS) 1992-1993. The authors indicated that minority ethnic groups experienced lower expenditure per capita. Likewise, Takahashi (2007) and Le & Booth (2013) applied the Blinder-Oaxaca decomposition to VLSS data for the period 1992-1998 and found significant evidence of increased income disparity in Vietnam. Liu (2001, 2008) used general entropy and Theil indices to measure disparity using the VLSS data for the years 1992-1993 and 1997-1998. They found slight inequalities in expenditure per capita between rural and urban areas as well as between eight regions in Vietnam. Also, Shankar & Shah (2003) and Le (2003) stated that Vietnam experienced a dramatic increase in regional income disparity which was measured by the Gini index, the Theil index and use of the weighted coefficient of variation (CV). Nguyen (2009) applied the β-convergence test and found no significant evidence of converging income per capita across provinces.

The unit root test method investigates evidence of convergence by testing to examine whether outputs are stationary across countries or regions. Results of unit roots tests for the USA and other developed countries remained consistent with β- and δ-convergence tests. For instance, in the USA, Loewy & Papell (1996), and Carlino & Mills (1996) found significant evidence of convergence during the 1929-1990 period while Genc et al. (2011) indicated evidence of a convergence trend in the period 1969-2001. However, the literature has shown less consis-

A recent development in the literature on tests of output convergence is the “log(t)” test approach proposed by Phillips & Sul (2007, 2009). Different from other tests, log(t) takes into account heterogeneity among individual regions and allows for the possibility of convergence among sub-groups of regions. Phillips & Sul (2009) found significant evidence of convergence in income per capita across 48 states in the USA between 1929 and 1998. A similar application using data from 14 European countries1 during the period 1980-2004 by Apergis et al. (2010) showed two convergence sub-groups. Likewise, Bartkowska & Riedl (2012) found six per capita income convergence sub-groups among 206 European regions between 1990 and 2002. Using an ordered logit estimator, Bartkowska & Riedl (2012) indicated that initial conditions such as human capital and per capita income play a crucial role in determining the formation of convergence sub-groups among the European regions. Borsi & Metiu (2015) indicated no overall convergence in real income per capita in the European Union during the period 1970-2010, however, convergence sub-groups were found. Vu (2015) found that the APEC countries’ GDP per capita diverged over the period 1990-2011; nevertheless, three convergence sub-groups are found using the Phillips-Sul’s approach.

In addition, the “log(t)” test method has been applied to some developing economies. Herreras & Ordonez (2012) showed convergence in income per capita in five groups of provinces in China between 1952 and 2008. Similarly, Ghosh et al. (2013) indicated a significant divergence in income per capita across 15 of India’s major states during the period 1968/69–2008/09.

In summary, the literature demonstrated that different convergence tests produce consistent results for countries with good data quality

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1 Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Portugal, Spain, Sweden, and the United Kingdom
such as the USA and Japan. Regarding developing economies such as China, results are sensitive to choices of methods and time periods. The literature also indicates that the “log(t)” test by Phillips & Sul (2007, 2009) could produce more robust results due to its ability to take into account heterogeneity across regions. To the best of our knowledge, the current study is the first study applying the log(t) test method to investigate the output convergence in Vietnam.

3 Methods

3.1 Log(t) test

Following the methodology of Phillips & Sul (2007, 2009), let \( y_{it} \) be the panel data of GDP per capita of province \( i \) at period \( t \) (\( i=1, \ldots, N \) and \( t=1,\ldots, T \)). Phillips & Sul (2007, 2009) argued that the growth path of GDP per capita in province \( i \), which can be proxied by \( \log(y_{it}) \), is formulated as follows:

\[
\log( y_{it} ) = b_t \mu_{it} \quad (1)
\]

where the idiosyncratic component \( b_{it} \) that is specific to province \( i \) measures the ‘distance’ between \( \log(y_{it}) \) and the common component \( \mu_t \) (i.e., the common technology).

The common technology that is accessible by all provinces in each period is represented by the average growth of provinces:

\[
h_t = \frac{\log(y_{it})}{N^{-1} \sum_{i=1}^{N} \log(y_{it})} = \frac{b_t}{N^{-1} \sum_{i=1}^{N} b_t} \quad (2)
\]

When the growth rates across provinces converge, \( h_{it} \rightarrow 1 \) for all \( i \) as \( t \rightarrow \infty \). The condition for convergence can be simplified by taking the mean squares of the difference between \( h_{it} \) and one. That is:

\[
H_t = N^{-1} \sum_{i=1}^{N} (h_{it} - 1)^2 \quad (3)
\]
Output growth of provinces converges when \( t \rightarrow \infty \), and \( H_t \rightarrow 0 \) while divergence occurs when \( t \rightarrow \infty \) and \( H_{it} > 0 \). In the latter scenario, the provinces diverge or may form convergence sub-groups.

Phillips & Sul (2007, 2009) further formulated a semi-parametric model that allows for heterogeneity of transition behaviour over time and across provinces as specified below:

\[
\Delta_t = b_t + \frac{\delta_t \xi_{it}}{L(t)t^{\gamma}}
\]  

(4)

where \( \xi_{it} \) is random noise assumed to follow a normal distribution; \( \sigma_t \) is the time-invariant growth factor for province \( i \); \( L(t) \) is a slow decay function represented by the log of the time trend and \( \alpha \) indicates the speed of convergence.

The test for the null hypothesis of growth convergence is represented as: \( b_i = b \) for all \( i \), while the alternative hypothesis of non-convergence is formulated as: \( b_i \neq b \) for some \( i \). The alternative hypothesis can be further tested for the formation of provincial convergence sub-groups specified as \( b_i = b_j \) for \( i \in G_i \) and \( j = 1, 2, ..., \) where \( j \) is the number of groups.

Assume further that \( H_{it} \sim A/(L(t)^{2\epsilon}) \) as \( t \rightarrow \infty \) for a constant \( A > 0 \). In this case, Phillips & Sul (2009) suggest the following “\( \log(t) \)” test for convergence:

\[
\log \frac{H_{it}}{H_t} - 2 \log(\log(t)) = \alpha + \gamma \log(t) + \epsilon_t
\]  

(5)

Under the null hypothesis of growth convergence, the point estimate of the parameter \( \gamma \) is greater than or equal to zero while a negative \( \gamma \) supports the alternative hypothesis of divergence or convergence in groups. The test for convergence is now simply the one-sided heteroskedasticity and autocorrelation consistent (HAC) t-test for \( \gamma \geq 0 \). Here, the null hypothesis for convergence is rejected if the t-value of parameter \( \gamma \) in Equation 5 is less than or equal to -1.65. In this scenario, the alternative hypothesis is further tested for the formation of convergence groups using the following four-step algorithm:

1. Order the provinces according to the final-year GDP per capita.
2. Select the first \( k \) provinces with highest income per capita in the
3.2 Sensitivity analysis

For sensitivity analysis, we use $\sigma$-convergence to measure trend and pattern of inequality in provincial GDP per capita. Following Sala-i-Martin (1996), $\sigma$-convergence is said to hold if the dispersion of GDP per capita across provinces falls over time. The weighted coefficient of variation ($CV_W$) is computed as:

$$CV_W = \sqrt{\frac{\sum_i (y_i - \bar{y})^2 \frac{p_i}{P}}{\bar{y}}}$$

(6)

where $y_i$ is the GDP per capita of province $i$; $\bar{y}$ is the mean GDP per capita of provinces; $P$ is the total population of provinces; and $p_i$ is the population of province $i$. $CV_W$ was argued to diminish the degree to which smaller provinces can skew the measure of inequality (Williamson, 1965). It varies from zero for perfect equality to one for perfect inequality where province $i$ has all the GDP.

We also conduct the pair-wise test by Pesaran (2007). The pair-wise test by Pesaran (2007) states that GDP per capita of any two provinces ($i$ and $j$) converges if, for a positive constant $C$, there exist a positive probability $\pi$ such that their output gaps at any time periods $s$ and $t$, conditioned on an information set $I_t$, is less than $C$:

$$Pr\left\{\bigcap_{i=1,...,N-1} \bigcap_{j=i+1,...,N} |y_{i,t+s} - y_{j,t+s}| < C |I_t\right\} > \pi$$

(7)
In practice, one can test for the overall convergence of all provinces by applying the standard unit root tests for all $N(N-1)/2$ pairs of provinces, using the fraction of pairs that pass the significance level test. For example, the null hypothesis of convergence is rejected at the 5% significance level if not all possible pairs have stationary output gaps at that significance level.

### 3.3 Determinants of GDP per capita growth

The sub-group convergence hypothesis suggests that economies that exhibit identical structural characteristics only converge with one another if they face the same initial conditions (Galor, 1996). Following Bartkowska and Riedl (2012), we discuss the key factors as possibly responsible for the formation of convergence sub-groups across the 61 provinces of Vietnam during the period 1990-2011. Specifically, we concentrate on the initial conditions (at the starting point in 1990) that are crucial in determining the growth path of a province.

To explain the formation of sub-groups across the 61 provinces, we use an ordered regression model as first introduced by McKelvey and Zavoina (1975). The variable to be explained, which is denoted by $c$, indicates the sub-group to which a province belongs. This variable can be categorized as an ordinal variable since the observed sub-groups can be ranked according to the steady-state GDP per capita levels of provinces in the respective sub-group (see Table 1). However, the differences between steady-state levels across sub-groups are not known. For example, provinces belonging to the first sub-group converge to a steady state GDP per capita level which is higher than the level of the remaining sub-groups. Assuming that membership in a certain sub-group is related to a continuous, latent variable that indicates a province’s individual steady-state GDP per capita level, the model can be written as

$$y_i = x_i \beta + \varepsilon_i$$

where $x_i$ are the explanatory variables (in the initial period), including foreign direct investment (FDI) per capita, domestic investment per capita, transfers from central to provincial governments per capita, as
well as a constant term, with \( i = 1, \ldots, 61 \) indicating the province. The column vector \( \beta \) comprises the structural coefficients. Bartkowska and Riedl (2012) suggested that as the dependent variable \( \tilde{Y}_i \) is unobserved, the model cannot be estimated with OLS. As a substitute, maximum likelihood (ML) techniques are used to calculate the probabilities of observing values of \( c \) given \( x \) (ordered regression model). To use ML, the distribution of the error term \( \varepsilon_i \) has to be specified. We assume the errors to have a logistic distribution with a mean of zero and a variance of \( \pi^2/3 \), meaning that the resulting ordered regression model can be referred to as a logit model. Since the latter is non-linear in its probability outcomes, the impact of a variable on the outcomes can be interpreted in various ways. To investigate the effect of a single variable on the probability of membership in a specific sub-group, we follow the literature and report marginal effects on the probabilities of each variable evaluated at its mean and the mean of all other explanatory variables. In addition, as we are interested in the influence of initial conditions on the formation of convergence sub-groups, we show the entire probability curve for each of the initial conditioning variables (assumed that they are significant) by holding the remaining variables constant. As a result, we can observe the probabilities of belonging to a certain sub-group depending on the level of the corresponding variable. Due to data such as labour force and human capital at provincial level being unavailable, we are not able to add them into equation 8 as additional explanatory variables. This is a shortcoming of our paper and the limitation will be addressed in our future research.

4 Data descriptions

4.1 Data sources

The data used in this paper include real GDP per capita at 1994 prices for 64 provinces of Vietnam, and which were collected from the General Statistics Office (GSO). Annual data for the public investment, domestic investment and foreign direct investment were collected from
Several adjustments were made to improve the quality of the original data collected. First, the use of multiple sources (GSO, ministries and provincial statistics) allowed us to cross-check and detect possible outliers. Consequently, data from the GSO are mainly used. Second, we use fixed 1994 prices to control for effects of inflation on all variables. Third, as three of the 64 provinces, namely Dien Bien, Dak Nong and Hau Giang were established in 2004, the data of these three provinces were combined with data of their former sibling-provinces and thus, the final data set includes only 61 provinces. For our future research, microdata (from the Vietnam Living Standard Surveys) will be used to re-examine income inequality in Vietnam.

4.2 Preliminary examinations of data

Figure 1 shows index trends of mean GDP per capita, FDI per capita, domestic investment per capita, and transfers from central to provincial governments per capita from 1990 to 2011. It can be seen that investment, including FDI and domestic investment grew substantially over the study period with 14 and 20 fold increases, respectively. There are also increasing attempts to mitigate effects of income inequality among provinces, with budget transfers increasing 11 fold during the study period. However, it appears that the growth of other GDP components such as private consumption, government expenditure and net exports were not influential factors, and/or population control policies were not as effective as expected, given GDP per capita in Vietnam increased 5.7 times over the study period.
5 Results and discussions

5.1 Overall divergence

Table 1 shows that the null hypothesis of the log($t$) convergence test of Phillips & Sul (2007, 2009) for overall convergence is rejected ($\hat{\lambda} = -0.543$ and $\bar{\theta} = -16.333$). This finding suggests that provincial GDP per capita in Vietnam tended to diverge during the period from 1990 to 2011.

The pair-wise test of Pesaran (2007) also suggests that Vietnam’s real GDP per capita did not converge during the study period. Specifically, only 204 of 1830 GDP per capita gap pairs (11%) were found stationary (at the 5% significance level) when the ADF-GLS test is employed. In the case of using the KPSS test, 475 of 1830 output gap pairs (25.95%) were found to be stationary at the five percent significance level (the detailed findings of Pesaran (2007)’s tests are available upon request). Thus, overall, our finding consistently revealed that income inequality has not reduced over the study period.
Table 1. Phillips-Sul tests of overall convergence and convergence sub-group formation

<table>
<thead>
<tr>
<th>Vietnam</th>
<th>Provinces</th>
<th>coefficient</th>
<th>t-stat</th>
</tr>
</thead>
<tbody>
<tr>
<td>All 61 provinces</td>
<td>Quang Ninh, Hanoi, Hai Phong, Hai Duong, Hung Yen, Ninh Binh, Vinh Phuc, Bac Ninh, Da Nang, Quang Ngai, Khanh Hoa, Lam Dong, Ho Chi Minh City, Tay Ninh, Binh Duong, Dong Nai, Binh Thuan, Ba Ria Vung Tau, Long An, Dong Thap, Kien Giang, Can Tho - Hau Giang, Tra Vinh, Soc Trang, Bac Lieu, and Ca Mau.</td>
<td>-0.543</td>
<td>-16.333</td>
</tr>
<tr>
<td>Sub-group 1</td>
<td>Cao Bang, Tuyen Quang, Ha Nam, Thai Binh, Thanh Hoa, Quang Nam, An Giang, Tien Giang, Vinh Long, and Ben Tre</td>
<td>-0.017</td>
<td>-0.254</td>
</tr>
<tr>
<td>Sub-group 2</td>
<td>Lang Son, Thua Thien Hue, and Binh Dinh</td>
<td>0.370</td>
<td>5.654</td>
</tr>
<tr>
<td>Sub-group 3</td>
<td>Son La, Lao Cai, Bac Kan, Yen Bai, Thai Nguyen, Phu Tho, Ha Tay, Nam Dinh, Nghe An, Ha Tinh, Phu Yen, Kon Tum, Gia Lai, and Binh Phuoc</td>
<td>0.300</td>
<td>2.963</td>
</tr>
<tr>
<td>Sub-group 4</td>
<td>Lai Chau-Dien Bien, Hoa Binh, Ha Giang, Bac Giang, Quang Binh, Quang Tri, Dak Nong-Dak Lak, and Ninh Thuan</td>
<td>-0.043</td>
<td>-1.540</td>
</tr>
</tbody>
</table>

Notes: (1) The Phillips-Sul log-t test is applied to sets of data for GDP per capita. A set of economies is considered a convergent set (or sub-group) if the log-t coefficient is positive, or if the log-t coefficient is negative but its t-statistic is > -1.65.
(2) An asterisk (*) indicates a set of divergent economies.
Source: Authors’ calculation

Conventional method of σ-convergence analysis also presents a consistent finding. As seen in Figure 2, the coefficient of variation (CVW) displayed a generally rising trend over the study period, indicating that provincial levels of GDP per capita diverged prior to 2004. Also, the regression results of CVW of provincial GDP per capita over time show that the CVW increased during the sub-period 1990-2003, while it decreased during the sub-period 2004-2011 at the significant level of 1%. Interestingly, Figure 2 also shows that the divergence trend has reversed sharply after 2004. One of the main reasons for the sharp change in the CVW in 2004 is that poorer provinces had received more-than-proportionate assistance from the central government since the 2002 State Budget Law, which was put into effect from 2004 (see section 5.4). Econometric estimations done by Vu et al. (2015) affirmed that in the post-2004 sub-period, the favourable treatment was statistically significant.
5.2 Convergence sub-groups

Since there is evidence of no overall convergence, we applied the four-step clustering algorithm presented previously to examine the likelihood of group convergence. This tests for the presence among provinces of those whose GDP per capita grows at a similar rate. The existence of such convergence sub-groups creates important social and economic policy issues. Therefore, determinants of convergence sub-groups are examined in a second-stage regression. The results reveal the presence of five sub-groups in which provincial GDP per capita converges. That is, coefficients are non-negative under the one-sided t-test during the study period (see Table 1).

We also tested the sensitivity of boundaries between the memberships of the various sub-groups and found robust results: log t tests consistently rejected the inclusion of, for instance, the top one-third of the members of sub-group \( j+1 \) with members of sub-group \( j \), and of, for example, the bottom one-third of the members of sub-group \( j \) with members of sub-group \( j+1 \), for \( j=1, \ldots, 5 \).

Table 2 shows that sub-group 1 is the richest with GDP per capita

Figure 2. The coefficient of variation (\( CV_w \)) of GDP per capita at 1994 price: all provinces

Source: Authors’ calculation
at approximately VND 13.6 million. This sub-group also possesses the highest contribution of exports and lowest contribution of agriculture, forestry and fishery to GDP. In contrast, members of Sub-group 5 are the poorest with an average GDP per capita of approximately VND 5 million. The provincial economies of sub-group five have low export levels and rely heavily on agriculture, forestry and fishery. As a result, most provinces in Sub-group 1 are net contributors to the central government while provinces in Sub-group 5 are mostly net receivers.

Table 2. Average macro-economic indicators of five convergence sub-groups

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Sub-group 1</td>
<td>13,569.91</td>
<td>24.01</td>
<td>63.95</td>
<td>-62.61</td>
</tr>
<tr>
<td>Sub-group 2</td>
<td>7,604.26</td>
<td>35.42</td>
<td>18.90</td>
<td>725.61</td>
</tr>
<tr>
<td>Sub-group 3</td>
<td>6,618.03</td>
<td>29.70</td>
<td>18.59</td>
<td>669.15</td>
</tr>
<tr>
<td>Sub-group 4</td>
<td>5,792.31</td>
<td>33.33</td>
<td>16.30</td>
<td>937.68</td>
</tr>
<tr>
<td>Sub-group 5</td>
<td>4,968.09</td>
<td>33.03</td>
<td>17.42</td>
<td>1230.47</td>
</tr>
</tbody>
</table>

Source: Authors’ calculation

5.3 A brief analysis of sub-groups and provinces

Among the provinces of Vietnam, Ho Chi Minh City (HCMC) plays a special role in GDP per capita growth dynamics. It has been the leading economy in Vietnam at the provincial level. Indeed, only Ba Ria-Vung Tau has a higher per capita GDP level than HCMC, owing mainly to its oil revenue (for more details, see Appendix C and Section 5.4).

There are several interesting geographical dimensions to the relative growth performances of provinces especially in sub-group 1. The 26 provinces in this sub-group (see those in red in Figure 3) recorded relatively high absolute levels and growth rates of GDP per capita.

In the South of Vietnam, the strongest performing provinces (Binh Duong, Dong Nai, and Tay Ninh) have strong economic ties with the country’s commercial capital (HCMC). In the north, Vinh Phuc has close connections with Hanoi - the administrative capital of Vietnam.
Ninh, Hai Phong, Da Nang, and Ca Mau show up as regional economic centres. These results confirm the fostering role and positive spill-overs from the economic centres to their surrounding provinces.

In contrast, in 2011, all ten provinces of sub-group 2 and 14 provinces of sub-group 4 had lower GDP per capita in comparison with the national average (see Appendix C). Also, the provinces of sub-groups 2 and 4 rely mainly on agriculture, forestry and fishery production.

In 2011, GDP per capita of the three provinces in sub-group 3 were roughly two-thirds of the national average (see Appendix C). These provinces also have advantages of agriculture, forestry and fishery pro-
duction. Nevertheless, all the provinces of sub-group 3 and sub-group 4 still received substantial subsidies from the central government.

A majority of provinces of sub-group 5 had very low ranking of GDP per capita in 2011 (see Appendix C). In the same year, almost all provinces of this sub-group had a high percentage of agriculture, forestry and fishery to GDP. In addition, all provinces of sub-group 5, especially Ha Giang, Lai Chau-Dien Bien and Hoa Binh, were significant recipients regarding subsidies from the central government.

Figure 3 also shows that member provinces of sub-group 5 are mostly located in remote, mountainous areas (Lai Chau - Dien Bien, Ha Giang and Bac Giang) or are not well connected to strong economic hubs (Hoa Binh, Quang Binh, Quang Tri, Dak Nong-Dak Lak, and Ninh Thuan). Their disadvantageous locations resulted in some of the weakest growth performances. Therefore, the government needs to pay greater attention to these poorest provinces if their socio-economic development is to be promoted.

5.4 Key factors behind the switch from divergence to convergence

This section presents a desk review of government materials, and data as indicated in Section 4.1 of this current paper.

5.4.1 Foreign Direct Investment (FDI)

The distribution of FDI across provinces has become less uneven, especially since 2004. In 1990, about 98% of the total amount of implemented FDI was located in the three richest cities, namely Hanoi, Ho Chi Minh City and Ba Ria Vung Tau. This ratio declined to roughly 75% in 1994, but was still approximately 51% in 2003. However, this ratio then declined rapidly to approximately 43% in 2011.

The decline of FDI in 2011 reflected the fact that FDI had increasingly gone to other provinces such as Quang Ninh, Hai Phong, Hai Duong, Hung Yen, Vinh Phuc, Bac Ninh, Da Nang, Tay Ninh, Dong Nai, Binh Duong and Long An. For example, the FDI per capita at 1994 prices of Vinh Phuc and Binh Duong increased dramatically from
about VND 495 thousand and VND 1,795 thousand in 2004 to VND 717 thousand and VND 2,678 thousand in 2011, respectively. As a result, the number of provinces with FDI-GDP ratios of 4.5% or higher increased from two in 1990, to 16 in 2003, and 25 in 2011.

It seems that the change in the State Budget Law in 2002 has created significant change in FDI, and hence, its impact to GDP growth. Before 2004, FDI was mainly distributed in Ho Chi Minh City (the commercial capital) and Hanoi (the administrative capital). Since 2004, the distribution of FDI across provinces has become less uneven. For example, FDI has increasingly gone to other provinces such as Quang Ninh, Hai Phong, Hai Duong, HungYen, Vinh Phuc, Bac Ninh, Da Nang, Tay Ninh, Dong Nai, Binh Duong and Long An. Also, since 2004, poorer provinces have received more public investment from the central government. Therefore, the inequality in GDP per capita between the provinces switched from divergence to convergence around 2004.

5.4.2 Public Investment

Public expenditure, especially public investment, has also played a key role in reducing inter-provincial disparities in recent years. For instance, while the investment-to-GDP ratio for the country increased from 40% in 2003 to 44% in 2011, in Lai Chau-Dien Bien, one of the poorest provinces, it surged from approximately 8% in 1990 to nearly 73% in 2003 and about 82% in 2011. Another example is Ha Giang, which is also a very poor province. It experienced a dramatic increase in investment-to-GDP ratio, from around 17% in 1990 to roughly 49% in 2003 and 81% in 2011.

In addition, the number of provinces with investment-to-GDP ratio at or above 50% increased from 13 in 2001 (eight of which could be considered relatively poor) to 25 in 2004 and 27 in 2011 (18 of which were poor). Such extraordinarily high investment-GDP ratios implied that much of the goods and services that went into the relevant capital formation must have come from outside the province. Typically, the investment would involve the construction of infrastructure for which the public sector must pay the lion’s share.
5.4.3 Central-Provincial Transfers

As many of the provinces which undertook the public investments were relatively poor, transfers must increasingly be made from the central budget to some provincial authorities (Vu, 2015). For example, in Ha Giang, the country’s poorest province, such budgetary support amounted to about 84% of GDP in 2011, compared with 56% in 2004. The corresponding subsidy-to-GDP figures for Bac Kan and Lai Chau - Dien Bien, were 74% and 66% respectively in 2011, considerably increased from 71% and 53% respectively in 2004. In this connection it should be noted that all provinces in the North West and the Central Highlands regions, as well as almost all provinces in the North East, North Central Coast, and South Central Coast, were recipients of subsidies from the central budget.

Reflecting these transfers, public investment per capita in poor regions such as the North West, North East, and North Central Coast region increased from 44%, 81%, and 70% of the national average in 2000, to 93%, 87%, and 74%, respectively, in 2011. In the South East (the richest) region, the corresponding ratio decreased from around 163% in 2000 to about 149% in 2011.

Similarly, public investment per capita, as a percentage of the national average, increased in the Central Highlands and the Mekong River Delta regions, from 69% and 59% in 2004, to 73% and 71% in 2011, respectively. In contrast, it decreased in two of the richer regions, the Red River Delta and the South East regions, from roughly 112% and 149% in 2004 to about 93% and 146% in 2011, respectively.

5.5 Factors determining sub-group membership

Table 3 presents the marginal effects for each outcome of the sub-group variable c. The individual partial derivatives indicate the change in the probability of belonging to a specific sub-group given a small change in the explanatory variables. The results show that FDI per capita, domestic investment per capita and per capita transfers from the central to provincial governments are significant determinants of
the growth rates in GDP per capita. In particular, the probability of belonging to high-income provinces (sub-group 1) increased by 0.076 percentage points and 0.007 percentage points, respectively when FDI per capita and domestic investment per capita increased by one million VND. In contrast, an increase of government transfers of one million VND is associated with a reduction in the probability of belonging to the rich-province sub-group by 0.04 percentage points. Overall, it can be concluded that FDI and domestic investment are positively associated with real GDP per capita growth while the reverse relationship is found for transfers per capita.

Table 3. Marginal effects on probabilities of joining a convergence sub-group

<table>
<thead>
<tr>
<th>Variable</th>
<th>Sub-group 1</th>
<th>Sub-group 2</th>
<th>Sub-group 3</th>
<th>Sub-group 4</th>
<th>Sub-group 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>FDI per capita</td>
<td>0.00076*</td>
<td>-0.00021*</td>
<td>-0.00008*</td>
<td>-0.00036*</td>
<td>-0.00010*</td>
</tr>
<tr>
<td>Investment per capita</td>
<td>0.00007*</td>
<td>-0.00002*</td>
<td>-0.00008*</td>
<td>-0.00004*</td>
<td>-0.00001*</td>
</tr>
<tr>
<td>Transfer per capita</td>
<td>-0.00041*</td>
<td>0.00011*</td>
<td>0.00004*</td>
<td>0.00019*</td>
<td>0.00006*</td>
</tr>
<tr>
<td>Number of provinces</td>
<td>26</td>
<td>10</td>
<td>3</td>
<td>14</td>
<td>8</td>
</tr>
</tbody>
</table>

Note: *indicates 1% significant level
Source: Authors’ calculation

6 Conclusions

This paper analyses the provincial disparities in GDP per capita across the 61 provinces of Vietnam during the period 1990-2011. The results of the “log(t)” test by Phillips & Sul (2007, 2009) and the pairwise test by Pesaran (2007) indicate that GDP per capita of provinces diverged over the study period. However, the result of σ-convergence shows that there was a clear break in the trend around 2004. To gain further insight into these dynamics, five convergence sub-groups are identified by using the clustering algorithm developed by Phillips & Sul (2007, 2009). The main factors underlying the switch from diver-
gence to convergence around 2004 were foreign direct investment, public investment, and central-provincial budgetary transfers. The results of estimates from an ordered probit model indicate that foreign direct investment, domestic investment, and transfers from central to provincial governments play an important role in forming the convergence sub-groups among the 61 provinces of Vietnam. These results produce a number of policy implications.

First, it is clear that there are major benefits in promoting further positive spillovers of the existing economic centres (the dynamic cities/provinces) on their adjacent provinces. Second, economic efficiencies in public expenditure programs have been a primary determinant of the success of past economic growth policies aimed at reducing regional disparity. Thirdly, therefore, to further promote the socio-economic development of the poorest provinces, the central government needs to re-prioritize the level of its investment and flows of resources via the budget transfer mechanism to these provincial governments.

References


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Williamson, J.G., “Regional inequality and the process of national devel-

Appendices

Appendix A: Provincial Map of Vietnam

Source: The General Statistics Office of Vietnam
Appendix B: Regional map of Vietnam

Source: The General Statistics Office of Vietnam
### Appendix C: GDP per capita of provinces in Vietnam in 2011 at 1994 price (VND thousand)

<table>
<thead>
<tr>
<th>Provinces</th>
<th>GDP per capita in 2011 at 1994 price (VND thousand)</th>
<th>Ranking of provincial GDP per capita in 2011</th>
<th>Sub-group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ba Ria - Vung Tau</td>
<td>54,476.92</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Ho Chi Minh City</td>
<td>22,127.48</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Hanoi</td>
<td>17,179.35</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Dong Nai</td>
<td>15,394.78</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Vinh Phuc</td>
<td>14,495.74</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>Binh Duong</td>
<td>14,442.47</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>Hai Phong</td>
<td>14,187.06</td>
<td>7</td>
<td>1</td>
</tr>
<tr>
<td>Da Nang</td>
<td>13,780.49</td>
<td>8</td>
<td>1</td>
</tr>
<tr>
<td>Tay Ninh</td>
<td>13,686.54</td>
<td>9</td>
<td>1</td>
</tr>
<tr>
<td>Ca Mau</td>
<td>13,259.92</td>
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<td>1</td>
</tr>
<tr>
<td>Quang Ninh</td>
<td>12,669.07</td>
<td>11</td>
<td>1</td>
</tr>
<tr>
<td>Kien Giang</td>
<td>12,280.38</td>
<td>12</td>
<td>1</td>
</tr>
<tr>
<td>Khanh Hoa</td>
<td>11,337.47</td>
<td>13</td>
<td>1</td>
</tr>
<tr>
<td>Bac Ninh</td>
<td>11,325.38</td>
<td>14</td>
<td>1</td>
</tr>
<tr>
<td>Bac Lieu</td>
<td>11,251.55</td>
<td>15</td>
<td>1</td>
</tr>
<tr>
<td>Lam Dong</td>
<td>11,166.11</td>
<td>16</td>
<td>1</td>
</tr>
<tr>
<td>Can Tho - Hau Giang</td>
<td>9,933.81</td>
<td>17</td>
<td>1</td>
</tr>
<tr>
<td>Long An</td>
<td>9,891.52</td>
<td>18</td>
<td>1</td>
</tr>
<tr>
<td>Dong Thap</td>
<td>9,756.15</td>
<td>19</td>
<td>1</td>
</tr>
<tr>
<td>Soc Trang</td>
<td>9,693.06</td>
<td>20</td>
<td>1</td>
</tr>
<tr>
<td>Tra Vinh</td>
<td>9,206.81</td>
<td>21</td>
<td>1</td>
</tr>
<tr>
<td>Hung Yen</td>
<td>8,980.95</td>
<td>23</td>
<td>1</td>
</tr>
<tr>
<td>Ninh Binh</td>
<td>8,972.18</td>
<td>24</td>
<td>1</td>
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<tr>
<td>Hai Duong</td>
<td>8,545.58</td>
<td>26</td>
<td>1</td>
</tr>
<tr>
<td>Quang Ngai</td>
<td>7,620.05</td>
<td>30</td>
<td>1</td>
</tr>
<tr>
<td>Binh Thuan</td>
<td>7,156.87</td>
<td>31</td>
<td>1</td>
</tr>
<tr>
<td>Cao Bang</td>
<td>6,361.50</td>
<td>40</td>
<td>2</td>
</tr>
<tr>
<td>Tuyen Quang</td>
<td>6,538.82</td>
<td>37</td>
<td>2</td>
</tr>
<tr>
<td>Ha Nam</td>
<td>7,785.74</td>
<td>29</td>
<td>2</td>
</tr>
<tr>
<td>Thai Binh</td>
<td>7,040.31</td>
<td>33</td>
<td>2</td>
</tr>
</tbody>
</table>
Compliance with Ethical Standards

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