USING SOLOW AND I-O MODELS TO DETERMINE THE FACTORS IMPACTING ECONOMIC GROWTH IN HO CHI MINH CITY

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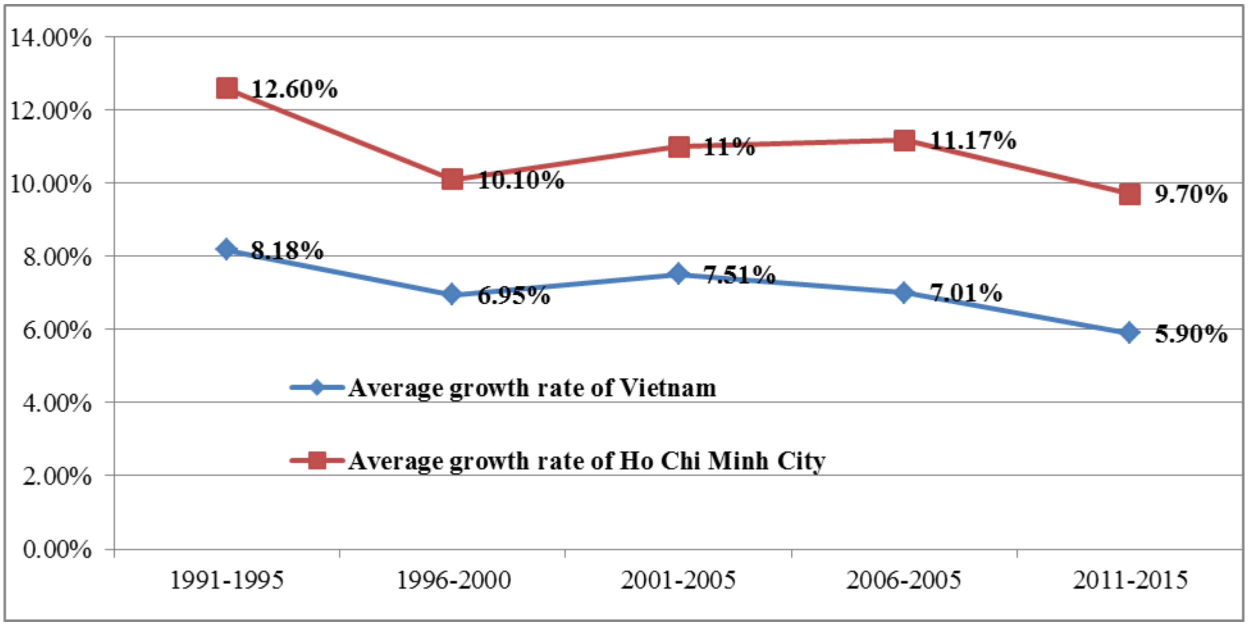
Abstract: This study incorporates both qualitative and quantitative approaches applying Solow model combined with I/O tables to determine the factors that contribute to economic growth in Ho Chi Minh City (HCMC) during the past periods (2006-2010 and 2011-2015). Research results have shown the HCMC economy always occupies a major role in the national economy in terms of its size and high growth rates. Although growth rate for the period (2011-2015) has decreased to compare with the previous period, but the quality of economic growth in HCMC has improved. Capital still holds important role and has high contribution towards HCMC economic growth.Yet, total factor productivity (TFP) has got enhancements and lifted its contribution towards HCMC economic growth, lowering its difference with capital factor. On the contrary, labour factor has reduced its contribution towards growth, giving in its position to TFP. This result implies that growth quality of HCMC has been lifted and has based on knowledge more. The study also calculates contributing level of factors towards the growth of industry groups. The result shows that mining and quarrying industry has highest TFP contribution towards growth, at 81.17%, second is traditional manufacturing ones with TFP contribution of 51.13%; next is agriculture, forestry and fishery with TFP contribution of 40,41%, followed by services industry with TFP contribution of 23,48% and finally critical industries with TFP contribution of 19,56%. Although, manufacturing industries, especially critical ones have a low TFP, but they have a high backward linkage and forward linkage coefficients that encourage and facilitate the development of other industries. The results of these analyses lay the foundation for policy recommendations for HCMC local government to develop sustainable economy over the coming period.

Keywords: Ho Chi Minh City Economic Growth, Factors, Solow model, I/O table, Cobb-Douglas function, Total factor productivity (TFP)

1. Introduction

Ho Chi Minh City has played an important part in developing the economy of the country. As the largest economic center in Vietnam, Ho Chi Minh City has always been a leader in the economic growth of the country. Currently, Ho Chi Minh City has about 9% of the nation's population and 7.5% of its labor force. Yet, the city accounts for more than 20% of Vietnam's GDP. With high shares in sector II (industry) and sector III (trade and services) Ho Chi Minh City's economy is helping Vietnam move to an industrial economy**.** In fact, Ho Chi Minh City's manufacturing gross value accounts for approximately 21% of the total value of the country. Similarly, exports from the city account for nearly 27% of nation's total, and its annual contribution to the national budget is more than 30%. Currently, FDI in Ho Chi Minh City accounts more than 30% of total FDI in Vietnam by number of projects and accounts about 10% of total investment value. Economic growth in Ho Chi Minh City usually is higher than economic growth rate of whole country. For example, average growth rate of Ho Chi Minh City for the period (2011-2015) is about 9.7% per year, this is for whole country is only about 5.9% per year in the same period (see Figure 1). The fact that economic growth in Ho Chi Minh City is higher than economic growth rate of whole country helped Ho Chi Minh City's poverty rate has been reduced and is the lowest rate in the country at the present. The current poverty rate in Ho Chi Minh City is now only 2%, while for whole country it is about 12%.

Figure 1: Average growth rate of Ho Chi Minh City and Vietnam for each 5 years (1991-2015)



Source: Vietnam Government Statistics Office (GSO) and Ho Chi Minh City's Statistics

To explore the reason of high economic growth, this research will proceed to answer the following questions:

(1) Which factors impacting economic growth of Ho Chi Minh City?

(2) Which industries are important for Ho Chi Minh City's economic growth?

2. Brief review of the literature and previous studies

Cobb-Douglas production function

Charles Cobb and Paul Douglas (1928) had a study in which they modeled the growth of the American economy during the period 1899 - 1922. They found that production output is determined by the amount of labor involved and the amount of capital invested.

The function they used to model production was of the form:

$$Y = AL^{\alpha}K^{\beta} \qquad (1)$$

Where:

Y = total production (the monetary value of all goods produced in a year)

L = labor input (the total number of person-hours worked in a year)

K = capital input (the monetary worth of all machinery, equipment, and buildings)

A = is a positive constant coefficient; α and β are the output elasticity of labor and capital, respectively. These values are constants determined by available technology.

Harrod (1939) and Domar (1946, 1947) following Keynesian model assumed a constant rate of saving and capital output ratio in deriving a simple formula for economic growth. In their model the rate of growth of output related to the rate of saving and capital output ratio as g=s/k, where *g* is the growth rate of output, *s* is the saving rate and *k* is the capital output ratio. This model growth is depending only on capital; there is lack of substitutability between capital and labour.

Solow growth model

Solow (1956) avoided this shortcoming by incorporating explicit substitutability between capital and labour, illustrated it using Cobb-Douglas production function.

The Neoclassical growth model developed by Solow (1956) is built on production function with constant returns to scale in its two arguments, capital and labor: $Y_t = F(K_t, L_t)$

The notation is as same as in the textbook, where *Y* is output of GDP, *K* is stock of capital, and *L* is Labor, t is time. Solow develops a production function with substitutability between factors of production, modeling output growth as a function of capital, labor, and knowledge. In his classical paper, Solow (1956) also extends the basic model with technical progress, *A* , which is assumed to growth at a constant rate, *g* . The technical progress and labor enter into the production function multiplicatively called labour-augmenting or Harrod-neutral (Dave Liu (2007)-Growth Theory and Application: The Case of South Africa)

Growth accounting literature (Solow, 1957) provides a simple way of decomposing output growth into different factors in the aggregate production function:

$$Y = F(K_t, A_t.L_t) = A_t K_t^{\alpha} L_t^{(1-\alpha)} \text{ with } 0 < \alpha < 1 ; \qquad (2)$$

where α is the fraction of output that is contributed by the capital input, and 1− α is the fraction that is contributed by the labor input. Output growth is segregated into three factors, the capital input *K*, the labor input *L*, and the total factor productivity A. Total factor productivity (TFP) is also called “Solow residual” since it is measured as a residual in the Cobb-Douglas production function: $A = Y / K^{\alpha}L^{(1-\alpha)}$. As a residual, TFP captures the rest factors other than capital and labor input, such as technical change.

We can rewrite $GDP_t = A_t f(K_t, L_t)$ (3)

With three sources of GDP growth, they are the capital input K, the labor input L, and total factor productivity A including technical progress and new good management method, we can differentiate function (3) by time (t) and have:

$$\frac{dGDP}{dt} = f(K,L)\frac{dA}{dt} + A\frac{\delta f}{\delta K}\frac{dK}{dt} + A\frac{\delta f}{\delta L}\frac{dL}{dt} \qquad (4)$$

Dividing both sides by GDP and altering we have

$$\frac{1}{GDP}\frac{dGDP}{dt} = \frac{1}{GDP}\left(\frac{GDP}{A}\frac{dA}{dt} + A\frac{\delta f}{\delta K}\frac{dK}{dt}K\frac{1}{K} + A\frac{\delta f}{\delta L}\frac{dL}{dt}L\frac{1}{L}\right)$$

or

$$\frac{1}{GDP}\frac{dGDP}{dt} = \frac{dA}{dt}\frac{1}{A} + \left(\frac{A\delta f}{\delta K}.\frac{K}{GDP}\right)\left(\frac{dK}{dt}\frac{1}{K}\right) + \left(\frac{A\delta f}{\delta L}\frac{L}{GDP}\right)\left(\frac{dL}{dt}\frac{1}{L}\right) \qquad (5)$$

with

$G_A = \frac{dA}{dt}\frac{1}{A}$ = Growth rate of total factor productivity

$G_K = \frac{dK}{dt}\frac{1}{K}$ = Growth rate of capital

$G_L = \frac{dL}{dt}\frac{1}{L}$ = Growth rate of labor

The economy tends to the steady state equilibrium with competitiveness, each production factor will get its marginal product. Thus, return rate equals the marginal product of capital and wage equals the marginal product of labor. That means

$\frac{A\delta f}{\delta K}$ = Capital return rate, and $\frac{A\delta f}{\delta L}$ = wage rate

Then $\beta_K = \frac{A\delta f}{\delta K}.\frac{K}{GDP}$ = Proportion of production surplus in GDP; and

$\beta_L = \frac{A\delta f}{\delta L}\frac{L}{GDP}$ = Proportion of labor surplus in GDP.

From (5), we can calculate GDP growth rate::

$$G_{GDP} = G_A + \beta_K G_K + \beta_L G_L \qquad (6)$$

Where G_{GDP} is GDP growth rate;

G_K is growth rate of capital; G_L is growth rate of labor

Các số liệu về tốc độ tăng GDP, vốn (G_K), lao động (G_L), β_K, β_L are the output elasticity of capital and labor. When G_{GDP}, $\beta_K G_K$ and $\beta_L G_L$ are known we can calculate contribution of G_A – This is contribution of total factor productivity (TFP) in GDP growth.

Capital change ΔK=sY-dK, Where d is capital depreciation rate

Labor change: $L_{t+1} = L_t\left(1 + gL\right)$**,** gL is labor growth rate

Growth functions:

$$gK = \frac{\Delta K}{K}$$: Capital growth rate

$$gY = \frac{\Delta Y}{Y}$$: GDP growth rate

$$gL = \frac{\Delta L}{L}$$: Labor growth rate

As mentioned above, output growth is segregated into three factors, the capital input *K*, the labor input *L*, and the total factor productivity (TFP)

Leontief's Input-Output Model (The model I/O). Input-output analysis is the name given to an analytical framework developed by Wassily Leontief. One often speaks of a Leontief model when referring to input-output.

The data of input-output analysis are the flows of goods and services inside the economy that underlie the summary statistics by which economic activity is conventionally measured.

More specifically, every row in an input-output table shows the sales made by one economic sector to every other sector, and every column shows what each economic sector purchased from every other sector.

Input-output analysis focuses attention on the flows of outputs and inputs among the various sectors of the system. In fact, the sectors of an economy are linked together. The production of many final goods requires not only the primary factors of labor and capital, but the outputs of other sectors as intermediate goods. For instance, the manufacture of automobiles requires the intermediate goods of tires and headlights, which, in turn, require the intermediate goods of rubber and glass, respectively. Therefore, the total demand for any product, (e.g. tires), will be equal to the sum of all the intermediate demands (e.g. by automobile manufactures) and final demand (e.g. by consumers and firms purchasing tires directly). Input-output models account for the linkages across the sectors or industries of the economy.

Theory I/O Table (Table 1)

Input-output analysis was first introduced by Wassily Leontief (1936), and is widely used as a quantitative model for national and regional economic analysis. In general terms, input-output analysis offers a static view of the structural relationships among the different sectors of an economy (typically national, or regional) for a certain period of time, generally a year. The table below illustrates the relationship between total gross output, value added, and gross domestic product (GDP). As shown in the table, commodities are consumed by industries—these are the intermediate inputs—and by final use. Intermediate inputs are goods and services that are used in the production process of other goods and services and are not sold in final-demand markets. Value added is equal to the income earned in production—this includes labor earnings. Total gross output is equal to the sum of intermediate inputs and value added. Value added summed across all industries is equal to GDP.

Production Sector. This sector shows that the value of inputs from industry i used to produce the output of industry j (i = 1,2,…n; j = 1,2,…., n). It represents the amount of the i^{th} industry' output used by the j^{th} industry to produce its output.
The production or interindustry sector is represented by matrix $A' = [X_{ij}]$, i = 1,...,n; j = 1,...,n
For example, X_{12} means in the 2aaa, there is X_{12} Vietnam Dong value of products from industry 1 used inputs of industry 2. Gross output of industry j in the year 2aaa is $X_j = \sum_{i=1}^{n+4} X_{ij}$.

Let $A=\{a_{ij}\}= X_{ij}/X_j$ be the direct requirements coefficient matrix, where X_{ij} is industry *j*'s direct input from industry *i*, and X_j is total gross output of industry *j*. Then the total requirements matrix is expressed as $B=\{b_{ij}\}=(I-A)^{-1}$ which is also called the Leontief inverse matrix or total requirements matrix.

Table 1*:* **Theory I/O Table (for the year 2aaa)**

Purchases by: Intermediate Users-Sectors/Industries						Final Demands						Total Demand
						Consumption expenditures		Investment /Saving in Asset		Export	Import	
		1	2	....	n	Personal	Government	Fixed	Working		(-)	
Sales by Sectors/ Industries	1	X_{11}	X_{12}	....	X_{1n}	$X_{1(n+1)}$	$X_{1(n+2)}$	$X_{1(n+3)}$	$X_{1(n+4)}$	$X_{1(n+5)}$	$X_{1(n+6)}$	
	2	X_{21}	X_{22}	....	X_{2n}	$X_{2(n+1)}$	$X_{2(n+2)}$	$X_{2(n+3)}$	$X_{2(n+4)}$	$X_{2(n+5)}$	$X_{2(n+6)}$	
	......	....	....	....	....	....	....	....	....	....	....	
	n	X_{n1}	X_{n2}	....	X_{nn}	$X_{n(n+1)}$	$X_{n(n+2)}$	$X_{n(n+3)}$	$X_{n(n+4)}$	$X_{n(n+5)}$	$X_{n(n+6)}$	
Compensation of employees		$X_{(n+1)1}$	$X_{(n+1)2}$	....	$X_{(n+1)n}$							
Production surplus		$X_{(n+2)1}$	$X_{(n+2)2}$	....	$X_{(n+2)n}$							
Depreciation		$X_{(n+3)1}$	$X_{(n+3)2}$	....	$X_{(n+3)n}$							
Taxes on productio		$X_{(n+4)1}$	$X_{(n+4)2}$	....	$X_{(n+4)n}$							
Total gross output		X_1	X_2	....	X_n							
Value added/GDP												

Consumption Sector. This sector expresses household or personal consumption expenditures and government consumption expenditures as purchases of the output of industry i.
Investment or Saving Sector. This sector expresses the value of saving in fixed and working assets in the year.

Export and Import Sector. In the I/O table, export is expressing by matrix F = [$X_{i(n+5)}$]; Total export value = $\sum_{i=1}^{n} X_{i(n+5)}$ and import is expressing by matrix G = [$X_{i(n+6)}$]

Compensation of employees. Compensation of employees in the I/O table is expressing by matrix H = [$X_{(n+1)j}$], j = 1,...,n . Total compensation of employees = $\sum_{j=1}^{n} X_{(n+1)j}$

Production Surplus. Production surplus in the System of National Accounts (SNA) is the final income of the company owner after deducting all expenses. Production Surplus is expressing by matrix I = [$X_{(n+2)j}$], j = 1,...,n; Total production surplus = $\sum_{j=1}^{n} X_{(n+2)j}$

Depreciation of fixed assets. Depreciation of fixed assets is an entire depreciation of fixed assets in the production process in a year. In the I/O table, ddepreciation of fixed assets is expressing by matrix J = [$X_{(n+3)j}$], j = 1,...,n

Taxes on production. Taxes on production is expressing by matrix K = [$X_{(n+4)j}$], j = 1,...,n

Total tax on production = $\sum_{j=1}^{n} X_{(n+4)j}$.

From I/O table we can calculate GDP by three methods:

Production Method: GDP = Total Gross Outputs - Total intermediate costs

Distribution Method : GDP = Compensation of employees + Production Surplus + Depreciation of fixed assets + Taxes on production

Using Products Method: GDP = Household consumption expenditures + Government consumption expenditures + Saving in fixed Assets +Saving in Working Assets + The difference between Exports and Imports

In the framework of the input-output model, industry production has two kinds of economic effects on other industries in the economy: Increased demand and supply. When industry *i* increases its production, there is increased demand for inputs from industries. In the input-output model, this demand is referred to as ***backward linkage***. An industry with higher backward linkages than other industries means that expansion of its production is more beneficial to the economy in terms of causing other induced productive activities. On the other hand, an increase in production by other industries leads to additional output required from industry *i* to supply inputs to meet the increased demand. This supply function is referred to as ***forward linkage***. An industry with higher forward linkages than other industries means that its production is relatively more sensitive to changes in other industries' output.

Input-output tables are compiled in many countries by official statistical offices, specialized official or semi-official institutes such as national banks or universities, private companies, or individual researchers. They use several methods to build input output tables, all of which share characteristics associated with the System of National Accounts. These guidelines guarantee internal consistency of the tables, consistency with widely used national aggregates such as gross national product, and comparability among tables representing different economies. International organizations such as the UN, OECD (previously OEEC) or Eurostat have played an important role in issuing guidelines for the national accounts, including for input-output tables. Many studies using I-O analysis in various fields have been implemented. More specifically, numerous studies have explored aspects of technological change using input-output analysis. However, the use of input-output methodological approaches in the transportation field is relatively limited. We focus mainly on those studies that address technological changes or have transportation applications.

Many studies using I-O analysis in various fields have been implemented. After the groundbreaking contribution of Leontief (1936) in developing input-output methodologies, input-output tools have been widely utilized not only in planning processes (Sand, 1988; Szymer, 1986), but also in policy design (Baumol and Wolff, 1994). Further, the IO model is used at the regional as well as the national level. Isard (1951) proposed the application of interregional and regional input-output analysis to reveal economic relations between and within two regions.

In the meantime, the basic I-O model was extended to the study of production technology in recent years. Studies in numerous fields have been conducted, such as the investment impact on productivity for the United Kingdom through the construction of the investment matrix (Gossling, 1975), and the impact of technological change (Miller *et al*., 1989; Leontief, 1986). Duchin (1989) examined structural change in the U.S. economy, and suggested that the dynamic input-output model can be a good approach for analyzing the future economic implications of technological change. Blair and Wyckoff (1989) noted structural changes in the U.S. economy resulting from changes in final demand. Kanemitsu and Ohnishi (1989) concluded that production costs and prices of goods have been reduced by technological change in the Japanese economy from 1970 to 1980. Leontief (1986) investigated the model's application to analysis of new patterns of technological change in the structure of the U.S. economy (Taihyeong Lee and Patricia L. Mokhtarian (2004)**,** An input-output analysis of the relationships between communications and travel for industry, Final Report of Research Project)

4. Methodology and Data

As stated above, from the Cobb-Douglas and the Solow models, we have a formula:

$G_{GDP} = G_A + \beta_K G_K + \beta_L G_L$

Where G_{GDP} is GDP growth rate;

G_K is growth rate of capital; G_L is growth rate of labor

β_K, β_L are the output elasticity of capital and labor. They can be calculated as follows:

$\beta_K = \frac{A\delta f}{\delta K} . \frac{K}{GDP}$ = Proportion of production surplus in GDP; and

$\beta_L = \frac{A\delta f}{\delta L}\frac{L}{GDP}$ = Proportion of labor surplus or labor compensation in GDP

From I/O Table we can calculate proportion of production surplus in GDP; and proportion of labor compensation in GDP. That means we can find β_K, and β_L

When G_{GDP}, $\beta_K G_K$ and $\beta_L G_L$ are known we can calculate contribution of G_A – This is contribution of total factor productivity (TFP) in GDP growth.

GDP growth (G_{GDP}), G_K capital growth, and employment growth G_L is based on statistics and company survey data annually. Knowing G_{GDP}, $\beta_K G_K$ and $\beta_L G_L$ we can calculate the contribution of technology and management G_A or called total factor productivity (TFP). When applying the principle Solow model with I/O Table, to calculate GDP growth rate , capital and labor growth rate is not for every year, they are calculated in average for a period (often for 5 years). In this study, we will calculate the average growth rate for the two periods 2006-2010 and 2011-2015 for comparison.

Particularly in 2011-2015, there is no survey data of 2015, we used the survey data in 2009 and 2014 of the General Department of Statistics to calculate the average growth rate for the period 2011- 2015. Calculate the growth rate of labor-based simply on labor survey data annually, but to calculate the capital growth rate G_K, we should define the basic concepts of investment (gross capital formation) and capital (capital stock). The general formula for calculating the volume of capital for a given year is:

$$K(t) = K(t-1) + I(t) - \sigma (I(t)/2+K(t-1))$$

With K (t) is the capital of year t, σ is proportional depreciation and I (t) is the amount of annual investment. The remaining value of the asset at the end (31 December) of each year can be reflected the annual volume of capital or capital stock according to the above formula. To calculate the capital growth rate we need to adjust the remaining value of the assets at constant prices (adjusting inflation index of the comparative years).

Based on the I/O Tables in 2007 and 2012 (these I/O tables were built for HCMC by experts from the General Statistics Office) we can calculate the elasticity coefficients of capital and labor β_K and β_L. Two I/O tables in 2007 and 2012 in 2007 and 2012 are representing the input-output relationship of the two periods (5- year plan). I/O Table in 2007 is calculating the elasticity of factors for the period (2006-2010) and the I/O Table in 2012 is to serve calculation of the elasticity factors for the period (2011-2015).

Specifically, based on I/O Table the coefficient β will be calculated as follows:

β_L = Labor Compensations/(Value Added – Tax on production - Asset depreciation)

$\beta_K = 1- \beta_L$ = Production Surplus / (Value Added – Tax on production - Asset depreciation)

In this paper, we calculate both backward and forward linkages from the Leontief inverse matrix.

Backward linkage is called diffuse coefficient (Index of the power of dispersion) and are defined as follows : $BL_i = \Sigma r_{ij}$ (summing by columns of the Leontief Inverse Matrix $(I–A)^{-1}$)

Backward linkage coefficients $= n.BL_i / \Sigma BL_i$
Where: r_{ij} is element of the Leontief Matrix
n is the number of industries in the model

Forward linkage coefficient is seen as the sensitivity of the economy and is measured by the sum of the elements in the rows of the Leontief Inverse Matrix $(I–A)^{-1}$ compared to the average of the entire production system. Forward linkages Coefficient is calculated as follows:
FLI = Σ rij (summing by rows of the Leontief Matrix)
Forward linkage coefficients $= n.FL_i / \Sigma FL_i$
Where: r_{ij} are the elements of the Leontief matrix
n is the number of industries in the model

5. Rresearch results

What are the drivers of Ho Chi Minh city's high growth rate? To answer this question, we apply Solow models and the I/O tables set up for Hochiminh city. Below are the results:

From the survey data of nation-wide firms in 2009 and 2014, the specialists from Government Statistics Office extracted HCMC firm data and created I/O tables year 2007 and 2012 for Ho Chi Minh city. With the I/O tables we can calculate the elasticity coefficients of capital and labour for each product industry, then group for the whole industry and economy as in Table 2.

The average elasticities of capital and labour of whole HCMC economy from HCMC I/O table year 2012 are $\beta_K = 0.37$ and $\beta_L = 0.63$, are to be used in the period of 5 years, from 2011-2015. The elasticities of capital and labour of whole HCMC economy from I/O table year 2007 are $\beta_K = 0.36$ and $\beta_L = 0.64$, respectively for the period of 5 years, from 2006-2010.

Based on the calculation from HCMC GSO, average growth rates of capital, labour and GDP of HCMC in 2006-2010 are 12.33%, 5.9% and 11.18% per year, respectively. The average GDP growth rate in 2011-2015 is 9.7% annually. Because of the lack of 2015 data regarding capital and labour, we utilize the firm survey data in 2009 and 2014 to gauge the average rate of increase in capital for the period of 5 years 2011-2015, as in Table 3.

Similarly, based on firm survey data which includes labour details up to 31/12 every year, we can calculate the average labour growth rate. The number of workers in firms surveyed in HCMC is 1.958.946 in 2009 and 2.363.613 in 2014 and the average growth rate of labour for this period is 3.82% per year.

Table 2: β_L, and β_K for all the industries and the whole economy from I/O table:

24 industries grouped from I/O table with 116 industries	**2006-2010**		**2011-2015**	
	β_L	β_K	β_L	β_K
1. Agriculture, forestry, fishery	0.15	0.85	0.38	0.62
2. Mining/ quarrying industry	0.39	0.61	0.93	0.07
3 Food manufacturing	0.39	0.61	0.44	0.56
4. Electronics - Information Technology	0.65	0.35	0.68	0.32
5. Chemicals - Rubber - Plastic	0.61	0.39	0.43	0.57
6. Mechanics	0.70	0.30	0.73	0.27
7. Textile	0.76	0.24	0.91	0.09
8. Leather shoes	0.88	0.12	0.65	0.35
9. Paper	0.54	0.46	0.80	0.20
10. Printing	0.48	0.52	0.61	0.39
11. Manufacturing items from non-metallic minerals	0.69	0.31	0.61	0.39
12. Manufacturing wooden beds, cabinets, chairs, tables	0.76	0.24	0.63	0.37
13. Manufacturing and distributing electricity and water	0.77	0.23	0.62	0.38
14. Other industries	0.64	0.36	0.46	0.54
15. Construction	0.68	0.32	0.63	0.37
16. Commerce	0.50	0.50	0.49	0.51
17. Hotels and restaurants	0.34	0.66	0.58	0.42
18. Logistics	0.64	0.36	0.57	0.43
19. Finance - Credit	0.77	0.23	0.68	0.32
20. Science	0.79	0.21	0.85	0.15
21. Real Estate Business and Consultancy	0.15	0.85	0.29	0.71
22. Education & Training	0.70	0.30	0.85	0.15
23. State management, National security	0.99	0.01	1.00	0.00
24. Other services	0.68	0.32	0.73	0.27
Whole economy	**0.64**	**0.36**	**0.63**	**0.37**

Source: calculated from Hochiminh city I/O tables year 2007 and 2012

Table 3: Average rate of increase in capital for industries (2011-2015). Unit: Billion VND, %

24 industries that are grouped from I/O table of 116 industries	Remaining asset value as surveyed in 2009 (31/12)	Remaining asset value as surveyed in 2014 (31/12)	Difference in 2009 price: 2014 price/CPI (CPI product in 5 years: 1.59)	Average capital growth rate in 2011-2015 (%)
1. Agriculture, forestry, fishery	673	1,357	853.46	4.87
2. Mining/ quarrying industry	6,053	15,639	9,835.85	10.20
3 Food manufacturing	8,174	18,980	11,937.11	7.87
4. Electronics - Information Technology	3,492	8,206	5,161.01	8.13
5. Chemicals - Rubber - Plastic	8,673	22,423	14,102.52	10.21
6. Mechanics	10,468	44,462	27,963.52	21.72
7. Textile	8,818	24,853	15,630.82	12.13
8. Leather shoes	7,899	16,567	10,419.50	5.70
9. Paper	2,039	5,293	3,328.93	10.30
10. Printing	1,573	4,270	2,685.53	11.29
11. Manufacturing items from non-metallic minerals	5,978	17,257	10,853.46	12.67
12. Manufacturing wooden beds, cabinets, chairs, tables	1,966	4,052	2,548.43	5.33
13. Manufacturing and distributing electricity, water	26,779	82,253	51,731.45	14.08
14. Other industries	9,727	34,698	21,822.64	17.54
15. Construction	4,345	12,166	7,651.57	11.98
16. Commerce	6,133	18,399	11,571.70	13.54
17. Hotels and restaurants	8,715	25,981	16,340.25	13.40
18. Logistics	45,446	89,056	56,010.06	4.27
19. Finance - Credit	15,527	34,050	21,415.09	6.64
20. Science	3,149	16,080	10,113.21	26.28
21. Real Estate Business and Consultancy	16,225	50,808	31,954.72	14.52
22. Education & Training	2,157	4,925	3,097.48	7.51
Total	**204,010**	**551,776**	**347,028.93**	**11.21**

Source: calculated from firm survey data in HCMC in 2009 and 2014 provided by GSO

When we know β_L, β_K, G_K (capital growth rate), and G_L (labour growth rate), G_{GDP} (average GDP growth rate) and with the formula $G_{GDP} = G_A + \beta_K G_K + \beta_L G_L$ we can calculate TFP which equals to GA. Table 4 presents contribution of factors towards GDP growth of HCMC economy in 2 periods.

Table 4: Factors contributing to the growth rate of HCMC economy

Period	Elasticity		Growth rate (%)			Contribution towards GDP growth rate-absolute value (%)			Contribution towards GDP growth rate-relative value (%)		
	Capital- β_K	Labor- β_L	Capital G_K	Labour G_L	GDP	***Capital*** $\beta_K G_K$	***Labor*** $\beta_L G_L$	**TFP-** G_A	***Capital***	**Labor**	**TFP**
2006-2010	0.36	0.64	12.33	5.9	11.18	4.44	3.78	2.96	39.71	33.81	26.48
2011-2015	0.37	0.63	11.21	3.82	9.7	4.15	2.41	3.14	42.78	24.85	32.37

Source: Calculated by author from I/O tables year 2007 and 2012 for HCMC and from survey data, Statistics Book HCMC and Vietnam from 2005-2015

The above results show that HCMC average growth rate from 2006-2010 is 11.18% per year, towards which highest contributor is capital factor (4.44%); then labour (3.37%) and finally TFP (2.98%). Based on relative values, capital factor accounts for 39.71%; labour 33.8% and TFP 26.48%. The average growth rate of HCMC economy in 2011-2015 is 9.7% per year, towards which highest contributor is capital factor (4.15%); then TFP (3.14%) and finally labour (2.41%). Based on relative values, capital factor accounts for 42.78%; TFP 32.37% and finally labour 24.85%.

As we compare the two periods, the contribution of TFP towards HCMC economy growth is higher in the latter period (2011-2015) than in the previous one (2006-2010), even though GDP growth in the latter period is lower. These results imply that the quality of HCMC growth has improved considerably, specifically the HCMC growth in the latter period has emanated more from knowledge and the combination of the increase in science-technology investment and improvement in human resources.

Factors contributing towards GDP growth - demand side : according to I/O table year 2007 for HCMC, total GDP is 205.322,416 billion VND, among which consumption factor holds

58.5%, savings 39%, export-import difference 2.5%. According to I/O table year 2012, total GDP is 691,334.35 billion VND, among which consumption factor holds 47.46%, savings 37.22% and export-import difference 15.32%. The import-export of HCMC presented in I/O tables comprises two elements: (i) exports from and imports to national borders, and (ii) exports from and imports to other provinces of Vietnam. In 2007, demand-boosting forces were state and private consumption and high savings. In 2012, consumption factor shrank deeply and savings contracted lightly versus in 2007. In 2012, despite of lower ratio of total consumption versus in 2007, the ratio of state consumption is higher versus in 2007 (3.5% versus 2.75%) - Table 5.

Table 5: Breakdown of demand factors in GDP

I/O years	GDP (Billion VND)	Share of total consumption	State consumption	Savings	Export-import difference
I/O 2007	205,322.416	58.5%,	2.75%	39%	2.5%
I/O 2012	691,334.35	47.46%	3.58%	37.22%	15.32%

Source: Calculated by authors from I/O tables year 2007 and 2012.

Contributing level of factors towards the growth of industry groups. The contribution of factors towards growth rates of critical and major industries are reported as below

Table 6: Contribution of factors towards growth rates of four critical industries in 2007-2012, % (absolute values)

Critical industries	***Labour*** $\beta_L G_L$	***Capital*** $\beta_K G_K$	***TFP-*** G_A	**(gVA)** G_{GDP}
1. Manufacturing of foods	0.82	3.77	0.63	5.23
2. Electrics - Information technology	5.02	2.23	4.13	11.38
3. Chemicals - Rubber - Plastics	1.27	5.11	5.10	11.48
4. Cơ khí chế tạo Mechanics	1.60	5.60	1.31	8.50
Average of critical industries	**1.42**	**6.00**	**1.81**	**9.23**

Source: Calculated by authors

Added values of critical industries increase 9.23% per year on average in 2007-2012 (which is lower than the average rate of 10.11% per year for the whole economy), towards which capital factor contributes the most at 6%, TFP 1.81% and labour 1.42% (Table 6). In terms of relative values, capital factor contributes 65.02%, TFP 19.56% and labour 15.42% (Table 7). Among the 4 critical industries, the one that TFP has highest contribution is Chemicals - Rubber - Plastics (at 44.42%), next is capital at 11.09%. The industry that TFP has the second highest contribution is Electrics - Information technology, at 36.31%, but labour factor has the highest contribution towards the growth of Electrics - Information technology, at 44.08%, and the contribution of capital for this industry is 19.61%. The industry that TFP has the third highest contribution is

Mechanics, at 15.42%, but the contribution of capital towards the growth of Mechanics is highest at 18.77%. TFP has the lowest contribution towards the growth of Manufacturing of foods, at 12.01%, while capital contribution is highest for this industry at 72.17% and labour at 13.73%.

Table 7: Contribution of factors towards four critical industries' growth rates in 2007-2012, % (relative values)

Critical industries	***Labour***	***Capital***	***TFP***
1. Manufacturing of foods	15.73	72.17	12.10
2. Electrics - Information technology	44.08	19.61	36.31
3. Chemicals - Rubber - Plastics	11.09	44.49	44.42
4. Mechanics	18.77	65.81	15.42
Average of critical industries	**15.42**	**65.02**	**19.56**

Source: Calculated by authors

GDP average growth rate of traditional industries in 2007-2012 is 7.7% per year (lower than the average rate of critical industries), towards which TFP has the highest contribution at 3.94%, equivalent to the relative value of 51.13%; next is capital at 2.13%, equivalent to the relative value of 27.6% and lowest contribution goes to labour factor at 1.64%, equivalent to the relative value of 21.27% (Tables 8-9).

Table 8: Contribution (absolute value) towards growth of 6 traditional industries in 2007-2012

Traditional industries	***Labour-$\beta_L G_L$***	***Capital-$\beta_K G_K$***	***TFP-G_A***	**(gVA) G_{GDP}**
1. Textile	1.24	0.94	6.42	8.60
2. Leather shoes	2.32	1.14	7.55	11.02
3. Paper	1.59	1.84	2.45	5.88
4. Printing	2.33	3.90	0.22	6.45
5. Manufacturing items from non-metallic minerals	1.90	4.49	1.29	7.68
6. Manufacturing wooden beds, cabinets, chairs and tables	0.09	1.55	-0.55	1.09
Average of traditional industries	**1.64**	**2.13**	**3.94**	**7.70**

Source: calculated by authors

Table 9: Contribution (relative value) towards growth of 6 traditional industries in 2007-2012, %

Traditional industries	**Labour**	**Capital**	**TFP**
1. Textile	14.37	10.95	74.69
2. Leather shoes	21.08	10.37	68.54
3. Paper	27.07	31.27	41.66
4. Printing	36.06	60.50	3.43
5. Manufacturing items from non-metallic minerals	24.79	58.42	16.79
6. Manufacturing wooden beds, cabinets, chairs tables	8.46	142.13	(50.59)
Average of traditional industries	**21.27**	**27.60**	**51.13**

Source: Calculated by authors

Among the traditional industries, the one that has highest TFP contribution towards growth is Textile, at 74.69%. Capital factor contributes 10.95% and labour 14.37% towards the growth of Textile industry. The reasons are that Textile has high growth rate, while capital and labour have slow rates of increase. This implies that Textile industry, especially sewing has successfully adopted external technology (outsourcing), management factor (management skills of firms) and markets (the number of contracts and export markets are sustained and on the increase).

TFP has the second highest contribution towards the growth of Leather shoes industry, at 68.54%. Labour adds 21.08% while capital adds 10.37% towards the growth of this industry. Similar to the Textile industry, Leather shoes has slow rate of capital expansion, but higher rate of labour growth though lower than the average rate. Leather shoes has high growth rate thanks to exploiting the previous technology and competition and market factors. Again as Textile industry, Leather shoes has many export markets and dominates domestic markets for customers of middle-income group and below. Therefore demand factor has increased TFP.

TFP has the third highest contribution toward the growth of Paper industry, at 41.66%. Capital factor contributes 31.27% and labour at 21.07%. TFP has the fourth highest contribution for the industry of manufacturing items from non-metallic minerals, at 16.79%. However, capital has highest contribution for the growth of this industry, at 58.42% while that of labour is at 24.79%.

TFP has lowest and negative contribution towards two industries within traditional group: Printing and Manufacturing wooden beds, cabinets, chairs and tables. Printing has TFP's contribution at 3.43%, and labour has the highest contribution at 60.5%, and that of capital is 36.06%. Manufacturing wooden beds, cabinets, chairs and tables has slow growth rate, at circa. 1% per year, in the mean time capital growth rate is higher than 4% per year, labour growth rate has insignificant growth, rendering TFP being negative.

Major services industries have average growth rate of 11.37% per year in 2007-2012, higher than the average growth rate of the whole economy (10.11% per year). Labour factor has highest contribution at 5.56%, equivalent to relative value of 48.89%; capital contributes 3.14%, equivalent to relative value of 27.63% and TFP has lowest contribution at 2.67%, equivalent to relative value of 23.48% (Tables 10, 11).

Within major service industries, the one whose growth enjoys highest TFP contribution is **Science service**, at 75.13%, while labour factor contributes 19.25% and capital 5.62%. This finding fares well in reality, despite of its small size, capital growth rate is high but still lower than average growth rate of the industry's added value (GDP), labour growth rate is high, especially white-collar workers, and science & technology have been successfully deployed.

Table 10: Contribution (absolute value) of factors towards growth rates of major service industries in 2007-2012, %

Major service industries	***Labour*** $\beta_L G_L$	***Capital*** $\beta_K G_K$	***TFP***-G_A	**(gVA)** G_{GDP}
1. Commerce	3.00	6.31	2.12	11.43
2. Hotels & Restaurants	3.58	5.06	-3.50	5.14
3. Logistics	7.88	1.36	5.93	15.17
4. Finance & Credit	9.91	1.76	0.22	11.89
5. Science	12.66	3.70	49.42	65.78
6. Education & Training	8.21	0.94	2.48	11.63
7. Real estate business and consultancy	0.80	9.40	-13.09	(2.89)
Average of major industries	**5.56**	**3.14**	**2.67**	**11.37**

Source: Calculated by authors from I/O tables

Table 11: Contribution (relative value) of factors towards growth rates of major service industries in 2007-2012, %

Major service industries	**Labour**	**Capital**	**TFP**
1. Commerce	26.26	55.18	18.57
2. Hotels & Restaurants	69.68	98.49	(68.17)
3. Logistics	51.97	8.95	39.09
4. Finance & Credit	83.37	14.81	1.82
5. Science	19.25	5.62	75.13
6. Education & Training	70.58	8.10	21.32
7. Real estate business and consultancy			**Negative growth**
Average of major industries	**48.89**	**27.63**	**23.48**

Source: Calculated by authors from I/O tables

Service industries that have highest TFP contribution towards growth in the major industries group is Logistics, at 39.09%, labour has highest contribution towards this industry at 51.97%

and capital 8.95%. Logistics has benefited from the investment in infrastructure in the previous periods, but this industry has high labour growth rate so labour has dominant role in this industry.

The service industry that has third largest TFP contribution towards growth in the major service industries group is Education & Training, at 21.32%, and labour has highest contribution in this service industry at 70.58% while that of capital is at 8.1%. Commerce (Wholesale & Retail) is the service industry that has fourth highest TFP contribution towards growth, at 18.57%. However, capital contributes 55.18% and labour 26.26%. Even though this is a labour-intensive industry, over time, capital investment in supermarkets and infrastructure is high, leading to capital making high contribution. Meanwhile, technology and management also work well but not to their full potentials.

Finance & Credit has low TFP contribution towards growth, at 1.82%, and labour has high contribution at 83.37% due to high growth rate of labour in this service industry, and capital contributes 14.81%. This reflects reality well since this service industry has its labour size increased at branches, but with low efficiency due to the impact of international financial crisis and the industry has suffered high risk (high none performance loan (NPL) ratio).

Hotels & Restaurants has low growth rate (above 5% per year), and capital increases at over 5% per year and labour at about 4% per year. Therefore, labour has main contribution in this industry at 68.68% and capital has higher contribution, thus TFP has negative contribution. The possible explanation is that the industry has developed markedly in HCMC but has low added value. Real estate business and consultancy has negative growth rate and the labour growth rate is lower than average while that of capital is higher than average.

Agriculture, forestry and fishery: GDP growth of this industry is lower than 4% per year in 2007-2012, since labour has very low growth rate (below 0.3% per year) and capital increase is higher than GDP growth rate, but not much (above 5% per year). Thus, capital has highest contribution towards this industry growth at 57.07%, next is TFP at 40.41% and labour at 1.9%. The explanation for the fact that Agriculture, forestry and fishery enjoys high ratio of TFP contribution is that during recent years HCMC has focused on transforming urban agricultural models, forming high-tech agriculture zones and restructuring agriculture towards products that have high added value that can serve well the consumption of a densely populated city with average income higher than that of other provinces.

Compared among the industry groups, mining industry has highest TFP contribution towards growth, at 81.17%, second is traditional manufacturing ones with TFP contribution of 51.13%; next is agriculture, forestry and fishery with TFP contribution of 40,41%, followed by services industry with TFP contribution of 23.48% and finally critical industries with TFP contribution of 19.56%.

To summarize, on average critical industries have not-so-high growth quality, TFP contribution is only 19.86%, much lower than the average TFP contribution towards HCMC economy in 2007-2012. To consider whether these are indeed critical industries, we need to verify the index of backward linkages (encourage and facilitate the development of other industries) which will be discussed below. Charts 2 shows that some industries have negative TFP due to negative growth or growth rates much lower than those of capital and labour (in the cases of Real estate business, Hotels and restaurants, and Manufacturing of wooden tables and chairs).

Backward linkages: if I/O table year 2007 represents the HCMC economic structure in 2002-2007 and I/O table year 2012 represents the same thing in 2007-2012, this means that the breakdown of intermediary costs to production costs doesn not have much change. In 2002-2007, this ratio is 67% and in 2007-2012, it is 67,8%. However, a closer look at the HCMC economic structure in terms of backward linkages and sensitivity in 2 periods shows that the demand of supply side for 1 unit of final consumption in 2007-2012 is higher than that in 2002-2007 (8%). Some industries have significant change in terms of power of dispersion (coefficient of backward linkages).

Table 12 describes backward linkages and forward linkage coefficients of product groups of HCMC industries in 2007 and 2012.

According to backward linkages and forward linkage coefficients of product groups in table 12, the coefficient of agriculture, forestry and fishery is up from 0.833 to 1.036, among which the husbandry has great change. The manufacturing of foods, leather shoes, paper, printing, wooden products, construction, commerce, hotels & restaurants, finance & credit, science have positive change in terms of power of dispersion (BL). Meanwhile, several other industries have reverse tendency (reduction in power of dispersion) such as electricity-eletrics, chemicals and products from chemicals, mechanics, textile, non-metallic products, logistics... The power of dispersion of critical industries is all larger than 1, reflecting the true nature of those industries that encourage and facilitate the development of other industries, however the average dispersion power in 2012 is lower than that in 2007. The Construction industry and other traditional industries also have dispersion power, and backward linkage coefficients larger than 1, and the average coefficients of traditional industries have increased in the 2 periods. On the contrary, some industries and services have forward linkages higher than 1 such as chemicals, rubber, plastics, paper, electrics and water, commerce, science, real estate... In general, products belonging to manufacturing industries and agriculture, forestry and fishery all have backward linkages and forward linkages higher than 1 and above services sectors. In services group, two industries that have FL > 1 are commerce and logistics. Even though BL coefficient does not measure direct contribution of industries toward economic growth, but those with high BL will contribute indirectly towards the growth of other industries and the economy as a whole thanks to its ability to encourage and facilitate the growth of other industries.

Table 12: BL and FL coefficients from HCMC I/O Tables 2007 and 2012 (24 industries)

Industries	**2007**		**2012**	
	BL	**FL**	**BL**	**FL**
1. Agriculture, Forestry and Fishery	0.833	0.922	1.036	1.113
2. Resource industry	0.901	0.503	0.850	0.602
3 Food manufacturing	1.222	0.905	1.323	0.838
4. Electronics - Information Technology	1.441	1.310	1.393	0.970
5. Chemicals - Rubber - Plastic	1.412	4.825	1.340	4.629
6. Mechanics	1.280	0.588	1.217	0.562
Average of 4 critical industries	**1.339**	**1.907**	**1.318**	**1.750**
7. Textile	1.152	0.989	1.161	0.834
8. Leather shoes	1.213	0.637	1.101	0.428
9. Paper	1.256	1.252	1.324	1.390
10. Printing	1.026	0.422	1.270	0.380
11. Manufacturing items from non-metallic minerals	1.188	2.521	1.155	1.893
12. Manufacturing wooden beds, cabinets, chairs and tables	1.182	0.551	1.107	0.480
Average of 6 critical industries	**1.170**	**1.062**	**1.186**	**0.901**
13. Manufacturing and distributing electricity and water	1.067	0.920	0.603	1.003
14. Other industries	1.052	0.836	1.037	1.230
15. Construction	1.129	0.374	1.166	0.444
16. Commerce	0.702	1.514	0.717	2.074
17. Hotels and restaurants	0.906	0.390	1.079	0.417
18. Logistics	1.005	0.938	0.916	1.142
19. Finance - Credit	0.519	0.421	0.547	0.523
20. Science	0.799	0.947	0.860	0.761
21. Real Estate Business and Consultancy	0.727	0.942	0.659	0.713
22. Education & Training	0.626	0.333	0.609	0.338
Average of 7 major industries	**0.755**	**0.784**	**0.770**	**0.852**
23. State management, National security	0.579	0.311	0.598	0.314
24. Other services	0.783	0.648	0.932	0.923
Average of Whole economy	**2.97**		**3.21**	

Source: Calculated by authors from HCMC I/O Tables year 2007 and 2012

6. Conclusion and implications

6.1. Conclusion

Research results give the following conclusions:

(i) HCMC economy plays an important role towards the growth of Vietnam as a whole thanks to its size and high growth rate in comparison with the country rate. Even with slower growth rate in 2011-2015 compared to previous period, the growth model has improved in quality. Accordingly, capital still holds important role and has high contribution towards HCMC economic growth. Yet, TFP factor has got enhancements and lifted its contribution towards HCMC economic growth, lowering its difference with capital factor. On the contrary, labour factor has reduced its contribution towards growth, giving in its position to TFP. This result implies that growth quality of HCMC has been lifted and has based on knowledge more;

(ii) Demand size within HCMC economy has also been in a better condition. Accordingly, GDP growth is now more appropriate in terms of structure of consumption, savings and difference in export-import. The high contribution of difference in export-import highlights the role of HCMC economy not only in national scale but also encourages the linkages of provinces through exporting items out of HCMC or providing inputs for manufacturing/consumption for other provinces.

(iii) Manufacturing industries, esp. critical ones, have high BL that encourage and facilitate the development of other industries, and so have positive effect on the growth of the economy as a whole; 50% of the industries have TFP higher than average; services industries have high TFP but low BL.

(iv) Inspite of the above positive results, there still remain several potential hindrances to the improvement in HCMC growth quality. Firstly, economic growth still relies on capital and labour. TFP has some improvement in position but is still at low and unstainable level (even in previous period TFP was higher than that in recent days). Non-state owned sector has high contribution in GDP but the majority of firm size is small and medium, outdated technology and using migrant, low quality and unstable labour force.

Based on the above findings, the authors present some policy implications/suggestions for improvements in the contribution of factors towards HCMC economic growth more sustainably.

6.2. Suggestions

Increase in capital flows and efficient investments are fundamental to sustaining economic growth. Recently capital factor still plays critical role in economic growth of HCMC. To make a leap in the quality of economic growth, the efficiency in capital deployment will need to be revamped through deep investment, technology update. For enterprises, the investors always require high-return or financially effective investments. In terms of regulation, with the view of ensuring eco-social efficiency, there is a need for an economic model that has structure moving towards sustainable growth and valid resource allocation. These two targets do not always come in the same direction. Thus, to receive more investments in the industries that shift economic structure towards modernization and sustainability, the government needs to provide supportive policies to make investors interested. HCMC already issued policies supporting firms in terms of capital, esp. for those in high-tech sector. However, the current policy is not available for all firms. Due to their size restriction, many private SMEs cannot access this policy in an effective manner. So, in future times HCMC probably needs more effective capital-supporting policies for SMEs. Those firms need funds to invest in state-of-the-art technology but are unable to pledge low value of assets for large bank loans. Consequently, to resolve the conflict, HCMC can provide credit policy with local state guarantee for SMEs making high-tech investments in industries that local government encourages.

HCMC needs determination in projects utilizing low-cost labour and gives priority towards investments in high-tech sector to avoid "competition in driving labour costs downward" with other provinces. HCMC is an economic hub with high potential in scientific power, so the city should pioneer to have break-through investment policies in science & technology, encourage investments in projects employing advanced technology, high added value, low labour-intensive and environmentally friendly. This is also a solution for HCMC towards sustainable development and bringing HCMC into the position of science and high-tech hub of the region and Vietnam, or even AEC in the future.

Solutions for human resources: to guarantee growth quality, the upgrade in human resource quality and labour efficiency is prerequisite. The findings show that, TFP in later period is higher than previous one thanks to lower growth of labour force joining the economy. This can be explained, labour does not increase much in size but HCMC needs to ensure high quality to improve efficiency and growth quality. Low labour efficiency is due to low labour quality, whereas the important factor that increases TFP is the quality of labour (in terms of knowledge and technology).

The result of labour-employment survey in 2013 by HCMC GSO also shows that, the ratio of skilled labour to total labour of HCMC is 31%, among which circa 18% holds university degree and 13% graduated from colleges, vocational schools, among which technical graduates account for over 7%. Therefore, the structure of labour fource is not suitable. On the other hand, the survey also shows, more than 70% labour working in industrial zones are from other provinces and most of them are un-trained general workers. As a center of science technology and training, HCMC needs to construct linkages with local vocational colleges and universities to build quality labour force, fitting global integration and meeting the requirement for the development of the whole economy and hi-tech sectors in particular. To deal with the problem of upgrading knowledge and skills for migrant workers accounting for 70%, HCMC needs collaboration with related provinces to train the labour force to satisfy the needs to develop hi-tech critical industries.

References

Bui Trinh, (2014) "Economic Structure's Change Based on the Relationship between Domestic Final Demand and Production, Value Added and Import", British Journal of Economics, Management & Trade 2014, pp. 213-217

Dave Liu (2007), Growth Theory and Application: The Case of South Africa, University of Pretoria, Working Paper: 2007-14

David Romer (1996), The Solow Growth Model, " Advanced Macroeconomics" McGraw-Hill, 1996, pp.5-140

GSO (2015) , Report on economic and social in 2015 , Hanoi , December 25, 2015

GSO (2015), Enterprise survey data in HCM City for 2009, 2014

GSO (2014) , Report on labor and employment survey in 2013, Hanoi , 2014

James Rieldel (2003), Economic Growth Models-Theory and Empirical Evidence, Paper Presentation, at Vietnam National University-Ho Chi Minh City, 2003

Jiemin Guo and Mark A. Planting (2000), Using Input-Output Analysis to Measure U.S. Economic Structural Change Over a 24 Year Period, The 13th International Conference on Input-Output Techniques,Macerata, Italy August 21-28, 2000

Faye Duchin and Albert E. Steenge (2007), Mathematical Models in Input-Output Economics, Rensselaer Polytechnic Institute, *Rensselaer Working Papers in Economics*

Felipe, Jesus (1999) 'Total Factor Productivity Growth in East Asia: A Critical Survey', *Journal of Development Studies*, 34(4) 1-41

Ho Chi Minh City Bureau of Statistics (2015), Some key indicators , economic and social information in December 2015

HCM City Institute for Development Studies (2015), I/O Tables in 2007 and 2012

Keshab Bhattarai, (2004), Economic Growth: Models and Global, Journal Research Memorandum, Business School, University of Hull (UK), August 2004

Leontief W, Strout A. (1963), Multiregional Input-Output Analysis, New York: St-Martin's Press 1963; pp 119-150

Michael Sonis, G.J.D. Hewings, and J. Guo (1996), Sources of Structural Change in Input-Output Systems: A Field of Influence Approach, *Economic Systems Research*,1996,Vol. 8,No. 1

Rebecca Bess and **Zoë O. Ambargis (2011),** Input-Output Models for Impact Analysis: Suggestions for Practitioners Using RIMS II Multipliers, Presented at the 50th Southern Regional Science Association Conference March 23-27, 2011, New Orleans, Louisiana

Robert M. Solow, (1957), Technical Change and the Aggregate Production Function. The Review of Economics and Statistics, Vol. 39, No. 3 (Aug., 1957), pp. 312-320

Solow, R. (2001), “Applying Growth Theory across Countries” *The World Bank Economic Review*, 15(2).

Taihyeong Lee and Patricia L. Mokhtarian (2004), An input-output analysis of the relationships between communications and travel for industry, Final Report of Research Project

Website:

http://www.pso.hochiminhcity.gov.vn/web/guest/home

http://www.gso.gov.vn/Default.aspx?tabid=217

Wikipedia, Cobb-Douglas. http://en.wikipedia.org/wiki/Cobb- Douglas