Investigating the Productivity of Singapore

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Abstract

Efficient resource use is important for a country in the competitive world. Higher productivity is usually associated with an enhanced standard of living. Among Southeast Asian countries, Singapore has developed into a remarkable industrialized country since its independence in 1965. In order to understand the efficiency of resource use in Singapore, this paper investigates the productivity of three main sectors: manufacturing, construction, and service, from 1999 to 2001. Some characteristics of Singapore’s productivity are obvious. Labor productivities of both manufacturing and construction sectors are higher than their capital productivities, while the service sector has declined. Since more than half of the Gross Domestic Product (GDP) is contributed by the service sector, and service capital productivity is much higher than labor productivity in the service sector, the nationwide capital productivity is greater than labor productivity.

Keywords: Productivity; Singapore; Resource utilization; Southeast Asia

1. Introduction

In the competitive global environment, the efficient use and allocation of limited resources are important. Productivity is an index for measuring a unit’s efficiency in transforming physical inputs to physical outputs [4]. Higher efficiency in the transformation process can create more values for a nation as higher productivity is usually associated an enhanced standard of living. Consequently, increasing productivity at the national level becomes a major challenge to policymakers. The increase in productivity closely correlates with the performance of a nation’s competitiveness. In other words, improving national productivity can increase national competitiveness.

A number of researchers have investigated national productivity with specific sectors. For example, Chen et al. [4] presented a productivity diagnosis approach to find the productivity characteristics of the manufacturing industry in Taiwan and to determine the relative output of a firm and its shortcomings in managing resources. By studying the manufacturing sector

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in Taiwan, Kao et al. [11] emphasized that productivity improvement cannot be achieved only by technology. In their study effective management was found to be an important, decisive factor. Grifell-Taquet and Lovell [7] examined the model of productivity change in Spanish banking over a period of seven years. They found that commercial banks had a slightly lower rate of productivity growth as compared to other business units in Spain. Boisso et al. [3] has also contributed to the study of national productivity. For Singapore, a number of researchers [1,5,6,8,9,15,17,19] have investigated the impact of economic-related issues to productivity. As one of the Asian “tigers,” Singapore has become one of the world’s most prosperous countries. It is worth examining further Singapore’s characteristics of productivity.

Singapore was established as a British trading colony in 1819. It joined the Malaysian Federation in 1963, and two years later it became an independent country. In 2003, Singapore’s population was estimated at 4.6 million on an area of 692.7 sq km [21]. Singapore has transformed into a remarkable industrialized country since 1965 [5], and has been achieving a high economic growth annually. In fact, Singapore has a Gross Domestic Product (GDP) per capita similar to many OECD (Organization of Economic Cooperation and Development) countries. In 2002, Singapore’s GDP was estimated at US$ 112.4 billion and her real GDP growth at approximately 2.2% [21]. Figure 1 shows Singapore’s GDP per capita and the average ASEAN (Association of South-East Asian Nations) GDP per capita from 1996 to 2002 [20]. There exists a large difference between them.

Singapore’s GDP per capita ranks first in ASEAN. Singapore’s economy depends on manufacturing, financial and business services, and commerce [22]. In the manufacturing sector, electronics emerges as the most important industry. Singapore also serves as a hub of financial and business services in Southeast Asia. The government liberalized financial services and in 1997 announced its target as being the financial hub for the broader region [22]. Although Singapore was hit hard in 2001 by the global economic recession, and by the slump in the technology sector [21], its economy remains fundamentally strong, and now the economy is recovering slowly.

Due to her great economic progress, the IMF (International Monetary Fund) recognized Singapore as an advanced economic entity in 1997 [5]. The economic structure of the Singapore economy has been significantly transformed, resulting in a vibrant manufacturing sector and a successful financial-services sector. Her success could be attributed to the sound macroeconomic polices and the considerable development of her industrial inf-
As an open and internationalized country, Singapore’s prosperity is highly dependent upon the sustained stability of the international economic system [6], despite her efficient use of domestic resources. Scholars have mined Singapore’s productivity in important published research [18]. Since productivity is closely related with national competitiveness, this paper mainly investigates Singapore’s productivity from 1999 to 2001.

In the following sections, productivity measures are formulated. Then the productivity of three important sectors in Singapore, namely manufacturing, construction, and service, are evaluated from 1999 to 2001. A conclusion from the study is provided in the final section.

2. Productivity Measure

Productivity is generally defined as the ratio of all outputs to all inputs in monetary terms for measuring the transformation efficiency [2]. Depending on the inputs and outputs used, a number of productivity measures have been proposed over the years. Among them, labor productivity (LP), capital productivity (CP), and total factor productivity (TFP) are commonly used [16]. Actually, LP and CP are partial productivity measures that provide an insight to productivity from a particular viewpoint. However, they alone may give deceptive clues regarding productivity level. The total factor productivity takes labor inputs and capital outputs into account, and therefore is generally considered as a more comprehensive measure of productivity [12]. TFP has been applied in much productivity-related research [4,11]. For more
detailed analyses, this study employs the above three measures.

Firstly, TFP is defined as

$$\text{TFP} = \frac{\text{Value-added}}{\text{Labor inputs} + \text{Capital inputs}}. \quad (1)$$

For a business unit, value-added is the net contribution of its production activity during a specific period. For a nation, value-added can be considered as the net contribution generated by the nation’s economic activities over a sustained period. Based on this definition, we use GDP (Gross Domestic Product) as a nation’s value-added to ascertain its economic outcome, excluding the net factor income from the rest of the world. Labor inputs include a variety of expenses related to employees. To evaluate a nation’s labor inputs (NLI), we examined the remuneration of all employees in the country. For ease in data collection, we use average remuneration per employee and the number of employees in the country to obtain NLI during a period, i.e.,

$$\text{NLI} = (\text{average remuneration per employee}) \times (\text{the number of employees in the country}).$$

Capital inputs for a firm include fixed capital inputs and working capital inputs. For a nation, gross capital formation (GCF) can be used as capital inputs in determining of TFP, since it includes foreign direct investments and domestic direct investments. Based on the above definitions, a nation’s TFP (NTFP) can be expressed as

$$\text{NTFP} = \frac{\text{GCF}}{\text{NLI} + \text{GCF}}. \quad (2)$$

Similarly, a nation’s labor productivity (NLP) and capital productivity (NCP) can be formulated as

$$\text{NLP} = \frac{\text{GDP}}{\text{NLI}} \quad (3)$$

and

$$\text{NCP} = \frac{\text{GDP}}{\text{GCF}}. \quad (4)$$

respectively. Substituting (3) and (4) into (2), we have
As mentioned earlier, both NLP and NCP are partial indices, and increasing either will definitively enhance the NTFP. The investigation of NTFP can be accomplished by examining NLP and NCP. Furthermore, analyzing NTFP can also be assimilated into the productivity analyses of various sectors that contribute to the national total factor productivity. In general, a nation’s GDP is attributed to five sectors, namely, agriculture, mining, manufacturing, construction, and services. It is worthwhile to examine each sector’s productivity in order to understand its influence on NTFP. Similarly, the total factor productivity, labor productivity, and capital productivity of each sector are measured. For these measurements, the associated elements of each sector’s productivity are used. As an example, the TFP of the manufacturing sector, \( \text{TFP}_M \), can be determined as

\[
\text{TFP}_M = \frac{\text{GDP}_M}{\text{LI}_M + \text{GCF}_M},
\]

where \( \text{GDP}_M \) is the GDP contributed by manufacturing sector, and \( \text{LI}_M \) and \( \text{GCF}_M \) are the labor inputs (total remuneration) and gross capital formation of the manufacturing sector, respectively. However, for a city-state like Singapore, the contributions of GDP from agriculture and mining sectors are minor. This makes the analyses of the above two sectors’ productivity negligible. Therefore, in this paper we only discuss productivity from manufacturing, construction, and service sectors.

3. Analysis

Based on the above definitions of productivity, three kinds of productivity, i.e., total factor productivity, labor productivity, and capital productivity, are measured in this section for Singapore and her three main sectors, namely manufacturing, construction, and service.

Singapore’s total factor productivity, labor productivity, and capital productivity for the nationwide measures and her three main sectors are listed in Table 1 and shown in Figures 2 to 5. The figures illustrate the trend for the nationwide measures, manufacturing, construction, and service sectors in 1999, 2000, and 2001.

Although Singapore’s GDP had a negative growth in year 2001 due to the global recession, both her NTFP and NLP maintained at almost the same
Table 1 The Labor Productivities, Capital Productivities, and Total Factor Productivities of the Three Sectors from 1999 to 2001

<table>
<thead>
<tr>
<th>Sector</th>
<th>Year 1999</th>
<th>Year 2000</th>
<th>Year 2001</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nationwide</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Labor Productivity</td>
<td>2.200</td>
<td>2.112</td>
<td>2.107</td>
</tr>
<tr>
<td>Capital Productivity</td>
<td>3.109</td>
<td>3.396</td>
<td>3.552</td>
</tr>
<tr>
<td>Total Factor Productivity</td>
<td>1.288</td>
<td>1.302</td>
<td>1.323</td>
</tr>
<tr>
<td>Manufacturing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Labor Productivity</td>
<td>2.588</td>
<td>2.796</td>
<td>2.505</td>
</tr>
<tr>
<td>Capital Productivity</td>
<td>2.061</td>
<td>2.028</td>
<td>2.039</td>
</tr>
<tr>
<td>Total Factor Productivity</td>
<td>1.147</td>
<td>1.175</td>
<td>1.124</td>
</tr>
<tr>
<td>Construction</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Labor Productivity</td>
<td>1.890</td>
<td>1.564</td>
<td>1.504</td>
</tr>
<tr>
<td>Capital Productivity</td>
<td>0.496</td>
<td>0.427</td>
<td>0.413</td>
</tr>
<tr>
<td>Total Factor Productivity</td>
<td>0.393</td>
<td>0.336</td>
<td>0.324</td>
</tr>
<tr>
<td>Service</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Labor Productivity</td>
<td>2.077</td>
<td>2.009</td>
<td>1.865</td>
</tr>
<tr>
<td>Capital Productivity</td>
<td>16.585</td>
<td>31.154</td>
<td>20.691</td>
</tr>
<tr>
<td>Total Factor Productivity</td>
<td>1.846</td>
<td>1.887</td>
<td>1.711</td>
</tr>
</tbody>
</table>

Figure 2 Three Nationwide Productivity Measures of Singapore in Years 1999, 2000, and 2001
Figure 3 Three Productivity Measures of the Manufacturing Sector in Years 1999, 2000, and 2001

Figure 4 Three Productivity Measures of the Construction Sector in Years 1999, 2000, and 2001
levels as those in 2000. Her NCP in 2001 was even larger than that in 2000. This confirms the official statement that her resource use is efficient, especially in capital use. From these nationwide productivity measures, Singapore’s productivities appear competitive. With regard to productivity in the manufacturing sector, labor productivity in 2001 was less than that in 2000. However, its total factor productivity and capital productivity maintained at an equitable level, even during the global economy recession. This consistency could be ascribed to Singapore’s efforts in promoting science and technology in the ‘90s. Its manufacturing base had been actively promoted to produce more high-tech and knowledge-intensive products by a concerted effort to upgrade the skills of the country’s labor force [10]. One example is reflected in the semiconductor industry, which has played an important role in the economic development of Singapore [14].

For the construction sector, as shown in Figure 4, labor productivity obviously is greater than total factor productivity and capital productivity. The construction sector has fewer labor inputs in comparison with capital inputs. It can be inferred that construction industry in Singapore is highly automated. Finally, the service sector has the largest capital productivity among the three productivity measures. While total factor productivity and labor productivity have similar levels, the levels of capital productivity are much higher than either or both. Capital productivity of the sector decreased dramatically in 2001, a year of global recession. However, based on her
economic characteristics, Singapore’s service sector, its most important, contributes more than 60% to her GDP. The highest capital productivity shows the high efficiency in managing capitals.

In addition, comparing the productivities of the three main sectors, labor productivity is the largest in the manufacturing and construction sectors, while capital productivity is much larger than the others in service sector. This accounts for Singapore’s high nationwide capital productivity.

4. Conclusion

As one of Asian tigers, Singapore’s economic development is remarkable. Its GDP per capita is one of the highest in the world. As high economic growth is usually related to the successful complementation of resources use, this paper investigates Singapore’s performance by examining the productivity of manufacturing, construction, and service sectors in 1999, 2000, and 2001. The total factor productivity of the three sectors in the three years had not changed greatly, even in the global recession year 2001. Manufacturing and construction sectors’ labor productivities are greater than their capital productivities, while for the service sector declined. Among productivities in the three sectors, capital productivity in the service sector is the most significant of the three. Since the service sector contributes more than 60% to the GDP, the nationwide capital productivity is greater than labor productivity. This may justify Singapore as a financial and business services hub in the Southeast Asia.

References