

ACCOUNTING FOR GROWTH: COMPARING ECONOMIC SECTORS IN THE UAE.

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Abstract: *UAE occupied an important position not only in the Arab world, but even in the worldwide economy. The country took a main oil producer and a business location hub with short duration of establishment as a country that consisted of seven emirates. Referable to the fluctuating of oil price, the country employed a strategy to diversify its economy to avoid the instability of income from oil revenue. The question was analyzed here what factor of production was the primary contributor to the growth in the concept of sectoral approach according to the UN. The purposed of this study to analyze the UAE's economy in perspective of sectoral approach from 1990 to 2015, that divided in three sectors such the primary sector, the manufacturing sector, and the service sector. The growth accounting used as a model to explain the growth. The methodology applied was a quantitative method. The data were gathered from the country statistics center, which in term employed empirical study. The empirical study resulted that the country shifted from agriculture to service and industry since 2000. The contribution share from the labor input was the main factor that contributed significantly to the growth of each sector specifically from 1990-2015, where were deserved 70%, 86%, and 62% to the primary, the manufacturing, and the service sectors, respectively. While, the contribution growth due to the capital were 24%, 45%, and 49%, for the primary, the manufacture, and the service sectors, respectively. While in contrast, the share of growth due to the TFP was negative in the manufacturing and the service sectors which were -31% and -12%, respectively, where unlike in the primary sector was 6% from 1990-2015. But in general, the sector output was obtained of the service sector was deserved the highest annual mean growth rate about 8.37%, which accompany by the manufacturing sector about 6.88%.*

Keywords: *Growth accounting; Productivity; TFP; UAE.*

JEL Classification: *C23; E23; E24.*

1. Introduction

The UAE is situated on the Arabian Peninsula and it is a portion of the Gulf Corporation Council (GCC) states. The UAE was established on the 2nd of December, 1971 and consisting of seven emirates are Abu Dhabi, Dubai, Sharjah, Fujairah, Umm Al-Quwain, Ras Al-Khaimah, and Ajman. It has a total area of approximately 83,600 sq. km (Yearbook, 2013). According to yearbook (2012) the UAE gained high reputation worldwide by achieving excellence in different areas such as technology, communication, science, launching aerospace satellites, aviation industry, manufacturing industry, infrastructure, tourist, financial markets, economic governance, and even in energy such as clear energy plants.

The UAE' economy has shifted from a low income based economy of fishing and pearling together with some agriculture to an oil-based high income economy within

the last four decades. The UAE has been considered one of the major ten top oil producers and reservoirs in the world (BP, 2015). However, the UAE adapted diversification strategy to lessen its reliance on oil income and focus on different sectors of the economy.

Given the previous decades to present, it can be seen that the UAE has achieved positive result by diversifying its economy. The country witnessed a great output of prosperity and welfare leading to growth. The UAE today is considered as a major financial hub in the region, and a center of international trading. Since the establishment of the UAE in the year 1971, its economic expansion was admired by hitting 200 times (UAE, 2013). In addition, the UAE is considered the second largest economy after Saudi Arabia in the Arab world and accounted for more than a fourth of total GCC's GDP in year 2012. Moreover, it accounted for nearly 14% of the total output (GDP) of the nations in the region (North Africa and Middle East). In sum, the diversification efforts have gained its way by strong the economy, which is driven by services, real estate, and infrastructure spending (UAE, 2013).

The purpose of this study is to understand the extend between the share of contribution due to factors of production and annual average growth into sectoral approach in the UAE, specifically after the transition of economy to diversify income. Thus, the question of this study is, which are the main factor that role the growth of UAE's economy in sectoral approach according to United Nation (UN) classification. The study is structured into sections. Section (1) presents literature reviews of the productivity and its measurement, section (2), demonstrates the source of divisions of the economy, data obtained, and methodology employed, section (3), presented the empirical results of three divided sectors by using the growth accounting model from 1990-2015 divided into periods (1990-2000, 2000-2010, and 2010-2015) to understand the change happened in growth of factors, and the last section (4) demonstrates the results. In general, the growth was related mostly to the increase in number of workers, unlike the improvement in TFP.

2. Productivity

The productivity can be identified as the relationship between inputs to output (Shebeb, 2011). Productivity is considered one of the most important measurement that measures economic performance, which is measured by the ratio of the total output to the weighted average of inputs (Samuelson & Nordhaus, 2010). Productivity has been used for long time to measure economic performance. By use of productivity as the measure of economic performance, high productivity has been identified as a sign of economic competitiveness and efficiency in its production cycle, while low productivity has been always affiliated with a low power to produce and service leading to weak trend of economic growth (Shebeb, 2000). There are many different types for measuring productivity, such single factor productivity that measures output to one factor of inputs and multifactor productivity (MFP), which calculates by dividing output to multifactor of inputs (OECD, 2001). The decision for the measurement method to any type is mostly based on its purpose and availability of data. Labor productivity, capital productivity, and multifactor productivity (MFP) are types of productivity measurements. MFP productivity is calculated by dividing output to all factors of input (labor, capital, and materials), the labor productivity measures the per unit produced by labor in such working hours, and the capital productivity is either produced by output or capital for per worker.

The measurement of economic productivity that been linked with growth accounting framework and rooted with production theory is back to the work of Jan Tinbergen (1942), and Robert Solow (1956) because of their formulating framework. Since that time, many major contributions have been done by researchers to analyze the phenomenon of economic growth and its factors. Today, as a result, the production, theoretical approach to measure the productivity offers a consistent roadmap (OECD, 2001). A production function is a mathematical formula which puts in relation the output obtained and the sum of the production factors such as capital, labor, and technology. The growth corresponds to the growth in the production obtained by the simple increase in the quantity of factors of productions. Hence, the production of goods and services is due to combinations of factors of production (Miles, et al., 2012; Olah & Pakurár, 2013). In terms of industry output, the growth accounting techniques help to examine the rate of change for combined factors. Production factors are also referred to as factors which have been used to measure the productivity of countries' economies (Nafziger, 2006; O'Mahony & Timmer, 2009). There have been various forms of productivity measures all aimed at ensuring efficiency in the way economy converts input to output by the use of the available resources. Thus, the growth accounting approach is used to analyze the three main divisions (primary, manufacture, and service sectors) of UAE's economy as explained in data and methodology part.

Just like other developing countries, the UAE has come up with strategies to aim at improving national productive capacity as a way of improving its economic development (IMF, 2015). This has led to sustainable economic development in the country that has reduced its reliance on oil as the major contributor of the nation's GDP. Figure 1 shows the moving trend of total production (GDP), non-oil production, capital input, and labor input from year 1990 to 2015. The inputs such as labor and capital indicate a sharp rise from 1990-2015. However, due to the decline in world oil price after 2007 the country's total production expresses a downward trend. Although, the descent of the total production, the production of non-oil sector improved towards the upside indicating the success of the strategy in the UAE to reduce dependence on oil revenues.

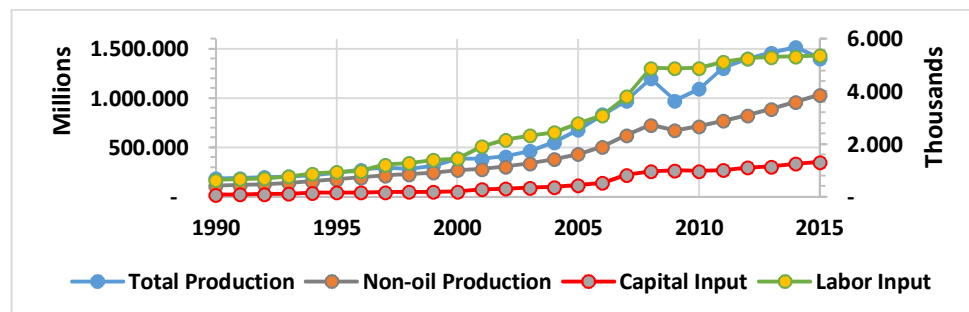


Figure 1. Total Production and Inputs Moving Trend (1990-2015).
Source: (FCSA, 2016).

3. Data and Methodology

Economic sectoral approach as the purpose of this study was divided into three divisions like the primary sector, the manufacture sector, and the service sector. The economic sectoral disaggregation is classified according to the international

standard industrial classification (ISIC) issued by United Nations (UN) in year 2008. These sectors are agriculture, livestock and fishing, mining and quarrying, manufacturing industries, electricity, gas and water, construction, wholesale, retail trade and repairing services, restaurants and hotels, transport, storage and communication, real estate and business services, social and personal services, the financial corporations sector, government services sector (Nations, 2008). This part of the paper considers the three major sectors as traditionally divided by United Nations and World Bank to three sectors (Bosworth & Collins, 2008). The primary sector is composed of agriculture, fishing, and livestock, the manufacture sector is composed of manufacturing, mining, construction, and utilities, and the last one is the service sector that includes the rest of economic divisions, which provides intangible products.

Three main data has been collected to study by economic sectoral approach. The total output expressed by GDP for each division of the economic sector, capital accumulation, and labor were sourced from UAE Federal Competitiveness and Statistics Authority (FCSA), except the data from 2011-2015 for labor, which was estimated by researchers based on two assumptions as follow:

- Taken the year 2010 as a basis to generate the percentage of contribution of the number of workers of any sector for next year.
- Presumed the number of workers in a certain percentage of the population according to previous years' data.

The UAE's natural population of which the majority are foreigners coming into the country through a sponsoring system introduced by UAE's citizens in term to occupy an open job. So, the UAE has a unique characteristic, the unemployment rate is very low and the UAE's citizens make up around 15% of the total population and 85% are immigrants (WB, 2016). Thus, the population data were taken from World Bank (in the absence of the state's data), then generated the changed ratios from year 2009 to 2010 and these ratios were implemented by adding in sequence to the population of each year 2011, 2012, 2013, 2014, and 2015. The author believed that the most can be used.

In 1957, Robert Solow was the initiative to propose a formal model of growth that put the role of the factors of production on productivity (Solow, 1957). This model (1) is grounded on a production function of two factors: the labor and capital. The production (Y) results therefore exclusively for the implementation of the combination of a certain quantity of capital (K) and labor (L). The third factor of production that has been introduced by neoclassical school (Solow, 1956) was technological progress (A), which known as "Solow residual". Solow residual is obtained as the remain of subtracting inputs from output. In general, called total factor productivity (TFP), which represents not only the technology used but also the improvements in production process, innovations, practice of management and institution, skills, etc. And according to Solow (1957) TFP is the most significant factor needed to achieve sustained economic growth in the long term.

$$Y = A(K, L) \quad (1)$$

The growth accounting tool is like the exponential growth function form, that helps to express the share contribution of factors of production (Hulten, 2010). The growth accounting framework doesn't give answers to the fundamental causes of growth, but it identifies the important sources of growth (OECD, 2001). The methodology employed in this study is quantitative and descriptive, and growth accounting framework is used to analyze the share of contribution of three inputs (capital, labor,

and TFP) in the analysis. The Cobb-Douglas production function is used to analyze the variables in long-run growth (Wolff, 1994), and also within a group of periods of time. This framework takes this form with respect of time is given:

$$Y_t = A_t K_t^\alpha L_t^{1-\alpha} \quad (2)$$

Where $[Y_t]$: noted as sector's output, $[K_t]$: represents the sector's capital stock, $[L_t]$: represents the sector's number of workers, $[A_t]$: as total factor productivity, $[\alpha]$: represents the capital's share, $[1 - \alpha]$: as labor's share, and assuming diminishing return to scale that capital's share is 0.3 and labor's share equal 0.7 (Piketty, 2014). Also, assuming competitive market, constant returns to scale, competitive market factors, and neutral technical progress (Solow, 1956). The change in output it back to the three variables, the alteration in the capital stock, change the number of workers, and improve in TFP (Wolff, 1994).

By illustrate the practice equations: for the first variable, capital, resulting from change in the current value K_t to value $K_t + \Delta K$, which considered an increase in change in proportional amount of capital $\frac{\Delta K}{K_t}$. If we apply a rule-of-thumb that capital raised to $[\alpha]$, which the proportional amount increase in output from the change of capital stock as equation:

$$\frac{\Delta Y}{Y_t} = \alpha \frac{\Delta K}{K_t} \quad (3)$$

For the second variable, labor, in term of an increase in labor from L_t to a value $L_t + \Delta L$ as proportional amount $\Delta L/L$. In labor variable raised to $[1 - \alpha]$, so can discover the amount increase in output because of change in labor is:

$$\frac{\Delta Y}{Y_t} = (1 - \alpha) \frac{\Delta L}{L_t} \quad (4)$$

Change in TFP as third variable, in effect of change in output because change in this variable. Any proportional amount increase will produce the same amount in output:

$$\frac{\Delta Y}{Y_t} = \frac{\Delta A}{A_t} \quad (5)$$

Therefore, if considering all three variables changing in practice so including equation (3), (4), and (5), then the proportional growth rate of sector's output, and rewrite in logarithm to form as log-liner equation (6):

$$\ln \frac{\Delta Y}{Y_t} = \alpha \ln \frac{\Delta K}{K_t} + (1 - \alpha) \ln \frac{\Delta L}{L_t} + \ln \frac{\Delta A}{A_t} \quad (6)$$

Thus, looking in equation (6), the first part $\alpha(\Delta K/K)$ representing the contribution of capital in sector's output growth, the second part, $(1 - \alpha) (\Delta L/L)$ representing the contribution of labor to sector's output growth, and $(\Delta A/A)$ as third part that giving the contribution of TFP in sector's output growth.

4. Growth accounting results of economic sector approach in UAE.

Table 1 describes the calculation for each economic sector (primary, manufacture, and service) as classified in long time-series from 1990-2015 and in group of periods of time from 1990-2000, 2000-2010, and 2010-2015. In the period of 1990-2015 service sector with 8.37% shows a higher growth in GDP's output compared to the primary and the manufacture sectors, where this rate was 6.7% and 6.88% respectively. From the period of 1990-2000 the average growth rate was higher in the primary sector (14.82%) compared by the manufacture and the service sectors with 6.0% and 5.89% respectively. Furthermore, the manufacture sector had a

higher growth of about 12.75% than the service sector with 10.49%, specifically from 2000-2010. However, between 2010-2015 the service sector gained a growth of about 7.99% followed by the manufacture sector with a growth of 4.01% fm. Thus, it be concluded that the development of average annual growth rate was generated mainly by the primary sector in 1990-2000, then by the manufacture sector in 2000-2010, and finally by the service sector in the period of 2010-2015. In general, service sector was followed by the manufacture sector, which they were more grown from 1990-2015.

Table 1. Growth Accounting calculation for Economic sectors from (1990-2015).

Primary	Average Annual Growth Rates				Share of Growth Due to:		
	Y	K	L	A	K	L	A
1990-2015	6.70%	1.59%	4.71%	0.40%	24%	70%	6%
1990-2000	14.82%	5.33%	6.75%	2.73%	36%	46%	18%
2000-2010	1.98%	-1.84%	4.15%	-0.34%	-93%	210%	-17%
2010-2015	1.44%	0.62%	1.09%	-0.27%	43%	75%	-19%
Manufacture	Y	K	L	A	K	L	A
1990-2015	6.88%	3.08%	5.93%	-2.13%	45%	86%	-31%
1990-2000	6.00%	1.82%	6.02%	-1.83%	30%	100%	-31%
2000-2010	12.75%	5.05%	7.61%	0.09%	40%	60%	1%
2010-2015	4.01%	1.31%	1.09%	1.61%	33%	27%	40%
Service	Y	K	L	A	K	L	A
1990-2015	8.37%	4.13%	5.21%	-0.97%	49%	62%	-12%
1990-2000	5.89%	3.97%	4.93%	-3.01%	67%	84%	-51%
2000-2010	10.49%	4.73%	6.98%	-1.22%	45%	66%	-12%
2010-2015	7.99%	1.69%	1.09%	5.22%	21%	14%	65%

Source: the calculation done by the researcher based on data from FCSA.

In term of capital accumulation (Table 1), the service sector with 4.13%, was higher in annual average growth from 1990-2015 followed by the manufacture sector with 3.08%. On the other side, for the period from 1990 to 2000 it was higher in the primary sector (5.33%). Furthermore, the manufacture sector with 5.05% was higher as well was in the same period.. The average annual growth rate for labor was between 1.09% and 7.61, namely higher compared to the capital accumulation. Thus, the growth in the manufacture sector was the highest with almost 6% compared to 5.21% and 4.71 in the service and manufacture sectors respectively. The technology factor was mostly given negative figure between 2010-2015 unlike the service sector with a growth of 5.22%. In close, the annual average growth in labor was the highest in all sectors at different group of periods. In addition, the TFP grew in the service sector between 2010-2015.

According to Table 1 the contribution to output growth share was driven by labor in all sectors and periods of time. From 1990-2015, the share of growth due to labor was 70%, 86%, and 62% as compared to the share of growth due to capital in same period with 24%, 45%, and 49%, for the primary, the manufacture, and the service sectors, respectively. Also, the share of growth due to capital declined between 2010-2015 in the service sector and manufacture sector, unlike the situation in primary sector, where it increased. TFP had negative figures, unlike in the primary sector from 1990-2015. In addition, the share of growth of TFP between 2010-2015 deserved positive value in the manufacture and service sector. The share of growth due to TFP was higher compared to capital and labor with 65% and 40% in the service and the manufacture sectors, respectively in the period of 2010-2015.

In conclusion, the path of development of the three sectors started with the primary sector from the period 1990-2000, then the manufacturing sector between 2000-2010, and lastly the service sector in the period 2010-2015. In general, the service sector contributed more to the growth followed by the manufacturing sector between 1990-2015. The contribution of labor was significantly to the output growth in all sectors due to the increase of the number of labor and not to the improvement in TFP. In addition, the share of capital accumulation to the growth deserved higher growth in the manufacturing and the service sectors owing to the huge investments taken place.

5. Discussion

The study provided a better understanding of the stages of growth in the economic sectors of the UAE. The results reached the stage of determining the actual moving of the UAE economy from agriculture to other sectors such as the services and the industry. It can be stated that the shift happened in the UAE economy has been observed from the beginning of year 2000 with the service and manufacturing were contributed more to UAE's GDP. On the other side, it can be concluded that the impact of growth in output was due mostly to increase in the number of workers.

6. In conclusion

The growth accounting approach was used to examine the division of UAE's economy through three sectors according to the classification of the UN. The calculated results contribute to the understanding of the stage of development of UAE's economy, and which sector was rolling at specific period of time. Therefore, results can be put in two perspectives as below:

Annual average growth rate:

- From 1990-2015, the output of the service sector was deserved the highest annual average growth rate about 8.37%, which followed by the manufacturing sector about 6.88%.
- From 1990-2015, the annual average growth rate for the labor inputs was dominated at all three sectors of the economy, where it was 4.71%, 5.95%, and 5.21% in the primary sector, the manufacturing sector, and the inspection and repair sector, respectively.
- From 1990-2015, the annual average growth rate for the capital accumulation deserved higher growth in the service sector and the manufacturing sector, where were 4.13% and 3.08%, respectively.
- From 1990-2015, the annual growth rate for TFP was negative in the service and the manufacturing sectors, unlike the primary sector.

- From 1990-2000, output of the primary sector deserved higher annual average growth rate about 14.82%.
- From 2000-2010, the output of the manufacturing sector deserved higher annual average growth rate about 10.49%
- From 2010-2015, the output of the service sector recorded the higher annual growth rate where it was 7.99%.
- From 2010-2015, the annual growth rate for TFP was positive in the manufacturing and the service sectors where they were 1.61% and 5.22%, respectively.

Contribution share of growth due to production factors:

- From 1990-2015, the share of growth due to the labor was deserving significant impact of the growth of each sector, where was 70%, 86%, and 62% in the primary, the manufacturing, and the service sectors, respectively.
- From 1990-2015, the share of growth due to the capital were 24%, 45%, and 49%, for the primary, the manufacture, and the service sectors, respectively.
- From 1990-2015, the share of growth due to TFP was positive only in the primary sector about 6%, where it was negative in the manufacturing and the service sectors which were -31% and -12%, respectively.

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