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Market access, organic farming and productivity: the effects of Fair Trade affiliation on Thai farmer producer groups*

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The study analyses the impact of Fair Trade (FT) and organic farming on a sample of FT rice producers in Thailand. It finds that per capita income from agriculture is positively and significantly affected by years of organic certification and FT affiliation. The estimated FT and organic certification contributions to producers' economic well-being are higher when account is taken of the relatively higher proportion of self-consumption among affiliated farmers. But the per capita income effect does not translate into higher productivity owing to a concurrent increase in hours worked.

Key words: Fair Trade, organic production, productivity, small business.

1. Introduction

Fair Trade (FT) is an increasingly topical economic practice aimed at promoting the inclusion of marginalised farmers by means of a package of economic initiatives, which include improved market access, capacity building, environmental sustainability, export services, price stabilisation and the provision of a premium used for investment or for the development of local public goods.[1] FT is gradually joining the mainstream after having been a niche phenomenon for several years. Between 2006 and 2007, total FT sales registered increases of 127 per cent in volume and 72 per cent in retail value.

* The study also tests for which of the two (organic and FT) effects is stronger, finding that the latter prevails.

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[1] According to IFAT (the main international organisation gathering producers and FT organizations), such criteria are: (i) creating opportunities for economically disadvantaged producers; (ii) transparency and accountability; (iii) capacity building; (iv) promoting FT; (v) payment of a fair price; (vi) gender equity; (vii) working conditions (healthy working environment for producers). The participation of children, if any, should not adversely affect their well-being, security, educational requirements and need for play and conform with the UN Convention on the Rights of the Child as well as the law and norms in the local context; (viii) the environment; (ix) trade relations (FT Organizations trade) with concern for the social, economic and environmental well-being of marginalized small producers and do not maximise profit at their expense. They maintain long-term relationships based on solidarity, trust and mutual respect that contribute to the promotion and growth of FT. Whenever possible, producers are assisted with access to preharvest or preproduction advance payment.

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Growth in Europe has annually averaged 50 per cent in the past 6 years. The theoretical literature on FT has recently expanded, but it generally has difficulties in capturing the variety and multiplicity of FT characteristics with a single model (see among others Leclair 2002; Maseland and De Vaal 2002; Moore 2004; Hayes 2011 and Redfern and Snedker 2002). A FT product, in fact, is a bundle consisting of a physical product plus an intangible social and/or environmental content. The latter is an essential component, but it is unfortunately not an experience good (one does not learn more about the social and environmental impact of FT by buying more of the product). It is for this reason that impact studies in this field are urgently required.

In this regard, the current literature comprises some valuable case studies (Pariente 2000; Nelson and Galvez 2000; Castro 2001a and b; Ronchi 2002; Bacon 2005; Liu 2009) and a few econometric analyses, which evaluate the impact of affiliation against the benchmark of a control group of non-FT producers living in the same area (for a comparative overview of such studies see Ruben 2008). Among the latter, Ronchi (2006)[2] has studied a panel of 157 mill data, finding that FT helped the affiliated Costa Rican coffee producers to increase their market power. Other empirical studies on producers' organisations in Kenya, Chile and Peru (Becchetti *et al.* 2007; Becchetti and Costantino 2008)[3] show that FT significantly affects child schooling by increasing household income and productivity, but only when household income exceeds a minimum threshold consistent with the 'luxury axiom' hypothesis (Basu and Van 1998).[4]

In all cases, the stereotype of an exclusive relationship between affiliated producers and the FT channel is rejected in favour of a more composite pattern of relationships. In this respect, FT is potentially an opportunity to

[2] Specifically, using a panel data set for the 157 mills operational in Costa Rica over the 26-year period between 1974/1975 and 1999/2000, Ronchi (2006) estimates a reduced form equation to test for the presence of market and for the presence of any 'Fairtrade effect' as well as possible determinants of mark-down behaviour detected in the Costa Rican market. The model is estimated in a fixed-effect regression framework, also corrected by using a weighted least squares procedure in which less weight is given to those fixed effects that are less precisely estimated.

[3] Becchetti *et al.* (2007) evaluate the impact of FT affiliation on a sample of around 250 producers involved in two different FT projects. They find a significant and positive effect of affiliation years on a wide set of qualitative and quantitative indicators. In addition, with back-cast panel data, they reconstruct farmers yearly decisions to send their children to school and find that FT affiliation has a significant and positive effect on them when children are aged between 15 and 18. Similarly, Becchetti and Costantino (2008) find a significant and positive impact of FT affiliation on monetary and non-monetary measures of well-being in a sample of Kenyan farmers. They do so by comparing affiliated farmers with a control group of non-affiliated ones. Methodological problems such as the relative contribution of FT affiliation versus cooperative membership, control sample and selection bias are also addressed, showing that ex ante (self) selection of members of the local cooperative contributes to explaining some but not all of the results.

[4] The expression 'luxury axiom' originates from the following statement by Basu and Van: 'A family will send the children to the labour market only if the family's income from non-child-labour sources drops very low' (Basu and Van 1998, p. 416). The statement implies that, in such a low-income situation, avoiding child labour is a luxury that the family cannot afford.

improve access to the market, reduce vulnerability to shocks and diversify trade channels for producers who often depend on monopolistic transportation intermediaries but nevertheless continue to sell part of their production to those intermediaries and on the local market.

The above-summarised theoretical and empirical FT literature suggests that the crucial hypothesis to be tested is this: does FT promote capacity building and the inclusion of farmers in international markets, as promised by its principles that play such a major role in motivating consumer purchases (Becchetti and Rosati 2007)?

The paper seeks to answer this question. It is divided into seven sections (including the introduction and conclusions). The second section outlines the analytical framework that will guide the analysis. The third section describes the characteristics of the Green Net Cooperative of Thai organic rice producers, which is the object of this study, while the fourth section describes the data set. The fifth and sixth sections illustrate and comment on the descriptive and econometric findings. The seventh section puts forward an overall interpretation of the results. The final section concludes.

2. Analytical framework and hypothesis testing

The implementation of organic farming is difficult and time-consuming. Moreover, yields are not as high as those from conventional farming in transition periods. It is for this reason that farmers need training support when they undertake organic farming (Woranott 2009).

Organic agriculture is promoted in Thailand by government policy, several NGOs (among them FT partners) and private players. Among the major FT partners are Green Net and Rice Fund. FT organisations distribute also other cooperatives' products under the FT label.

The area under organic farming is increasing from just over 2100 ha in 2001 to 21,701 ha in 2005, with 2498 organic farms (Ellis *et al*. 2006), but it is still very small in relative terms (0.049 per cent of the total number of farms in the country in 2004). In 2005, the government launched a 5-year (2005–2009) organic agriculture promotion program, one of whose main goals was to convert 13.6 million hectares of conventional agriculture areas into organic agriculture areas where the use of organic fertilisers and biopesticides would be promoted (Mingchai and Yossuck 2008).

The aim of this study is to evaluate the effect of organic farming on the incomes of Green Net–affiliated farmers and to determine whether FT (by easing exports and promoting capacity building) can help offset the potential negative productivity effects of transition to organic farming mentioned at the beginning of this section.

The general analytical framework consists of the following model

$$\mathrm{Log}(Y)_i = \alpha_0 + \alpha_1 AffYears_i + \sum\nolimits_j b_j X_j + u_i \qquad (1)$$

where Y is the target variable (per capita income from agriculture), X is a set of control variables and *AffYears* are (according to the different specifications) the number of years of either affiliation with FT (*FTYears*) or organic certification (*OrgYears*). More specifically, the null hypothesis on the significance of FT or organic certification is H_{01}: $\alpha_1 = 0$. If the coefficient is significantly different from zero, the null hypothesis is rejected and affiliation years have a significant impact on the target variable, net of the concurrent impact of the set of the X control variables introduced into the estimate.

The two problems in the analytical framework are endogeneity and the difficulty of disentangling FT affiliation from organic certification effects. In regard to the first problem, rejection of the null hypothesis and significance of the FT affiliation coefficient may not imply causality from FT affiliation to per capita income from agriculture. The nexus can be reversed, or a third omitted driver may affect both FT affiliation and the dependent variable, thereby causing their spurious correlation. Three alternatives are proposed to overcome this problem: (i) an instrumental variable approach; (ii) a propensity score evaluation and (iii) restriction of the analysis to the treatment sample alone to eliminate any potential heterogeneity between the treatment and control samples. Technical details on the instrumental variable approach and the related diagnostics are provided in Section 4 of Appendix S1.

With regard to the second problem, separate tests are made on the organic certification and FT affiliation effects, which are often combined and observationally equivalent in FT projects. This is done by exploiting the relatively shorter FT affiliation spell with respect to the organic certification period. In this regard, the study also contributes to the literature on the relationship between organic farming and productivity, which reports mixed findings.[5]

More formally, the Davidson–McKinnon (1993) approach is used to test which of the non-nested 'competing models', including either organic certification or FT affiliation years, perform best.

According to this test, given model A

$$Y_i = \alpha_0 + \alpha_1 \mathrm{OrgYears}_i + \sum\nolimits_j b_j X_j + u_i \tag{2}$$

and model B

[5] Offerman and Nieberg (2000) compare the economic performance of organic and conventional farms in different countries and find that organic farms have lower yields, higher output prices and slightly lower unit costs. Ricci Maccarini and Zanoli (2004) find that part of the reduced efficiency of organic farming is because of the difficulties and length of the conversion period. On the same lines, Oude *et al.* (2002) observe that it takes time to reach the optimal nutrient stock of soil and optimal nutrient supply for arable crops under organic farming. This extends the effective conversion period during which productivity slows down to 6–7 years. Kassie *et al.* (2008) find, on the contrary, a clear superiority of organic farming practices over chemical fertilizers in enhancing crop productivity for resource-constrained farmers cultivating land in a semi-arid Ethiopian area.

$$Y_i = \alpha_0 + \alpha_1 FTYears_i + \sum_j b_j X_j + u_i, \quad (3)$$

each model is estimated separately, predicted values for models A and B ($Y_{i(A)}$ *and* $Y_{i(B)}$) are generated, and the following additional regressions are performed

$$Y_i = \alpha_0 + \alpha_1 OrgYears_i + \alpha_{2A} Y_{i(B)} + \sum_j b_j X_j + u_i \quad (1')$$

$$Y_i = \alpha_0 + \alpha_1 FTYears_i + \alpha_{2B} Y_{i(A)} + \sum_j b_j X_j + u_i \quad (2')$$

The test shows that model 1 outperforms model 2 if $\alpha_{2B} \neq 0$ while $\alpha_{2A} = 0$ and vice versa. The explanation for this is that, if the predicted dependent variable from model B has additional explanatory power in model A (but not the reverse), FT affiliation years capture part of the variability of the dependent variable, which is not explained by organic affiliation years (while organic years do not add anything in the specification with FT affiliation years). In all other cases (both coefficients not significant or both coefficients significant), it is not possible to establish which of the competing models performs best.

The rationale for assuming that FT has independent effects on observed farmers, net of the organic certification impact, derives from the specific characteristics of FT.

Besides automatic inclusion in a foreign market channel and the provision of marketing services, FT helps by creating a long-term relationship with the cooperative, which assists the latter in improving quality standards, and it reduces the negative impact of productivity shocks that have occurred during the history of that relationship.[6]

3. The FT Project in Thailand

The Green Net Cooperative is a major organic FT producer in Thailand. It was established in 1993 by a group of producers and consumers with the aim of supporting environmentally and socially responsible business. In 2002 it received the FT label from the FT Labelling Organization (FLO). Green Net makes advance payments to the producer groups. The latter buy the paddy and stock it, while Green Net receives export orders for the entire year and gives instructions to the group on the quantity of rice to deliver. The milled rice is then delivered to Green Net for packaging. Green Net pays the producer group and then exports and/or sells the rice locally.

[6] Anecdotal examples relative to this point are omitted for reasons of space but are available in Appendix S1.

In addition, organic farmers receive the following two benefits from Green Net: (i) in accordance with FLO laws, a FT premium to be used for various social and capacity-building activities for organic farmers (i.e. scholarships, emergency funds, credit facilities, training) and (ii) an additional yearly FT bonus (1280 baht per tonne in 2008) for organic production (see Table 1).

Green Net is therefore a second-level cooperative providing services to first-level local associations. The second level is required for the purposes of coordinating production among local cooperatives, developing research and promotion of organic agriculture, and providing export services on a larger scale. All members of first-level associations are also members of Green Net.

To evaluate the impact of Green Net affiliation, now considered are affiliated farmers in two first-level organisations operating in two different areas of the Yasothorn Province (see Figure 1): the Bak Rua Farmer Organization and the Nature Care Society. More details on the characteristics of the two organisations are provided in Section 2 of Appendix S1.

4. The data set

During 2008, a questionnaire was administered to 360 farmers operating in Kud Chun and Bak Reua districts (Table 2). In each district, respondents were randomly chosen from two extended lists of affiliated (members of the Green Net cooperative) and non-affiliated farmers to create two groups of equal number. The treatment group was randomly generated from the list of all organic Green Net farmers in the two areas selected, while the control group was randomly created from a list including all farmers living close to (within 10 km of at least one of the selected) organic farmers. As will be shown in the descriptive statistics, the treatment and control samples exhibited no significant differences in terms of sociodemographic characteristics.

Cooperative membership is widespread in the area and not limited to FT–affiliated farmers. This implies that whilst all affiliated farmers are obviously cooperative members, also 60 per cent of non-affiliated members belong to cooperatives. Controlling for this feature makes it possible to measure the specific effect of FT and/or organic certification on Green Net farmers, rather than a generic cooperative effect.

As to the kind of information collected, the questionnaire contained 75 questions concerning various measures of qualitative and quantitative well-being.[7]

5. Descriptive findings

The treatment and control samples do not present significant differences in terms of sociodemographic characteristics (see Table S1 in Appendix S1). On

[7] The questionnaire is omitted for reasons of space and available from the authors upon request.

Table 1 Breakdown of price and FT benefits determination in 2008 for Green Net–affiliated farmers in Bak Reua and Kud Chun

	Bak Reua	Kud Chun
October 2007 – organic farmers discuss the price of the paddy and set it at around…	THB 10,000	
January 2008 – Conventional farmers receive from the market the same price as organic farmers (THB 10,000). Organic farmers receive a bonus for organic production of…	+ THB 2500	
Additionally, the FT premium awarded only to producer groups is for 2008 (according to FLO law …)	+ THB 750	
The FT bonus (also called paddy fund) granted directly to organic farmers is…	+ THB 1280	
Further FT benefits	Local training, extension activities, advice and support for organic farmers	
Local cooperatives' dividend (to organic and conventional members)	Variable (positive) computed as follows: 8% of the capital share farmers invested in the cooperative + THB 50 per tonne of paddy sold.	Variable (0 in the last years)
Fair trade premium utilisation	The premium is divided into several funds to which farmer members can apply for support (i) green manure seed; (ii) farmer training; (iii) member welfare, e.g. education of their children, natural disaster relief	(i) 50% is allocated to the mill to improve its management; (ii) 25% is allocated to the extension works; (iii) 25% is allocated to Organic Fair-Trade Fund. This fund also receives contributions from other sources and provides loans to members wanting to con vert to sustainable production, as well as other community benefits
Local cooperatives' funds (to organic and conventional members) taken from cooperatives' profits	Loans Saving Groups	

FLO, Fair Trade Labelling Organization; FT, Fair Trade.

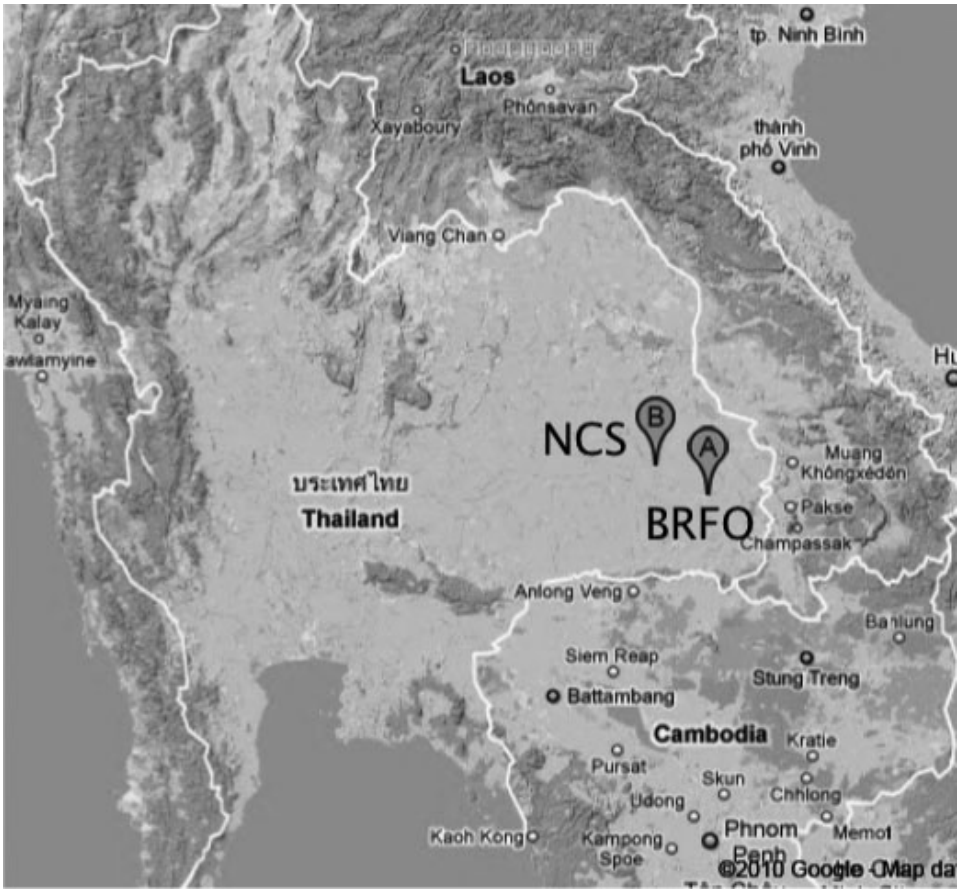

Figure 1 Location of the Bak Rua Farmer Organization (BRFO) and Nature Care Society (NCS) in Thailand (Yasothorn Province).

Table 2 Summary information on the samples

	Bak Reua	Kud Chum	Total farmers
No. of observations	210	150	360
No. of organic farmers	105	75	180
No. of non-organic farmers	105	75	180
No. of farmers in cooperative/producer group	162	126	288
No. of non-organic farmers out of cooperative/producer group	48	24	72
No. of non-organic farmers in cooperative/producer group	57	51	108
No. of farmers in conversion	7	7	14

average, the price paid by local cooperatives per tonne is significantly higher than the price paid by other buyers (10,902 versus 10,459 baht) and, in turn, the FT price (13,941 baht) is significantly higher than the price paid by local

cooperatives. Interestingly, affiliated farmers obtain better conditions than control famers also when selling to local cooperatives (11,305 against 10,019 baht). This difference may depend on differences in bargaining power, or it may be the organic premium granted by the local market. The treatment and control samples are not significantly different at 95 per cent confidence level (but are at the 90 per cent level) in terms of productivity calculated as income from agriculture per hour worked. However, per capita incomes from agriculture are significantly different.

Farmers' average income from agriculture is around 51,321 baht per year. The average income of affiliated farmers is significantly higher than that of non-affiliated farmers, both overall (60,942 against 41,646 baht) and in the two different areas. This difference is matched by a similar difference in income from agriculture per hour worked (126 against 98 baht), even though the standard deviation is large and the significance is much weaker. Almost half of farmers have a second activity (craftwork, construction and work in other sectors). Considering the sum of income earned from the first and second activities, the two main results previously mentioned are confirmed, because income from the two activities is slightly higher for affiliated (78,779 baht per year) than for non-affiliated farmers (55,174 baht per year). In both cases, the difference is significant at 5 per cent.

An invisible, though important, component of productivity and creation of economic value is self-consumption. As can be easily imagined, 100 per cent of the rice consumed in (both treatment and control) farmers' households is self-produced and not bought on the market. Besides rice, organic FT-certified producers do not buy 81 per cent of the vegetables that they consume, compared with 71 per cent in the case of control producers. Self-consumption shares are higher for many other products as well.

This implies that the positive differences in income from agriculture observed between affiliated and non-affiliated farmers are downward biased if the value of self-consumption is not included. The advisable solution is therefore to sum the visible and the invisible income by evaluating the income from the self-consumed share of the various food products at the local market value. Obtained findings document that the total value of self-consumption is higher for affiliated farmers than for the control sample, the difference being 29,503 versus 24,217 baht per year. When this is taken into account, the individual standard of living rises from 6.17 to 7.87 (4.69–6.14) dollars per day in PPP in Bak Reua (Kud Chun). As a consequence, the difference in income from agriculture between affiliated and non-affiliated farmers is higher when self-consumption is considered, in that it stands at around 6239 versus 5032 baht (when self-consumption is not included) per capita per year.

Affiliated farmers appear to be relatively better off in terms of financial conditions: their savings share is around 15.5% of total income, against 11.15% for control farmers, while the total family debt to income ratio is slightly higher in the control than in the treatment sample (1.2 versus 1).

6. Econometric findings on the organic certification effect

The descriptive findings highlight a significant difference in the creation of economic value between the treatment and control groups (Section 5). Now checked, therefore, is whether the finding is confirmed when controlling for concurrent factors in econometric estimates.

The controls are education, geographical location, age, sex, marital status, the number of children, years of work experience, the number of temporary employees, affiliation to a local cooperative and land size (for variable definitions see the Variable Legend in the Appendix). The significance of the agricultural income per capita gap between treatment and control farmers is supported by the first specification, where the marginal effect of 1 year of organic certification amounts to around 818 baht, which corresponds to approximately 2 per cent of the current average income from agriculture in the control group (Table 3, column 1). The only other variables that matter are geographical area and land size.[8]

The organic certification result persists when control is made for the size of the FT premium (the magnitude falls to 632 baht) (Table 3, column 2). Hence, the FT premium is indeed a component of the current difference in agricultural income between control and affiliated farmers, but it cannot explain the marginal effect of the treatment (i.e. why any additional year of organic certification contributes significantly to this difference in income). The premium may have helped farmers to save more and to reduce their debt to income ratio across years (see descriptive findings), but it generates a positive effect of affiliation years on income from agriculture only if it is invested (together with higher savings) in capacity building. The likely explanation of the positive effect of certification when controlling for the FT premium is therefore that a combination of productivity and commercialisation gains progressively widened the income gap across years. The hypothesis that the effect is the same in the two areas is rejected because certification years have a stronger impact in the Bak Reua area (Table 3, columns 3 and 4). This is consistent with the significantly higher income and productivity of this area.

6.1. How to tackle endogeneity and selection bias

The relationship between affiliation years and creation of economic value is not free from endogeneity. To tackle this problem, a good set of exogenous instruments has been selected. These are the farmer's distance from the cooperative affiliated to FT and the number of exogenous memorable events[9] with

[8] The hypothesis of a quadratic relationship between land size and the dependent variable has been tested and rejected. The results are omitted for reasons of space, but are available upon request.

[9] Even cross-sectional surveys are based on memory efforts of respondents when they are asked for basic information such as last year's income. Survey data maintain the same reliability if memories are extended back in the past for important events in life. For a discussion on the validity of using retrospective information based on memorable events, see McIntosh *et al.* (2007).

Table 3 The effect of organic certification years on per capita household income from agriculture (thousands of baht)

	OLS				Instrumental variables (2SLS)	
	Dependent variable: per capita household income from agriculture				Instrumented variable: organic certification years	
	Equation 1	Equation 2	Equation 3	Equation 4	Equation 5	Equation 6
Control cooperatives group	2.096261 (1.437)	2.515116 (1.749)	2.164635 (1.482)	2.049935 (1.398)	37.95238 (1.529)	33.50922 (1.716)
Area 1	−7.468254** (−5.525)		−5.624645** (−3.745)			
Area 2		6.452535** (4.352)		5.643593** (3.750)	15.4101* (2.532)	14.44963** (2.925)
Certification years	0.8185072** (4.640)	0.6316182** (2.859)			6.110847 (1.718)	5.462464 (1.942)
Certification years 1			0.5778565** (2.990)	0.5965702** (2.789)		
Certification years 2			1.136404** (3.971)	1.241406* (1.975)		
Temporary employees	0.0085186 (0.0687)	−0.0010207 (−0.008)	−0.0205889 (−0.166)	−0.0222329 (−0.1784)	−0.1400134 (−0.669)	−0.1207512 (−0.661)
Land size	0.3483096** (6.942)	0.3482052** (6.974)	0.3536237** (7.045)	0.3544759** (6.986)	0.2959587** (3.517)	0.3024255** (3.725)
FT premium		0.0007708 (1.428)		−0.0002305 (−0.235)		
Constant	1.267371 (0.281)	−5.998363 (−1.298)	0.7549146 (0.165)	−4.724651 (−1.083)	−32.55138 (−1.589)	−29.40346 (−1.765)

Table 3 (*Continued*)

	OLS				Instrumental variables (2SLS)	
	Dependent variable: per capita household income from agriculture				Instrumented variable: organic certification years	
	Equation 1	Equation 2	Equation 3	Equation 4	Equation 5	Equation 6
No. of obs.	358	358	358	358	294	294
P-value (overall goodness of fit)	3.94e-16	7.19e-16	1.14e-17	1.56e-19	4.09e-07	4.56e-08
Endogeneity test						
Robust score χ^2					4.5472	6.94002
P-value					0.0330	0.0084
Tests of weak identification						
F-stat					3.555	1.477
Weak-Instrument-Robust inference						
Score χ^2					5.227	9.010
P-value					0.0222	0.0292
Overidentification test						
Score χ^2 (2)						0.421
P-value						0.810

Coefficients and *t*-stats; **1 per cent significance, *5 per cent significance. All estimates are with heteroskedasticity robust standard errors. Age, number of children, years in agriculture, school years, gender and marital status are included in all estimates.
Instrumented variable: certification years. Instruments: distance from cooperative (equation 5); distance from cooperative, positive exogenous events, negative exogenous events (see Section 5 for a list) (equation 6).
Tests of endogeneity: Wooldridge's (1995) robust score test. H_0: the instrumented variable is exogenous.
Test for weak identification: *F* statistic (I stage).
Weak-Instrument-Robust inference Test – Anderson and Rubin (1949): H_0: coefficients of the endogenous regressors in the structural equation are jointly equal to zero. The test is robust to the presence of weak instruments.
Test of overidentifying restrictions: Sargan (1958). Variable legend: see Appendix.
FT, Fair Trade.

positive or negative economic consequences declared by farmers (for event descriptions see the variable legend in the Appendix). The distance is correlated with affiliation because it is a component of the cost of transporting the product to the cooperative and of any other activity, which requires face-to-face meetings at the cooperative. To check for the exogeneity of this instrument, verification is now made of whether sample farmers are 'locked' in their geographical location and have not changed it since starting their agricultural activity. In the estimate shown in column 5 (Table 3), certification years are instrumented only by farmers' distance from the cooperative, while exogenous events are introduced as additional instruments in column 6.

While it can be ruled out that the set of instruments suffers from the reverse causality problem, it is necessary to test for exogeneity of the instrumented variable conditional on the set of instruments with appropriate diagnostics (details on the tests described below are provided in Section 4 of Appendix S1). Used for this purpose is the standard approach of verifying whether the residual (from a 'modified specification' in which instruments replace selected endogenous regressors) has significant effects when introduced into the standard non-instrumented equation. As well known, instrumented variables are exogenous if the null of the insignificance of the added variable (residual from the 'modified specification') in the standard non-instrumented equation is not rejected. To determine whether this is true, the Wooldridge's (1995) heteroskedasticity robust score test is computed. The test shows that the null hypothesis of exogeneity is rejected at the 5 per cent level but not at the 1 per cent level when only the distance from the cooperative is used as instrument (Table 3, column 5, Endogeneity test). Being in a limit case concerning the use of OLS and IV estimates, the IV approach is nonetheless selected for the robustness check.

The results on the base estimate obtained with the above-mentioned instruments for the certification age variable show that the latter is positive, but significant only at 10 per cent (Table 3, columns 5 and 6). Below, these weak results will be compared with the much better ones obtained from specifications in which organic years are replaced with FT affiliation years, and the invisible part of self-consumption in income is included.

The Sargan (1958) test on overidentifying restrictions does not reject the null in the specification in which more than one instrument is used (Table 3, column 6).

To verify the quality of selected instruments, the weak identification test is implemented and the *F*-statistics of instruments excluded from the first stage with the critical values tabulated by Stock *et al.* (2002), and by Stock and Yogo (2005) are compared. The weak identification test identifies a bias in the magnitude of the instrumented variable coefficient (Stock–Yogo test). However, to check whether the null hypothesis that the coefficients of the endogenous regressors in the structural equation are jointly equal to zero also in the presence of weak instruments, the Anderson and Rubin

(1949) test is performed. In this case, both specifications, with one and more instruments, perform relatively well (Table 3, columns 5 and 6), rejecting the null at the 5 per cent confidence level, suggesting that, even in the presence of a magnitude bias, selected instruments are robust when testing the overall significance of the instrumented variable.[10]

The wider problem of heterogeneity between the treatment and control samples requires further testing before the results can be considered reliable. Notwithstanding the impossibility of running a randomised experiment, it is always possible that the observed difference in performance variables between the treatment and control samples does not depend on the treatment, but rather on ex ante characteristics which affected the decision to affiliate (implicit selection), or on explicit admission rules discriminating entrance (explicit selection).

Two additional checks to control for selection bias are performed. First, treatment and control producers are compared with a propensity score approach. When estimating the propensity score, the inclusion of variables with a positive impact on income per capita (the variables included are age, number of children, gender and geographical location) is carefully avoided. In modified specifications school years, job experience and land size are added. In all cases, the difference between treatment and control sample is significant and strong (between 4200 and 4500 baht) (Table 4a and b).

As propensity score matching has limitations when used on variables in levels and not in first differences, an ultimate remedy against heterogeneity between treatment and control producers consists in estimating the effect of affiliation years in the subsample of affiliated producers only.[11] This is an option not available in impact studies, in which there is no graduation of the treatment, but it is available here because years of affiliation differentiate producers in terms of exposure to the program.

When the estimate is restricted to affiliated producers only, the affiliation effect is much weaker (t-stat around 1.55) and its magnitude falls to 545 baht (Details of the estimation are given in Table S2 in Appendix S1, column 1). When the effect is calculated separately for the two areas, the result is significant at the 5 per cent level in the Bak Reua area, but is not significant in the Kud Chun area (column 2).

[10] The Anderson–Rubin statistic is a Wald test robust to the presence of weak instruments where the null hypothesis tested is that the coefficients of the endogenous regressors in the structural equation are jointly equal to zero and that the overidentifying restrictions are also valid. The test is equivalent to estimating the reduced form of the equation (with the full set of instruments as regressors) and testing that the coefficient of the excluded instrument is equal to zero.

[11] We carefully verified the absence of survivorship bias among members in Green Net. Exits were around 1 per cent in the last 10 years and not caused by worsening economic conditions. We also found no significant difference in preformation trends between younger and older affiliated farmers.

Table 4 The effect of FT affiliation on per capita household income from agriculture (a) propensity score estimate (b) propensity score matching

(a) Propensity score estimate – probit regressions (dependent variable: affiliation dummy)

	Model 1*		Model 2†		Model 3‡		Model 4§	
	Coefficient	*z*-stat	Coefficient	*z*-stat	Coefficient	*z*-stat	Coefficient	*z*-stat
Area 1	−0.0186111	−0.14	−0.0396236	−0.29	−0.02578	−0.19	−0.0467297	−0.34
Age	−0.0159115	−2.34	−0.0055874	−0.57	−0.0159042	−2.34	−0.0055908	−0.57
No. of children	0.046204	0.82	0.0369817	0.65	0.0386919	0.69	0.0292869	0.51
Male	0.2868614	2.04	0.2355149	1.61	0.2712882	1.92	0.2215747	1.51
School years			0.030153	1.14			0.0288375	1.08
Married			0.4176686	1.27			0.420615	1.28
Years in agriculture			−0.0055407	−0.75			−0.0056923	−0.77
Land size					0.0067741	1.44	0.0066482	1.41
Constant	0.5564597	1.84	−0.2894752	−0.50	0.4159409	1.31	0.4159409	−0.70

(b) Propensity score matching (dependent variable: per capita income from agriculture)

	No. of treatment	No. of control	ATT	*t*-stat
Model 1	180	180	4.507	3.573
Model 2	180	180	4.293	2.836
Model 3	180	180	4.951	3.959
Model 4	180	180	4.951	3.181

*No. of obs. = 360, LR χ^2 (4) = 7.61, Prob > χ^2 = 0.1069, Pseudo R^2 = 0.0152, Log likelihood = −245.72776.
†No. of obs. = 360, LR χ^2 (7) = 11.03, Prob > χ^2 = 0.1375, Pseudo R^2 = 0.0221, Log likelihood = −244.02013.
‡No. of obs. = 360, LR χ^2 (7) = 9.68, Prob > χ^2 = 0.0850, Pseudo R^2 = 0.0194, Log likelihood = −244.69519.
§No. of obs. = 360, LR χ^2 (7) = 13.01, Prob > χ^2 = 0.1114, Pseudo R^2 = 0.0261, Log likelihood = −243.02714.
ATT is the average treatment of the treated. Regressors in the ATT estimate are dummies for FT-affiliated producers, land size, [land size]^2 for models 1 and 3, with the addition of temporary employees in models 2 and 4. The balancing property is satisfied. Standard errors with bootstrapping and 50 replications.
Variable legend: see Appendix.
FT, Fair Trade.

6.2. Econometric findings on the FT affiliation effect

As clearly shown when describing the Green Net project, organic certification anticipates affiliation to FT, which only started in 2002. The specifications presented in Table 3 are therefore re-estimated by replacing years of organic certification with those of FT affiliation. This corresponds to rescaling the previous variables by introducing an upper bound of 6 years for all farmers with organic certification for more than 6 years.

The empirical findings from this new specification show that FT affiliation years are significant and stronger in magnitude (Table 5).

In the base estimate, the magnitude of the effect is larger than the organic certification effect (1350 baht per year) and rises to 1458 when the FT

Table 5 The effect of FT affiliation years on per capita household income from agriculture (thousands of baht)

	OLS				Instrumental variable (2SLS)	
	Dependent variable: per capita household income from agriculture				Instrumented variable: FT affiliation years	
	Equation 1	Equation 2	Equation 3	Equation 4	Equation 5	Equation 6
Control cooperatives group	3.14652* (2.199)	3.152634* (2.198)	3.04989* (2.0939)	2.695405 (1.835)	26.38337 (1.743)	23.33963 (1.947)
Area 1	−7.18528** (−5.527)	−7.483749** (−5.044)				
Area 2			6.524948** (4.264)	6.683946** (4.357)	9.308472** (4.061)	9.012142** (4.338)
Ft years	1.350382** (5.586)	1.45805** (3.619)			5.80117* (2.050)	5.218551* (2.312)
Temporary employees	0.0135053 (0.1079)	0.0162447 (0.130)	0.0058999 (0.047)	0.00071 (0.006)	0.0056845 (0.041)	0.0092844 (0.068)
Land size	0.3441327** (6.990)	0.3436279** (6.951)	0.346097** (6.942)	0.3494768** (7.018)	0.3133825** (5.255)	0.3177537** (5.289)
Ft premium		−0.0002308 (−0.327)		−0.0023215* (−1.99)		
Ft years 1			1.20334** (3.594)	1.653129** (4.159)		
Ft years 2			1.450869** (4.544)	2.966236** (3.269)		
Constant	0.1245096 (0.028)	0.2846922 (0.062)	−6.588748 (−1.466)	−5.947474 (−1.334)	−27.64499 (−1.899)	−25.15812* (−2.036)
No. of obs.	358	358	358	358	294	294
P-value (overall goodness of fit)	6.03e-18	3.53e-18	1.35e-19	1.90e-20	2.57e-13	1.45e-13
Endogeneity test						
Robust score χ^2					3.3048	4.61158
P-value					0.691	0.0318

Table 5 (*Continued*)

	OLS				Instrumental variable (2SLS)	
	Dependent variable: per capita household income from agriculture				Instrumented variable: FT affiliation years	
	Equation 1	Equation 2	Equation 3	Equation 4	Equation 5	Equation 6
Tests of weak identification						
Weak Identification Test: *F*-stat					8.614	2.988
Weak-Instrument-Robust inference						
Score χ^2					5.227	9.010
P-value					0.0222	0.0292
Overidentification test						
Score χ^2 (2)						1.640
P-value						0.441

Coefficients and *t*-stats; **1 per cent significance, *5 per cent significance. Age, number of children, years in agriculture, school years, gender and marital status are included in all estimates. All estimates are with heteroskedasticity robust standard errors. Instrumented variable: FT years. Instruments: distance from cooperative (equation 5); distance from cooperative, positive exogenous events, negative exogenous events (see Section 5 for a list) (equation 6).
Tests of endogeneity: Wooldridge's (1995) robust score test. H_0: the instrumented variable is exogenous.
Test for weak identification: *F* statistic (I stage).
Weak-Instrument-Robust inference Test – Anderson and Rubin (1949): H_0: coefficients of the endogenous regressors in the structural equation are jointly equal to zero. The test is robust to the presence of weak instruments.
Test of overidentifying restrictions: Sargan (1958). Variable legend: see Appendix.
FT, Fair Trade.

premium is introduced (Table 5, columns 1–2). The latter corresponds to around 3.5 per cent of the current average income from agriculture in the control sample. It is significant when calculated separately in the two areas (Table 5, columns 3–4) and remains so in the instrumental variable estimate (Table 5, columns 5–6). The single instrument equation does not reject the null of exogeneity, while the multiple instrumented equation does so. Furthermore, when only distance from the cooperative is used as an instrument (Table 5, column 5), the *F*-statistics of the excluded instrument is quite close to the 10 per cent threshold, providing some evidence against weaknesses. In contrast, the specification in which more than one instrument is used (Table 5, column 6) does not perform well under the weak instrument identification test, because the *F* of the excluded instrument is small enough to reject the null of weakness.

When the sample is restricted to affiliated farmers, the 1-year effect magnitude is stronger and remains significant after correcting for the 2008 FT premium (Table S3 in Appendix S1, columns 1–2), unlike what happens when the organic certification effect is measured (Table S3, columns 1–2).

The FT and organic certification years are obviously highly correlated (0.92). However, it is possible to test directly whether one of the two effects prevails over the other in two ways: (i) by estimating the base and the restricted model with both variables and (ii) by using the Davidson and McKinnon (1993) test described in Section 2. The test clearly shows that the FT affiliation effect is stronger. The predicted dependent variable from the FT affiliation estimate is significant at 5 per cent in the organic certification estimate (Table 6, column 3), however the predicted dependent variable from the organic certification estimate is not significant in the FT affiliation estimate (Table 6, column 2).

7. Interpretation of empirical findings

To sum up, the results presented earlier document that FT affiliation affects the creation of economic value more than do organic certification years. This may be partly due to the double bonus of FT (a price premium directly granted to farmers and a premium granted to the organisation to be invested for innovation and the provision of local public goods). And it may also partly depend on marketing gains generated by FT. In this regard, consider that affiliated producers sell a significantly higher share of their Jasmine rice production (83 against 72 per cent of control sample producers), while there are no significant differences between the two groups in family size and in the share of self-consumed rice (100 per cent for both).

Note, however, that when the estimates discussed in Section 6 are repeated using total productivity or income from agriculture per worked hours, no significant effect of organic farming or FT affiliation years is found.[12]

[12] Estimates are omitted for reasons of space and available upon request.

Table 6 Organic certification versus FT affiliation years (Davidson–McKinnon Test)

Davidson–McKinnon Test OLS estimates with RSE Dependent variable: per capita household income from agriculture (thousands of baht)			
	Equation 1	Equation 2 (Predicted Var.: dependent variable in the organic certification years OLS model)	Equation 3 (Predicted Var.: dependent variable in the FT years OLS model)
Area 1	−7.260584** (−5.342)		
Area 2		6.169198 (1.815)	0.9224076 (0.264)
Control cooperatives group	3.141594* (2.194)	2.835254 (1.675)	0.366031 (0.203)
Ft years	1.19118* (2.136)	1.34145* (2.021)	
Certification years	0.1196139 (0.306)		0.1196141 (0.306)
Temporary employees	0.0116371 (0.093)	0.0103923 (0.0832)	−0.0002759 (−0.002)
Land size	0.3441203** (6.966)	0.2932195 (1.714)	0.0405589 (0.267)
$\bar{y}$ (organic certification years model)#		0.1461367 (0.306)	
$\bar{y}$ (FT affiliation years model)†			0.8821057* (2.136)
Constant	0.2786064 (0.062)	−6.075801 (−1.147)	−0.7536317 (−0.137)
No. of obs.	358	358	358
P-value (overall goodness of fit)	7.54e-18	8.24e-18	9.34e-18

#Predicted dependent variable from model in column 3 when excluding $\bar{y}$ (FT affiliation years) from the estimate.
†Predicted dependent variable from model in column 2 when excluding $\bar{y}$ (FT certification years) from the estimate.
Coefficients and *t*-stats; **1 per cent significance, *5 per cent significance. All estimates are with heteroskedasticity robust standard errors. Age, number of children, years in agriculture, school years, gender and marital status are included in all estimates.
Variable legend: see Appendix.
FT, Fair Trade.

The interesting question raised by empirical findings is therefore why affiliation years increase economic value and production yield without increasing productivity per worked hour.

Economic growth may derive from higher productivity or from an increase in worked hours. Here, the latter case applies, because affiliated workers do not record hours worked per day significantly different from those of control workers, but work 20 days more per year on average in agriculture (151 against 131). Moreover, hours worked increase with affiliation years. Farmers below the median affiliation year work on average 1461 h per year compared with the 1723 h worked by those above the median.

In the light of the two different branches of the empirical literature on FT and organic farming effects, empirical findings suggest the overall balance in terms of productivity and creation of economic value is not unfavourable for organic farmers. This is a substantial finding if one considers past results in

the literature (see the Introduction and footnote 5) and the productivity slowdown of the postconversion learning period. Another important result is that FT affiliation generates progressive growth in per capita income from agriculture in the sample. The findings on both effects are stronger when income generated by self-consumption is incorporated into producers' income. When comparing the relative strength of the two (organic and FT certification) effects, FT certification seems to prevail.

Finally, consider that the three findings mentioned in this section (increase in per capita income from agricultural activity, more hours worked, and not significantly different productivity) do not conflict with a positive productivity effect of organic and FT affiliation if one assumes that (i) the law of decreasing marginal productivity operates, (ii) marginal costs do not change and (iii) in equilibrium, farmers choose their optimal number of worked hours in agriculture so that marginal productivity and marginal costs per worked hours are equal. If these assumptions hold, it may well be that the initial effect of FT is one of increasing productivity and that this initial effect induces farmers to increase hours worked in agriculture up to a point at which, because of the law of decreasing marginal productivity, equilibrium is re-established. As a consequence, no significant differences in productivity are observed, but rather more hours worked and higher income from agriculture.

8. Conclusions

The paper has investigated the nexus between FT affiliation and farmers' income on a sample of Thai organic rice producers working for the Green Net cooperative.

The econometric findings show that any additional affiliation year has a positive and significant effect on the income from agriculture of the affiliated producers in the sample. This effect does not translate into significantly higher productivity because affiliated workers tend to work progressively more hours. Obtained findings are robust when controlling for endogeneity and selection bias with instrumental variable estimation, propensity score evaluation and restriction of the estimate to affiliated producers only, when considering FT (and not organic) affiliation years. These results still hold when the invisible part of self-consumed income is accounted for.

Empirical findings induce us to agree with the conclusion of a FAO working paper (Liu 2009) which, in regard to a case study on bananas, states that the FT choice 'is the one that yields the highest FOB prices and export/retail price ratio, above conventional and even organic bananas.' and that 'Another advantage of the Fairtrade standard is that it does not raise much the costs of production. For small-scale growers seeking to improve their incomes, Fairtrade certification seems to be the most profitable option provided they can meet FLO's requirements'. The policy suggestion is that international institutions and local authorities should inform farmers (i.e. with instruction

manuals as in a FAO project) about the opportunities available to them and how they can enter the FT value chain.

More in general, following the guidelines set out in the European Parliament report on FT and Development (European Parliament 2005), it is reasonable to assume that the potential of FT could be enhanced with the promotion of education programs intended to raise awareness of the merits of FT and with special consideration made of FT products in public procurement by regional authorities.

On the other hand, it is of utmost importance that international institutions liaise with the international FT movement in supporting clear and widely applicable criteria and in promoting a culture of impact evaluation to assess the effects of FT principles and enhance their effectiveness in promoting the capacity building and market access of affiliated farmers. This is also what we have sought to do with the research presented in this paper.

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Appendix Variable legend

Variables	Description	Variables	Description
Area 1	Dummy: 1 if respondents live in Kud Chun	Employee daily wage	Temporary employees' daily wage (baht)
Area 2	Dummy: 1 if respondents live in Bak Reua	Investment in input	Investment in input during last year (baht)

Appendix (*Continued*)

Variables	Description	Variables	Description
Affiliation dummy	Dummy: 1 if respondents are affiliated to FT	Male	Dummy: 1 if respondents are male
Age	Respondents' age (years)	Married	Dummy: 1 if respondents are married
Control cooperatives group	Dummy: 1 if respondents are members of cooperatives but are not FT-affiliated	Divorced	Dummy: 1 if respondents are divorced
School years	Years of school attendance	Unmarried	Dummy: 1 if respondents are unmarried
Number of children	Number of children	Certification years	Number of organic certification years
People in the household	Number of people living in the household other than the respondent	Certification years 1	Certification years in area 1 (Kud Chun)
Family food consumption	Household's food expenditure in a week (baht)	Certification years 2	Certification years in area 2 (Bak Reua)
Durables owned	Sum of durables owned by respondents (Baht)	FT years	Number of FT affiliation years
Cooperatives price	Price of Jasmine rice paid by local cooperatives (Baht/kg)	FT years 1	FT years in area 1 (Kud Chun)
Other buyers price	Price of Jasmine rice paid by other buyers (Baht/kg)	FT years 2	FT years in area 2 (Bak Reua)
Cooperatives advance payments	Advance payment from local cooperatives (Jasmine rice) (Baht/kg)	FT price	Fair Trade price for Jasmine price (Baht/kg)
		Ft premium	Difference between FT price and the price payed by local cooperatives (Baht/kg)
Self-consumption (per year)	Value of self-production (baht per year)	Total productivity	Total income per hour worked (baht)
Years in agriculture	Working years in agriculture	Productivity 1st activity	Respondents' income from agriculture per hour worked (baht)
Income from agriculture	Respondents' yearly income in agriculture (baht)	Productivity 2nd activity	Respondents' income from second activity per hour worked (baht)
Total income	Respondents' yearly income from the main and the second activity (baht)	Debt/income	Family debt to income ratio
Family income	The sum of the yearly income earned by all members of the household (baht)	Saving/income	Last year saving as a percentage of income
Temporary employees	Number of the respondents' temporary employees	Land size	Total land size (rai)

Appendix (*Continued*)

Variables	Description	Variables	Description
Number of positive exogenous events	Number of exogenous events having a positive impact on respondents' income (i) increase in the paddy rice market price, (ii) a positive shock on production, (iii) present from farmer's child (e.g., money, car), (v) wage shock in the second activity, (vi) lottery win and (vii) granting of awards. (The threshold for production, price and wage shocks is 20% change with resapect to the previous year)	Number of negative exogenous events	The number of exogenous events having a negative impact on respondents' income (i) close relative's death, (ii) disease, (iii) car accident, (iv) fire, (v) car break down, (vi) an increase in the input market price, (vii) the death of animals used as capital investment (such as water buffalos) and (viii) negative production shock (The threshold for production, price and wage shocks is 20% change with respect to the previous year)
Distance from cooperatives	Distance from cooperatives (kilometres)		

Supporting Information

Additional Supporting Information may be found in the online version of this article:

Appendix S1. Supplementary empirical evidence.

Table S1. Confidence intervals of selected variables for FT producers, the control sample and the whole sample.

Table S2. The effect of organic certification years on per capita household income from agriculture (sample restricted to affiliated producers) (thousand baht).

Table S3. The effect of FT affiliation years on per capita household income from agriculture (sample restricted to affiliated farmers) (thousand baht).

Table S4. The effect of Certification years and FT years on per capita income when self-consumption* is accounted for.

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