CHAPTER 4

EMPIRICAL LITERATURES

The literatures of this field at an international level are not quite a few. However, the availability of the investigations on labor productivity related to others factors is slightly appeared, many of them emphasize on the enterprise level or the total productivity of the whole economy.

This literatures of study is organized into 3 parts, concerning to the methodology in the paper. The first part relates to the labor productivity. The second part is about the effect of public capital on private output and the last one is about the production function. The literature reviews emphasize on the second and third subject in order to search the proper model to estimate the role of public and private capital to the labor productivity.

4.1 Labor Productivity

There are 2 methods to measure labor productivity; the partial labor productivity and marginal labor productivity. The measurements to evaluate partial productivity[1] are variety depending on the data brought to calculate and criteria of the study.

The initial paper concerning labor productivity of Thailand is owing to Sivaranon(1970) who examined Thai labor productivity during 1961-1966. He identified the difference between production and productivity, and classified into 4 inputs; lands, capitals, materials or intermediate products and labors. He also examined the amount of production of Thai and percentage of production in the value by divided the amount of production by the number of labor input given 1961 as the based year. The increase in labor productivity throughout 6

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[1] Partial Labor Productivity is the ratio of output divided by each of factor of production. It called "partial" because of its calculated method.

Partial Productivity	=	Physical Output / Physical Input
Labor Productivity	=	Output / Unit of Labor

years of the whole economy, agriculture, and manufacturaing are 32.8, 26.0, and 21.1 respectively.

Nakajima(1997) estimated the relationship between the "Total Labor Inputs" and "Value Added per Direct Labor" (another meaning about Labor Productivity) based on the calculation from Input-Output Tables of Japan,the Republic of Korea, and the United States in 1960, 1965, 1970, 1975, 1980, and 1985 in 24 industries based on the input-output table. He found that the total labor inputs and the value added productivity are not only highly correlated, but also drawable as a U curve. Furthermore, the ratio of labor to capital is fixed among countries. The average value added coefficients among industries are quite stable overtime in those 3 countries. The result indicates that the more developed country, the more value-added productivity, and the less value of the standard deviation to the average value gained. However, the declining tendency of the valued added productivity was noticed along with the economic development.

Baily, Bartelsman, and Haltiwanger's study (2001) mentioned in their study that most of the existing empirical analyses limit only in aggregate estimation. Thus, the plant-level analysis is utilized in their study to distinguish the cyclical behavior of aggregate labor productivity from plant-level productivity. Their key expectation is to explore the relationship between heterogeneity in the long run structural changes across individual plants and heterogeneity in patterns of short-run procyclical productivity in the large sample of plants in the 1970s and the 1980s. Not only do they find the procyclicality within plants, but the disproportional cyclicality of plant-level productivity among long-run downsizers. However, in my view, it is impracticable to the agricultural sector and the service sector because of their characteristic which is beyond the bounds of possibility to examine every business unit.

Bland and Will(2001) sought for labor productivity at the level of firms. Their paper results clarified the relationship of the labor productivity change and resource movements. They measured the ratio of value added to full-time equivalent workers of Australian firms and opposed that the labor productivity could be increased while the Total Factor Productivity decrease due to the firms' input substitution.

The Total Factor Productivity (TFP) can be determined in order to perform the technology and other residual factors that effect the growth in output. Some studies claimed the TFP value as labor productivity. The studies used TFP are, such as, Bertelsman and Dhrymes (1998), Kripornsak(1998), Wiboonchutikul(1986), Akrasanee and Wiboonchutikul(1994), Urata and Yokata (1994), Tinakorn and Susangkarn(1994)(cited form Trakulroong, 2001:24).

4.2 The Effect of Public Capital on Output

While the private capital is unarguable about its contribution to output., the public capital is still at the issue. There have been discussed papers related to the public capital and the output. Many studies empirically concluded that public capital has significant effect on output as following papers.

Ratner(1983)'s study found that the public capital of the United States during 1949-1973 had an significant role to private output. He applied the Cobb-Douglas Production Function with constant return to scale and the Hicks neutrality and then revealed that the elasticity to public output with respect to public capital is 0.06. This is one of the primary papers concerning the effect of public capital to output.

Lynde and Richmond (1993) examined the role of public investment to the growth of aggregate output and productivity of the United Kingdom Manufacture. They approached the problem of estimating the impact of public production by using the dual relation between the production technique and the cost function based on value added framework, and estimating the distribution of changes in the public capital–labor ratio to labor productivity growth over the period of 1966-90. They suggested that the infrastructure services had played the significant role on production and costs in the United Kingdom manufacturing sector, and the higher rate of infrastructure investment could have brought about an increase in the rate of growth of labor productivity in the United Kingdom manufacture.

There is a study that investigates the role and technical relationship between public capital and private inputs in terms of productivity effect and estimates the technical relationship by Suwanrada(1999). He utilized data of

every sector during 1970 – 1996 of Thailand regarding public capital as one of a productive factor. He utilized Cobb-Douglas Production Function by Ordinary Least Squared estimation and Cochrane-Orcutt method. The productivity of public capital is significantly positive and smaller than that of private capital. He found that if Thai government increases productive infrastructure 1%, it will cause GDP to increase by 0.2-0.3%. Whereas the productivity of private capital effect the output about 0.51-0.54%. His study is helpful to clarify the role of public capital and shows the observable differences between the role of public and private capital to output of Thailand.

Though, there are many empiricals, supporting the positive effect of public capital to output. Many researchers stand at the opposite point. Munnell (1992) disputed that, from the previous studies, the impact of public infrastructure investment on private sector output emerging from the aggregate time series studies is too large to be credible. The aggregate results cannot be used to guide actual investment spending. It does not make sense for public capital investment to have a substantially greater impact on private sector output than private capital investment. Particular considering that so much public investment goes for improving the environment and other goals that are not captured in national output measures. Only Cost-benefit studies can determine which projects should be implemented.

Then, he decided to look at the relationship between public capital and measures of economic activity at the state level. The result is parallel to the national production function, public capital still has a positive, and statistically significant.

There are 3 major critics emerging from estimated production functions. Firstly, the broad criticism is that the common trends in the output and public infrastructure data have led to a spurious correlation. The method to get rid of this problem is the first-differencing specification, which creates the lagged problems. He suggests that the variables should be tested for co-integration, adjusted and estimated accordingly.

The second criticism is the wide range of estimates emerging from the various studies renders the coefficients suspect. He stated that it is seriously misreading the evidence. The public capital spending contributes to national output as conventionally measured.

Finally, he stated that a causation run not from public capital to output, but rather in the other direction. In fact, capital investment, private as well as public goes hand in hand with economic activity. However, most of his supported empiricals are studied in the United States and Japanese region which might not be explinable to developing countries as Thailand.

The literatures that reject the role of public capital to output are, for example, Tatom(1991), Holtz-Eakin(1992), Evans and Karras(1994), and Milà, McGuire, and Porter (1996).

Tatom used the similar model to Ratner(1983). He practiced Cobb-Douglas Production Function with constant return to scale to examine the effect of public captal stock during 1948-1989. The relative price of energy and the slowing trend rate of technological change were added to the model. The outcome, which was applied by the First-Differenced estimation and the cointegration test, found that public capital had no significant effect to productivity of the United States. His result reporting the insignificance of public capital to output is similar to Holtz-Eakin's.

Moreover, Evans and Karras who examined the productiveness of government activities by panel data of 48 states of the United States in 1970 and 1986 using Cobb-Douglas Production Function, and Translog Production Function found that the basic infrastructure generated the negative effect to the private productivity. They suggested that the basic infrastructure provided by government might not be sufficient.

Milà, McGuire, and Porter tested for the proper specification of a state-level production function with public capital as an input by Cobb- Douglas Production Function. Their contribution is to employ specification tests to guide the preferred estimated method, involving first difference data with fixed effects. The panel data consist of annual observation from 1970 through 1983 for the 48 contiguous states on GSP. The first model was run with annual time dummies (fixed time effects) and no state effects. They also specified the random state effects and the fixed state effect to the estimated models. It is found that the specification in first differences with fixed state effects is the preferred one. Their systematic search has led to a specification in which three types of public capital make no contribution to private output. It is contrasted to many previous articles using panel data sets. They implied that the previous

estimates reflect spurious correlation. Thus, it creates the significant effect of public capital to output. However, they claimed that they conclude by a narrow framework.

4.3 The Production Function

"The production function" is commonly stated in the textbooks and the articles, respected to the fundamental of the microeconomic. It is almost emphasized on the explanation of "How or when the factors of production should be used to produce output at the maximum level". Generally, the Cobb-Douglas Production Function is applied in many studies as a common model to explain the characteristic of the production. However, whatever functional form is remarked out, the argument about "What are the real factors of production in the production process and how to apply to the model" is continually argued. Even though the issues about the production function have been discussed for a long time and there are many equations to explain the production function in various aspects, the indisputable model for the macroeconomic level has not been universally accepted.

In this section, the chosen literatures concern with human capital, education, and empirical production functions of Thailand in respect of the methodology of this study.

The study that attempt to signify the role of human capital as an input factor is, for example, Haskel, and Martin(1993)'s research. They investigated the effort of both skilled and unskilled labor shortages in the the United Kingdom on productivity growth by using a panel of 81 three digit industries 1980 – 86. Their study examined by treating the effective labor input as an input factor in Cobb-Douglas Production Function. They found that the shortage of unskilled workers had no significant effect and skill shortages tilted the composition of employment away from skilled workers towards the unskilled workers. The increase in skill shortages over the mid 1980s of the United Kingdom reduced productivity growth by around 0.7% per annum.

Nevertheless, some researches found negative effect of human capital as an input factor to output such as Lawrence, Dean and Frederic (1999)'s study who studied about the effect of education on the aggregate real output based on

the Cobb-Douglas Production Function. Their estimation is an aggregate production function, using the quantities of capital, labor, land, average educational attainment of the labor force and chronological time of 58 developing countries from 1960 to 1986. They eliminated the multicollinearity and the non-identification of the key parameters of the aggregate production function by pooling the time-series data of several countries and by standardizing the measurement of the inputs. The amount of the percentage change in the region's real GDP in response to an increasing of one year in the average educational attainment of the working age population in 1985 is negative more than 5 per cent a year.

The alternative approach, catch-up approach, was utilized by the studies of Benhabib and Spiegel(1994), and Yuji Kubo and Hong-dall Kim (1996). Their results support the hypothesis of Nelson and Phelps (1966) that human capital has a positive payoff only if technology is always changing.They found that human capital and imported technology have played important roles in economic growth.

Benhabib and Spiegel(1994) confirmed that human capital contributes to economic growth by promoting endogenous technological process and enlarging the ability of a country to adopt and implement new technology. They convinced that the method which is widely used to evaluate the affect of human capital on the output and the growth of an economy is not appropriate. They distinguished 2 methods: treating human capital or average year of schooling as an ordinary input on the production function, and calculating the endogenous growth by total factor productivity. It is found that human capital growth has an insignificant role to the economic growth. Therefore, they applied an alternative model which allows human capital directly affects aggregate factor productivity. Besides, they found that human capital played an important role in attracting physical capital.

Yuji Kubo and Hong-dall Kim (1996) worked similar to Benhabib and Spiegel by examining the role of human capital in economic growth using annual data of Korea and Japan. They also applied the 'technological diffusion' effect of 'imported technology' in the model of output growth as well. Their result indicates that many cross-country studies face the positively correlation with economic growth. However, they claimed that putting human capital as an

input factor can not demonstrate how human capital affect economic growth. Thus, they preferred to catch-up approach. They consider it as the suitable model for the empirical study of growth especially in developing countries where technological improvements are mainly imported through capital goods.

Their result shows that the level of human capital and imported technology played important roles in the process of economic development with a strong complementary linkage between them. That is contribution of imported technology to economic growth is enhanced by its interaction with the level of human capital. In addition, their result gives reason to the relatively weak growth performance of countries with high level of human capital such as the Philippines and some Latin American countries. Since the potential to catch-up in a country depends on the number of conditions that govern the diffusion of technology or knowledge, and the rate of investment and mobility of resources, it is hard to separate the catch-up process from more general process of growth.

Besides, Howard Pack consultant (1980) reported in the working paper number 37 of World Bank that in the developing country the substantial social and private benefits can be obtainded by systematically adopting appropriate technology rather than capital–intensive technology in the modern manufacturing. Bernard and Charles (1996) were also employed catch-up approach by apply to TFP function at the industry level in 14 OECD countries from 1970-1987 and found that it was significant to the growth.

The human capital with catch up technology is examined its importance to output in Thailand but found to be insignificant by Wongudom(2001). He measured human capital in Thailand during 1977-1996 and investigated the relationship between human capital and output growth. He followed Nelson and Phelps(1966)'s approach, catch up appraoach, using the TFP as the proxies of advance technology. In contrast to other countries' result, he found no evidence supporting the hypothesis that human capital is a source of tecnnology progress through innovation and adoption process.

A paper explored the production function in the macro-view of Thailand, was written by Kraipornsak (2000). He compared empirical results of the production function by different 3 methods using Thai data whether three functional forms give the different result. Those are 1) a traditional method

with the most effective use of output behavior 2) a dual function production function via cost function and 3) a production function with the inefficient mix of output bring the same result of estimations. He shows quite the same results of those 3 methods. This would be implied to assume that maximize behavior exist in the real world and be allowed in the research, but the problem he stated is the insufficient number of sample size which comes along the multicollinearity between the independent variable.