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The role of manufacturing Industry in economy: The case of the southern in Vietnam

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ABSTRACT
The methodology is Path analysis model. The objective is to study how Index of Industrial Production (IIP) of five City-provinces in the Southern in Vietnam effect each other on these City-provinces' GDP. How GDP of each City-province effects on Vietnam's GDP. Results are Vietnam's GDP is positively indirectly effected by IIPs of Ho Chi Minh, Binh Duong, Binh Phuoc, Tien Giang and is negatively affected by Tay Ninh' s IIP. Besides, while GDP and IIP of Tay Ninh have negative general effect on GDP and IIP of other City-provinces and GDP of Vietnam, GDP and IIP of Binh Phuoc have the strongest general effect on GDP and IIP of other City-provinces and GDP of Vietnam. Next, GDP and IIP of Binh Duong have the second strongest general effect, GDP and IIP of Ho Chi Minh are the third strongest general effect, GDP and IIP of Tien Giang have the smallest general effect on GDP and IIP of other City-provinces and GDP of Vietnam. Therefore, we suggest that Tay Ninh should have a specific support mechanism. In particular, promoting development of science and tech in Ho Chi Minh to achieve the "spillover effect" to the other four City-provinces.

KEYWORDS
manufacturing industry; economic region; IIP; index of industrial production

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(1) INTRODUCTION

Manufacturing industry is involved in transforming cargo, raw materials or different materials into new products. This transformation process can be physical, chemical or mechanical to process and produce goods for domestic consumption and export need. Those are economic activities with are production scale. These are strongly supported by technological, scientific and technical advances in order to improve product quality and meet the requirements of insert 'the development process [1]. Manufacturing industry is understood to mean the transformation of raw materials into a finished product. This includes transforming energy, cutting fluids, sound emission, dust particles, scraps, and other waste items in each industry respectively [2]. Nowadays in manufacturing sustainability plays a key role [3]. Indonesia is one developing country where the manufacturing industry sector is expected to drive Indonesia's economic growth to achieve the targeted average growth of 6% per year in the next five years 2026 [4].

Vietnam's mechanical manufacturing industry is increasingly lagging behind economically. Domestic mechanical manufacturing enterprises are currently facing many challenges, competitiveness is weaker than mechanical manufacturing enterprises in other countries in the ASEAN region and the world [5]. Vietnam's manufacturing industry is heavily dependent on foreign countries through outsourcing. It is not able to occupy an effective position in the global processing chain. It has not been possible to develop an independent path. In addition, the manufacturing industry has not been able to meet the needs of providing advanced production equipment and tools, and modern products that can serve as a basis to enable Vietnam to develop a strong-sustainable economy.

Between 2011-2020, Vietnam's industrial structure was moved in the direction of gradually reducing the mining industry's proportion. It has rapidly increased manufacturing sectors's proportion. The index of manufacturing industrial production is increased by an average of 8%/year. in which, manufacturing industry grew by about 10%/year.

The Southern Key Economic Region of Vietnam has five city-provinces including Ho Chi Minh, Binh Duong, Tay Ninh, Binh Phuoc and Tien Giang. Ho Chi Minh is the leader where science and technology is concentrated and developed. In recent years, this economic region has always been considered as the driving force for the growth of the whole country. This is reflected in the indicators of contribution to GDP and manufacturing industrial development.

The southern key economic region has an area of more than 30,000 square kilometers, accounting for more than 9% of the country's total area. The population in 2019 is more than 21 million people, accounting for more than 20% of the country's population. The region has more than 12 million employees, accounting for more than 20% of the country's total number of employees. This region has generated more than 45% of GDP for the whole country, contributing nearly 50% of the national budget and over 60% of the export value of the country. The region has 66 industrial parks and export processing zones, accounting for nearly 71% of the total industrial park area of the country.

Thus, as a driving force, it is necessary to have a deep and comprehensive view in order to promote the manufacturing industry in depth in the region in order to improve the growth quality of the region. However, investment in industrial production needs to be done properly and sufficiently to maintain the centrality of the region. The objective of this paper is to analyses and evaluate the Index of Industrial Production in the southern key economic region of Vietnam. From study result and based on background theoretical perspectives, authors will have implications and suggestions to improve growth of GDP and manufacturing industry in region.

Paper has 6 sections: section 1 is the introduction, section 2 is the literature review, section 3 is methodology, section 4 is study result, section 5 will be discussion and section 6 will present the conclusion included implications.

LITERATURE REVIEW

- **Background theoretical perspectives**

Keynes' theory [6] argued "The imperfect market assumption allows for regional variation. Convergence of regions can be achieved through economic policy. Capital intensity boosts productivity and growth". Although theories and policies of Keynes are essentially macroeconomics, they also have important implications for regional analysis. The interventionist policy is the basis for traditional regional policy. This policy was born in 1950s and 1960s. It attempted to achieve greater equity between regions. For instance, by promoting public investment, by subsidizing businesses and promoting technology transfer to poorer regions. Myrdal's theory of cumulative and circular causality [7] argued that "Government intervention is needed to ensure that positive 'spillover effects' emanate from zones such as technological progress". Implications of Myrdal's theory is The Central regions with the initial production advantage are likely to maintain their lead over the less productive periphery regions. Updating productivity across regions can be a slow process. Policies should take the region's stage of development into account and Policies are needed to promote spillover effects through foreign direct investment or development funds. Rostow's development stages theory [8] classifies society according to five distinct stages: tradition, transition, take-off, maturity, and mass consumption. Each stage of development has its own characteristics and must meet specific conditions for the economy to rise to a higher stage. In other words, if market forces do their job alone, it will not get the job done.

- **Previous studies**

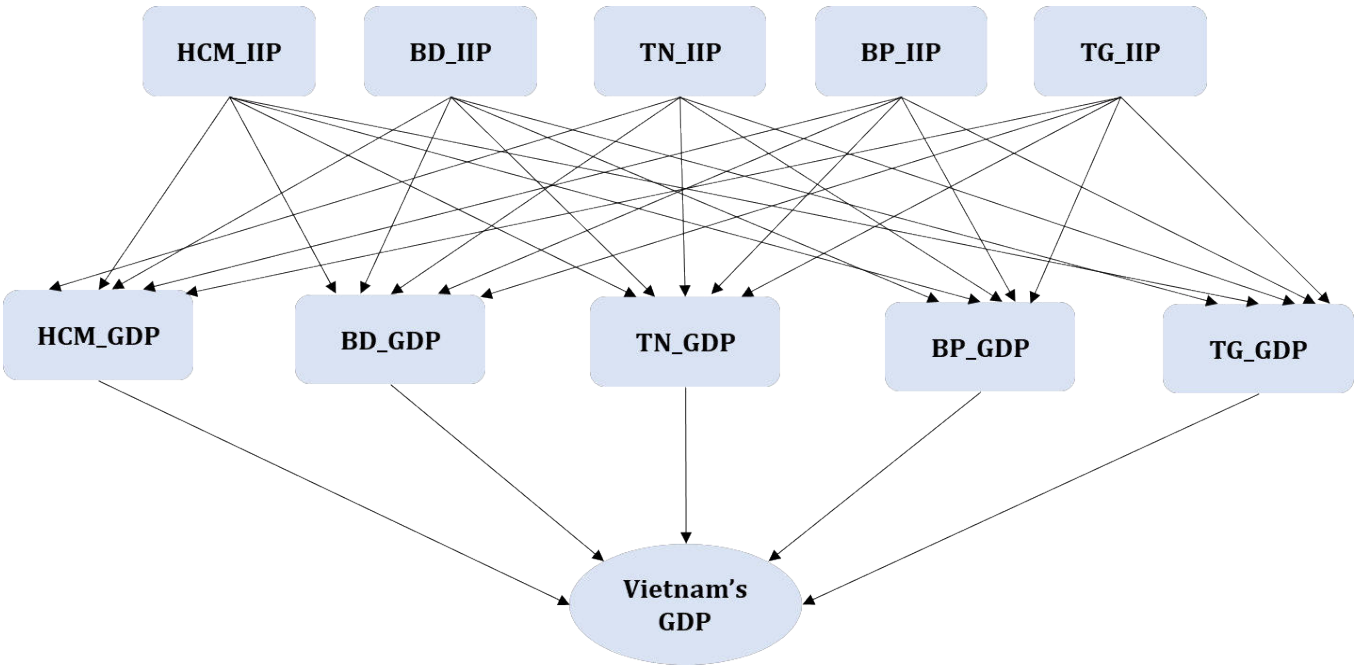
Manufacturing industry in Iraq had been faced with several obstacles that have had devastating effects on the Iraqi economy. This industry has become distorted because of the heavy dependence on the oil sector. The oil resources' supremacy as a main source for creating economic growth and achieving a high level of prosperity has resulted in the great neglect of the manufacturing sector [9]. Science and technology are crucial conditions for successful deployment of manufacturing in process industry. Artificial intelligence is strongly necessary for manufacturing industry [10]. Outsourcing is understood to be an important strategy in the mechanical manufacturing industry [11].

In Europe, manufacturing industry embraces circular economy principles in its business. Manufacturing industry can apply customer value proposition networks and interface dimension network in a companies' business model [12]. We illustrate this by a case in Ethiopia, where manufacturing industry's workplaces are less considered and gotten priority, although productivity's improvement has been impacted by participant elements and? human and machines which effect their working conditions [13]. With cross sectional data of 500 Chinese manufacturing enterprises in 2017 were studied, the influencing factors of green transformation in manufacturing industry is firstly human capital, financing ability, technology innovation, and government intervention. Secondly, environmental regulation is positively affected the green transformation in the manufacturing industry by acting on technology innovation and governmental behavior. Thirdly, environmental regulation is a complete change mechanism, which affected green transformation by influencing financing capacity, technology innovation, and governmental behavior of manufacturing enterprises. It is suggested that the government should consider these influencing factors' positive impact. They will need to design appropriate environmental regulation policies to promote the green transformation in the manufacturing industry to achieve economic green growth [14]. The ISO 9001:2015 quality management system's implementation will make significant positive impacts on manufacturing industry/s operational performance. However, there are major obstacles in ISO 9001's effective implementation in manufacturing industry, including a lack of qualified personnel, inadequate training, employee resistance, and commitment among top-level management executives [15]. Managerial interpretation and responsibility's ascription have an important role in predicting green information technology in manufacturing industry [16]. Manufacturing process for energy-intensive manufacturing industries can be improved by the efficient use of energy and resources [17].

Every manufacturing industry is much concerned with their Total Productive Maintenance strategies adopted on the shop-floor to avoid breakdowns. Because breakdowns directly lead to lowering capacity utilization [18]. Manufacturing industries currently focus on cleaner production to reduce pollution levels and other hazardous emissions emitted from manufacturing industries. It is found that changes in electricity sources in additive manufacturing industries result in about a 40 % reduction in emissions [19]. Manufacturing industry mostly tends to be less efficient in transformation income rather than into business value [20]. The green growth level of manufacturing industry has declined in China. The Green growth situation is not optimistic. Global value chain's effect is embedded position on China's manufacturing industry, green growth has significant industry heterogeneity [21]. Industrial Revolution 4.0 plays role in manufacturing industry's activities and worker capabilities [22].

METHODOLOGY

- **Study model**



- **Variables explanation**

TABLE 1: Variables name and variables explanation

Independent Variables name	Variables explanation	Formula
HCM_IIP	Ho Chi Minh city's Index of Industrial production (IIP)	$IIP = \frac{\Sigma_{n=1}^{k} I_{xn} * W_{XN}}{\Sigma W_{XN}}$ (1) As equation (1) states: Where, i_x is general production's index i_{xn} is production's index of one product n or one industry n w_{xn} is production weight of a product n or of industry n. Inthis formula, the weight is presented as proportion of products in a industry or proportion of a detailed industry in a higher-level industry
BD_IIP	Binh Duong province's Index of Industrial production	
TN_IIP	Tay Ninh province's Index of Industrial production	
BP_IIP	Binh Phuoc province's Index of Industrial production	
TG_IIP	Tien Giang province's Index of Industrial production	
Intermediating Variables name		
HCM GDP	Ho Chi Minh city's GDP	
BD GDP	Binh Duong province's GDP	
TN GDP	Tay Ninh province's GDP	
BP GDP	Binh Phuoc province's GDP	
TG GDP	Tien Giang province's GDP	
Dependent variables name		
Vietnamese national GDP	Vietnamese national's Gross Domestic Product	

Source: Study result of authors.

Table 1 shows name and explanation of variables. There are five independent variables includes HCM_IIP is Ho Chi Minh city's Index of Industrial production , BD_IIP is Binh Duong province's Index of Industrial production, TN_IIP is Tay Ninh province's Index of Industrial production, BP_IIP is Binh Phuoc province's Index of Industrial production and TG_IIP is Tien Giang province's Index of Industrial production. There are five intermediating variables consists of HCM GDP is Ho Chi Minh city's GDP, BD GDP is Binh Duong province's GDP, TN GDP is Tay Ninh province's GDP, BP GDP is Binh Phuoc province's GDP and TG GDP is Tien Giang province's GDP. Vietnamese national GDP is dependent variables. The formula is illustrated in a column on the right of Table 1.

- **Path analysis model (PAM)**

PAM is a type of structural equation modeling (SEM). However, it is unlike SEM which always contains latent variables. PAM includes only observed variables. With the advantage of including all direct and indirect causal relationships between variables through the simultaneous estimation of all equations in a single model. PAM is considered as an efficient extension of multivariate regression. In PAM, it is assumed that there is no error in the measurement of the variables. And thus, the only error terms in these models are residuals for endogenous variables.

As an SEM, the general equation in matrix form for a PAM is:

$W = BW + \omega O + \psi$,

Where,

W is m $\times$ 1 matrix of endogenous variables

O is n $\times$ 1 matrix of exogenous variables

B is m × m matrix of regression coefficients between endogenous variables and other endogenous variables

ω is m × n matrix of regression coefficient between endogenous variables and exogenous variables

ψ is m × 1 matrix is of residuals in the equations

Besides, there are other parameters related to variance and covariance of the exogenous variables O_i and of the error terms:

The matrix of variance - the covariance of O_i: $\Pi = \begin{bmatrix} \Pi_{11} & \cdots & \Pi_{1n} \\ \vdots & \ddots & \vdots \\ \Pi_{n1} & \cdots & \Pi_{nn} \end{bmatrix}$

The matrix of variance - the covariance of the residuals: $\theta = \begin{bmatrix} \theta_{11} & \cdots & \theta_{1m} \\ \vdots & \ddots & \vdots \\ \theta_{m1} & \cdots & \theta_{mm} \end{bmatrix}$.

The variance - covariance matrix between W and O is:

$\Omega = \mathrm{Cov}(W, O) = (I - B)^{-1}.\omega.\mathrm{Var}(O)$

There is a variety of estimation methods for SEM and maximum likelihood method is the most commonly used method. Coefficients of a PAM are presented in two forms which includes unstandardized and standardized. The non-normalized estimation coefficients do not include the scale information of the relevant variables, so the interpretation must refer to the scales of these variables. In contrast, the standardized coefficients have been adjusted to remove information about the scale, so they can be used to compare the different influence of exogenous variables on endogenous variables in the model.

- **Criterion to evaluate the fit of the model**

The main feature of SEM is that researchers are first required to declare initial values known as hypothetical models. Then, it proceeds through an iterative sequence of volatility indicators to provide finally a consistent model that is capable of explaining the maximum fit between the model and the actual data.

The fit of the entire model is usually evaluated through the following criteria of relevance, similar to [23]. Other researchers have also suggested that some commonly used absolute fit indices to determine the fit of a model to sample data are Standardized root mean squared residual, coefficients of determination. These indicators may provide researchers with the most basic signal to determine how well the proposed theory matches the actual data.

- **Standardized root mean squared residual (SRMR)**

SRMR is used to show the standardized difference between observed versus estimated correlation. A model is considered to be an absolute fit if the SRMR value is zero. Since SRMR does not consider the complexity of the model. A model with SRMR is less than 0.08 will be considered as a fit model [24].

- **The overall coefficient of determination (CD)**

Formula to calculate CD is: $\mathrm{CD} = 1 - \frac{\det(\hat{\Psi})}{\det(\hat{\Omega})}$. Which is similar to R^2 for the regression model, a model is a perfect fit if it has CD equal to 1.

- **Stability analysis of simultaneous systems**

This is the index which is used to measure the stability of the model through eigenvalues of matrix B. A nonrecursive PAM is said to be stable if it has this index less than 1.

- **Model's residuals analysis to satisfies OLS's assumptions (Ordinary Least Square (OLS)).**

Similar to SEM, in PAM has also assumed $E(\Psi) = 0$ and $\mathrm{Cov}(O, \Psi) = 0$. Therefore, a necessary post-test is to check whether the PAM satisfies these assumptions.

- **Modification Indices (MI)**

This is an index that estimates the change of $\chi 2$ for each case of adding a possible relationship (corresponding to one degree of freedom). If $\Delta\chi^2 > 3.84$, it indicates a relationship that increases the fit of the model. However, the researcher should be cautious because the relationship added to the model is only considered when it supports the theory and should not try all the ways to improve the indices to make the model more suitable [25].

However, the good fit indicators show us that the data support the recommended model. They do not mean that the selection model is correct or the best model among the theoretically possible models.

STUDY RESULTS

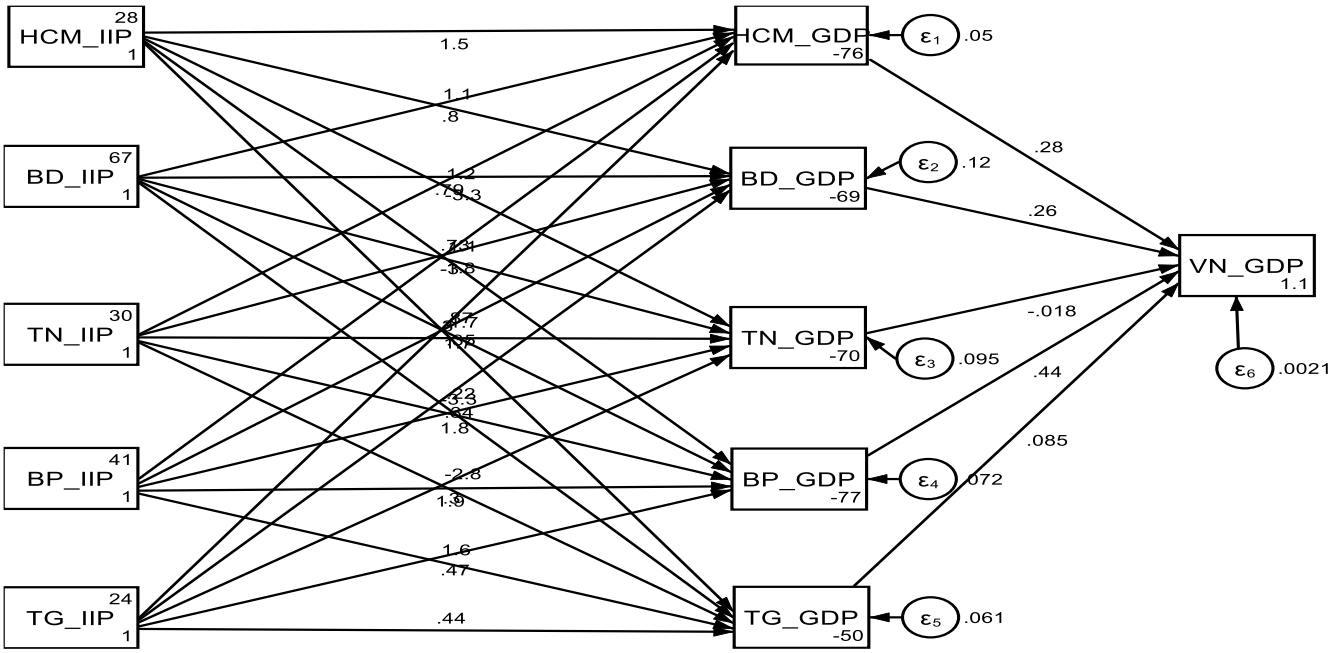


FIGURE 1: Estimation path graph
Source: Study result of authors.

Firgure 1 gives result of path's estimation graph. The graph illustrates direct and indirect causal relationships between five observed exogenous variables includes HCM_IIP, BD_IIP, TN_IIP, BP_IIP, TG_IIP and six observed endogenous variables consists of HCM_GDP, BD_GDP, TN_GDP, BP_GDP, TG_GDP, VN_GDP. Observed endogenous variables and observed exogenous variables are in boxes. There are six latent variables in circles.

The detailed estimation is presented in table 2.

TABLE 1: Result of estimation path analysis model

Structural	Coefficient	OIM std. err.	z	P>|z|	[95% conf.	interval]
VN_GDP						
HCM_GDP	1.063752	.456922	2.33	0.020	.1682016	1.959303
BD_GDP	3.231653	2.266326	1.43	0.154	-1.210265	7.673571
TN_GDP	-1.278495	9.773819	-0.13	0.896	-20.43483	17.87784
BP_GDP	34.04211	9.953273	3.42	0.001	14.53405	53.55017
TG_GDP	4.36211	2.980702	1.46	0.143	-1.47996	10.20418
Constant	1102405	274878.4	4.01	0.000	563653.2	1641157

Structural	Coefficient	OIM std. err.	z	P>|z|	[95% conf. interval]	
HCM_GDP						
HCM_IIP	104290.9	11829.81	8.82	0.000	81104.95	127476.9
BD_IIP	127328.7	25318.74	5.03	0.000	77704.89	176952.5
TN_IIP	-227122.1	23508.79	-9.66	0.000	-273198.5	-181045.7
BP_IIP	178843.3	21201.45	8.44	0.000	137289.2	220397.4
TG_IIP	19219.05	9012.077	2.13	0.033	1555.709	36882.4
Constant	-1.96e+07	3308775	-5.94	0.000	-2.61e+07	-1.32e+07
BD_GDP						
HCM_IIP	23472.65	5872.351	4.00	0.000	11963.05	34982.25
BD_IIP	39536.74	12568.3	3.15	0.002	14903.33	64170.15
TN_IIP	-64528.52	11669.83	-5.53	0.000	-87400.97	-41656.06
BP_IIP	53106.52	10524.46	5.05	0.000	32478.96	73734.08
TG_IIP	5867.061	4473.621	1.31	0.190	-2901.075	14635.2
Constant	-5645939	1642486	-3.44	0.001	-8865152	-2426726
TN_GDP						
HCM_IIP	4410.852	884.7931	4.99	0.000	2676.69	6145.015
BD_IIP	6310.614	1893.678	3.33	0.001	2599.073	10022.15
TN_IIP	-11106.55	1758.306	-6.32	0.000	-14552.76	-7660.332
BP_IIP	9724.927	1585.731	6.13	0.000	6616.951	12832.9
TG_IIP	907.0102	674.045	1.35	0.178	-414.0937	2228.114
Constant	-988886.3	247475	-4.00	0.000	-1473928	-503844.2
BP_GDP						
HCM_IIP	3989.411	705.0955	5.66	0.000	2607.45	5371.373
BD_IIP	6920.264	1509.081	4.59	0.000	3962.521	9878.008
TN_IIP	-11197.86	1401.202	-7.99	0.000	-13944.16	-8451.552
BP_IIP	9228.776	1263.676	7.30	0.000	6752.016	11705.54
TG_IIP	1299.116	537.1495	2.42	0.016	246.3228	2351.91
Constant	-1005739	197213.9	-5.10	0.000	-1392272	-619207.2
TG_GDP						
HCM_IIP	8626.286	977.3027	8.83	0.000	6710.808	10541.76
BD_IIP	2577.542	2091.672	1.23	0.218	-1522.059	6677.144
TN_IIP	-14316.49	1942.146	-7.37	0.000	-18123.03	-10509.96
BP_IIP	11458.82	1751.527	6.54	0.000	8025.889	14891.75
TG_IIP	1827.256	744.5199	0.014	0.014	368.0242	3286.488
Constant	-966635.7	273349.8	-3.54	0.000	-1502391	-430880
Var(e.VN_GDP)	2.07e+09	9.78e+08			8.23e+08	5.22e+09
Var(e.HCM_GDP)	3.40e+09	1.60e+09			1.35e+09	8.56e+09
Var(e.BD_GDP)	8.37e+08	3.95e+08			3.32e+08	2.11e+09
Var(e.TN_GDP)	1.90e+07	8961318			7546019	4.79e+07
Var(e.BP_GDP)	1.21e+07	5690946			4792150	3.04e+07
Var(e.TG_GDP)	2.32e+07	1.09e+07			9206461	5.84e+07

Source: Study result of authors.

The first section of table 2 presents effect of GDPs of five city - provinces on the GDP of Vietnam. In this part, P-values (P>|z|) of estimated coefficients show that only HCM's GDP and BP's GDP have an effect on VN's GDP and these effect is all positive. Meanwhile, GDPs of TN, BD and TG have no effect on VN's GDP. Thus, growth of HCM's GDP and BP's GDP contributes positively to the growth of VN's GDP in the period 2012-2020. Moreover, based on the magnitude of the estimated coefficients, the GDP's growth of BP greatly affects on the growth of VN's GDP.

The next section shows

$$HCM_{GDP} = -1.96e+07 + 104290.9HCM_{IIP} + 127328.7BD_{IPP} - 227122.1TN_{IIP} + 178843.3BP_{IIP} + 19219.05TG_{IIP} \quad (2)$$

As equation (2) states: Because the estimated coefficients are significant at the 5% level, IIP of all 5 city - provinces have an effect on HCM's GDP. In which, IIPs of HCM, BD, BP and TG have a positive effect on HCM's GDP. On the contrary, TN's IIP has a negative effect on HCM's GDP. The absolute value of the estimated coefficients shows that TN's IIP in this period has the strongest influence on the growth HCM's GDP. However, this effect is in the direction of reducing HCM's GDP, BP's IIP has the strongest positive impact on HCM's GDP.

It is similar to endogenous variables BD's GDP and TN's GDP. There is only the coefficient of variable TG's IIP is not statistically significant. So, there is no effect on the growth of BD's GDP as well as TN's GDP. Similar to the case of HCM's GDP, that IIPs of HCM, BD and BP have a positive effect on BD's GDP and TN's GDP with the effect of BP's IIP is the largest in this group. Meanwhile, TN's IIP has a negative effect on BD's GDP and TN's GDP.

For the endogenous variable BP's GDP: All the estimated coefficients are statistically significant at 5% level, showing that the IIPs of 5 city - provinces have an effect on BP's GDP. Similar to the above mentioned cases that except TN's IIP had negative effect on BP's GDP, the IIPs of other city - provinces have positive impact on the growth of BP's GDP.

Finally, with the dependent variable TG's GDP; At the 5% level of significance, there is only the coefficient of the BD's IIP that is not statistically significant. Thus, the IIPs of HCM, BP, TN and TG really have an effect on TG's GDP. In which, with negative coefficient, TN's IIP has a negative effect the growth of TG's GDP.

The values of the estimated coefficients in table 2 are unnormalized values. Therefore, to evaluate the real effect of exogenous variables on endogenous variables in the model, we normalize the coefficients. The detailed results are given in Table 3.

TABLE 2: Result of the regression's standardization Coefficient

Dependent variable VN_GDP on endogenous variables HCM_GDP, BD_GDP, TN_GDP, BP_GDP, TG_GDP						
Observed variables	**VN_GDP**	**HCM_GDP**	**BD_GDP**	**TN_GDP**	**BP_GDP**	**TG_GDP**
VN_GDP	0	.2760607	.2647036	-.0180673	.4419082	.0850451
HCM_GDP	0	0	0	0	0	0
BD_GDP	0	0	0	0	0	0
TN_GDP	0	0	0	0	0	0
BP_GDP	0	0	0	0	0	0
TG_GDP	0	0	0	0	0	0
Endogenous variables VN_GDP, HCM_GDP, BD_GDP, TN_GDP, BP_GDP, TG_GDP on exogenous variables HCM_IIP, BD_IIP, TN_IIP, BP_IIP, TG_IIP						
Observed variables	**HCM_IIP**	**BD_IIP**	**TN_IIP**	**BP_IIP**	**TG_IIP**	
VN_GDP	0	0	0	0	0	0
HCM_GDP	1.500486	.8022769	-3.331747	1.837373	.3480054	
BD_GDP	1.069982	.7892739	-2.999115	1.728628	.3365918	
TN_GDP	1.165406	.7301949	-2.991995	1.834765	.3016028	
BP_GDP	1.147473	.8717041	-3.283945	1.895472	.4702735	
TG_GDP	1.65204	.2161797	-2.795506	1.567025	.4404176	

Covariances of error variables (standardized); diagonal only, off-diagonal=0						
	e.VN_GDP	**e.HCM_GDP**	**e.BD_GDP**	**e.TN_GDP**	**e.BP_GDP**	**e.TG_GDP**
diagonal	.0020704	.0503724	.1246004	.0950298	.0715205	.0609142
Intercepts of endogenous variables (standardized)						
	VN_GDP	**HCM_GDP**	**BD_GDP**	**TN_GDP**	**BP_GDP**	**TG_GDP**
Constant	1.10148	-75.61357	-68.87103	-69.91769	-77.41148	-49.5388
Covariances of exogenous variables (standardized)						
Observed variables	**HCM_IIP**	**BD_IIP**	**TN_IIP**	**BP_IIP**	**TG_IIP**	
HCM_IIP	1					
BD_IIP	.5317605	1				
TN_IIP	.592376	.7950887	1			
BP_IIP	-.2607569	.1289795	.4858653	1		
TG_IIP	.7130331	.7180017	.6903056	-.1475034	1	
Means of exogenous variables (standardized)						
	HCM_IIP	**BD_IIP**	**TN_IIP**	**BP_IIP**	**TG_IIP**	
Mean	28.28264	66.57815	30.22985	41.4524	23.83449	

Source: Study result of authors

Table 3 shows the standardization coefficient between endogenous variables and dependent variable and between endogenous variables and exogenous variables.

Endogenous variables GDPs of HCM, BD, BP and TG have effect positively on dependent variable VN's GDP. In contrast, TN's has negative effect on VN's GDP. Based on the values of the normalized coefficients, there is only TN's GDP has a negative effect on GDP's VN. Furthermore, the magnitude of the normalized coefficients shows that BP's GDP has the largest positive effect on VN's GDP, while TG's GDP has the smallest positive effect.

While IIPs of other city - provinces have positive effect, there is only TN's GDP has negative effect on total five VN's GDP, HCM's GDP, BD's GDP, TN's GDP, BP's GDP, TG's GDP.

TABLE 3: Result of standardized root mean squared residual (SRMR) and coefficient of determination (CD)

Fit statistic	**Value**	**Description**
Information criteria		
AIC	1430.554	Akaike's informationn criterion
BIC	1436.865	Bagersian information criterion
Size of residuals		
SRMR	0.027	Standardized root mean squared residual
CD	0.998	Coefficient of determination

Source: Study result of authors

Table 4 shows absolute index of SRMR = 0.027 and CD = 0.998, which defines model is perfectly fitted innto input data. Models' significance testing result through Wald statistic testing method with a hypothesis pair:

$$\begin{cases} H_0: \text{All coefficients are } 0 \\ H_1: \text{At least one coefficient } \neq 0 \end{cases}$$

The test results will be presented in Table 5

TABLE 4: Result of Wald test

Wald tests for equations			
	Chi2	Df	p
Observed variables			
VN_GDP	4507.65	5	0.0000
HCM_GDP	169.67	5	0.0000
BD_GDP	63.23	5	0.0000
TN_GDP	85.71	5	0.0000
BP_GDP	116.84	5	0.0000
TG_GDP	138.75	5	0.0000

Source: Study result of authors

Table 5 presents statistics χ^2 is very big between 63.23 and 4507.65. Which means that all P-value all are 0 (= 0). This result is to show null hypothesis can be rejected at any level of significance. Thereby, the model is actually statistically significant.

TABLE 5: Result of stability analysis of simultaneous systems

Eigenvalue stability condition	
Eigenvalue	**Modulus**
0	0
0	0
0	0
0	0
0	0
0	0

Source: study results of authors

Table 6 shows Stability index is 0 (= 0). All eigenvalues are smaller than 1 (eigenvalues < 1) , which is to mean the path model satisfies the stability condition.

TABLE 6: Result of Average residuals = 0

Residual of exogenous variables						
	VN_GDP	**HCM_GDP**	**BD_GDP**	**TN_GDP**	**BP_GDP**	**TG_GDP**
Raw	0.000	0.000	-0.000	-0.000	0.000	-0.000
Normalized	0.000	0.000	-0.000	-0.000	0.000	-0.000
Standardized	0.000	0.000	.	-0.000	.	-0.000
Residual of endogenous variables						
		HCM_IIP	**BD_ IIP**	**TN_ IIP**	**BP_ IIP**	**TG_ IIP**
Raw		0.000	0.000	0.000	0.000	0.000
Normalized		0.000	0.000	0.000	0.000	0.000
Standardized		0.000	0.000	.	0.000	0.000

Source: study results of authors

Table 7 describes average residuals of exogenous variables and endogenous variables = 0, which means path analysis model's residuals analysis satisfies Ordinary Least Square's ssumptions.

TABLE 7: Result of correlation of residuals

	HCM_GDP	**VN_GDP**	**BD_GDP**	**TN_GDP**	**BP_GDP**	**TG_GDP**	**HCM_IIP**
HCM_GDP	0.000						
VN_GDP	0.081	-0.000					
BD_GDP	0.151	0.122	-0.000				
TN_GDP	0.113	0.171	0.237	0.000			
BP_GDP	0.098	0.074	0.024	0.183	0.000		
TG_GDP	0.033	0.000	-0.023	-0.015	-0.008	-0.000	
HCM_IIP	-0.000	0.066	-0.000	-0.000	-0.000	-0.000	0.000
BD_IIP	-0.000	0.058	0.000	-0.000	-0.000	-0.000	0.000
TN_IIP	-0.000	0.032	0.000	-0.000	-0.000	-0.000	0.000
BP_IIP	-0.000	-0.031	0.000	0.000	-0.000	0.000	0.000
TG_IIP	-0.000	0.040	0.000	-0.000	0.000	-0.000	0.000
	GD_IIP	**TN_IIP**	**BP_IIP**	**TG_IIP**			
BD_IIP	0.000						
TN_IIP	0.000	0.000					
BP_IIP	0.000	0.000	0.000				
TG_IIP	0.000	0.000	0.000	0.000			

Source: study results of authors

Table 8 illustrates normalized covariance between residuals is less than 1.96 ($Z_{0.025}$), which is mean that covariances = 0. So, conclusion is there is no residual correlation.

Besides, modification indices' calculation result shows all MI values less than 3.84 (< 3.84). Hence, the model does not miss any relationship.

It is then continued to adjust the model through testing linear constraint between residuals of the endogenous variables in the model and null hypothesis (H_0), which is var(e.HCM_GDP) = var(e.BD_GDP) = var(e.TN_GDP) = var(e.BP_GDP) = var(e.TG_GDP).

Result is value of test statistics $\chi^2(4) = 1.93$ and P-value= 0.7494. So, the null hypothesis H_0 cannot be rejected, that is the variances are equal.

Based on this test result, that having a correction by estimating the path analysis model with the constraint which residuals of endogenous variables are equal. The results will be illustrated in Table 9.

TABLE 8: Result of path model estimation with constraint that residuals variance is equal

Structural	Coefficient	OIM std. err.	z	P>|z|	[95% conf. interval]	
VN_GDP						
HCM_GDP	.2712974	.1207128	2.25	0.025	.0347048	.5078901
BD_GDP	.2690069	.1868865	1.44	0.150	-.0972838	.6352976
TN_GDP	-.0181297	.138057	-0.13	0.896	-.2887164	.252457
BP_GDP	.4387116	.1302004	3.37	0.001	.1835235	.6938996
TG_GDP	.0840068	.0584236	1.44	0.150	-.0305015	.198515
Constant	1.090978	.2810278	3.88	0.000	.5401734	1.641782
HCM_GDP						
HCM_IIP	1.487674	.1258263	11.82	0.000	1.241059	1.734289
BD_IIP	.7954267	.1472894	5.40	0.000	.5067448	1.084109
TN_IIP	-3.303299	.232727	-14.19	0.000	-3.759435	-2.847162
BP_IIP	1.821685	.1665739	10.94	0.000	1.495206	2.148164
TG_IIP	.345034	.1610049	2.14	0.032	.0294702	.6605977
Constant	-74.90326	11.20012	-6.69	0.000	-96.8551	-52.95143
BD_GDP						
HCM_IIP	1.105435	.2315811	4.77	0.000	.6515441	1.559325
BD_IIP	.8154258	.2305277	3.54	0.000	.3635999	1.267252
TN_IIP	-3.098488	-.3905833	-7.93	0.000	-3.864018	-2.332959
BP_IIP	1.785905	.2651549	6.74	0.000	1.266211	2.305599
TG_IIP	.3477445	.2531514	1.37	0.170	-.1484231	.8439121
Constant	-71.32712	17.89766	-3.99	0.000	-106.4059	-36.24835
TN_GDP						
HCM_IIP	1.183718	.1972114	6.00	0.000	.7971911	1.570245
BD_IIP	.7416689	.2045127	3.63	0.000	.3408312	1.142506
TN_IIP	-3.03901	.3471294	-8.75	0.000	-3.719371	-2.358649
BP_IIP	1.863596	.2246046	8.30	0.000	1.423379	2.303813
TG_IIP	.3063421	.2217694	1.38	0.167	-.128318	.7410021
Constant	-71.14419	15.56309	-4.57	0.000	-101.6473	-40.6411
BP_GDP						
HCM_IIP	1.150521	1730396	6.65	0.000	.8113692	1.489672
BD_IIP	.874019	.172272	5.07	0.000	.536372	1.211666
TN_IIP	-3.292666	.2778959	-11.85	0.000	-3.837332	-2.748
BP_IIP	1.900506	.1919242	9.90	0.000	1.524341	2.27667
TG_IIP	.4715223	.1895517	2.49	0.013	.1000078	.8430369
Constant	-77.63482	13.2212	-5.87	0.000	-103.5479	-51.72175
TG_GDP						
HCM_IIP	1.647048	1.1246035	13.22	0.000	1.40283	1.891266
BD_IIP	.2155265	.174475	1.24	0.217	-.1264382	.5574913
TN_IIP	-2.787059	.2965928	-9.40	0.000	-3.36837	-2.205748
BP_IIP	1.56229	.1995588	7.83	0.000	1.171162	1.953418
TG_IIP	.4390869	.17554432	2.50	0.012	.0950264	.7831474
Constant	-49.37474	13.30152	-3.71	0.000	-75.44523	-23.30424
Var(e.VN_GDP)	.002031	.0010001	2.03	0.042	.0000708	.0039912
Var(e.HCM_GDP)	.0665892	.0146226	4.55	0.000	.0379294	.0952491
Var(e.BD_GDP)	.0665892	.0146226	4.55	0.000	.0379294	.0952491
Var(e.TN_GDP)	.0665892	.0146226	4.55	0.000	.0379294	.0952491
Var(e.BP_GDP)	.0665892	.0146226	4.55	0.000	.0379294	.0952491
Var(e.TG_GDP)	.0665892	.0146226	4.55	0.000	.0379294	.0952491

Source: study results of authors

Table 9 illustrates path model estimation with constraint that residuals variance is equal. These resullt are similar to the results of table 2. However, table 9 has result of Var of GDPs of five city – provinces and Vietnam. Var of five city – provinces are same is to show Residual's Variation of five city – provinces means that the model at the first section of table 9 with a dependent variable VN's GDP and endogenous variables GDPs of five city - provinces meets the OLS assumption of constant variance between cross-sections.

TABLE 9: Direct effects analysis result

Structural	Coefficient	OIM std. err.	z	P>|z|	Std. Coef.
VN_GDP					
HCM_GDP	1.063752	.456922	2.33	0.020	.2760607
BD_GDP	3.231653	2.266326	1.43	0.154	.2647036
TN_GDP	-1.278495	9.773819	-0.13	0.896	-.0180673
BP_GDP	34.04211	9.953273	3.42	0.001	.4419082
TG_GDP	4.36211	2.980702	1.46	0.143	.0850451
HCM_IIP	0	(no path)			0
BD_IIP	0	(no path)			0
TN_IIP	0	(no path)			0
BP_IIP	0	(no path)			0
TG_IIP	0	(no path)			0
HCM_GDP					
HCM_IIP	104290.9	11829.81	8.82	0.000	1.500486
BD_IIP	127328.7	25318.74	5.03	0.000	.8022769
TN_IIP	-227122.1	23508.79	-9.66	0.000	-3.331747
BP_IIP	178843.3	21201.45	8.44	0.000	1.837373
TG_IIP	19219.05	9012.077	2.13	0.033	.3480054
BD_GDP					
HCM_IIP	23472.65	5872.351	4.00	0.000	1.069982
BD_IIP	39536.74	12568.3	3.15	0.002	.7892739
TN_IIP	-64528.52	11669.83	-5.53	0.000	-2.999115
BP_IIP	53106.52	10524.46	5.05	0.000	1.728628
TG_IIP	5867.061	4473.621	1.31	0.190	.3365918
TN_GDP					
HCM_IIP	4410.852	884.7931	4.99	0.000	1.165406
BD_IIP	6310.614	1893.678	3.33	0.001	.7301949
TN_IIP	-11106.55	1758.306	-6.32	0.000	-2.991995
BP_IIP	9724.927	1585.731	6.13	0.000	1.834765
TG_IIP	907.0102	674.045	1.35	0.178	.3016028
BP_GDP					
HCM_IIP	3989.411	705.0955	5.66	0.000	1.147473
BD_IIP	6920.264	1509.081	4.59	0.000	.8717041
TN_IIP	-11197.86	1401.202	-7.99	0.000	-3.283945
BP_IIP	9228.776	1263.676	7.30	0.000	1.895472
TG_IIP	1299.116	537.1495	2.42	0.016	.4702735
TG_GDP					
HCM_IIP	8626.286	977.3027	8.83	0.000	1.65204
BD_IIP	2577.542	2091.672	1.23	0.218	.2161797
TN_IIP	-14316.49	1942.146	-7.37	0.000	-2.795506
BP_IIP	11458.82	1751.527	6.54	0.000	1.567025
TG_IIP	1827.256	744.51992	2.45	0.014	.4404176

Source: study results of authors

Table 10 presents the direct effect of GDPs and IIPs of five city - provinces on GDP of Vietnam. P-values (P>|z|) of estimated coefficients show that only HCM's GDP and BP's GDP have positive direct effect on VN's GDP. While GDPs of TN, BD and TG have no effect on VN's GDP, GDP_VN is positively directly affected by the growth of HCM's GDP and BP's GDP between 2012-2020. Furthermore, the magnitude of the estimated coefficients show that GDP's growth of BP greatly affects on the growth of VN's GDP.

The estimated coefficients are significant at the 5% level which means that IIPs of all 5 city - provinces have an effect on HCM's GDP. While TN's IIP has negative effect, IIPs of HCM, BD, BP and TG have positive effect on HCM's GDP. The absolute value of the estimated coefficients shows that while TN's IIP in this period has the strongest negative effect on the growth HCM's GDP, BP's IIP has the strongest positive impact on HCM's GDP.

The effect on endogenous variables BD's GDP and TN's GDP: there is only the coefficient of TG's IIP is not statistically significant. Hence, there is no effect on the growth of BD's GDP and TN's GDP. The same is true of the case of HCM's GDP, that IIPs of HCM, BD and BP have positive effect on GDPs of BD and TN. The effect of BP's IIP is the largest in this group. However, TN's IIP has negative effect on BD's GDP and TN's GDP.

For Endogenous variable BP's GDP: All the estimated coefficients are statistically significant at 5%, which shows that the IIPs of five city - provinces have effect on BP's GDP. Similar to the above mentioned cases, except for TN's IIP which had negative effect on BP's GDP, the IIPs of other city - provinces had positive impact on the growth of BP's GDP.

Finally about endogenous variable TG's GDP: At the 5% level of significance, there is only the coefficient of the BD's IIP that is not statistically significant. Thus, the IIPs of HCM, BP, TN and TG really have effect on TG's GDP. However, TN's IIP has a negative effect the growth of TG's GDP.

TABLE 10: Indirect effects analysis result

Structural	Coefficient	OIM std. err.	z	P>|z|	Std. Coef.
VN_GDP					
HCM_GDP	0	(no path)			0
BD_GDP	0	(no path)			0
TN_GDP	0	(no path)			0
BP_GDP	0	(no path)			0
TG_GDP	0	(no path)			0
HCM_IIP	354592.7	34349.23	10.32	0.000	1.323973
BD_IIP	501971.1	73624.66	6.82	0.000	.8208063
TN_IIP	-879584.6	68325.82	-12.87	0.000	-3.34853
BP_IIP	713585.2	61272.13	11.65	0.000	1.902544
TG_IIP	90440.37	25883.59	3.49	0.000	.4249916

Source: study results of authors

Table 11 tells by? indirect effects analysis that with VN's GDP there is no path effected by GDPs of HCM, GD, TN, BP, TG. However, it is indirectly effected by IIPs of HCM, BD, BP, TG at P-Value (Sig.) > 0.5, Beta = 354592.7, 501971.1, 713585.2, 90440.37, respectively. TN's IIP has negative effect VN's GDP at P-Value (Sig.) = 0.000, Beta =-879584.6.

HCM's GDP, BD's GDP, TN's GDP, TG's GDP have Beta = 0 and no path of OIM std.err.

TABLE 11: General effects analysis result

Structural	Coefficient	OIM std. err.	z	P>|z|	Std. Coef.
VN_GDP					
HCM_GDP	1.063752	.456922	2.33	0.020	.2760607
BD_GDP	3.231653	2.266326	1.43	0.154	.2647036
TN_GDP	-1.278495	9.773819	-0.13	0.896	-.0180673
BP_GDP	34.04211	9.953273	3.42	0.001	.4419082
TG_GDP	4.36211	2.980702	1.46	0.143	.0850451
HCM_IIP	354592.7	34349.23	10.32	0.000	1.323973
BD_IIP	501971.1	73624.66	6.82	0.000	.8208063
TN_IIP	-879584.6	68325.82	-12.87	0.000	-3.34853
BP_IIP	713585.2	61272.13	11.65	0.000	1.902544
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HCM_GDP					
HCM_IIP	104290.9	11829.81	8.82	0.000	1.500486
BD_IIP	127328.7	25318.74	5.03	0.000	.8022769
TN_IIP	-227122.1	23508.79	-9.66	0.000	-3.331747
BP_IIP	178843.3	21201.45	8.44	0.000	1.837373
TG_IIP	19219.05	9012.077	2.13	0.033	.3480054
BD_GDP					
HCM_IIP	23472.65	5872.351	4.00	0.000	1.069982
BD_IIP	39536.74	12568.3	3.15	0.002	.7892739
TN_IIP	-64528.52	11669.83	-5.53	0.000	-2.999115
BP_IIP	53106.52	10524.46	5.05	0.000	1.728628
TG_IIP	5867.061	4473.621	1.31	0.190	.3365918
TN_GDP					
HCM_IIP	4410.852	884.7931	4.99	0.000	1.165406
BD_IIP	6310.614	1893.678	3.33	0.001	.7301949
TN_IIP	-11106.55	1758.306	-6.32	0.000	-2.991995
BP_IIP	9724.927	1585.731	6.13	0.000	1.834765
TG_IIP	907.0102	674.045	1.35	0.178	.3016028
BP_GDP					
HCM_IIP	3989.411	705.0955	5.66	0.000	1.147473
BD_IIP	6920.264	1509.081	4.59	0.000	.8717041
TN_IIP	-11197.86	1401.202	-7.99	0.000	-3.283945
BP_IIP	9228.776	1263.676	7.30	0.000	1.895472
TG_IIP	1299.116	537.1495	2.42	0.016	.4702735
TG_GDP					
HCM_IIP	8626.286	977.3027	8.83	0.000	1.65204
BD_IIP	2577.542	2091.672	1.23	0.218	.2161797
TN_IIP	-14316.49	1942.146	-7.37	0.000	-2.795506
BP_IIP	11458.82	1751.527	6.54	0.000	1.567025
TG_IIP	1827.256	744.5199	2.45	0.014	.4404176

Source: study results of authors

Table 12 presents general direct effect GDPs and IIPs of five city - provinces on VN's GDP. P-values (P>|z|) of estimated coefficients show that there is only HCM's GDP and BP's GDP that have an positive general direct effect on VN's GDP. GDPs of other provinces TN, BD and TG have no general effect on VN's GDP. The growth of VN's GDP is positively affected by the growth of HCM's GDP and BP's GDP in the period 2012-2020. Furthermore, the estimated coefficients' magnitude is to define that GDP's growth of BP greatly effects on the growth of VN's GDP.

The estimated coefficients are significant at the 5% level. Hence, IIP of all 5 city - provinces have general effect on VN's GDP. While TN's IIP has negative general effect, IIPs of HCM, BD, BP and TG have positive general effect on VN's GDP. The absolute value of the estimated coefficients shows that while TN's IIP in this period has the strongest negative general effect, BP's IIP has the strongest positive general effect on VN's GDP.

Similarly, the estimated coefficients are significant at the 5% level. So, IIP of all 5 city - provinces have general effect on HCM's GDP. While TN's IIP has a negative general effect, IIPs of HCM, BD, BP and TG have positive general effect on HCM's GDP. The absolute value of the estimated coefficients is to define that while TN's IIP has the strongest negative general effect, BP's IIP has the strongest positive general effect on VN's GDP between 2012 and 2020.

About endogenous variables BD's GDP and TN's GDP; there is only the coefficient of TG's IIP which is not statistically significant. Therefore, there is no general effect on the growth of BD's GDP and TN's GDP. Similarly, with the case of HCM that IIPs of HCM, BD and BP have positive general effect on GDPs of BD and TN. The general effect of BP's IIP is the largest in this group. But TN's IIP has negative general effect on BD's GDP and TN's GDP.

For Endogenous variable BP's GDP: All the estimated coefficients are statistically significant at 5%, that is to show IIPs of five city - provinces have general effect on BP's GDP. However, except TN's IIP which had negative general effect on BP's GDP, IIPs of other city - provinces had positive general effect on the growth of BP's GDP.

Finally about endogenous variable TG's GDP: At the 5% level of significance, there is only the coefficient of the BD's IIP which is not statistically significant. Hence, IIPs of HCM, BP, TN and TG really have general effect on TG's GDP. However, TN's IIP has negative general effect the growth of TG's GDP.

DISCUSSION

Estimation of the Path analysis model's results shows GDPs of HCM, BD, BP are positive and significant predictors of achievements at P-Value (Sig.) < 0.5, coefficient > 0. HCM's GDP: IIPs of all five city - provinces are significant predictors of achievements at P-Value (Sig.) < 0.5. However, only TN's IIP is negative at coefficient < 0. BD's GDP. TN's IIP is negative significant at P-Vale (Sig.) > 0.5 and coefficient < 0. TG's IIP is not statistically significant IIPs of HCM, BD and BP are positive and significant predictors at P-Value (Sig.) < 0.5, coefficient > 0. TN's GDP. TG's IIP is not statistically significant. TN's IIP is negatively significant predictor of achievements at P-Value (Sig.) < 0.5 and coefficient < 0. IIPs of HCM, BD and BP are positive and significant predictors of achievements at P-Value (Sig.) < 0.5, coefficient > 0. BP's GDP. IIPs of HCM, BD, BP, TG are positive and significant predictors of achievements at P-Value (Sig.) < 0.5, coefficient > 0. TN's IIP is negative and significant predictors of achievements at P-Value (Sig.) < 0.5, coefficient < 0. TG's GDP and TN's IIP are negative and significant predictors of achievements at P-Value (Sig.) < 0.5, coefficient < 0. IIPs of HCM, BP and TG are positive and significant predictors of achievements at P-Value (Sig.) < 0.5, coefficient > 0.

The highlight point is TN's IIP has negative and significant predictors of achievements at coefficient < 0 for all five city - provinces. Regression's standardization coefficient shows VN's GDP has positive correlation with GDPs of HCM, BD, BP and TG. However, it has negative correlation with TN's GDP. HCM's GDP is effected positively by IIP of BD, BP, TG. However, it is effected negatively by TN's IIP. BD's GDP and effected positively by IIP of HCM, BD, BP, TG. The hightlight point is TN's IIP negatively effects on GDP of almost other four city-provinces.

Stability analysis of simultaneous systems shows that the Path analysis model satisfies stability condition. Path analysis model's residuals satisfies OLS's assumptions. There is no residual correlation. Path analysis model estimation with constraint is that residuals variance is equal. Which means that VN's GDP is effected positively by GDPs of HCM and BD.

HCM's GDP is effected positively by IIPs of HCM, BD, BP, TG and is effected negatively by TN's IIP. BD's GDP is effected positively by IIPs of HCM, BD and it is effected negatively by TN's IIP. TN's GDP is effected positively by IIPs of HCM, BD, BP, and which is effected negatively by TN's IIP. TG's IIP is not statistical significant. BP's IIP is effected positively by IIPs of HCM, BD, BP, TG and it is effected negatively by TN's IIP. TG's GDP is effected positively by IIPs of HCM, GP, TG and is effected negatively by TN's. There is not statistical significance for BD's IIP. The emphasized point is estimated coefficients of TG's IIP and BD's IIP are not statistically significant.

Direct effects analysis shows VN's GDP is effected directly positively by GDPs of HCM and BP. BD's GDP is positively directly affected by IIPs of HCM, BG, BP, TG and is negatively directly affected by TN's IIP. BD's GDP is positively directly effected by IIP of HCM, BD, TN, BP, negatively directly effected by TN's IIP and is not effected by TG's IIP. TN's GDP is positively directly affected by IIPs of HCM, BG, BP and it is negatively directly affected by TN's IIP. BP's GDP is positively directly affected by IIP of HCM, BG, BP, TG and is negatively directly affected by TN's IIP.

Indirect effect analysis defines VN's GDP is positively indirectly effected by IIPs of HCM, BD, BP, TG and is negatively indirectly affected by TN's IIP. HCM's GDP, BD's GDP, TN's GDP, TG's GDP have Beta = 0 and no path of OIM std.err.

General effects analysis shows VN's GDP is positively generally affected by GDPs of HCM, BP and IIPs of HCM, BD, BP, TG and is negatively generally effected by TN. HCM's GDP is positively generally effected by IIPs of HCM, BD, BP, TG and is negatively generally effected by TN's IIP.

BD's GDP is positively generally effected by IIPs of HCM, BD, BP and it is negatively generally effected by TN's IIP. TN's GDP is positively generally effected by IIPs of HCM, BD, BP, is negatively generally effected by TN's IIP and is not generally effected by TG's IIP. BP's GDP is positively generally effected by IIP of HCM, BD, BP, TG and is negatived generally effected by TN's IIP. TG's GDP is positively generally effected by IIP of HCM, BD, BP, TG and is negatively generally effected by TN's IIP.

The highlight point is GDP and IIP of TN which have negative general effect on other city - provinces in the general correlation. GDP and IIP of BP has the strongest general effect on other city - provinces in general correlation. GDP and IIP of BD has the second strongest general effect, GDP and IIP of HCM has the third strongest general effect and GDP and IIP of TG has the smallest general effect on other city - provinces in general correlation.

CONCLUSION

Estimation of Path analysis model's results shows Tay Ninh province's IIP has negative and significant predictors of achievements at GDP and IIP of all other city - provinces and Vietnam in each correlation. Path analysis model estimation with constraint that residuals variance is equal which shows Tien Giang province's IIP and Binh Duong province's IIP are somtimes not statistical significant. Direct effects analysis defines GDP and IIP of Tay Ninh province have negative effect on GDP and IIP of all other city - provinces and Vietnam in each correlation. Indirect effects analysis shows VN's GDP is indirectly effected positively by IIPs of Ho Chi Minh city, Binh Duong province, Binh Phuoc province, Tien Giang province and it is affected negatively by Tay Ninh province's IIP. General effects analysis defines GDP and IIP of Tay Ninh province as having general negative effect on GDP and IIP of other city - provinces and Vietnam in general correlation. GDP and IIP of Binh Phuoc province have the strongest general effect on GDP and IIP of all other city - provinces and Vietnam in general correlation. GDP and IIP of Binh Duong province has the second strongest general effect, GDP and IIP of Ho Chi Minh city has the third strongest general effect, and GDP and IIP of Tien Giang province has the smallest general effect on GDP and IIP of other city - provinces and Vietnam in general correlation.

IMPLICATIONS

According to the study results, in the period 2013-2020, IIPs of the city-provinces really has an effect on the growth by themselves, of other city-provinces in the region and the whole country. However, the effect is very different, IIP of Tay Ninh has the effect negatively on the growth of four city-provinces and the nation. The main cause is lack of rationality in allocating investment and taking advantage of each province's own strengths.

Based on the theoretical perspectives Keynes (1936), using macroeconomic policy by boosting capital intensity, Vietnam's government needs to focus on investment and encouraging policy in Binh Phuoc province. Therefore, one hand is considered to create a support specification mechanism in Tây ninh supportive links from the four other city-provinces the region. On the other hand, it should adjust reasonable capital dosage in three other provinces included Ho Chi Minh, Binh Duong and Tien Giang.

Besides, according to Myrdal's theory Myrdal (1957), Because Ho Chi Minh is the leader where science and technology is concentrated and developed in the region, Vietnam's government should have a right route to invest in Ho Chi Minh in promoting science and technology's development to gain "spillover effects" emanate from Ho Chi Minh to other four provinces.

FURTHER STUDY

authors plan to have a next study which is continue on the topic of this study. This is intended to discover why GDP and IIP of TN province always have negative effect and why GDP and IIP of Binh Phuoc province always have the largest effect on all other city – province in each and general correlation.

DECLARATION OF COMPETING INTEREST

We declare that we have no significant competing interests including financial or non-financial, professional, or personal interests interfering with the full and objective presentation of the work described in this manuscript.

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AUTHOR CONTRIBUTIONS

Both authors contributed equally to the conception and design of the study.

DATA AVAILABILITY STATEMENT

The time series data been 2012 and 2020 which have been collected and extracted manually by authors Vu Thi Kim Hanh and Vo Thi Le Uyen. Data is from Ho Chi Minh City's Statistics Department, Binh Duong province's Statistics Department, Tay Ninh province's Statistics Department, Binh Phuoc province's Statistics Department, Tien Giang province's Statistics Department. And Statistical Year-Book of these city – provinces.

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