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Impact of provincial competitiveness index (PCI) on economic development in the Red River Delta, Vietnam

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Abstract: The development of an economy is significant since it has far-reaching implications for several industries. Particularly, the income levels of inhabitants in crucial locations must reach a specific threshold for an economy to flourish effectively. To achieve this goal, it is vital to determine the factors that affect economic development. A significant aspect that can improve people's living standards is enhanced competitiveness. Therefore, this study employs the generalized ordinary least squares (GLS) method to examine the provincial competitiveness index (PCI) on economic development as measured by per capita income in the Red River Delta of Vietnam. The panel data of eleven Red River Delta provinces from 2010 to 2021 was studied. The results indicate that the provincial competitiveness index has a beneficial impact on economic growth and contributes to an increase in the income levels of the populace. The study also shows that labor literacy rate and trade openness also contribute to economic development while labor growth rate inhibits long-term economic development. Governments need to analyze indicators to find solutions to improve national competitiveness. In particular, it is necessary to pay attention to the business environment, apply technology in handling administrative procedures and have policies to support business capital creation for domestic enterprises.

Keywords: Competitiveness Index; Economic Development; Per Capita Income
JEL Classification: R38; O10; N3

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Introduction

When the economy improves, and people's living standards improve, it will contribute significantly to the cause of national building, bringing great advantages to the country. Consequently, how to encourage economic growth has always been a concern for the governments of many countries today. In order to formulate suitable policies, countries must recognize the factors that influence economic development. One of the significant factors to mention here is competitiveness. Competition is key for a country to have economic development. Policy-contending capabilities must be developed to have a competitive advantage internationally (Muradov et al., 2019). This indicator reflects a nation's capacity to achieve great, sustainable, and quick improvements in living standards. Competitiveness is a multi-dimensional concept, encompassing aspects related to macroeconomic indicators (both price and non-price factors, related to institutions, infrastructure, politics, frameworks, etc.), legal and social,

etc.), operating at the corporate level and across borders, against the backdrop of emerging global value chains. Thus, competitiveness has direct and indirect effects on the prosperity of a country and the proper functioning of its economy. Numerous scholars have examined the effect of national competitiveness on a nation's economy. The study of Cazacu (2015) is a good example.

The study used data from 28 countries from 2006 to 2013 to the relationship between economic development and competitiveness. According to an empirical study, a competitiveness shock has a beneficial influence on the change in GDP (same research opinion as Dadgar et al., 2018; Neagu, 2018). Muradov et al. (2019) also examined this effect in relation to the ranking position of competitiveness; their findings were more thorough. The authors investigate the effect of competitiveness on economic growth in oil-rich countries in relation to global rankings. Some noteworthy outcomes are: Greater than 1 is the semi-elasticity of the amount of non-oil GDP on the competitiveness index. In other words, if Azerbaijan's competitiveness increases above the ranking. The global non-oil GDP will expand by more than 1 percent in the coming year. It is the improvement of Azerbaijan's competitiveness metrics for the current year when the non-oil economy grows the next year. On the competitiveness index, the semi-elasticity of GDP size is less than that of non-oil GDP in oil-rich nations. The empirical link between global competitiveness and economic development has been studied by Kordalska and Olczyk (2015) with conflicting results. Using Granger causality analysis based on yearly data for 114 countries separated into five income groups and for the period 2006-2014, the authors confirm a substantial one-way causal link between the countries' studies. Most of these studies present evidence that a country's economic growth rate is proportional to its competitiveness as measured by Global Competitiveness. However, the limited research studies of the authors indicate that the research results demonstrate the impact of competitiveness on the overall national economy through the country's growth rate. In contrast, very few studies evaluate the impact of regional competitiveness in that country on the economic development of that part of the country through the standard of living of the people. Considered a research gap, the authors want to give more empirical data.

According to the findings of a prior study, a country's competitiveness significantly influences its economic growth and development. Assessing the influence of the regional competitiveness index on regional economic growth is important to a nation's economy, but little research has been conducted on this topic. Therefore, the authors have chosen to examine the impact of the provincial competitiveness index on the economic development of the Red River Delta, Vietnam, including 11 provinces (Hanoi, Vinh Phuc, Bac Ninh, Quang Ninh, Hai Duong, Hai Phong, Hung Yen, Thai Binh, Ha Nam, Nam Dinh, and Ninh Binh) from 2010 to 2021 using the generalized ordinary least squares method (GLS).

Research Method

Data and research methods

Authors acquire and synthesize secondary data from reputable sources to produce research data. The major collecting source is The General Statistics Office of Vietnam's website. From 2010 to 2021, the study team utilized information from eleven Vietnamese provinces, including Ha Noi, Vinh Phuc, Bac Ninh, Quang Ninh, Hai Dng, Hai Phong, Hung Yen, Thai Binh, Ha Nam, Nam Dinh, and Ninh Binh.

Analyzing the Provincial Competitiveness Index (PCI) on the economic growth of the Red River Delta, Vietnam, The authors use a multivariate regression model on tabular data with GLS estimation. Since the model has difficulties with variable variance and autocorrelation, it makes little sense to employ Pool OLS. The authors employed FEM (Fixed effects model) and REM (random effects model), deciding whether to apply FEM or REM based on the Hausman test. FEM is a regression model with fixed effects, while REM is a regression model with random effects. These two models are extensions of the standard model of linear regression. The authors used the fixed effects estimator approach for FEM. The fixed effect estimate examines the change in the independent and dependent variables over time to determine the causal influence of the independent factors on the dependent variable. For the FEM model, however, an unobserved variable that fluctuates across objects but remains constant over time will not be able to influence model evolution. Therefore, it cannot explain any model modification over time. Using the random effects regression model allows us to avoid the fixed influence of this variable on the model. OLS estimation for the random effects model (REM) yields estimates parameters that are unbiased but inefficient. Even when the authors employ these two models, heteroskedasticity and autocorrelation remain. General Least Square (GLS) can be used to overcome these problems. Consequently, the authors has opted to employ this method.

Research model

Based on the research model of Muradov et al. (2019) and Dadgar et al. (2018), the authors proposes the following research model:

$$lnED_{i,t} = \alpha + \beta_1 lnPCI_{i,t} + \beta_2 LR_{i,t} + \beta_3 NEg_{i,t} + \beta_4 lnTRADE_{i,t} + \mathcal{E}_{i,t}$$

In: The dependent variable is lnED, which is measured by the Natural Logarithm of per capita annual income; The independent variable includes lnPCI (Natural Logarithm of Provincial Competitiveness Index); the control variable: LR (literacy rate of labor); Neg (growth rate of the number of employees) and lnTRADE (trade opening). i: province; t: year; α intercept coefficient; βi: regression coefficient; Ɛ: corresponding error.

Variables

Dependent variable - Economic development (lnED) is measured by the Natural Logarithm of per capita annual income. Economic development is growing and improving all aspects of the economy. It includes economic growth and, at the same time, completeness in terms of economic structure, institutions, quality of life, and social justice. Therefore, economic development is assessed through many factors. One of those factors is income level. It reflects the quality of people's lives. Per capita income will more accurately reflect the population's standard of living than GDP per capita. (Islam, 1996; Thorn, 1968).

Independent variable - Provincial Competitiveness Index (lnPCI) is measured by the Natural Logarithm of the Provincial Competitiveness Index. The Provincial Competitiveness Index, or PCI, evaluates and ranks the governments of provinces and cities in terms of the quality of economic management and building a favorable business environment for the development of private enterprises. PCIs are collected from data sources from the General Statistics Office of Vietnam and the Provincial Statistics Offices. Control variables: LR (literacy rate of labor) is the number of literate people of working age (from 15 years old and above) compared to the labor force in the province (%); Neg (growth rate of the number of employees) is an annual growth rate of the number of people of working age and non-working age who are still working, and lnTRADE (trade opening) is Natural Logarithm of the total value of exports and imports, are also included in the model to control the impact on economic development.

The authors carried out descriptive statistics, the multicollinearity test, heteroskedasticity, and correlation between independent and control variables. A suitable model will be selected and deployed to analyze the impact of the Provincial Competitiveness Index on the economic development of the region of the country.

Result and Discussion

Descriptive statistics

In this study, the authors take samples from 11 provinces of the Red River Delta, Vietnam, over 12 years from 2010 to 2021. Before conducting correlation and regression analysis, the authors conduct statistical analysis. Descriptive statistics of economic development (lnED) variables, provincial competitiveness index (lnPCI), and other variables. The specific results are presented in Table 1.

Table 1 Descriptive statistics of variables

Variable	Obs	Mean	Std. Dev.	Min	Max
lnED	132	3.578284	0.433277	2.606239	4.341673
lnPCI	132	4.113691	0.078052	3.907381	4.318635
LR	132	97.96758	0.732547	95.5	99.2
Neg	132	-0.02343	3.102201	-13.5334	6.564479
lnTRADE	132	8.627408	1.23857	6.071933	11.19162

Note: Obs denotes the number of observations. Std.Dev. denotes standard deviation. Mean denotes the *mean* of a set of observations - the arithmetic average of the values. *Min is* the lowest observation. Max is the highest observation.

Through Table 1, it can be seen that economic development data and data related to the provincial competitiveness index, labor literacy rate, growth rate of labor force, and trade openness fluctuate(s) at a weak average with a data coefficient of variation less than 1. Looking at the descriptive statistics table, we can also see that there is not much difference between the maximum and minimum values for variables in the model.

Pearson correlation coefficient

The correlation matrix between the variables presented in Table 2 shows that there is a correlation between the dependent variable lnED and the independent variables lnPCI, LR, Neg, lnTRADE with the value sig = 0.0000 < 0.05 (significant level - significance level 5%). Specifically, the dependent variable lnED and the independent variable lnPCI have a positive correlation with each other with a correlation coefficient of 0.6724. Similarly, the variable lnED positively correlates with the variables LR and lnTRADE with the correlation coefficients of 0.5031, 0.7005, respectively. In contrast, the lnED variable negatively correlates with the Neg variable with a correlation coefficient of -0.3623. However, Table 3 also shows no multicollinearity between these variables because the correlation coefficient between the independent variables in this study is small and less than 0.7. Researchers use this level of correlation to compare to test the possibility of multicollinearity. In addition, we can rely on the value of variance inflation coefficient (VIF) regression to be more certain of this assertion. The value of the variance inflation coefficient (VIF) is also presented in Table 3. These coefficients are all < 5, showing no multicollinearity between the variables.

Table 2 The correlation matrix

	lnED	lnPCI	LR	Neg	lnTRADE
lnED	1.0000				
lnPCI	0.6724	1.0000			
	0.0000				
LR	0.5031	0.1091	1.0000		
	0.0000	0.2130			
Neg	-0.3623	-0.3113	-0.2868	1.0000	
	0.0000	0.0003	0.0009		
lnTRADE	0.7005	0.4240	0.3769	0.0161	1.0000
	0.0000	0.0000	0.0000	0.8545	

Note: ED (economic development); PCI (Provincial Competitiveness Index); LR (literacy rate of labor); Neg (growth rate of the number of employees) and TRADE (trade opening).

Table 3 VIF test of Model

Variable	VIF	1/VIF
lnTRADE	1.55	0.645008
lnPCI	1.44	0.692186
LR	1.35	0.743353
Neg	1.31	0.762079
Mean VIF	1.41	

Note: Variance inflation factor (VIF) measures the amount of multicollinearity in a set of multiple regression variables. Mathematically, the VIF for a regression model variable is equal to the ratio of the overall model variance to that of a model that includes only that single independent variable. Mean VIF is the mean of variance inflation factor**.**

Regression results

The authors regressed the model with Pool OLS, FEM, and REM, respectively. Besides, the author also performed White's test/ Modified Wald's test/ Breusch and Pagan test/ Wooldridge's test to check this model's assumptions and fit. White's test/ Modified Wald's test/ Breusch and Pagan's test for Heteroskedasticity, and Wooldridge's test for autocorrelation. And Hausman test for FEM and REM models. The authors first scale the model with the Pool OLS least squares method. Simultaneously, White's test was conducted for the variable variance. The results show that p-value = 0.0057 < 0.05, so the model has a variable variance problem with 95% confidence level. The authors also conduct Wooldridge's test for autocorrelation and gives p-value = 0.0001 < 0.05, showing that the model has autocorrelation with a 95% confidence level. These two tests show

Table 4 Regression results of the model

	Pool OLS	FEM	REM	GLS
lnPCI	2.251***	1.005***	1.659***	1.139***
	-7.86	-3.46	-5.55	-4.26
LR	0.144***	0.146***	0.171***	0.135***
	-4.89	-4.32	-5.15	-5.03
Neg	-0.0242***	-0.0127*	-0.0207***	-0.0180***
	(-3.52)	(-2.28)	(-3.39)	(-3.75)
lnTRADE	0.154***	0.404***	0.243***	0.201***
	-8.22	-11.15	-8.74	-9.02
_cons	-21.11***	-18.30***	-22.05***	-16.14***
	(-6.53)	(-5.78)	(-6.81)	(-6.06)
No. of obs	132	132	132	132
No. of groups		11	11	11
Prob>F/Prob> chi2	0.0000	0.0000	0.0000	0.0000
R-squared	0.7659	0.6370	0.7332	
White's test	Prob > chi2 = 0.0057			
Wooldridge's test	Prob > F = 0.0001	Prob > F = 0.0001		
Wald's test		Prob>chi2 = 0.0000		
Hausman test		Prob>chi2 = 0.0000		

Note: t statistics in parentheses * p<0,1; ** p<0,05; *** p<0,01

that the model suffers from variable variance and autocorrelation, so using Pool OLS is almost meaningless. Because of this, the authors have used fixed effects model (FEM) and random effects model (REM) based on Hausman test. The Hausman test gives p-value = 0.0000 < 0.05, so the authors choose the FEM fixed-effects model. With the FEM fixed-effects model, the authors uses Wald's test to test the variance for the results p -value = 0.0000 < 0.05, showing that the model still suffers from the phenomenon of variance with varying degrees of variance-95% confidence. At the same time, the model still cannot overcome the phenomenon of autocorrelation when the results of Wooldridge's test show that p-value = 0.0001 < 0.05. General Least Square (GLS) can overcome both problems. The estimated least squares (GLS) method has overcome two problems of the model and gives regression results with a significance level of 1%. All of the results are summarized in Table 4.

Discussion of results

By the method of General Least Square (GLS), the regression results in Table 4 show that the provincial competitiveness index positively impacts economic development when the variable lnPCI has a positive sign with coefficient regression = + 1.139, with a significance level of 0.01. This result provides more empirical evidence that the provincial competitiveness index promotes economic development. When a region in particular or a country, in general has a reasonable reform policy, it will help improve competitiveness, leading to an increase in local/national GDP, promoting the development of some industries, key economic sectors (consumer industry, machinery manufacturing, etc.), increase credit rating, increase the efficiency of resource use, improve investment efficiency, etc., thereby promoting economic development. Competitiveness is a measure of a country's economic potential and viability. When a country has a high position of international competitiveness, there are many benefits from free trade and easier achievement of its economic goals. If that country loses its international competitiveness, it will face difficult economic, political, and social problems. In other words, improving competitiveness will improve the quality of life and increase per capita income. The higher the region's competitiveness index, the higher the ranking indicates that the region can achieve outstanding and sustainable living standards. According to the National Competitiveness & Productivity Council (2006), enhanced competitiveness means achieving success in markets, leading to better living standards for all. It is a combination of enterprise-level competitiveness enhancement and a supportive business environment that encourages innovation and investment, thereby helping to strong productivity growth, real income growth, and sustainable development (Islam, 1996; Darsono et al, 2022; Tseng et al, 2019; Thorn, 1968; Ryu & Slottje, 2020).

The impact of two variables, labor literacy rate (lnLR) and trade openness (lnTRADE), on economic development is positive. The regression coefficients in the model are 0.135 and 0.201, respectively, with significance level 1%. This means that when the literacy rate increases, the workers' qualifications also improve, giving them more access to advanced knowledge. Thereby helping them have the ability to get a better job and have a higher income to improve their lives. Desai (2012) confirmed the importance of literacy rates. He said literacy rate is the key to socio-economic growth because an economy's prosperity

depends on its economic resources. And one of the indispensable economic resources is human resources. Whether human resources are enhanced in skills and qualifications depends greatly on the literacy rate. In the same vein, many empirical studies have used literacy rates to represent human capital such as studies (Azariadis & Drazen, 1990; Desai, 2012; Diebolt & Hippe, 2022; Herachwati et al, 2023; Romer, 1989; Setyadi et al., 2020). Besides, promoting imports and exports will help promote the regional economy and the national economy. This is because import and export activities are goods circulated on foreign markets. This will help countries open up opportunities for trade, and cross-border cooperation, and increase profits for the country (Chang et al, 2022; Oanh et al, 2021; Oanh & Ha, 2023).

However, with a regression coefficient of -0.018, the growth rate of employees negatively correlates with economic development at the 1% significance level. This can be explained by the increase in the number of workers, which will contribute to the increase in the population. This will decrease per capita income (Amna Intisar et al., 2020; Fashina et al., 2018; Ifa & Guetat, 2018; Pomi et al., 2021).

Conclusion

The study is based on data from 11 provinces of the Red River Delta, Vietnam, by GLS estimation method over 12 years from 2010 to 2021 to examine the impact of the provincial competitiveness index on the economic development of an economic region of a country. The research results show that the Competitiveness Index positively impacts the development of the information economy by increasing people's income. The only other labor and international trade issues included in this study to highlight the importance of improving labor qualifications and expanding international trade will also contribute to the background promotion economic development.

As mentioned above, the competitiveness index is a fairly comprehensive indicator because it includes aspects related to macroeconomic indicators (both price and non-price factors, related to institutions, infrastructure, politics, legal and social frameworks, etc.), operating at the corporate level and across borders. From the results of empirical research, it shows that improving the ranking position of the provincial competitiveness index will promote regional economic development. A high competitiveness index will represent an area capable of achieving sustainable development in all aspects, improving living standards in the region. Local and national governments need to have appropriate policies to exploit the potential of key economic regions, improve the competitiveness of low-income areas, and enhance competition in developed and developing economic sectors. Only then will that country's economy develop sustainably, and the people's quality of life will be good and stable in the long term.

To improve competitiveness, the authors propose some basic solutions as follows: First, strengthen the responsibility and proactiveness of the departments assigned to act as focal points to monitor the improvement of indicators: numbers and fractional indices. Second, promote technology and prioritize the settlement of administrative procedures

in the electronic environment to save time, costs, and effort. Third, there are policies to create a favorable business environment for businesses and preferential policies and government support on credit to create business capital for businesses. Fourth, promote international trade by raising the quality standards of domestic goods and services to create opportunities for goods and services to participate in larger markets.

Author Contributions

Conceptualisation, N.T.B.N and N.V.D.; Methodology, N.T.B.N.; Investigation, N.T.B.N; Analysis, N.T.B.N.; Original draft preparation, N.T.B.N.; Review and editing, N.T.B.N. and N.V.D.; Visualization, N.T.B.N.

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Conflicts of Interest

The authors declare no conflict of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript, or in the decision to publish the results.

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