Available online at www.sciencedirect.com
SCIENCE DIRECT®
Journal of Asian Economics 17 (2006) 103–125
JOURNAL OF ASIAN ECONOMICS

The economics and politics of rice export taxation in Thailand: A historical simulation analysis, 1950–1985

Hong Choeun [a], Yoshihisa Godo [b], Yujiro Hayami [c,*]

[a] *CAMCONTROL Department, Ministry of Commerce, Phnom Penh, Cambodia*
[b] *Meiji Gakuin University, Tokyo, Japan*
[c] *Foundation for Advanced Studies on International Development, GRIPS-FASID Joint Program, 7-22-1 Roppongi, Minato-ku, Tokyo 106-8677, Japan*

Received 1 March 2005; received in revised form 14 September 2005; accepted 15 November 2005

Abstract

Based on simulation analysis using the partial equilibrium trade model, this study tries to identify the factors underlying changes in rice export taxation in Thailand in 1950–1985. It was found that the Thai government over-taxed rice exports during the low-income stage and gradually reduced it to a more optimum level corresponding to increases in per-capita income, but more recently moved to under-taxation in terms of social welfare maximization for the nation. The results are consistent with the hypothesis that the process of export tax reductions reflects the shifts in the political equilibrium from the point of favoring urban interests at the expense of farmers to that of favoring farmers more. In this process, the economic welfare of the nation as a whole does not appear to have entered into politicians' calculations as a significant factor in their policy decisions.
© 2006 Elsevier Inc. All rights reserved.

JEL classification: Q17; Q18; N55

Keywords: Food policy; Welfare effects; Political economy; Rice; Thailand

1. Introduction

Most food-exporting countries tax their exports heavily in the early development stage and reduce taxation later as they advance into higher development stages. This study aims to identify the factors underlying this evolution of trade policies by using the partial equilibrium model simulating the efficiency and distributional effects of taxation on staple food exports. Thailand

* Corresponding author. Tel.: +81 3 5413 6033; fax: +81 3 5413 0016.
E-mail address: hayami@grips.ac.jp (Y. Hayami).

1049-0078/$ – see front matter © 2006 Elsevier Inc. All rights reserved.
doi:10.1016/j.asieco.2005.11.001

has been chosen as a relevant example for this purpose because the country has been among the largest rice exporters in the world, and the Thai government used to impose a heavy tax on rice exports in its early development stage and later reduced it as this country achieved successful industrialization.

The strong empirical regularity observable worldwide is that, while trade and taxation policies in developing countries tend to be distorted in the direction of exploiting (or taxing) agricultural producers, these policies in developed countries are designed to protect (or subsidize) them (Anderson & Hayami, 1986; Krueger, Schiff, & Valdes, 1992; Sadoulet & de Janvry, 1995; Schultz, 1978; Timmer, 2002). Particularly, agricultural exporting-developing countries often tax their exports by a variety of devices such as export taxes, export quotas, overvalued exchange rates, and forced procurement at lower prices by the government's parastatal. The stated objectives of these government interventions have been to correct market failure such as imperfect information, to extract surplus from agriculture which is the major sector in low-income economies, to provide food security to the poor, and to raise government revenue for national development purposes. In terms of political-economy realities, such policy choices have been the rational responses to an array of political lobbying pressures from vested interest groups including urban consumers, industrialists, and labor unions even if they might reduce the net social welfare of the nation in terms of standard economics.

Having chosen Thailand as an example, the study attempts to measure the efficiency and the welfare distributional effects of the rice export taxation on different interest groups in Thailand for the 1950–1985 period, and to shed light on factors underlying the process of Thai rice pricing policy formulation. Traditionally, the rice industry played a critically important role in the Thai economy by providing the main staple food, employing a large portion of the labor force, and contributing to government revenue and foreign exchange earnings. For the past three decades, however, the rice sector's share in the Thai economy has rapidly declined corresponding to the dramatic progress in industrialization as a part of the East Asian Miracle (World Bank, 1993). Correspondingly, a major shift in policy has progressed from taxing to subsidizing rice farmers.

Most past studies on the effects of the rice export taxation in Thailand (e.g. Siamwalla & Setboonsarng, 1989; Usher, 1978; Wong, 1978) have either failed to make a comprehensive calculation of its welfare distributional effects or simply calculated them for one time point. By applying the welfare economic analysis of the partial equilibrium framework combined with the political-economy approach to the data over the period from 1950 to 1985, this study attempts to provide a historical perspective on the effects of policy changes as well as factors underlying these changes. The whole period is sub-divided into the high taxation period (1950–1970) and the transitional period (1971–1985) from the high taxation to the non-taxation period classified according to the nominal rate of protection on rice. Moreover, political-economy inferences for the period after 1985 will also be made.

Knowledge of the distributional effects of the export taxation on different groups' welfare is essential for understanding the various stakeholders' pressures on the government policy formulation process, and, hence, is an indispensable input to politicians in their attempts to alter incentive constraints through institutional reforms. The long-term simulation analysis spanning over different development stages will enable us to identify the dynamic effects of structural and institutional changes on the bargaining power of opposing interest groups in the Thai rice policy formulation process, rendering useful lessons for other staple food-exporting developing countries. The analysis will also enable us to infer how dominant the political lobbying for group interests would be relative to considerations of the social welfare maximization for the nation in politicians' decisions.

The remaining sections of this paper are organized as follows. In Section 2, a brief review of the rice economy and policies in Thailand is conducted to provide insights into the historical paths of rice policies. Section 3 develops a model for measuring the welfare effects of the rice export taxation. Explanations on the data sources used and the parameters employed in the simulation analyses are provided in Sections 4 and 5, respectively. The results of the historical simulation under both the large and small country assumptions are presented in Section 6. Finally, Section 7 summarizes the main findings and discusses their implications.

2. Review of the rice economy and policies in Thailand

Rice has played a pivotal role in the economy of Thailand throughout its history. In spite of its declining importance in the national economy, Table 1 shows that in 1995 rice still constituted 27% of agricultural GDP, 4% of total merchandise export and 5% of total private expenditure, and employed 60% of the total labor force.

After signing the Bowring Treaty with Great Britain in 1855 up to World War II, Thailand adopted a free trade system, as its tariff autonomy was deprived by this treaty. The surge in the

Table 1
Synopsis of economic development and structural change in Thailand, 1951–1995[a]

	1951	1960	1970	1980	1990	1995
GDP per capita (in 1988 baht)[b]	6885	8287	13054	19889	35491	50289
GDP per capita (in 1988 US dollar)	355	394	625	937	1392	2000
Percentage of GDP per capita of the United States	3.7	3.7	4.4	5.4	6.5	8.8
Share of GDP						
Agriculture	36.3	31.6	26.6	20.6	14.2	10.9
Industry	17.7	20.3	25.3	30.3	37.7	41.5
Share of labor force						
Agriculture		83.3[c]	79.4	71.0	64.0	60.3
Industry		4.2	5.9	10.3	14.0	19.8
Share of rice in						
GDP	22.1	17.2	10.7	7.4	4.1	3.0
Agricultural GDP	60.8	54.3	40.1	35.8	28.8	27.4
Share of						
Rice in merchandise export	60.3	35.5	20.0	15.0	5.7	3.5
Thai rice export quantity in world export	30.2	18.9	16.7	23.7	36.3	27.4
Rice and cereal in private expenditure		17.2	12.7	9.9	5.9	4.5
Rice and cereal in food expenditure		35.9	29.7	27.0	26.1	22.8

Source: GDP, agricultural GDP, rice GDP, private expenditure, food expenditure, rice and cereal expenditure are from the National Income of Thailand, 1951–1996, Office of the National Economic and Development Board, Office of the Prime Minister (1999). U.S. GDP is from U. S. Bureau of Economic Analysis (2004). Official exchange rate and total world rice export are from International Rice Research Institute (2004). Total labor force and agricultural labor forces for 1960–96 are from Food and Agriculture Organization of the United Nations (FAO) (2004), and for 1954 are from FAO's Production Year Book (1960). For industrial labor force, data for 1960–1970 are from Mitchell (1998), and for 1980–1995 are from World Bank's World Development Indicators 2001 (2001). Total merchandise export and rice export values are from Mitchell (1998).

[a] For 1951 and 1995, 3-year average centering on the years shown. For 1960, 1970, 1980, and 1990, 5-year average centering on the years shown.

[b] Converted into US dollars by using the official exchange rate.

[c] Three-year average of 1960, 1961, and 1962.

demand for rice from the industrializing West and Western colonies in Asia induced large government and private investments in canal construction in the Chao Phraya Delta for opening uncultivated land areas for rice production, resulting in large-scale rice exports. This vent-for-surplus development process in the sense of Hla Myint (1965) had driven Thailand to become a rice monoculture economy in the late 19th century (Hayami, 2001; Ingram, 1955; Muscat, 1994).

The history of the rice trade policy in Thailand after World War II represents a typical process of change from taxing to subsidizing agriculture in the course of economic development. The government's taxation on rice exports can be classified into three main stages as reflected by the nominal protection rate (NPR), measured as the rate of difference of the domestic wholesale price from the export price (FOB Bangkok), in Fig. 1(a): the high export taxation regime in 1950–1970, the transitional period in 1971–1985 in which taxation on rice export was phased out gradually, and the period after 1985 when all export taxes were removed and some rice export subsidies were introduced.

In the early post-World War II period, the need to lower domestic food prices in order to curb the high domestic inflation, to generate government revenue, and to meet the rice compensation payment to the United Nations for Thailand's alliance with Japan during the war compelled the Thai government to intervene in rice trades. The Rice Office under the Ministry of Commerce

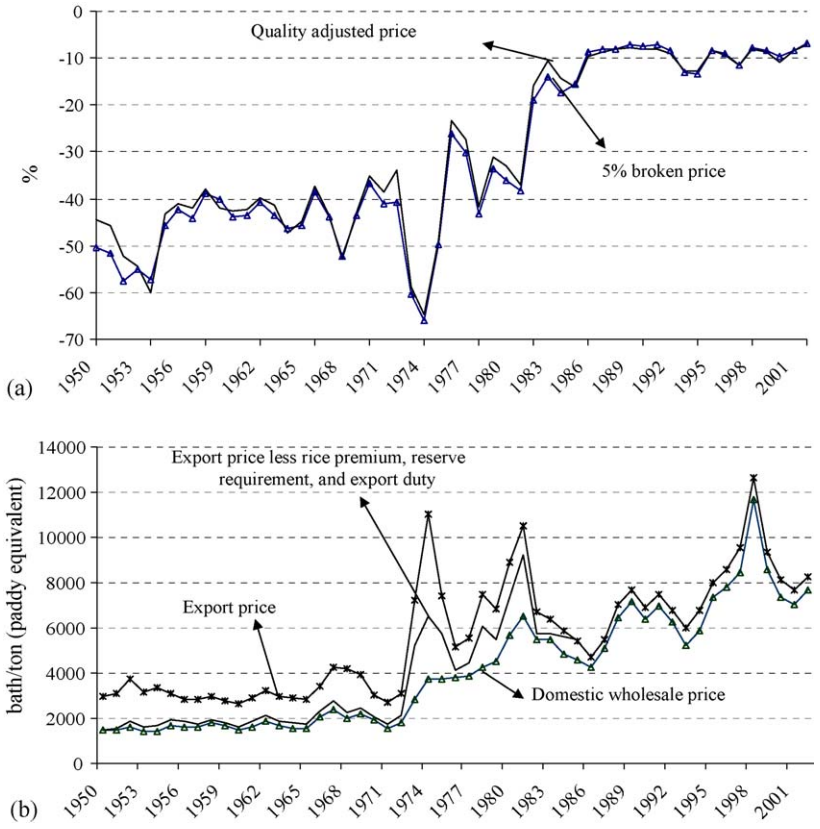

Fig. 1. (a) Nominal protection rate (NPR), and (b) export and domestic price of rice 5% broken in Thailand, 1950–2002. Source: Bank of Thailand Monthly Bulletin (various issues); Chuchart (1957); Foreign Trade Statistics of Thailand (various issues); International Rice Research Institute (2004).

was established to monopolize all rice exports from rice procured at prices lower than international market prices (Siamwalla & Setboonsarng, 1989; Welsch & Tongpan, 1972). The Import and Export Act of 1939 and the Rice Trading Act of 1946 provided the Ministry of Commerce the legal power and wide discretion over the setting of rice trade policies without the legislative branch's approval. In order to extract more surplus from the rice sector, the government also required rice exporters to exchange their earning to domestic currency through the Bank of Thailand at about two-thirds the market rate (Siamwalla & Setboonsarng, 1989; Welsch & Tongpan, 1972; Wong, 1978).

After the Ministry of Commerce relinquished its monopoly over rice trade in 1954, private traders were allowed to export rice, but had to pay a premium for obtaining an export license. In addition, a 5% ad valorem export duty was also levied by the Ministry of Finance. From 1962, the government introduced a rice reserve requirement under which rice exporters were obliged to sell a fixed proportion of exported rice to the government at below market prices. This reserved rice was later sold to urban consumes at subsidized prices by the Public Warehouse Organization (PWO) of the Ministry of Commerce.

During the late 1950s and 1960s, the import substitution industrialization strategy was adopted by the government. Consequently, as the promoter of industrialization, the government's interest in keeping the domestic rice price low coincided with that of Bangkok-based industrialists, rice exporters and urban workers, and consumers. On the other hand, local rice millers and farmers adversely affected by the export taxation were not able to organize counteracting political lobbies due to high transaction costs (Christensen, 1993).

The 1970s witnessed a remarkable change in the direction of rice pricing policy. The dual structure of the Thai economy which developed as a result of successful industrialization resulted in increasing rural-urban income disparity. This problem, compounded by mounting dissatisfaction with the military regime, induced students to stage a riot which brought down the military government in 1973. As an attempt to appease farmers, the new representative government enacted the Farmers' Aid Fund Act in 1974, which subsequently brought the Ministry of Agriculture for the first time into domestic rice policy formulation. Eventually, all the revenues from the rice premium were placed in the Farmers' Aid Fund to support farmers (Siamwalla, 1987). During the 1975–1982 period, most of this fund was used to finance the rice price support program operated by the Agricultural Ministry's Marketing Organization for Farmers (MOF) and PWO. Nonetheless, due to the simultaneous implementation of the program with the export taxation which had the opposite effects on the domestic price, together with limited funds and the lack of experience of MOF and PWO officials, the rice support programs were not successful in raising domestic rice price to the targeted level. This price support scheme was mainly targeted at politically faithful elite farmers and local rice millers, while the export tax was retained to satisfy the interest of rice exporters and Commerce Ministry officials.

As per-capita income in Thailand rose further, farmers' welfare gained greater political weight in the government rice policy objective. The failure of the price support program under the pressure of the continued downfall of world rice prices in the 1980s induced the government to suspend the rice premium in 1986. However, as argued by Hayami and Godo (2004), the country in the middle-income stage was still unable to protect farmers strongly enough to close the rural-urban income gap unlike in high-income countries.

Although most of the individual intervention instruments failed to achieve their stated objective during the 1950–1985 period, Fig. 1(b) shows that the Thai government, using all the tools combined, was quite successful in preventing domestic rice prices from fluctuating with the

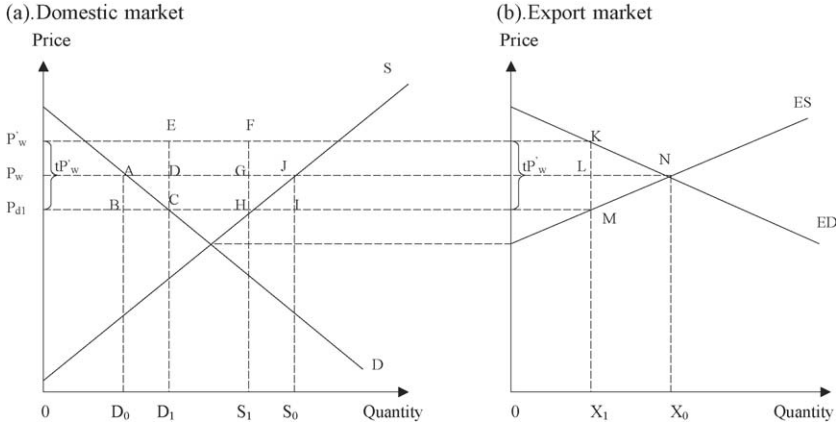

Fig. 2. The effects of rice export taxation in Thailand, large country case.

world price from the beginning of the first commodity boom in 1973 to the collapse of the second boom in 1981. The rice premium alone, however, was not very effective in stabilizing domestic prices. Other measures such as export quotas and export bans may have played significant roles.

3. A model for Thai rice trade

To evaluate the welfare distributional effects of past rice export taxation in Thailand, the static partial equilibrium trade model is used in this study. The method has been widely employed in agricultural trade analyses because, in spite of its limitations, it uses a relatively simple formula requiring a relatively modest amount of data to derive policy implications (Francois & Hall, 1997; Sadoulet & de Janvry, 1995; Tsakok, 1990).

As mentioned in the previous section, Thailand implemented multiple trade policy instruments for rice export taxation, which consisted of rice premiums, export restrictions, export duties, and reserve requirements. For the sake of simplification, the combined effects of all the policy instruments are measured in terms of an ad valorem export tax equivalent. The export quota has the same effects as the export tax except for the difference in the distribution of revenue. While the revenue from the export tax is collected by the government, the excess profit or rent due to the export quota is captured by export license holders if the license is issued free of charge. However, if the quota is auctioned under competitive bidding, the government can collect the revenue equivalent to the export tax revenue. In order to estimate the quota rent to rice exporters, the export-tax-equivalent rate of the quota is computed as the difference between the nominal protection rate and the sum of the rice premium, the reserve requirement, and the export duty.

The graphical presentation of the model and the estimation formulas used shall be shown for the large country case only, which is defined as the country whose export is so large as to significantly influence the world price of rice, since the same graph and formulas can be applied to the small country case in which the rice export demand elasticity facing Thailand approaches infinity. All the formulas will be expressed in terms of the observable variables in trade statistics and parameters obtained from existing studies, except the hypothetical world price in the absence of trade distortions in Thailand (P_w) which must be estimated from the observed variables and chosen parameters in the large country case, whereas the observed world price itself is used as P_w in the small country case.

In Fig. 2, panel (a), D and S represent, respectively, the domestic demand and supply of rice in Thailand. Their horizontal difference is its export supply to the foreign market, denoted by ES. Panel (b) depicts the export market where the export supply from Thailand, ES, intersects the export demand from the rest of the world, ED.

Without an export tax, with the domestic price of rice, P_{d}, equal to the world price, P_{w}, domestic producers supply S_0, and domestic consumers consume D_0. The excess supply measured by $S_0 - D_0$, is exported to the rest of the world.

Thailand's taxation on rice exports at an ad valorem rate of t raises the world price of rice to P'_{w} and reduces the domestic price in Thailand to $P_{\mathrm{d1}} = (1-t)P'_{\mathrm{w}}$. Corresponding to the lowered domestic price, the domestic demand increases to D_1, whereas the domestic supply and export supply drop to S_1 and $S_1 - D_1$, respectively.

For simplification, let the domestic rice demand and supply be in the following constant elasticity form along the tradition of agricultural trade analysis (Demont & Tollens, 2002; Hayami, 1979; Hayami & Godo, 1997; Otsuka & Hayami, 1985):

$$D(P) = aP_{\mathrm{w}}^{-\eta}, \tag{1}$$

$$S(P) = bP_{\mathrm{w}}^{\beta}, \tag{2}$$

where D and S denote, respectively, the quantities of domestic rice demand and supply, a and b denote the demand and supply shifters, and $-\eta$ and β denote the price elasticities of domestic demand and supply of rice, while P_{w} is the world price which is equal to the domestic price under no export taxation.

The export supply function without export taxation by Thailand can be derived by subtracting Eq. (1) from Eq. (2):

$$\mathrm{ES}(P) = S(P) - D(P) = bP_{\mathrm{w}}^{\beta} - aP_{\mathrm{w}}^{-\eta}, \tag{3}$$

where ES denotes the quantity of rice exported from Thailand.

In addition, the export demand function for Thai rice from the rest of the world is also assumed to take the following constant elasticity form:

$$\mathrm{ED}(P) = cP_{\mathrm{w}}^{-\lambda}, \tag{4}$$

where ED is the quantity of export demand for Thai rice from the rest of the world, c is the demand shifter, and $-\lambda$ is the price elasticity of export demand.

The world equilibrium price of rice P_{w} with no export taxation by Thailand as shown in Fig. 2 is determined by equating Eq. (3) with (4):

$$bP_{\mathrm{w}}^{\beta} - aP_{\mathrm{w}}^{-\eta} = cP_{\mathrm{w}}^{-\lambda}. \tag{5}$$

P_{w} can be obtained from the above non-linear equation through iteration.

Rice farmers' welfare loss due to the lowered domestic price caused by the export taxation can be expressed as:

$$\text{area } HJP_{\mathrm{w}}P_{\mathrm{d1}} = \int_{P_{\mathrm{d1}}}^{P_{\mathrm{w}}} bP^{\beta}\,\mathrm{d}P = \frac{S_1}{(1+\beta)[(1-t)P'_{\mathrm{w}}]^{\beta}}[P_{\mathrm{w}}^{1+\beta} - [(1-t)P'_{\mathrm{w}}]^{1+\beta}]. \tag{6}$$

A part of the rice farmers' income loss is transferred to the domestic consumers expressed as:

$$\text{area } ACP_{d1}P_w = \int_{P_{d1}}^{P_w} aP^{-\eta}\,dP = \frac{D_1}{(1-\eta)[(1-t)P'_w]^{-\eta}}[P_w^{1-\eta} - [(1-t)P'_w]^{1-\eta}], \tag{7}$$

and another part becomes the government export tax revenue and export quota holders' rent equal to:

$$\text{area } CEFH = (S_1 - D_1)tP'_w. \tag{8}$$

Due to the rise of the world rice price from P_w to P'_w driven by the taxation, the export tax revenue and quota rent also include terms-of-trade gain equal to:

$$\text{area } EFDG = (S_1 - D_1)(P'_w - P_w). \tag{9}$$

The export taxation creates domestic efficiency losses in production and consumption expressed, respectively, as:

$$\text{area } HGJ = \frac{S_1}{(1+\beta)[(1-t)P'_w]^{\beta}}[P_w^{1+\beta} - [(1-t)P'_w]^{1+\beta}] - [P_w - (1-t)P'_w]S_1, \tag{10}$$

$$\text{area } ADC = [P_w - (1-t)P'_w]D_1 - \frac{D_1}{(1-\eta)[(1-t)P'_w]^{-\eta}}[P_w^{1-\eta} - [(1-t)P'_w]^{1-\eta}]. \tag{11}$$

At the same time, the country also loses the opportunity in foreign exchange earning equal to:

$$\begin{aligned}&\text{area } ADD_1D_0 + \text{area } GJS_0S_1 - \text{area } DEFG\\ &= P_w(D_1 - D_0 + S_0 - S_1) - (S_1 - D_1)(P'_w - P_w).\end{aligned} \tag{12}$$

The rice export taxation in a large country case may create a net social gain or loss to the home country, which depends on the difference between the transfer of surplus from foreign consumers through the gain in terms-of-trade and the domestic efficiency loss in production and consumption expressed by area $EFDG$ − (area HGJ + area ADC). This net welfare gain from rice export taxation under the large country assumption is maximized if the tax rate is set at the optimal level, i.e., the tax rate which equates the inverse of the absolute value of export demand elasticity (Corden, 1974).

The model developed above is static by nature. It is used in the simulation analysis across different development stages based on the approach of comparative statics for inferring the dynamic effects of structural and institutional changes. The model does not incorporate the time lag structure of the supply response to price, because our simulation analysis is not conducted on annual data but on the averages for the period longer than 10 years representing different development stages as explained below. It is expected that the time lag effects were cancelled out for such long time spans. In addition, by using the averages for long periods, the possibility of observations to deviate from the equilibria assumed in our model would likely be relatively small.

4. Data

All the data for 1950–1985 are taken from various published sources. In order to weed out the effects of abnormal years, the data of 1973, 1974, and 1975 during the first world oil crisis, and those of 1980 and 1981 during the second world oil crisis are excluded from the analysis.

The quantities of milled rice production and export are taken from the *Agricultural Statistics of Thailand* from the Ministry of Agriculture and Cooperatives of Thailand. Domestic rice

consumption is computed as the difference between the production and export adjusted for stock changes. Stock adjustments were not made for 1950–1955 in the absence of data. The stock data for 1956–1959 are from the *Agricultural Statistics of Thailand* and the 1960–1985 data are from *FAOSTAT 2004* from the Food and Agriculture Organization of the United Nations.

Because of the many different grades of rice with different milling rates in Thailand, our calculation of rice prices follows Siamwalla and Setboonsarng (1989) in assuming that one ton of paddy is equal to 660 kg of milled rice, which consists of 450 kg of white rice 5% broken, 150 kg of broken rice A1 extra, 30 kg of broken rice C1 extra, and 30 kg of broken rice C3. Rice price data by grade are taken from Chuchart (1957), *Foreign Trade Statistics of Thailand* from the Customs Department of Thailand, *World Rice Statistics* from International Rice Research Institute, and *The Bank of Thailand Monthly Bulletin*.

Data for agricultural GDP, rice GDP, total private food expenditure, and total rice and cereal expenditure are from the *National Income of Thailand* (1951–96) from the National Economic and Social Development Board (1999). However, due to the unavailability of data for the early years, agricultural GDP and rice GDP, and total food expenditure and rice and cereal expenditure for 1950–1970 are the simple averages of 1951–1970 and 1957–1970, respectively. Data for total government revenue, total export value, and total rice export value are taken from Mitchell's *International Historical Statistics* (1998, pp. 539–550, 654–664, 899–904).

As mentioned earlier, because the Thai government adopted several instruments to tax rice exports during the period under study, the nominal protection rate (NPR) is used to measure the rice export taxation rate. It is calculated as the rate of difference of the domestic wholesale price from the export price of rice (FOB Bangkok) adjusted for different grades of rice as explained above. For the rice premium, the reserve requirement and the export duty, the 1960–1985 data are taken from Siamwalla and Setboonsarng (1989), and the 1950–1959 data are from Pookkachatikul and Welsch (1976) and Chuchart (1957).

5. Parameters

To measure the welfare effects of the rice export taxation on the different groups mentioned in Section 3, the magnitudes of the price elasticities of domestic supply, domestic demand, and export demand for Thai rice are needed. The values of these parameters employed in this study are selected from the estimates in past econometric studies. A sensitivity test will be conducted by using the boundary values of plausible parameter ranges.

5.1. Price elasticity of domestic rice supply

There have been many studies on domestic rice supply in Thailand employing different data, periods, models, and estimation methods. Siamwalla and Setboonsarng (1989, pp. 237–238) compile the previous estimates of the price elasticity of Thai rice supply from studies conducted since 1968, and Vanichjakvong (2002) reviews other studies. In addition to these two sources, this study surveyed the more recent literature. Those previous estimates compiled in Appendix A(a) show that the short run price elasticities of rice supply range from 0.02 to 0.65 with an average value of 0.25 and the mode from 0.1 to 0.2. The long run price elasticities are averaged at 0.59 with the range from 0.09 to 2.67 and the mode between 0.6 and 0.7.

The average of the short run price elasticities of planted area is 0.18 with the mode between 0.1 and 0.2, while the average of the long run price elasticities is 0.42. The average short run price elasticity of total rice supply is 0.34, with the mode between 0.4 and 0.5, and the long run

elasticity is averaged at 0.86 with the mode between 0.6 and 0.7. Based on the parameter estimates summarized in Appendix A(a), 0.3 is used as the mean value for the price elasticity of rice supply with 0.1 and 0.5 being its lower and upper bounds, respectively.

5.2. Price elasticity of domestic rice demand

As for domestic rice demand, adding to the surveys done by Siamwalla and Setboonsarng (1989) and Vanichjakvong (2002), this study reviewed the more recent literature. From the fifteen studies compiled in Appendix A(b) which employed different data, periods, and estimation methods, the average of the short run own price elasticities of domestic rice demand in Thailand is −0.42 ranging from −0.01 to −0.93 with the mode between −0.6 and −0.7. It should also be noted from Appendix A(b) that the estimated elasticities based on time series data are lower than those based on cross-sectional data.

Based on these estimates, this study will use the price elasticity of domestic rice demand of −0.4 as the mean value with −0.2 and −0.6 being its lower and upper bounds, respectively.

5.3. Price elasticity of export rice demand

Studies on the price elasticity of the rice export demand facing Thailand have been scarce in spite of its critical importance in assessing Thai rice trade policies. Two commonly used methods are the direct and the synthesis estimation methods. The direct estimation method regresses the export quantity on the border price together with other variables, while the synthesis method combines the estimates of domestic supply and demand elasticities with the estimates of the price transmission elasticity. Usually, the direct method provides less elastic estimates than the synthesis results. However, so far no consensus has been reached on which method would provide more reliable estimates, even for the case of the United States (Gardiner & Carter, 1988; Karp & Perloff, 2002).

Among the studies compiled in Appendix A(c), Wong's pioneering study in 1978 estimated the long run price elasticity of the export demand of Thai rice to be −4. Meenaphant (1981) found it to be −1.07. Tyers and Anderson (1988) estimated it to be −4 for the price adjustment within the first year, −8 for the price adjustment after 1 year, and −17 after full adjustment. Roumasset and Setboonsarng (1988) calculated it to be between −5 and −8 based on the world price elasticity of rice demand of −2 divided by the world market share of Thai rice of 25%. Recently, Warr and Woller (1997), who employed the modified Phillips-Hansen error-correction econometric regression approach, found the elasticity to lie between −1.2 and −1.9.

Due to the great uncertainty about the magnitude of this elasticity as reflected in such a wide range of previous estimates for the large country case, this study will use −4 as the mean value for the own price elasticity of export demand with −2 and −6 being the lower and upper bounds, respectively.

6. Simulation results

The simulation in this section is performed by plugging in the data explained in Section 4 and the relevant parameters chosen in Section 5 into the relevant formulas in Section 3. The results under the large country assumption are reported first in this section because this assumption is considered to be more realistic for Thailand which occupies a large share in the world rice export market. The results for the small country case shall be presented later as a part of the sensitivity test.

6.1. Using mean parameters

The simulation results for the high taxation period and the transitional period for the mean price elasticities of domestic supply, domestic demand, and export demand of 0.3, −0.4, and −4, respectively, are reported in Simulation I of Table 2. The high taxation period 1950–1970 is denoted as Period 1, and the transitional period 1971–1985 is denoted as Period 2.

The average actual rice export taxation rates for the two periods are 45% for 1950–1970 and 24% for 1971–1985, respectively.

If the export demand elasticity of −4 is plausible, the inverse elasticity rule of Corden (1974) dictates that the Thai government imposed an export tax on rice nearly two times higher than the optimum rate (25%) in terms of social welfare maximization for Thailand in Period 1 and reduced it to an almost optimal rate in Period 2 corresponding to economic development.

Table 2
Simulation results on the welfare effects of rice export taxation in Thailand using the mean values of elasticities, large country case

	Simulation formulas[b]	Simulation I ($\beta = 0.3$; $-\eta = -0.4$; $-\lambda = -4$)[a]	
		Period 1 (I-1) 45[d]	Period 2 (I-2) 24[d]
Estimated changes due to export taxation			
World price		20.0	9.4
Domestic price		−33.7	−17.2
Domestic production		−11.6	−5.5
Domestic consumption		17.8	7.8
Export		−51.9	−30.1
Welfare effects of export taxation			
Producer surplus loss (PSL)(billion baht- BB[c])	(6)	18.2	13.5
Percentage of rice GDP		60.2	27.2
Consumer surplus gain (BB)	(7)	12.0	9.3
Percentage of PSL		66.1	69.1
Percentage of rice and cereal expenditure		34.8	17.1
Government revenue	(8)	5.3	4.0
Percentage of total government revenue		17.3	3.0
Quota rent		0.9	1.3
Percentage of total government revenue		2.9	1.0
Terms-of-trade gain (TTG) (BB)	(9)	2.4	1.9
Percentage of rice GDP		7.7	3.7
Domestic efficiency loss (BB)	(10) + (11)	2.3	0.8
Percentage of rice GDP		7.5	1.5
Net gain to Thailand (BB)	(9) − (10) − (11)	0.1	1.1
Percentage of rice GDP		0.2	2.2
Foreign exchange earning loss (BB)	(12)	14.8	10.4
Percentage of total export value		43.7	6.4
Percentage of rice export value		124.0	44.7

[a] β: price elasticity of domestic supply; $-\eta$: price elasticity of domestic demand; $-\lambda$: price elasticity of export demand.
[b] Numbers in parentheses are corresponding to the equation numbers in the text.
[c] Billion baht at 1988 price.
[d] Total export taxation rate (%).

However, as the Thai economy developed further, the export taxation was reduced to zero after 1985, which was less than optimum.

However, if the lower bound of −2 is the correct value of the export demand elasticity, the average taxation rate in Period 1 is considered to have been close to the optimum rate (50%) and that of Period 2 is only about half the optimum. On the other hand, if the upper bound of −6 is correct, rice exports in Thailand are considered to have been grossly overtaxed relative to the optimum rate (17%), although the degree of over-taxation significantly decreased from Period 1 to 2. Even in this case, the elimination of export taxation after 1985 is seen as being less than optimum in terms of the social welfare maximization for Thailand.

Regarding the simulation results, all the values are expressed in billion baht (BB) at 1988 constant prices after deflation by the average GDP deflator. The upper five rows of Table 2 present the results of the estimated changes caused by the export taxation on the world price, the domestic price, the production, the consumption, and the exports of Thai rice.

Corresponding to the different export taxation rates applied to Period 1 and 2, the world rice price rose by 20% and 9% while the domestic price declined by 34% and 17% for Period 1 and 2, respectively (compare between Simulation I-1 and I-2). The lowered domestic rice price caused the domestic production to drop by about 12% and 6%, and the domestic consumption to increase by 18% and 8% in Period 1 and 2, respectively. As a result, exports fell by 52% and 30%, respectively.

The welfare re-distribution effects of the rice export taxation are estimated as follows: the tax inflicted a large welfare loss to rice farmers through the reduction in the producer surplus, amounting to about 18 BB or 60% of rice GDP in Period 1, which declined to 14 BB or 27% of rice GDP in Period 2 as the government reduced the export taxation from Period 1 to Period 2. Domestic rice consumers were the main beneficiaries from the taxation, capturing 12 BB and 9 BB or 35% and 17% of rice and cereal expenditure in Period 1 and 2, respectively. The government extracted the export tax revenue equal to 5 BB or 17% of the government revenue in Period 1, which fell to 1 BB or 3% of the government revenue in Period 2. The quota rent accrued to the export license holders amounted to 0.9 BB in Period 1 and rose slightly to 1.3 BB in Period 2.

Though the taxation created a domestic efficiency loss of 2.3 BB and 0.8 BB in Period 1 and 2, respectively, it effectively transferred the surplus from foreign consumers of 2.4 BB and 1.9 BB in the two respective periods. As a whole, due to the greater gain in terms-of-trade than the domestic efficiency loss, this taxation resulted in a net welfare gain to Thailand of about 0.9 BB or 0.2% of rice GDP in Period 1 and 1.1 BB or 2.2% of rice GDP in Period 2. This means that if the government had reduced the taxation rate in Period 1 to the level of Period 2 that was close to the optimum rate according to the inverse elasticity rule, given the export demand elasticity of −4, Thailand would have gained additional social welfare of about 1 BB or 2% of rice GDP in Period 1. Such results imply that the reduction in taxation from Period 1 to Period 2 not only reduced inequity to farmers but also improved economic efficiency to the nation.

This export taxation, however, caused a substantial loss in potential foreign exchange earning of the magnitude of 43% and 11% of total export value or 123% and 74% of total rice export value for the two respective periods. This loss could have been serious for developing countries which rely on the imports of capital goods and technological know-how to fuel domestic industrialization.

Based on the political-economy approach, it is hypothesized that the observed policy changes were the products of interactions between politicians seeking to maximize the probability of staying in power and pressure groups lobbying for policies that maximized their welfare (Bates,

1981; Breton, 1974; Buchanan & Tullock, 1962; De Gorter & Swinnen, 2002; Downs, 1957; Hayami, 1988). For this purpose, politicians attempted to equate the marginal political benefit and the cost of agricultural taxation to them, which may be conceptually measurable in terms of changes in the political support from various constituencies.

During the low-income stage, the food problem a la Schultz (1953) was dominant. Rice was the main staple food constituting about 36% of total food expenditure in 1960 (Table 1). With a high Engel coefficient, high rice prices would have produced a major adverse effect on the welfare of urban consumers. They were geographically concentrated and strategically located in the metropolis, and, hence, would find it less costly to organize protests which were likely to endanger the current regime. Moreover, since rice was a wage good, not only workers, but also industrialists and the government, who wanted to maintain low wages to their employees, demanded cheap rice. Also, it should be noted that many industries and commercial firms in Thailand were partly owned by powerful bureaucrats and government leaders (Phongpaichit & Baker, 2002). During the early development stage, furthermore, the source of government revenue was very limited. Taxation on rice exports was an administratively easy way for the government to raise a large amount of revenue. Thus, urban consumers, industrialists, and government agencies naturally formed a coalition in the sense of Bates (1981) demanding for lowered rice prices by means of export taxation.

On the other hand, during the low-income stage, rice farmers constituted nearly 80% of the labor force (Table 1), but were less educated and dispersed over wide rural areas with poor communication and transportation infrastructure. They had little knowledge about the adverse effects of the export taxation and found it costly to organize political lobbies for opposition. Moreover, during much of this period the Thai government was ruled by military strongmen, who would have thought that farmers' opposition did not pose an immediate threat to their regime.

In Period 2, with successful industrialization and economic development, the rural-urban income disparity widened. The rice cultivation frontier was being closed while the world rice price was declining steadily as a result of the successful Green Revolution in Asia, except for the World Food Crisis years in the mid-1970s. The increase in farmers' education level under improved communication and transportation infrastructure made them more sensitive to their relative income with urban dwellers. Correspondingly, the number of protests and demonstrations by farmers began to rise during this period.

The transition from the bureaucratic-based politics to the interest-group politics after the student-led riot in 1973 led to the formation of a new cabinet with representatives of broader interests. With the growing farmers' voices together with the rising Communist insurgents in rural areas, political leaders began to realize the increased political cost of taxing rice farmers. Meanwhile, corresponding to increases in the income level, the importance of rice in household expenditure declined (Ito, Wesley, Peterson, & Grant, 1989). As shown in Table 1, for the whole period 1951–1985, the shares of rice in total food expenditure declined steadily, implying that consumers became less resistant to increases in rice prices. In addition, the reliance of the government budget on rice export tax revenues declined sharply from about 15–17% to less than 3% owing to large increases in tax revenues from commerce and industry. The tax reduction, however, resulted in a slight increase in the quota rent captured by the rice exporters as shown above. This suggests that the rice exporting business elites in collusion with Commerce Ministry officials should not have opposed this export tax reduction. If the taxation rate in Period 1 had been maintained in Period 2, it should have widened the rural-urban disparity more than what actually occurred, which could have added to the political instability.

Thus, in Period 1 the rice export taxation at the rate heavier than a national optimum for Thailand would have been politically rational for political leaders in maximizing the probability of their staying in power, though economically inefficient in terms of the social welfare maximization criteria. At this stage, the needs to raise government revenue and to supply rice to urban consumers at low prices should have predominated politicians' decision making, while economic welfare maximization would have been a minor consideration. The reduction of the taxation rate to the national optimum in Period 2 would have been not only politically rational but also economically efficient. Nevertheless, although it is highly likely that this export tax reduction was motivated by politicians' need to appease farmers' discontent against rural-urban polarization, their consciousness about the efficiency increasing effects of the tax reduction are questionable. In fact, the political need to reduce the rural-urban disparity induced the virtual elimination of the rice export taxation after 1985 despite its negative effect on the net social welfare of Thailand.

6.2. *Sensitivity tests using alternative elasticities*

The estimates of the net loss or gain to Thailand resulting from the rice export taxation are very sensitive to the values of the elasticities of domestic demand, domestic supply, and export demand facing Thailand.

First, to grasp the variations in the results when the export demand elasticity changes, this study conducted simulations using its lower and upper bound values of −2 and −6, respectively. In Simulation II of Table 3, using −2 as the lower bound value estimate of the export demand elasticity while the elasticities of domestic supply and demand are set at average values, the imposition of the rice export tax resulted in a net gain to Thailand of about 2.4 BB in the two periods, but relative to the rice GDP, the gain accounted for 8% in Period 1 and only 5% in Period 2. In contrast, if the export demand elasticity is assumed to be as elastic as −6, the taxation would have inflicted a net loss to Thailand of about 1.2 BB or 4% of the rice GDP in Period 1, though it yielded a net gain of 0.4 BB or 0.8% of the rice GDP in Period 2 (Simulation III).

When this elasticity approaches infinity (small country case), with other relevant elasticies set at their means (compare Simulation I in Table 2 with Simulation V in Table 4), the rice export taxation would have decreased domestic price, and decreased domestic production, increased domestic consumption, and, hence, reduced exports more. The taxation would have also imposed a greater welfare loss on rice farmers, amounting to 30 BB and 21 BB or 99 and 21% of the rice GDP in the Period 1 and 2, respectively. The domestic rice consumers would have experienced a more than 30% increase in their consumer surplus compared to the large country case. The net loss in national welfare would have amounted to 17 and 8% of the rice GDP for Period 1 and 2, respectively.

Secondly, the magnitudes of the loss or gain are also sensitive to the choice of domestic supply and demand elasticities. According to Siamwalla and Setboonsarng (1989), the rice supply elasticity in Thailand became less elastic as the land opening frontier was being closed. The domestic rice demand elasticity also became less elastic when per-capita income increased according to Pinstrup-Andersen (1988). Therefore, Simulation IV of Table 3 presents the results using the higher bound price elasticities of supply and demand of 0.5 and −0.6, respectively, for Period 1, and the lower bounds of these elasticities of 0.1 and −0.2 for Period 2 with an average export demand elasticity of −4.

Compared with the cases using the average elasticities of supply and demand in Table 2, the results from Table 3 indicate that, under the large country case, if both the domestic supply and

Table 3
Sensitivity tests using alternative elasticities of export demand, domestic supply and domestic demand, large country case

	Simulation formulas	Simulation II ($-\lambda = -2$)		Simulation III ($-\lambda = -6$)		Simulation IV ($-\lambda = -4$)	
		Period 1 (II-1) ($\beta = 0.3$; $-\eta = -0.4$) 45[a]	Period 2 (II-2) ($\beta = 0.3$; $-\eta = -0.4$) 24[a]	Period 1 (III-1) ($\beta = 0.3$; $-\eta = -0.4$) 45[a]	Period 2 (III-2) ($\beta = 0.3$; $-\eta = -0.4$) 24[a]	Period 1 (IV- 1) ($\beta = 0.5$; $-\eta = -0.6$) 45[a]	Period 2 (IV- 2) ($\beta = 0.1$; $-\eta = -0.2$) 24[a]
Estimated changes due to export taxation							
World price		33.9	14.9	14.1	6.8	26.0	5.0
Domestic price		−26.0	−13.1	−36.9	−19.2	−30.4	−20.5
Domestic production		−8.6	−4.1	−12.9	−6.2	−16.6	−2.3
Domestic consumption		12.8	5.8	20.3	8.9	24.3	4.7
Export		−44.2	−24.2	−54.7	−32.7	−60.3	−17.8
Welfare effects of export taxation							
Producer surplus loss (PSL)(billion bath- BB)	(6)	12.4	9.7	21.1	15.4	16.1	16.5
Percentage of rice GDP		41.0	19.5	70.1	31.1	53.4	33.1
Consumer surplus gain (BB)	(7)	8.5	6.8	13.7	10.6	10.0	11.8
Percentage of PSL		68.9	70.4	64.8	68.5	62.4	71.4
Percentage of rice and cereal expenditure		24.7	12.4	39.7	19.3	29.2	21.5
Government revenue	(8)	5.3	4.0	5.3	4.0	5.3	4.0
Percentage of total government revenue		17.3	3.0	17.3	3.0	17.3	3.0
Quota rent		0.9	1.3	0.9	1.3	0.9	1.3
Percentage of total government revenue		2.9	1.0	2.9	1.0	2.9	1.0
Terms-of-trade gain (TTG) (BB)	(9)	3.5	2.8	1.7	1.4	2.9	1.0
Percentage of rice GDP		11.7	5.6	5.7	2.8	9.5	2.1
Domestic efficiency loss (BB)	(10) + (11)	1.1	0.4	2.9	1.0	2.7	0.5
Percentage of rice GDP		3.7	0.8	9.7	2.0	9.0	1.0
Net gain to Thailand (BB)	(9) − (10) − (11)	2.4	2.4	(1.2	0.4	0.2	0.6
Percentage of rice GDP		7.9	4.8	−4.0	0.8	0.6	1.1
Foreign exchange earning loss (BB)	(12)	11.8	8.8	16.5	11.2	−19.7	−5.5
Percentage of total export value		34.7	5.4	48.6	6.9	−58.0	−3.4
Percentage of rice export value		98.5	38.0	137.9	48.3	−164.5	−23.7

[a] Total export taxation rate (%).

Table 4
Simulation results on the welfare effects of rice export taxation in Thailand using the mean values of domestic supply and demand elasticities and sensitivity tests using alternative domestic supply and demand elasticities, small country case ($-\lambda = -\infty$)

	Simulation formulas	Simulation V ($-\lambda = -\infty$)		Simulation VI ($-\lambda = -\infty$)	
		Period 1 (V-1) ($\beta = 0.3$; $-\eta = -0.4$) 45[a]	Period 2 (V-2) ($\beta = 0.3$; $-\eta = -0.4$) 24[a]	Period 1 (VI-1) ($\beta = 0.5$; $-\eta = -0.6$) 45[a]	Period 2 (VI-2) ($\beta = 0.1$; $-\eta = -0.2$) 24[a]
Estimated changes due to export taxation					
Domestic price		−44.7	−24.3	−44.7	−24.3
Domestic production		−16.3	−8.0	−25.7	−2.7
Domestic consumption		26.8	11.8	42.8	5.7
Export		−60.9	−38.8	−71.5	−20.8
Welfare effects of export taxation					
Producer surplus loss (PSL)(billion baht- BB)	(6)	29.9	21.2	32.0	20.6
Percentage of rice GDP		99.2	42.6	106.1	41.4
Consumer surplus gain (BB)	(7)	18.4	14.1	17.3	14.6
Percentage of PSL		61.4	66.8	53.9	70.8
Percentage of rice and cereal expenditure		53.3	25.8	50.1	26.6
Government revenue (BB)	(8)	5.3	4.0	5.3	4.0
Percentage of total government revenue		17.3	3.0	17.3	3.0
Quota rent (BB)		0.9	1.3	0.9	1.3
Percentage of total government revenue		2.9	1.0	2.9	1.0
Net loss (BB)	(10) + (11)	5.3	1.8	8.5	0.7
Percentage of rice GDP		17.7	3.5	28.3	1.5
Foreign exchange earning loss (BB)	(12)	21.6	13.8	34.9	5.7
Percentage of total export value		63.9	8.4	102.9	3.5
Percentage of rice export value		181.2	59.1	291.9	24.5

[a] Total export taxation rate (%).

demand elasticities had been more elastic as assumed in Simulation IV-1 for Period 1, the producer surplus loss and the consumer surplus gain would have become smaller in absolute terms, but the terms-of-trade gain and the domestic efficiency loss would have been larger. The net welfare gain would have been larger if the export tax had been set close to the optimal rate because the rate of change of the terms-of-trade gain would have been larger than that of the domestic efficiency loss corresponding to the change in both the supply and demand elasticities. However, if the taxation rate had been set too high above the optimal level, it would have resulted in a net loss. The results would have been reversed if both the supply and demand elasticities as assumed in Simulation IV-2 for Period 2 were less elastic. The government could have appropriated higher revenue in Period 2 if it had maintained the high export taxation rate as used in period 1. In that case, however, the quota rent to the rice exporters would have been smaller in absolute value. If so, the major rice exporters entitled to hold export licenses should have welcomed the relaxation of the export quota.

The results of Simulation IV reinforce the findings from previous simulations in the previous section that structural changes in the Thai economy from Period 1 to Period 2 created the conditions that strengthened political pressure from rice farmers demanding for export tax reduction and weakened resistance from consumers, industrialists, and exporters against the farmers' demand. In all cases, however, economic efficiency as measured by net welfare gain to Thailand does not appear to be a major factor to explain the changes in the export taxation rate from the average of 45% in 1950–1970 to the virtual zero level after 1985.

In contrast, for the small country case, the sensitivity test results from Simulation VI in Table 4 show that the more elastic the domestic supply and demand are, the greater are the producer surplus loss, the consumer surplus gain, and the net welfare loss to the nation. Despite such a large net social welfare loss, small food-exporting countries such as Cambodia commonly tax their exports in the early stage of development. This observed tendency appears to be clear evidence in support of the hypothesis that policy decisions are mainly based on re-distributional goals rather than considerations on economic efficiency in terms of the social economic welfare of the nation.

7. Conclusions

In this paper, partial equilibrium welfare economic analysis combined with political-economy approach is applied to evaluate the 1950–1985 rice export taxation policies in Thailand. Simulations were conducted for the period 1950–1970 characterized by high taxation and the period 1971–1985 characterized by a transition from the high taxation to the zero taxation era. The results of the simulation analysis are consistent with the hypothesis that historically observed policies were the results of interactions between rational political leaders trying to maximize the probability of their staying in power and various interest groups seeking profits to their group. In this process, economic efficiency measurable by net social welfare to the nation does not appear to have entered the politicians' calculation as a major factor.

The results reveal that in the low-income stage, the Thai government taxed the rice sector much higher than optimum, but reduced the tax gradually to optimum during the course of development. More recently, however, the taxation rate has been reduced to less than optimum. Our findings suggest that, during the early stage of development when the Schultzian food problem was dominant, the Thai government redistributed substantial income from rice farmers to urban consumers, industrialists, exporters, and the government agencies in collusion since the political benefit of doing so to politicians was much greater than the political cost of taxing

farmers. Urban consumers were geographically concentrated and more easily organized themselves for political lobbying than rice farmers who were dispersed over wide remote areas. Moreover, autocratic leaders of the military junta before the early 1970s would have found little need for major electoral support from rural areas. On the other hand, in the early development stage, the rice sector was dominant in the national economy, from which rice export taxation enabled the government to extract large revenue at a relatively low administrative cost. Therefore, rice export taxation should have been politically efficient for Thai political leaders, though economically inefficient.

The results also reveal that in the more advanced stage of development, as a result of successful industrialization, rural-urban income disparity widened while the food problem lost its ground gradually. This structural change established the conditions to strengthen the farmers' political power in demanding for export tax reductions while it reduced the opposition from the coalition of urban consumers, industrialists, rice exporters and government agencies. These conditions were also reinforced by the change in political institution from bureaucratic-centered to interest-group politics. This tax reduction, however, did not affect the quota rent to rice trading elites in collusion with Commerce Ministry's officials, implying their decreasing resistance to tax reduction.

The tax reduction occurring in the 1970s to the early 1980s was associated with efficiency improvements from the over-taxation to the optimum taxation in terms of the social welfare criteria to the nation. However, as the political equilibrium moved toward favoring farmers more after the mid-1980s, the export taxation was further reduced to zero. This recent move should have been politically rational in terms of politicians' private welfare maximization, though not economically rational in terms of social economic welfare maximization.

As for policy implications for food exporting-developing countries, the results show that, provided that the government has the capacity to use the tax revenue efficiently for national development purposes, there is a good possibility for large food-exporters to promote economic development by taxing their exports at a relatively high rate during their low-income stage when the tax base outside agriculture is weak, because the loss in social economic welfare due to the taxation is small relative to the tax revenue generated during the low-income stage, as illustrated by our simulation for the case of Thailand. However, once this system is instituted, it is susceptible to manipulations by the rent-seeking activities of vested interest groups, resulting in the imposition and maintenance of taxation at a much higher rate than the social optimum and for a longer period than necessary, resulting in a major loss in social economic efficiency as well as undue sacrifice of farmers. This problem may be aggravated by the government's lack of capacity to utilize the tax revenue efficiently for the development of the national economy including the rural sector. Greater caution must be paid to the use of export taxation in small food exporting-developing countries because the taxation is sure to cause major losses in both efficiency and equity.

How efficiently did the Thai government use the rice export tax revenue in the past? Were the gains from national economic growth due to the use of the tax revenue larger or smaller than static efficiency losses due to market distortions by export taxation in the case of Thailand? This question cannot be answered by our partial equilibrium analysis. It requires a more comprehensive general equilibrium analysis, which is beyond the scope of this study. The possibility, however, may exist for food exporting-developing countries to use a part of the revenue from food export taxation for financing investments in programs to increase agricultural productivity, such as agricultural research, irrigation infrastructure and fertilizer subsidy, with the result of not only increasing social economic welfare for the nation as a whole but also improving

inter-sectoral equity. How large this possibility would be and how such agricultural development policies may be best combined with food export taxation shall be among the important policy research agenda in the future.

Acknowledgments

The authors gratefully acknowledge helpful comments and suggestions from Tetsushi Sonobe, Keijiro Otsuka and other FASID monthly seminar participants, and two anonymous reviewers. The remaining errors are the authors'.

Appendix A

Summary of estimates of elasticities of domestic supply and demand, and export demand for rice in Thailand

No.	Source	Short run	Long run	Period	Dependent variable
(a) Price elasticites of domestic supply					
1	Behrman (1968)	0.18	0.31	1940–1963	Planted area
2	Behrman (1968)	0.40	1.02	1947–1962	Market surplus
3	Arromdee (1968)	0.29	0.25	1951–1965	Planted area
4	Arromdee (1968)	0.48		1951–1965	Rice production
5	Konjing (1970)	0.45		1952–1966	Paddy production
6	Ramangkura (1972)	0.26		1953–1969	Production
7	Ramangkura (1972)	0.17		1953–1965	Planted area
8	Ganjarerndee (1975)	0.17	0.21	1960–1972	Paddy production
9	Chaipravat (1975)	0.07		1951–1971	Planted area
10	Ramangkura (1976)	0.10		1953–1969	Planted area
11	Prakongtanapan (1976)	0.17	0.71	1951–1973	Planted area
12	Prakongtanapan (1976)	0.20	0.31	1951–1964	Planted area
13	Prakongtanapan (1976)	0.10	0.13	1965–1973	Planted area
14	Wattanucthariya (1978)	0.21		1951–1971	Planted area
15	Wong (1978)	0.41	0.91	1951–1972	Rice production
16	Wattanucthariya (1978)	0.19		1951–1975	Paddy production
17	Wattanucthariya (1978)	0.26		1951–1975	Planted area and yield
18	Loonhawenchit (1977)	0.36		1955–1972	Planted area
19	Kanivichaporn (1979)	0.09	0.09	1952–1975	Planted area
20	Konjing (1979)	0.64	2.67	1956–1976	Rice production
21	Petcharatana (1980)	0.15		1961–1977	Planted area
22	Lokapadhana (1981)	0.18	0.65	1959–1979	Rice production
23	Pongsrihadulchai (1981)	0.10		1969–1977	Planted area
24	Suwanphitoon (1982)	0.13	0.99	1967–1980	Planted area
25	Setboonsarng and Evenson (1983)	0.02		1966–1979	Paddy production
26	Aschakul (1983) [a]	0.36	0.55	1967–1981	Planted area
27	Dowling and Krongkaew (1983)	0.13	0.14	1964–1975	Planted area
28	Trairavotvorakul (1984)	0.37	0.65	1957–1979	Paddy production
29	Trairavotvorakul (1984) [b]	0.29	0.57	1957–1979	Planted area
30	Orapin (1985)	0.41	0.64	1957–1982	Rice production
31	Aschakul (1985) [b]	0.14	0.64	1967–1982	Planted area
32	Puapanichya and Panayotou (1985) [c]	0.65		1980–1981	Rice production
33	Puapanichya and Panayotou (1985) [d]	0.50		1980–1982	Rice production
34	ABRS of Kasertsart (1997) [e]	0.06	0.10	1962–1993	Planted area
35	Isvilanonda (2002)	0.10	0.14	1971–1997	Planted area and yield
36	Vanichjakvong (2002)	0.26	0.68	1978–1998	Planted area

Appendix A (*Continued*)

No.	Source	Short run	Long run	Period	Dependent variable
		Average Planted area and aggregate production: 0.25 (short run); 0.59 (long run) Planted area: 0.18 (short run); 0.42 (long run) Aggregate production: 0.34 (short run); 0.86 (long run)			

No.	Source	Price (short run)	Price (long run)	Income (short run)	Income (long run)	Period	Data source
(b) Price and income elasticities of domestic demand							
37	Sriplung (1972)	−0.32		0.30		1967–1971	
38	Chaipravat (1975)	−0.48		0.37		1951–1973	
39	Wattanucthariya (1978)	−0.69				1951–1975	
40	Wattanucthariya (1978)	−0.93				1951–1975	
41	Wong (1978)	−0.43	−0.47	0.09	0.10	1951–1972	
42	Petcharatana (1980)	−0.12				1961–1967	
43	Lokapadhana (1981)	−0.12				1959–1979	
44	Trairavotvorakul (1984) [f]	−0.64		0.13		1975	SES[g]
45	Trairavotvorakul (1984) [h]	−0.43		0.29		1975	SES
46	Adulavidhaya, Kuroda, Lau, and Yotopoulos (1984)	−0.37				1972–1973	CS (CM)[i]
47	Puapanichya and Panayotou (1985)	−0.38		0.08		1967–1979	
48	Isvilanonda and Poapongsakorn (1995)	−0.61				1990	SES
49	Isvilanonda (2002)	−0.01				1971–1999	
50	Orapin (1985)	−0.13	−0.20	0.1	0.15	1957–1982	
51	Vanichjakvong (2002)	−0.64				1999	SES
		Average Rice demand with respect to price: −0.42 (short run)					

No.	Source	Short run[j]	Long run[k]	Long run[l]	Period
(c) Price elasticities of export demand					
52	Wong (1978)		−4.00		1951–1972
53	Meenaphant (1981)	−1.07			
54	Orapin (1985)	−4.06	−5.14		1957–1982
55	Tyers and Anderson (1988)	−4.50	−8.30	−17.30	1982–1983
56	Roumasset and Setboonsarng (1988)	−5.00 to −8.00			
57	Warr and Woller (1997)		−1.90		1976–1990

[a] Nine provinces.
[b] Wet season.
[c] Irrigated rice.
[d] Non-irrigated rice.
[e] Agricultural Business Research Section.
[f] Non-glutinous rice.
[g] Socio-Economic Survey.
[h] Glutinous.
[i] Cross section (Chieng Mai).
[j] Adjustment within the first year.
[k] Adjustment after 1 year.
[l] After full adjustment.

References

Adulavidhaya, K., Kuroda, Y., Lau, L. J., & Yotopoulos, P. A. (1984). The comparative statics of the behavior of agricultural households in Thailand. *Singapore Economic Review, 29*, 67–96.

Agricultural Business Research Section (ABRS). (1997). *Study of agricultural strategic project: The case of rice (in Thai)*. Bangkok: Department of Agricultural and Resource Economics, Kasetsart University.

Anderson, K., & Hayami, Y. (1986). *The political economy of agricultural protection: East Asia in international perspective*. Sydney: Allen and Unwin.

Arromdee, V. (1968). *Economics of rice trade among countries of Southeast Asia* (Ph.D. dissertation). University of Minnesota, St. Paul.

Aschakul, T. (1983). *Estimate of aggregate response model of five major annual crops in Thailand, 1967–1981* (Ph.D. dissertation). University of Colorado, Boulder.

Aschakul, J. (1985). *Estimates of area response, planted area and production of major annual crops in Thailand (Research Report in Thai)*. Bangkok: Chulalongkorn University.

Bank of Thailand, various issues. *Bank of Thailand Monthly Bulletin*. Bank of Thailand, Bangkok.

Bates, R. H. (1981). *Markets and states in tropical Africa: The political basis of agricultural policies*. Berkeley and Los Angeles: University of California Press.

Behrman, J. R. (1968). *Supply response in underdeveloped agriculture: A case study of four major annual crops in Thailand, 1937–1963*. Amsterdam: North-Holland.

Breton, A. (1974). *The economic theory of representative government*. Chicago: Aldine.

Buchanan, J. M., & Tullock, G. (1962). *The calculus of consent*. Ann Arbor: University of Michigan Press.

Chaipravat, O. (1975). Aggregate production structure of paddy cultivation in Thailand. In P. Sondysuvan (Ed.), *Finance, trade and economic development* (pp. 191–205). Bangkok: Sompong Press.

Christensen, S. R. (1993). *Coalition and collective choice: The politics of institutional change in Thai agriculture* (Ph.D. dissertation). University of Wisconsin, Madison.

Chuchart, C. (1957). *Rice marketing in Thailand* (Ph.D. dissertation). Louisiana State University, Baton Rouge.

Corden, W. M. (1974). *Trade policy and economic welfare*. Oxford: Clarendon Press.

De Gorter, H., & Swinnen, J. (2002). Political economy of agricultural policy. In B. Gardner, & G. Rausser (Eds.), *Handbook of agricultural economics*. Vol. 2B (pp.1893–1943). Amserdam and Tokyo: North-Holland and Elsevier Science.

Demont, M., & Tollens, E. (2002). *Impact of Agricultural Biotechnology in the European Union's Sugar Industry* (Working Paper No. 2002/61). Faculty of Agricultural and Applied Biological Sciences, Katholieke Universiteit Leuven, Leuven.

Dowling, J. M., & Krongkaew, M. (1983). *Agricultural supply response of some major crops in Thailand* (Research Report No. 41). Bangkok: Department of Economics, Thammasat University.

Downs, A. (1957). *An economic theory of democracy.* Harper and Row, New York Food and Agriculture Organization of the United Nations, 2004. FAOSTAT Database. Available online at: http://faostat.fao.org/.

Francois, J. F., & Hall, K. H. (1997). Partial equilibrium modeling. In J. F. Francois, & K. A. Reinert (Eds.), *Applied methods for trade policy analysis: A handbook* (pp. 122–155). New York: Cambridge University Press.

Ganjarerndee, S. (1975). *A model of Thailand's economy: An econometric approach* (Ph.D. Dissertation). Monash University, Victoria.

Gardiner, W. H., & Carter, C. A. (1988). Issues associated with elasticities in international agricultural trade. In C. A. Carter, & W. H. Gardiner (Eds.), *Elasticities in international agricultural trade* (pp. 1–16). Boulder and London: Westview Press.

Hayami, Y. (1979). Trade benefits to all: A design of the beef import liberalization in Japan. *American Journal of Agricultural Economics, 62*, 342–347.

Hayami, Y. (2001). Ecology, history, and development: A perspective from rural Southeast Asia. *World Bank Research Observer, 16*, 169–198.

Hayami, Y. (1988). *Japanese agriculture under siege*. New York: St Martin's Press.

Hayami, Y., & Godo, Y. (1997). Economics and politics of rice policy in Japan: A perspective on the Uruguay round. In T. Ito, & A. Krueger (Eds.), *Regionalism versus multilateral trade agreements* (pp. 714–771). Chicago: University of Chicago Press.

Hayami, Y., & Godo, Y. (2004). The three agricultural problems in the disequilibrium of world agriculture. *Asian Journal of Agriculture and Development, 1*, 3–16.

Hla Myint, U. (1965). *The economics of the developing countries*. New York: Praeger.

Ingram, J. C. (1955). *Economic change in Thailand since 1850*. California: Stanford University Press.

International Rice Research Institute. 2004. World Rice Statistics. Available online at: http://www.irri.org/science/ricestat/index.asp.

Isvilanonda, S. (2002). Rice supply and demand in Thailand: Recent trends and future outlook. In M. Hossain, & H. Hardy (Eds.), *Development in the Asian rice economy (Proceedings of the International Workshop on Medium and Long Term Prospects of Rice Supply and Demand in the 21st Century, 3–5 December 2001)* (pp. 211–236). Los Banos (Philippines): International Rice Research Institute.

Isvilanonda, S., & Poapongsakorn, N. (1995). *Rice supply and demand in Thailand: The future outlook*. Bangkok: Thailand Development Research Institute.

Ito, S., Wesley, E., Peterson, F., & Grant, W. R. (1989). Rice in Asia: Is it becoming an inferior good? *American Journal of Agricultural Economics, 71*, 33–42.

Kanivichaporn, P. (1979). *An econometric studies of the Asian rice economies (1956–1975)* (Ph.D. dissertation). University of Pennsylvania, Philadelphia.

Karp, L. S., & Perloff, J. M. (2002). A synthesis of agricultural trade economics. In B. Gardner, & G. Rausser (Eds.), *Handbook of agricultural economics*. Vol. 2B (pp.1945–1998). Amserdam and Tokyo: North-Holland and Elsevier Science.

Konjing, C. (1970). *Demand and supply of rice in Thailand (Staff Paper No. 3)*. Department of Agricultural Economics, Faculty of Economics and Business Administration, Kasetsart University, Bangkok.

Konjing, K. (1979). *An economic analysis of reserve stock program for rice in Thailand (Mimeo)*. Faculty of Economics, Thammasat University, Bangkok.

Krueger, A. O., Schiff, M., & Valdes, A. (1992). *The political economy of agricultural pricing policy: A synthesis of the political economy in developing countries* (Vol. 5). Baltimore and London: Johns Hopkins University Press.

Lokapadhana, T. (1981). *The impact of trade policy on six agricultural exports of Thailand* (Ph.D. dissertation). University of Minnesota, St. Paul.

Loonhawenchit, C. (1977). *A dynamic multi-crop model for Thai agriculture with special reference to the rice premium and agricultural diversification* (Ph.D. dissertation). Princeton University, New Jersey.

Meenaphant, S. (1981). *An economic analysis of Thailand's rice trade* (Ph.D. dissertation). Rice University, Houston.

Mitchell, B. R. (1998). *International historical statistics: Africa, Asia & Oceania, 1750–1993*. London: Macmillan Reference LTD.

Muscat, R. J. (1994). *The fifth tiger: A study of Thai development policy*. Helsinki: United Nations University Press.

Orapin, S. (1985). *An econometric analysis of rice export tax policy in Thailand (Mimeo)*. Bangkok: Department of Agricultural Economics, Kasetsart University.

Otsuka, K., & Hayami, Y. (1985). Goals and consequences of rice policy in Japan, 1965–1980. *American Journal of Agricultural Economics, 67*, 529–538.

Petcharatana, T. (1980). *Supply, demand, and price analysis for rice in Thailand* (Ph.D. dissertation). Washington State University, Pullman.

Phongpaichit, P., & Baker, C. (2002). *Thailand: Economy and politics*. New York: Oxford University Press.

Pinstrup-Andersen, P. (1988). The social and economic effects of consumer-oriented food subsidies: A summary of current evidence. In P. Pinstrup-Andersen (Ed.), *Food subsidies in developing countries: Cost, benefits, and policy options* (pp. 3–18). Baltimore and London: Johns Hopkins University Press.

Pongsrihadulchai, A. (1981). *Supply analysis of important crops in Thailand* (Ph.D. dissertation). Iowa State University, Ames.

Pookkachatikul, J., & Welsch, D. E. (1976). *Thai Rice Premium Data, 1954–1976 (Staff Paper No. 12)*. Department of Agricultural Economics, Kasetsart University, Bangkok.

Prakongtanapan, S. (1976). *Change in the supply response of aggregate rice output in Thailand* (Masters thesis). University of the Philippines, Manila.

Puapanichya, K., & Panayotou, T. (1985). Output supply and input demand in rice and upland crop production: The quest for higher yields in Thailand. In T. Panayotou (Ed.), *Food policy analysis in Thailand* (pp. 23–153). Bangkok: Allied Printers.

Ramangkura, V. (1972). *A policy simulation model for the development of the economy of Thailand* (Ph.D. dissertation). Iowa State University, Ames.

Ramangkura, V. (1976). *The Chulalongkorn econometric model. Economic Research Unit*. Bangkok: Faculty of Economics, Chulalongkorn University.

Roumasset, J., & Setboonsarng, S. (1988). Second-best agricultural policy: Getting the price of Thai rice right. *Journal of Development Economics, 28*, 323–340.

Sadoulet, E., & de Janvry, A. (1995). *Quantitative development policy analysis*. Baltimore and London: Johns Hopkins University Press.

Schultz, T. W. (1953). *The economic organization of agriculture*. New York: McGraw-Hill.

Schultz, T. W. (1978). *Distortions of agricultural incentives*. Bloomington: Indiana University Press.

Setboonsarng, S., & Evenson, R. E. (1983). *Research extemsion, literacy and productivity growth in agricultural sector in Thailand (Mimeo)*. Bangkok: Thailand Development Research Institute.

Siamwalla, A. (1987). *The farmers' aid fund act of 1974: Its genesis and aftermath*. Bangkok: Thai Development Research Institute.

Siamwalla, A., & Setboonsarng, S. (1989). *Trade, exchange rate, and agricultural pricing policies in Thailand*. Washington, DC: World Bank.

Sriplung, S. (1972). *The demand of rice for domestic consumption* (Research Bulletin No. 44). Bangkok: Office of Agricultural Economics, Ministry of Agriculture and Cooperatives.

Suwanphitoon, W. (1982). *Supply response of rice in Thailand* (Masters Thesis in Thai). Chulalongkorn University, Bangkok.

Thailand Customs Department. (Various issues). *Foreign trade statistics of Thailand*. Customs Department of Thailand, Bangkok.

Thailand Office of the National Economic and Social Development Board. (1999). *National income of Thailand, 1951–1996*. Bangkok: Office of the Prime Minister.

Thailand Office of Agricultural Economics. (Various issues). *Agricultural Statistics of Thailand*. Ministry of Agriculture and Co-operatives, Bangkok.

Timmer, P. C. (2002). Agriculture and economic development. In B. Gardner, & G. Rausser (Eds.), *Handbook of agricultural economics*. Vol.2 B (pp.1487–1546). Amserdam, London, New York; Paris, Shannon and Tokyo: Elsevier, Oxford.

Tsakok, I. (1990). *Agricultural price policy: A practitioner's guide to partial-equilibrium analysis*. Ithaca and London: Cornell University Press.

Trairavotvorakul, P. (1984). *The effects on income distribution and nutrition of alternative rice price policies in Thailand (Research Report No. 46)*. Washington, D.C. International Food Policy Research Institute.

Tyers, R., & Anderson, K. (1988). Imperfect price transmission and implied trade elasticities in a multi-commodity world. In C. A. Carter, & W. H. Gardiner (Eds.), *Elasticities in international agricultural trade* (pp. 255–295). Boulder and London: Westview Press.

Usher, D. (1978). *The Economics of Rice Premium* (Discussion Paper Series No. 60). Faculty of Economics, Thammasat University, Bangkok.

Vanichjakvong, P., 2002. *The rice economy of Thailand: Supply, demand and price* (Ph.D. dissertation). University of Illinois, Urbana.

Warr, P. G., & Woller, F. J., 1997. *The International Demand for Thailand's Rice Export (Mimeo)*. Australian National University, Canberra.

Wattanucthariya, S. (1978). *Demand and supply analysis of rice production in Thailand* (with the reference to government policies on prices) (Ph.D. dissertation). College Station: Texas A&M University.

Welsch, D. E., & Tongpan, S., 1972. *Background to the introduction of high yielding varieties of rice in Thailand* (Staff Paper Series P72-6). Institute of Agriculture, University of Minnesota, St. Paul.

Wong, C. M. (1978). A model for evaluating the effects of Thai government taxation of rice exports on trade and welfare. *American Journal of Agricultural Economics, 60*, 65–73.

World Bank. (1993). *The east Asian miracle*. New York: Oxford University Press.