Dynamism of the Thai Agriculture

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1. Introduction

There is a pessimistic view about the future of Thailand's agriculture sector. This view is reinforced by the fact that the share of agricultural output in GDP and the share of agricultural exports have been declining continuously over the past three decades[1] Moreover, the terms of trade between agriculture and manufacture have been generally unfavorable to farmers. From 1995 to 2001, export prices of agricultural products have declined relatively more than those of manufacture. Also, after economic recovery in 2002, agricultural export prices have recovered more slowly than labor-intensive and high-tech manufactured products.

Output growth in the agricultural sector fluctuates more than in non-agricultural sector due to random shocks from both demand and supply sides. Its standard deviation is seven times higher than the growth rate of non-agricultural output.[2] In 2004 agricultural output declined by 4.4 percent; paddy, sugarcane, and cassava were adversely affected by the drought. The revisit of Avian Influenza also led to the poor performance.

As early as in the mid 1990s, Siamwalla (1996) predicted that Thailand would lose comparative advantage in agriculture as manufacturing became more important than agriculture. Due to shortages of labor and water during the dry season and with the shrinkage of farm land in the 1980s, the future of Thai agriculture looked bleak. Coxhead and Plangpraphan (1999) pursued the issue of declining agriculture further by linking the Dutch-disease to an irreversible decline of the Thai agriculture. The line of their argument follows the conjecture that the boom in the non-agricultural sector leads to higher wage rates in urban areas. The lack of labor resulting from migration will intensify farm mechanization, which in turn will diminish employment opportunities in agriculture. Further, wage pressure and declining agricultural prices will squeeze farm profits, discouraging investment and further reducing agricultural growth.

[1] Agricultural export share declined from the average of 54.3 percent during the period 1979-1981 to 24 percent during the period 1989-91. By 2002, agricultural exports declined further to 12.2 percent of total exports.

[2] Basically the variance of growth depends on the sum of variances from output and price fluctuations. Because of the financial crisis in the late 1990s and the oil price shocks in the early 1970s, fluctuations of income growth in the non-agricultural sector income remain the same between the period 1979-1989 and the period 1990-2003, with the standard deviation around 3.9.

In reality, the future of the Thai agriculture is not that depressing. Farm mechanization, improvement in irrigation, and adoption of high-yielding varieties have somewhat eased the agricultural problems. The average growth rate of agricultural output between 2000 and 2003 was around 5.5 percent, which was higher than the average growth rate witnessed between 1965 and 1995. In the early 2000s, favorable agricultural prices spurred the growth rate of the agriculture sector. If there had been no boom, the agriculture share in GDP would have shrunk. However, one of the stylized facts of economic development is that agricultural share in GDP declines as a country attains higher levels of per capita income.

Harris-Todaro model of sectoral wage differentials captures the trend of labor migration between rural and urban sectors in developing countries. The Dutch-disease phenomenon is irrelevant because both manufacture and agriculture sectors produce traded goods, competing directly with the non-traded sector. But manufacturing output growth was impressive, and it experienced faster productivity growth than agriculture did. The manufacturing sector was able to exploit the benefit of improving export prices without suffering from deteriorating terms of trade between traded and non-traded sectors.

Labor migration strengthens the relationship between urban and rural incomes. Seasonal unemployment in rural areas is reduced by migration of agricultural workers to construction sites in urban areas. There is also an interconnection between the two sectors through income transfers by workers. Baumal-Bowen's (1965) cost-disease model is more relevant to the Thai agriculture than the Dutch-disease model. The agricultural sector faces higher wage cost, because of rural migration to the manufacturing sector. Rural workers move to urban areas where they are paid higher wages corresponding to the higher productivity in urban areas. As a result, the agricultural sector suffers from cost disadvantage as because its productivity lags behind that of other sectors.

It is argued in this paper that the Thai agricultural sector is full of dynamism. It continues to improve its productivity and increase its competitiveness in the global market. Thai farmers are receptive to price changes and adoption of new technology.[3] Although the Thai agriculture may lose its competitiveness in some commodities, it can come up with new competitive products. The major problem of the Thai agricultural sector lies in the area of productivity, which needs to be enhanced so that (a) agricultural labor can be released fast enough to lessen the pressure on the wage rate in manufacturing and service sectors, and (b) Thai agricultural products can compete effectively in the world markets.

[3] Siamwalla (1996) argued that agricultural technology in advance countries cannot be adopted by Thai farmers due to different physical and economic environment in Thailand. However, technology in the Thai agriculture is neither backward nor static, because the government has spent adequate amount on agricultural research, while relying on the private sector to provide new technology.

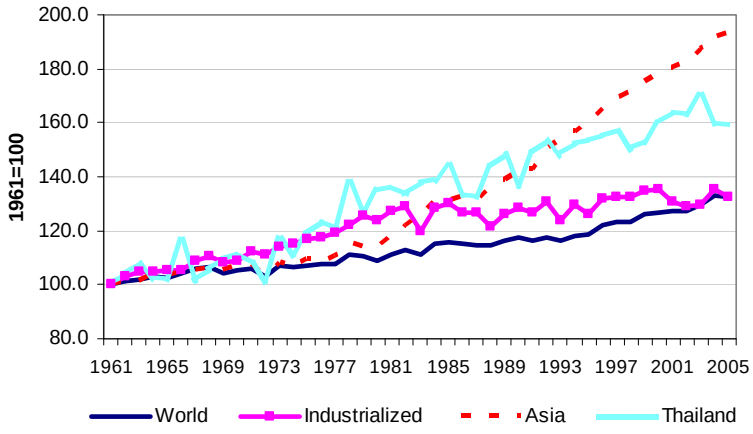
This paper attempts to answer the following questions. In light of changing comparative advantage, can Thai agriculture produce sufficient surplus to support the growth of manufacturing and services? Will the force of globalization and free trade help or hamper the growth of Thai agriculture? Can the agricultural sector release labor to the service sector by increasing its productivity fast enough to lessen the pressure on the wage rate in the urban sector? What will be the new challenges to Thailand's agricultural exports when tariff walls come down further?

The paper is organized as follows. Section 2 describes the long-term growth of Thailand's agricultural output by referring to factors contributing to productivity changes. Section 3 discusses the shifting pattern of competitiveness of Thailand's agricultural exports over the last 40 years by analyzing growth and market shares of Thailand's agricultural commodities. Section 4 deals with the adjustment of some agricultural exports to recent shocks such as GSP withdrawals, Avian Influenza, tsunami, and anti-dumping duties. Section 5 discusses the relationship between agricultural growth and rural poverty. Section 6 provides some concluding remarks.

2. Agricultural Productivity

There have been considerable improvements in Thai agriculture in the past 40 years. Per capita agricultural output in Thailand increased at a faster rate than in the world on average and in industrialized countries (Figure 1). The pace of improvement has become more rapid since 1990s. However, Thailand lags behind some other Asian countries, particularly China, which witnessed explosive growth since 1978. Also, there are still very large productivity gaps, though declining, between Thailand and developed countries. One indicator of the low productivity is the proportion of the labor force remaining in agriculture. This proportion also serves as a good indicator of the level of real per capita income. If the agricultural labor force comprises 40 percent of the total workforce, while agriculture's share in GDP is only 10 percent, then the labor productivity in the agricultural sector must be only 25 percent of the average labor productivity of the whole economy.

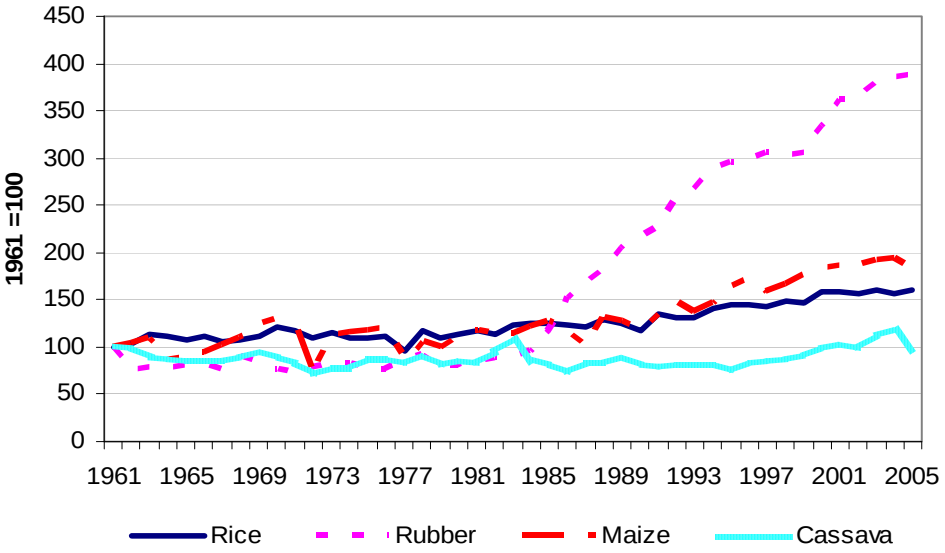
Figure 1: Indices of Per capita Agricultural Production



Source: FAOSTAT

The Thai population growth rate was 1.9 percent in 1985, declining continuously to 0.8 percent in 2003. During the same period, urban population increased slowly from 18 percent of total population to around 30 percent. According to Johnson (1997), rapid urbanization and growth of population in developed countries in the 19th century was made possible by great improvements in agricultural productivity. Johnson further argues that the growth in agricultural productivity, as measured by increase in food production and reduction in labor requirement facilitated the Industrial Revolution, which in turn led to enhancing agricultural productivity during the last and current centuries. The low degree of urbanization and the gradual reduction of agricultural labor force are therefore consistent with the low productivity growth in Thai agriculture.

Figure 2: Index of Major Crop Yields in Thailand



Source: FAOSTAT

Figure 2 compares the long-term improvement of major crop yields. We observe a remarkable productivity surge in rubber after 1985. There were some productivity gains in maize and rice, but increases in yield were relatively small. For cassava, yields remained relatively low and did not show any sign of improvement from the level in 1960s. The improvement in farm productivity in rice and maize can be attributed to various factors. There was a substantial increase in irrigated farm land, rising above 30 percent of arable land in the 2000s (Figure 3). More intensive application of fertilizer to complement irrigation also contributed to the improvement (Figure 4). Large declines in imports of agricultural machinery[4] can be attributed to large currency depreciations in the early 1980s and during the currency crisis. The employment of domestically produced agricultural machinery would be in line with imported machinery as they are complementary. According to the Livestock Department, the number of water buffaloes declined from six million in 1980 to 1.5 million in 2004. This decline indicates the extent of rapid farm mechanization in Thailand.

[4] Values of imported machinery rather than number of machinery are employed due to the inaccurate statistics in recent years, although employment of agricultural machinery involves domestically produced machinery.

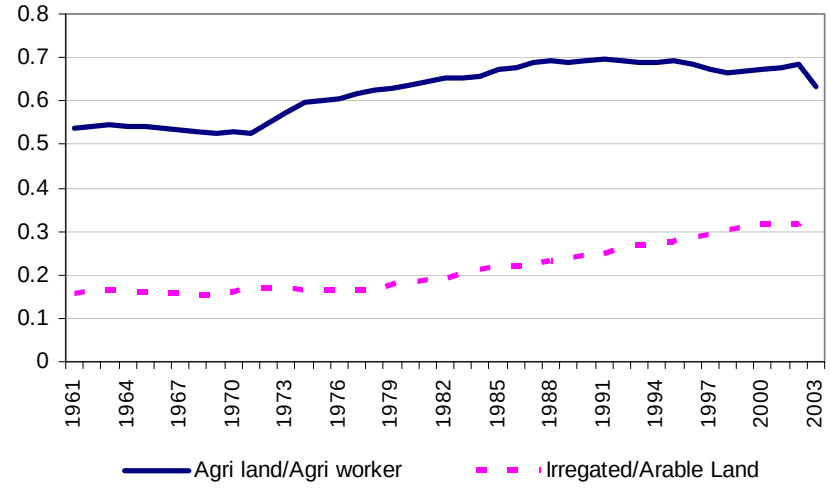
Table 1: Factor Intensity in Agriculture (ratio to initial year)

	1972/1961	1985/1973	2002/1986	2002/1961
Fertilizer/Land	7.07	2.35	3.40	62.32
Arable Land/Worker	0.98	1.04	0.83	0.87
Irrigated/Arable Land	1.07	1.31	1.42	2.00
Imported Machine/Worker	2.59	2.29	2.76	16.30

Source: calculation made from FAOSTAT

Table 1 indicates that there has been a continuous increase in the intensity of inputs that are complement to irrigation. The irrigated area as a percentage of arable land increased from 15 percent in 1960 to more than 30 percent in 2000. Irrigation made it possible for the use of high-yielding varieties of rice to spread. Shintani (2003) constructed input series for Thai agriculture for 1950-1997 and found the evidence that labor and fertilizer use were complementary. While labor and machinery prove to be complementary for 1960-1990, they became substitutes afterwards. According to Shintani, labor was paid according to its marginal value product. If this proposition holds true, low real wages in the agricultural sector throughout 1950-1997 must imply low marginal productivity in Thai agriculture.

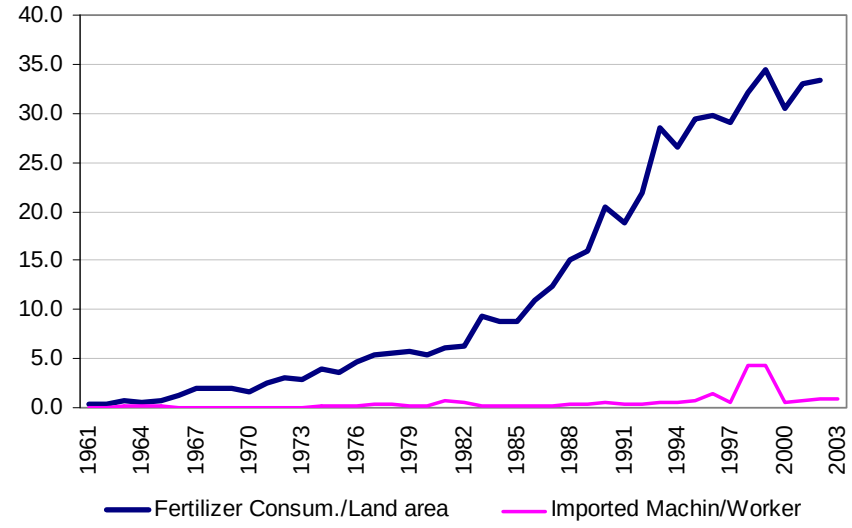
Figure 3: Factor intensity of Farm Land



Source: FAOSTAT

Mundlak et al. (2002) report that between 1971 and 1981 Thai agricultural output grew at an average of 3.8 percent, of which 67.6 percent was due to growth in input. The remaining 32.4 percent is due to Total Factor Productivity (TFP). However, between 1981 and 1995, output growth rate was 3.2 percent, of which 73 percent is attributed to input growth, while the remaining 27 percent is due to TFP. The growth rate of TFP declined from 1.3 percent in the first period to 0.87 percent in the later period. TFP, in this case reflects mainly improved varieties of crops and changes in output composition. If TFP growth slows down, output growth will depend mainly on input growth. Mundlak et al.'s (2002) results support the hypothesis that the productivity growth in Thai agriculture lags behind that in Thai manufacture.

Figure 4: Fertilizer and Farm Mechanization



Source: FAOSTAT

Table 1 reports factor intensity in terms of rate of change in factor input ratios. From 1962 to 1972, arable land per worker declined by 2 percent. However, between 1973 and 1985, arable land per worker increased by 4 percent. In the 1960s population growth in Thailand was still high relative to subsequent periods. Consequently, from 1986 to 2002, arable land per worker declined by 17 percent. Figure 3 exhibits the long-term trend of such movement in the land-labor ratio, which tends to stabilize in the early 2000s.

Expansion in agricultural land area depends on per capita income, agricultural yield, cropland share of land area, agricultural export share, arable land per capita, population density or growth, GDP growth, and institutional factors (Barbier, 2004). Between 1973 and 1985 agricultural sector employed land-intensive technique, with the consequence of diminishing returns in rubber and cassava. However, there was a substantial improvement in crop yields for rubber, rice, and maize after 1985 (Figure 2).

Institutional factors also explain the increase in agricultural productivity. Securing property rights can give rise to productivity improvement due to investment incentives arising from owning land titles that can be used as collateral to access institutional credit market. Due to the success of the 20-year project began in 1982 to title and register farmland throughout Thailand, the number of registered rural land titles increased from 4.5 million in 1984 to 18 million in 2001. According to Burns (2004), titled farmers secured larger loans on better terms than untitled farmer, and productivity on titled parcels rose appreciably. The Agricultural Land Reform Office, as of 2004, has benefited 1.6 million landless farmers. Previously the land-reform plots could not be pledged as collateral, because they were not transferable. The government's assets-to-capital conversion scheme has permitted farmers to use their land-right certificates as collateral for bank loans since 2004.

Martin and Mitra (2001) employed panel data from 50 countries over the period 1967-92 and found that for both industrial and developing countries, productivity growth has been higher in agriculture than in manufacture. The shift away from agriculture in developing countries has not been driven by higher productivity growth in manufacturing. Instead the rapid accumulation of human capital contributed to a strong shift out of agricultural activities and into export-oriented manufacturing industry in East Asian economies.

However, this may not be the case for Thailand, where productivity growth in manufacture has been higher than in agriculture. Although human capital accumulation in Thailand has increased rapidly in the last decade, physical capital accumulation has increased at a much faster pace. Foreign direct investment and capital inflows concentrated in the manufacturing and services sectors, thereby substantially raising capital-labor ratio in both these sectors. Thus, as shown in Table 2.2, productivity increase in the manufacturing sector was higher than in the agricultural sector, in particular prior to the financial crisis. From 1985 to 2003, the ratio of output per worker in the manufacturing sector increased by 98 percent, while the same ratio in the agricultural sector rose by 76 percent.[5] The productivity gap between the two sectors remains as large as before--if not larger. There may be a problem of overestimation of the number of laborers in agriculture, thereby underestimating agricultural labor productivity. This would imply that the productivity gap was actually smaller. On the other hand, if the number of agricultural laborers was underestimated, the productivity gap would be higher. Given that these possible measurement errors are consistent over time, and we only employ the average labor productivity to measure productivity changes over time, we can conclude that the productivity gap between the two sectors has not changed substantially over time.

[5] According to Johnson (1991), American agriculture has a capital-labor ratio that is six times the ratio in manufacturing. In other words, agriculture in developed countries is more capital intensive than developing countries.

Table 2: Average Labor Productivity: Agriculture vs. Manufacture
(value added in baht per labor)

	1985	1990	1995	1999	2000	2001	2002	2003
Agriculture (1)	12.9	13.4	16.3	18.6	19.3	20.8	20.9	22.7
Manufacture (2)	129.8	172.7	219	235.1	229	233.9	235	257.2
Relative Productivity (2)/(1)	10.1	12.92	13.4	12.66	11.9	11.24	11.24	11.34

Source: Calculations based on value added per worker, ADB Key Indicators

High capital-labor ratio in the manufacturing sector implies limited capacity to generate employment. The shift out of the agricultural sector has been painfully slow. If the rate of the decline remains the same as in the past decade, the share of agricultural labor in total employment in 2020 will still be above 10 percent. The productivity increase in the agricultural sector has been too slow to release enough labor to other sectors. As a consequence, high manufacturing wage rates encourage industry to rely on labor-saving technology, which in turn compounds the problem of agricultural labor absorption. As the manufacturing sector is losing its competitiveness in labor-intensive products, it has to forge ahead with skilled-labor intensive exports products. However, the manufacturing sector faces problems of rising wage rates. The slow improvement in agricultural productivity is therefore restraining manufacturing growth.

Table 3: Public spending on agricultural sector

	1995	1999	2000	2001	2002	2003
Ratio to Total Spending (1)	0.1	0.07	0.08	0.08	0.08	0.07
Ratio to GDP (2)	0.17	0.14	0.15	0.16	0.15	0.12
Agricultural output share in GDP (3)	0.1	0.09	0.09	0.09	0.09	0.1
Spending Bias (1)/(3)	1.08	0.8	0.89	0.91	0.84	0.71

Source: ADB Key Indicators

The evidence provided by Mundlak et al. (2002) shows that the growth of agricultural production in Thailand also depends on provision of public goods, such as roads, electricity, health, and education. Table 3 reports the pattern of recent public spending on the agricultural sector. The share of pubic budget allocated to agriculture declined from 10 percent in 1995 to 7 percent in 2003. During this

period, the share of agriculture in GDP remained roughly the same, around ten percent. Thus there is a bias against spending on agriculture: the proportion of budget allocated to agriculture is less than the proportion of agriculture output in GDP. The public spending on agriculture as a percentage of agricultural output declined from 17 percent in 1993 to 12 percent in 2003. The composition of the budget is also important, since current spending does not have as much impact on productivity improvement as capital spending has. The share of capital spending allocated to agricultural budget also declined. However, since capital spending on other public goods in education and health can indirectly improve output growth in agriculture, the bias shown in Table 3 may be somewhat overstated.

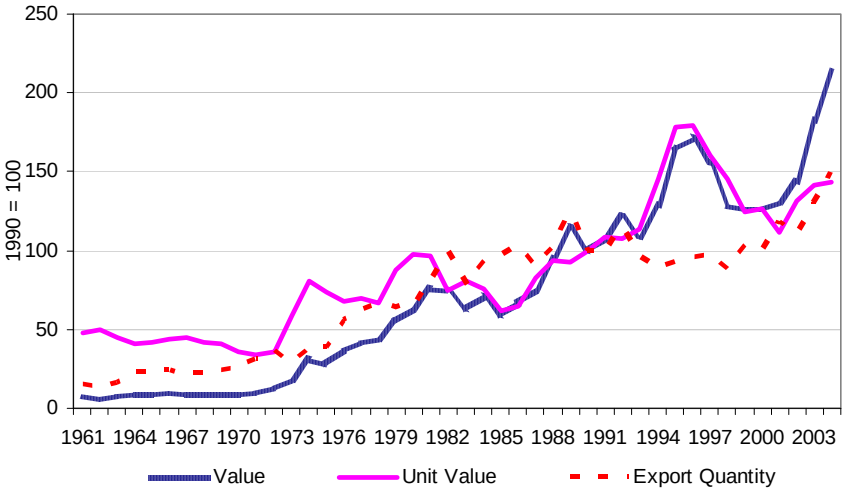
It should be noted that the budget also needs to be allocated for research and development in agriculture. Evidence provided by Thirtle et al. (2003) indicates that research-led technological change in agriculture generated sufficient productivity growth to yield high rates of return in Africa and Asia. The investment in agricultural research has a substantial impact on poverty, whereas productivity growth in industry and services has less such impact.[6] Although the Thai Department of Agriculture has developed various high-yielding varieties of rice, farmers have problems with farm management, leading to low yields. For example, farmers often prepare land hastily without sufficient land leveling, causing widespread herbs. Also, wrong timing and over-application of both fertilizer and seedlings lead to more insects in the rice fields. Thus agricultural research and providing education on farm management can improve farm productivity.

3. Dynamism in agricultural exports

Rice is a food crop as well as a cash crop for Thailand. Export of rice represents the excess of production over domestic consumption. Other agricultural exports represent mainly cash crops. Farmers are responsive to price incentives and adjust their production according to long-term price trends, which are dictated by world prices. Ability to export is the key to survival for the Thai agriculture. The long-term trends of agricultural exports are expressed in the form of indexes of price and value in Figure 5. The long-term increasing trend of export is in line with the production trend shown in Figure 1. The value index tracks more closely the price index rather than the quantity index. Because quantity fluctuates less, exports values are determined largely by movements in prices rather than in quantities. In the early 1990s, the export volume (quantity) fell, but it was overcompensated by the rise in the price level. Thus Thailand enjoyed a period of commodity boom in those years. However, the subsequent period of 1996-2001 witnessed a commodity slump. The volume of exports grew but not high enough to offset the fall in price level. As a result, the dollar value of agricultural exports fell during that period.

[6] Thirtle et al. (2003, p.1970) reports that agricultural R&D expenditures was only 3.3 dollar per ha in Thailand, while Malaysia spent almost 15 dollar in 1995. The R&D investment produced the rate of return at 23 and 9 percent respectively in both countries.

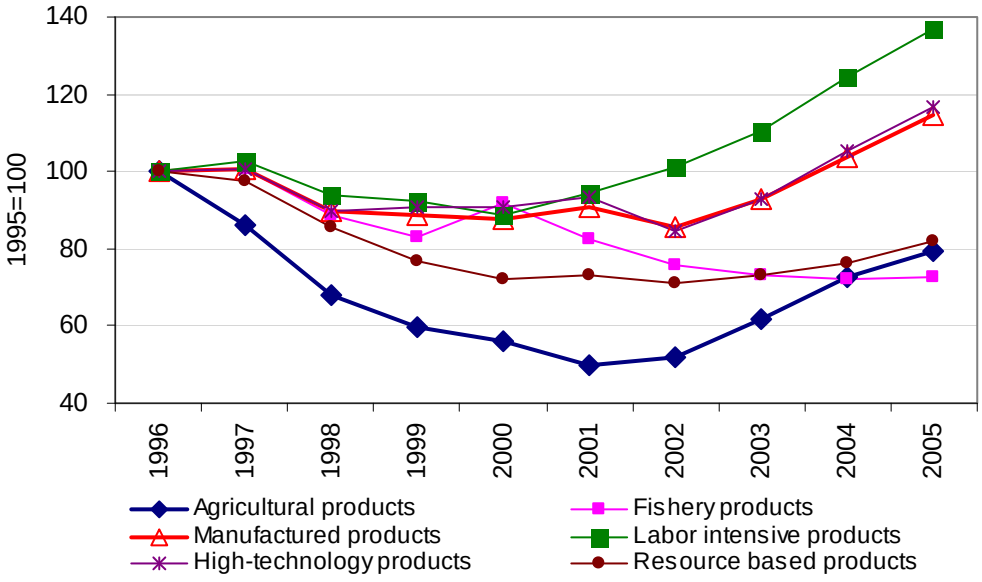
Figure 5: Indices of Agricultural Exports



Source: FAOSTAT

Since 1996, the terms of trade have been unfavorable to Thai exports (Figure 6). Agricultural products suffered more than other commodities, experiencing a decline by 50 percent in 2001 from the level in 1995. Export prices of fisheries and resource-based products suffered the same fate—albeit less severe. Manufactured goods in labor-intensive and high-tech related products also suffered from the declining trend, but there were some improvements after a brief world economic slump in 2001. The price of rubber has increased recently, because expansion in automotive industry generates demand for automotive tires. In addition, the price of natural rubber always increases in line with oil prices, because synthetic rubber is a by-product of crude oil.

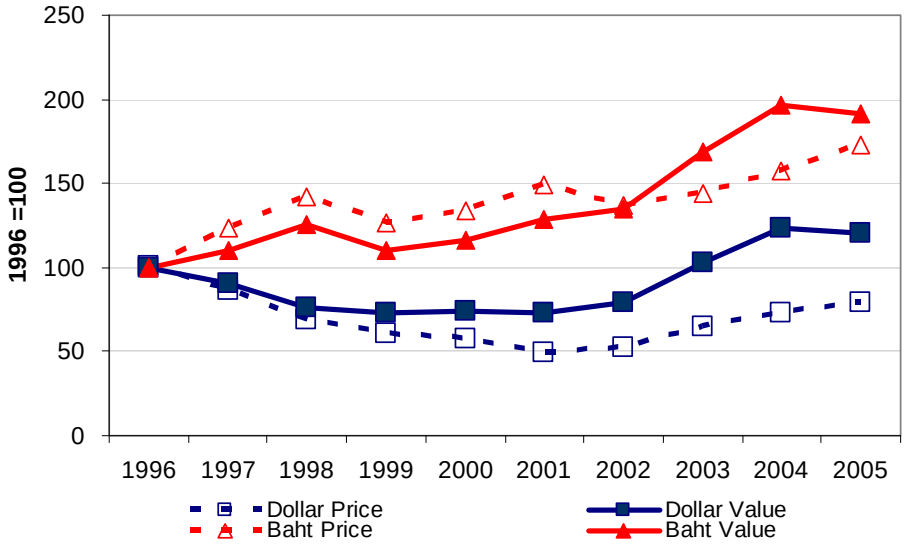
Figure 6: Export Price Indexes in dollar



Source: Bank of Thailand

Agricultural exports were subject to more price variations than were manufactured goods. Also, the recovery of agricultural export prices was slower. The depreciation of the *baht* came to the rescue when the dollar price took a nose drive. Due to the depreciation, agricultural export prices did not decline as much in terms of *baht* as in terms of dollar (Figure 7). What matters the most for exporters is the *baht* value of their exports which has been on the rising trend, except for 1999 when *baht* sharply appreciated against the dollar. The exchange rate depreciation helped propel agricultural exports for only a few years, because the dollar prices continued to decline. As *baht* appreciated against dollar in 2004, the situation deteriorated. The Bank of Thailand intervened regularly in the foreign exchange markets, in order to prevent appreciation of *baht* against dollar. As a result, the level of international reserves has been increasing steadily after the financial crisis in 1997, reaching 43 billion dollar in 2004. The large accumulated amount of international reserves cannot continue forever, nor can export competitiveness indefinitely be maintained by undervalued currencies. In the long run, productivity in agriculture will determine the strength of the Thai competitiveness in the world market.

Figure 7: Price and Value Indexes of Agricultural Exports Before and After currency depreciation



Source: Bank of Thailand

It is of note that if Thailand wants to maintain its competitiveness in manufacture, enhancing agricultural productivity is an indirect solution. Economies of scale are important if firms want to reduce unit cost of production. Exports are required to exploit the scale economies. Processed food industry can be a crucial link between traditional agriculture and modern manufacturing sector. The processed-food industry can generate higher valued added than primary agricultural commodities. The industry produces higher degree of linkages and commands higher values of income elasticity of demand.

The growth-share matrix of corporate strategy developed by the Boston Consulting Group (BCG) in the 1970s is applied to study the changing pattern of major agricultural exports of Thailand. Table 4 presents the changing pattern of Thailand's agricultural exports in the last four decades by providing snapshots of top five agricultural commodities. Back in 1961, the top five products were milled paddy rice, natural rubber, jute, maize, and cassava flour, accounting for 88.4 percent of total agricultural exports. Over the years, diversification of products has gradually increased, leading to a continued decline in the share of these top five products to 80 percent in 1980, 64 percent in 1990, and 53 percent in 2000. Thus there was less product concentration in the 2000s than in the 1960s. Accordingly, the risk from reliance on certain agricultural commodities has lessened considerably.

Shares of rice and natural rubber in total agricultural exports have been declining gradually as new products have emerged. Jute, maize, and cassava are also no longer the principal agricultural commodities as these have witnessed little productivity improvement. In the 1980s, sugar started to make an impact, raising the world market share from 1 percent in 1980 to 5.2 percent in 1990, and 7.2 percent in 2000 (Table 5). Canned pineapple made a significant quantum jump from 2.2 percent in 1970 to 20.2 percent in 1980, and 41 percent in 2000. Because the world market share of Thai canned pineapple industry has been high, it is likely to face various obstacles such as competition from new firms in other developing countries, imposition of anti-dumping duties by developed countries, and a removal from the GSP list by the European Union. In order to survive, the industry must continue adjusting itself to new hostile environment.

Beginning in 1976, exports of chicken meat were made possible by the introduction of closed farming systems operated by large companies. Exports expanded through learning curve effect and exploitation of economies of scale through expansion into various foreign markets. Thai share of the world chicken meat market rose from 1 percent in 1980 to 3.8 percent in 2000.[7] Other emerging products that acquired large world market shares in the 1990s are canned tuna and shrimps.

Traditional exports such as rice and rubber have been robust for some reasons. Both commodities have experienced improvement in productivity. Rice, as a major staple food, has seen considerable productivity growth, while natural rubber is a business-cycle sensitive product related to industrial growth. Rubber has gained a significant market share rising from 8.6 percent in 1961 to 38 percent in 2000. High labor cost in Malaysia requires immigrant workers from Indonesia to work in rubber plantation. The retreat of Malaysian rubber plantation to palm oil production enables Thai rubber to gain more market share. Plantations have begun to expand from southern Thailand to all other regions except the central plains.[8]

[7] The chicken industry suffered a severe blow by the avian flu virus and it cost the industry more than 80 billion baht in 2004.

[8] There are six million people involving in the rubber industry with 13.5 million rai of land. Thailand is the world's largest producer of natural rubber, who exports value ranked fourth among the country's exports in 2004.

Table 4: Top 5 Agricultural Commodities by rank
(value shares in total Thailand's agricultural exports)

2002		2000		1990	
Items	Share (%)	Items	Share (%)	Items	Share (%)
Rubber Natural Dry	17.3	Milled Paddy Rice	20.3	Milled Paddy Rice	18.5
Milled Paddy Rice	17.1	Rubber Natural Dry	17.7	Rubber Natural Dry	16.2
Chicken Meat	6.5	Chicken Meat	5.4	Cassava Dried	14.7
Meat Canned chicken	5.2	Meat Canned Chicken	4.6	Sugar(centrifugal raw)	9
Sugar refined	4.6	Sugar (centrifugal, Raw)	4.6	Chicken Meat	5.5
Total share	50.7		52.6		63.9

1980		1970		1961	
Items	Share (%)	Items	Share (%)	Items	Share (%)
Milled Paddy Rice	28.1	Milled Paddy Rice	24.3	Milled Paddy Rice	42.7
Cassava Dried	19.8	Rubber Natural Dry	21.7	Rubber Natural Dry	25.7
Rubber Natural Dry	18.1	Maize	18	Jute	7.5
Maize	10.5	Cassava Dried	9.8	Maize	7.3
Sugar(centrifugal, Raw)	4.3	Jute	6.9	Cassava Flour	5.2
Total share	80.8		80.7		88.4

Source: Calculated from FAOSTAT

Table 5: Thailand's agricultural export shares in world markets

	1961	1970	1980	1990	2000	2002
Rice	24	10.1	19	26.2	25.1	25.8
Rubber	8.6	10.4	14.5	28.8	37.9	41.8
Chicken Meat	0	0	1	4.4	3.8	4.6
Sugar	0	0	1	5.2	7.2	8.8
Canned Pineapple	0	2.2	20.2	40.4	41.1	43.4

Source: FAOSTAT

The world market share of Thai rice suffered a decline from 24 percent in 1961 to only 10 percent in 1970. But its resilience was demonstrated by the regain of the market share to 19 percent in 1980 and 26 percent in 2000 (Table 5). Thailand's rice market share declined marginally to 25 percent in 2000 as a result of competition from other developing countries such as Vietnam, where productivity has been improved tremendously from the past decade.

For the agricultural sector to thrive, it must be efficient and productive. What matters the most is the value of exports—not the quantity. In case of some commodities such as rice, maize, and wheat, crop genetic improvement has increased their yields so much that prices in real terms have been falling since 1975. The choice of export commodities is therefore important to make sure that their market demand is increasing together with rising world income. On the production side, the Thai agricultural sector must be able to shift its production away from the falling to rising stars. Table 6 compares growth rates of world trade in Thailand's principal commodities in the past 4 decades. Commodities with low income elasticity of demand such as jute disappeared completely during 1981-2003. Maize was a boom commodity during 1961-1980. Thailand's exports of maize also grew by 13.8 percent (Table 6). When the world market growth rate of maize declined to 0.34 percent during 1981-2003, Thailand's exports of maize also declined sharply by 15 percent. From being a rising star during 1961-1980, Cassava also retreated during 1981-2003. Thailand's export of cassava adjusted to the negative price changes and the declining value share in the world market. Canned pineapple exports of Thailand also changed from being a rising star in the first period into a falling star in the second period. The top five agricultural export commodities reported in Table 2.5 followed the same pattern as previous successful commodities (Table 6). In future, some of these top products will be disappearing; they will be replaced by newly emerging agricultural commodities.

Table 6 World Markets and Thailand's Export (Growth Rates)

	1961-1980		1981-2003		1961-2003	
	World	Thailand	World	Thailand	World	Thailand
Rice	9	8.6	3.8	3.2	5.8	7.1
Rubber	7.5	10.2	1.8	6.3	4.3	8.7
Chicken Meat*	13.7	80	8.6	12	10.6	16.8
Sugar	12.1	45.7	-0.22	5.1	4.8	19.2
Canned Pineapple**	9.4	49.7	2.4	4.8	5.3	15.2
Cassava Dry	31.4	42.2	-5.9	-5.5	10.4	12.3
Maize	15.4	13.8	0.34	-15.5	5.9	-2.7
Jute-fibers***	-1.8	-3.3	-3.8	-4	-2.8	-2.6

Source: FAOSTAT

Notes: *beginning 1976

**beginning 1968

***ending 1999

As another example of the dynamism of Thai agriculture, one can look at vegetable and fruit export that illustrates the flexibility of the agricultural export sector. When the world market demand expanded during 1976-1989, the Thai industry responded quickly in both value and quantity terms. We observe in Table 7 that Thailand's market growth rates were higher than the world market growth rate, implying that Thai vegetables and fruits increased their share in the world market. Starting from low bases, the growth rates in the initial period would always be very high. After they have firmly established their positions and started to export in large volume in the second period between 1990 and 2003, the growth rates slowed down appreciably. Fresh vegetables still remain a rising star, while prepared vegetables have lost their market shares due to high labor cost. Vegetables preserved with vinegar, which had enjoyed higher market growth than the world average in the first period, retreated in the second period. However, frozen vegetables, whose world demand rose rapidly in the second period, maintained the status of a rising star with continued gain in the world market share.

Dynamism of Thai fruit exports can be seen in the light of their changing market positions. With abundant skilled labor in the processed fruit industry, prepared fruit exports enjoyed substantial gains in the world markets in both periods. The resilience of the pineapple industry is illustrated in Table 7. The world markets for pineapples and juice grew rapidly in both periods of the analysis.

However, the world growth rates of canned pineapple were low in the first period and negligible in the second. The pineapple industry was able to command larger market shares in both juice and canned pineapple during 1976-1989. The two products became the cash cow for the industry. However, in the 1990s and early 2000s, market growth in pineapples was higher than canned and pineapple juice. The industry therefore shifted away from canned pineapple to pineapple and concentrated juice whose markets were expanding more rapidly. Canned pineapples in the second period became a case of retreat.

Table 7: Vegetables and fruit exports (percentage growth rate)

	World				Thailand			
	1976-1989		1990-2003		1976-1989		1990-2003	
	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity
Fresh Vegetable	3.8	3.7	8.6	3.6	8	-2.8	14	18.1
Prepared Vegetables	5.5	7.2	11	8.8	21.2	8.4	2.42	0.9
Frozen Vegetables	3.5	5	6.9	5.4	33.2	25.9	8.3	3.6
Vegetables in Vinegar	3.2	3.6	2.9	1.6	42.1	36.7	-4.4	-4.9
Fruit Prepared	4.4	2	3.2	3.9	27	19.9	5.4	6.7
Pineapple	12.6	6.3	7.6	11.6	na	na	20.9	22.7
Pineapple juice	16.8	9.8	4.1	1.6	26.1	22.3	2.2*	0.0*
Canned Pineapple	3.8	2.6	-0.4	0.6	12.8	12.1	-1.3	-0.7

Note: * shift to concentrate juice

Source: FAOSTAT

Thai agricultural commodities appear to follow the pattern of a product cycle. They initially enjoy considerable growth arising from learning curve effects. After a certain period, they begin to lose their strength. The industry must be robust and resilient to come up with new products to replace the old ones. The foregoing analysis of Thai fruit and vegetable exports demonstrates that agriculture can survive and compete successfully in the world markets if the agriculture processing industry is flexible and adaptive to changes in market demand and cost structure.

4. Concluding Remarks

Although the Thai agricultural sector has performed well in the past, its productivity growth has been moderate. As a result, there is a substantial income gap between the agriculture and non-agriculture sectors. Contrary to the general view, Thailand's productivity in agriculture grew at a slower pace than it did in manufacture. Free trade agreements can enable Thai farmers to reap the benefit of cheaper imported fertilizers and machinery. Those are two important inputs of farm production when land expansion is currently limited. Unless there is a substantial improvement in agricultural productivity, the majority of labor force will remain in the rural sector.[9] The problems of labor shortage and high wage rate in the urban areas will hamper Thailand's export competitiveness in both manufacture and agriculture. The productivity growth of the Thai agriculture is lower than in manufacture, causing a cost disadvantage for the rural sector. Agricultural productivity in Thailand is relatively low compared with the international standard.

Exports of agricultural products are the key for the survival of the sector. The agriculture sector must be linked to the processed food industry in order to add more value added and create linkages between rural and urban sectors. Large processed food exporting firms continue upgrading their quality and food-safety standards. Only firms that have dynamic schemes of quality improvement can survive in the new competitive market environment.

The emerging new regionalism with proliferation of free trade agreements will involve agriculture. In the end, tariff wall of agricultural protection will slowly be dismantled. Negotiations of free trade agreements between Thailand and other developed countries must include agricultural products. Johnson (1991) observes that agricultural products are usually overvalued in developed countries and undervalued in developing countries. If free trade agreements between Thailand and other developed countries exclude agricultural commodities, we will not be able to avoid what Johnson described in the early 1990s as disarray in the world agriculture. In addition, issues of non-tariff barriers, such as food safety standard etc., must be fully addressed so that the tariff reduction is not simply substituted by technical barriers in the name of food safety standards.

Although Thai farmers cannot compete with cheap Chinese onions and garlic, Thailand has tremendously increased exports of tropical fruits to China. If Thailand really wants to increase agricultural productivity, farmers must welcome new challenges and opportunities. Farmers have to be resilient to changing market conditions and adjust their cropping pattern accordingly. The GMO technology will ultimately change traditional agricultural production. In the end, Thailand cannot delay the inevitable.[10] Supply of GMO agricultural products will increase tremendously and produce disequilibrium in the future. Any resistance to the adoption of new biotechnology in agriculture will only make future adjustment more painful and unnecessarily expensive.

[9] Raising agricultural productivity is one of the government's strategies to reduce rural poverty. It should be noted that both rural and urban poverty can be reduced by enhancing agricultural productivity.

[10] Department of Agriculture has no policy of conducting GMO research in rice, arguing that Thailand has more than 100 high-yielding rice varieties that can be suitably grown in different regions throughout the country.

The role of the government is crucial in providing investment in infrastructure and agricultural research in order to make sure that farm productivity can be enhanced continuously. The government must reduce distortions in markets of farm output and factor inputs. Agricultural credit, an important factor input, has been provided to Thai farmers by the Bank of Agriculture and Agricultural Cooperatives. The current support of the rural sector has gone too far in injecting money into rural areas without considering the basic cost-benefit principle and without concern about alternative uses of limited financial resources. Intervention by the government has already gone to the point of guaranteeing prices of rice and rubber. As experiences of Japan and Taiwan indicate, the decline in agriculture's terms of trade induced resource flows and encouraged industrial development (Hondai, 1985). However, there must be continuous technological change in agriculture to offset the terms of trade that continuously move against agriculture. When productivity in agriculture increases, it will allow labor to shift to non-agricultural sectors rapidly without having to distort the terms of trade in favor of agriculture.

Policies generating growth in the agriculture sector may not be enough to reduce rural poverty. They must be accompanied by expansion of the non-agricultural sector. Agriculture and non-agricultural sectors are interrelated through migration and financial resource flows in the form of income transfer and deposit-lending activities of the banking sector. Strong growth in the non-agricultural sector can reduce rural poverty despite stagnation in the agriculture sector. Although the income gaps between the agriculture and non-agriculture sectors tend to decline, the convergence process, left to it, will take a long time. Enhancing agricultural productivity can reduce income inequality more effectively than the mere process of labor migration can do. Dynamism of the Thai agriculture and its survival depend primarily on continued productivity improvement in the sector.