Economic Analysis of Eco-Labeling: The Case of Labeled Organic Rice in Thailand

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1 Background

Eco-labeling, like the other types of environmental labeling (i.e. mandatory and self-declarations), is the practice of supplying information on the environmental characteristics of a commodity to the general public (Markandya 1997). As a market-based approach to reduce environmental impacts of production, eco-labeling is applied with the assumption that the purchasing behavior of consumers is not just motivated by price, quality, and health standard, but also by environmental or ecological objectives (Deere 1999). Eco-labeling achieves its environmental purpose by influencing change in the purchasing behavior of the consumers in a way that creates incentives for the production of less environmentally harmful products.

Eco-labeling in the agricultural sector, specifically certified organic products, is still gaining ground. The economic and environmental justifycation for eco-labeling can be considered strong enough to promote its adoption in the developing countries. However, there are issues that remain to be resolved. These include the income risks due to uncertainties in productivity, price premium, and the market[1]; the lack of technology or know-how and support services; and the low awareness of this option among producers. These issues may be highly related to how the government is supporting the eco-labeling activities in the country. In the case of the EU, most governments have supported organic farming and eco-labeling via research and development, education, training and extension, market development, and certification, not to mention the financial support for conversion and continued organic production (Padel and Lampkin 1994).

The lack of clear policies in developing countries about organic farming and eco-labeling can be accounted to inadequate information of governments on how eco-labeling fares environmentally, socially, and economically. This study, therefore, aims to contribute to the available body of in-

[1] This refers to the stability in supply and demand for these products.

formation on the costs and benefits of eco-labeling or certified organic farming which are deemed useful for more informed policy- and decision-making by governments. This study particularly focused at how production and marketing of eco-labeled products affect the economic standing of the producers. In this regard, the study undertakes to: (i) estimate the costs and benefits of producing labeled organic rice in Thailand relative to its conventional counterpart, (ii) assess the implication of eco-labeling on the profits received and their distribution along the marketing chain, (iii) assess the factors accounting for the difference in marketing margins of eco-labeled and conventional products, and (iv) examine the determinants affecting farmers' decision to adopt eco-labeling.

2 Methods

2.1 Data Sources and Requirements

Since the study aims to learn from the experiences of a developing country, Thailand was selected as one of the study sites. Thailand has pioneering efforts in implementing eco-labeling programs and already established local standards and certification system for organic products. The choice of commodity was based on two considerations: (i) the extent with which eco-labeling has been applied in the commodity's market, and (ii) its importance in the export market. While both considerations were strategic as they ensured availability and easier data collection, the latter has also been a relevant research concern since most - if not all - labeled organic products of the developing countries are being exported.

Both primary and secondary data were used in the analyses. The data collection, particularly on labeled organic rice, entailed field interviews and correspondence through various media (e.g. telephone, e-mails, and letters). The latter collection method was necessary because data on eco-labeled products are not yet systematically collected and published in local and international statistical books. Primary data were collected through a survey of sample farm households and interviews with exporting firms. Structured questionnaires for each type of respondents, i.e. farmers and exporters, were used to elicit the necessary information. Secondary data, i.e. prices, labor wages, etc., were collected from local ministries/agencies and other concerned international agencies, like the ITC/WTO/UNCTAD, FAO, IFOAM, USDA-FAS, and Fair Trade Labeling Organization in Europe, as well as from several special studies on eco-labeling.

The survey was conducted in areas where both labeled organic and conventional rice are mainly grown and produced in Thailand, Surin and

Yasothorn provinces in the northeast region, and Chiang Rai province in the northern region. The two regions accounted for almost 73% of the harvested rice area. The three provinces together accounted for 10% of the rice areas in the two regions, but most of eco-labeled rice for export comes from these provinces. Almost 70% of the estimated total organic rice areas can be accounted to these provinces (Panyakul 2002). The survey was undertaken in 12 villages covered by five districts with high concentration of farmers producing certified and labeled organic rice.

The survey was conducted from February to May 2003 after a pretest was performed to identify the questions in the questionnaire where respondents may encounter problems in answering. Sampling was strati-fied for both the organic and conventional farms according to farm size. Organic farmers were further stratified based on the number of years into organic farming and about 50% of those with at least five years of experience were randomly picked and interviewed. Some replacements had also been resorted to in view of some constraints. Overall, 123 farm households were interviewed in Thailand.

2.2 Analytical Methods

The following analytical methods were applied respectively to address the main objectives of the study: (i) cost-benefit analysis for the assessment of economic and environmental gains from eco-labeling, (ii) commodity chain analysis for assessment of profit distribution, (iii) ordinary least square estimation of marketing margins, and (iv) LOGIT analysis for the determinants of adopting the required organic production approach in eco-labeling.[2]

Assessment of Costs and Benefits

The cost-benefit analysis included an estimation of the financial performance under certified organic commodity production as well as an assessment of its environmental and health implications. For *financial profitability analysis*, this study estimated the net returns for farmer-producers of eco-labeled products, and compares them with those of conventional farmer-producers. In doing so, costs and returns were first evaluated. In general, the difference in revenues per unit of eco-labeled and conventional commodities will depend on the magnitude of the price premium, if

[2] Methods of analyses were condensed to fit publication. See Carambas (2005) for detailed explanation and justification.

any. On the other hand, the costs involved in producing eco-labeled products relate to capital costs due to adjustment to new technologies, additional costs of production and processing, increase in labor requirements, additional costs for raw materials, and costs of testing, monitoring, and certification (Grote and Kirchhoff 2001; van Ravenswaay and Blend 1997). These types of costs were estimated through straightforward accounting.

Relative to *environmental concerns*, the long-term costs and benefits of certified organic production were estimated after accounting for the impact of organic production system on soil fertility. The change in soil quality or soil fertility improvement in organic farms was assessed and valued through productivity-change approach. This approach is frequently used in environmental economics to estimate the indirect use value of ecological functions of a natural resource based on its contribution to market activities (Dreschel and Gyiele 1999). In this study, the natural resource is the soil, and its indirect use value is measured by crop productivity or yield. Productivity change is attributed to the farming system used in the production. This means that all the components[3] of the farming system are considered, in general, to affect soil quality. The intertemporal value of the soil can then be determined through the income stream it generates (Grohs 1994). Since commodity outputs are valued at market prices, the value of soil is likewise expressed in terms of market prices.

Considering this analytical framework, the valuation of the environmental benefit (i.e. soil quality/fertility) involves the assessment of the stream of revenues associated with the trend in productivity in a particular production system vis-à-vis the costs of obtaining such a productivity trend. The computation of costs is straightforward and is ba-sed on the previous computation of production cost. Overall, the assess-ment of productivity change in this study involved estimation of yield response model(s) for the conventional and organic production systems, and assessment of net benefits using the internal rate of return (IRR), benefit-cost ratio (BCR) and net-present-value (NPV) measures.

The estimation of a yield response function assesses the influence or significance of production system variables (e.g. inputs, labor, etc.) on the variations in the productivity of farms producing eco-labeled and conventional commodities. The yield response model is a simplistic model for predicting productivity given other alternatives (e.g. bio-dynamic mo-dels)

[3] As Lampkin and Padel (1994) noted, organic farming involves restructuring of the whole farming system. It involves modification of agricultural practices like the use of inputs as well as changes in management and labor to replace inputs that are withdrawn after the shift to organic farming.

that have higher predicting capability. The general form of the quadratic function was used to estimate the yield response as follows:

$$Y_t = \alpha_t + \beta_1 x_t + \beta_2 x_t^2 + \beta_3 Z_{it} + \varepsilon \quad (1)$$

where Y_t represents the yield; x_t, the rate of fertilizer application; Z_{it}, the vector of other variables such as labor and interaction variables (eg. time***x***-production system) which were included in the estimation of combined yield data from farms producing eco-labeled and conventional products; α and β_i, the parameters; and ε_i, the unexplained term. Most models include biophysical factors and soil properties as explanatory variables for the yield response function. In this study, climate and soil-type factors were controlled by utilizing data from the study areas where these factors are, by and large, homogeneous. The difference in soil quality was taken to be a condition resulting from the difference in farming techniques employed in conventional and organic production systems.[4] These also include the fertilizers and labor used which are distinctly different, either in type or in quantity, in the two farming systems. Never-theless, this study recognized that there may be other possible factors/ farming techniques that cannot be considered in or integrated into the model but which may account for significant difference in soil quality in the two production systems, e.g. use of cover crops. In this regard, a dummy variable for production system is included in the model to capture the impact of these farming techniques.

The combined yield response model for conventional and organic production systems that was estimated is as follows:

$$Y = a + b_1FER + b_2FER^2 + b_3LAB + b_4LAB^2 + b_5PS + b_6T + b_7FERxT + b_8PSxT + \mu \quad (2)$$

where Y, FER, LAB, PS, T, FER***x***T, and PS***x***T are yield, fertilizer, labor, production system (binary variable: organic = 1; conventional = 0), time trend index (based on the year of collected data: e.g. 1998=1, 1999=2, 2002=5), interaction of time and fertilizer, and of time and production system. Y is measured by a pooled time series and cross section data.

A quadratic yield response function such as Equation (2) has been widely used for yield response models. The specification of the quadratic function was based on economic theory and agronomic considerations (Larson et al. 2001) where yield-enhancing inputs were allowed to exhibit

[4] It should be emphasized that this assumption was adopted in this study since data measuring annual changes in soil quality attributes were not available. These data would have been also useful in identifying which of the specific soil properties could account for the differences and variations in yield.

diminishing marginal productivity. Inasmuch as the impact of most farming techniques[5] on soil quality are realized in the long-term, the time trend index variable, T, was included to capture the expected long-term yield benefits from the two production systems. Including time trend index in a production function is a standard method for modeling technical change that refers to any kind of shift in the production function. This also reflects the fact that changes in soil or yield may be observable only in the long-term (FAO 1998). Linear interaction terms are used to evaluate potential complementary and competitive technical relationships among relevant variables (Debertin 1986). The interaction terms included in E-quation (2), FER***x***T and FS***x***T, have the same intent of determining the long-term impacts of fertilizer and the production system, in general, in terms of yield change. Given the estimated long-term yield from conven-tional and organic farms, the environmental impact of eco-labeling was evaluated by assessing the net market value of the change in yield during a time period.

As for *the health impact*, willingness-to-pay (WTP) is used to measure the economic value of the good or service, i.e. improving health. In this study, information on value, if any, placed by the respondents on the change in environmental amenity that subsequently affect their health, were obtained by directly asking the respondents on how much they value the change, if any. To verify the results, data on the cost of illness, if any, and the cost of averting activities were also asked. A contingent valuation was undertaken in view of the difficulty of getting reliable data on costs of illness and averting activities and information on the causality between the illness and exposure to chemicals and pesticides which are the sources of change in the environmental amenity. The study's reliance on self-reported incidence of disease posed two problems. First, there may be subtle but serious long-term adverse effects to pesticide applicators that they may not be aware of. There might also be health effects to the respondent's families which might affect his utility. These might not be fully captured by the responses. Thus, their self reports could lead to serious underestimations of the health consequences. On the other hand, they could also report illnesses that have nothing to do with the pesticides. This may then lead to a serious overestimation of health effects. In such cases, there would be no assurances that these offsetting influences would cancel out. In addition, there were farmers who, having had no experience of sickness, have expressed willingness to pay for the general reason of having a 'healthier life'.

In view thereof, the contingent valuation undertaken in this study asked the following: (i) concerning the conventional producers, the farmers were

[5] Examples are the use of rotation, integrated and/or cover cropping.

asked the minimum and maximum amounts they were willing to pay in terms of a change in productivity in order to attain a healthier farming life by shifting to an eco-friendly production system; and (ii) in the case of the producers of eco-labeled products, they were asked the minimum and maximum amounts they were willing to pay in terms of a reduction in price premium in order to continue a healthier farming life. As Freeman III (2003) noted, willingness to pay can be measured in terms of any other good that mattered to the individual. In this study, these were two `goods´ that were considered relevant: price premium for the organic producers, and yield for the conventional producers. These factors, i.e. the presence of a price premium and the possibility of a yield reduction, summarize the major issues related to organic farming. Instead of money which is the usual form of payment asked in contingent valuation, these goods are considered realistic form of payments from the farmers. They can also be compared in monetary terms as crop yields have market values.

Distribution of Profits

A straightforward assessment of the financial position (in terms of profits received) of the agents or key players in the marketing chain, i.e. from production through processing to export, as market conditions change, was also undertaken. As this study focuses on the production side of the market, the measure of benefits is in terms of profit or the firms' objective function. In addition, as eco-labeling results in product differentiation or a specialized market in the case of labeled organic products,[6] the analysis of profit distribution along the marketing chain would entail several econometric estimations of profit functions for conventional and eco-labeled markets at each level of the marketing chain. This analytical ap-proach is constrained by limitation of time series data on costs and profits at the processing and export market level. At the time of interview, there were only 2 major exporting firms of labeled organic rice. Two conven-tional rice exporters were also interviewed with regard to this study. The assessment of profit distribution in this study, therefore, is a static comparison of profits in the markets for the differentiated products. In particular, the changes in the prices received and the costs incurred from production to

[6] Eco-labeling, like other forms of labeling, signifies quality and is a basis for product differentiation (Caswell and Mojduska 1996; Roe and Sheldon 2000; Antle 2001). This implies that a primary result of eco-labeling is to create differentiated markets for labeled and conventional counterpart of a particular commodity. In fact, in the case of labeled organic products, the market is considered a niche (Lohr 2001) or a specialized market.

the exportation of eco-labeled and conventional products are computed at one common time period, and compared at each level of the marketing chain.[7] Since the marketing chain for labeled organic products that are produced in developing countries commonly ends in the export market, the changes in profits and profit distribution were demonstrated at the production and export market levels of labeled organic rice. Assess-ment of profits at the processing level was not possible because for labeled organic rice, this activity is, in most cases, undertaken by the exporters.

The assessment of the distribution of profits considered the general profit function which is defined as follows:

$$\prod (p, w) = \max_x p \bullet f(x) - wx \qquad (3)$$

where $\prod$ = profit, p = price of the product, **w** = vector of prices corresponding to input vector, f(x) = production function .

In the context of this study, four profit functions are relevant in the profit distribution assessment. These are Π^{FN}, Π^{XN}, Π^{FE}, and Π^{XE}, where Π^{FN} = profit function for the producers of conventional rice, Π^{XN} = profit function for the exporters of conventional rice, Π^{FE} = profit function for the producers of eco-labeled rice, and Π^{XE} = profit function for the exporters of eco-labeled rice. Each of these profit functions faces a different set of output prices and vector of inputs. A total profit identity, Π^{TN} (for conventional rice) and Π^{TE} (for eco-labeled rice), can be derived as:

$$\Pi^{TN} = \Pi^{FN} + \Pi^{XN} \qquad (4)$$

$$\Pi^{TE} = \Pi^{FE} + \Pi^{XE} \qquad (5)$$

[7] This approach is akin to the framework of commodity chain analysis which looks at the financial and economic position of different agents along the length of a production chain. This framework, however, specifically provides a methodological means for analyzing the political economy of global production and trade by Gereffi (1994 and 1999). Although two of the most important dimensions of the analysis are the governance structure and the institutional framework along the chain, the key aspect of the analysis is the location of profits within a chain (Raikes et al. 2000). In this respect, this study's approach can also be seen as an adaptation of the application of commodity chain analysis.

The distribution of total profits between producers and exporters, respectively, can be derived as:

$$\Pi^{FN} / \Pi^{TN} \text{ and } \Pi^{XN} / \Pi^{TN} \textit{ Conventional Rice} \quad (6)$$

$$\Pi^{FE} / \Pi^{TE} \text{ and } \Pi^{XE} / \Pi^{TE} \textit{ Eco-labeled Rice} \quad (7)$$

Finally, the difference between Equations (6) and (7) provides an assessment of the variation in profit distribution between the two markets.

Determinants of Marketing Margins

An econometric analysis of marketing margins was undertaken to compare conventional and eco-labeled markets in terms of the magnitude and significance of the impacts of demand, supply, and marketing cost in explaining marketing margins. While marketing margins provide neither a measure of farmers' well-being nor of marketing firms' performance, they give an indication of the performance of a particular industry (Tomek and Robinson 1990), or an indication of the market's structure and efficiency.

As Wohlgenant (2001) showed, a marketing margin model could be derived from an analysis of a market equilibrium. Based on a structural model that summarizes the relationships of relevant endogenous and exogenous variables through the specification of supply and demand at the farm and retail market levels, marketing margins can be determined for specific values of exogenous and endogenous variables. With marketing margin equation in the form,

$$M = P_r - P_f\,(Q_f/Q_r)^{8} \quad (8)$$

and given the demand and supply functions for the farm, retail and marketing input markets, Wohlgenant (2001) showed that partially-reduced form equations yield the following relationships for an econometric estimation of the retail-to-farm price linkage:

$$P_r = P_r\,(Z, W, T, Q_f) \quad (9)$$

$$P_f = P_f\,(Z, W, T, Q_f) \quad (10)$$

$$M = M\,(Z, W, T, Q_f) \quad (11)$$

[8] It should be noted that the marketing margin is intended to measure the per-product unit costs of assembling, processing, and distributing foods from the farm. Allowing the input-output ratio (Q_f/Q_r) to change represents an efficient utilization of marketing inputs (Reed and Clark, 1998).

where P_r = retail price, P_f = farm price, M = marketing margin, equal to $P_r - P_f$, Q_f = quantity of the farm input, Q_r = quantity of the retail product, Z = retail demand shifters, W = marketing input prices, and T = other exogenous marketing sector shifters (such as time lag in supply and demand, risk, technological change, quality and seasonality, etc.).

As noted by Wohlgenant and Mullen (1987), since shifts in both demand and supply can cause the output and the retail price to change, a complete analysis of price spread or marketing margin is only possible through an analysis of the complete set of market-behavior equations. However, on the basis of data constraints, a number of analyses on marketing margins used reduced-form models. In Wohlgenant's (2001) empirical model, for instance, Equation (11) was used to estimate mar-keting margins.

In addition to this model, there are four other marketing margin models, based on Wohlgenant (2001) and Lyon and Thompson (1993) which can be used alternatively as reduced-form models. These are:

$$M = f(P_r, W, T) \quad \textit{Mark-up Model} \qquad (12)$$

$$M = f(P_r, P_r Q_f, W, T) \quad \textit{Relative Price Spread Model} \qquad (13)$$

$$M = f(Q_f, W, T) \quad \textit{Marketing Cost Model} \qquad (14)$$

$$M = f(P_f, E_t[P_{f\,t+1}], W, T) \quad \textit{Rational Expectations Model} \qquad (15)$$

where $E_t[P_{f\,t+1}]$ = expected value of farm price at time t+1.

While the choice of the model(s) had to depend on the significance of the estimation results, the econometric estimations made in this study did not include the mark-up, the marketing cost, and the relative expectations models. This decision was based on theoretical grounds. Lyon and Thompson (1993) had shown that the reduced-form models, particularly Equations (12) to (15), have varying importance in explaining marketing margins depending on spatial and temporal aggregation of data. However, the justification for the specification of the mark-up model is primarily empirical (Wohlgenant and Heidacher 1989). The other models have strong theoretical bases and, thus, render themselves potential alternative marketing margin models. As for the rational expectations model, its assumption on the influence of cost of inventories in price determination is considered irrelevant in the case of eco-labeled commodities given currently low production of these products. In addition, the proposal that the current and past values of farm price affect retail price is also not relevant for the eco-labeled products since prices, both at the farm and consumer levels, are still bilaterally negotiated. Also, rational expectations model is specified for the short term but the data used in this study were on annual basis.

The choice for the reduced-form model derived from the structural model (Equation (11)) and the relative price spread model (Equation (13)) is consistent with the conceptual framework put forth by Gardner (1975). Gardner's framework emphasized the relevance of marketing costs, farm supply, and consumer demand in the determination of price spread. These factors are all represented in the two models. In Equation (11), Z represents the consumer demand factor. In the relative price spread model, the quantity of output and the retail price are the avenues through which the shifts in retail demand and supply are manifested (Wohlgenant and Mullen 1987). The marketing cost model shown is an alternative way of obtaining the relative price spread model will not be estimated, too. As this model is expected to be generally significant given specific data on various marketing inputs and costs, this is unlikely to be the case for eco-labeled markets where official data and statistics are still lacking. In general, the relative price spread model is expected to perform well considering the results of previous studies of Wohlgenant and Mullen (1987), Marsh (1991), Lyon and Thompson (1993), and Richards et al. (1996).

However, it should be pointed out at this point that there might be econometric constraints in estimating this model due to the appearance of an endogenous variable like retail price on the right-hand side of the equation. This issue has rarely been questioned in the literature. In this study, attempts were undertaken to address the issue but nevertheless raises some caveats in the interpretation of the results. There are two ideas to partly address this issue: one is a conceptual clarification and the other is an estimation technique. With respect to the latter, it should be noted that the dependent variable, marketing margin, is not just a difference between retail and farm prices. It also includes the conversion factor in adjusting the quantities. The use of instrumental variable and a two-stage least squares estimation technique may directly but still partly address this issue. In particular, retail price is included in the margin equation as an instrument, i.e. estimating it first using its reduced form in Equation (9). Sargan test was employed to determine whether the instrumental variable used is valid (Gujarati 2003). Based on the results, the econometric estimation of the relative price model may not be reliable in view of the implicit correlation between the dependent variable and one of the independent variables, export price. Though the latter was used as an instrumental variable, results of the Sargan test employed to verify the validity of the instrument cast a doubt that the instrument used is uncorrelated with the error term. In this regard, the general reduced-form model was used in this study to explain the variations in the marketing margins in both eco-labeled and conventional rice markets.

In this study, the analysis of marketing margins which typically refers to the retail-farm price spread, was extended to the export-farm price spread.[9] This seems more appropriate because developing countries are primarily producing labeled organic products for exports. The existing literature has analyzed determinants of marketing margins using structural specifications that involve farm and retail markets. The model specifications used in this study are based on the same structural specifications and derived reduced-form equations. Considering the Law of One Price, or the tendency of prices to equalize across freely trading nations (Houck 1986), the use of the parallel specifications can be justified as the law's assumption of free transfer costs. The fixed exchange ratio of 1:1 implies that when these assumptions are relaxed, the difference in the world price and the domestic price can be explained by exchange rates, transportation costs, and other relevant marketing costs.

Analysis of the Determinants of Farmers' Decision

Finally, the last empirical analysis involved the use of LOGIT regression, i.e. an econometric analysis involving a dependent variable that signals a probability condition for adopting organic farming. As Gyawali et al. (2003) noted, economic theory provides limited guidance in the selection of variables to explain the participation behavior of farmers. However, the findings of previous studies provided relevant inferences on the factors to be considered in this study. In this regard, the specific hypotheses with respect to the direction of the effects of each factor are based on the general findings of previous researches on similar topics.

It is hypothesized in this Chapter that the farmers' decision to adopt or not to adopt organic farming is influenced by a wide range of factors that can be categorized as: (i) socio-economic characteristics of the farmers, (ii) characteristics of the farm, (iii) factors relating to farmers' support/ assistance, (iv) farmers' perceptions on the impacts of adopting the farming approach required for eco-labeling, and (v) other economic factors.

The *socio-economic characteristics* included in this analysis are sex, age, civil status, education, farming experience, major source of income, and the level of income. During the survey in Thailand, a number of farmers mentioned the importance of their own children's health in their deci-

[9] Ahmed and Rustagi (1987) also considered in their analyses of marketing margins the export prices for foreign consumers as the other end of the market levels analyzed.

sion, at least, in converting to organic farming. In view thereof, the number of children and the number of family members working in the farm were also included in the model.

Among the *farm characteristics* considered relevant in the analysis are farm size, number of plots, and ownership status. *Farmers' support/ assistance* (informational and technical) has also been cited in the literature as significant factors to persuade farmers to adopt a certain technology or production approach. Farmers' awareness, availability of information, and farmer organization's /association's role in promoting the adoption are included in this category.

As Burton et al. (1998) noted, farmers' opinions and attitudes account for the probability to adopt a new production approach. In this study, the *perception of the farmers* concerning the impact of certified organic farming on health, environment, yield, cost, and income are expected to be relevant indicators of the farmers' decision to adopt. Lastly, the *other factors* relate to the revenue/income effect of adopting eco-labeling and to the actual experience of the negative health effects of the conventional production system. For the purpose of this study, only the experience of sickness was included under this category because the farmers' decision to adopt or not is likely to be based on their perception on revenue/income effect of organic farming. As income effect is actually felt only after adoption, actual revenues would influence the farmers' decision to continue organic farming or not.

3 Results

The following are the major findings of the study:

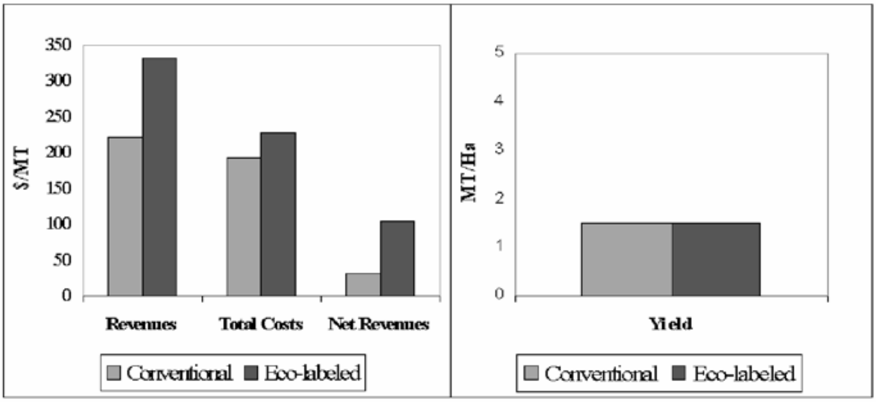
3.1 Assessment of Costs and Benefits

On Production Costs and Returns

Based on the average mean of the survey data, rice farms producing and marketing labeled organic rice performs at par with the conventional counterpart (Figure 1). Despite increased cost due to higher input, labor and certification costs, net revenues per metric ton (MT) unit of organic rice are higher than the conventional rice because of price premium.[10] On the

[10] Price premium is expressed as percentages by which the prices of labeled organic products are above the prices of similar conventional products.

average, price premium for labeled organic is 100% for farmers selling to the major NGO exporter and 4% for those selling to private companies.



Source: Own computations/illustrations based on survey data.

Fig. 1. Yield and revenue comparisons for labeled and conventional rice in Thailand (in milled paddy rice), 2002

On Productivity Assessment

The yield response function[11] was estimated (Table 1) using a panel data of farmers' yield during the last five years, and was applied in obtaining a deterministic prediction of organic and conventional rice yield growth in the long term.[12] Using the yield forecasts and assumptions[13] on other relevant variables, the long-term benefits obtained due to productivity change in the two production systems were computed and assessed using benefit-cost ratio (BCR) and net present values (NPV).

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[11] The relevant final model is a Cobb-Douglas function rather than a quadratic function which had low coefficient of determination (R-squared).

[12] The prediction holds labor and fertilizer inputs constant, and relies on the technical change and long-term impact of the production system.

[13] Starting yields and farm prices for conventional and organic rice are based on 2002 official national data and the exporting companies, respectively. Input costs are based on the inflation rate and average growth in wage during the last 10 years. Exchange rate used is fixed at the 2002 level, while the discount rate used is 15%.

Table 1. Estimated rice yield response functions for conventional and organic production systems (double log functional form)

Variable	Pooled	Organic	Conventional
1. Constant		5.11	4.06
		(25.83)***	(11.27)***
2. Production System			
a) Conventional	4.05		
	(11.47)***		
b) Organic	4.91		
	(2.53)***		
3. Fertilizer			
a) Conventional	0.35		0.33
	(3.61)***		(3.49)***
b) Organic	0.05	0.05	
	(1.89)*	(1.88)*	
4. Labor	0.26	0.16	0.28
	(6.18)***	(1.73)*	(5.41)***
5. Time			
a) Conventional	0.01		0.01
	(1.05)		(1.14)
b) Organic	0.03	0.03	
	(2.48)**	(2.35)**	
Observations	336	126	210
	0.92	0.92	0.92

Source: Own computations
Notes: |z| statistics in parentheses
Significance levels: * (α=0.10), ** (α=0.05), ***(α=0.01).

a) The production system is included as a dummy variable. In this model, the conventional production system appeared as a constant.
b) The original coefficient of the dummy was 0.86. For presentation purposes, this value is already evaluated with respect to the constant or the second category of the dummy on the production system, i.e. 4.04+0.86.

Results show that, in general, the economic value of the environmental benefits of organic farming, even with price premium for those that are marketed as labeled organic rice could only be realized in the long-term. If there are no price premia, the net present value of the benefits for producing eco-labeled commodities will be lower than that of the conventional counterpart. In particular, Table 2 shows that it takes about 15 years for the organic production system to reach the same productivity level as that of the conventional production system, i.e. 2.24 MT/ha.[14] The realized long-term NPV of producing eco-labeled rice through organic farming is positive, and greater than the NPV obtained from the production of conventional rice if the price premium for eco-labeled rice is maintained (Scenario 1). Without price premium (Scenario 2), both BCR and NPV are lower for eco-labeled rice compared with those of the conventional rice. During this 15-year period, therefore, producer of eco-labeled rice may still find productivity change benefits to be negative, i.e. in terms of net economic value of the difference in crop yield between the two production systems.[15]

Over a longer time period, rice yield from organic production surpasses its conventional counterpart, as shown in the 30-Year time horizon in Table 2. BCR and NPV have also significantly improved. However, although the productivity benefits have improved, the magnitude is rather small particularly in terms of NPV. Considering the declining discount factor over time,[16] a positive productivity benefit may come only in a very long-term period. Notwithstanding this, it should be noted that with the presence of price premium for labeled organic rice, economic benefits received by producers of eco-labeled products are positive and higher than those received by conventional producers, as seen in Scenario 1. In general, the results of the productivity change analysis have been found consistent with general knowledge on organic farming or any soil-conserving practices, i.e. yields are expected to differ more significantly only in the future (Enters 2000). However, as a caveat for interpreting the results, it should be noted that the models face several limitations. For example, due to lack of data, the variables included in the model may have limited the explanatory power of the model. In addition, the analysis does not take into account the

[14] This is consistent with the findings of Lampkin and Padel (1994) that absolute yield levels under organic management are increasing over time but at a slower rate relative to the conventional system.

[15] This result is consistent with a conclusion of Lampkin and Padel (1994) that based on the farm-level studies, price premia are needed to compensate for reduced output and increased labor use. They noted from the studies by Braun (1994) and Zerger and Bossel (1994) that farm incomes fall when farmers do not obtain premium prices. This is, however, assuming that all farms have converted to organic farming. Meanwhile, other studies indicated that incomes could be higher as a result of reduced output supply. Nevertheless, Lampkin and Padel warned that this last result should consider the problem in extrapolating from the current state of organic farming which is only a small part of agricultural activities.

[16] This implies that although total NPV is higher in a 30-year period than in a 15-year estimation period, the annual rate of change declines every year.

possible impact of production of eco-labeled products on prices. Considering the small production size of these products, we posit that its impact on price may be neglected. In view of this, the estimates should be interpreted together with some results on the sensitivity of the estimates on deviations in costs and benefits.

Table 2. Cost-benefit analysis of producing labeled organic and conventional Thailand rice: 15-year and 30-year time horizon

	End Period Yield	**Mean Yield**	**Benefit-Cost Ratio**	**Net Benefits**	**Net Present Values (NPV)**
	(MT/ha)	(MT/ha)	(BCR)	(US$)	(US$)
15-Year Time Horizon					
Scenario1: Eco-labeled Rice Receives Price Premium					
(i) Conventional Rice	2.24	2.06	2.58	4,043.97	1,350.00
(ii) Eco-labeled Rice	2.25	1.79	2.69	5,994.05	1,799.90
(iii) Productivity and Price Benefits				1,950.08	449.90
Scenario 2: Eco-labeled Rice Does Not Receive Price Premium					
(i) Conventional Rice	2.24	2.06	2.58	4,043.97	1,350.00
(ii) Eco-labeled Rice	2.25	1.79	1.64	2,276.47	612.33
(iii) Productivity Benefits				-1,767.50	-737.67
30-Year Time Horizon					
Scenario1: Eco-labeled Rice Receives Price Premium					
(i) Conventional Rice	2.68	2.26	3.13	14,159.55	1,767.22
(ii) Eco-labeled Rice	3.76	2.39	4.07	28,109.82	2,605.33
(iii) Productivity and Price Benefits				13,950.27	838.11
Scenario 2: Eco-labeled Rice Does Not Receive Price Premium					
(i) Conventional Rice	2.68	2.26	3.13	14,159.55	1,767.22
(ii) Eco-labeled Rice	3.76	2.39	2.54	14,119.89	1,058.16
(iii) Productivity Benefits				-39.66	-709.06

Source: Own computations

[a] Computed as the difference of benefits, i.e.Net Benefits and NPV, received by producers of labeled organic and conventional rice, that is, (ii) less (i).

[b] Productivity benefits also refer to difference in benefits, i.e. Net Benefits and NPV, received by producers of eco-labeled and conventional rice.

On Health-Related Effects of Organic Farming/Eco-labeling

The economic value of health benefits of organic farming are revealed by the willingness to pay (WTP) of both the conventional and organic farmers. WTP is measured in terms of yield (for conventional producers) and price premium (for organic producers) that farmers are willing to forego in order to practice organic farming and reap the health benefits associated with it. Although the amount that the conventional rice farmers are willing to pay is less than the amount that the producers of organic rice are willing to pay, the former is nonetheless willing to pay about 21% of its expected total production revenue. Organic farmers can pay up to 49% of their potential revenues with price premium accorded to labeled organic products. Potential revenues were computed based on the potential yield of each group and the farm price in 2002.

3.2 Profit Distribution Analysis

Table 3. Relative profits at the marketing chain[a]

Thailand Rice	Relative Profit [b] (Eco-labeled vs Conventional)	
	Farm Level (Π^{FE} / Π^{FN})[c]	Export Level (Π^{XE} / Π^{XN})
Product channeled through:		
i. NGO	17.97	17.96
ii. Private exporting company	3.73	19.45

Source: Own computations.
[a] Profits are in per-unit basis for comparison purposes; calculated using 2002 data.
[b] Ratio of profits received either by farmers or exporters at the eco-labeled markets and profits received at the conventional market.
[c] Π^{FN} = profit for the producers of conventional rice; Π^{XN} = profit for the exporters of conventional rice; Π^{FE} = profit for the producers of eco-labeled rice; and Π^{XE} = profit for the exporters of eco-labeled rice.

The computed relative profits (Table 3) indicate that profits, both at the farm and export levels of eco-labeled rice market, are generally higher than profits at the conventional counterparts. In particular, the findings show that the per-unit profits for producing eco-labeled rice range from about 4 to 18 times that of the profits for conventional rice. Relative profits at the export level are higher than at the farm level. It is noted that rice farmers who are producing for an NGO-exporter in Thailand have higher relative profit than those producing for a private company.

In terms of profit distribution (Table 4), the results show a reduction in the share of profits at the producers' level, i.e. the share of the farmers producing labeled organic rice is lower by about 30% compared to the share of the conventional counterpart. For labeled organic rice produced for private company, the share is lower by about 80%. On the other hand, the share of exporters of labeled organic rice in the profits is higher by about 10 to 30% compared to the share of the exporters of conventional products.

Table 4. Distribution of profits between farmers and exporters, 2002

	Profit Shares (%)		Change in the Profit Share (%)	
	Farm level	Export Level	Farm level	Export Level
Thailand Rice	(Π^{FE}/Π^{TE}) or $(\Pi^{FN}/\Pi^{TN})^a$	(Π^{XE}/Π^{TE}) or (Π^{XN}/Π^{TN})	$[(\Pi^{FE}/\Pi^{TE}) - (\Pi^{FN}/\Pi^{TN})]$	$[(\Pi^{XE}/\Pi^{TE}) - (\Pi^{XN}/\Pi^{TN})]$
a. Eco-labeled				
Channeled through:				
i. NGO	20.2	79.8	-26.3	9.9
ii. Private company	5.1	94.9	-81.4	30.6
b. Conventional	27.3	72.7		

Source: Own computations.
[a] $\Pi^{TN} = \Pi^{FN} + \Pi^{XN}$ and $\Pi^{TE} = \Pi^{FE} + \Pi^{XE}$.

3.3 Analysis of Marketing Margins

Based on both the trend of prices vis-à-vis marketing margins and the results of the regression (Table 5), it is noted that there is an inconsistency in price determination particularly at the farm level in Thailand. This is evident in the increasing export prices juxtaposed with declining farm prices, and a very low transmission elasticity, i.e. from export price to farm price (Table 5).

In Table 5, it was noted that the marketing margins in labeled organic rice are relatively more elastic with respect to consumer income than for the conventional rice. This shows that it is more difficult for the supply for labeled organic rice to respond to change in demand given the requirements for producing this commodity. Under the assumption of positively-sloped marketing inputs supply, substitution of marketing inputs for farm inputs may be undertaken to increase supply of the final product. However, this could raise consumer prices thereby resulting in higher marketing margins. The empirical observation that demand has greater influence on marketing margins than farm supply was confirmed by result of the regression where the latter's coefficients are generally low in magnitude and in statistical significance. It is interesting to note that organic rice farm supply has positive influence on marketing margins which is contrary to theoretical expectations.

Table 5. Regressions on marketing margins using the general reduced-form model for labeled organic and conventional rice

	Consumer Income (GDP/capita)	Farm Input Supply	Marketing Cost Index (includes fuel and wage costs only)	Constant	Adj. R-squared
Conventional Rice	0.62	-0.07	0.63	-0.13	0.37
	(1.84)*	(0.08)	(2.20)**	(0.64)	
Labeled Organic Rice	1.53	0.53	0.31	-6.03	0.92
	(3.26)**	(4.71)***	(2.49)*	(3.95)*	

Source: Own computations.

Notes: Significance levels: * (α=0.10), ** (α=0.05), ***(α=0.01).

Table 6. Elasticities[a] of farm price with respect to FOB price

Conventional	Eco-Labeled
0.94***	0.86
(0.96)	(0.84)
[2.37]	[1.80]

Source: Own computations.

Notes: Significance levels: * (α=0.10), ** (α=0.05), ***(α=0.01).

[a] The elasticities of price transmission are obtained by estimating a long-run backward price transmission model, i.e. ln(FARMPRICE) = a + b·ln(FOBPRICE) + c·TIME.

[b] Values in parenthesis are the adjusted coefficients of determination (Adj. R-squared); Durbin-Watson statistics, in brackets.

Marketing costs were also found to be significant explanatory variable for the variation in marketing margins in conventional rice but relatively less significant for the variation in marketing margins in eco-labeled rice. In this regard, it may be argued that in the case of labeled organic rice, wages and fuel costs may be poor proxies for costs of marketing or that the high marketing margins for labeled organic rice is explained by other factors than marketing costs which is conventionally the primary factor considered in explaining marketing margins. For instance, market power in terms of price determination at the farm level may be looked into.

3.4 Analysis of the Determinants of Farmers' Decision

The significant factors affecting Thai farmer's decision to adopt organic production represent each of the five major categories of determinants discussed in the methods section that are hypothesized to be relevant in explaining the decision of the farmers to adopt (Table 7). Of these factors, socio-economic characteristics, i.e., sex and family size, and farm characteristic, i.e. tenure, have relatively smaller influence on the decision based on the values of marginal probabilities. On the other hand, the marginal probability that a farmer will adopt organic production system increases by an average of 50% when: (a) it is easy to get technical information about eco-labeling, (b) farmers perceive positive yield and environmental effects of organic farming, and (c) farmers experienced sickness in conventional farming.

Table 7. Maximum likelihood estimates and goodness-of-fit measures

Predictors	Coefficient	Odds Ratio	Wald Stat	Change in Probability
Sex	0.94	2.57	1.76*	0.22
Family Size	-0.53	0.59	-2.11**	-0.12
Major Source of Income (Agri=1, Non-Agri=0)	-1.36	0.26	-1.50	-0.26
No. of Plots	0.53	1.69	1.82*	0.12
Land Owner (Yes=1, No=0)	1.55	4.73	1.02	0.37
Access to Technical Information_2 [a]	-0.04	0.96	-0.07	-0.01
Access to Technical Information_3 [a]	3.68	39.73	2.80***	0.47
Expected Yield Impact of Organic Farming_2 [b]	-2.23	0.11	-2.67***	-0.50
Expected Yield Impact of Organic Farming_3 [b]	-2.09	0.12	-2.58***	-0.46
Expected Impact of Organic Farming in Reducing Negative Environmental Impact of Farming_3 [b]	2.48	11.90	1.64*	0.52
Experience of Sickness During Conventional Farming (Yes=1, No=0)	2.60	13.45	3.80***	0.47
Number of observations	118			
LR chi^2 (Prob > chi^2)	58.16	(0.00)		
Pseudo R^2	0.36			

Source: Own computations.
Note: Significance levels: * (α=0.10), ** (α=0.05), ***(α=0.01).
[a] (Difficult=1, Not so Difficult=2, Easy=3)
(1=None, 2=Reducing, 3=Increasing, 4=Cant assess)

4 Conclusions and Policy Implications

This study has shown that financial, environmental and health benefits could accrue to producers of labeled organic rice. However, financial benefits largely depend on the presence of price premium. In this regard, the decision on which farming system would be preferable on the farmers' point of view may have to depend on the extent to which the environmental and health impacts could compensate for the uncertainty of relying on a price premium for financial profits. On the part of the government, it may have to balance the need to address current food security vis-à-vis long-term food security attained through a more environment-friendly use of the soil for crop production. Lampkin and Padel (1994) noted that despite a yield-reducing effect of organic production, organic food can still meet domestic food demands in most countries in the EU. However, the issue of lost opportunity to produce for the rest of the world becomes imperative. In the developing countries, the discourse on the extent to which they should be encouraged will have to balance the importance of quantity, price, and income effects to producers with the price and quantity effects to consumers.

The issue on the physical productivity of the (organic) farming system still remains. Lampkin and Padel (1994) previously stated that yield penalties for producing organic products may have been frequently overstated due to inappropriateness of the comparative-static approach or the analytical model used in assessing productivity impacts. Apart from this, however, it is fundamental to consider that the organic farming system lacks the needed research and technological development. While the model used in this analysis may run the risk of either underestimating or overestimating the productivity potential of the organic farming system, there may be quite an adequate evidence that organic farming system has untapped productivity potential due to lack of government support. The fact that the yield potential had increased from the 1950s to the 1990s (Lampkin and Padel 1994) implies that it may be increased further if adequate governmental support is given. Given this, the current lack of support may have rendered the comparison of its productivity potential grossly misleading. Notwithstanding these issues, the fact that there are farmers who are undertaking and willing to participate in eco-labeling should prompt the government to provide the necessary support to enable them to successfully shift to the desired production system. Overall, the assessment does not and, as intended, should not give exact indications on whether to implement eco-labeling or encourage the adoption of organic farming system. Indeed, at this point in time when the technology for organic farming is still underdeveloped and by itself would not be able to meet the current food demand, the preference on which farming system to undertake should be left to farmers' discretion. However, being free to decide on which to undertake means that the farmers are also provided with not only adequate information but also the necessary technology and support services that will be needed should they decide to undertake an alternative to conventional farming system.

This study has shown the potentially positive impacts of producing eco-labeled products using the organic farming system in the developing countries despite the low level of support that governments provide to the industry. Given this, the provision of governments' support and assistance through, first and foremost, a clear policy towards the promotion of eco-labeling or organic farming could further strengthen the potential of this industry to provide positive and significant economic and environmental impacts. In this regard, there will be a need for credible and effective institutions to implement the policy as well as corresponding support services particularly on research, technology promotion, and extension. As shown in the analysis of determinants of farmers' adoption of organic farming, information on the technicalities of organic farming as well as on the possible impacts of organic farming serves as an important incentive for farmers' decision to adopt this farming approach.

In this study's assessment of profit distribution, it is shown that although profits at the farm level could be higher in absolute terms than those of the conventional counterparts, the latter gets a higher percentage share of the total profits in the marketing chain than the former. While this does not alter the fact that the farmers are better off in participating in eco-labeling, the assessment of profit distribution is relevant as it provides an indication on how the labeled organic product market currently operates. It also raises an issue on whether there are possible measures that can be undertaken to ensure that farmers get optimal economic benefits, without prejudice to the share of the other market participants.

Finally, the analysis of marketing margins shows that high marketing margins for labeled organic rice are not highly explained by marketing costs. Based on the historical trends in prices and marketing margins, there are some indications that marketing margins may also be explained by pricing arrangements between farmers and exporters. Although the study has shown that producer of labeled organic rice have indeed received economic gains through higher prices and income compared to their conventional counterparts, an assessment of price determination in the marketing chain should be undertaken to ensure that all market players have equal opportunities to capture optimal price benefits offered by the market. This would also ensure that these market players are given the right incentives to participate in the production of environment-friendly products.

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