博士学位論文

Impact of the Lewis Turning Point on the Industrialization and the Capital Accumulation in Thailand 1960-2015: A Counterfactual Analysis of Corporate Income Tax

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Impact of the Lewis Turning Point on the Industrialization and the Capital Accumulation in Thailand 1960-2015: A Counterfactual Analysis of Corporate Income Tax

Dissertation
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ABSTACT

Thailand should take action on the reform so that Thailand will be more competitive in the next century since the recent Thai economic growth was far from very impressive, according to the previous Asian financial crisis. This dissertation applied the "Lewis-Ranis-Fei theory" and a shred of empirical evidence to investigate the impact of Lewis turning point to industrialization and the capital accumulation of Thailand. The study found that since Thailand had passed the turning point around 2000, Thailand's industrialization has been going in a slower pace because of insufficiency in cheap labor. The decrease in profit share leads to lower savings and underinvestment. Consequently, country growth is hardly seen, and reform is urgently needed. Here, we study the impact of the corporate income tax reform, one of the policies that can boost investment, by using the counterfactual analysis to see the impact on the level of investment and on Thailand’s economy after the tax reform is undertaken as soon as possible when the economy passed the turning point. We simulate two choices of the corporate income tax reform, revenue-neutral, and expenditure cut scenarios. The result from the general equilibrium model shows that the reform tax in both scenarios has a positive benefit to the long-term investment and to Thailand’s economy. If both scenarios are compared, the expenditure cut seems difficult at a glance, but we can benefit from the better result in the long run. Thus, Thailand should reform the tax in order to be more economically competitive in the near future.

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Thongchart Bowonthumrongchai

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CHAPTER 1
Introduction

1.1 Significance of the Study

Labor mobility has become a significant driver of the current economic globalization, especially the movement of unskilled labor between rural and urban areas. In the early stage of economic development, the shifting of population from rural to urban areas, “urbanization”, is the phenomenon that occurred worldwide in terms of bringing economic growth and taking advantages of wasteful surplus labor in rural areas. Lewis (1954) and Ranis and Fei (1961) propose the well-known theory of economic development called the Lewis-Ranis-Fei model. It describes the transition of developing economy from an unlimited supply of labor to a shortage of labor supplies. The model categorizes the economy development into three phases. The most mentioned one is the phase of the Lewis turning point (Commercialization point), where laborers in the whole economy work at their full potentials. The economies which have passed the turning point are both benefits and losses. Lewis model is a famous tool used to study the development path from an agriculture-based to a modern manufacturing-based economy.

During the 1960s, Thailand's Economy had extremely been driven by agriculture sector, the main source of employment in Thailand. Over a period of time, Thailand’s economy strictly follows the Lewis theory by absorbing the low productivity labor to the manufacturing sectors, which have higher productivity. Thailand has obviously shifted from agriculture-based to manufacturing and service-based economy with a massive amount of migration. Recently, labor shortage in the agriculture sector is now a main concern of Thailand's economy. However, there is no empirical study in Thailand discussing when the shortage labor began or in other words, specifying Thailand’s turning point.

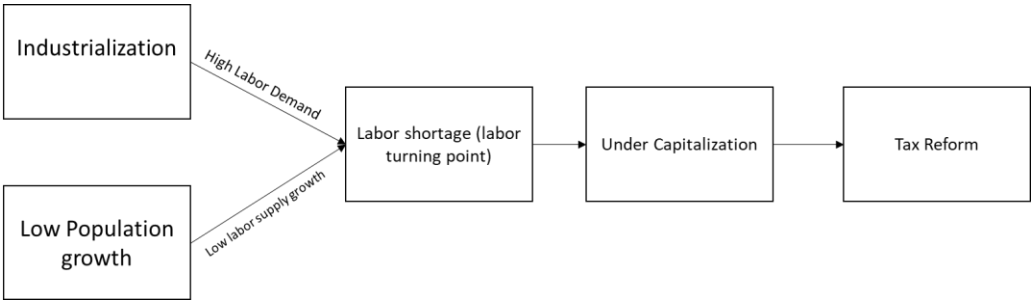
After the turning point, Thailand's economy has experienced a structural change during its rapid growth in 1997 during the Asian financial crisis. The process of capital accumulation is affected by the crisis and the slowdown after crisis. Thailand seems to slow its economic growth after the 1998 crisis of which the growth rate is lower than pre-1998 period from 5-10 to 0-5 percent after 1998. Inada, Sekiguchi, and Shoda (1992) proposes the theory of development

examining the conditions which a developing country can "take-off." The take-off is the self-sustainable growth of heavy industry. Japan is successful in undertaking this case. We will discuss if Thailand's economy strictly follow the theory, the effects of labor turning point on the take-off of the economy, and the reasons why Thailand failed to use the take-off but it is stuck in the middle-income trap and cannot follow the take-off of East-Asian economy.

Foreign Direct Investment (FDI) is necessary for any developing countries' economies like Thailand. They must enhance the domestic economic performance to compete with others. FDI inflow to Thailand had risen since 1985 but it has been slowed down after the 1997 crisis. Thailand's lost in competitiveness affects the profitability craving in the domestic market. Corporate tax reform is introduced here to promote Thailand's investment scheme. Several studies explain a positive impact on private investments and long-time economic growth after lowering the corporate tax rate. However, the tax cut still has a negative effect, especially on the government's budget constraint. It does not merely have effects on economy but also on the tighter expenditure of government. Therefore, the necessity of corporate income tax reform will be discussed here.

The objectives of this study are to identify the empirical turning point of Thailand, the impact on capital accumulation path, and recommend policy for further challenge. The analysis consists of three parts. The first part narrated Thailand's economic development, the migration, and the empirical turning point of Thailand. The second part is the effect of the turning point on Thailand's economic development especially capital accumulation. The final part simulates the tax reform effect by using the general equilibrium macroeconomic model.

Figure 1.1 The conceptual framework of this dissertation



1.2 Research objectives

1. To study the path of rural-to-urban migration and the labor market progress using the Lewis-Ranis-Fei model and find which stage the economy of Thailand is standing as per the Lewis-Ranis-Fei model. In other words, has Thailand yet passed the Lewis turning point?
2. To study the path of capital accumulation of Thailand and the transition from light industries-based economy to an economy with heavy industries.
3. To analyze the impact of a labor turning point on industrialization and the key economy factors
4. To measure the impact of corporate income tax reform for Thailand.

1.3 Scope of the study

The scope of this study focusses on the development of the labor market, migration, capital accumulation, and impact on the economic growth of Thailand between 1960-2015

1.4 Chapter's composition

After Chapter 1, Introduction, chapter 2 will narrate the economic development of Thailand, the migration, and the turning point of Thailand. Chapter 3 is the effect of turning point to the capitalization and industrialization, Chapter 4 is the empirical model simulation of the tax reform, and Chapter 5 is a conclusion.

CHAPTER 2

Economic development and the Lewis turning point in Thailand 1960-2015

Since the 1960s, Thailand had been an economic rising star as the rapid growth five to ten percent a year. Thailand also has been being an impressive structural change country by shifting from an agrarian economy to an export-led economy. However, during the mid-1990s, The Asian financial crisis, Thailand has started to collapse and never back to be impressive growth again.

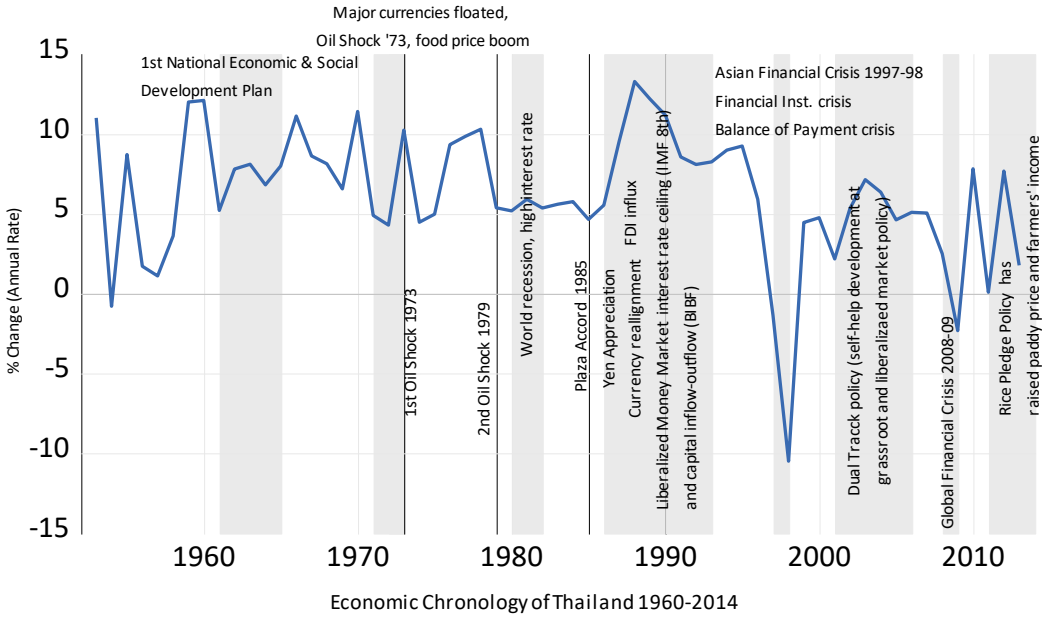
What cause Thailand, which once was expected to be a "Newly developed country" of Asia, becomes trapped in a middle-income country for a long time? This chapter would like to provide the historical story of Thailand's economic development before 1997 and the failure after the crisis in the perspective of labor migration, capital accumulation, and the school of turning point theory. We report the overview of economic development, industrialization along with migration to move the labor from the less productivity to higher productivity sectors, and the empirical turning point analysis for Thailand.

2.1 Overview of Economic Development of Thailand 1960-2015

The macro-economic performance in Thailand has been subjected to several epochs. The growth record was quite impressive until the Asian Financial Crisis in 1997-1998. Thailand has gradually reached the status of a middle-income country after that due to the weak growth comparing the before crisis periods.

Figure 2.1 provides an overview of Thailand's economic development. The economic growth episode of Thailand has been taken-off since 1954 and continually expanded until 1960. The first National Economic and Social Development Plan has been established to promote investment. Under the plan, basic institutions were set up to facilitate planning and infrastructure development. The push of investment expands export growth. The expansion in export had shifted from main agriculture commodities (rice, rubber, corn, and cassava) to more light industry commodities (Textiles and garments) as shown in the table below.

Figure 2.1: Economic Chronology of Thailand 1960-2015



Note: The economic chronology has not described the *domestic disruptions* from a series of *political unrests* in Thailand. We have treated them as e*ndogenous impulse responses to external shocks, e.g., Vietnam War and* between imbalanced *class struggles* among the power bases. It is assumed to be non-economic Chronology as such.

Source: Limskul and Bowonthumrongchai (2019)

Table 2.1 Export share of Thailand 1958- 1983

	1958	**1963**	**1968**	**1973**	**1978**	**1983**
Rice	46.0	35.4	27.6	11.2	12.6	13.8
Rubber	20.6	18.7	13.3	14.2	9.7	8.1
Corn	2.8	8.9	12.0	9.2	5.2	5.8
Tin	4.0	7.7	11.0	6.3	8.7	3.6
Cassava	3.0	4.5	5.6	7.9	13.1	10.5
Teak	3.7	1.4	1.2	1.3	0.3	-
Wooden products	0.0	0.1	0.1	1.4	1.2	0.9
Sugar	-	1.3	-	3.6	4.8	4.3
Shrimp	-	0.5	2.0	2.5	1.8	2.2
beans	0.4	0.6	1.0	1.2	1.4	1.1
Po	1.1	0.7	4.9	3.3	0.5	0.8

	1958	1963	1968	1973	1978	1983
Tungsten	0.1	0.03	0.3	0.8	1.2	0.1
Fluoride	-	0.07	0.8	0.7	0.2	0.2
Textile	-	-	-	2.1	8.3	10.0
gem	-	-	-	-	2.5	4.9
Tobacco	1.3	0.4	1.5	1.0	1.4	1.2
electronic board	-	-	-	-	2.6	4.0
Canned pineapple	-	-	-	-	1.4	1.3
cement	0.2	0.6	0.1	1.0	0.04	-
other	16.8	15.1	18.6	32.3	23.1	27.2
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

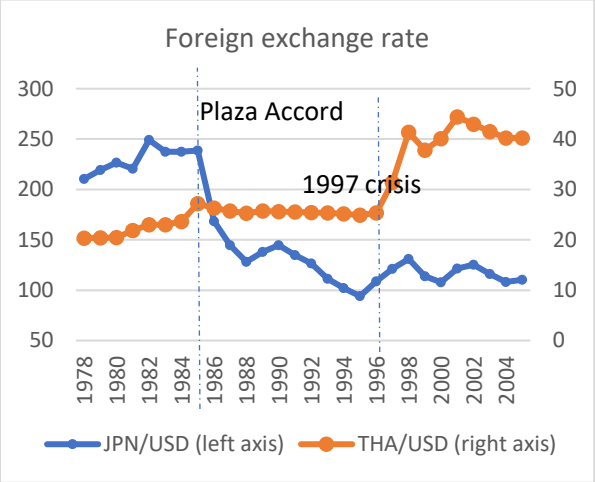
Source: Manarangsan (2009)

During 1970-1980, the float of major world currencies and commodities boom flowed by the oil crisis interrupted Thailand's growth. Due to the collapse of the Bretton Woods system in 1973, the major world currencies were floated, and commodities boom flowed by the first oil crisis in 1973 and the second oil crisis in 1979. The end of the Bretton Woods system in 1973 affects a lot to the Thailand's economy that used the fixed exchange rate system of Thai baht per US dollar. First, because of the depreciating of the US dollar, Thailand was affected by high inflation, which was between 7 – 10 percent per year. The growth of GDP slightly declined from 7 percent per year on average during the 1970s to 5.5 percent per year in the early 1980s. Secondly, however, the export expanded well due to the lower export price because of the weakness of the US dollar. The price hike in agriculture prices still benefits Thailand's economy. In 1980-1985, Thailand entered a recession and ran into a problem of balance of payments due to the low export price and high import price according to the second oil shock in 1979. Thailand's export growth was negative for the first time in the past centuries in 1983.

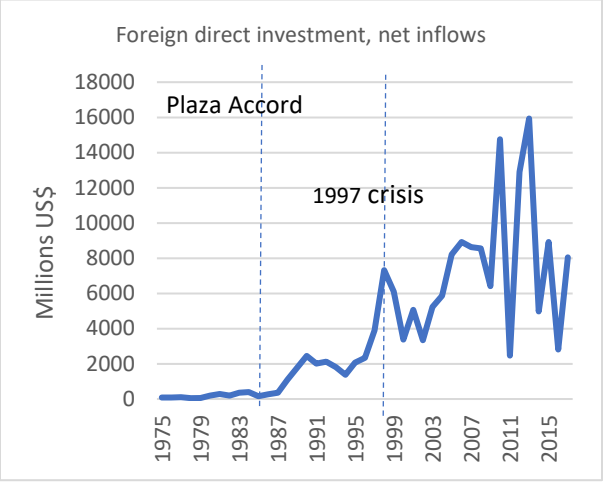
In the 1980s, Thailand's economy had entered a boom period after the Plaza accord agreement. From 1980 to1985, the US dollar had appreciated by 50 percent against major currencies. This caused difficulties for American industries to export their goods. At the same time, the major European nations and Japan experienced a negative GDP growth and a large current account surplus against the United States. Thus, in 1985, the Plaza accord agreement was signed

by G5 nations[1] at the Plaza Hotel in New York City to force the US dollar depreciated and reduce the trade deficit. After the agreement, the devaluation of the US dollar made US exports more competitive in the market again. Thailand's economy benefits from the devaluing of the US dollar, making Thailand's exports more competitive. Thailand's economy was instantly recovery back, in which the debt-service ratio decreased from 21.9 percent in 1985 to 17 percent in 1987, GDP growth by 7.1 percent, and export growth by 28.5 percent.

Figure 2.2: Effect of Plaza Accord 1985 to exchange rate and FDI to Thailand



(a) Foreign exchange rate



(b) Foreign Direct investment

Source: WDI, World bank

This has led the Japanese foreign direct investment poured to other East Asian economies as well as Southeast Asian countries. Thailand has been one of the major recipients of FDI from Japan and developed countries in the 1987-1990's. After 1987, foreign direct investment from Japan had played an important role in the economic growth of Thailand. According to the Plaza accord, the exchange rate value of the *US dollar versus the Japanese yen had quickly declined by 51%from 1985 to 1987* (Figure 2.2a). In 1987, the Louvre Accord was signed in Paris to stabilize the currency markets and slow down the depreciation of the US dollar. However, the US dollar continued to decline. The appreciation of the Japanese yen resulted in the stagnant of JP export growth and loss of its comparative advantage.

Moreover, an expanded monetary policy by the Japanese government encouraged the bubble price in the economy since most of the loans went to speculate in the real estate market and

[1] Including West Germany, France, the United States, Japan and the United Kingdom.

stock market instead of expanding the production side. As a result, Japanese industries had relocation by shifting investment into cheaper countries, including Thailand, in order to move the production base. Thus, foreign direct investment to Thailand, especially from Japan, had increased rapidly since 1987 (figure 2.2b). Table 2.2 shows the net flows of foreign direct investment to Thailand by countries. Japan's direct investment in Thailand holds the highest proportion among countries during 1987-1991, which peaked at 52 percent in 1988. The share of Japan declined after 1989, in which Hongkong and ASEAN countries increased in percentage share.

Table 2.2 Source of Foreign Direct Investment to Thailand Classified by Countries 1987-1997 (Percentage share)

	1987	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**
Japan	36.14%	52.24%	41.06%	44.50%	30.34%	15.94%	23.05%	20.59%	27.77%	23.06%	36.01%
Hong Kong	8.80%	9.99%	12.51%	12.01%	22.51%	27.06%	10.57%	21.56%	13.93%	9.47%	12.59%
Taiwan	7.60%	11.22%	11.08%	11.45%	5.36%	4.13%	3.68%	15.81%	4.82%	6.08%	3.90%
USA	20.08%	11.39%	11.42%	9.35%	11.52%	21.93%	18.45%	27.54%	12.97%	18.91%	21.95%
EU	10.40%	8.04%	8.36%	6.86%	7.71%	12.81%	15.73%	17.71%	7.57%	7.24%	9.10%
ASEAN	5.87%	5.89%	6.15%	10.30%	12.80%	13.34%	13.58%	-17.22%	8.00%	13.58%	9.07%
Switzerland	8.69%	1.99%	2.69%	1.26%	2.38%	1.44%	0.66%	4.51%	0.79%	2.29%	3.35%
South Korea	0.25%	1.09%	0.56%	0.78%	0.58%	0.49%	0.88%	2.16%	0.62%	1.09%	0.78%
China	0.70%	0.69%	0.30%	0.16%	0.08%	-0.21%	0.42%	-0.20%	0.09%	0.17%	-0.24%
Australia	0.28%	0.15%	0.25%	0.19%	3.55%	0.31%	-2.28%	1.82%	1.26%	1.50%	3.25%
Canada	0.12%	0.22%	0.37%	0.15%	0.30%	0.17%	0.36%	0.77%	-0.12%	0.05%	0.04%
Others	1.07%	-2.90%	5.26%	2.98%	2.89%	2.59%	14.89%	4.96%	22.29%	16.56%	0.20%
Total	**100.00%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**

Source: Bank of Thailand

Thailand had entered the extraordinarily high growth period. The rapid economic growth of Thailand caused by the relocation of large companies come to Thailand and the export of goods to generate income into the country. Thailand's economy quickly expands not only from the real sector but also in the asset market. Table 2.3 shows the average growth during 1972-1995 and the sources of growth from the supply side. The average growth in 1987 suddenly increases to 10.94 per year, on average from 5.37 per year in the previous several years. The growth was mainly from capital growth which was around 7.26 percent per year increasing from 4.36 percent per year

during 1982-86. The total factor productivity (TFP) was 2.82 percent per year which consider a high growth comparing to 0.43 percent per year during 1982-1986. The rapid growth according to the FDI from the rest of the world led Thailand to be one of the East Asia miracle countries (World Bank, 1993).

Table 2.3: Sources of Growth from the Supply Side in Thailand 1972-1991
(Measured in Percentage per year)

Year	Avg. GDP growth	Labor growth	Land growth	Capital growth	TFP
1972-76	6.53	0.68	0.31	3.06	2.49
1977-81	7.23	1.52	0.26	4.60	0.85
1982-86	5.37	0.54	0.05	4.36	0.43
1987-91	10.94	0.87	0.00	7.26	2.82

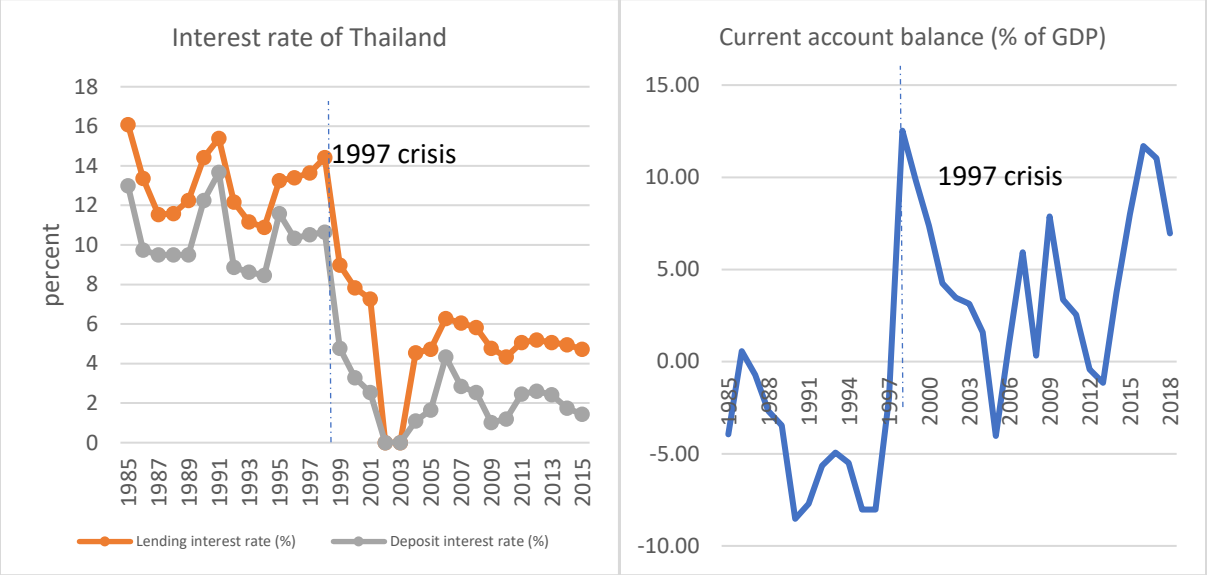
Source: Limskul and Bowonthumrongchai (2019)

After 1991, Thailand was running a current-account deficit due to the depreciation of the Thai Baht. The current account deficit was as high as 8% of GDP in 1995 (Figure 2.3b). In 1993, Thailand had decided to liberalize the money market to comply with the IMF 8th article by free the ceiling of interest rate and later allow a free flow of foreign capital by setting up the 'Bangkok International Banking Facility' or BIBF. As a result, the rapid capital had inflowed into Thailand from 1994-1997. The central bank, however, still pegged the currency at 25 baht to the dollar. Therefore, the Thai baht that fix to the US dollar still depreciated and reached the bottom around early of 1995. Exports in this period still grown well due to the depreciation in price. The rate of economic growth came from investment and export expenses for products and services. The accelerating investment in the private sector leads to a high amount of foreign borrowing. Nevertheless, the FDI inflow made the balance of payments continually surplus and is at a satisfactory level.

. The open of money and the capital market had been against the 'Impossibility Trinity'. To promote stable export earnings of foreign currency, under a fixed exchange rate regime, Thailand must not rely too much on free capital flow. However, the current account deficit for a developing country like Thailand must allow an automatic adjustment on the capital account to balance. In

such sake, the interest rate arbitrage would need to run a high-interest policy domestically. Clearly, this will harm export as the cost of production of export will increase. Thus, the free capital inflow would be contractor require to cushion the rising of domestic interest rates. The cheap capital and oversupply of money have caused any inflationary impact. In order to hedge against these inflationary, speculators would need to hoard non-producing assets rather than real investment goods. This had resulted in the accumulation of 'non-tradable' goods such as 'real estate'. Land price has boomed artificially dressing the balance sheet of private banks and finance companies.

Figure 2.3 Interest rate and Current account balance of Thailand 1975-2015



Source: World Bank

During 1995-1997, the US dollar stopped depreciating and started appreciating again. The appreciation of the Thai baht hampered the exports of Thailand. Thai government became unable to maintain its currency peg to the dollar and decided to float the exchange rate system. As a result, the Thai baht had quickly floated from 25 baht per dollar in 1996 to 57 baht per dollar in 1998. Then, the economy was quickly collapsed due to the Baht crashed. The Asian Financial Crisis had originated from Thailand in 1997, as the bubble busted, banking crisis, and balance of payment crisis thereafter. Thailand by the central bank of Thailand was defeated from currency war with speculators in February and May 1997.

After the crisis, as the Thai currency has been reduced, the cost of export products in Thailand has decreased. The Thai economy has recovered quickly through export-driven from 30% exports to more than 70% of GDP. However, GDP growth was never back as high as before the bubble burst even the foreign direct investment was higher than the previous crisis.

The overview of Thailand's economic development shows the vital factors that are key factors contributing to the fluctuation of the historical growth of Thailand, mainly the external factors. The key situations that affect a lot to the growth of Thailand are 1. Plaza accord in 1985 leads to a high level of foreign direct investment 2. The Asian Financial crisis in 1997 makes Thailand's economy collapsed

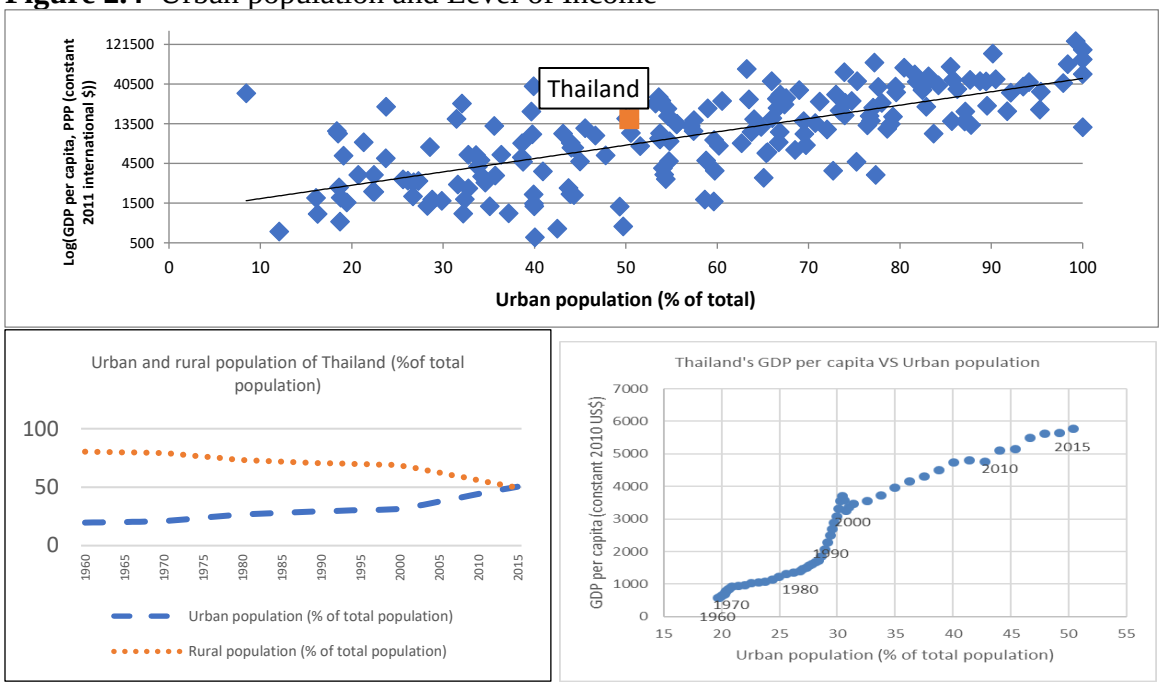
Lastly, the internal migration that has not been mentioned in this session yet, has been the key factor that major contribution to economic growth. In the next session, we will focus more on the role of urbanization and its contribution to the growth of Thailand’s economy.

2.2 Internal migration in Thailand

2.2.1 Stylize facts

In the early stage of Thailand's economic development, the shift of labor from rural to urban area, “urbanization”, is occurred in terms of creating economic growth and taking advantage of wasteful surplus labor in a rural area as Lewis (1954) theory of economic development. Figure 2.4 confirms a positive relationship between urban population fraction and the level of income. Thailand's urban population growth has been rapid over the past two decades and is around half in 2014 with a certain level of income. Thailand has shifted from agriculture-based economies to manufacturing and service-based economies. The number of personnel employed in agriculture changed from 80 percent in 1960 to 32 percent in 2015.

Figure 2.4 Urban population and Level of Income[2]

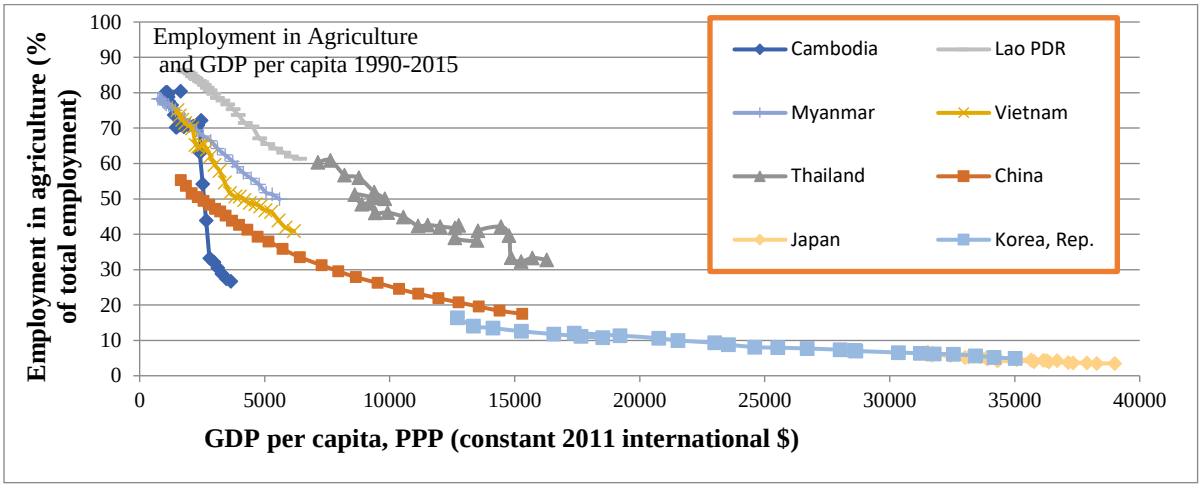


Source: World development indicator, World Bank.

More precisely, Thailand followed the footsteps of the transition path of those forerunners like Japan and Korea. The agriculture development of the selected Mekong economies as compared with some East Asian countries like Japan, Korea, and China is shown in Table 2.4 and Figure 2.5 respectively. In 2015, Thailand has its agriculture value-added of 8.6 percent as compared with the forerunners like Korea and Japan of 1.9 and 1.2 percent respectively. The employment in the agriculture sector of Mekong has adjusted with a time lag after the production share. Thailand and the Mekong economy still have a dominant share of employment in agriculture. Thailand has its employment share of 27.4 percent. The value-added and employment shares indicate the likelihood of an existing of the turning points. It may also be hypothesized from the rising trend of the agriculture value added per head of employers in Mekong economies that the agriculture sector is typical and following the path of transition.

[2] Urban population refers to people living in urban areas as defined by national statistical offices. The data are collected and smoothed by United Nations Population Division. (World bank).

Figure 2.5 Employment in Agriculture, GDP per capita and value-added per head 1990-2015



Source: World Bank (reproduced from Klyuev, 2015) and FAO stat

Table 2.4 Key Economic Indicators of Thailand, CLMV and east Asian countries.

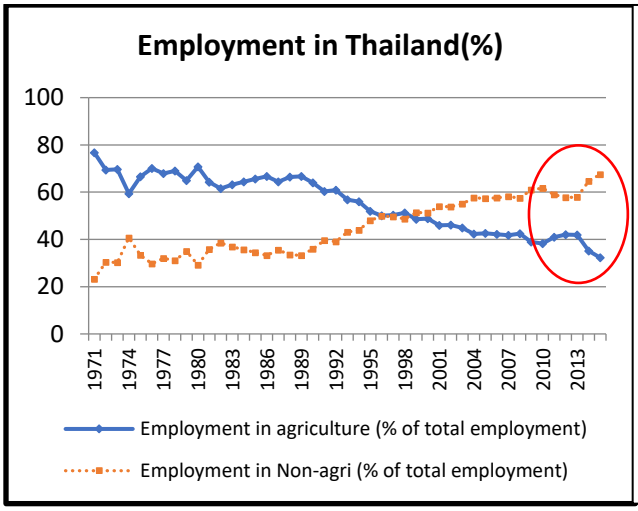
	Cambodia	Lao PDR	Myanmar	Vietnam	**Thailand**	China	Korea, Rep.	Japan
Agriculture, forestry, and fishing, value added (% of GDP)	24.7	17.2	25.5	16.3	**8.5**	8.6	1.9	1.2
Employment in agriculture (% of total employment)	27.4	62.0	51.3	41.9	**33.3**	18.4	4.9	3.5
Employment in industry (% of total employment)	27.1	9.5	16.3	24.8	**22.8**	26.8	24.9	25.6
Employment in services (% of total employment)	45.5	28.5	32.4	33.4	**44.0**	54.9	70.2	70.9
GDP per capita (constant 2010 US$)	1,079.1	1,642.7	1,408.1	1,735.3	**5,910.5**	6,894.5	25,484.0	47,660.9
Agriculture, forestry, and fishing, value added per worker (constant 2010 US$)	1,696.5	873.3	1,584.5	1,080.3	**2,797.8**	5,325.8	18,795.7	22,653.4
Services, value added per worker (constant 2010 US$)	1,593.2	NA	NA	3,405.5	**13,031.3**	10,509.5	37,151.3	91,829.5
Agriculture/Service ratio of value added per worker	1.06	NA	NA	0.32	**0.21**	0.51	0.51	0.25

Source: World Bank

In the previous day, agriculture plays a vital role in the growth of the Thai economy as it is a significant source of production and employment in the country. The shift in employment from

agriculture to industry and service can be seen in figure 2.6. The composition of the agricultural sector's employment reduced from 76.72 in 1971 to 32.28 percent in 2015 while the industry and service sector's employment increased from 16.38 and 6.85 in 1971 to 43.87 and 23.68 percent, respectively. The employment share in manufacturing is higher than in agriculture around 2010 while the percentage in non-agriculture (industries and services) exceed the employment share in agriculture around 1996 which means the agricultural sector is not a significant source of employment any longer.

Figure 2.6 Labor market characteristic in Thailand

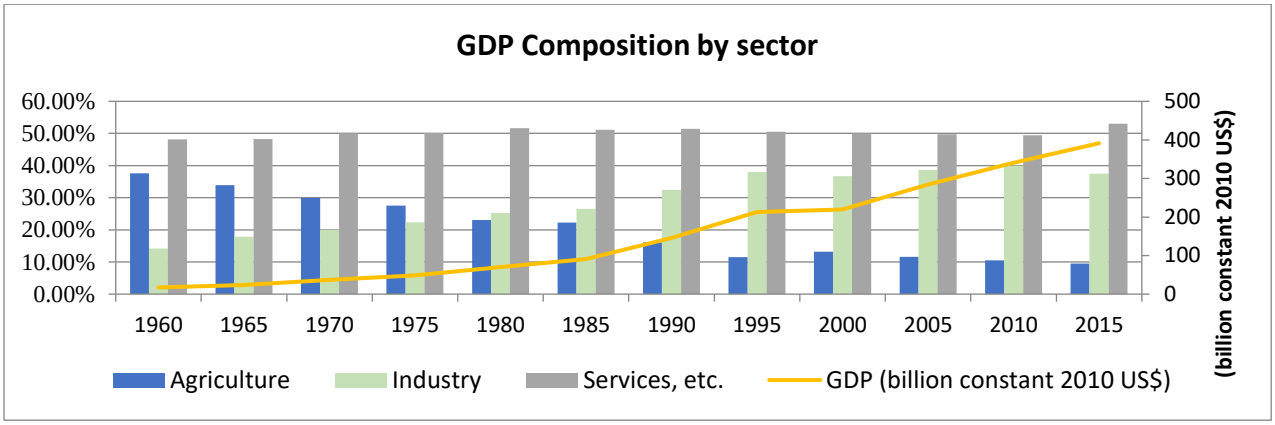


Million persons	Number of Persons Employed		Agriculture		Non-Agriculture		Unemployme	
1998	30.10	100%	13.41	44.5%	16.70	55.5%	1.41	4.7%
2000	31.29	100%	13.83	44.2%	17.46	55.8%	1.19	3.8%
2002	33.06	100%	14.04	42.5%	19.02	57.5%	0.82	2.5%
2004	34.73	100%	13.63	39.3%	21.09	60.7%	0.74	2.1%
2006	35.69	100%	14.17	39.7%	21.52	60.3%	0.55	1.5%
2008	37.02	100%	14.70	39.7%	22.32	60.3%	0.52	1.4%
2010	38.04	100%	14.55	38.2%	23.49	61.8%	0.40	1.1%
2012	38.94	100%	15.43	39.6%	23.51	60.4%	0.26	0.7%
2014	38.08	100%	12.73	33.4%	25.34	66.6%	0.32	0.8%
2016	37.69	100%	11.75	31.2%	25.95	68.8%	0.38	1.0%

Source: World Bank and Bank of Thailand

Before 1997, the year that caused an Asian financial crisis, Thailand's economy had grown rapidly along with industrialization which industry growth was more than 10 percent per year while the industry and service growth faster than agriculture one. After the crisis, it seems that the Thai economy is slow down which roughly growth around 4 percent a year. The Agriculture share in GDP composition reduced from 37.5 percent in 1965 to 9.46 percent in 2015 while the industry share of GDP increased from 14.24 percent to37.48 percent in 1965 and 2015, respectively. The agriculture growth is slowdown after the crisis which growth 0.62 -2.69 percent compared with 3.01-6.25 percent a year before the crisis.

Table 2.5 Thailand's economy by sector



Annual Growth*	**1960-1965**	**1965-1970**	**1970-1975**	**1975-1980**	**1980-1985**	**1985-1990**	**1990-1995**	**1995-2000**	**2000-2005**	**2005-2010**	**2010-2015**
Agriculture	4.75%	6.25%	3.79%	4.04%	4.60%	3.01%	0.89%	3.39%	2.69%	1.60%	0.62%
Industry	11.83%	11.47%	8.01%	10.37%	6.42%	14.36%	11.29%	-0.09%	6.41%	4.45%	1.45%
Services, etc.	6.94	9.76%	5.59%	8.39%	5.18%	9.98%	7.47%	0.43%	5.21%	3.55%	4.24%
GDP	**6.92%**	**8.94%**	**5.57%**	**7.74%**	**5.37%**	**9.88%**	**7.86%**	**0.60%**	**5.34%**	**3.68%**	**2.78%**

GDP Composition	**1960**	**1965**	**1970**	**1975**	**1980**	**1985**	**1990**	**1995**	**2000**	**2005**	**2010**	**2015**
Agriculture	37.58 %	33.93%	29.94%	27.49%	23.09%	22.25%	16.11%	11.54%	13.23%	11.65%	10.53%	9.46%
Industry	14.24 %	17.83%	19.99%	22.40%	25.27%	26.56%	32.45%	37.95%	36.67%	38.57%	40.01%	37.48%
Services, etc.	48.18 %	48.24%	50.07%	50.11%	51.64%	51.19%	51.44%	50.51%	50.09%	49.78%	49.46%	53.05%
GDP**	**17.19**	**24.02**	**36.86**	**48.34**	**70.17**	**91.13**	**145.94**	**213.03**	**219.46**	**284.65**	**341.11**	**391.32**

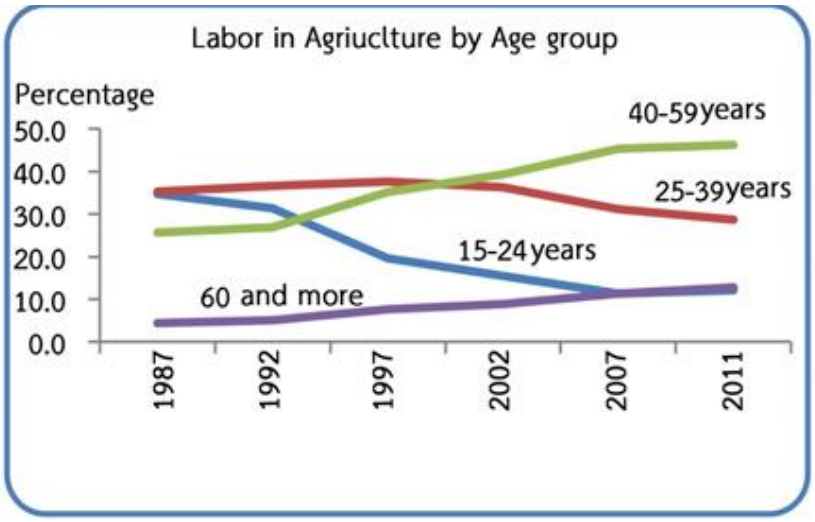
*Growth rates are shown as compound averages between the reported years.
**1997Asian Financial Crisis
***value added (billion constant 2010 US$)

Source: World development indicator, World Bank

A shift in employment from agriculture to industry and service can be observed as shown in the table. The composition of agriculture employment reduced from 76.72percent in 1971 to 32.28 percent in 2015 while industry and service employment increased from 16.38 and 6.85 in 1971 to 43.87 and 23.68 percent respectively. The direction of agricultural labor is also concerned because most laborers are aged, low-educated, gain low income, and the laborers in the new generation are not enough. According to the recently updated report by the Office of the National Economic and Social Development Board, the labor in the agricultural sector decreased from 38.94 million in 2012 to 37.69 million persons in 2016, or around 1.3 million persons within four years. The decline of employment in the agricultural sector is due to the relocation of workers to the non-agricultural sector because the weather is unpredictable, and the farmers are too aged to work.

Thailand had entered the aging society including the agricultural laborers. Meanwhile, the new generation of farmers has reduced as a result of schooling for social mobility and the rising wage gap between rural-urban during the last decades. The new generations have chosen to work in the non-agricultural sector, like the manufacturing and services sector instead. Meanwhile, the farmers from the new generation reduce because the agricultural business is full of strict conditions but gain unstable benefits, so the income does not attract them to work on the farm. They choose to work in the non-agricultural sector instead. The declining trend in agricultural labor is consistent with other agricultural areas which have decreased from the past around 0.16 percent per year after 2003[3]

Figure 2.7 Labor in agriculture by age group



Source: Bank of Thailand

Table 2.6 Employment by education 2001-2015

Agriculture	**2001**	**2005**	**2010**	**2015**
primary education and less	87.02%	83.72%	76.22%	77.58%
lower secondary	8.02%	10.71%	13.90%	14.36%
upper secondary	3.80%	4.02%	7.96%	6.54%
post-secondary	0.61%	0.63%	1.01%	0.68%
Bachelor or higher	0.56%	0.93%	0.91%	0.85%
Non-Agriculture	**2001**	**2005**	**2010**	**2015**
primary education and less	41.49%	37.95%	34.24%	31.30%
lower secondary	16.50%	16.97%	16.67%	17.06%
upper secondary	15.53%	16.82%	17.78%	17.80%

[3] https://www.thairath.co.th/content/953812 retrieved on 14 May 2018 (Thai language)

post-secondary	6.73%	6.60%	7.46%	6.95%
Bachelor or higher	19.75%	21.66%	23.85%	26.89%

Source: Labor Force Survey, the national statistical office

Agriculture's labors in Thailand still have low education. An employment composition by the education of each sector shows a change in skill labor used by the sector. According to the statistic, the agriculture sector uses mainly low education workers while the non-agriculture shift to use higher education more than in the past. This can be concluded that agriculture sector labor in Thailand still has a poor education and a lack of skilled labor. This comes to a concern about the lacking skill of labor required for the manufacturing sector. If we believe that the migration process occurred as agriculture is the source of labor for manufacturing. The age and low education make them stuck in low-productivity jobs in agriculture and neither cannot find a job in the city nor work in the informal sector.

In conclusion, from the perspective of the labor market, Thailand has changed her economic structure from agriculture-based to a manufacturing-based economy by pooling surplus labor from less productivity activity to higher productivity. The decline of employment in agriculture, as well as the decline of the working-age population, lead to the transition from a labor surplus economy to be a labor shortage economy.

The shortage of labor is one of the key factors that has affected a lot to Thailand's potential growth, wage level, income distribution, and investment. In economic theory, this situation is called "Lewis turning point", a situation in economic development where surplus rural labor is fully absorbed.

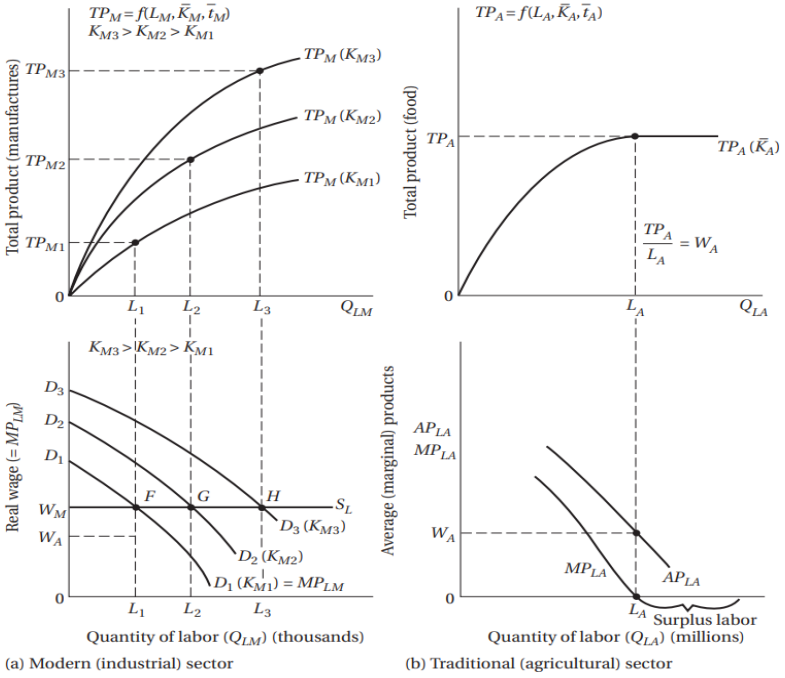
2.2.2 Lewis-Ranis-Fei theory of migration

The dual economy model is a famous tool to explain the coexistence of wages and internal migration. The model was first investigated by Lewis (1954) with the well-known paper, Economic Development with Unlimited Supplies of labor, and later formulated and extended by Fei and Ranis (1961) known as Lewis-Ranis-Fei theory of migration. The dual economy approach is the famous theory of theoretical models of development during the 1960s and early 1970s to encounter single sector models of economic growth. A dual economy consists of two sectors, agriculture (rural or traditional sector) and manufacturing (urban or modern sector) within one country. Typically, the main idea of the model is the labor in the manufacturing sector earns higher wages than in the agriculture sector, and the different characteristics between industries exist.

Many economists can explore the problems and points of economic development using the asymmetric dual economy, e.g. the migration between sectors. The dual approach plays an essential role in Economics development theory to study the early stage of development in developing countries.

One economy operates in the traditional sector using primary production. Other economies operate in the modern sector using advanced technology that requires a lot of skilled labor and physical capital. During economic expansion, the capitalist is absorbing the surplus labor from the traditional sector and reinvesting until the labor surplus in the economy completely absorb

Figure 2.8 Lewis model



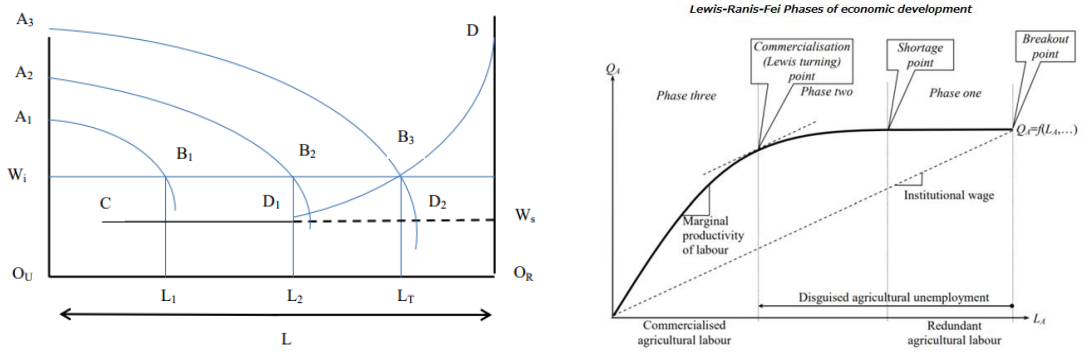
Source: Todaro and Smith (2012, pp.125)

The model can be illustrated as the figure. Consider the following two-sector economy, figure (a) shows the modern (industrial) sector while figure (b) shows the traditional (agriculture) sector. The upper graphs show the total production (TP) which depends on capital and labor. The capital in the agriculture sector is fixed ($\overline{K_A}$), hence, the total product varies by the only variable input, labor (L_A). The wage in the agriculture sector assumes to be determined by average product

(AP_{LA}) not the marginal product (MP_{LA}) while the marginal (MP_{LA}) is equal to zero as the underdeveloped economy has much of the population works in agriculture in the early stage of development. The wage in this sector is the same as income sharing $TP_A/L_A = W_A$.

The Total production of the industrial sector is a function of labor (L_M) for a given capital ($\overline{K_M}$). The industrial sector can reinvest profit to increase the capital from K_{M1} to K_{M2} to K_{M3} and then the total production curve shifts upward to $TP_M(K_{M2})$ and $TP_M(K_{M3})$. The demand for labor shift from D1(K_{M1}) to D2(K_{M2}) to D3(K_{M3}) respectively. The marginal product of labor also shifts right along with the TP curve and equal to the demand for labor under the perfect competition. The supply of labor is assumed to be unlimitedly represented by the horizontal line S_L. Also, the real wage rate in the modern sector, W_M, is assumed to be higher than the rate in the traditional sector, W_A. The profit of the modern sector is reinvested, leading the number of laborers hired in the industrial sector to increase from L1 to L2 and L3 respectively. The employment expansion continues until the entire labor surplus in the traditional sector is absorbed.

Figure 2.9 Lewis-Ranis-Fei Phases of Economic Development



Source: Basu (1997, pp. 154) and M. G. Egcolani and Fei (2010 ,pp. 7)

Ranis and Fei (1961) have formalized further the Lewis theory. They have partitioned development phases into three stages. The first stage, $\overline{wB_1}$, is the early stage of development with *surplus labor*. In this stage, the marginal product of rural labor (equivalent to the agriculture in most developing countries in the Mekong), rMPL, is close to zero, shown as the horizontal line on the right of B_1. The average productivity of labor (APL) is equivalent to the imputed average wage

rate or *income sharing* in the rural sector. Thus, in this economy, the rMPL= 0 and rAPL = imputed average wage or income sharing Wr respectively.

The industrial development in the non-agriculture sector, owing to FDI and export-led growth policy has led to the rising demand for labor in the modern sector. The two-sector wage differential has induced and internal migration from agriculture to modern industry in the urban area. The continuation of emigration toned down the excess supply or surplus labor in the Agricultural sector. The process continues until the economy reached B_2. In this phase, the shortage of rural labor may occur. Here, the condition is explained as the marginal productivity of the agricultural labor is positive but still less than its average productivity, 0<rMPL<rAPL= imputed average. The capital accumulation process continues until the economy reached the third point at B_3 where the economy will face a labor shortage situation. From this point B_3 onward, the rural wage increases, too. The point is known as the ***'Lewis Turning Point*** *'where* the marginal productivity of labor in the agriculture sector equals the *market wage*, rMPL = Wr.

According to Egcolani and Fei, (2010), the Lewis-Ranis-Fei has three phases of economic development, as shown in the right-hand graph of the figure. The economic development now is separated into three phases which are leftward depicted as the 'breakout', 'shortage', and 'turning points respectively. It is defined as follows: **The breakout** is the phase where there is a redundancy of agricultural labor. **The shortage phase** is the development with the disguised agricultural unemployment. **The commercialization phase** is the self-sustaining economic growth t with the commercialization in the agricultural sector. It is nominated as the **'Lewis Turning Point'.**

The effect of a country that reaches the turning point is essential to focus. First, if any country reached a Turning point, the industrialization process will slow down as cheap labor from the agriculture sector is now not available. Secondly, the wage level and general price will rapidly increase due to the lack of labor. If any industry would like to hire more workers, they should raise their wages to pull the worker from their origin sector. Then, the result ends up at a higher cost of production and a higher price level in the whole country. The profit rate will decline, and less attracted to invest. Thirdly, the wage income inequality must be reduced. Since all the surplus labor is absorbed, the wage in the rural sector must increase to respond to their labor productivity.

The wage rate between rural and urban areas must become closer to each other and the income distribution is an improvement.

The Lewis- Ranis-Fei model is a helpful framework for analyzing the labor market in developing countries; however, it has been criticized from various perspectives. For example, it is argued that the decision made by the capitalist sector in a dynamic context is limited rationality. Since, in the Lewis-Ranis-Fei model, the firm assumes to maximize its profit at the point of time, there is no clear rationale about the investment, which is an intertemporal decision. Thus, the capitalist assumed to invest their entire profit is not a valid decision due to the diminishing return (Basu, 1997 ,pp. 157-161).

Furthermore, the existence of disguised unemployment or surplus labor was also criticized, especially there is not exist in the neo-classical approach. The various data show that disguised unemployment was rarely observed, and even a shortage of labor was found in the agriculture sector of underdeveloped countries (Jorgenson,1967, referred in Hirota, 2002).

Besides, since the model is a closed economy that can explain the economy well in the 1960s, the model may not explain well in the globalization like nowadays. Thus, the modern dual economy has to give a more relevant account of the characteristic of developing economies.

Lastly, the worker working in the rural sector may move out to work in the urban sector due to the expected higher wage income. However, they may not find jobs in this period but in the hope of finding a job in the future. This is precisely the starting point of the well-known Harris-Todaro model, the dual economy with unemployment. (Harris and Todaro,1970)

Lewis-Ranis-Fei model is a critical theory to explain the growth of developing countries even got several criticized. The model itself extended to several ways and is the starting point of many famous economic development theories.

2.2.3 Harris-Todaro Model and the theory of internal migration

As previously mentioned, one of the famous reformulations of Lewis's ideas is the Harris-Todaro model (Todaro,1969 and Harris and Todaro, 1970). Harris-Todaro model has been a valuable instrument in the hands of economists in order to analyze the effects of various trade and development policies on national welfare, income distribution, and factor allocation.

Unlike Lewis theory, which consider as the classic model, ***the Harris-Todaro model, the neo-classic model, denied an existence of surplus labor.*** Since the empirical evidence existed that rural labor still moves to urban seeking a job despite the high levels of unemployment in the urban area, Harris, and Todaro (1970) focus on a rural-urban migration and unemployment existing explanation. They developed a model that explains the rising of rural-urban migration and rising of urban unemployment. In brief, the expected income of rural labor to move to urban area is based on the actual wage in urban area and the probability of finding a job as follows

Expected urban income = probability of finding job * w (2.1)

Where

W = Urban Wage

Wr = Rural wage ; Wr< W

Lm = Employment in an urban area

Lr = Employment in a rural area

L = Total labor, Thus L-Lm-Lr = Unemployed Labor

Lus =The number of job seeker in urban area = L-Lr

If there is L-Lr amount of labor who want to work in an urban area the probability of finding job in urban area (E(em)) is equal to the ratio of job available to the number of job seeker in urban area

E(em) = Lm/Lus (2.2)

Then

Expected urban income = Lm/Lus*W (2.3)

If there is more job available (Lm ↑), the expected income would be rising. Then, expected urban income is higher than rural wage (Wr), rural labor will move to work in an urban area until expected income is equal to rural wage (Wr) and the migration will be stopped. Thus,

Expected urban income Lm/Lus*W = Wr Rural wage (2.4)

The above equation is known as the Harris-Todaro Equation. The above equation can change into

Lr = (Wr*L-W*Lm)/Wr (2.5)

Then

∂Lr/∂Lm= -W/Wr (2.6)

Since W > Wr (wage in an urban area is higher than rural area) so -W/Wr > 1. If the employment in urban area increases 1 unit, the labor in rural area will decrease more than 1 units. Therefore, the job seeker would turn to be unemployment or work in informal sectors.

The full formulation of the model is as follow.

Agricultural Production Function

$$X_A = q\left(N_A, \overline{L_A}, \overline{K_A}\right), q' > 0, q'' < 0 \quad (2.7)$$

Where,

X_A is output of the agricultural good,
N_A is the rual labor used to produce this output,

$\overline{L_A}$ is the fixed agriculture land
$\overline{K_A}$ is the fixed capital stock,
q' is the derivative of q with respect to N_A

Manufacturing Production Function

$$X_M = f(N_M, \overline{K_M}), f' > 0, f'' < 0 \qquad (2.8)$$

Where

X_M is the output of the manufactured good,

N_M is the total labor (urban and migrant from rural) used to produce this output

$\overline{K_M}$ is the fixed capital stock,

f' is the derivative of f with respect of N_M

The agriculture production relies on 3 inputs, labor, land, and capital while manufacturing relies on two inputs, labor, and capital. q' and $f'$are the derivatives of q and f with respect to labor or the marginal products of labor which are required to be positive. q'' and f'' are the second derivative with respect to L to represent the existing of the diminishing of marginal products of labor.

The term of trade expressed as the price of agricultural in terms of the manufactured good, P, is the function of the relative output between manufacturing and agricultural (X_M and $X_A$respectively)

Price Determination

$$P = \frac{P_A}{P_M} = p\left(\frac{Y_M}{Y_A}\right), p' > 0 \qquad (2.9)$$

Where

P, the price of the agricultural good in terms of the manufactured good, is a function of the relative outputs of agricultural and manufactured goods when the latter serves as numeraire

Then, the first-order condition. We got 4) and 5)

Wage determination

$$W_A = P\ q' \quad (2.10)$$

$$W_M = f' \geq \overline{W_M} \quad (2.11)$$

Where

W_A , the real agriculture wage

W_M , the real manufacturing wage

The real wage in both agriculture and manufacturing expressed in terms of the manufactured good are equal to its marginal product of labor under the profit maximization on the perfectly competitive market. The manufacturing real wage is constrained to be greater than or equal to the minimum wage.

Urban Expected Wage

$$\boldsymbol{W_u^e = \frac{\overline{W_M} N_M}{N_u}}, \frac{N_M}{N_u} \leq 1, \quad (2.12)$$

Where

W_u^e , the expected real wage in the urban sector

The expected real wage in the urban sector is equal to the real minimum wage adjusted by the proportion of total labor force in urban area (urban plus migrant) and employed. The only case of full employment in the urban sector is the expected wage equal to the minimum wage.

Labor Endowment

$$N_A + N_U = \overline{N_R} + \overline{N_U} = \bar{N} \quad (2.13)$$

Labor constraint is the sum of all worker must equal to total labor endowment

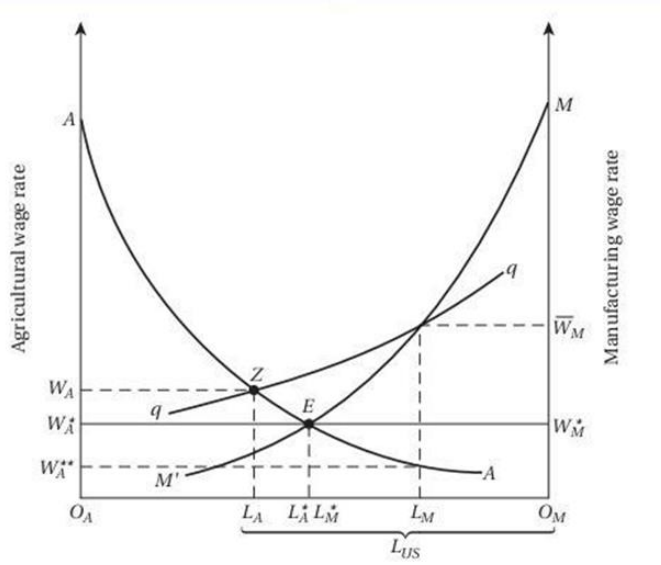
Equilibrium condition:

$$W_A = W_u^e \quad (2.14)$$

Equation 8 is an equilibrium condition derived from the hypothesis that migration to the urban area is a positive function of the urban-rural expected wage differential.

With eight equations and eight unknowns, we can solve for sectoral employment, unemployment, level of output, and term of trade.

Figure 2.10 : Harris-Todaro Migration Model



Source: Todaro and Smith (2012, pp. 361)

The model can be explained as the figure above, Agricultural and Manufactural have their own origin Oa and Om respectively. $\overline{AA}$ line, the marginal productivity of labor in agriculture, and $\overline{MM}$ line, the marginal productivity of labor in manufacturing, is the slope downward presenting the diminishing return of labor[4].If there is no policy intervention, both sectors will hire labor at a wage rate equal to marginal productivity. The equilibrium is point E, and there is no unemployment in the economy.

The implication of the model is that 1. Migration is a rational decision based on an expected wage of an urban area. Any increase in the expected wage results in an increase in migration to the urban sector. 2. Urban policy intervention cannot solve an unemployment problem since policy

[4] Since Harris-Todaro model denied the existence of surplus labor, there is no horizontal line of marginal product.

would lead to migration from a rural area. 3. Policy Implication suggests that wage subsidy and labor mobility restriction would produce a welfare gain to an economy.

They are many extensions of the basic Harris Todaro model. Several studies introduced the endogenous wage to explain the wage difference between sectors. Stiglitz (1974), "Labor turnover model," extended model in which urban wage rate and unemployment are endogenous variables. Therefore, the firm in manufacturing raises their wage to minimize turnover costs. As a result, manufacturing always raises their wage themselves higher than in agriculture to attract workers. Calvo (1978) extended the H-T model by setting wage as the dependent variable depended on 'labor union.' The study explains how labor trade-union affects the labor market by setting the two ways of equilibrium, firm as price-taking, and react as Nash-equilibrium. The study shows that, in both cases, wage in the urban sector if there is no subsidy from the government depends on wage on rural area and technology parameter. Bencivenga and Smith (1995) built an overlapping generation model with an adverse selection problem and shown that sometimes the labor migrates back to the rural area during the economic fluctuation.

To conclude, the Harris-Todaro model is a valuable theory of economic development to analyze the effects of development policies on migration, factor allocation, and welfare. Both Lewis-Ranis-Fei and Harris-Todaro's theory of migration corresponds to the historical scenario of migration, wage level, and the turning point in Thailand.

2.3 **Lewisian Turning point in Thailand**

2.3.1 **Hypothesis: the existence of the *Lewis turning point***

Internal migration in Thailand and the rising of labor shortages and wage rate have raise question about the existence of the Lewis turning point in Thailand. Previous studies show that Lewis turning point theory has been fit the empirical data well in many of East Asia pacific countries. Many studies confirm that Japan has passed the turning point during 1960s (Minami (1968) and Watanabe (1994)). Minami (1968) has studied the turning point in the Japanese economy around the 1960s by pointing out five criterions. Watanabe (1994) confirms the idea well by testing the hypothesis that Japanese emigrants to rest of the world cause a Reduction of surplus labor and thereby quickening an economy's arrival at its turning point. The study has also

concluded that the Japanese economy had reached its turning point around 1960, but the 'emigration factor' had played little role in this process.

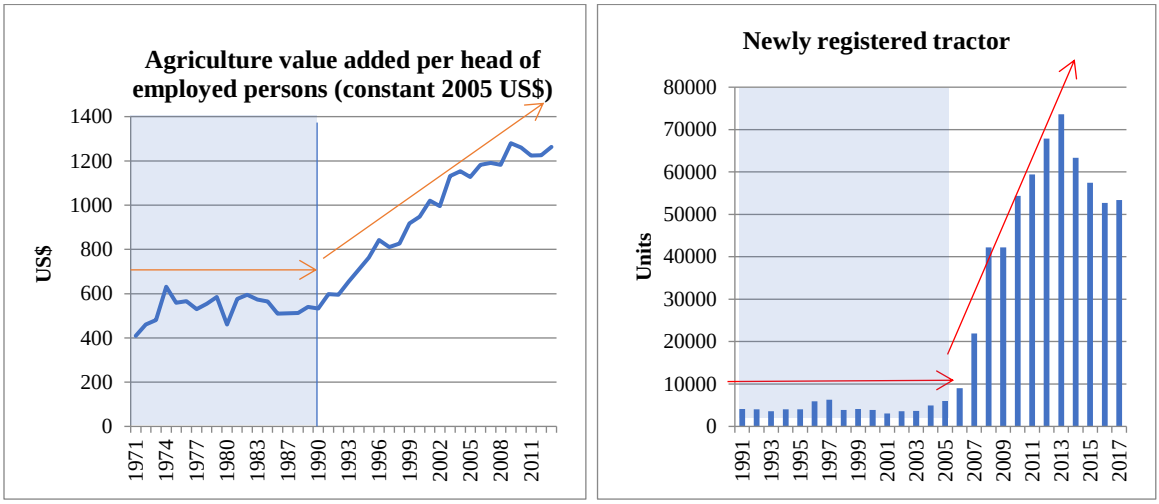
In case of South Korea, Moo-ki (1985) has applied the tests and proved that the Korean economy has agricultural labor had the marginal productivity approach real wage in the 1970s. Besides, Kim (2014) has also traced the South Korean economy and found consistently that the Korean's turning point was around 1973.

There are many recent debates around the Lewisian turning point of the Chinese economy due to the rise in the labor shortage problem. Minami and Ma (2014) point of that the Chinese economy has not yet passed its turning point. Kyoji and Yuan (2012) had constructed a three-sector open economy model to explain the Chinese economy. The study had concluded that China has still not yet passed its turning point. This might be owing to the characteristics of Chinese economic development. China has growth of export or the low absolute price, retard the economy from reaching its turning point. Mitali and N'Diaye (2013) have further constructed the simultaneous equation model determining the mechanism of the labor market in China. They have applied the model to predict a Turning point in China. The result showed that China is likely to reach its turning point around 2020-2025. Zaheer and Kadri (2015) had tried to apply to the Pakistan economy by constructing the production function of two sectors. They concluded that Pakistan is at the first stage of economic development and not yet passed the turning point.

There are also many studies in ASEAN countries, Nguyen (2014) has applied the descriptive statistics to track the structural change and the turning point in Vietnam. He concluded that the Vietnamese economy follows the Lewis- Fei and Ranis' growth model and exhibit a significant transition of labor from agriculture to the manufacturing sector. This study did not predict the turning point of the Vietnamese economy. Yamada (2016) however has applied the Minami's criterions to estimate the turning point of Vietnam and concluded that the economy had not reached its turning point. Hondai and Nakamura (2014) have tried to explore the Indonesian turning point. They have estimated agriculture production function in line with the Minami's attempt. They finally have pointed out that the surplus labor in the agricultural sector has still existed in Indonesia. Cheng et al. (2015) have applied a panel model to predict the return on education investment in Cambodia. They have applied a Mincerian wage equation which categorized into areas-occupations. They had found that Cambodia has not passed its turning point yet. They had found a labor shortage in certain specific rural areas in 2011.

In Thailand, there are few recent studies and was no explicit conclusion of the 'turning point'. Most of the studies were centered on labor shortages in Thailand, especially in the Agriculture sector. Charoenwongsak (2000) pointed out that labor in agriculture has declined over time. Tansri (2014) has pointed out the labor shortage in agriculture due to the lack of new entrant of a farmer, the rise in production cost and price instability. The rising of a migrant worker from neighbor countries, the substitution of agricultural machinery like tractors, etc. are a current phenomenon of labor shortages and structural change in Thai agriculture sector.

Figure 2.11 Thailand's Agriculture Value added per worker and Newly Registered Tractor Record



Source: FAO statistics and Department of Transport, Thai government.

As Thailand is observed to have a rising of value-added per head of the employed person in Thai agriculture production after 1990, it can be postulated the rising average wages in the rural labor market which should induce the substitution between labor-land and farm machinery-land ratio. However, this has not happened until 2005. This can be explained as the data on the land area for agriculture has been decreased from the past trend at a rate of 0.16 percent per year after 2003. The rapid substitution trend of the tractor to labor-land use was gradually increased after 1990 but had sudden rapid surged after 2005. It is whether Thailand has already passed the turning point according to the theory proposed by Lewis and 'Fei-Ranis'.

2.3.2 Empirical *Lewis turning point in Thailand*

Bowonthumrongchai (2019) used Minami (1968) method which is the most famous and direct method to determine the empirical turning point Thailand. In brief, to identify the empirical Lewis turning point, Minami (1968) proposed Minami's five criterions:

Criterion 1: Comparison between Real Wages and Marginal Productivity of Labor in the Subsistence Sector[5]

If MPL= W/P, the economy has already passed the turning point. If MPL<W/P, the worker does not work at full potential. We can define the equilibrium employment as L*. Then, any L> L* is considered as surplus labor.

Criterion 2: Correlation between the Real Wages and the Marginal Productivity of Labor in the Agriculture Sector

The non-existence of the correlation suggests that the wage rate is determined by the *agriculture sector 's* level of income or 'income sharing hypothesis'.

Criterion 3: Movements of Real Wages in the agriculture sector

The time-series data of the real wages in the *agriculture sector* may show a shift from constant (or slowly increasing trend) to a rapidly rising trend. This could verify the relationship between the subsistent income sharing return to labor towards the marginal productivity is equalized with market wage finally in the long run.

Criterion 4: Change in Wage Differentials

The wage differentials between unskilled and skilled workers will tend to rise over a period if skilled workers are limit during the initial stage of development. After the turning point, the wage differentials will gradually disappear.

Criterion 5: Elasticity of Labor Supply to the non-agriculture sector

[5] The 'subsistence will be interchangeably with agriculture sector'. In fact, Thailand's agriculture sector is much different from the image of 'subsistence' in the sense of Lewis, even in 1960s. However, this is just to keep the original word of the literature.

Among these five criteria, criterion 1 is the most direct and rigid benchmark for finding the turning point. It needs to remark that there might be some cases that the economy temporarily passes the turning point like the economic fluctuation, for example.

Result

Criteria 1 Comparison between Real Wages and Marginal Productivity of Labor in the Subsistence Sector

The study constructed the production function of the agriculture sector. We estimated marginal productivity and compared to the real wage in *monthly* term deflated by the consumer price index (CPI). Then, we estimated surplus labor which can obtained from the difference between actual employment (1) and equilibrium employment (2) in agriculture.

Table 2.7 Comparison between labor productivity and real wages and estimation of surplus labor in agriculture 1990-2015

(1) Comparison between labor productivity and real wages

Years	Output elasticity of labor	APL	MPL	Real Wage	Relative income share W/APL
		Baht/Month			(%)
1990	0.577	3,471.58	2,003.10	3,054.4	88
1995		5,024.05	2,898.87	4,202.3	84
2000		5,863.42	3,383.19	4,091.9	70
2002		5,959.75	3,438.78	3,517.5	59
2004		6,795.51	3,921.01	3,691.4	54
2006		6,790.62	3,918.19	4,072.7	60
2008		6,866.94	3,962.23	4,819.7	70
2010		6,890.19	3,975.64	4,685.4	68
2012		7,090.13	4,091.00	5,024.3	71
2014		8,629.57	4,979.26	5,682.6	66
2016		8,551.90	4,934.45	5,597.1	65

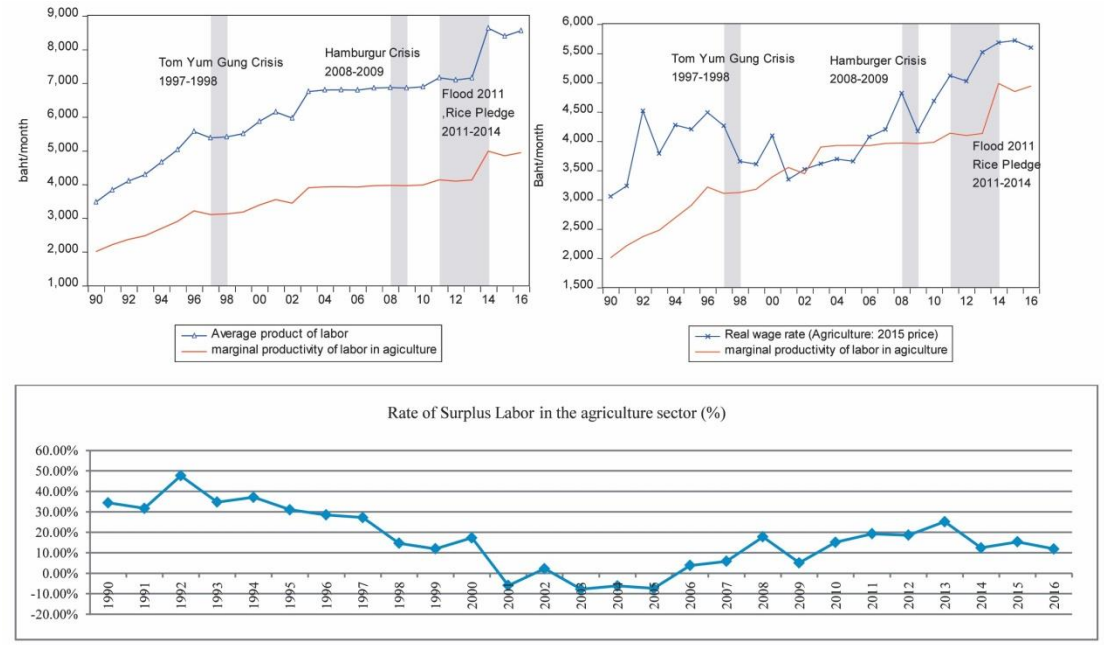
(2) Estimation of surplus labor

Years	Employment	Equilibrium Employment	Surplus employment	Rate of Surplus Labor
	Thousands of persons	(%)		
	(1)	(2)	(3) =(2) - (1)	(4) = (3)/(1)
1990	1,608.51	1,054.89	553.62	34.4
1995	1,366.58	942.70	423.87	31.0
2000	1,383.04	1,143.51	239.53	17.3
2002	1,404.18	1,372.76	31.41	2.2
2004	1,363.39	1,448.18	-84.80	-6.2
2006	1,417.05	1,363.29	53.75	3.8
2008	1,469.91	1,208.40	261.51	17.8
2010	1,454.69	1,234.336	220.35	15.1
2012	1,543.36	1,256.676	286.68	18.6
2014	1,273.27	1,115.671	157.60	12.4
2016	1,174.66	1,035.594	139.07	11.8

Source: Author's calculation

Surplus labor in the agriculture sector had declined from 1990 until 2002. The 2008-09 there was a Global Financial Crisis impact on the Thai economy. In 2011, there was 'flood' in Thailand which had further accentuated the effect on manufacturing in the urban area. The government then had introduced the 'Rice Pledge Policy' to buy in paddy at a subsidized price. Thus, it was likely that labors in the non-agriculture sector have perhaps sought their sanctuary back home in rural to do agriculture. This proved that the neoclassical conjecture of the 'Turning point' was not a 'once and for all' in a developing country like Thailand. The government policy was, in fact, has a significant impact on the ups-and-downs of the labor demand in agriculture vis-à-vis the non-agriculture sector. It can be postulated that the Minami (2014) hypothesis is a 'local equilibrium' in the case of Thailand whereas it might be a 'global equilibrium' in the case of Japan and some other forerunners.

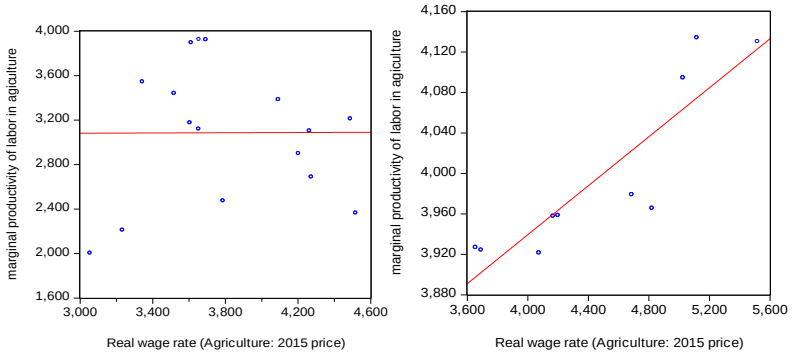
Figure 2.12 Marginal productivity of labor, real wage of agriculture in Thailand, an estimated surplus labor 1990-2015 (at a constant price of 2015)



Criterion 2: Correlation between real wages and marginal productivity of labor in the in agriculture

We estimated the correlation between the real wage rate and marginal productivity. If it is positively correlated, it will depict the situation of a turning point.

Figure 2.13 Correlation between real wages and marginal productivity in agriculture 1990-2001 and 2001-2015

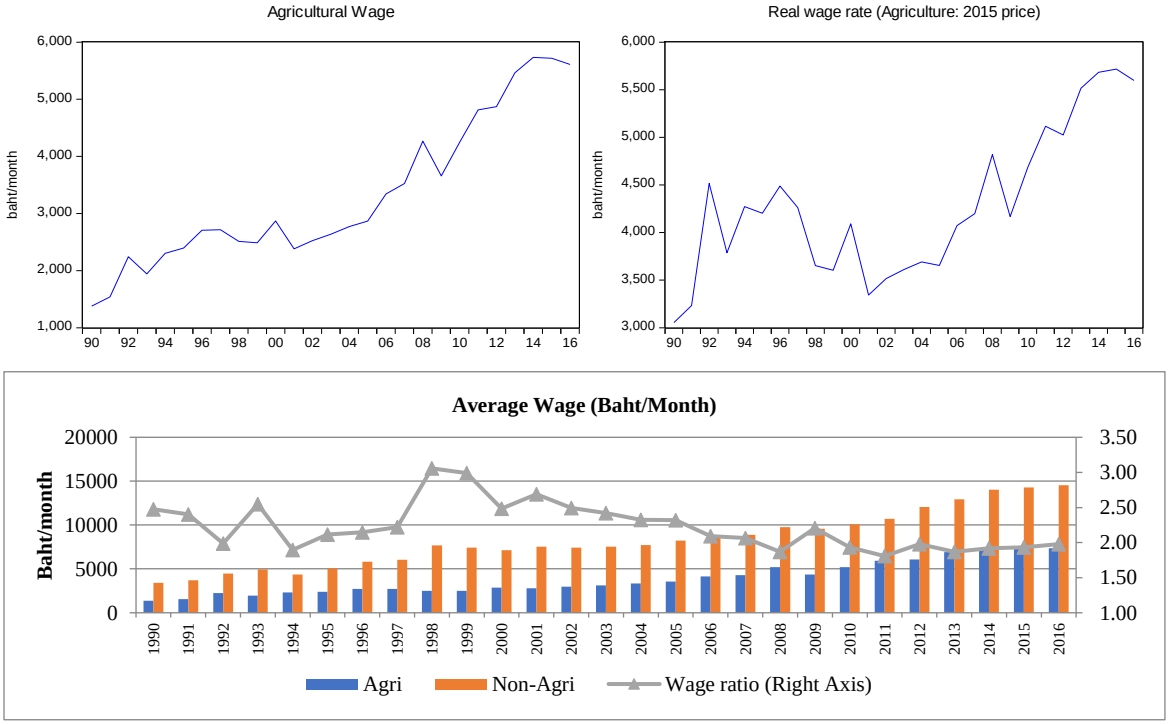


(a) 1990-2001 (b) 2001-2015

It is clearly shown that before 2001, there is no correlation between the two variables. However, we have found a strong positive relationship between real wage and agriculture marginal productivity of labor. This reconfirms that Thailand has passed the turning point around 2001.

Criterion 3: The Movements in Real Wages in the Subsistence Sector and Criterion 4: Change in Wage Differentials

Figure 2.14 Real wages in Agriculture and the comparison with a real wage in manufacturing.



Source: Labor force survey 1990-2015

In criterion 3 it is verified that wage in the agriculture sector has risen in a nominal and real term. The real wage rate in agriculture shows the shift from a sideways to a clear upward trend after 2001, declined during crisis, and has increased sharply again after 2009. The Thai economy has started new episode of economic development after the GFC 2008-09.

In criterion 4, although the average wage differential between the agriculture and non-agriculture sectors still exists, the wage-ratio has declined smoothly during 2001-2008. After the GFC in 2008-2009, there was a differential shock temporary. Thereafter during 2010-2016, the wage differential between sectors has smoothly kept at the level of 2.0 throughout rather than tending to 1.00 to show equality of wages. (See Figure 2.14, second graph). Thus, it is conjecture that the wage ratios have moved consistently together. This seems to contradict with the Minami's conjecture in criterion 4 which stated that wage gap should disappear at a certain point in time of 'Turning Point'. In our analysis, the ratio was constructed from a ratio of the composite wage of skilled and unskilled labor (non-agriculture) divided by the unskilled labor (agriculture). The skilled-to-unskilled wage ratio of the manufacturing sector was recorded as follows: The daily minimum wage in non-agriculture was 6,000 baht per month (equivalent 300 baht per day) while the wage for a new entrance to the company was 12,000- 15,000 baht per month. In other words, the skill wage is 2.0- 2.5 times of the unskilled wage. This accurately explained the ratio of 2.0 in our graph. The wage in agriculture sector is also 300 baht per working day with less effective hours of a day. They work from very early morning (3 hours before noon) afternoon but take an extended break during hot sunlight (12.00-14.00 hrs) and resume effectively working from 14.00-17.00 hrs. Thus, Minami criterion 4 is verified.

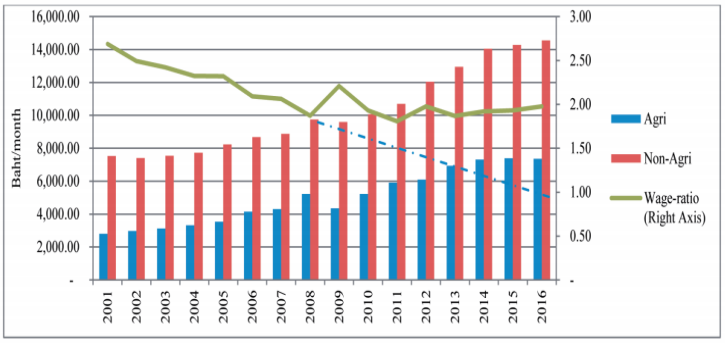
Criterion 5: Elasticity of Labor Supply to the non-agriculture sector

Lewis' Theory indicates that the elasticity of labor supply is infinite and decreased after passing the turning point. In our paper, the wage rate in the agriculture sector is a proxy of the minimum supply price of labor supply (Minami, 1968)[6]. We also use the labor in non-agriculture as the proxy of labor supply outflow from the agriculture sector. In Fig. 8 we have shown the scattered plot of the employment in the non-agriculture against the wage in agriculture on a logarithmic scale. The slope of this graph can be interpreted as the elasticity of supply and it shows

[6] In the sense that laborers do not want to work if their wages are less than this level. See Minami (1968) page 3 for more detail

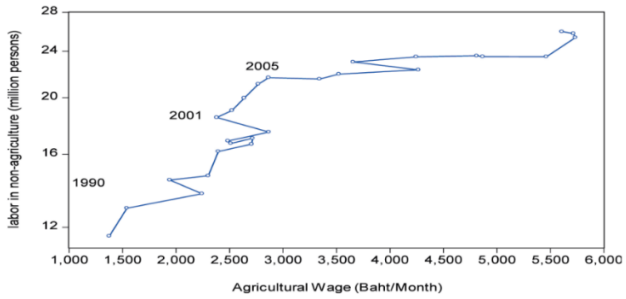
a clear kink at 2005. We have estimated the elasticity of labor supply. They are 1.10 for 1990-2001, 0.54 for 2001-2005 and 0.24 for 2005-2015 respectively.

Figure 2.15 Real wages in Agriculture and the comparison with a real wage in manufacturing



Source: Bank of Thailand

Figure 2.16 Elasticity of Labor supply to the non-agriculture sector



Clearly, the labor supply in the agriculture sector has a transition from elastic to inelastic with respect to a change in the wage rate. Thus, this can verify the Minami's criterion 5 that the unlimited labor supply from agriculture has reached its end after 2001-2005.

Thailand's agricultural sector is an important sector of economic development in Thailand as the main source of employment and surplus labor . The change in the labor market structure especially the decrease in labor supply due to the low birth rate and the huge migration to the non-agricultural sector lead to a change in production and quickly accelerate to the turning point. The empirical result using Minami’s criteria shows that Thailand has passed the shortage point around 1990 and has passed the turning point around early of 2000s, respectively. The reach of turning point means Thailand already enter a new era of labor shortage and lose the status of a cheap labor country.

CHAPTER 3

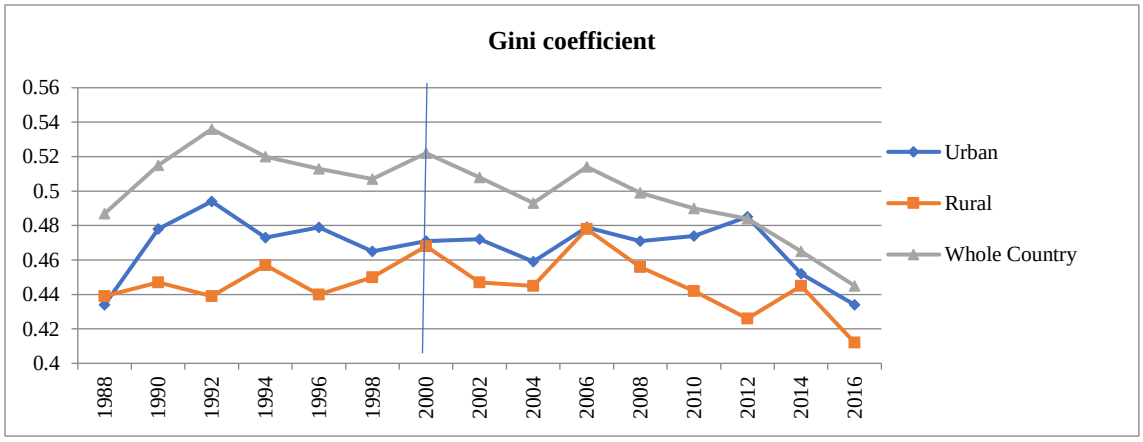
Implication of the turning point and the path of Industrialization

3.1 Implication of the turning point and the path of Industrialization

In the previous chapter, we have confirmed that Thailand has end of surplus labor era since the early 2000s. Beyond the turning point, what will happen to the economy after reached the labor turning point?

Firstly, if the Lewis (1954) hypothesis has been proved to pass the turning point, it would be generally postulated that income distribution would be more equalized. As the wage increased hence the income inequality would decrease in the agriculture or rural sector. This follows the Kuznets inverse-U shaped hypothesis (Kuznets, 1955) where inequalities would decline according to Minami (1998). According to the data, the Gini's coefficients in Thailand have decreased since the 1990s as showed by Gini's Coefficients in Figure 3.1. The pace of decline was rapid in a rural area after 2006. However, unlike the conclusion of Minami for Japan's experiences, the decline of the coefficients in Thailand may be attributed to many government policies.

Figure 3.1 Thailand Gini's coefficients and Kuznets curve

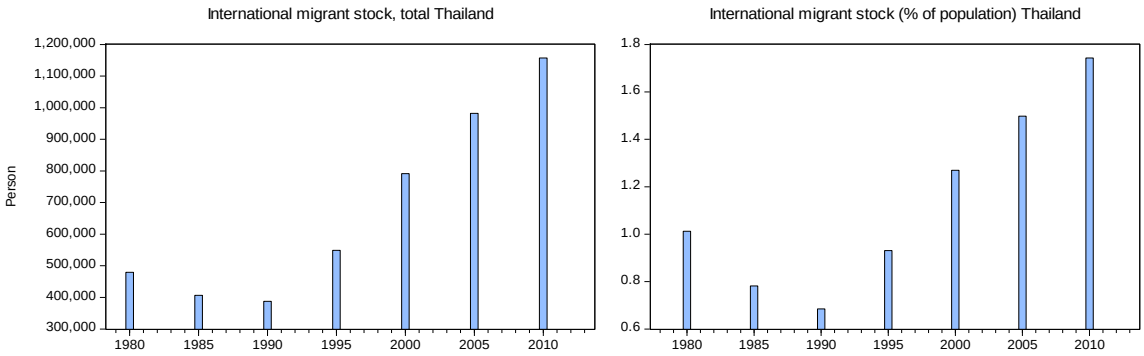


Source: NESDB

Also, labor shortage leads to an enormous amount of migrant workers even in the agriculture sector. According to the Ministry of Labor, migrant workers from Myanmar, Laos

PDR, and Cambodia are registered to work in manufacturing, construction and service sectors and in the agricultural and fishery sectors. In January 2018, there 2.14 million migrants are from CLM countries, of which 17.33 percent (372,477 persons) work in agriculture sectors. Clearly, their demand for migrant labor is in the construction and manufacturing sector as well as private and household services, respectively (see Table 3.1). This indicates the tight labor market in agriculture as well as a labor-intensive sector in the urban area in Thailand. Figure 3.2 shows the registered migrant stock and migration stock percentage of the total population in Thailand 1980-2010.

Figure 3.2: Migrant stock and migrant stock per population in Thailand 1980-2010



Source: Bilateral Migration, World bank

Table 3.1 Registered Foreign Migrant Workers in Thailand as of January 2018

	Persons	**percent**
Total	2149328	100.00%
from CLM	1913533	89.03%
working in		
-Agriculture	372477	17.33%
-Fishery	111599	5.19%
-Construction	304818	14.18%
Manufacturing	394284	18.34%
-Mining	1895	0.09%
-Private and Household	465535	21.66%

Source: Ministry of Labor, Thailand

Lastly, the Lewis turning point seems to be an obstacle to the path industrialization. Since the labor is shortage and the wage share of income rises, the consumption expects to rise, and the savings to fall due to the smaller profit share. Therefore, the investment due to the lower profit and lower saving is likely to fall. The effect on industrialization will be discuss in detail based on the theorical model.

3.2 Inada, Sekiguchi, and Shoda Model : The Mechanism of Economic Development

The successful of Japan development after postwar has been a popular topic in a wide range of economic literature. For example, Minami (1968) employed the dualistic development models of Lewis (1954) and Ranis and Fei (1961), to identify the turning point where the economy changes from a labor-abundant economy to the labor-shortage phase as discussed earlier.

Many theoretical studies from the 1960s and 1970s formulated to be multi-sector economic growth models. Indeed, Inada, Sekiguchi, and Shoda (1992) present a formal theory of economic development to explain the economic development pattern in Japan which considers the important role of labor supply and food products from the agriculture sector. Inada, Sekiguchi, and Shoda (1992) model specifics on resource allocation in non-agricultural sector by the investment decision divided into light and heavy industry and explain how the economy can take-off to sustainable growth.

The basic set up of the model is that the economy consists of three sectors, the subsistence sector (The S-sector), and the two industry sectors, the light industry sector (The X-sector), and the heavy industry sector (The Z-sector). The characteristic of S-sector is the same as Lewis (1953) which, in this model, it mainly plays the role of supplier of low-wage labor. The X-sector and Z-sector together are the capitalist sector in Lewis paper. Disguised unemployment always exists in the S-sector. Thus, the marginal productivity of labor in this sector is always lower than the subsistence wage level.

The price of X-sector goods relative to S-sector goods is a decreasing function of X-sector output, $p'(X) < 0$. Further, the price elasticity of demand for X-sector goods is less than 1, $\varepsilon_{p(x),x} < 1$ for X>0. Also, the price of Z-sector goods relative to S-sector goods is assumed to be fixed. We can express the price of Z-sector goods in whatever unit is needed to make the relative price 1.

Moreover, the sum of investment in the X- and Z- sectors is equal to the sum of profits in the X- and Z-sectors which the production function of the X-sector satisfies the following conditions

$$\frac{\partial F_X}{\partial K_X} > 0, \frac{\partial^2 F_X}{\partial K_X^2} < 0. \frac{\partial F_X}{\partial N_X} > 0, \frac{\partial^2 F_X}{\partial N_X^2} < 0, \frac{\partial^2 F_X}{\partial K_X \partial N_X} > 0, \qquad (3.1)$$

$F_X(\alpha K_X, \alpha N_X) = \alpha F_X(K_X, N_X)$. $(\alpha > 0)$ Constant return to scale

Also, the production function of the Z-sector satisfies the following conditions

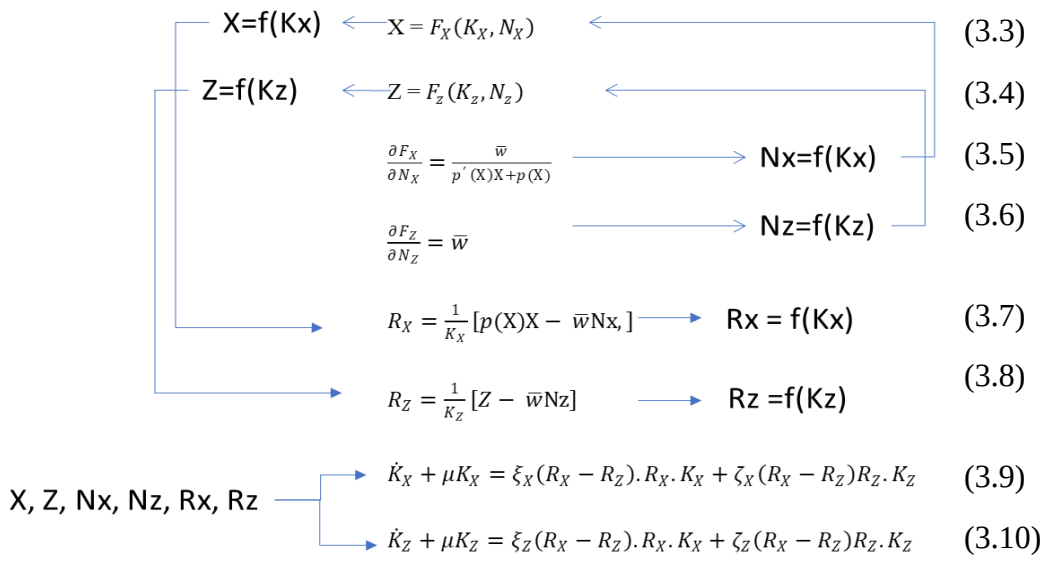
$$\frac{\partial F_Z}{\partial K_Z} > 0, \frac{\partial^2 F_Z}{\partial K_Z^2} < 0. \frac{\partial F_Z}{\partial N_Z} > 0, \frac{\partial^2 F_Z}{\partial N_Z^2} < 0, \frac{\partial^2 F_Z}{\partial K_Z \partial N_Z} > 0, \quad (3.2)$$

$F_Z(\alpha K_Z, \alpha N_Z) > \alpha F_Z(K_Z, N_Z)$. $(\alpha > 1)$ Increasing return to scale

Lastly, the output level of both the X-sector and Z-sector are determined as maximizing profits, given the amount of accumulated capital at each moment, the subsistence wage level, and the demand function for X-sector goods and Z-sector goods respectively.

The X-sector production technology is subject to constant return to scale, and that term of trade vis-à-vis the S-sector decline as the production of X-goods increases. On the other hand, The Z-sector technology is subject to increasing the return to scale while the term of trade is independent of the Both characteristics indicate the critical feature of the model that the profits obtained in the X-sector (Z-sector) decrease (increase) as the increasing amount of accumulated capital. $\frac{dR_X}{dK_X} < 0, \frac{dR_Z}{dK_Z} \geq 0$. The profit realized in the two sectors are reinvested in the following ways: If the X-sector(Z-sector) profit rate is higher than that of the Z-sector (X-sector), all X-sector (Z-sector) profit will be re-invested in the X sector (Z-sector) but if the profit rate is less than that of the Z-sector (X-sector), some profit will leakage to another sector.

The full formulation of Inada, Sekiguchi, and Shoda (1992) model is as follow.



Where

X	The output of domestic light industries measured in real terms. We call this sector the X-sector
K_X	The accumulated capital stock of the X-sector, measured in real terms
$\dot{K}_X$	Net investment in the X-sector
N_X	Employment in the X-sector
$F_X(K_X, N_X)$	The production function of the X-sector
R_X	The gross profit rate of the X-sector, measured in terms of the goods of the subsistence sector
p(X)	Terms of trade of the X-sector
$\bar{w}$	Subsistence wage rate, or institutional wage rate, measured in terms of subsistence sector goods
Z	The output of heavy industries measured in real terms. We call this sector the Z-sector
K_Z	The accumulated capital stock of the Z-sector, measured in real terms
$\dot{K}_Z$	Net investment in the Z-sector
N_Z	Employment in the Z-sector
$F_Z(K_Z, N_Z)$	The production function of the Z-sector
R_Z	The gross profit rate of the Z-sector, measured in terms of the goods of the subsistence sector
μ	the depreciation rate on capital goods.

Exogenous variables: K_X, K_z, $\bar{w}$
Endogenous variables: X, Z, N_X, N_z, R_X, R_Z

Equation (3.3) and (3.4) are the production function of The X-sector and Z-sector, respectively. By maximizing profit subject to (3.3) and (3.4), (3.5) and (3.6) are obtained from the first-order condition. (3.7) and (3.8) are the identity equation. Relations (3.3)-(3.8) are a short-term equilibrium system known as ***miniature Walrasian system*** in which the values of Kx and Kz are viewed as parameters. All variables are solved as functions of the parameters Kx and Kz. If these functions are substituted into (3.7) and (3.8), we obtain two differential equations express the constants that the dynamic paths of the capital accumulation process should be satisfied.

The right-hand sides of (vii) and (viii) show the rule for how profits obtained at each moment in each sector are directed to each sector. $\xi_X, \xi_Z, \zeta_X, \zeta_Z$ are the functions of $(R_X - R_Z)$. ξ_X is the proportion of profits obtained in the X-sector and reinvested in the same sector while $\xi_Z(R_X - R_Z)$ is the proportion of profits obtained in the X-sector and invested in the Z-sector. Since the model assume that profits are invested in two sectors and are not directed to consumption or foreign countries and that no foreign funds are invested in the X- and Z-sectors, that is

$$\xi_X(R_X - R_Z) + \xi_Z(R_X - R_Z) = 1. \qquad (3.11)$$

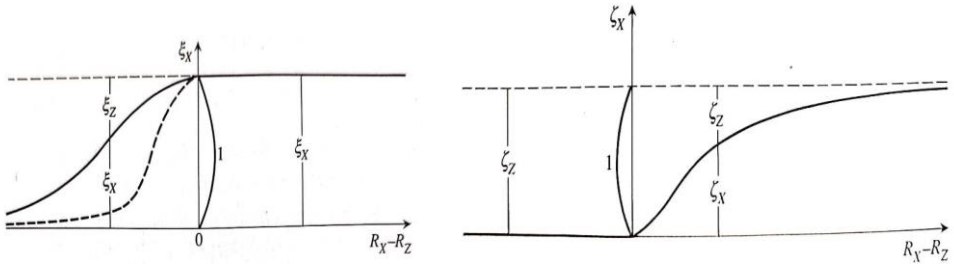
The proportion of profits obtained in the X-sector and reinvested in the same sector is assumed to depend on the magnitude of the difference between the profit rates of the two sectors. If $R_X \geq R_Z$, then the profits obtained in X-sector are assumed to be entirely reinvested in the same sector, $\xi_X(R_X - R_Z) = 1$. If $R_X < R_Z$, some portion of the profits in the X-sector are assumed to be invested in the Z-sector. The bigger the difference in profits, the larger this portion is. That is $\xi_Z(R_X - R_Z) > 0$ for $R_X - R_Z < 0$. The shape of the investment distribution is shown in the figure below. The extreme case is $\xi_X(R_X - R_Z) = 1$ for $R_X - R_Z \geq 0$, and $\xi_X(R_X - R_Z) = 0$ for $R_X - R_Z < 0$ is excluded from analysis because we assume the continuity of the $\xi_X(R_X - R_Z)$ function.

The function ζ_X, ζ_Z are defined in a similar way to $\xi_X and\ \xi_Z$. The proportion of the profits obtained in the Z-sector that is invested in the X-sector and the Z-sector, respectively is shown as figure. That is,

$$\zeta_X(R_X - R_Z) + \zeta_Z(R_X - R_Z) = 1 \qquad (3.12)$$

The rates of depreciation on capital goods in the two sectors are assumed identical for simplicity.

Figure 3.3 The shape of the proportion of profits.



Source: Inada, Sekiguchi, and Shoda (1992)

Next, substituting Rx and Rz functions, which are functions of Kx and Kz into (3.9) and (3.10), we obtain two functions of Kx and Kz, respectively. Denote these as $\varphi_X(K_X, K_Z)$ and $\varphi_Z(K_X, K_Z)$, respectively. That is,

$$\dot{K}_X = \varphi_X(K_X, K_Z) - \mu K_X, \qquad (3.13)$$

$$\dot{K}_Z = \varphi_Z(K_X, K_Z) - \mu K_Z \qquad (3.14)$$

where,

$$\varphi_X(K_X, K_Z) \equiv \xi_X\big(R_X(K_X) - R_Z(K_Z)\big).R_X(K_X).K_X + \zeta_X(R_X(K_X) - R_Z(K_Z))R_Z(K_Z).K_Z$$

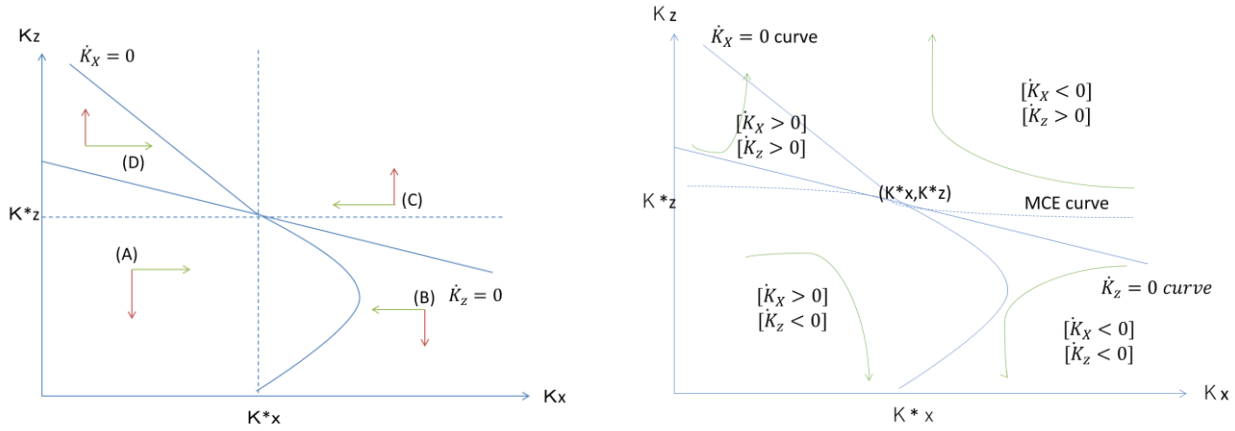
$$\varphi_Z(K_X, K_Z) \equiv \xi_Z(R_X(K_X) - R_Z(K_Z)).R_X(K_X).K_X + \zeta_Z(R_X(K_X) - R_Z(K_Z))R_Z(K_Z).K_Z$$

The model's aim now is to examine the dynamic characteristics of the differential equation system (3.13) and (3.14). Every dynamic path is expressed as the movement overtime of point (Kx, Kz) on the coordinate plane whose axes are the Kx-axis and the Kz-axis. We can determine the signs of the right-hand sides at each point in the Kx-Kz plane and estimate the directions of the dynamic paths.

The $\dot{K}_X = 0$ curve is the point set defined by $\varphi_X(K_X, K_Z) - \mu K_X = 0$. K_X neither increases nor decreases along the curve and only Kz changes. The direction of the dynamic path is vertical which $K_Z > 0$ ($K_Z < 0$) makes the dynamic path moves upwards (downwards) vertically. Similarly, the $\dot{K}_Z = 0$ curve gives the direction horizontally. The horizontal movement is

leftward (rightward) if $K_X > 0$ ($K_X < 0$). The intersect point of $\dot{K}_X = 0$ and $\dot{K}_Z = 0$ curve , (K_X^*, K_Z^*) divides the dynamic path into four regions showed in Figure 3.4.

Figure 3.4 Outline of the dynamic paths



Source: Inada, Sekiguchi, and Shoda (1992)[7]

The sign of each region shows the direction of the dynamic path. The interesting regions are region A and D where the economy is starting from small. If the economy starts from a point region A where both K_X and $K_Z$are small, the profit of the X-sector is high while that of the Z sector is low and then $\dot{K}_X > 0 \; and \; \dot{K}_Z < 0$ .Thus, the investment in the X-sector is greater than the depreciation while that in the Z-sector is not enough to offset capital depreciation. The X-sector will grow, and the Z-sector will contract. The economy will finally end up at $(K_X^*, 0)$ which the Z-sector disappears in the long run, and the take-off fails. The next case is in region D where K_X is small and K_Z is large. The profit in both sectors is high. That is, $\dot{K}_X > 0 \; and \; \dot{K}_Z > 0$ and the economic success to take-off in this case. Hence, in order to take-off, a self-sustainable growth of any sector is expected. However, the X-sector cannot grow without limit. Therefore, the economy take-off in the Inada-Sekiguchi-Shoda model is sustainable growth of the Z-sector, heavy industry.

The minimum critical effort curve (MCE curve) is introduced. If the economy starts from the above the MCE curve, the sustainable growth of the Z-sector is existing, and the economy take-

[7] See Inada, Sekiguchi and Shoda (1992) pp. 72-75 for the precise proof of the shape of $\dot{K}_X = 0$ and $\dot{K}_Z = 0$ curve

off is possible. On the other hand, the economy will fall to take off and will end up and $(K_X^*, 0)$, the economy without heavy industry in the long run.

Consequently, the aim goal of the policymaker is to move the economy to above the curve and enjoy the sustainable growth of the Z-sector later. The policy intervention by the government can help the economy to take-off by reduce the minimum critical effort curve or shift the economy to above the curve. The policy such a setting import tariffs to protect the domestic industries will help the economic take-off.

Besides, even they are two equilibriums exist in the Inada-Sekiguchi-Shoda model, we can show that the (K_X^*, K_Z^*) is not stable. We can show by computing the Jacobian matrix. Define Jacobean matrix as $J_{(K_x, K_Z)}$ where

$$J_{(K_x,K_Z)} = \begin{bmatrix} \frac{\partial \dot{K_X}}{K_x} & \frac{\partial \dot{K_X}}{K_z} \\ \frac{\partial \dot{K_Z}}{K_x} & \frac{\partial \dot{K_Z}}{K_Z} \end{bmatrix}$$

@(K_X^*, K_Z^*), $\mu = R_X = R_Z$ *,we can show that*

$$\frac{\partial \dot{K_X}}{K_x} = -\mu + \left(\xi_X R_X + \left(\frac{\partial R_X}{\partial K_x}\xi_X + \frac{\partial \xi_X}{\partial K_x}R_X\right)K_X^*\right) + \frac{\partial \zeta_X}{K_x}R_Z.K_Z^* \quad <0$$

(-) (+)(+) (-)(+) (-)(+) (+) (-) (+) (+)

$$\frac{\partial \dot{K_X}}{K_z} = \frac{\partial \xi_X}{\partial K_Z}R_X.K_X^* + (\zeta_X K_Z^* + \left(\frac{\partial \zeta_X}{\partial K_Z}R_Z + \frac{\partial R_Z}{\partial K_Z}\zeta_X\right))K_Z^* \quad <0$$

(-) (+)(+) (+)(+) (-)(+) (+)(+) (+)

$$\frac{\partial \dot{K_Z}}{K_x} = \left(\xi_Z R_X + \left(\frac{\partial R_X}{\partial K_x}\xi_Z + \frac{\partial \xi_Z}{\partial K_x}R_X\right)K_X^*\right) + \frac{\partial \zeta_Z}{\partial K_X}R_Z.K_Z^* \quad >0$$

(+)(+) (-) (+) (+)(+) (+) (+) (+) (+)

$$\frac{\partial \dot{K_Z}}{K_Z} = -\mu + \frac{\partial \xi_Z}{\partial K_Z}R_X K_X^* + (\zeta_Z K_Z^* + \left(\frac{\partial \zeta_Z}{\partial K_Z}R_Z + \frac{\partial R_Z}{\partial K_Z}\zeta_Z\right))K_Z^* \quad >0$$

(-) (+) (+) (+) (+)(+) (+) (+) (+) (+) (+)

Then, One of the eigenvalues in Trace(J), $\frac{\partial \dot{K_Z}}{K_Z}$, is > 0. This can imply that (K_X^*, K_Z^*) is not a globally asymptotically stable. Therefore, this equilibrium does not happen in the real world. A slight disturbance will cause the direction away from the equilibrium point.

Similarly, $@(K_X^*, 0)$, $R_X > \mu > R_Z$,*we can show that*

$$\frac{\partial \dot{K_X}}{K_x} = -\mu + \left(\xi_X R_X + \left(\frac{\partial R_X}{\partial K_x}\xi_X + \frac{\partial \xi_X}{\partial K_x}R_X\right)K_X^*\right) \quad <0$$

(-) (+)(+) (-)(+) (-)(+) (+)

$$\frac{\partial \dot{K_X}}{K_z} = \frac{\partial \xi_X}{\partial K_Z} R_X . K_X^* \quad <0$$

(-) (+)(+)

$$\frac{\partial \dot{K_Z}}{K_x} = \left(\xi_Z R_X + \left(\frac{\partial R_X}{\partial K_x}\xi_Z + \frac{\partial \xi_Z}{\partial K_x}R_X\right)K_X^*\right) \quad >0$$

(+)(+) (-) (+) (+)(+) (+)

$$\frac{\partial \dot{K_Z}}{K_Z} = -\mu + \frac{\partial \xi_Z}{\partial K_Z} R_X K_X^* \quad <0$$

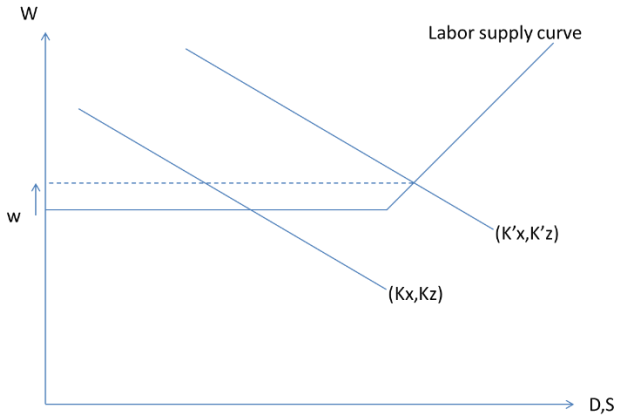
(-) (+) (+) (+)

Another equilibrium, $@(K_X^*, 0)$, has the eigenvalues in Trace(J), $\frac{\partial \dot{K_X}}{K_x}$ and $\frac{\partial \dot{K_Z}}{K_Z}$, < 0. This equilibrium is structurally stable. This also confirms that, if the economy starts below the MCE curve, the economy will end up at $(K_X^*, 0)$, the economy without heavy industry, in the long run.

Lewis turning point and the effect on capital accumulation and the take-off of economy

As in Lewis-Fei-Ranis model, the economic development process will lead to a shortage of labor supply (Figure 3.5). The surplus labor in the S-sector is not last long. Hence, we need a precise theory that shows the effect of labor shortage on the investment and the capitalization.

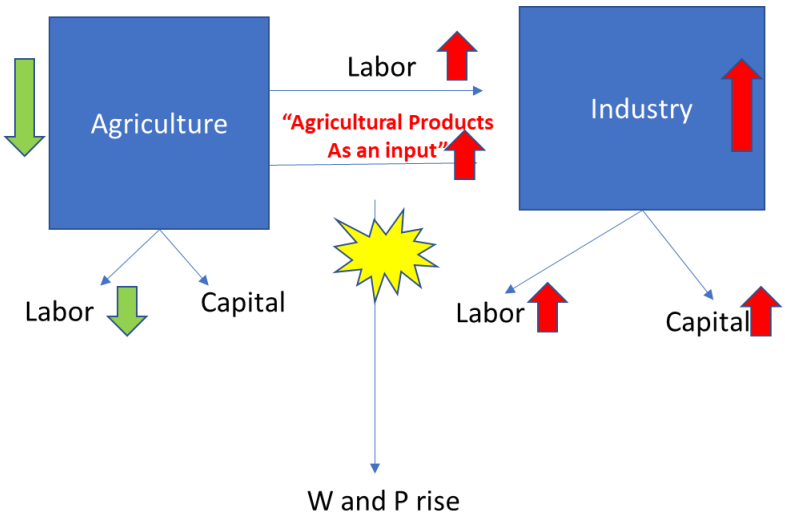
Figure 3.5 Labor shortage



Source: Inada, Sekiguchi, and Shoda (1992).

Consider the economy with unlimited supply with the labor demand curve (K_X, K_Z) represented by the flat of the labor supply curve. Then, after the economic progress, the labor demand shift until (K'_X, K'_Z) and the labor supply has changed from the horizontal line to slope upward line. As a result, the wage rate will increase due to the capitalization process. Thus, the expansion of production will bring about an increase in the wages of workers, and the profit rate will decline.

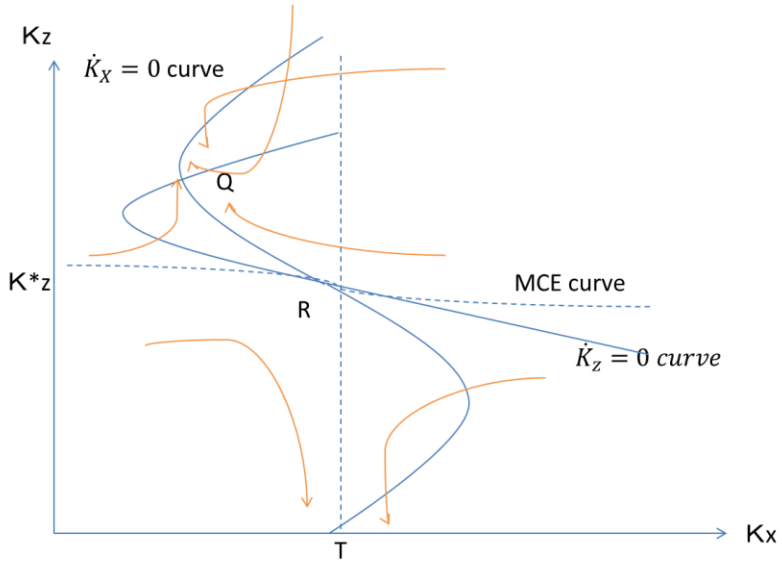
Figure 3.6 Effect of labor shortage: static view



Source: author based on Inada model

As a result, the expansion of the industry decelerates after economy reached the turning point. When the labor shortage is occurring in the S-sector, any labor demand from the X-sector and Z-sector will increase the wage rate and result as a decrease in the supply of the S-sector due to the lack of labor supply. At the same time, the demand for agricultural goods increases as the expansion of production leading to a higher cost of production in industries. Therefore, both wage and price levels will increase, and the profit rate will be smaller.

Figure 3.7 Effect of Lewis turning point to Dynamic path



Source: Inada, Sekiguchi, and Shoda (1992)

Consequently, the dynamic path will change to figure 4.5. The $\dot{K}_X = 0$ *and* $\dot{K}_Z = 0$ curves are bent due to the decline in profit and shift to invest in the higher profit sector instead. The new equilibrium, Q, exists, and stable. If the absorption of labor from the S-sector (agriculture) reduces food production, the wage level will rise. The take-off will be hampered, which means the industrialization is impossible without economic reform.

The capital flows from abroad are also essential. In the early period where the wage level is low, and the profit rate is still high compared to the worldwide level, the capital from abroad will inflow, and industrialization is faster. However, if the profit rates are low, especially when the wage level already increases, the capital inflow will slowdown. Even worse, some portion of the profits will flow out of the country to higher profit countries.

The shortage of labor hampers the capitalization and the take-off of the economy. Then,

economic reform is necessary.

Effect of the turning point in the mathematic form

At the turning point, w is an endogenous variable which

$$\frac{\partial W}{\partial X} = \underset{(-)\,(-)\,(+)}{\frac{\partial W}{\partial N_S}\frac{\partial N_S}{\partial N_X}\frac{\partial N_X}{\partial X}} > 0 \text{ and } \frac{\partial W}{\partial Z} = \underset{(-)\,(+)\,(+)}{\frac{\partial W}{\partial N_S}\frac{\partial N_S}{\partial N_Z}\frac{\partial N_X}{\partial Z}} > 0$$

In verbal, the expansion of the x-sector and the z-sector cause the wage level increase via the labor demand and a shortage in the supply of the s-sector, agriculture. Any expansion of sector X and Z require more labor demand, thus, $\frac{\partial N_X}{\partial X}$ and $\frac{\partial N_X}{\partial Z} > 0$. Since the labor supply is limit, we can easily see that $\frac{\partial N_S}{\partial N_X}$ and $\frac{\partial N_S}{\partial N_Z}$ are <0, any increase in labor demand in sector X and Z will result as a decrease in labor supply in sector S . Lastly, the lack of supply will lead to an increase in wage rate in the S sector.

Moreover, the higher cost of labor, the higher price of goods and services in the market, $\frac{\partial P}{\partial W} > 0$. This implies $\frac{\partial X}{\partial P}$ <0 and $\frac{\partial Z}{\partial P} < 0$ too. In fact, the expand of the X-sector and the Z-sector lead to the decrease in employment of the S-sector. If the economy has reached the turning point, the S-sector production will decrease, and the price will rise especially if the agriculture import substitution is difficult.

Case of Thailand

As shown in the previous chapter, Japan reached the turning point around the 1960s, (Minami 1973, Watanabe 1994), South Korea reached during around 1973-1975 (Moo-ki 1984, Kim 2014), Thailand reached around 2000 (referred from this study), and China is yet to reach the turning point (various sources of data). Since most countries in the Asia Pacific economy shares a similar pattern of economic development, the theory is widely known as the flying geese pattern (Akamatsu 1930, Okita 1985). We can be informed of what happened to the economies which reached a turning point in next periods.

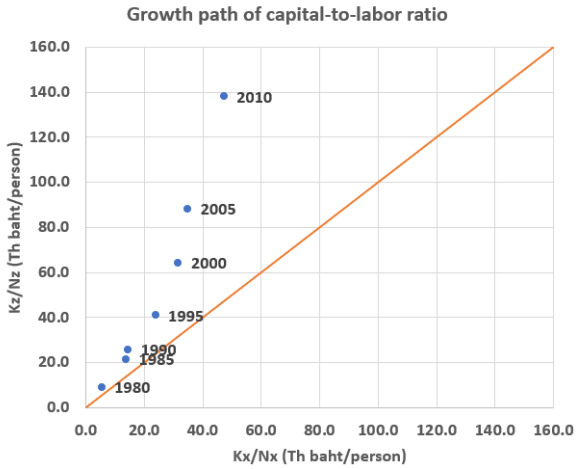
Figure 3.8 Export-oriented industries of selected East Asia Pacific countries.

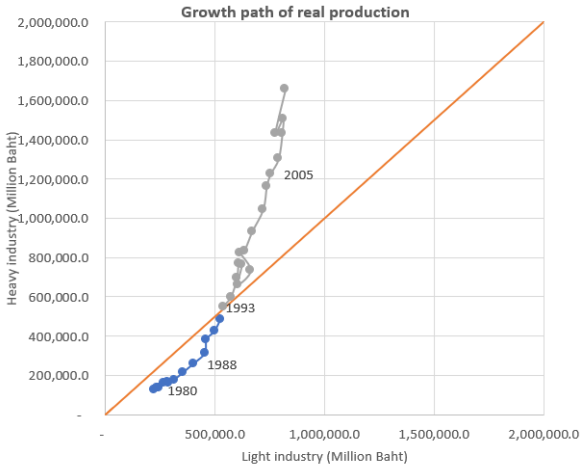
Export oriented Industries	1950s	1960s	1970s	1980s	1990s
Japan	Textile, light goods → Heavy industries				
Korea	Textile, sugar → Heavy industries				
Taiwan	Light goods, processed food --> Heavy industries				
Malaysia	Agriculture product → Machinery				
Indonesia	Agriculture product → Petroleum products				
Thailand	Agriculture product → Textile			→ Electronics , Automotive parts	

Source: reproduce from www.pdx.edu

Figure 3.8 confirms the flying geese pattern of East Asian countries and of the selected ones. The shift from light to heavy industry can be seen as the pattern. Thailand also strictly followed the pattern by shifting from agriculture to light industry in the mid-1970s but shifted to heavy industry of electronics and automotive parts in the 1990s.

Figure 3.9 Path of capital accumulation in Thailand during 1980-2010



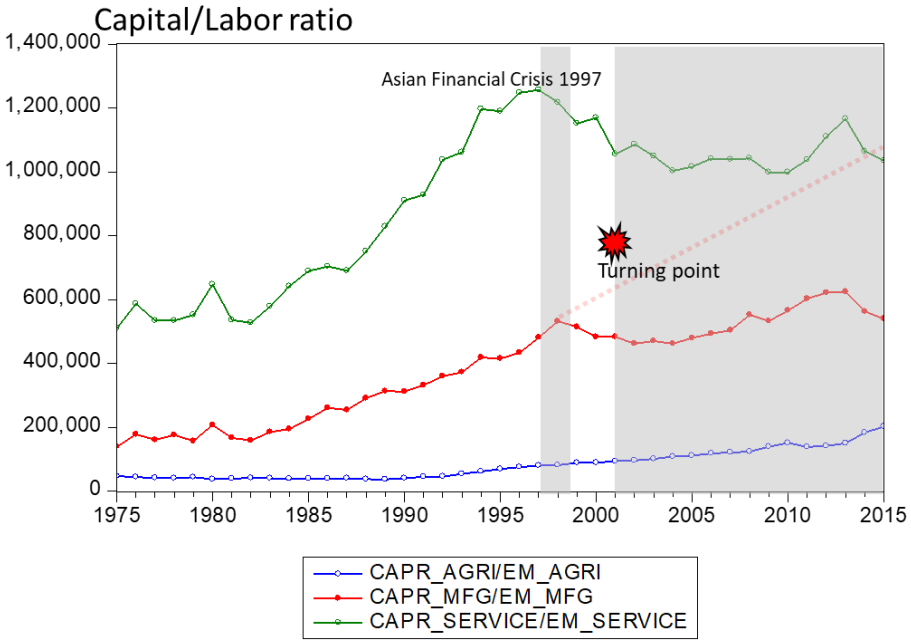


Source: NESDB and National statistical office

The path of capital accumulation proves the theory. According to the Inada, Sekiguchi, and Shoda (1992) theory, similar to East Asian economy, Thailand's economy itself is likely to shift from an economy with the light to heavy industry. The left figure using the data from the Input-Output table of Thailand shows the path of expansion in the capital-labor ratio of both sectors.

However, the path moved vertically east from 1980-2010 above the 45-degree line, indicating that the Z-sector is dominant. The plotted growth path in real production of both sectors confirms that the heavy industry has grown faster after the plaza accord and become the main sector around 1993.

Figure 3.10 Capital-labor ratio of Thailand in 1975-2015[8]

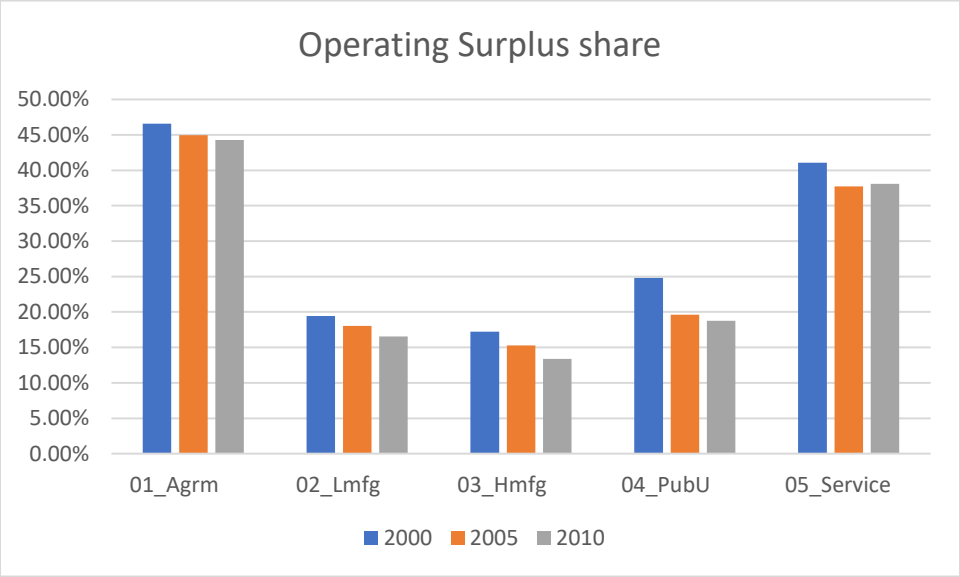


Source: NESDB and National statistical office

At the same time, it is obviously seen too that the turning point has some risks in the take-off of Thailand's economy. The capital-labor ratio, which represents the transformation from labor-intensive to capital-intensive countries, shows a rapid growth during 1985-1997 due to the Plaza accord agreement. However, the capital accumulation process was disrupted by the crisis in 1997 and the turning point in 2000. It seems that Thailand's capital-labor ratio is never back to the same path before 1997, even being a horizontal line.

[8] The service sector includes real estate activities and Transportation, which also have a high value of the capital stock. Thus, the result shows the higher capital / capital-labor ratio in total.

Figure 3.11 Operating surplus as a share in a production function



Source: NESDB

Thailand's sectors are categorized into five groups, (1) agriculture and mining, (2) light industries, (3) heavy industries, (4) public utilities, and (5) services. The operating surplus of all sectors shows a percentage of decline in most sectors. From 2000- 2010, the operating surplus share in most sectors decreased, except only for services. This clearly shows the influence of the turning point to the industrialization.

In conclusion, the Lewis turning point of the agriculture sector slows the capital accumulation of industries and the take-off of the economy. Thailand has recorded slower growth compared to the previous Asian Financial Crisis as well as the turning point period. This usually occurs in the economy reaching the turning point. The economy does not grow at the same pace as earlier without any economic reforms. Thus, agriculture sector reform is essential to achieve the take-off or avoid the middle-income trap. First, improving labor productivity is needed. It can be done through either capital accumulation or technological progress in the agriculture sector. Second, modernizing the agriculture sector in order to use less labor is also suggested. So, the output of the agriculture sector can increase even if some parts of labor are cut.

3.3 Discussion on Capital accumulation process

As argued in Inada, Sekiguchi, and Shoda (1992) model, the reach of the Lewis turning point slows down the capital accumulation process, and the economy does not grow without economic reforms. The result proves that Thailand follows the pattern. However, it is argued that the passing turning point causes under-capitalization. To raise an example from the Inada model derived from the supply side, the lower rental price of capital (less profit rate) provides less saving and investment. But the lower relative real rental price of capital induces the higher demand for capital instead.

Practically, the rate of capitalization does not need to be low due to the smaller profit share caused by the turning point. First, in an open economy, even if the saving rate falls, the trade surplus may rebalance from investment demand to consumption without any reductions in the rate of investment. Moreover, if there is enough increase in productivity growth, the profit rate loss due to the wage increase can be offset, and the under-capitalization does not occur.

Theoretically, there is a controversy among schools of thought. The neoclassical school believes in the smooth inverse relationship between capitalization and factor price ratio whereas the Post Keynesian school believes that the relationship is determined in a narrow range. That is why the profit rate does not need to decrease in the long run.

In the case of Thailand, reverse migration occurred in 1997/98 – 2000 because of the Asian financial crisis so the part of the labor influx from rural to urban after the turning point happened to the industrial and services sector after the economic recovery. However, since the real and financial capital stock had been damaged so much during the AFC, most firms are not able to borrow capital from financial institutions. Thus, instead of new machine investment, most gross fixed capital formation of the private sector was full of replacement investment.

Furthermore, the profit rate in Thailand is declining owing to stagnant labor productivity. Since labor productivity or productivity is not fully improved, the industries prefer to hire low-paid migrant workers. This is consistent with entrepreneurs' decision to delay capital investment as observed from the slower capital accumulation and low-paid labor influx from neighboring countries. Financial institutions recognize a low rate of return for lending to the real sector, compared with the non-tradable sector like a housing estate. Hence, the banks hardly give a loan to real sectors. The aforementioned issue is the other reason why Thailand has not sufficient capital investment in industries.

3.4 Counterfactual Analysis

Inada model correctly predicts the effect of turning point to the process of industrialization in Thailand. The result shows that Thailand strictly follows the pattern of the country with light industry to become an economy with heavy industry nominated the light industry. However, since the profit rate decline due to an increase of wage level, the growth rate also declines and results in a slower pace of capital accumulation.

The slow pace of capital investment without any surplus labor in the rural area is the dilemma of Thailand's economy. To reach a level of development, an enormous investment is required to keep economic growth, but an investment is not sufficient on their own. This is a vicious circle in which the economy is trapped and unable to escape until an economic reform is undertaken. (Inada et. al, 1992 page 45). Consequently, the economy needs government intervention. Inada et al. suggest that specialized institutions, economic system reform, and education development are necessary for promoting industrialization.

Theoretically, the government has a role in industrial activities through two main channels: taxation and fiscal expenditures. The goal of the policy instruments is to deal with hurdles of industrialization. Some policies, such as public investment or subsidies to industries by the government, are preferred but fiscal sustainability cannot be ignored. Thus, any policy needs a source of income, starting from taxation, the government’s primary income.

Because of this challenge, it is suggested that Thailand need an economic reform. The corporate tax reform is one of the policies that can boost the investment of capital and decrease the labor use. Moreover, consumption tax is another policy useful for developing investments. Therefore, the counterfactual Analysis by CGE model is used here to measure the impact of tax reform in the next chapter.

CHAPTER 4

The Corporate Income Tax Policy : The counterfactual analysis

Since the economic reform is necessary, in this chapter, we simulate the counterfactual study to measure the impacts of corporate income tax (CIT) cut which affect Thailand's capital accumulation.

Since Inada, Sekiguchi, and Shoda (1992) model is mainly based on the supply side, we extend the model in terms of the general equilibrium model by using Computable General Equilibrium (CGE) model. We, therefore, use the CGE model with a small open economy which represents the characteristics of Thailand's economy.

4.1 Structure of the Corporate Income Tax in Thailand

Revenues from the corporate tax rate are one of the major sources of income for Thai government. The Corporate Income tax rate in Thailand is collected from companies which is based on net income companies obtained during one business year. The corporate income tax rate in 2015 in Thailand is 20 percent on net profit. However, the rate depends on type of business, size of company, and whether it is a regional operating headquarters company. Corporate income tax revenue has become more important source of income for the government. This shows the rapid growth in industrial activities. Corporate income tax revenue as a share of total revenue has risen over time from 15 percent of total revenue in 1990 to 22 percent in 2015. The other main sources of income of Thai government are value-added tax, excise tax, and personal income tax respectively which have more than 10 percent share of total revenue. On the other hand, the export and import tax revenue tends to decline over time due to the rise of the free trade agreement.

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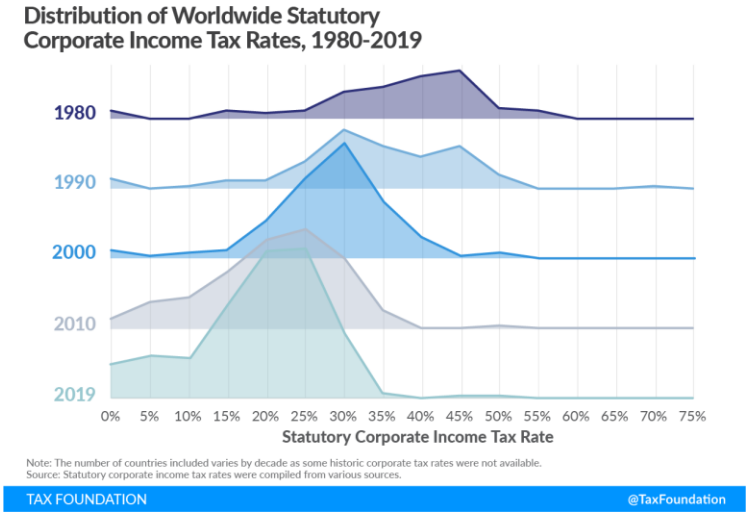
Table 4.1 Government revenue by source of income 1990-2015

(Million baht)	Government Revenue (Million baht)						% of total revenue					
	1990	1995	2000	2005	2010	2015	1990	1995	2000	2005	2010	2015
Gross Revenue	**404,941**	**815,143**	**817,597**	**1,474,421**	**2,003,044**	**2,619,866**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**
Corporate income tax	**58,900**	**157,078**	**145,554**	**329,516**	**454,565**	**566,150**	**0.15**	**0.19**	**0.18**	**0.22**	**0.23**	**0.22**
Personal income tax	39,338	86,190	91,790	147,352	208,374	302,491	0.10	0.11	0.11	0.10	0.10	0.12
Petroleum Income Tax	1,794	3,196	10,739	41,178	67,599	83,522	0.00	0.00	0.01	0.03	0.03	0.03
Sale tax	88,035	1,082	126	-	-	-	0.22	0.00	-	-	-	-
Value added tax	-	163,122	192,510	385,718	502,176	708,905	-	0.20	0.24	0.26	0.25	0.27
Specific business tax	-	28,311	17,015	26,304	22,892	54,175	-	0.04	0.02	0.02	0.01	0.02
revenue stamp	3,780	5,284	3,351	6,816	8,735	13,572	0.01	0.01	0.00	0.01	0.00	0.01
Excise Tax	73,279	155,308	168,824	279,395	405,860	439,093	0.18	0.19	0.21	0.19	0.20	0.17
Export/Import Tax	91,026	128,548	87,195	110,404	97,148	115,488	0.23	0.16	0.11	0.08	0.05	0.04
Other Tax	642	249	236	266	243	388	0.00	-	-	-	-	-
Other revenue	48,147	86,775	100,257	147,472	235,452	336,082	0.12	0.11	0.12	0.10	0.12	0.13
Less- *tax return and etc.*	-	60,045	67,513	151,091	232,834	309,705	-	0.07	0.08	0.10	0.12	0.12
Net revenue	**404,941**	**755,098**	**750,084**	**1,323,330**	**1,770,210**	**2,310,161**	**1.00**	**0.93**	**0.92**	**0.90**	**0.88**	**0.882**

Source: Ministry of Finance

Furthermore, the increasing trend of CIT tax revenue happens simultaneously with the effort to reduce the corporate tax rate. Many countries choose to reduce corporate tax to boost investment and attract new businesses into their markets. It can be seen that corporate tax reduction shifts to taxing corporations lower than 30 percent. (Figure 4.1)

Figure 4.1: The Worldwide Distribution of Statutory Corporate Income Tax Rates 1980-2019



Source: Asen (2019)

Figure 4.1 shows the distribution of corporate income tax rates around the world. We can see that the largest shift between 2000 and 2010, with 77 percent of countries imposed a statutory rate below 30 percent in 2010 but only 42 percent of countries imposed a statutory rate below 30 percent in 2000. The shift implies that the corporate income tax reform is an important policy for reducing the tax to attract any international investors.

Thailand strictly follows this pattern. Generally, the corporate income tax rate would have been 30 percent of the net profit before 2011 unless the company had registered in the stock exchange market. After that, the corporate tax income rate diminished from 30 to 23 percent and 20 percent of the net profit in 2012 and 2013. This is a current rate of Thailand's corporate income tax. At the same time, Thai government supports both small and medium enterprises. Companies with paid-up capital less than 5 million baht at the end of the financial year are charged at a reduced rate. The reduced rate depends on net profit, which changes from the first 3 million baht since 2015. Figure 4.2 shows the corporate income tax as the percentage of revenue over time. Corporate income tax is one of the primary government income sources. The percentage of corporate income tax to total revenue increased from 20 to around 31.4 percent of total tax revenue during 2000-2011. But after 2011, the share of corporate tax income slightly has declined. More details of tax rate categorized by a type of company are shown in table 4.2

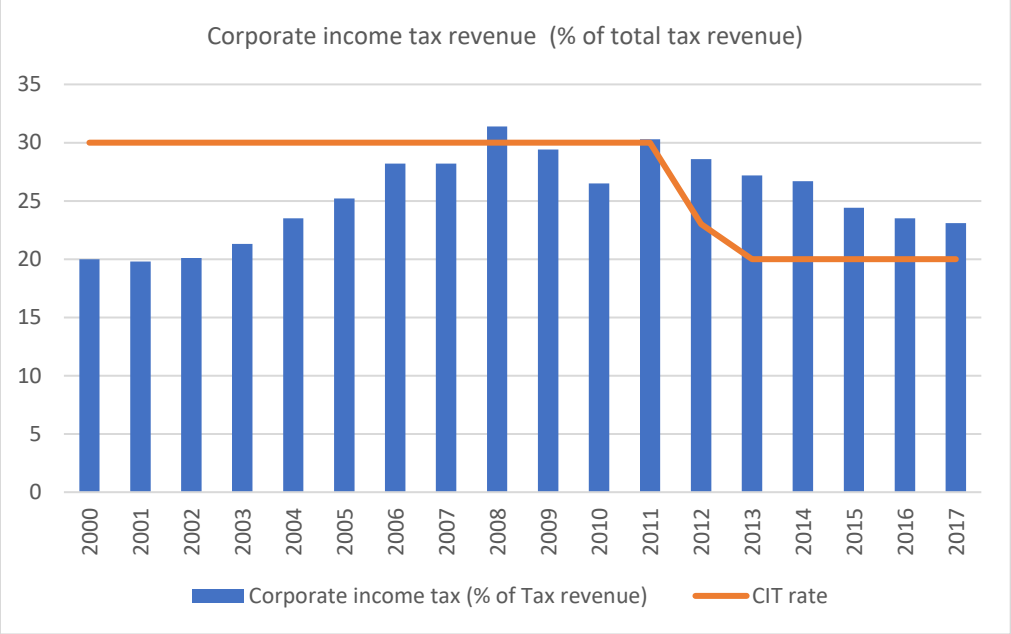
Table 4.2 Historical record of the corporate income tax rate in Thailand

Time frame	Rate (%)
1.Before 1977	
(1) Net profit of the first 500,000 baht	20
(2) Net profit of next 500,000 baht	25
(3) Net profit of 1,000,000 baht or more	30
2. 1977-1980	
(1) Companies registered in the Stock Exchange of Thailand	30
(2) A company unregistered on the Stock Exchange of Thailand	35
3. 1981-1985	
(1) Companies registered in the Stock Exchange of Thailand	30
(2) Companies unregistered on the Stock Exchange of Thailand	40

Time frame	Rate (%)
4. 1986-1991	
(1) Companies registered in the Stock Exchange of Thailand	30
(2) Companies unregistered on the Stock Exchange of Thailand	35
5. 1992-2000	
Tax on net profits of a corporation or registered ordinary partnership	30
6. 2001-2007	
(1) Companies registered in the new Stock Exchange of Thailand	20
(2) Companies registered in the Stock Exchange of Thailand	25
(3) Companies unregistered on any Stock Exchange of Thailand	30
7. 2008-2011	
(1) Companies registered in the MAI Stock Exchange of Thailand	20
(2) Companies registered in the SET Stock Exchange of Thailand	25
(3) Companies unregistered on any Stock Exchange of Thailand	30
8. 2012-2013	
(1) Companies in general	23
(1) Small and Medium Enterprise (Net profit of the first 150,000 baht)	0
(2) Small and Medium Enterprise (Net profit from 150,000 baht but not exceeding 1 million baht)	15
9. 2013-2014	
(1) Companies in general	20
(2) Small and Medium Enterprise (Net profit of the first 150,000 baht)	0
(3) Small and Medium Enterprise (Net profit from 150,000 baht but not exceeding 1 million baht)	15
9. 2015-now	
(1) Companies in general	20
(2) Small and Medium Enterprise (Net profit of the first 300,000 baht)	0
(3) Small and Medium Enterprise (Net profit from 300,000 baht but not exceeding 3 million baht)	15

Source: TDRI, and The Revenue Department of Thailand

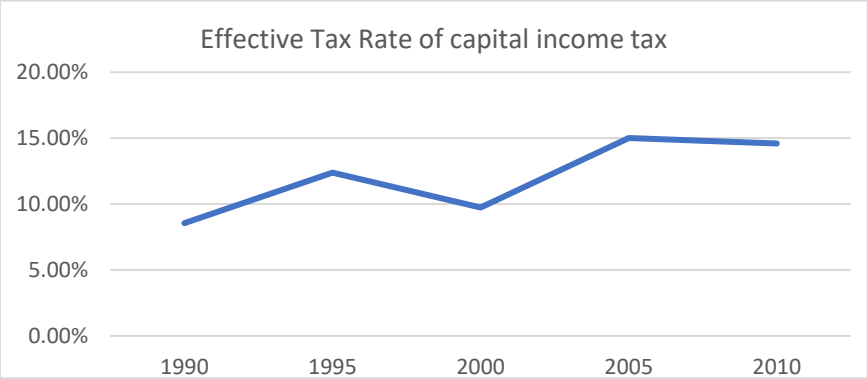
Figure 4.2 Corporate income tax rate and income of Thailand (% of total tax revenue)



Source: Ministry of Finance, Thailand

Despite the usual actual tax rate is 20 percent, the effective tax rate of corporate income tax rate is lower than 20 percent. According to the statistics, the actual effective tax rate of the whole economy calculated by corporate tax revenue collected over the operating surplus is only between 8-15 percent of the gross profit. The tax rate collected is lower than the actual rate because of several factors. First, Thailand offers many tax deductions for entrepreneurs. Since most enterprises in Thailand are SMEs , the government encourages the Small and Medium Enterprise (SMEs) by charging at the lower rate (Table 4.2) to stimulate domestic investments and support small enterprises. Even companies registered in the stock market are charged at a lower rate. Lastly, there are many companies which are out of the tax system. They pay small amounts of tax.

Figure 4.3 Effective Tax rate of Corporate Income Tax 1990-2010



Source: Author's calculation[9]

Besides, even if Thailand has recovered from the Asian financial crisis in 1998, the manufacturing absorption results in quick labor shortages, but brings a large amount of unskilled immigrants from neighboring countries instead. As a result, the profit rate of manufacturing and investment declines, proved by the slower capital accumulation over time. These problems dissuade international investors to run businesses in Thailand. Therefore, reforming the corporate tax rate will create a business-friendly environment to stimulate wide-ranging investments.

Moreover, corporate tax reform has many positive views. There are several studies in Thailand about corporate income tax reform and its effect. But researches on the dynamic impact of tax reform are undertaken. Chotchuangnirun (2018) found the positive influence of the corporate income tax policy on GDP. Because of regressing a production function including tax of Thailand, the result shows that the elasticity of corporate tax to GDP of Thailand equals to 0.132 on the negative sign. It implies that the reduction of corporate tax will have a positive effect on GDP in Thailand. Pitidol (2018) confirmed that Thailand urgently needed tax reform to destabilize the domestic economy. The study showed that tax reform can both increase revenue and reduce inequality. Benjasak and Bhattarai (2019) simulated the effect of reform in the corporate income tax in Thailand and compared it to the VAT reform by using a static CGE model. They simulated the impact of a decrease in the corporate income tax rate from 30 to 23 and 20 percent respectively by using the 2010 SAM data. The result shows that although tax reduction has a positive effect on

[9] The calculation is based on revenue from corporate income tax over the operating surplus. We assume that 40 percent of operating surplus are SMEs since the statistic shows that over 99 percent of firms in Thailand are SMEs and cover 40 percent of GDP (SME.go.th). See appendix A for the detail of calculation.

household welfare, it has a negative effect on public welfare and the usual price level of the economy rises due to the higher demand.

After reducing a corporate income tax in 2012 and 2013, Thailand reformed it for the second time, unlike any other countries. Thus, we would like to simulate the impact of changing the corporate tax rates once the economics reaches the turning point in 2000 by using counterfactual analysis.

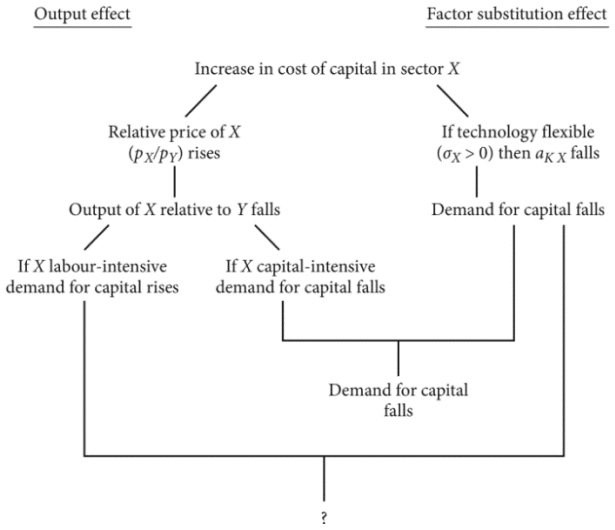
4.2 Methodology

4.2.1 Theoretical model

Harberger Model of Corporate Income Taxation

Harberger model is the most famous theoretical framework for the analysis of the effects of the corporate income tax. The general approach of taxation was firstly developed by Harberger (1962). He derived the effect of corporate income tax using the general equilibrium two sectors model; one is a corporate sector subject to a tax and the non-corporate sector without tax. Each sector produces separate goods using two factors of production, capital, and labor. The Harberger model considers the incidence and the deadweight loss of the corporate income tax by taxing the corporate firm.

Figure 4.4 Effect of corporate income tax



Source: Atkinson and Stiglitz (2015)

The tax on corporate capital will affect two different channels, the excise tax (output) effect, and the factor substitution effect. Firstly, the tax increases cost to the corporate sector and raise the price of goods in that sector. Therefore, the quantity of goods produced is fallen, and both capital and labor used in this sector decline, but the effect on the factors price will depend on the capital-labor ratio of both sectors. A tax on corporate capital will also have a factor substitution effect. Since the cost of capital rises, labor is more preferred. Producers will substitute away from the capital. Capital will push to the non-tax firms, and the price of capital will fall, and those of labor will rise. While the burden of excise tax effect can fall on labor, capital, or both depending on substitutability, the substitution effect will negative only for the capital.

The Harberger model is the two-sector model based upon standard neoclassical assumptions. They are two competitive industries, X and Y, and two factors, capital (K) and labor (L), under the constant returns to scale technology. The basic demand equation in simple versions of the Harberger model is $\frac{dx}{x} = -E\frac{d(P_x/P_y)}{P_x/P_y}$. Where E is the income-compensated elasticity of demand for good x with respect to relative product prices. Differentiation and use of the convention that all prices are initially unity produces the standard Harberger equation,

Demand for X

$$dx/x = -E\left(dP_x - dP_y\right) \qquad (4.1)$$

The demand for X depends only on changes in relative product prices results from the simplifying assumption that 'small' taxes are imposed. Thus, any redistribution of purchasing power from the private sector to the government or within the private sector has no effect upon demand. E in eq. (4.1) is the Hicksian substitution term in the Slutsky equation.

Supply of X

$$\frac{\mathrm{d}x}{x} = f_L\frac{\mathrm{d}L_x}{L_x} + f_K\frac{\mathrm{d}K_x}{K_x}, \qquad (4.2)$$

where f_L and f_K are the initial shares of capital and labor in industry x. Simply stated, the percentage change in the output of good x is the weighted average of the percentage changes in the two inputs, where the weights are initial factor shares. f_L and f_K are the partial elasticities of output with respect to the two inputs.

The equation for industry y is redundant, as any factors not employed in x are automatically employed in Y. We also know that a demand equation for good Y by Walras' law.

Then, the possibilities of factor substitution in production are indicated by the elasticities of substitution in the two industries, Sx and Sy, are

$$\frac{\mathrm{d}(K_x/L_x)}{K_x/L_x} = -S_x \frac{\mathrm{d}(P^*_{Kx}/P^*_{Lx})}{P^*_{Kx}/P^*_{Lx}}, \tag{4.3}$$

and

$$\frac{\mathrm{d}(K_y/L_y)}{K_y/L_y} = -S_y \frac{\mathrm{d}(P^*_{Ky}/P^*_{Ly})}{P^*_{Ky}/P^*_{Ly}}, \tag{4.4}$$

where asterisks on price variables indicate factor prices as entrepreneurs see them, that is, factor prices inclusive of factor taxes. The gross factor prices in industry x can be related to the corresponding net factor prices in the following way:

$$P^*_{Kx} = P_{Kx} + T_{Kx} + T_K, \tag{4.5}$$

and

$$P^*_{Lx} = P_{Lx} + T_{Lx} + T_K, \tag{4.6}$$

Differentiating the above equations defining the elasticities of substitution and the relationships between gross and net factor prices, setting all factor taxes initially equal to zero, and making use of the convention that all initial prices are unity, we derive the following standard Harberger equations:

Factor response in X

$$\frac{dK_x}{K_x} - \frac{dL_x}{L_x} = -S_x(dP_{Kx} + dT_{Kx} + dT_K - dP_{Lx} - dT_{Lx} - dT_L) \tag{4.7}$$

Factor response in Y

$$\frac{dK_y}{K_y} - \frac{dL_y}{L_y} = -S_y\left(dP_{Ky} + dT_{Ky} + dT_K - dP_{Ly} - dT_{Ly} - dT_L\right) \tag{4.8}$$

The relation of changes in product prices to changes in tax-inclusive factor prices and sales taxes is given by the following version of Euler's theorem[10]

$$dP_x = f_L dP^*_{Lx} + f_K dP^*_{Kx} + dT_x + dT_c, \qquad (4.9)$$

and

$$dP_y = g_L dP^*_{Ly} + g_K dP^*_{Ky} + dT_y + dT_c, \qquad (4.10)$$

The percentage change in the price of a product is the weighted average of the percentage changes in the tax-inclusive prices of factors (where the weights are factor shares), plus any ad valorem excise tax on the product and any ad valorem sale tax (Tc). Substituting into these equations we have the standard Harberger expressions for the relationship between product prices, net factor returns and various kinds of taxes,

$$\mathrm{d}P_x = f_L(\mathrm{d}P_{Lx} + \mathrm{d}T_{Lx} + \mathrm{d}T_L) + f_K(\mathrm{d}P_{Kx} + \mathrm{d}T_{Kx} + \mathrm{d}T_K) + \mathrm{d}T_x + \mathrm{d}T_c, \qquad (4.11)$$

and

$$\mathrm{d}P_y = g_L\left(\mathrm{d}P_{Ly} + \mathrm{d}T_{Ly} + \mathrm{d}T_L\right) + g_K\left(\mathrm{d}P_{Ky} + \mathrm{d}T_{Ky} + \mathrm{d}T_K\right) + \mathrm{d}T_y + \mathrm{d}T_c \qquad (4.12)$$

The next four equations describe the fixity of total factor supplies and alter- native mobility assumptions. Equation (4.13) and (4.14) simply state that in total both factors are fixed in supply,

$$\mathrm{d}K_x + \mathrm{d}K_y = 0 \qquad (4.13)$$

and

$$\mathrm{d}L_x + \mathrm{d}L_y = 0 \qquad (4.14)$$

It is important to note that these two equations imply that there is no net saving (or if a longer-range view is taken, that the rate of saving is not economically determined) and that there is no labor-leisure choice (and that growth of the labor force is exogenous, in a long-run context).

Alternative assumptions about the inter-industry mobility of the two factors are described by equations (4.15) and (4.16) for capital and by equations (4.17) and (4.18) for labor,

[10] Under the assumptions that all taxes are initially zero and all prices are initially unity. See Harberger (1962) for the derivation.

$$\mathrm{d}P_{Kx} = \mathrm{d}P_{Ky} = \mathrm{d}P_K \qquad (4.15)$$

or

$$\mathrm{d}K_x = 0 \qquad (4.16)$$

and

$$\mathrm{d}P_{Lx} = \mathrm{d}P_{Ly} = \mathrm{d}P_L \qquad (4.17)$$

or

$$\mathrm{d}L_x = 0 \qquad (4.18)$$

Equation (4.15) and (4.17) imply that capital and labor are completely mobile between sector, and therefore receive a common rate of return. (4.16) and (4.18) are the alternative expression implying that capital and labor are completely immobile between sectors and then the different of the return to factors are exist.

Thus far we have ten equations to solve for eleven unknowns. To close the system, we must either choose one good or one factor to serve as numeraire or add to the model a simple description of macroeconomic policy. Equation (4.19) to (4.22) are the example in which the system can be closed that have been employed in the literature,

$$dP_L = 0, \qquad (4.19)$$

$$dP_y = 0 \quad , \qquad (4.20)$$

$$L_x dP_{Lx} + L_y dP_{Ly} + K_x dP_{Kx} + K_y dP_{Ky} = dM, \qquad (4.21)$$

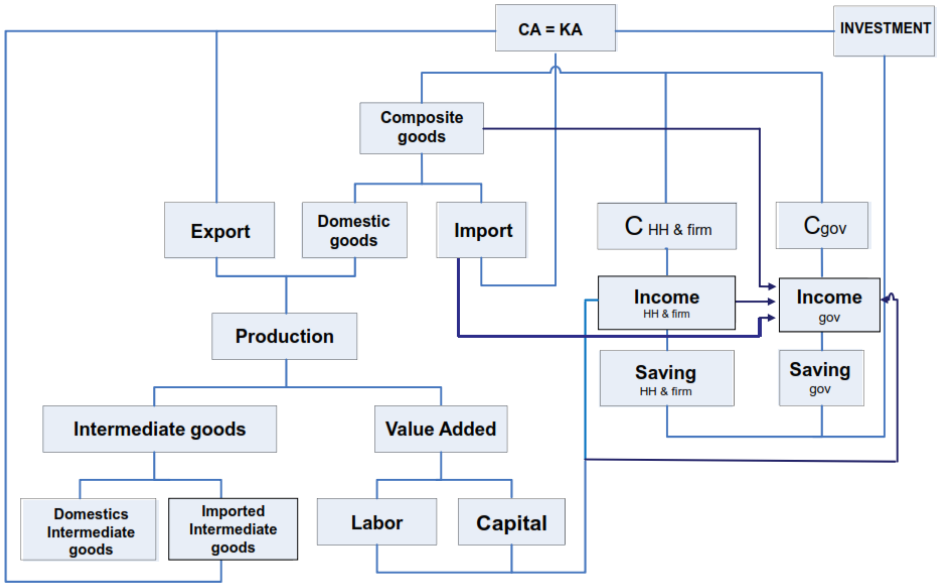
$$x dP_x + y dP_y = V dM \qquad (4.22)$$

In the first of these, the original Harberger formulation, labor is taken to be the numeraire. In the second, product y, usually the untaxed product, is chosen as the numeraire. In the third and fourth alternative descriptions, in which V is the velocity of money and M the money supply, it is assumed that the monetary authorities act to stabilize (or otherwise affect) the value of either disposable income (eq. (4.21)) or net national product (eq. (4.22)).

4.2.2 Empirical model: A Computable General Equilibrium Model

Computable general equilibrium (CGE) model is a powerful tool for analyzing policy alternatives, especially in international trade policy. Along the way, CGE models have become increasingly sophisticated, with features that address, for example, economies of scale, imperfect competition, and investment.

Figure 4.5: Main structure of the CGE model



The model base on the Standard CGE model developed by Robichaud, Le Melin, Maisonnave and Decaluwe (2010) under the PEP research network. Our model is slightly different from the original one especially we have adjusted the nested structure of production function, commodities aggregation, capital formation allocation, endogenous labor supply, labor productivity, and growth assumption on exogenous variables, etc.

Corporate and corporate tax in PEP model

In the model, main source of firm's income is the return on capital , $YFK_{f,t}$ plus transfer income, $YFTR_{f,t}$.

$$YF_{f,t} = YFK_{f,t} + YFTR_{f,t} \quad (4.23)$$

where

$YF_{f,t}$: Total income of type f businesses

$YFK_{f,t}$: Capital income of type *f* businesses

$YFTR_{f,t}$: Transfer income of type *f* businesses

The enterprise then pays the corporate income tax, $TDF_{f,t}$, and allocates the after-tax income to household.

$$YDF_{f,t} = YF_{f,t} - TDF_{f,t} \quad (4.24)$$

where

$SF_{f,t}$: Savings of type *f* businesses

$TDF_{f,t}$: Income taxes of type *f* businesses

$YDF_{f,t}$: Disposable income of type *f* businesses

Government earns its incomes from the corporate income tax collected on the capital income.

$$TDF_{f,t} = ttdf0_{f,t} + ttdf1_{f,t}YFK_{f,t} \quad (4.25)$$

where

$ttdf0_{f,t}$: Intercept (income taxes of type *f* businesses)

$ttdf1_{f,t}$: Effective Corporate income tax rate of type *f* businesses

Investment Decision

There are relevant to investment and capital accumulation in the Inada model and the PEP standard CGE model. We can show that even a slightly different in the equation formula, both are the same theory viewed on a different side of the coin.

Investment Decision in Inada, Sekiguchi, and Shoda (1992) model

From equation (3.9) and (3.10) in chapter 3 If Rx=Rz then, ξ_X, ζ_Z=1 and ξ_Z, ζ_X =0

$$\dot{K}_X = R_X.K_X - \mu K_X \quad (3.9')$$

$$\dot{K}_Z = R_Z.K_Z - \mu K_Z \quad (3.10')$$

In discrete time,

$$K_{X,t+1} = K_{X,t}(1-\mu) + \xi_X R_X.K_X = K_{X,t}(1-\mu) + IND_X \quad (3.9'')$$

$$K_{Z,t+1} = K_{Z,t}(1-\mu) + \zeta_Z R_Z . K_Z = K_{Z,t}(1-\mu) + IND_Z \qquad (3.10'')$$

Where $\xi_X R_X . K_X = IND_X$,and $\zeta_Z R_Z . K_Z = IND_Z$

are the basic capital accumulation rule.

Investment Decision in PEP-CGE model (Tobin Q)

In the PEP-CGE model, the capital accumulation equation is a basic neoclassical equation

$$KD_{k,j,t+1} = KD_{k,j,t}\left(1-\delta_{k,j}\right) + IND_{k,j,t} \qquad (4.23)$$

Where

$KD_{k,j,t}$: Demand for type *k* capital by industry *j*
$IND_{k,j,t}$: Type *k* of new capital investment in sector *j* (whether public or private)
$\delta_{k,j}$: The depreciation rate of the capital of type *k* used in industry *j*

The stock of type k capital in industry j in period t + 1 is equal to the stock of the preceding period, minus depreciation, plus the volume of new capital investment in the prior period.

An investment decision is based on the Tobin Q theory. The amount of investment expenditures is determined by

$$IND_{k,j,t} = \phi_{k,j}\left[\frac{R_{k,j,t}}{U_{k,j,t}}\right]^{\sigma_{k,j,t}^{INV}} KD_{k,j,t} \qquad (4.24)$$

Where

$\emptyset_{k,j}$: Scale parameter (allocation of investment to industries)
$\sigma_{k,bus}^{INV}$: The elasticity of private investment demand relative to Tobin's *q*
$U_{k,j,t}$: User cost of type *k* capital in industry *j*

The volume of new type k capital allocated to each industry is proportional to the existing stock of capital; and the proportion varies according to the ratio of the rental rate to the user cost of that capital, which may be interpreted as Tobin's q.

To sum up, in the PEP-CGE model, the model assumes a *Putty-clay* model of investment[11]. The elasticity of factor substitution is an ex-ante and in the short run is equal to zero. Ex post or in the long run, the elasticity of factor substitution is equal to one. Therefore, once the capital stock has been accumulated, the investment will be unresponsive to changes in factor prices: the ex-post elasticity of substitution will be considerably less than one, and new investment decisions will be constrained by the existing technology embodied in the current capital stock.

Both of Inada et al. (1992) theory and Tobin q theory in the PEP-CGE model are the similar characteristics of an investment per se since we can see that the amount of investment will go to a higher profit sector and is economically rational.

4.2.3 Data and Parameter calibration

We constructed a database for the CGE model using the following databases. The database has five sub-sectors: (1) agriculture and mining, (2) light industries, (3) heavy industries, (4) public utilities and (5) services.

Abbreviation	Sector description
01_Agrm	Agriculture and Mining
02_Lmfg	Light industries
03_Hmfg	Heavy industries
04_PubU	Public utilities (Electricity, Water and Gas)
05_Service	Services

National Income Data

The data from the national income data of Thailand provided by the office of the national economic and social development council is both in current market prices and chain volume measure (reference year = 2000).

Input-Output Table

The input-output table of Thailand is a table showing the relationships and links of production and distribution of products and services produced that occur in the economy in a period. The table, in the case of Thailand, is done every five years, which the latest one is 2015

[11] The capital is like 'putty or jelly' ex-ante but 'baked in clay' ex-post. This, the investment will be unresponsive to changes in factor prices in the short run but not in the long run

data. We also collect the data of the Input-output table from 1975-2010 and use it as the base data to estimate the parameter.

Capital Stock

The capital stock is officially available at the national account data of Thailand except for the sub-sector in manufacturing. We firstly estimate the capital stock, which is consistent with the IO structure in the planning period by applying the "Perpetual Inventory Method" following Berlemann and Wesselhoft (2014).

It is assumed that the stock of inventory increases with capital formation (investments).

$$K_t = (1-\delta)K_{t-1} + I_{t-1} \qquad (4.25)$$

where δ is the geometric depreciation rate. Repeatedly substituting this equation for the capital stock at the beginning of

the period, leads to the capital stock in period t is a weighted sum of the history of capital stock investments

$$K_t = \sum_{i=0}^{\infty}(1-\delta)^i I_{t-(i+1)} \qquad (4.26)$$

Assuming the base year (origin of series) capital stock$\overline{K}$, and depreciation rate δ the capital stock series becomes $K_t = (1-\delta)^{t-1}\overline{K} + \sum_{i=0}^{t-1}(1-\delta)\, I_{t-(i+1)}$. Berlemann and Wesselhoft have proposed the 'Steady State Approach' based on Harberger (1978). At the 'steady state' output $gGDP$ grows at the same rate as the capital stock $gGDP = gK = \frac{K_t - K_{t-1}}{K_{t-1}} = \frac{I_t}{K_{t-1}} - \delta$. Thus, it is sufficient to calculate the capital stock in the initial period$K_{t-1} = \frac{I_t}{gGDP+\delta}$. However, there is a short-term investment shock we may have to smooth the investment series using three-year moving averages to generate stable capital stock estimates. The study has applied regression of log of investments on time variable to calculate the initial capital stock.

The estimation result of imputed depreciation rate is equal to (1- 0.9652)*100 =3.48 percent per year on average for aggregate capital for national and assuming the rate for the manufacturing sector. The estimation of initial capital stock by sector for i= light industry, heavy industry $K_{i,t-1} = \frac{I_{i.t}}{gGDP_i+\delta}$ *with* $\sum_i K_{i,t} = K_t$ as the constraint or the summation of capital stock of sub-sectors equal to the total capital stock in manufacturing. In short, the capital stock series are estimated from base year capital stock.

Labor

In this study, we use data from the Labor Force Survey (LFS) conducted by the National Statistical Office. Here, we have our intention to apply the base data for model simulation and forecasting.

Table 4.3: Skill – Unskilled Labor Matching Criteria

Occupation	Educaition	Skill Classification
1. Managers	Occupation dominant.	Skilled
2. Professionals Technicians and associate professional	Occupation dominant	Skilled
3.1 Clerical support workers	Undergraduate and above	Skilled
3.2 Clerical support workers	Below undergraduate	unskilled
4.1 Service and sales workers	Undergraduate and above	Skilled
4.2 Service and sales workers	Below undergraduate	unskilled
5.1 Skilled agricultural, forestry and fishery workers	Undergraduate and above	Skilled
5.2 Skilled agricultural, forestry and fishery workers	Below undergraduate	unskilled
6.1 Craft and related trades workers	Undergraduate and above	Skilled
6.2 Craft and related trades workers	Below undergraduate	unskilled
7.1 Plant and machine operators and assemblers	Undergraduate and above	Skilled
7.2 Plant and machine operators and assemblers	Below undergraduate	unskilled
8.1 Elementary occupations Workers	Undergraduate and above	Skilled
8.2 Elementary occupations	Below undergraduate	unskilled
9. Workers not classifiable by occupation	(assumed)	unskilled
10. Unknown	(assumed)	unskilled

Note: Skilled Matching Criterion by Occupation by Human capital Investment

Source: Pattanapong, Limskul, and Bowonthumrongchai (2017)

Social Accounting Matrix (SAM)

Finally, the Social Accounting Matrix is constructed. The main source of the data is based on Input-Output Table. We collected the data of income side of each agents from national income to complete the table. We also divided the enterprise into two categories, big enterprises, and small and medium enterprises (SMEs). Main duty of the big enterprise in SAM is to pay the corporate income tax and later pay the stake to shareholders which are households while the SMEs is assumed to pay directly to households without paying the corporate income tax.

Table 4.4 Social Account Matrix 2000 of Thailand

Billion Baht		j	j	j	j	j	i	i	i	i	i	x	x	x	x	x	L	L	K	AG	AG	AG	AG	AG	AG	AG	AG	OTH	OTH
		01	02	03	04	05	01	02	03	04	05	01	02	03	04	05	U	S	C	HH	gvt	En	SM	TD	TM	TI	RoW	INV	VSTK
j	01_Agrm						745					45																	
j	02_Lmfg							1,248					664																
j	03_Hmfg								1,917					1,913															
j	04_PubU									803					12														
j	05_Service										3,350					611													
i	01_Agrm	56	405	394	95	57														120	1							0.8	(27)
i	02_Lmfg	54	541	72	1.2	213														762	20							1.1	(36)
i	03_Hmfg	105	177	1,929	211	492														581	34							641	72
i	04_PubU	3.1	48	88	78	94														93	14							418	0.2
i	05_Service	75	203	401	111	570														1,613	519							194	17
x	01_Agrm																										45		
x	02_Lmfg																										664		
x	03_Hmfg																										1,913		
x	04_PubU																										12		
x	05_Service																										611		
L	U_LAB	107	83	126	45	339																							
L	S_LAB	22	83	161	72	571																							
K	Capital	368	372	659	202	1,626																							
AG	HH																701	909			1	1965	1291				3.9		
AG	gvt																			2				264	193	384	3.4		
AG	Enterprise																		1936		196								
AG	SMEs																		1291										
AG	TD																			98		167							
AG	TM						21	29	143	0.3	0.2																		
AG	TI						15	77	105	23	164																		
AG	RoW						321	274	2,077	11	188									10	0.3								
OTH	INV																			1,591	61						(372)		
OTH	VSTK																											26	

Where j = Industries , i = Commodities , x = exports, L = laborers, K = capitals, AG= agents, OTH= others

Table 4.5: Key macro variables in SAM2000 Thailand (2000 price)

	(Billion Baht)	% of GDP
GDP final demands	**5,413.88**	
Private Consumption expenditures	3,169.62	58.55%
Public Consumption expenditures	588.73	10.87%
Gross Fixed Capital Formation	1,255.02	23.18%
Exports	3,245.81	59.95%
Imports	2,871.18	53.03%
Change in stocks	25.88	0.48%
GDP Productions	**5,413.88**	
Agriculture and Mining	532.83	9.84%
Light Industries	644.47	11.90%
Heavy Industries	1,194.26	22.06%
Public Utilities	342.49	6.33%
Services	2,699.83	49.87%
Government Revenues	846.47	15.64%
Personal Income Tax	97.59	1.80%
Corporate Income Tax (1)	166.57	3.08%
Indirect Taxes	384.14	7.10%
Import Taxes	193	3.57%
Other revenues	5.17	0.61%
Operating surplus		
Big Enterprises (2)	1,936.36	35.77%
SMEs	1,290.91	23.84%
The effective tax rate of Corporate Income Tax (CIT)	**(2)/(1)=8.6%**	

The table above depicts the baseline macroeconomic information derived from SAM2000. This is to check consistency between the official account and our personal one. The gross domestic product at the market price of the Social Account Matrix table in 2000 equals to 5,413.88 billion baht, compared to the value officially publicized by the Office of the National Economic and Social Development Board in which Gross Domestic Product for the year 2000 equals to 5,069.82 billion baht. The corporate tax income collected in 2000 equals to 384.14 billion baht or 3.08 percent of GDP. The corporate income tax was 19.6% of total government revenue. The operating surplus of big enterprises is 1,936.36 billion baht while the effective tax rate of corporate income tax is 8.6%

Parameters

Elasticity of substitution

Even there are many parameters in the model, but the most important in this study is the elasticity of substitution between capital and labor by sector controlled by the Constant elasticity of substitution (CES) .

Table 4.6 Substitutability between Capital and Labor by sector

	σVA
Agriculture and Mining	1.15
Light industries	0.86
Heavy industries	0.86
Public utilities (Electricity, Water and	1.02
Services	1.04

Source: Limskul and Bowonthumrongchai (2019)

The elasticity of substitution between capital and labor is estimated by using the National Accounts Statistics of the NESDB. The result shows that the elasticity of substitution between capital and labor of Thailand is nearly 1. The most elastic case is in the agriculture sector, which equals to 1.15. This implies that the capital flexibly substitutes for agricultural labor. However, we found that the industrial process is more complicated and stricter so using machines as substitutions of labor has several limitations. So, labor is still needed even in the near future.

Growth parameter

Parameters indexed in t	**2000/2001**	**2002/2003**	**2005/2006**	**2007/2008**	**2010/2011**	**2012/2013**	**2014/2015**
n	0.005	0.004	0.003	0.003	0.002	0.001	0.000
eg	0.046	0.074	0.091	0.101	0.069	0.046	0.051
ig	0.041	0.038	0.047	0.042	0.056	0.027	0.026
etr	0.028	0.111	0.108	0.109	0.115	0.018	0.027
ppg	0.006	0.006	0.006	0.006	0.006	0.006	0.006
kg	0.005	0.005	0.005	0.005	0.005	0.005	0.005
lg	0.005	0.005	0.005	0.005	0.005	0.005	0.005
slg	0.003	0.002	(0.000)	(0.002)	(0.004)	(0.006)	(0.008)
ulg	0.003	0.002	(0.000)	(0.002)	(0.004)	(0.006)	(0.008)

Where

n	Population Growth
eg	Government Consumption Expenditure Growth
ig	Public Sector Investment Growth
etr	Export Growth
ppg	Total Factor Productivity Growth
kg	Capital Productivity Growth

lg	Labor Productivity Growth
slg	Skilled Labor Growth
ulg	Unskilled Labor Growth

4.2.4 Hypothesis: A Counterfactual of a corporate tax policy

We can see that although Thailand reduced a corporate income tax in 2012-2013, the reform started after any other countries. In order to develop Thailand's economy, the tax reform should be done earlier than 2000 before surpassing the turning point. Thus, we simulate the impact of changing the corporate tax rates once economics reaches the turning point in 2000 for long-term investment and economic growth.

We simulate the model for several scenarios of Thailand

1. **Business as Usual (BAU)**

Corporate Income Tax decrease from 30 percent to 23 percent and 20 percent in 2012 and 2013 respectively. (BAU)[12]

2. **Scenarios**

Corporate Tax Reform: Corporate Income Tax decrease from 30 percent to 20 percent in 2000 by

2.1 Revenue neutral

By increasing consumption tax to make the government income equal to BAU (SIM1)

2.2 Balance budget: Expenditure cut

By Uniform cutting public expenditure to make the government saving equal to BAU (SIM2)

4.3 Empirical Result

4.3.1 Baseline scenario (Business as Usual) result

The CGE model has produced a baseline of equilibrium growth path for Thailand 2010-2015, which we simulate closely to the real Thailand economic performance.

[12] This is computed by set the tax rate in the model equal to 23/30 = 0.766 and 20/30 = 0.667 of the base tax rates, respectively.

Figure 4.6 Real GDP and GDP growth in CGE model (Baseline)

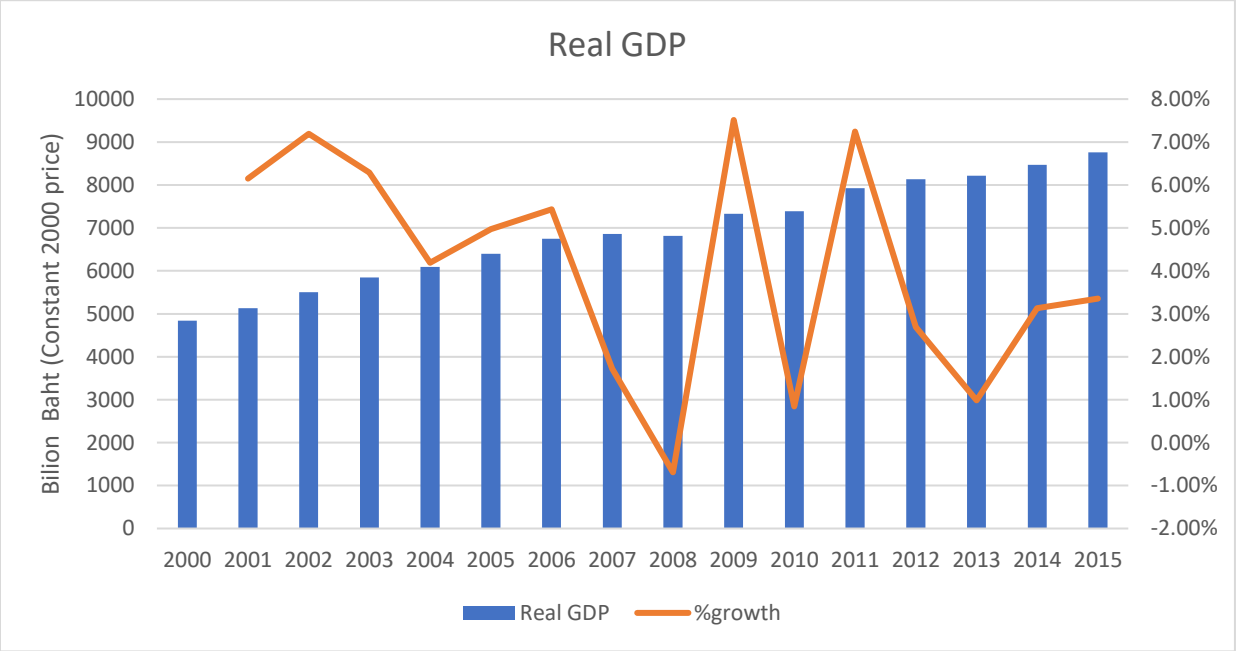


Table 4.7 Thailand Macro-Economic Performance 2000-2015 by CGE Model

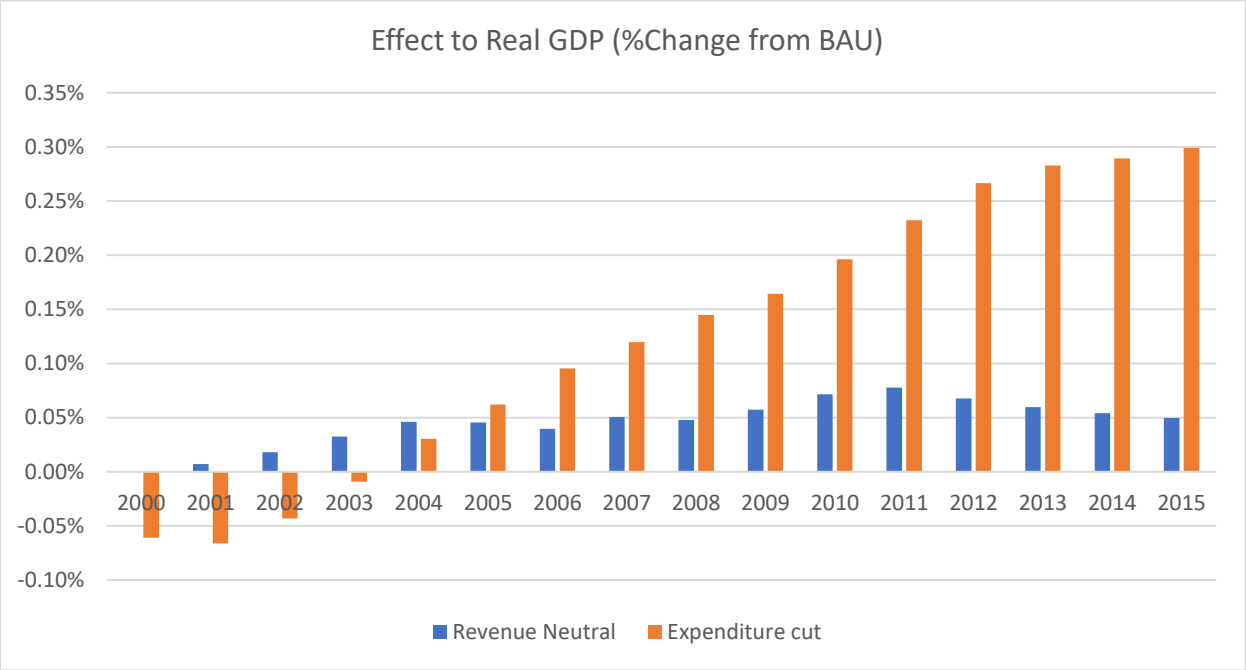
In constant 2000 price (Billion baht)

	2000	2005	2010	2015	2000-2005	2005-2010	2010-2015
GDP final demands	5,413.88	7,160.42	8,268.77	9,802.12	5.75%	2.92%	3.46%
Private Consumption expenditures	3,169.62	4,159.05	4,605.70	5,115.51	5.58%	2.06%	2.12%
Public Consumption expenditures	588.73	807.12	1,285.06	1,827.13	6.51%	9.75%	7.29%
Gross Fixed Capital Formation	1,255.02	2,039.63	2,215.47	2,478.30	10.20%	1.67%	2.27%
Exports	3,245.81	4,007.70	4,434.79	5,106.00	4.31%	2.05%	2.86%
Imports	2,871.18	3,877.27	4,287.93	4,767.30	6.19%	2.03%	2.14%

The base result shows that the range of data in our model is so accurate that it can be used to simulate the impact. The average growth rate of Thailand in 2000-2005 was 5.75 percent a year but decreased to 2.92 and 3.46 percent in 2005-2010 and 2010-2015 respectively.

4.3.2 Scenarios result

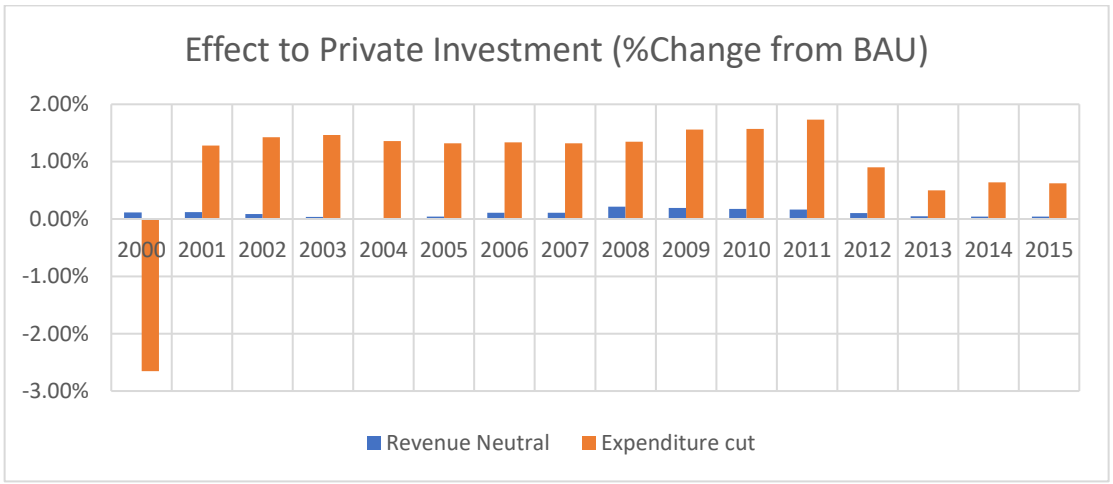
Figure 4.7 Effect on Real GDP (%Change from BAU)

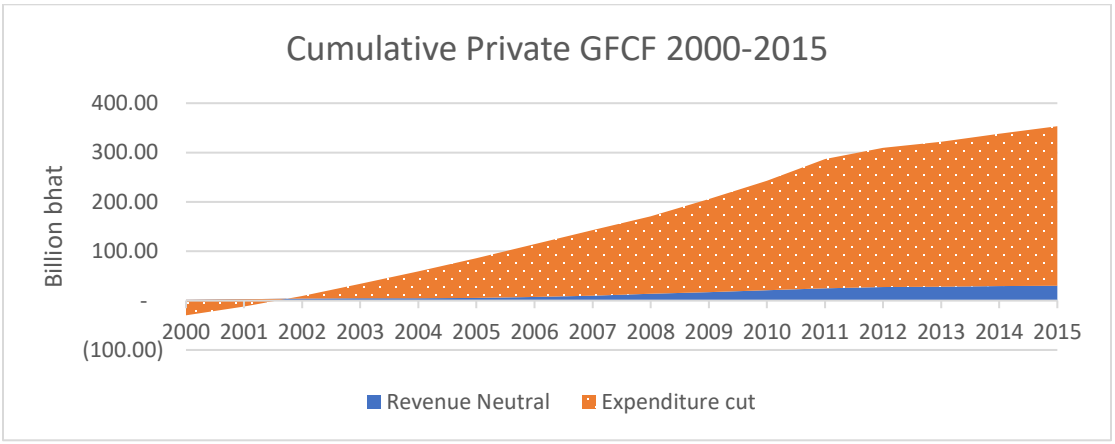


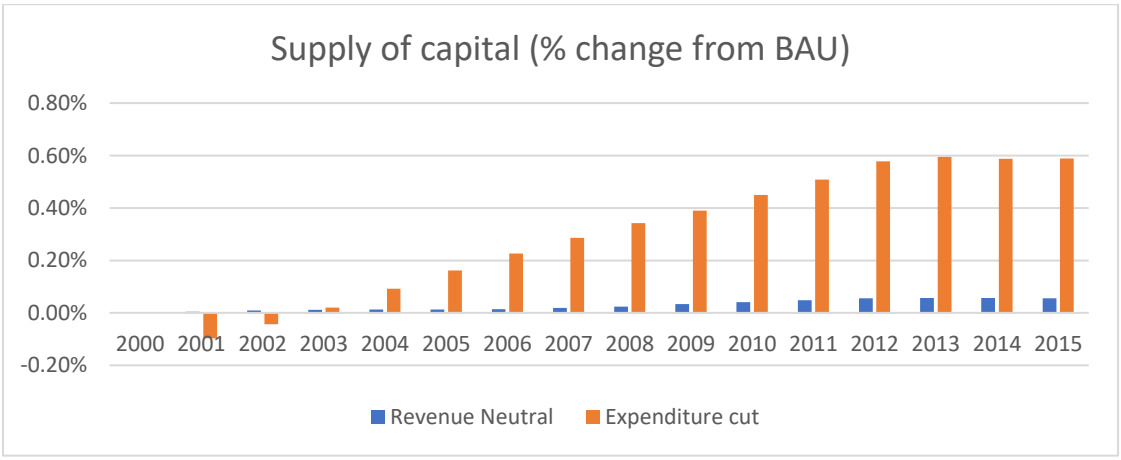
	BAU	SIM1	SIM2	Revenue Neutral	Expenditure cut
2000	5,413.88	5,413.88	5,410.58	0.00%	-0.06%
2005	7,160.42	7,163.68	7,164.86	0.05%	0.06%
2010	8,268.77	8,274.69	8,285.00	0.07%	0.20%
2015	9,802.12	9,806.98	9,831.44	0.05%	0.30%

In the alternative scenarios, corporate income tax was reduced earlier in 2000. The government has two choices which are raising the consumption tax to fill the government revenue as BAU scenario (Revenue Neutral) or reducing the government expenditure in the same amount of income lost (Expenditure cut). In the revenue-neutral scene, the result shows a slightly negative effect on GDP in the first period, but it becomes positive later. The expenditure cut scenario shares a similar result, but the magnitude is more intense. The expenditure cut scenario has an adverse effect for four years until it becomes a higher growth in the long run.

Figure 4.8 Effect on the Real private gross fixed capital formation and capital accumulation (%Change from BAU)







The reason behind the positive impact, in the long run, is the increasing amount of private gross fixed capital formation. Figure 4.9 shows that both scenarios increase both private investment and the supply of capital in the long run. The revenue-neutral has less impacts on

investments than expenditure cut, which significantly has negative effects in the first period. Cumulatively, the neural revenue increases a private gross fixed capital formation for 30 billion baht while the expenditure cut increases by 323 billion baht. Both of them are shown at a constant 2000 price. The impact slightly declines after 2012 because the BAU scenario decreases the corporate tax rate in the same year.

Table 4.8 Effect on Real private consumption

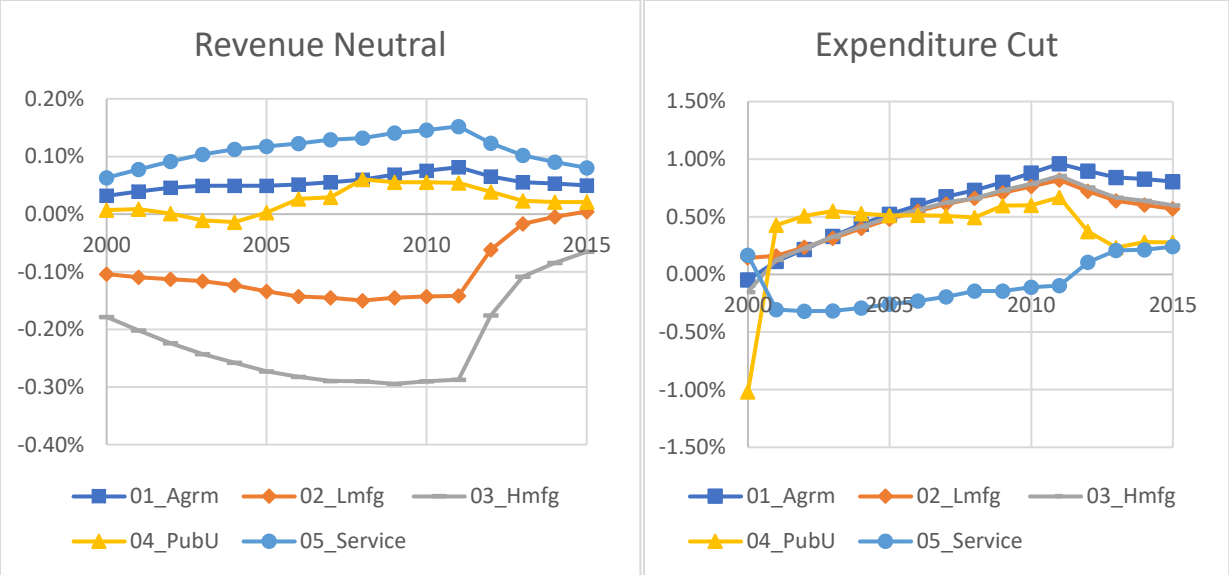
	Billion baht			% change from BAU	
	BAU	SIM1	SIM2	SIM1	SIM2
2000	3169.6	3172.9	3204.1	0.10%	1.09%
2001	3366.8	3370.7	3402.0	0.11%	1.05%
2002	3614.2	3618.8	3652.5	0.13%	1.06%
2003	3882.6	3888.2	3924.6	0.14%	1.08%
2004	4045.7	4052.1	4091.1	0.16%	1.12%
2005	4159.0	4165.7	4208.1	0.16%	1.18%
2006	4208.6	4215.4	4261.9	0.16%	1.27%
2007	4327.9	4335.2	4383.2	0.17%	1.28%
2008	4289.0	4296.1	4345.2	0.17%	1.31%
2009	4522.8	4531.0	4583.7	0.18%	1.35%
2010	4605.7	4614.7	4668.8	0.20%	1.37%
2011	4915.1	4925.1	4984.6	0.20%	1.41%
2012	4961.1	4967.0	4992.5	0.12%	0.63%
2013	4999.4	5003.3	5014.0	0.08%	0.29%
2014	5115.5	5119.1	5130.9	0.07%	0.30%
2015	5115.5	5118.9	5131.9	0.07%	0.32%

The effect on the welfare measured by private consumption shows positive fashion in both scenarios. Since the corporate income tax cut has positive income effects on the corporate, of which the shareholder of corporate is households, the income of household increases, too. Then, the portion of the income is used in consumption until the private consumption level increases. The revenue-neutral scenario, however, has a less positive effect since the consumption tax increases the price level of the goods and services. Therefore, the price effect from raising a consumption tax decreases the purchasing power, which leads to the consumption decrease. But it is slightly less than the income effect from the corporate tax cut. Similarly, because the BAU

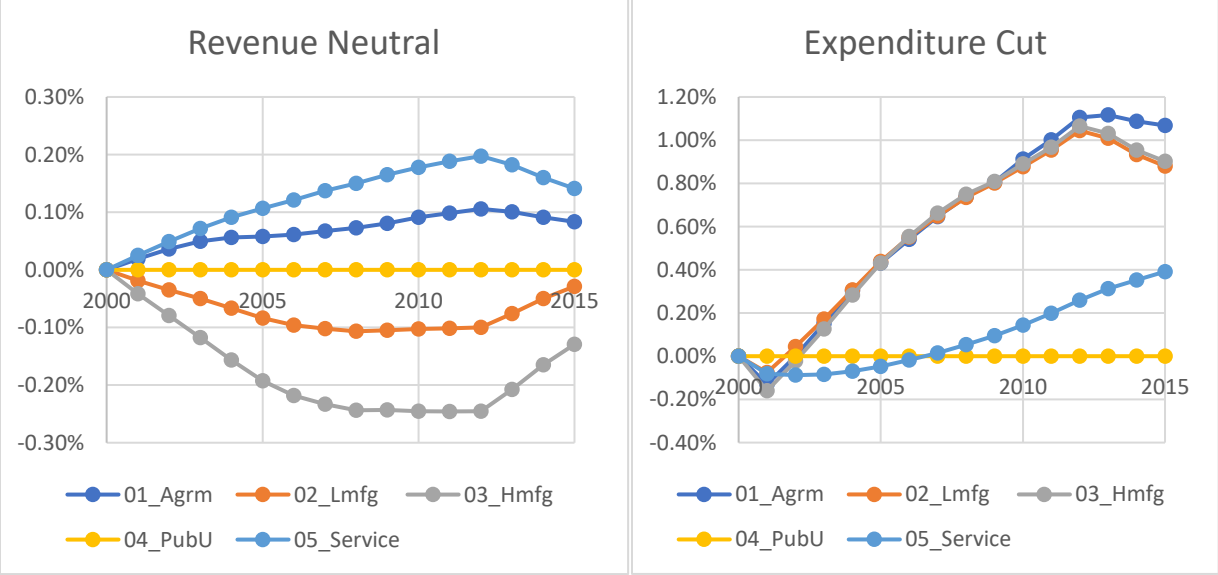
scenario decreased the corporate tax rate in 2012, the positive effect of both scenarios declined in 2012 onwards.

Figure 4.9 Sectoral Impact

(a) Impact on gross output



(b) Impact on capital accumulation by sector[13]



However, the sectoral impact shows that the consumption tax scenario (Revenue Neutral) has an adverse effect on light and heavy industries, but it has a positive impact on the agriculture

[13] The investment in public sector is assumed to be controlled by government.

and service sectors. The expenditure cut scenario shows negative effects on public utilities in the first period but shows positive impacts in the long run as well as the service sector. As discussed, the effect has slightly declined in both positive and negative views after 2011.

Next, we will discuss the reasons why the revenue-neutral scenario has a negative effect on light and heavy industries. First, as consumption tax rises, the price level of goods and services increases but the domestic consumption level of both light and heavy industries decreases. This results from the price elasticity of consumption. The price elasticity of demand for light and heavy industry's goods are slightly higher than in other sectors; therefore, the consumption tax hikes will shift the consumption to decrease more than others do, especially heavy industry goods which are considered luxury goods. Then, the light and heavy industries face a decline in profit. Besides, as the investment decision in the model is based on Tobin Q, the volume of new capital allocated to each industry is proportional to the ratio of the rental rate to the user cost of capital, the portion of profits will be distributed to higher profit industries, and result in lower capital accumulation in both sectors. Lastly, the inelastic of the elasticity of substitution between capital and labor is one of the other main factors because the production technology of light and heavy industries is not flexible enough. The decline in capital accumulation shows a heavy decline in output.

The expenditure-cut scenario shows a positive effect on most industries, except for the service sector. We predict the uniform expenditure-cut of the government basket, but most government spending is directly used in the service sector. Thus, expenditure cut is not a policy suitable for most service sectors. The result of the sectoral impact will not be the same if we assume that the government must reduce expenditure to compensate for the government income reduction, but the economic growth will show a positive effect in the long run.

CHAPTER 5
Conclusions and Policy Recommendation

5.1 Conclusion remarks

Thailand has been a country able to drastically change its economic structure from an agrarian to an export-led economy. The first part of this dissertation shows that the macroeconomic performance in Thailand was outstanding until it ended during the Asian Financial Crisis in 1997-1998. The industrialization has changed Thailand's economic structure from an agriculture-based to a manufacturing-based economy. This pulled surplus labor from the agriculture sector to work at higher productivity, based on Lewis's (1954) theory. The society can gain from transferring "surplus labor" from rural to urban for industrial development induced by wage differential between sectors until it reaches the turning point, in which the surplus labor is completely absorbed. Then, we test Thailand's empirical turning point by using Minami's criteria (1968). The most direct and rigid benchmark for finding the turning point is a comparison between real wages and marginal productivity of labor in the agriculture sector. The result shows that the surplus labor era had ended shown by a labor shortage in Thailand since the early of the 1990s and has respectively passed the turning point around the early 2000s. The other four criteria (correlation between real wages and marginal productivity of labor, movements of real wages in the agriculture sector, change in wage differentials, and elasticity of labor supply to the non-agriculture sector) confirms the turning point, too. This implies that the cheap-labor era of Thailand had come to an end.

After the hypothesis had been tested that Thailand had come to the labor shortage period, the second part of the dissertation shows what happened after the labor turning point reached. First, the study shows that the income distribution is more equalized, according to the Kuznets (1955) inverse-U shaped hypothesis. Second, the massive influx of migrant workers exists even in the agriculture sector. The main discussion of this chapter explains that the reach of the turning point is an obstacle to the path of industrialization. We use Inada, Sekiguchi, and Shoda's (1992) theory of economic development to explain how the economy can take-off to sustainable growth and how

the economy decelerates after reaching the turning point. The success in economic development in the Inada model is the take-off of the heavy industry, extendable on a self-sustaining growth path. The phase diagram analysis shows that the transition from the light industry to heavy industry is the exact capital accumulation path if the economy starts above the minimum critical effect curve. But the capital accumulation path will get stuck if the labor shortage situation is critical and the economy take-off is impossible without any economic reform.

Accordingly, the study shows that the path of capital accumulation in Thailand, following the path well by transitioning from a light-industry economy to heavy-industry economy. However, since the Asian Financial Crisis and turning point, a capital-labor ratio and transformation from labor-intensive to capital-intensive countries was disrupted by the crisis in 1997 and the turning point in 2000, respectively. It seemed that Thailand's capital-labor ratio had never been back to the same path before 1997, even being on a horizontal line. Besides, the Input-output analysis shows that the operating surplus as a share in production function had been declining since 2000 and confirms the disruption of capital accumulation. Thus, the take-off of the economy is impossible without any economic reforms as suggested in Inada, Sekiguchi and Shoda (1992).

The debate on the capital accumulation process is also discussed. Even though the result confirms that Thailand correctly follows the pattern, the passing turning point does not always cause under-capitalization. In case of Thailand, the Asian financial crisis is the crucial incidence that forces Thailand to face such a situation. The capital stock had been badly damaged during the crisis. Almost all of investments were replacement ones.

The slow pace of capital investment while there is no surplus labor in the rural area is clearly the current dilemma of Thailand's economy. Thus, the useful economic reform relying less on labor is necessary. We hypothesize that the corporate tax reform can boost the investment of capital and dissuade the economy to rely on labor. Also, the consumption tax can increase an investment indirectly. The fiscal policy is legitimate because taxation is the primary tool of the government to boost the economy as well as the fiscal sustainability.

The final part discusses the counterfactual analysis of Corporate Income Tax reform. We show the necessity of corporate tax reform first. The corporate tax around the world has shifted its rates lower than 30 percent to boost investment and attract new business sectors to invest in their

markets. Since the significant shift from 1990 to 2000, although Thailand correctly follows this pattern by reducing a corporate income tax in 2012 and 2013, the reform started after any other countries. Here we simulate the impact of changing corporate tax rates in a time of economics reaching the turning point in 2000 by using counterfactual analysis.

Then, we construct Social Accounting Matrix (SAM) 2000 consisting of five sectors: agriculture, light industries, heavy industries, public utilities, and services. We then simulate the model of Thailand's three scenarios. The first one is Business as Usual (BAU). The second and third ones are corporate tax reform. We compare the two choices of tax reform. We compare Revenue neutral (SIM1) by increasing consumption tax to equalize the government income with BAU while comparing Balance Budget: Expenditure cut (SIM2) by uniform cutting public expenditure for the government saving equal to BAU. The result shows that if we reform the corporate tax earlier, the positive impact will occur in Thailand's growth, welfare measured by private consumption, and investment both in revenue-neutral and expenditure cut scenarios. The income effect of corporate tax reduction leads to an increase in both consumption and saving which are equal to investment. Both scenarios show the increase in capital accumulation because of an accumulation of private investment which become the capital in the sector later. If both scenarios are compared, the expenditure cut seems difficult at a glance, but we can benefit from the better result in the long run. But the sectoral impact probably has the negative impact in other sectors. Policymakers should not ignore this issue, however.

Lastly, there is a discussion that in order to develop Thailand's economy, the tax reform should be done earlier than 2000 before surpassing the turning point. In our opinion, the earlier tax reform would generate more positive effects. First, since the comparative corporate tax is cheaper when compared to other countries, investors would choose Thailand. Second, the available surplus labor shows that the number of cheap labors is enough. Corporate can generate a bigger profit. Lastly, the economy would be better whenever the accumulative capital investment goes higher.

Corporate income tax reform is one of the policies that can help boost investment and capital accumulation. This policy alone may not help Thailand to avoid the middle-income trap as the size of the effect on capital accumulation is insufficient to compensate for the capitalization deepening since the Asian Financial Crisis 1997. However, the corporate tax reform, at least, is a

good starting policy that makes Thailand back to the correct track of economic development and capital accumulation.

5.2 Policy implications

1. Since Thailand is in the labor shortage era, the government needs to promote the new machine investment to replace labor. ***The corporate income tax reform*** is one of the policies which boosts the private investment and have a positive effect in the long run.
2. However, the fiscal sustainability is the other important factor. Tax reduction indicates that the government's revenue would decrease. Policymakers should think of increasing the consumption tax or tightening the expenditure. The latter suggestion is difficult because of a negative effect at the first period but we can benefit from a better result in the long run.

5.3 Further study

Since this dissertation only studies the uniform of corporate tax reform which provides a good starting point for discussion and further researches. Future research should study the corporate size effect of the specific corporate income tax reform based on a corporate's type and size. This can be done by adding the detail of the production function by firm size and the detail of the household by class. Moreover, expenditure-cut should be considered to specify some government spending categories. It is an interesting topic for further studies.

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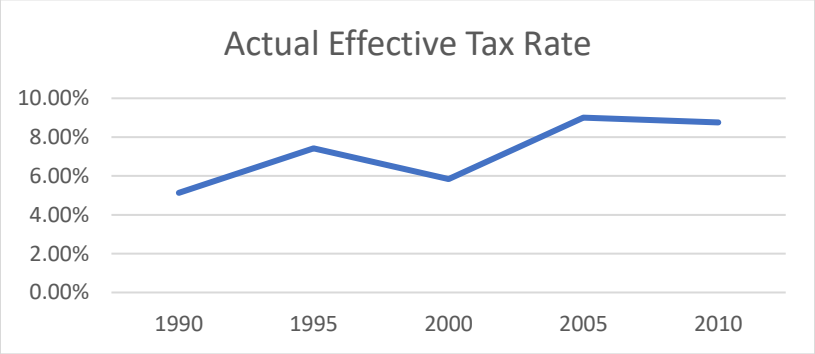
APPENDIX A

Computation Note on Effective Tax Rate of Corporate Income Tax

Even the Statutory tax rates of the corporate income tax rate is 20-30 percent of the gross profit, the effective tax rate is much lower rate. As mention earlier, the effective tax rate is calculated from the formula $\frac{\text{Corporate tax income}}{\text{Pre-tax Profit}}$, however, the pre-tax profit is not reflex the actual corporation that bears the burden of tax. Thus, the tax rate is not correct and considerably low and need to recalculate. Figure A1 shows the preliminary effective tax rate calculated. The effective rate is between 5-10 percent of the gross profit of all corporations.

Figure A1 Preliminary effective tax rate of corporate income tax



Source: Author

However, there are a number of corporates that must exclude from the calculation, SMEs. The SMEs are the enterprises which employ fewer than 200 employees and have fixed assets not exceeding 50 Million Thai Baht. According to the statistic, 99 percent of corporates in Thailand are small and medium enterprises. Most of them are a small enterprise which considerably pays at the lower rate or not have to pay the corporate income tax because their profit is in the range of exemption.

Table A1 Number of Enterprises Classified by Size 2013-2014

Size of Enterprises	**2013**			**2014**		
	Number of Enterprises (person)	**Ratio to Total Number of Enterprises**	**Ratio to SMEs**	**Number of Enterprises (person)**	**Ratio to Total Number of Enterprises**	**Ratio to SMEs**
Small and Medium Enterprises (SMEs)	**2,728,683**	**99.73**	**100.00**	**2,736,744**	**99.73**	**100.00**
Small Enterprises (SEs)	2,716,038	99.27	99.54	2,723,932	99.26	99.53
Medium Enterprises (MEs)	12,645	0.46	0.46	12,812	0.47	0.47
Large Enterprises (LEs)	6,966	0.25		7,062	0.26	
Unknown	392	0.01		392	0.01	
Total	**2,736,041**	**100.00**		**2,744,198**	**100.00**	

Source: The office of small and medium enterprises promotion (OSMEP)

Table A2 Overall Gross Domestic Product of SMEs in 2014

	Small (S)	Medium (M)	SME	Large (L)	Of the country
GDP (Trillion Baht)	3.65	1.56	5.21	5.74	13.15
Proportion to Overall GDP (%)	27.8	11.8	**39.6**	43.6	100
Growth rate (%)	0.2	0.2	0.2	1.4	0.9

Source: The office of small and medium enterprises promotion (OSMEP)

Small and medium enterprises play an important role in Thai economy. SMEs hire a labor 80% of total employment and account for 39 percent of the country's GDP or about 5.21 trillion baht in 2014.

We, then, assume that the SMEs do not bear the corporate income tax which covers 40 percent of the gross profit. Then, we obtain the new effective tax rate as shown in figure 4.3 in the text. The effective tax rate is between 8-15 percent of the gross profit of the large enterprises.

Table A3 Calculated effective tax rate

(Million baht)	Corporate tax income (1)	Operating Surplus (2)	Preliminary Effective Tax Rate (1)/(2)	SMEs share of gross profit (assume)	Effective tax rate (1)/((2)*(1-0.4))
1990	58,900	1,147,702	5.13%	40%	8.55%
1995	157,078	2,115,419	7.43%		12.38%
2000	145,554	2,493,198	5.84%		9.73%
2005	329,516	3,659,437	9.00%		15.01%
2010	454,565	5,189,171	8.76%		14.60%