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Determinants of economic growth in the Mekong Delta provinces

Le Minh Son* and Bui Kieu Anh
Vietnam Institute for Development Strategies, Ministry of Planning and Investment, Vietnam
**Correspondence: Le Minh Son (email: sonlm.vids@mpi.gov.vn)*

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ABSTRACT

The paper, based on the database of 13 provinces (including Can Tho city) in the Mekong Delta in the period of 2010 - 2016, is aimed at analyzing the relationship between per capita GRDP growth and the ratio of local investment capital, foreign direct investment and local government expenditure to GRDP, population and human capital (proxied by Labor Training Index - a component of Vietnam Provincial[1] Competitiveness Index), infrastructure and spatial structure. Multivariate regression results showed little evidence for positive impact of implemented FDI to GRDP per capita, negative impacts of government spending on education, training, vocation, science and technology to GRDP per capita, in the short-term. Labor quality, infrastructure and spatial concentration are shown to have positive impacts to economic growth. Policy recommendations to the region GRDP growth were then proposed

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1 INTRODUCTION

The Mekong Delta (MD) region includes 12 provinces and a city: Can Tho, Long An, Tien Giang, Ben Tre, Tra Vinh, Vinh Long, An Giang, Dong Thap, Kien Giang, Hau Giang, Soc Trang, Bac Lieu and Ca Mau. With a total area of more than 40.8 thousand km^2, population of 17.7 million people, GRDP in 2017 at VND 533,272 billion (these figures account for approximately 12.3%, 18.9% and 12% of the national figures, respectively), the MD is a key economic region for food, aquatics and fruit production of Vietnam, and an important strategic location for national defense, security and foreign affairs. Currently, the Government of Vietnam is drafting the Master Plan for the MD region in 2021-2030, with vision set to 2050. Interestingly, this plan coincides with the approval of Vietnam Planning Law 2017 which was effective since January 1st 2019. The new Planning Law 2017 affirms that socio-economic planning and spatial development planning are now an integrated process (before Planning Law was approved, these were two separate planning processes) and are no longer conducted separately. The MD region is not only at the center of Vietnamese Government investment but also is the pioneer region for new policies making, so revisiting the case of economic growth in this region has both empirical and practical significance. This article focuses on investigating the determinants of economic growth of MD provinces in the period of 2010 - 2016. Based on the analysis of the

[1] *In this paper, "local" and "provincial" are used interchangeably*

paper, some policy implications are drawn for the region economic development.

2 LITERATURE REVIEW

Research on the determinants of economic growth is one of the research areas that attract most interest in economics, thus there is a large related literature body. Many studies have attempted to explain the source of economic growth from different angles. Lucas (1988) identified the impact of human capital and showed that human capital plays a decisive role in economic growth. Barro (1990), King and Rebelo (1990) argued that policies on taxes and government spending affect economic growth. Landau (1983, 1986), Kormendi and Meguire (1985), Barro and Sala-i-Martin (1991) argued that investment in physical and human capital is positively proportional to economic growth while government size (measured by the ratio of government expenditure to GDP) has a negative relationship. Edwards (1992) found evidence on strong relationship between economic performance (measured by real growth rate of GDP per capita) and trade orientation (measured by various trade openness indices, p. 40); in particular "countries with more open and less distortive trade policies have tended to grow faster than those with more restrictive commercial policies" (p. 54). Feder (1983) founded evidence to support that the "success of economies which adopt export-oriented policies is due, at least partially, to the fact that such policies bring the economy closer to an optimal allocation resources" (p. 71).

Some studies on the impact of foreign direct investment on economic growth and GDP show that FDI has a positive influence on GDP in countries with different conditions such as high-income countries (Blomstrom *et al.*, 1994), countries which pursue an outwardly-oriented, rather than an inwardly-oriented, trade policy (Balasubramanyam *et al.*, 1996) and in countries with higher level of human capital available in the host economy (Borensztein *et al.*, 1998). Positive effects of infrastructure are also found in the study of Aschauer (1989), Canning *et al.* (2004).

The relationship between regional *spatial structure* and economic development has also been discussed and examined. Broadly speaking, the spatial structure of a region refers to how the region organizes its economic activities in space, or how economic activities are distributed spatially in a region. Parr (1979) diligently described the regional economic change and regional spatial structure as follows: "the differences between the two sets of regional economic activity in terms of internal economies of scale, locational orientations, and agglomeration tendencies can be expected to lead to differing regional spatial structures" (p. 825) and vice versa, "on the grounds that, given the quantity and the quality of labor, capital, and land, a different spatial structure would be associated with a different level of regional output" (p. 826). Parr argued that, historically, the research fields of Economic Development and Spatial Economics were developing parallelly; however, they have almost never overlapped with each other. Consequently, the relationship between a region's spatial structure and its economic development was left unexplored. A literature review by Kim (2011) has identified a causal link between land use and regional economies via development pattern changes and spatial structure reformation (pp. 36-38). Cervero (2001) analyzed both inter-city data with 47 observations and at the 27 super-districts in the San Francisco Bay Area, US and found evidence to show a link between the characteristics of urban spatial structure and economic development: districts with larger land areas, better commuting connections between employment and housing, more efficient transportation systems often have more economic advantages in terms of labor productivity and agglomeration economies.

Other researches have attempted to examined cross-sector growth (using a multivariate model). Barro and Sala-i-Martin (1991) studied economic growth in 48 states of the United States (US) and 47 prefectures of Japan and found evidence for economic convergence in both countries: less developed regions tend to have higher growth rates. At a lower data level, Crihfield and Pangabean (1995) investigated the determinants affecting economic growth in 282 cities in the US and found little evidence of the link between state investment and private investment with average GDP growth. Similarly, Glaeser *et al.* (1995) studied the determinants affecting economic growth in 203 US cities and found evidence to show that city income and population growth move together, they are positively related to initial schooling and negatively related to initial unemployment (the number of years of schooling and the level of unemployment in the first period of observation); government expenditures are uncorrelated with growth.

In the case of the MD region, there have also been some studies on economic growth. For example, Dao Thong Minh and Le Thi Mai Huong (2016) studied the impacts of private investment, labour and infrastructure on economic growth in the MD.

Using multivariate regression and local statistics of 13 provinces in the period of 2009-2013, they showed a positive relationship between private investment, labour force and electric energy consumed in industrial production, construction, road length and economic growth. Dinh Phi Ho and Tu Duc Hoang (2016) evaluated the impact of human capital on economic growth in the MD using panel data of 13 provinces in the period of 2006-2013. Their research showed the positive impact of indicators representing human capital on economic growth such as the average number of years of schooling of the labour force, the ratio of state expenditure on education, the ratio of state expenditure on health. Ngo Anh Tin (2017) utilized a regression model examining the impact of public investment on economic growth in the provinces in the MD in the period of 2001-2014. His thesis' result showed that public investment in the MD provinces and cities does not have a positive impact on economic growth but also has a negative impact on private investment, reducing the effectiveness of FDI on economic growth. Nguyen Kim Phuoc (2015) used data in 30 provinces and cities to find no evidence of a link between GDP and FDI in the MD provinces.

Literature on MD region economic growth is still relatively sparse. This paper is aimed to contribute to the literature of MD region economic research with two following main points of departure:

Firstly, 'Labor Training Index' is used as a proxy for labor quality. The Labor Training Index is one of ten component indices which are used to calculate Vietnam Provincial Competitiveness Index (PCI). PCI consists of a comprehensive set of data and reports that are annually published by Vietnam Chamber of Commerce and Industry (VCCI and USAID, 2019). Figure 1 illustrates the position of Labor Training Index in the construction of PCI.

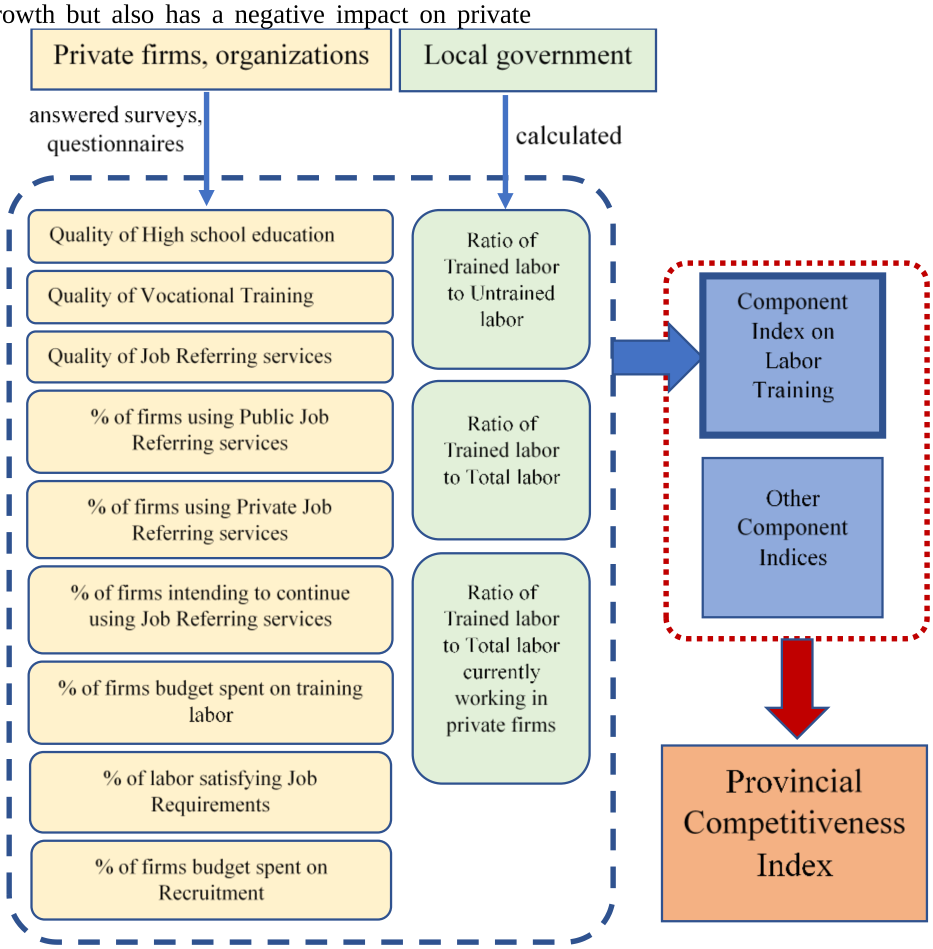

Fig. 1: The indicators of Labor Training Index in the construction of PCI (VCCI and USAID, 2019); rendition by authors

The Labor Training Index has two outstanding elements. It consists of local firms' evaluation (by giving questionnaire feedback) on labor education and labor training services provided by the local government and third-party providers; how well labors qualify for job requirements at work. Therefore, it directly reflects how firms evaluate labor quality (thus, human capital) in a province. Besides, there are three statistics calculated by the local government namely (i) ratio of trained/untrained labor, (ii) ratio of trained/total labor and (iii) ratio of trained/total labor currently working in private firms which are not covered in the annual provincial statistical data. Dinh Phi Ho and Tu Duc Hoang (2016) used the number of years of schooling as proxy for human capital due to data availability and consistency. In this paper, it is argued that the availability of Labor Training Index (annually) and its unique elements make it an ideal proxy for human capital.

Secondly, as discussed, research in economic growth in the MD region has often not considered how economic activities are organized spatially. The relation between spatial structure and economic performance is left unexplored in previous studies. Perhaps, it is not because researchers have overlooked this relationship. The availability of statistics in Vietnam presents many limitations which make it challenging to investigate economic activities in space effectively. For example, data about infrastructure, physical distance, travel-time are often not collected or fully published in Vietnam. In this paper, some spatial structure indicators are constructed with available data to examined the relation between regional spatial structure and economic performance. Hopefully, further discussion and clarification will be engaged to contribute to this research gap in Vietnam.

3 METHODOLOGY AND DATA

3.1 Research methods

To investigate the impact of determinants on economic growth in the MD provinces, a multivariate regression model with panel data is utilized. The model and research variables are based on the aggregate production function of Lin and Song (2002) as follows:

$$Y_t = F(L_t, K_t, X_t, H_t, R_t, G_t) \qquad \textbf{\{1\}}$$

Lin and Song assumed constant return to scale. In endogenous growth models, variables such as investment or government spending (a special type of investment) are treated as endogenous model, and thus they are not used as explanatory variables. In the model utilized by Lin and Song above, factors determining economic growth are treated as exogeneous and therefore used as independent variables. This form of production function was utilized in previous empirical studies (Feder, 1983; Romer, 1990); the use of variables representing the ratio of government to GDP and ratio of investment to GDP was utilized in research by Romer (1990, p. 275) and Levine and Renelt (1992, p. 950). In the case of the MD region, the use of multivariate model was also used by Dao Thong Minh and Le Thi Mai Huong (2016).

In equation {1}, Lin and Song (2002) uses the city-level observations, whereas Y_t is the actual total product of the city, L_t is the total labor force of the city, K_t is the total amount of capital in the city, X_t is the total amount of foreign capital in the city, H_t is human capital, R_t represents city infrastructure; G_t is the expenditure of the city government expressed by the provision of public services.

The derivation of regression model from function {1} conducted by Lin and Song (2002, pp. 2256-2257) is presented here. With the assumption of constant returns to scale, they divided both sides of equation {1} by the total city population to obtain:

$$yt = f(lt, kt, xt, ht, rt, gt) \qquad \textbf{\{2\}}$$

Equation {2} is interpreted as the total per capita product of city, y_t is the equation of capital per capita k_t, foreign investment per capita x_t, ratio of labor to population per population l_t and human capital h_t, infrastructure per capita r_t and city expenditure per head g_t.

Taking the whole differential of equation {2} and divide both sides by y_t:

$$\frac{dy_t}{y_t} = f_l\frac{L_t}{Y_t}\frac{dL_t}{L_t} + f_k\frac{dK_t}{Y_t} + f_x\frac{dX_t}{Y_t} + f_h\frac{dH_t}{H_t}\frac{H_t}{Y_t} + f_r\frac{R_t}{Y_t}\frac{dR_t}{R_t} + f_g\frac{dG_t}{G_t}\frac{G_t}{Y_t} + (fl\frac{L_t}{Y_t} + fk\frac{K_t}{Y_t} + fx\frac{X_t}{Y_t} + fh + fr\frac{R_t}{Y_t} + fg\frac{G_t}{Y_t})\frac{dP_t}{P_t} \qquad \textbf{\{3\}}$$

set $\dot{x}_t = dx_t/x_t$ for each variable x, equation {3} is rewritten as:

$$\dot{y}_t = a_1\dot{P}_t + a_2\frac{i_t^f}{y_t} + a_3\frac{i_t}{y_t} + a_4\frac{g_t}{y_t} + a_5\dot{L}_t + a_6\frac{h_t}{y_t} + a_7\dot{R}_t \qquad \textbf{\{4\}}$$

In their research, Lin and Song (2002) added a dummy variable *coast* (which takes the value of 1 or 0 depending on whether a city has a coast line or not) and a constant u_t, which makes equation {4} be:

$$\dot{y}_t = a_0 + a_1\dot{P}_t + a_2\frac{i_t^f}{y_t} + a_3\frac{i_t}{y_t} + a_4\frac{g_t}{y_t} + a_5\dot{L}_t + a_6\frac{h_t}{y_t} + a_7\dot{R}_t + a_8 coast + a_9 t_0 + u_t \quad \mathbf{\{5\}}$$

Equation {5} is the equation used in Lin and Song (2002) for their estimation. It is interpreted as the per capita product growth depending on population growth $\dot{P}_t$, share of foreign investment compared to total product i_t^f/y, share of investment compared to total production product *i/y*, the share of government expenditure compared to the total product *g/y*, the growth rate of the labour force $\dot{L}$, the ratio of human capital to the total product *h/y*, the rate of growth of infrastructure $\dot{R}$, whether the city is coastal or not (via the dummy variable *coast*) and product per capita year of first observation y_0.

Vietnam General Statistical Office published economic data at both provincial and national level; however, the economic statistics at provincial level are relatively consistent between provinces in the MD region and compatible with the model. Based on the production function of Lin and Song (2002), a multivariate regression model of the general form is constructed:

Economic Growtht = α + β1Labort + β2Investmentt + β3Local Government Expendituret + β4Infrastructuret + β5Spatial Structuret + εt

In which *Labor*, *Investment*, *Local Budget*, *Infrastructure and Spatial Structure* are groups of independent variables which are further explained below; *ε* is the residuals of the model; *t* stands for time dimension (year) of estimation period. Unlike Lin and Song (2002), the regression model in this article does not include any dummy variables. The general form can be written into (full) regression equation of the following:

$$\ln(\text{GRDP per capita}) = a + b_1\ln(\text{Population})_t + b_2(\text{Human capital}) + b_3\frac{i_t}{y_t} + b_4\frac{i_t^{local}}{y_t} + b_5\frac{i_t^{FDI}}{y_t} + b_6\frac{g_t}{y_t} + b_7\frac{g_t^{edusci}}{y_t} + b_8\frac{g_t^{rest}}{y_t} + b_9\ln(\text{Road}) + b_{10}\text{EMPDENSE} + b_{11}\text{CP1} + b_{12}\text{CP2} + u_t$$

The inclusion and estimation of these variables are presented in the next part.

Dependent variables (Economic Growth): log the total product per capita of a province in a year, taking the comparative (fixed) price in 2010 (lnGRDPPERCAP). The use of total product per capita (or per capita total output) as a variable of economic growth is popular in economic research (Barro, 1990; Romer, 1990; Lin & Song, 2002; Canning *et al.*, 2004); in the case of the MD region, Su Dinh Thanh (2014), Dao Thong Minh & Le Thi Mai Huong (2016) also used growth in per capita output as indicator of economic growth.

Independent variables (by groups)

Labor

These are the variables that represent the human capital of the provincial workforce. Lin and Song (2002) used the population growth rate and the proportion of illiterate people in the city as a proxy for human capital. The ideal variable to reflect labor and human capital would be the number of labor force in the provinces. However, data from provincial statistical yearbooks does not contain reliable data about labor force. In Vietnam, this kind of statistics is usually collected by the General Statistical Office through separate surveys or by the General Census (which is done every ten years). Even though the number of people within the employment age can be estimated, the task is very time consuming, and estimations might not be reliable.

As the result, the annual average population log (lnPOP) and the provincial competitiveness index for Labor Training Index (LTI_LABOUR) are selected for their availability and consistency. On the one hand, population growth is positively corelated to an increase in the labor force, and thus the total product in general; on the other hand, higher population might result in lower average per capita income. So, the expected impact of population growth is either negative or positive. The rationale for selecting Labor Training Index as a dependent variable was discussed in the previous part. Expectations on the impact of this variable are positive (+).

Investment

Studies on economic growth using investment variables often use ratio of investment/total product as variables. The variables used in the model include the ratio of total provincial investment to provincial GDP (rI_ALL), the ratio of total local provincial investment to provincial GDP (rI_LOCAL) and the ratio of total implemented provincial FDI to provincial GDP (rI_FDI). Ratios of investment to provincial GDP are used to assess the impact of investment size on total product. Data on FDI investment from the provincial statistical yearbooks are "Implemented FDI" instead of "Registered FDI". This is one point of departure from previous studies (Su Dinh Thanh, 2014; Nguyen Kim Phuoc, 2015) which used Registered FDI as independent variable in their research. The expected impact of the ratio of total investment, domestic investment and Implemented FDI on per capita GDP is positive (+).

Local Government Expenditure: includes (i) the ratio of the total local government expenditure to provincial GDP (rG_ALL), (ii) the ratio of total local government expenditure on education, training and vocational training, science and technology to provincial GDP (rG_EDUSCI) and (iii) ratio of total local government expenditure on other local budgets to provincial GDP (rG_REST). The ratio of local government expenditure to provincial GDP is used to assess the impact of state size. In contrast to the study of Dinh Phi Ho and Tu Duc Hoang (2016), a variable representing human capital is calculated from the combination of local government spending on education, training and vocational training and local government expenditure on science into technology. The assumption here is that budget spending on education, training, vocational training, science and technology creates accumulation of human capital (Lucas, 1988). Together with LTI_LABOUR, rG_EDUSCI is also used as a proxy for labor capital. It is expected that the effect of these variables are positive (+).

Infrastructure: reflects the capacity of provincial infrastructure to meet local transport demand (lnROAD). Unlike Lin and Song (2002) study which used the growth of the number of road kilometers of the city, here data on the volume of freight-kilometers carried in the province by road each year is used as a representative variable. Data about infrastructure, especially transport infrastructure, is unavailable in Vietnam.

Sources such as Vietnam Ministry of Transport or Vietnam Road Administration do not publish data on the transport infrastructure (for instance, road lengths, number of kilometers in a province, number of paved road (measured in kilometers), number of ports, airports, etc.) Provincial Statistical Office data on infrastructure is only limited to the volume of *freight-kilometers* in their province. It is calculated by the volume of goods transported (thousand tons) multiplied by the number of km of local roads (km) - it is the best publicly available data that can be used as a proxy for infrastructure. The expected effect of this variable is positive (+).

Spatial Structure: these are constructed variables to assess the impact of the spatial structure of a province on its economic growth. These constructed variables, essentially are alternative measurement of urbanization however differ from conventional calculation by Vietnam General Statistical Office (GSO). Conventional method taken by GSO calculates the percentage of urban population (or urbanization rate) based on household registration. Because household registration is administrative, the drawback of GSO's method is it does not show the distribution of people (and therefore economic activities) accordingly.

An alternative method to solve this issue is to calculate an index for Market Access - how easily it is for people to access their labor market (place of work) or consumption market (shopping, entertainment, etc.) - by estimating their distance, travel time, opportunities cost of travel, for example. By assigning districts their own Market Access index, a spatial structure of a province or a region can be demonstrated using GIS tools mapping software (some related studies are Davis and Weinstein, 1998; Baum-Snow *et al.*, 2015; Duranton, 2016).

Unfortunately, as discussed above, statistics about distance in kilometers, travel time is often not published in Vietnam; provincial data about infrastructure is also very limited. This is due to the lacking attention of spatial elements in economic research done in Vietnam, resulting in less demand for publication of such data. Yet, one of our motivation for creation and inclusion of these variables is that hopefully this exercise would engage further discussion and clarification in this research gap, which is becoming more and more pressing in new policy shifts in Vietnam.

Following the research of Cervero (2002), three variables are constructed: (i) average labor density on the provincial area (EMPDENSE), the ratio of the population in the urban to population across the province (City Primacy 1 or CP1) and (iii) the ratio of urban density to population density of the province (City Primacy 2 or CP2). Specifically, these variables are calculated as follows:

Average labor density in the province total land area:

$$\text{EMPDENSE} = \frac{Total\ Labour\ force\ aged\ 15\ and\ above}{Total\ provincial\ area}$$

The ratio of population in urban to population of the province:

$$\text{CP1} = \frac{Total\ Provincial\ Urban\ Population}{Total\ Provincial\ Population}$$

The ratio of Urban population density to Average population density of the province:

CP2= $\frac{(Total\ Provincial\ Urban\ Population)/(Total\ Urban\ Area)}{(Total\ Provincial\ Population)/(Total\ Provincial\ Area)}$

CP1 shows the importance of a central city compared to the whole province, specifically the percentage of the population lives in the central city.

CP2 shows how much more concentrated the central city is compared to its wider province.

The variables used in the model are summarized in Table 1.

Table 1: List of variables

Groups	Variables	Variables' elaboration	Expected sign of impact on dependent variable
Dependent	lnGRDPPERCAP	log (gross regional product per capita at comparative prices in 2010)	
Labor	lnPOP	log (Average population by province by year)	?
	LTI_LABOUR	Labor Training Index - a component index of Provincial Competitiveness Index	(+)
Investment	rI_ALL	Ratio of total investment/GRDP	(+)
	rI_LOCAL	Ratio of total local investment/GRDP	(+)
	rI_FDI	Ratio of total implemented foreign direct investment/GRDP	(+)
Local Government Expenditure	rG_ALL	Ratio of total local government expenditure/GRDP	(+)
	rG_EDUSCI	The ratio of total local government expenditure on education, training and vocational training, science and technology/GRDP	(+)
	rG_REST	Ratio of other local government expenditure/GRDP	(+)
Infrastructure	lnROAD	log (volume of freight-kilometers carried in the province by road)	(+)
Spatial Structure	EMPDENSE	Labor density on the provincial area	?
	CP1	Ratio of urban population in city(ies)/population of the province	?
	CP2	Ratio of population density in city(ies)/ population density of the province	?

3.2 Data

Data of 13 provinces in the MD in the period of 2010 - 2016 were collected from the provincial statistical yearbook. The Labor Training Index is taken from the corresponding PCI data for provinces from 2010 to 2016.

Table 2: Summary Statistics

	Mean	Minimum	Maximum	Standard Deviation
GRDPPERCAP (thousand VND/person)	23,748.97	22,672.86	56,142.64	3,846.91
lnGDPPERCAP	9.98	10.03	10.94	8.26
POPULATION (thousand people)	1,655.45	1,304.70	5,294.90	759.8
lnPOP	7.28	7.17	8.57	6.63
rG_ALL	0.26	0.26	0.45	0.12
rG_EDUSCI	0.04	0.04	0.07	0.01
rG_REST	0.22	0.21	0.4	0.09
rI_ALL	0.4	0.36	1.15	0.19
rI_FDI	0.02	0.01	0.11	0
rI_LOCAL	0.37	0.3	1.12	0.19
LTI_LABOUR	5	5.01	6.3	3.85
INFRA_ROAD (thousand tons-km)	198,918.01	160,840.00	639,113.00	12,400.00
lnROAD	11.87	11.99	13.37	9.43
EMPDENSE	28.98	28.48	49.68	12.79
CP1	0.17	0.14	0.54	0.09
CP2	5.53	4.32	18.85	1.3

Source: calculated from MD Provincial Statistical Yearbooks

4 RESULTS AND DISCUSSION

There are 14 regressions tested whose results are reported in Tables 3-5. Table 3 shows the regression results using panel data for 13 provinces in the MD in the period of 2010 – 2016. Regression (1) examines the effect of population on economic growth with lnPOP as the only variable. Regressions (2), (3), (4), (5) examine the impacts of government spending, investment, labor quality, infrastructure with spatial variables added correspondingly. The purpose is to examine the stability and significance of each variable in the presence of others. Investigation on the impact of the ratio of local government and investment to GRDP by *types* is demonstrated in Table 4 (regressions (6), (7), (8), (9)). A separate assessment for spatial structure variables to GDP per capita growth (regressions (10), (11), (12), (13), (14)) is presented in Table 5.

Regression (1) examines the correlation between per capita GRDP and population, the coefficient of lnPOP variable is negative at (-0.654) and is statistically significant at 1%. In regressions (6), (7), (8), (9) and (10), the population growth has a negative coefficient between (-0.745) and (-0.663) and is statistically significant at 1%, even when other variables are introduced in regression. Therefore, the relationship between GRDP per capita and the population of the MD provinces is relatively stable when controlling for other factors. It can be interpreted as, *ceteris paribus*, when the population of provinces increases by 1%, per capita GRDP decreases by approximately 0.6 to 0.7%.

The impact of local government expenditures is generally positive and statistically significant; coefficients of variable rG_ALL fluctuate in the range of 1.099 - 1.392 and are statistically significant at 5% in regressions (3) and (4), at 10% in regressions (2) and (5). The coefficient of local government expenditure variable shows a positive impact of public expenditure on economic growth. The results from the regression here are different from the research results of Ngo Anh Tin (2017) which obtained no evidence of impact of public investment and recurrent expenditure on economic growth. The results from Table 4 can be interpreted as, *ceteris paribus*, when the ratio of total local government expenditure to GRDP increases by 1%, GDP per capita increases approximately 1.2 - 1.3%.

Table 3: The determinants of GDP per capita of MD provinces in 2010 – 2016

Dependent variable: lnGRDPPERCAP

Variables	Regression 1	Regression 2	Regression 3	Regression 4	Regression 5
C	14.739*** (0.000)	5.796*** (0.000)	6.063*** (0.000)	6.040*** (0.000)	6.469*** (0.000)
lnPOP	-0.654*** (0.000)				
rG_ALL		1.256* (0.079)	1.339** (0.044)	1.392** (0.043)	1.099* (0.099)
rG_EDUSCI					
rG_REST					
rI_ALL		0.315 (0.223)	0.254 (0.290)	0.274 (0.272)	0.073 (0.776)
rI_FDI					
rI_LOCAL					
LTI_LABOUR		0.365*** (0.000)	0.249*** (0.005)	0.246*** (0.006)	0.243*** (0.005)
lnROAD		0.161*** (0.005)	0.148*** (0.006)	0.151*** (0.006)	0.118** (0.031)
EMPDENSE			0.016*** (0.000)	0.016*** (0.000)	0.016*** (0.000)
CP1				-0.136 (0.746)	
CP2					0.021* (0.059)
R^2	0.399	0.284	0.390	0.390	0.415
n	91	91	91	91	91

(*), (**) and (***) correspond to statistical significance at 10%, 5% and 1%. Source: calculated from MD Provincial Statistical Yearbooks

Regressions (6), (7), (8) and (9) further analyze local government expenditure by types. It is worth noting that the coefficient of variable rG_EDUSCI is negative and statistically significant; while the variable coefficient of rG_REST is positive and not statistically significant. The difference in sign and statistical significance between variables rG_ALL, rG_EDUSCI and rG_REST shows that the effect of local government expenditures varies depending on the type of expenditure. Negative results show that increasing the share of local budget to GRDP at the provincial level for education, training and vocational training, science and technology in the short term does not increase local GRDP per capita.

The impact of LTI_LABOR variable shows a different picture of human capital in the MD provinces. In regressions (2) to (9), the coefficients of the LTI_LABOR variable are positive, ranging from 0.203 to 0.365, and are statistically significant at 1%. Compared to rG_EDUSCI, variable LTI_LABOR has a positive impact on lnGRDPPERCAP, which implies that local government expenditure on education, training and vocational training, science and technology has a long-term impact on human capital in the province, not in the short-term (for instance, increasing public investment in general education will lead to increased human capital in the following years when the students are active labors in the workforce).

In the short term, expenditures on education, training and science - technology are often "investment" that are fundamental, however always under-provided and not attractive to the private sector because of low profitability. Therefore, the state usually assumed the provision of such services. Yet, in terms of long-term and overall socio-economic benefits, investment in this education and science might be the most effective investment. The observation here considers the period between 2010 - 2016, so it is relatively short to assess the relationship between rG_EDUSCI and GRDP per capita. The results in Table 3 and 4 are interpreted as, *ceteris paribus*, when the labor training component index increases by 1 point, the average GRDP per capita of the province increases from 1.23 to 1.44% (ie. from $e^{0.203}$ to $e^{0.365}$%).

Table 4: The determinants of GDP per capita of MD provinces in the period of 2010 - 2016, with Investment and Government Expenditure examined by types

Dependent variable: lnGRDPPERCAP

Variables	Regression 6	Regression 7	Regression 8	Regression 9
C	12.121*** (0.000)	11.872*** (0.000)	11.980*** (0.000)	12.468*** (0.000)
lnPOP	-0.697*** (0.000)	-0.663*** (0.000)	-0.667*** (0.000)	-0.675*** (0.000)
rG_ALL				
rG_EDUSCI	-11.115*** (0.001)	-10.640*** (0.001)	-11.098*** (0.001)	-10.307*** (0.001)
rG_REST	0.428 (0.574)	0.514* (0.500)	0.416 (0.588)	0.100 (0.892)
rI_ALL				
rI_FDI	1.163 (0.300)	1.040 (0.353)	1.347 (0.245)	1.159 (0.276)
rI_LOCAL	-0.075 (0.660)	-0.069 (0.684)	-0.131 (0.467)	-0.284 (0.106)
LTI_LABOR	0.232*** (0.000)	0.209*** (0.001)	0.215*** (0.001)	0.203*** (0.000)
lnROAD	0.181*** (0.000)	0.177*** (0.000)	0.169*** (0.000)	0.140*** (0.000)
EMPDENSE		0.004 (0.199)	0.004 (0.220)	0.004 (0.197)
CP1			0.313 (0.297)	
CP2				0.023*** (0.002)
R^2	0.725	0.730	0.734	0.761
n	91	91	91	91

(*), (**) and (***) correspond to statistical significance at 10%, 5% and 1%. Source: calculated from MD Provincial Statistical Yearbooks

Table 5: The determinants of GDP per capita of MD provinces in 2010 - 2016, selected spatial variables

Independant variable: lnGRDPPERCAP

Variables	Regression 10	Regression 11	Regression 12	Regression 13	Regression 14
C	12.724*** (0.000)	8.206*** (0.000)	8.043*** (0.000)	8.205*** (0.000)	8.318*** (0.000)
lnPOP	-0.745*** (0.000)				
lnROAD	0.225*** (0.000)	0.150*** (0.006)	0.112** (0.021)	0.150*** (0.006)	0.126** (0.017)
EMPDENSE			0.021*** (0.000)		
CP1				0.009 (0.984)	
CP2					0.029** (0.013)
R^2	0.578	0.082	0.280	0.082	0.144
n	91	91	91	91	91

(*), (**) and (***) correspond to statistical significance at 10%, 5% and 1%. Source: calculated from MD Provincial Statistical Yearbooks

For the impact of investment, highlighted by Table 4, there are no statistically significant variables in the regressions tested. In regression (2), (3), (4), (5), the coefficient of rI_ALL is positive; in regression (6), (7), (8), (9) the coefficient of rI_FDI is positive while the coefficient of variable rI_LOCAL is negative. This result is consistent with the research results of Nguyen Kim Phuoc (2015) the relationship between GRDP and FDI in the MD so far is unclear; but different from the results of Su Dinh Thanh and Nguyen Minh Tien (2014) which found evidence suggesting that FDI has important impact to overall growth in the MD.

Compared with these two studies, the ratio of *implemented* foreign direct investment to GRDP is calculated (not the *registered* FDI). The comparative data in Table 6 shows the difference between registered and implemented FDI capital from 2010 - 2016 among provinces in the MD: during the observation period of the paper, the total implemented FDI of the whole region was only about 45.8% of the registered FDI capital. The results of the regression model in this study found no evidence that the positive impact of foreign direct investment on economic growth.

Table 6: The total amount of registered and implemented FDI in the MD annually and accumulatively, 2010 – 2016

Unit: million USD at current price of 2017

Year	Annual Total of Registered FDI	Annual Total of Implemented FDI	Ratio of implemented to registered FDI capital
2010	557.16	315.36	56.6%
2011	1591.87	566.08	35.6%
2012	523.26	509.96	97.5%
2013	531.09	543.40	102.3%*
2014	1011.48	708.97	70.1%
2015	3683.81	936.30	25.4%
2016	1369.48	664.82	48.5%
Accumulative Total	9268.15	4244.87	45.8%

Source: FDI data from MD region Statistical Yearbooks and calculated by authors using Microsoft Excel

**implemented FDI exceeds registered FDI possibly as a result of lagged disbursement in some provinces from previous year(s)*

Local investment in the province includes investment by private enterprises and state-owned enterprises. The results of the article are relatively consistent with the research results of Ngo Anh Tin (2017) when no empirical evidence is found between public investment and private investment. Some of the reasons may be ineffective due to the operation of state-owned enterprises or the use of state capital investment in production and business in Vietnam (see research by CIEM and Friedrich Ebert Stiftung, 2012). It should be addressed that this is not the problem specific to the MD but a common problem in other parts of Vietnam. Perhaps this is the reason why there is no evidence of a link between the ratio of total investment, FDI and local provincial investment to GRDP and the growth of per capita GRDP in the province.

From regressions (2) to (9), variables related to infrastructure lnROAD (expressing the growth in volume of freight-kilometers carried in the province) are statistically significant and the coefficient is positive. When putting lnROAD in regressions with fewer number of variables (10), (11), (12), (13), (14), lnROAD still is a positive and statistically significant variable. Thus, the impact of transport capacity is relatively stable to the average GRDP per capita. This result is consistent with the results of the study of Dao Thong Minh and Le Thi Mai Huong (2016) which found that an increase of 1% of road kilometers increases GDP by 0.47%. The results of this study are interpreted as: an increase by 1% of the volume of freight-kilometers carried in the province increases GDP per capita by 0.11% - 0.22%.

At regressions (3), (4), (5) and (12) - with lnPOP not included - the population density EMPDENSE is 1% statistical significance (the value of t-statistics in these regressions are different, respectively at 3.839, 3.812, 3.890 and 4.922). When introducing the lnPOP variable in regressions (6), (7), (8) and (9) - where some other variables are present - EMPDENSE lost its statistical significance. The average labour density in the province in regression from (03) to (9) are positive, but only statistically significant at 1% regression (3), (7), (8) , (9). It can be seen that the impact of average employment density on GRDP per capita growth is relatively unstable. This result is consistent with the results of Cervero's study (2011), which only finds evidence of the link between population density and per capita GRDP when testing at micro level (observed in 27 districts) and not at a more macro level (ie. the wider San Francisco Bay Area).

For the two variables CP1 and CP2, the results presented in Tables 4 and 5 show that CP1 is not statistically significant when introduced in regressions (4), (8) and (13) while CP2 is statistical significant at 1%, 5% and 10% corresponding to regressions (9), (14) and (5). The R-squared value is higher when introducing CP2 than CP1 in the regression. The results presented here partly support the hypothesis of Parr (1987) and are consistent with Cervero (2001), which indicates a the link between the provincial spatial structure - expressed in the degree of urban agglomeration - and economic growth expressed by GRDP per capita. This would mean that when the ratio of urban population density to provincial population density increases by 1 unit, per capita GDP increases from 1.02 to 1.03% (ie. from $e^{0.021}$ to $e^{0.029}$%), *ceteris paribus*.

5 CONCLUSION AND POLICY IMPLICATIONS

Data from 13 provinces in the MD in the period of 2010 - 2016 (91 observations), is utilized in a multivariate regression model with the dependent variable set to be GRDP per capita growth and independent variables grouped to represent labor, investment, local budget spending, infrastructure and spatial structure. The analysis showed that the labor capability to meet the working requirements, infrastructure growth and the level of agglomeration in the province has a very positive impact on per capita GRDP growth. Given that other factors remain unchanged, some specific findings from the study are: when the population of provinces increases by 1%, per capita GRDP decreases by approximately 0.6 to 0.7%; when the ratio of total local government expenditure to GRDP increased by 1%, per capita GRDP increased by 1.2 - 1.3%; 1% increase in volume of freights-kilometer carried in the province increases GDP per capita by 0.11% - 0.22%. The calculation results, however, do not clearly show the relationship between total investment capital, implemented FDI and GRDP per capita growth.

New departure from previous study is the use of the Labor Training Index to reflect the quality of labor. It is found that, when the training index labor increased by 1 point, GDP per capita of the province will increase from 1.23 to 1.44%. Besides, analysis showed that there is evidence of the relationship between spatial structure and economic development: when the ratio of urban population density to population density of the whole province increased by 1 unit, per capita GRDP increased from 1.02 to 1.03%. This implies that when the urban population density increases faster than the population density in the whole province, it will bring about economic growth benefits. This is in line with the contemporary context of territorial development in the world, which promote focused growth in large cities as the growth poles of the region.

Three policy implications can be drawn from this research results: (1) the condition of infrastructure, especially transport and urban infrastructure needs to be continually improved; (2) more attention should be paid to enhance the quality of connecting services in job and labor markets such as job placement, labor training and matching services which connect potential workers and employers together in the province; (3) local government budget should be spent more efficiently. As discussed in the analysis of section IV above, the type of budget expenditure has different impacts on economic growth, in particular: increasing the proportion of local budget expenditures compared to the provincial GRDP in general positively impact GRDP growth per capita, but increasing the proportion of local budget spending on education, training and vocational training, science and technology to GRDP does not have a positive impact on GRDP growth per capita *in the short-term*. Local expenditures in these areas should be considered a type of investment in public-good and should be maintained because of its *long-term* economic impacts.

The variables representing the level of agglomeration in the paper are relatively simple. If local statistics in Vietnam are published in more details, for example, information on distance, travel time by road, etc. then the measures of agglomeration level will specifically better reflect the region spatial structure, thereby becoming more efficient variables in the model. The relationship between the spatial structure and the new economic development is just partly revealed in this article, but it will be an interesting research direction for future research, especially when this is a pressing research area in Vietnam. Hopefully, the paper would contribute to clarifying the gaps left open in understanding economic growth in the MD, and the results presented here would be a useful reference for policy makers of the MD in particular and Vietnam in general.

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