

# **An Analysis for the Northern Key Economic Region: Vietnam Based on the Input - Output Table Non- competitive Style**

**Nguyen Phuong Thao<sup>1</sup>**

## **Abstract**

The development of the Northern key economic region of Vietnam is one of the main motivations for the economic development of Vietnam. The analysis and selection of appropriate directions for the region is very important for the overall development of this region and the nation. This paper uses input – output model (I/O), an effective quantitative tool with the purpose of offering a scientific basis for key sectors selection, investment areas need to be prioritized for the development of the Northern key economic region. The input – output model, which are used in this study, is the expansion intra-regional I/O table with non-competitive type. It is non-competitive because it makes an explicit distinction between intra- regional produced and imported products (including: domestic import and foreign import). Such a distinction provides a better reflection of the use of intra - regional production technology and inputs in the production of output in other regions (or other countries).

**JEL classification numbers:** C13, C32, C51, G10

**Keywords:** Intra-regional, Input-output, Northern key economic region, key sector, investment.

## **1 Introduction**

In 1785, Quensnay published a “tableau économique”, which was the first model of the economy, describing the relations between economic sectors. Then, Leon Walras developed a theory of general equilibrium on prices. In his model, Walras utilized a set of production coefficients defined as the respective quantities of each of the productive service that enter into the production of a unit of each the products [10]. Inherited from previous researches,

---

<sup>1</sup>National Center for Socio-Economic Information and Forecast, Vietnam Ministry of Planning & Investment.

Leontief mathematically formulated the relationship of supply - demand of the entire economy. W. Leontief considered production technology coefficients. He said on the macro economic a linear functions relationship between the supply side and demand side to be consistence. This relationship is represented by system of linear functions with the coefficient which is determined by technological coefficient on process of production [11]. The Inter-regional input-output framework was developed by Isard (1951). This framework has been empirically articulated only once and even then on a very small scale [5]. Then, the idea of inter-regional I/O model was specified by Richardson and it has been becoming an important tool for region studying. Inter-regional I/O model not only describes the relationship between sectors but also describes the relationships between regions, regions and regions of foreign country or between countries through trading flows [4]. Inter-regional IO model was developed further by Chenery-Moses (also known as Chenery-Moses model) and Miller-Blair (1985). Chenery and Moses developed a model, independently of one another, which is similar to the Isard model but requires considerably less data in order to be statistically implemented [3]. Their model has in fact been statistically implemented for system of regions in, for example, Italy, the United State of America, and Canada. In Asia, the interregional input – output model was strongly applied and developed in analyzing and assessing the economy and the environment in Japan (Mishikawa and Miyazi, 2004). In recent years, researches that based on the inter-regional input output model was developed in other Asian countries such as China (Okamoto, 2005 and Okuda, 2004); Phillipines (Francisco T secretario, 1994, 1999, and 2002); and Vietnam (Bui Trinh, Francisco T.Secretario, Kwang Moon Kim, 1996, 2006 and 2007; Bui Trinh, Kwang Moon Kim, Duong Manh Hung, 2000 [1]; Bui Trinh, Duong Manh Hung and Henning, 2005; Bui Trinh, Kiyoshi Kobayashi, Trung-Dien Vu, 2011; Bui Trinh, Kiyoshi Kobayashi, Nguyen Viet Phong, Vu Trung Dien, 2012; Bui Trinh, Nguyen Viet Phong, 2014...) [2].

However, the most of pervious research based on the interregional model, relatively little research has been done on intraregional model. Research about region must using inter-regional I/O model but due to the high cost condition to set up this table style, this research will use the intra-regional expansion I/O table with non-competitive type for analysis. This model is based on the idea about inter-regional I/O model, which describes the relationship of one region with the other regions within country and foreign countries through the import of this region with other regions within country and import of this region from other countries.

The expansion intra-regional IO table with non-competitive type of the Northern key economic region, Vietnam is created by author Bui Trinh<sup>2</sup> in 2007, which separated the import of regions within country and the foreign imports into the regional domestic production. From this model, it can be estimated backward linkages, forward linkages, spreading to other parts of the country and spreading to foreign import which can indicate that the sector should be prioritized for development. Besides, Leontief was quantified Keynes's idea in the relationship between supply and demand, this means the relationship between the elements of final demand and supply side is quantified [6], this is a “cause and effect” relationship between the demand side and the supply side, thereby leading to the changing in income and backward influence the behavior of demand, from the expansion intra-regional IO table with non-competitive type it can also calculate the spreading of final

---

<sup>2</sup>Dr. Bui Trinh – Vietnam National Accounts Department, General Statistics Office Of Vietnam

aggregate demand factors to production and income in the region, which can make some judgments about the macroeconomic.

In order to promote the overall development of the whole country as well as create linkages and coordination in the development of economic - society among economic regions, Vietnam government has tried to select several provinces/cities to form national key economic region with the breakthrough capabilities and creating motivation for the development of economic - society of the whole country with high speed and sustainability, creating conditions to improve living standards of the people and quickly achieve social fairness in the country. The Northern key economic region including Ha Noi, Quang Ninh, Hai Phong, Hai Duong, Hung Yen, Vinh Phuc, Bac Ninh. This is one of four key economic regions of Vietnam (including Northern key economic Region, middle key economic region; Southern key economic Region; Mekong Delta key economic Region) [9].

With the goal of becoming a leading region in the industrialization and modernization of the country, which always holds the leading role for the Northern region and the country in promoting, supporting other regions, especially disadvantaged areas to development, the Northern key economic region always get investment priority of the Government, and therefore the economy - society of the Northern key economic region have had the steps in the growing progress, technical facilities increased significantly, the provinces in the region have the potential of economy and labor. However, a leading industry has not been created yet recently, with the role of enticing other industries in the region in particular and the country in general. In addition, the Northern key economic region is one of the regions that contribute to the macro-economic instability of the country as the long-lasting trade deficit for many years.

This paper, using the expansion intra-regional IO table with non-competitive - import type in 2007 of the Northern key region of Vietnam to provide a few suggestions on sector that should be prioritized to develop, as well as a number of other opinions relating to domestic and foreign investments in the region.

## 2 Methodology

The intra-regional I/O table (non – competitive style), as configured in Figure 1:

Sector	INTERMEDIATE DEMAND			FINAL DEMAND			GO
	1	2	3	C	I	E	
1	$X_{11}^d$	$X_{12}^d$	$X_{13}^d$	$C_{11}^d$	$I_{11}^d$	$E_{11}$	$X_1$
2	$X_{21}^d$	$X_{22}^d$	$X_{23}^d$	$C_{21}^d$	$I_{21}^d$	$E_{21}$	$X_2$
3	$X_{31}^d$	$X_{32}^d$	$X_{33}^d$	$C_{31}^d$	$I_{31}^d$	$E_{31}$	$X_3$
Domestic import	$M_{11}^d$	$M_{21}^d$	$M_{31}^d$	$M_c^d$	$M_I^d$		$M^d$
Foreign Import	$M_{11}^f$	$M_{21}^f$	$M_{31}^f$	$M_c^f$	$M_I^f$		$M^f$
VA	$V_1$	$V_2$	$V_3$				
GI	$X_1$	$X_2$	$X_3$				

Figure 1: Intra-regional I/O table (non – competitive style)

The outlined Intra- Regional IO model is of the non-competitive. It is non-competitive because it makes an explicit distinction between intra- regional produced and imported products (including: domestic import and foreign import). Such a distinction provides a better reflection of the use of intra - regional production technology and inputs in the production of output in other regions (or other countries).

The relationship in the Intra – regional I/O (non-competitive style) is represented as follows:

In the Intra – regional I/O (non-competitive style), the intermediate inputs are broken-down into commodities produced intra - regional and commodities imported from the rest of the country and import from foreign. In this IO table, intermediate demand and final demand has been separated into intra-regional products, negative column of import from the rest of country and import from foreign did not exist while two imported row (domestic import and foreign import), are separated.

Where:

$X^{dij}$  is estimated value of regional domestic product  $i$  consumed by sector  $j$  in the region  $i$  ;

$C^d_i$  : final consumption of regional domestic product  $i$ ;

$I^d_i$  : Gross capital formation of regional domestic product  $i$ ;

$E_i$ : Export of product  $i$ ;

$M^d_j$  : (Sector  $j$ ) is estimated intermediate imported inputs of sector  $j$  from other domestic regions;

$M^f_j$  : (Sector  $j$ ) is estimated intermediate imported inputs of sector  $j$  from foreign;

$M^d_c$  và  $M^f_c$  :is estimated final consumption imports in other domestic regions in the and foreign.

$M^d_I$  và  $M^f_I$  : is estimated gross capital formation imports in other domestic regions and foreign.

## 2.1 Basic Relationships

The expansion intra-regional I/O table with non-competitive - import type was estimated as Equatinon (1):

$$(A^d + A^m_d + A^m_f).X + Y^d + Y^m_d + Y^m_f - M^d - M^f = X \quad (1)$$

Or:

$$A^d . X + Y^d + A^m_d.X + Y^m_d - M^d + A^m_f.X + Y^m_f - M^f = X \quad (2)$$

Where:  $X$  is the vector of gross output;

$A^d$  is the matrix of intermediate consumption of regional domestic products;

$A^m_d$  is the matrix of intermediate consumption of other regional domestic products;

$A^m_f$  is the matrix of intermediate consumption of foreign products;

$Y^d$  is the matrix of final demand of regional domestic products;

$Y^m_d$  và  $Y^m_f$  is the matrix of final demand of imported products from other domestic regions. Final demand included: Final consumption; Gross capital formation and Export.

We can see:

$$A^m_d.X + Y^m_d = M^d \quad (3)$$

$$A^m_f.X + Y^m_f = M^f \quad (4)$$

Relationship (3) and (4) is understood import from other parts of the country and abroad which are divided into import for production vector ( $A^m_d.X$ ;  $A^m_f.X$ ) and import for final demand vector ( $Y^m_d$ ;  $Y^m_f$ )

We can rewrite equation (2) as follow:

$$A^d . X + Y^d = X \tag{5}$$

And:

$$X = (I - A^d)^{-1} . Y^d \tag{6}$$

Where  $(I - A^d)^{-1}$  is the Leontief matrix multiplier that shows regional domestic product requirements for a unit increase in regional domestic final demand.

- The index of the power of dispersion is identified as follow:

The index of the power of dispersion =  $n.BL_j / \sum BL_j$

In which:  $BL_j = \sum r_{ij}$  (the sum of the column elements of the Leontief inverse matrix)

This ratio is greater than 1 and higher, it means that the backward linkage of sector is larger as well as the development of this sector will lead to faster growth of entire supply sectors (products and services) of the entire system.

- The sensitivity index is identified as follow:

The sensitivity index =  $n.FL_i / \sum FL_i$

In which:  $FL_i = \sum r_{ij}$  (The sum of the row of the Leontief inverse matrix)

This ratio is greater than 1 and higher, it means that the forward linkage of sector is larger and expressed the relative necessity of this sector to other sectors.

From relationship (6) we present the linkage between final demand and income, this relation presented as follow:

$$V = v.(I-A^d)^{-1}.Y^d \tag{7}$$

$$\Delta V = v.(I-A^d)^{-1}.\Delta Y^d \tag{8}$$

Where: V is matrix of value added; v is coefficient matrix of value added. This relation represents the change in income depends on the change of the regional demand. (Figure 2)

On the other hand, the equation (2) can be written as follows:

$$X - A^m_d.X = A^d . X + Y^d + Y^m_d - M^d + A^m_f.X + Y^m_f - M^f \tag{9}$$

Or:

$$X = (I - A^m_d)^{-1} . (A^d . X + Y^d + Y^m_d - M^d + A^m_f.X + Y^m_f - M^f) \tag{10}$$

Where:  $(I - A^m_d)^{-1}$  is the import multiplier matrix from the other regions. Equations (9) and (10) presented the demand of import from other regions induced by regional domestic demand.

- The power of dispersion on other regions index is identified as follow:

The power of dispersion on other regions index =  $n.IM_j^d / \sum IM_j^d$

In which:  $IM_j^d = \sum m_{ij}^d$  (The sum of the column of  $(I - A^m_d)^{-1}$  matrix)

The higher the diffusion ratio (greater than 1), it means that this sector will have an impact on attracting production of other regions.

Similarly, relationship (2) can also be written:

$$X - A^m_f \cdot X = A^d \cdot X + Y^d + A^m_d \cdot X + Y^m_d - M^d + Y^m_f - M^f \tag{11}$$

Or:

$$X = (I - A^m_f)^{-1} \cdot (A^d \cdot X + Y^d + A^m_d \cdot X + Y^m_d - M^d + Y^m_f - M^f) \tag{12}$$

Where:  $(I - A^m_d)^{-1}$  is the import multiplier matrix from foreign. Equations (11) and (12) presented the demand of import from foreign induced by regional domestic demand.

- The power of dispersion on foreign import index is identified as follow:

The power of dispersion on foreign import index =  $n \cdot IM_j^f / \sum IM_j^f$

In which:  $IM_j^f = \sum m_{ij}^f$  (The sum of the column of  $(I - A^m_d)^{-1}$  matrix)

The sector in the region has a greater ratio (greater than 1) means that the sector will stimulate foreign imports and it can lead to national trade deficit.

The effect on inter-regional spillover and feedback effects was fully described by Bui Trinh, Kiyoshi Kobayashi, Thai Nguyen Quang, Phong Nguyen Viet [2], as follow:

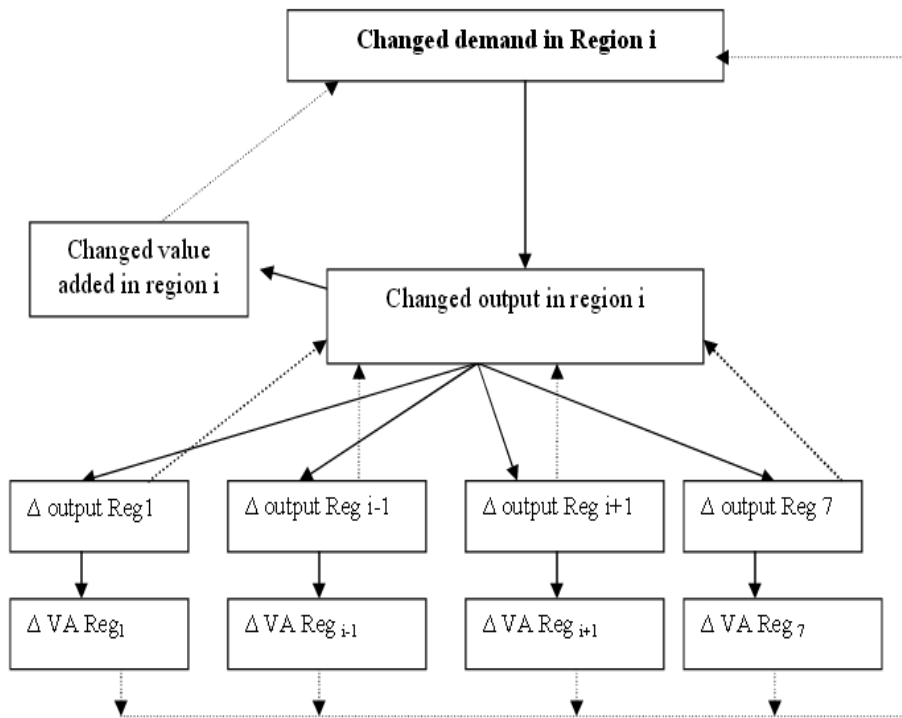


Figure 2: Spillover and feedback effects in a 7-regions model of Vietnam (Source: Bui Trinh, Kiyoshi Kobayashi, Thai Nguyen Quang, Phong Nguyen Viet (2012), “Multi-interregional economic impact analysis based on multi-interregional input output model considering of 7 regions of Vietnam, 2000”, Journal of Finance and Investment Analysis)

However, this research considers only the effects of the intra-regional relationship, as follow

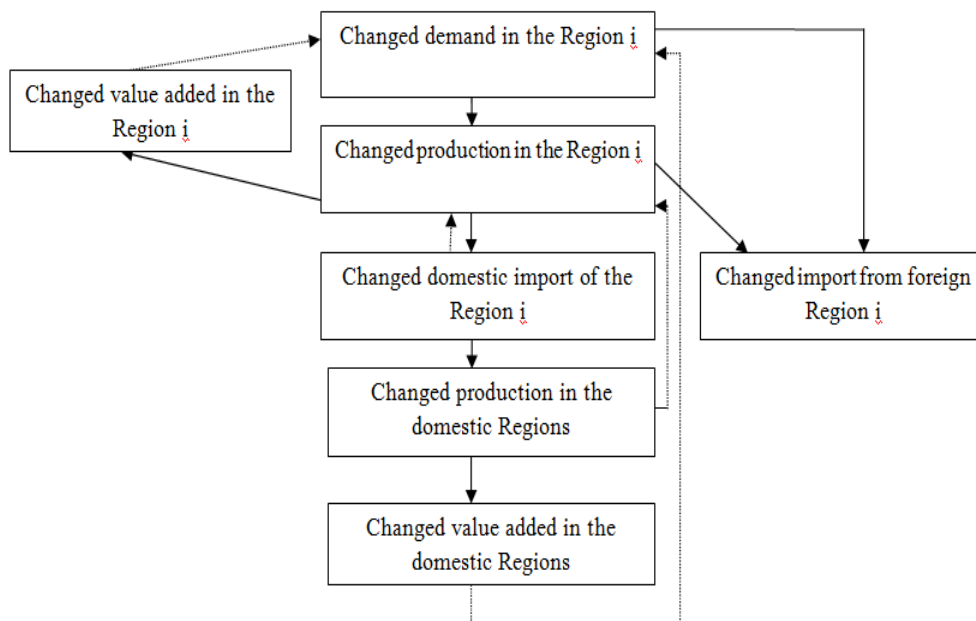


Figure 3: The induced impact and intra-regional feedback effect

### 3 Empirical Study

The Northern key economic region consists of Hanoi, Quang Ninh, Hai Phong, Hai Duong, Hung Yen, Vinh Phuc, Bac Ninh. This is also a dynamic economic region of the country. The proper orientation of investment priority for sectors of this economic region not only creates the favorable momentum for regional development, but also is the motivation for the neighborhoods to develop.

Using the expansion intra-regional I/O table with non-competitive type in 2007 of the Northern key region of Vietnam to calculate the power of dispersion on economic index, sensitivity index of 27 sectors and the power of dispersion on other areas as well as the power of dispersion on foreign imports, the results indicate that some industries should be prioritized for development and investment to create economic spread to the region and neighboring areas without requirement of large imports from foreign countries. This will not only bring economic growth to the Northern key economic region, but also contribute to the motivation for the surrounding regions, and above all to reduce the trade deficit of Vietnam in the future.

Table 1: The power of dispersion index (BL), sensitivity index (FL), power of dispersion on domestic import and power of dispersion on foreign import

		Power of dispersion index	Sensitivity index	Power of dispersion on domestic import	Power of dispersion on foreign import
1	Paddy	0.942932	1.537862	0.942178	0.785742
2	Other crops	0.836039	1.099644	0.936753	0.762846
3	Livestocks & Poultry	1.011423	1.071729	0.978339	0.851803
4	Forestry	0.836209	0.784549	0.987811	0.767202
5	Fish Farming	1.005467	0.991205	0.98077	0.768875
6	Fishery	0.912795	0.917025	0.988669	1.057057
7	Mining	0.882401	0.830137	0.989694	0.870553
8	Processed seafood	1.156069	0.810815	1.10094	0.873289
9	Processed Rice	1.559527	0.87137	0.947747	0.723565
10	Other Agricultural Processing	1.23492	1.031947	0.97081	0.889891
11	Textiles	0.904273	0.817754	0.975354	1.811899
12	Paper	1.104409	1.08438	1.060747	1.063839
13	Wood	0.918268	0.786342	1.296561	0.909216
14	Rubber	1.041457	0.91091	1.010002	1.03364
15	Non-Metallic Mineral Products	0.919824	0.873695	0.982156	1.800324
16	Transport Equipment	1.082297	1.288314	0.952185	1.261793
17	Metal Products	1.013199	0.777111	1.0096	1.281614
18	Other Manufacturing	0.985811	1.861409	1.059443	1.221707
19	Electricity & Water	0.88627	1.183229	0.989391	0.905795
20	Construction	0.940476	0.773897	1.047615	1.262296
21	Transport	1.009996	0.953227	0.988781	0.974123
22	Communication	0.868059	0.910424	0.966151	0.860422
23	Trade	0.944354	1.099736	0.943977	0.857409
24	Financial services	0.971072	0.849906	0.977735	0.818997
25	Public Administration	0.963438	0.774217	0.973288	0.851147
26	Hotels & Restaurants	1.061654	0.844283	0.977318	0.870808
27	Other Services	0.924259	1.264882	0.965988	0.864148

(Source: Author's calculation base on the expansion intra-regional I/O table with non-competitive type in 2007 of the Northern key region of Vietnam)



The above table shows sectors: Livestock & Poultry, Processed seafood and other agricultural products processing have relatively good indicators as the power of dispersion on economic index and the power of dispersion on surrounding areas are greater than one, and the power of dispersion on foreign imports is less than 1. This result coincides with the calculation of general spread of the entire economy. Obviously, these are the key economic sectors of the nation as well as of the region and should be prioritized for investment. Besides, the Northern key economic region has advantages in terms of natural conditions for the development of these sectors. Therefore, investment in these industries can both exploit the strengths of the region and decrease stimulation to import.

For some industries such as textiles, paper, rubber and some other manufacturing, though having good economic spread as well as good spread to other regions, the spread to import from abroad is still high. In fact, the main industrial products for export of the Northern key economic region are from FDI enterprises, these enterprises import raw materials and components from abroad, organize processing, assemble in Vietnam then export the products. The remaining benefits received by Vietnam are mainly processing with low value. As a result, the continuing prioritize the development of these industries without clear direction of investment lead to increase the trade deficits of Vietnam and the benefits will only go to FDI enterprises.

Regarding the service sectors: Transport and hotel & restaurant are the sectors having relatively good indicators, as the power of dispersion on economic index is over one, the power of dispersion on other regions is relatively high, the power of dispersion on imports from abroad is low. Therefore, according to the calculation, these are the industries having potential development for the Northern key economic region. As a matter of fact, the region has its unique characteristics to develop these two service industries, with the diverse transportation network (including rail, road, sea, air), in addition to the favorable natural conditions for developing tourism, hotels and restaurants. With the aim of developing strategies for the Northern key economic region to structure the main products and priority areas as the high-end, high quality services; especially commercial, financial, banking, tourism, IT, telecommunications, domestic and international transportation, real estate, capital market, stock market services..., the other service industries besides the transportation and hotel-restaurant sectors are not really deserved the priority when the calculating indexes are not good.

Table 2: The effects of the final demand on output and income

	C	I	E	
			Foreign	Domestic
<b>Output induced by final demand</b>	1.42	1.23	1.27	1.26
<b>Income induced by final demand</b>	<b>0.7</b>	0.37	0.39	<b>0.61</b>

(Source: Author's calculation base on the expansion intra-regional I/O table with non-competitive type in 2007 of the Northern key region of Vietnam)

Keep using the expansion intra-regional I/O table with non-competitive type in 2007 of the Northern key region of Vietnam to calculate the effect of factors of final demand on output and income in the region. The table 2 shows that, within the factors of final demand, not investment but consumption and exports effects on output the most. In addition, investment is also a factor that has the lowest spread to income. This shows that the investment efficiency of the Northern key economic region is currently very low;

investment not only does not create conditions to improve production capacity, but also does not have an impact on the creation of value added for the region.

For the export of Northern key economic region, the calculation results indicate that the export of foreign invested region effects on output more than domestic exports do. However, it is noteworthy that domestic exports have better effect on the value added, which reinforces the argument that production of foreign invested sectors of the Northern key economic region is mainly processing and export that do not bring a lot of value added to this region. In addition, domestic export brings more value added though the export ratio is becoming smaller than that of the foreign invested regions. Therefore, should there be more preferential policies for domestic enterprises producing products for export so this sector can develop stronger, and be more competitive compared to foreign invested enterprises?

#### **4 Conclusions and recommendations**

Through the above analysis, the author finds out that the Northern key economic region is, though, a dynamic economic region and given priority for economic development by the Government to create motivation for the surrounding areas, but clearly the region still holds some problems that need to be solved. Firstly, though prioritized for investment but investments of the Northern key economic region has yet brought the production capacity to the region. More importantly, investment is the factor having the lowest influence on value added among the factors of the total final demand. Secondly, the foreign invested sector is the developed region which receives a lot of preferential treatments but does not bring great value added. Meanwhile, the domestic economic sector is actually the sector that has positive influence on the value added for the region. Thirdly, the Northern key economic region has the goal of developing high-tech industries and high quality services; however, according to the calculated indexes of spread, these industries have not really promoted the leader role. In addition, some industries in the group of agriculture and agricultural products processing, are the industries that have a positive impact on the economic development of the region.

From these conclusions, we have made some recommendations: Firstly, investment efficiency needs to be improved, investment needs to be orientated towards improving production capacity of the supply side, paving the way for the development of production. Secondly, the Northern key economic region needs to reconsider the attraction of foreign direct investment, in addition to having policies to encourage the development of domestic businesses which bring the real benefits to the region. Thirdly, there should be policies of development priority for some sectors with good indicators (as discussed above) to be able to produce the better spread to economic development in the region and the surrounding areas, exploit competitive advantages of the region without causing the trade deficit.

**ACKNOWLEDGEMENTS:** I am very grateful to Dr. Bui Trinh for his very kind help, encouragement, and support throughout to my research.

## References

- [1] Bui Trinh, Duong Manh Hung and Nguyen Van Huan, “Vietnam Inter-Regional Input – Output Analysis: The Bi-regional and 8-regional Case of Vietnam”, *Journal of Contemporary Management*, Article ID: 1929-0128-2013-04-11-10, (2013).
- [2] Bui Trinh, Kiyoshi Kobayashi, Thai Nguyen Quang, Phong Nguyen Viet, “Multi-interregional economic impact analysis based on multi-interregional input output model considering of 7 regions of Vietnam, 2000”, *Journal of Finance and Investment Analysis*, **1**(2), pp.83-118, (2012).
- [3] Chenery, Hollis B, “Interregional and International Input-output Analysis”, *Structural Interdependence of the Economy*, ed. By Tibor Barna, John Wiley, New York, (1954).
- [4] H.W Richardson, *Input-Output and Regional Analysis*, John Wiley and Sons, New York; 1972.
- [5] Isard, Walter, *Interregional and Regional Input-Output Analysis: A Model of a Space Economy*, *Review of Economics and Statistics*, **33**(4), (1951).
- [6] Keynes MK. *The General Theory of Employment, Interest and Money*. Palgrave Macmillan, (1936).
- [7] Leontief W, Strout A. *Multiregional Input-Output Analysis*. In: T. Barna (ed.). *Structural Interdependence and Economic Development*, New York: St-Martin’s Press. (1963); 119-150.
- [8] Miller RE, Blair PD. *Input-Output Analysis. Foundations and Extensions*, Englewood Cliffs, New Jersey: Prentice Hall, (1985).
- [9] Socialist republic of Vietnam government portal, website: <http://www.chinhphu.vn/portal/page/portal/English>
- [10] Walras Leon, *Elements of pure Economic*, translated by W.Jaffe, Richard Irwin Inc, Homewood, Illinois, (1954).
- [11] Wassily Leontief. *Input-output Economics*. Oxford University press, New York, (1986).