The Impacts of Increased Labor Productivity of the Service Sector in Thailand: Analysis of Standard Computable General Equilibrium (CGE) Model

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Abstract

This paper aims to investigate the impact magnitude of the increased labor productivity in the service sector both at macro and sectoral levels. Due to Thailand's service sector having shown the lower productivity growth than other sectors, this reflects a lack of knowledge and skills as well as industry-related work environment problems. This study is unlike the majority of previous empirical research studies which mainly intended to calculate labor productivity or to study factors affecting labor productivity or the causes of low labor productivity in Thailand. This study employs a standard computable general equilibrium (CGE) model to analyze the impact magnitude. The database was compiled using the 2010 social accounting matrix (SAM) which has 21 sectors to analyze. Three different scenarios were simulated for the service sector in Thailand with the labor productivity increased by 1, 2 and 3% relative to the baseline scenario. The results reveal the real Gross Domestic Product

(GDP) increases by 1.75, 2.19 and 2.64% and the total domestic output increases by 1.16, 1.45 and 1.75%, respectively. The direct effect on domestic output when the labor productivity increased mostly occurs in Public Administration sector, followed by Education sector, Hospital sector, Finance, Banking and Insurance sector, Wholesale-Retail Trade and Other Services sector, Communication sector, Transportation and Logistics sector, Electricity and Water Supply System sector, Real Estate sector and Construction sector, respectively. While the indirect effect on domestic output when the labor productivity increased mostly happens in Paper Industries and Printing sector, Mining and Quarrying sector, Rubber, Chemical and Petroleum Industries sector, Metal, Metal Products and Machinery sector and Food Manufacturing sector, respectively. The reason being that these sectors are more upstream and are highly inter-linked with other service sectors in Thailand.

Keywords: The Impacts of Increased Labor; the Service Sector; Computable General Equilibrium Model

Introduction

The Thai economy has evolved immensely from a primitive agricultural economy to industrial and service economy. In 1951-1967, agricultural, industrial and service sectors accounted for 32.4, 16.2 and 51.1% of Gross Domestic Product (GDP) while in 1990-2015, agricultural sector only accounted for 10.1% of GDP, industrial sector (27.5%) and service sector (62.4%). The service sector is the main sector in the Thai GPD, mainly contributed by Wholesales-Retail Trade and Repair sector (generated 6.14% of GPD in 2012-2017), Transportation, Warehouse and Communication sector (7.1%), Financial Institution sector (7.1%), Real Estate sector (7.6%) and Public Administration, Defense and Social Security sector (0.6%). Most importantly, the service sector employed as many as 57.25% of the total workforce nationwide in 2016.

The study of Bank of Thailand (2558) pointed out that Thailand is struggling to escape the middle-income trap, mainly due to the decrease of labor productivity in the service sector. This reflects a lack of knowledge and skills as well as industry-related work environment problems which will obscure Thailand's long-term economic growth. Unlike the majority of previous empirical research studies which mainly intended to calculate labor productivity or to study factors affecting labor productivity or the causes of low labor productivity in Thailand. (Paitoon Kraipornsak (1998) Sumalee Santipolavut, Supachart Sukharomana, Rosada Vesdapunt, and Sommai Udomwitid (2001) Dilaka Lathapipat and Thitima Chucherd (2013) Sethaput Suthiwart-Narueput and Sirikanya Tunsakul (2014) and The National Account Division of National Economic and Social Development Board and The World Bank. (2007))

This study aims to investigate the impact magnitude of the increased labor productivity in the service sector both at macro and sectoral level by employing a standard computable general equilibrium (CGE) model. Even though it is widely known, increasing labor productivity in the service sector will enhance global competitiveness, no empirical research shows the impacts of increased labor productivity of the service sector in Thailand

economy. This study intends to unveil the direction and magnitude of impacts caused by the increase of labor productivity of the service sector in Thailand economy which will benefit policy makers to further develop and implement. Conceptual, Theoretical and Literature Reviews

This study employs two concepts in the analysis: Labor Productivity concept and Computable General Equilibrium (CGE) Model. Labor productivity measures the ratio of total output to the total number of labor. In theory, it can be measured in terms of average labor productivity and marginal labor productivity (Bureau of Labor Statistics (BLS) ((2010 and International Labour Organization (ILO) (((2010. Two primary components of labor productivity are labor productivity growth and per-hour productivity growth or labor employment growth (Gilles Mourre ((2009.

Computable General Equilibrium (CGE) Model is based on General Equilibrium Theory and is often used incorporation with Social Accounting Matrix (SAM). Computable General Equilibrium (CGE) Model captures the inter-dependencies among factor sector, production sector, household sector, government sector, investment sector and foreign sector. Inter-sector linkages are through income, expenditure, economic unit needs and market equilibrium by having price acting as a mechanism in a market economy for equilibrating demands and supplies if there is a change in policy or change in exogenous variables (Shoven and Whalley ((1972, Shoven ((1976and Whalley ((197.

In relevant literatures, Chockpisansin) 2002(used Total Factor Productivity (TFP) in the Production Function as an indicator. The study finds that labor force with bachelor degree or higher education significantly impacts the growth rate of labor productivity. In addition, the higher the education, the higher labor productivity growth rate. Different industries require different skill sets and qualifications. Charsombut and Kitprathan)1996) studied labor productivity in Thai industries, find that high-tech industry has a higher proportion of labor force with vocational education or higher, its labor productivity is as a result higher.

In empirical research studies related to the analysis of Thai labor market and labor productivity Lathapipat and Chucherd (2013(interviewed entrepreneurs and find that Thailand is facing labor shortage problem both in terms of insufficiency of qualified candidates and skill mismatch candidates. Real wages are not growing in spite of having labor demand. Reasons being are insufficient investment in modern production sector, the failure of Thailand's education system and the failure of workforce planning to produce skilled labor to meet the market needs. The National Account Division of National Economic and Social Development Board and the World Bank. (2007) also analyzed and calculated labor productivity of the Thailand's service sector in 1993-2005 and found that the labor productivity in Trade sector, Restaurants and Hotels sector, Finance sector, Real Estate sector and Business Services sector were on the downward trends while the labor productivity in Public Administration sector and Education sector were on the upward trends.

Methodology

To analyze the impact magnitude of labor productivity increased in the service sector, this study used a standard computable general equilibrium (CGE) model based on empirical equation modeling introduced by Dervis et al. ((1982Robinson ((1989Shoven and Whalley ((1992Dixon et al. ((1992and Ginsburgh and Keyzer ((1997 and the database was formed using the 2010social accounting matrix (SAM) for Thailand to compute in the computable general equilibrium (CGE) model.

The computable general equilibrium (CGE) model explains a behavioral response of Thailand's economic units, consisting of 21 economic sectors: household, government,

investment and foreign sectors. The non-linear equations define the behavior of these different sectors. The equations also include a set of constraints, being conditioned by the resource allocation mechanisms available in the market economy. This study covers the constraints on constant returns to scale technology's production function, by having one product or service produced and output sold on the domestic market or for exports. The model also assumes the perfect competitive market structure whereby primary and intermediate inputs are used in the production and it generates normal profit margin for manufacturers. End consumptions are consumed among household, government and investment sectors. They spend their income on composite commodities being domestically produced or imported at their optimal choice. More importantly, this model assumes these economic activities do not affect the world price, being a small-country assumption holds for Thailand. The model is detailed as follows.

Behavioral equations explaining manufacturers in the production sector consist of:

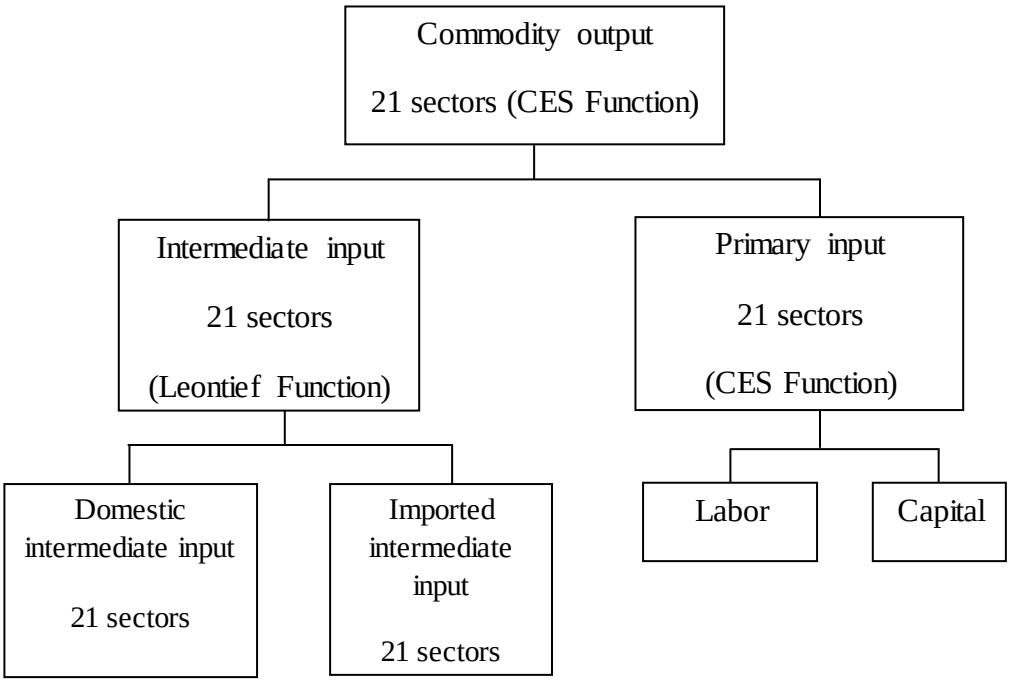
1.1) Equations of primary and intermediate input demand

This model assumes primary and intermediate inputs are used to produce the domestic output. The manufacturer's decision is based on cost minimization rule to determine the best mix of labor and capital which are mobile factors that can move between sectors to produce output at the lowest cost. The returns of these twos are different depending upon its production sector. In addition, the constant elasticity of substitution (CES) function between capital and labor is assumed. The elasticity can be different in different production sectors (Figure 1).

1.2) Equations of domestically sold output and for exports

The domestic output being allocated between domestic sales and exports is on the assumption of imperfect transformability, expressed by a constant elasticity of transformation (CET) function. The elasticity can be varied depending upon the product type.

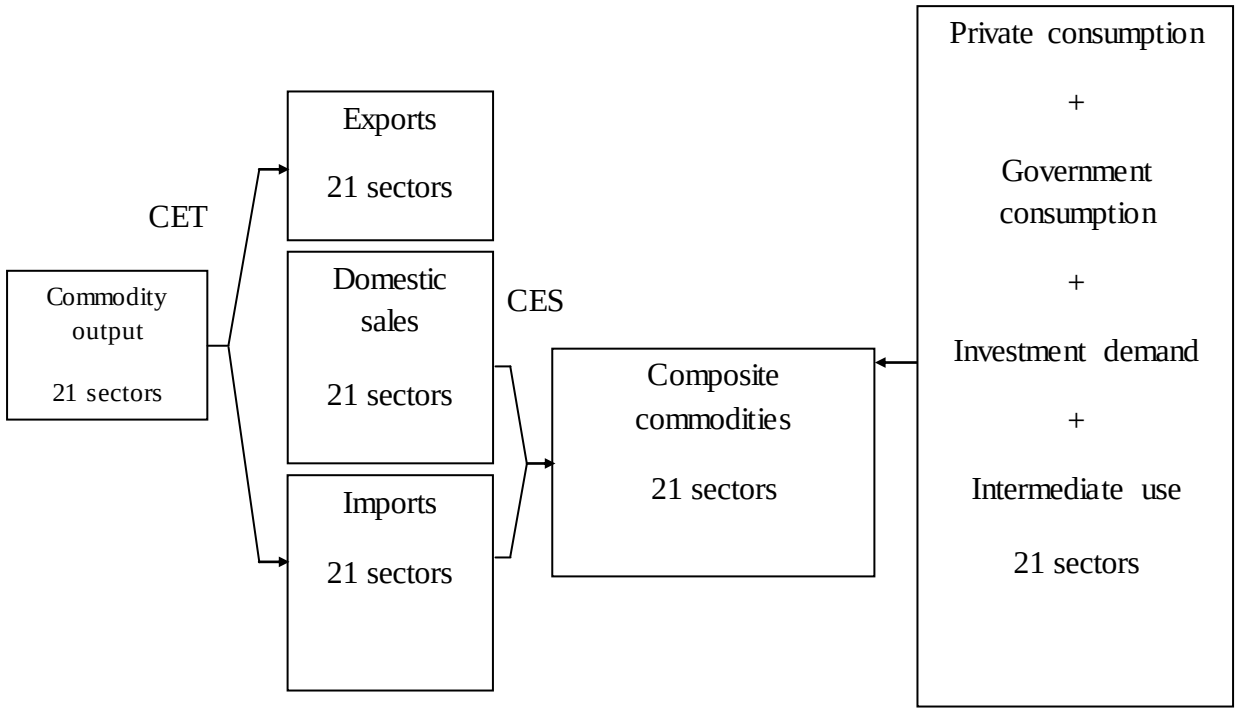
Figure 1 Production technology structure in standard computable general equilibrium (CGE) model



2)Final demand equation This equation explains investment demand on goods and services, household consumption and government consumption. The model assumes final demands of each goods and service type are in fixed proportions to total consumption.

3)Normal profit equation The model assumes the perfect competitive market structure. At economic equilibrium, the manufacturers can generate normal profit margin as a result. The resource allocation and consumption demand are illustrated in Figure 2.

Figure 2: Resource allocation and consumption demand structure in standard computable general equilibrium (CGE) model



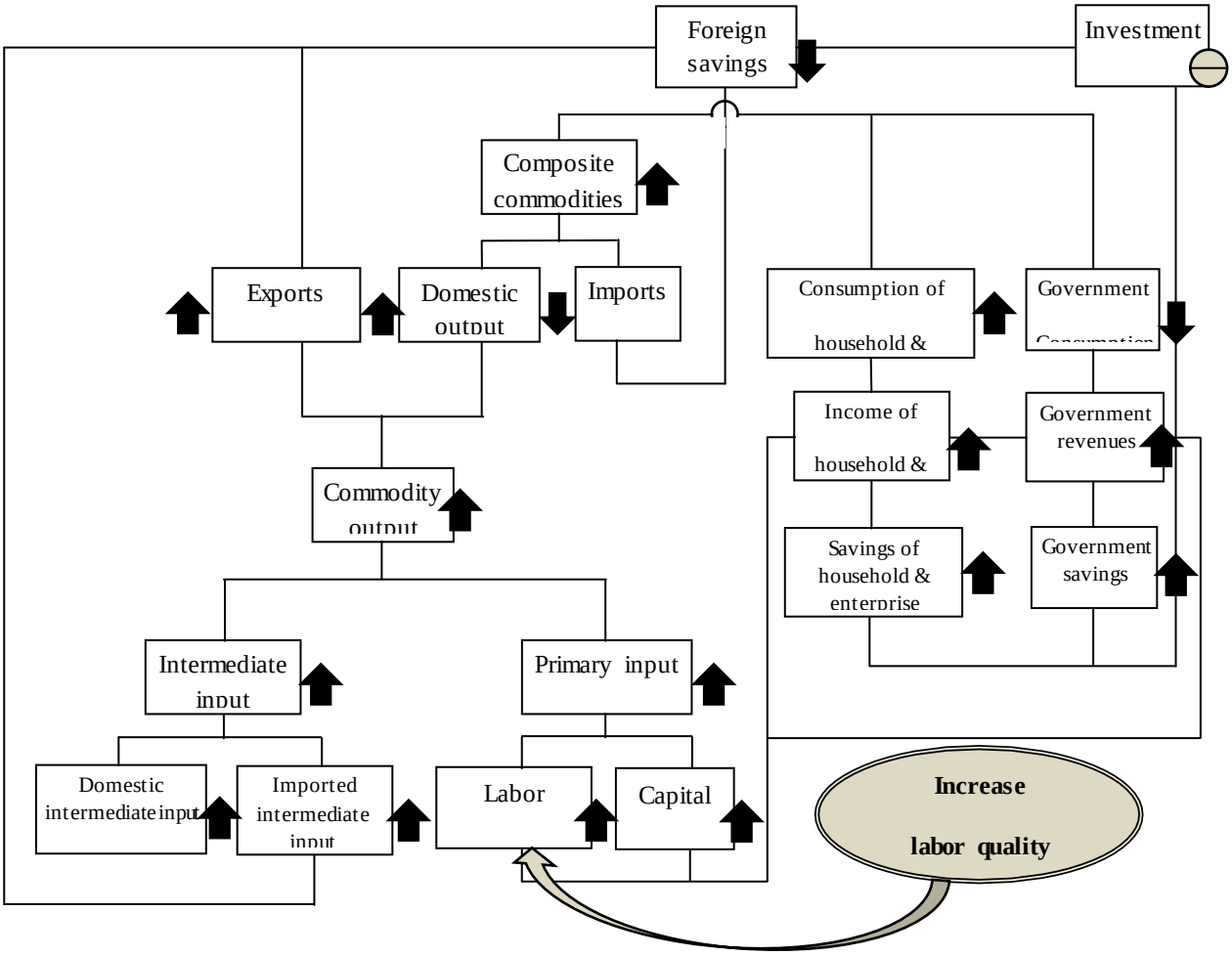
4)Economic equilibrium equation It consists of domestic market equilibrium, factor market equilibrium, balance of payment and saving and investment equality.

5)Relationship equation of economic units It consists of household income, household expenditure, government revenues and government expenditures, together with GDP equation and GDP deflator.

6)Closure rules in computable general equilibrium (CGE) model Four closure rules are applied i.e. foreign exchange market closure, savings-investment balance closure, government balance closure (government revenues and expenditures) and factor-market closure.

The use of computable general equilibrium (CGE) model to study the impacts of increased labor productivity of the service sector was simulated by changing the labor productivity level and being processed by transmission mechanism to predict the effect in the model (Figure 3).

Figure 3: Transmission mechanism process to predict the impacts of increased labor productivity of the service sector in standard computable general equilibrium (CGE) model



Results and Analyses

The impacts of increased labor productivity of the service sector both at macro and sectoral levels are gauged through three different scenarios with the labor productivity increased by 1, 2 and 3% relative to the baseline scenario Inverse of Labor Coefficient (Sauian, M.S. Kamarudin, N. and Rani, R.M. (2013)(Saipin Cintakulchai (2015) The simulation was conducted using the standard computable general equilibrium (CGE) model for Thailand's service sector. Ten sectors are included: Electricity and Water Supply System sector, Construction sector, Transportation and Logistics sector, Communication sector, Banking and Insurance sector, Real Estate sector, Public Administration sector, Education sector, Hospital sector and Wholesales-Retail Trade and Other Services sector. The details of simulation scenarios are presented in Table 1.

Table 1 Simulation scenarios

No	Sector	Labor Productivity			
		Baseline	Simulation Scenario		
			I	II	III
Service Sector (Sectors 11-20)					
11	Electricity and Water Supply System	8.61	8.70	8.78	8.87
12	Construction	13.54	13.68	13.81	13.95
13	Transportation and Logistics	7.88	7.96	8.04	8.12
14	Communication	6.26	6.32	6.39	6.45
15	Banking and Insurance	4.46	4.50	4.55	4.59
16	Real Estate	11.81	11.93	12.05	12.16
17	Public Administration	1.34	1.35	1.37	1.38
18	Education	1.71	1.73	1.74	1.76
19	Hospital	3.37	3.40	3.44	3.47
20	Trade and Other Services	6.19	6.25	6.31	6.38

Remarks: Simulation scenarios I, II and III are three different scenarios with the labor productivity increased by 1, 2 and 3% relative to the baseline scenario.

Source: By the author, calculation of an input-output table and the 2010 social accounting matrix (SAM)

The results from the standard computable general equilibrium (CGE) model reveal that an increase of 1% labor productivity for all 10 sectors leads to the increase of 1.75% real GDP relative to the baseline scenario. The real consumption expenditures of household, government and investment increase by 1.23, 0.40 and 0.80%, respectively. While the real exports increase by 1.02%, the real imports decreased by 0.16% (Table 2). For scenarios II and III when there is an increase of 2 and 3% labor productivity relative to the baseline scenario, the real GDP increases by 2.19 and 2.64%, respectively.

Table 2 The impacts of increased labor productivity of the service sector at macro level

Macroeconomic Variables	Labor Productivity (Percentage Change from Baseline)		
	I	II	III
Real GDP	1.75	2.19	2.64
- Real Household Consumption Expenditure	1.23	1.52	1.80
- Real Government Consumption Expenditure	0.40	0.49	0.56
- Real Investment Expenditure	0.80	0.95	1.11
- Real Exports of Goods and Services	1.02	1.43	1.88
- Real Imports of Goods and Services	-0.16	-0.12	-0.06

Remarks: Simulation scenarios I, II and III are three different scenarios with the labor productivity increased by 1, 2 and 3% relative to the baseline scenario.

Source: By the author, calculation of standard computable general equilibrium (CGE) model

Considering the impacts on domestic output at sectoral level, the results show that an increase of 1% labor productivity relative to the baseline scenario for all 10 sectors has a positive direct effect on domestic output. The vast increase mostly occurs in Public Administration sector with the domestic output increase of 99.8% relative to the baseline scenario. Reason being this sector has a high share of labor cost (52.74% of total production cost), followed by Education sector with the domestic output increase of 07.7% (given 60.58% share of labor cost in total cost), Hospital sector with the domestic output increase of 58.3% (given 70.29% share of labor cost in total cost) and Banking and Insurance sector with the domestic output increase of 71.2% (given 43.22% share of labor cost in total cost).

In addition, the indirect effect on domestic output caused by the 1% increase of labor productivity relative to the baseline scenario also happens in Paper Industries and Printing sector with the domestic output increase of 87.1%, followed by Mining and Quarrying sector 76.0)% (and Rubber, Chemical and Petroleum Industries sector 54.0)%((Table 3).

Table 3 The impacts of increased labor productivity of the service sector at sectoral level

		in baseline (Millions of THB)	(Percentage change from baseline)		
			I	II	III
1	Agriculture	1,787,359.15	0.18	0.22	0.27
2	Mining and Quarrying	477,001.44	0.76	0.95	1.15
3	Food Manufacturing	2,381,197.04	0.20	0.25	0.30
4	Textile Industry	771,757.05	0.10	0.12	0.15
5	Saw Mills and Wood Products	199,231.61	0.22	0.28	0.33
6	Paper Industries and Printing	256,166.92	1.87	2.33	2.81
7	Rubber, Chemical and Petroleum Industries	2,904,469.11	0.54	0.68	0.82
8	Metal, Metal Products and Machinery	399,582.39	0.48	0.60	0.73
9	Non-metallic Products	5,875,674.36	0.11	0.13	0.16
10	Other Manufacturing	1,050,616.24	0.16	0.19	0.23
11	Public Utilities	1,167,225.72	1.40	1.75	2.11
12	Construction	915,044.39	0.89	1.11	1.34
13	Transportation and logistic	1,352,636.08	1.53	1.91	2.31
14	Communication	501,398.00	1.93	2.41	2.90
15	Banking and Insurance	777,806.15	2.71	3.38	4.08
16	Real Estate	361,600.09	1.02	1.28	1.54
17	Public Administration	640,814.70	8.99	11.23	13.54
18	Education	525,714.77	7.07	8.83	10.65
19	Hospital	278,936.45	3.58	4.48	5.40
20	Wholesale Trade and retail trade	4,676,497.47	1.95	2.43	2.94
21	Unclassified	214,652.73	0.44	0.55	0.66
Total		**27,515,381.85**	**1.16**	**1.45**	**1.75**

Remarks: Simulation scenarios I, II and III are three different scenarios with the labor productivity increased by 1, 2 and 3% relative to the baseline scenario.
Source: By the author, calculation of standard computable general equilibrium (CGE) model

Comparing the three different scenarios with the labor productivity increased by 1, 2 and 3% relative to the baseline scenario. An increase of 1% labor productivity produces 1.16% of total domestic output. For scenarios II and III when there is an increase of 2 and 3% labor productivity relative to the baseline scenario, the total domestic output increases by 1.45 and 1.75%, respectively.

Conclusions and Recommendations

As per the findings unveil, the increase of labor productivity through the labor quality uplift in the service sector shows the positive impact on Thai economy both at the macro and sectoral levels. It also enhances the global competitiveness in the service sector, particularly those labor intensive sectors i.e. Public Administration sector, Education sector, Hospital sector and Banking and Insurance sector. On top of that, the increase of labor productivity also produces a positive indirect effect, especially for production sectors which are highly inter-linked with other service sectors i.e. Paper Industries and Printing sector, Mining and Quarrying sector and Rubber, Chemical and Petroleum Industries sector.

For government units, being responsible for industrial development, labor productivity or labor quality improvement can consider to improve labor productivity by pursuing high quality education system for both vocational and academic education, reinforcing universities to engage the private sector in curriculum development to better understand market needs, reinforcing universities to continuously imbuing students on theoretical-practical knowledge in their field, reinforcing companies to provide an employee training and development program, implementing effective employee appraisal system, investing in research and development, etc.

Suggestions for future research, the impacts of increased labor productivity for the service sector can be investigated between small and medium-sized enterprises (SMEs) versus large enterprises and doing the subgroup analysis between skilled and unskilled labor to better understand the magnitude of impact in different workforce segments.

References

Bureau of Labor Statistics (BLS), BLS Handbook of Methods: Chapter 11: "Industry Productivity Measures." 13th December 2010. Referred from Anothai Phutharee; and Poontarik Supha-amornkul; and Pornsawan Rakpentum. "Labour Productivity Index." Bangkok: Bank of Thaialnd, 2010.

Dervis, K., De Melo, J., & Robinson, S. (1982). "General Equilibrium Models for

Development Policy." Cambridge, UK: Cambridge University Press. Quoting Hans Lofgren, Rebecca Lee Harris, & Sherman Robinson; with assistance from Marcelle Thomas and Moataz El-Said. International Food Policy Research Institute, 2002.

Dilaka Lathapipat and Thitima Chucherd. (2013). "The Role of Labor Market and Capacity Competition of Thailand" Bank of Thailand. Discussion Paper 03.

Dixon, P. B., B. R. Parmenter, A. A. Powell, & P. J. Wilcoxen. (1992). "Notes and Problems in Applied General Equilibrium Economics." New York: North-Holland. Quoting Hans Lofgren, Rebecca Lee Harris, & Sherman Robinson; with assistance from Marcelle Thomas and Moataz El-Said. International Food Policy Research Institute, 2002.

Gilles Mourre. "Underutilisation of Labour in (continental western) Europe: A Detailed GDP Accounting Perspective." Brussels: Solvay Brussels School of Economics and Management, 2009. (Mimeographed).

Ginsburgh, V., & Keyzer, M. (1997). "The Structure of Applied General Equilibrium Models." Cambridge, Massachusetts: MIT Press. Quoting Hans Lofgren, Rebecca Lee Harris, & Sherman Robinson; with assistance from Marcelle Thomas and Moataz El-Said. International Food Policy Research Institute, 2002.

International Labour Organization (ILO), "Key Indicators of Labour Market (KILM)." 2010. Referred from Anothai Phutharee; and Poontarik Supha-amornkul; and Pornsawan Rakpentum. "Labour Productivity Index." Bangkok: Bank of Thailand, 2010.

Kanchana Chokpaisarnsin. (2002). "Analysis of Total Factor Productivity Growth in Thailand (1977-1999)". (Doctoral dissertation). Chulalongkorn University (in Thai).

Paitoon Kraipornsak (1998), The Role of Total Factor Productivity Growth in the Thai

Economy. Thammasat Economics Journal, 16(2), pp. 5-54. (in Thai).

Pradit Charsombut and Anuthep Kitprathan, "Labor Productivity in Thailand 's Manufacturing Sector." Journal of Economics, Kasetsart University (January-June 1996), pp. 1-12. (in Thai).

Robinson, S. (1989). "Multisectoral Models," In H. Chenery and T. N. Srinivasan (Eds.), Handbook of development economics, vol. 2 (pp. 885-947). Amsterdam: North-Holland. Quoting Hans Lofgren, Rebecca Lee Harris, & Sherman Robinson; with assistance from Marcelle Thomas and Moataz El-Said. International Food Policy Research Institute, 2002.

Sethaput Suthiwart-narueput and Sirikanya Tunsakul (2014), Seven Causes of Low Productivity of the Thai Labor Force, Thailand Future Foundation.

Shoven, J. B. (1976). "The Incidence and Efficiency Effects of Taxes on Income from Capital." Journal of Political Economy, 84(6), pp. 1261-1283.

Shoven and Whalley, "A General Equilibrium Calculation of the Effects of Differential Taxation of Income from Capital in the U.S." Connecticut: Yale University, 1972. (Mimeographed).

Sumalee Santipolavut, Sopachart Sukharomana, Rosada Vesdapunt, and Sommai Udomwitid . (2004). "A study of Labor productivity, the relationship between real wage and wage rate, and Change in modern technology". Bangkok: Kasetsart University. (in Thai).

The National Account Division of National Economic and Social Development Board and The World Bank. (2007). "Measuring Output and Productivity in Thailand's Service-producing Industries." pp. 22-26.

Whalley, J. (1977). "The United Kingdom Tax System, 1968-1970: Some Fixed Point

Indications Of Its Economic Impact", Econometrica, 45(8), pp. 1837-1858.