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IS ORGANIC AGRICULTURE AND FAIR TRADE CERTIFICATION A WAY OUT OF CRISIS? EVIDENCE FROM BLACK PEPPER FARMERS IN INDIA

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Abstract

This article examines the impact of a joint organic and fair trade certification on productivity and material costs based on data collected from 277 smallholder black pepper farmers in India. We estimate a multinomial endogenous switching regression along with a counterfactual analysis to ascertain the effects of certification. Our results indicate that certified farmers have higher yields. Counterfactual study shows that conventional farmers can increase their yields by 35% with less than half the costs by venturing into organic and fair trade networks. Further, treatment and transitional heterogeneity effects reveal that a joint organic and fair trade certification has the strongest effect on productivity for the less successful farmers.

Keywords: impact evaluation, multinomial endogenous switching regression, organic, fair trade

1 Introduction

Global debates on sustainable agriculture have brought alternative farming systems like organic agriculture and fair trade to the forefront. While organic certification focuses on production methods, fair trade is concerned with agricultural marketing. Both these certified systems critique conventional agriculture and claim to follow eco-friendly cultivation and ethical aspects of trade respectively (RAYNOLDS 2000). In the recent decades, organic and fair trade certification schemes have captured the willingness to buy of the environmentally conscious and morally motivated consumer; threatening to break out of its current niche markets. This is reflected in the worldwide sales of these products. The organic market witnessed a five-fold increase in revenues since 1999 and reached 72 billion USD in 2013 (FIBL and IFOAM 2015). Similarly, money spent on fair trade products increased 15% from 2012 to global sales of 5.5 billion euros in 2013 (FAIRTRADE INTERNATIONAL 2014). Moreover, many studies have reported that such certifications improve smallholder producer livelihoods (e.g. BACON, 2005; KLEEMANN and ABDULAI, 2013; PARVATHI and WAIBEL, 2015)

Yet, the principal objection towards certified systems like organic agriculture is low yields (DE PONTI et al., 2012). This is reinforced by SEUFERT et al. (2012) in their seminal paper wherein they find that organic yields are lower than conventional crop yields. On the contrary, PIMENTEL et al. (2005) argues that yields of organic and conventional crops are almost similar and organic crops perform better during droughts. Also, BADGLEY et al. (2007) suggests that not only can organic production feed the world but also that the current agricultural land base could eventually be reduced if such eco-friendly production methods were widely adopted. But, crop yields depend on input costs of fertilizers and pesticides as pointed by BRUNELLE et al. (2015). Although, organic farming systems are traditionally known for its cheaper inputs (SEUFERT et al., 2012), many organic farmers increasingly buy organic fertilizers and pesticides making inputs expensive (VALKILA, 2009; BEUCHELT and ZELLER, 2011). However, many smallholder organic farmers may not be able to afford these costs. Hence, they may limit application of high cost organic inputs resulting in lower yields. Therefore, it is important to understand the impact of such certification systems on material input costs. Yet,

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only few studies compare organic and conventional in terms of input costs (e.g. TZOUVELEKAS et al., 2001; GÜNDOĞMUŞ, 2006; PIMENTAL et al., 2005; VALKILA, 2009). Moreover, most of these studies on yield and material input costs do not control for selection bias. Besides, literature does not discuss in detail whether organic farmers also having a fair trade certification are better producers. Although fair trade is focused on agricultural trade aspects and labor conditions of workers, it does have the possibility to affect efficiency of the smallholders indirectly through its social standards (PARVATHI and WAIBEL, 2013). For example, the ease of credit access under fair trade schemes can help meet input costs (BACON, 2005). Therefore, a joint organic and fair trade certification can influence smallholder crop productivity. Nonetheless, these aspects are yet to be widely discussed in agricultural literature. Hence, our study attempts to build this gap in literature by examining whether a joint adoption of organic and fair trade certification can increase yield and reduce costs.
In this context, we study the black pepper crop in India which has been floating in troubled waters since 2003 (HEMA et al., 2007). The declining pepper yields along with soil fertility problems, pests, high input costs and fluctuating market prices has made black pepper farming unremunerative for domestic producers. Consequently, this pushed many smallholder black pepper farmers to venture into alternative system of agriculture like organic and fair trade. Hence this makes it an interesting case study to understand if certification systems can pave a way out of crisis. Thus, the main objective of this article is to examine the impact of a joint adoption of organic and fair trade certification by smallholders on black pepper yields and material input costs. Also, methodologically this article contributes to the counterfactual analysis literature. We follow CATER and MILON (2005) and DI FALCO, VERONESI and YESUF (2010) and expand on their binary counterfactual model to assess base and transitional heterogeneity effects to a multinomial model. Results from the counterfactual analysis show that conventional farmers can increase yields at reduced costs by adopting joint organic fair trade certification. Heterogeneity effects indicate that a joint organic fair trade certification is most essential for those farmers who were less high-yielding when they ventured into certified farming systems.

2 Study Area

Kerala state produces 80 - 90% of the total pepper production in India (SPICES BOARD OF INDIA, 2009). Pepper farming is the major source of income for around two million households in this region (HEMA et al., 2007). In Kerala, the mountainous region of Idukki district has the largest area under pepper cultivation and is also the largest black pepper producing district in the state (ESD, 2013). Hence, Idukki district is chosen as our study area. In Idukki, the taluks[2] of Udumbanchola and Peerumedu were non-randomly selected as they grow majority of the pepper in the district. It also needs to be noted that both these regions share similar climatic conditions, rainfall and topography. A cross-section data from 277 smallholder black pepper households was collected in 2012. The data pertains to previous production year 2011.

A list of smallholder conventional pepper farmers were obtained from the agricultural office of Idukki district. With regard to certified farmers, the details were collected from a local non-government organisation (NGO) promoting organic agriculture and fair trade certification. Thereby, we have three farm management regimes namely, (1) conventional, (2) organic and (3) organic and fair trade. Hence, using stratified random sampling data was collected from 90 conventional, 98 organic and 89 joint organic and fair trade certified farmers resulting in a total sample of 277 farmers.

[2] Taluk is an administrative division of the district. It is like an entity of the local government and has certain fiscal and administrative powers over the villages and municipalities coming under its jurisdiction

A household survey questionnaire was used to draw information on household characteristics, agricultural activities, off-farm employment, asset endowments and credit access. It was noted from the data that although pepper was the major crop produced, all surveyed farm households followed mixed cropping. Almost all farm households intercropped pepper with coffee and cardamom. The second major crop produced by conventional households was cardamom followed by coffee. While both the categories of certified households produced coffee as their second major crop followed by cardamom. Also, it was observed that in the data collected that there was no partial organic certification among organic and the joint organic and fair trade certified farmers. The entire land area was certified organic.

3 Methodology

To account for endogeneity and self-selection bias, we apply a multinomial endogenous switching regression along with a counterfactual analysis following DI FALCO and VERONESI (2013) and TEKLEWOLD et al. (2013). It is a two-step model. First, we use a selection equation to correct for multinomial selection bias and use the selection correction terms generated from the multinomial logit model as generated regressors in the regression. Second, we implement a counterfactual analysis to estimate the yield and cost impact of certified farmers in case they were non-certified and vice-versa.

3.1 Modelling selection and outcome equations

In this article, the farm household is confronted with no certification option and two certification options namely; organic and joint organic and fair trade. We define the chosen system of pepper farming of the household as: s = 1 if no certification is chosen or the household follows conventional farming, s = 2 if organic certified pepper farming is chosen and s = 3 if joint organic and fair trade certified pepper farming is practised. Hence, a household will choose a farming system 3 if this system helps in maximising yield and reducing costs over another farming system r (BOURGUIGNON, FOURNIER and GURGAND 2007). We state this in terms of a multinomial logit model as a selection equation following MCFADDEN (1973).
Then an ordinary least square regression (OLS) is estimated by including the selection correction terms calculated from the selection equation entering the OLS as generated regressors. We use the same multinomial selection equation that identifies the drivers of adoption of organic and fair trade certification by smallholder black pepper farmers for the yield and material input cost outcome regressions. However the explanatory variables used slightly vary between the yield and material cost outcome regressions. Drawing from Dubin and MCFADDEN (1984) and BOURGUIGNON, FOURNIER and GURGAND (2007) and applying the Normalized Dubin McFadden (DMF 2) model, the multinomial selection corrected OLS yield and cost equation are obtained. As using generated regressors can lead to heteroskedasticity, the standard errors are bootstrapped in the outcome regressions. Moreover, selection instruments based on falsification tests as suggested by DI FALCO, VERONESI and YESUF (2011) are included for the identification of the model. Falsification tests allow variables to be used as selection instruments if they affect the adoption of certification decision in the multinomial logit selection equation but not the yield or cost of black pepper produced by non-adopters or conventional farmers. Also, it needs to be noted that irrespective of the Independent of Irrelevant Alternatives (IIA) limitation of the multinomial logit model, BOURGUIGNON, FOURNIER and GURGAND (2007, p.199) state that “selection bias correction based on the multinomial logit model can provide a fairly good correction for the outcome equation, even when the IIA hypothesis is violated.”

3.2 Estimating and analysing counterfactual outcomes

In the second stage a counterfactual analysis is implemented to ascertain the yield and cost impacts of conventional farmers in case of certification and vice-versa drawing from CARTER and MILON (2005), DI FALCO and VERONESI (2013) and TEKLEWOLD et al. (2013) . For example, we ascertain the amount of black pepper quantity produced per hectare by organic farmers if they were conventional and vice-versa. Hence, as we have three farm management regimes, we have nine counterfactual cases as presented in table 1. Cases (3)(3), (2)(2) and (1)(1) refer to actual log quantity produced per hectare and actual log material input costs per hectare for joint organic fair trade, organic and conventional farmers respectively. Cases (3)(2) and (3)(1) show counterfactual yield and cost outcomes for joint organic fair trade farmers in case they were only organic and conventional respectively. Similarly cases (2)(3) estimates counterfactual yield and cost outcomes for organic farmers in case they were also fair trade certified and (2)(1) calculates the yield and cost outcomes for organic farmers if they were conventional. Correspondingly, cases (1)(3) and (1)(2) computes counterfactual yield and cost outcomes for conventional farmers if they were joint organic fair trade certified and if they were only organic certified respectively. We calculate ATT and ATU effects following HECKMAN et al. (2001). ATT is the average treatment effect on the treated. It shows the counterfactual difference in outcomes of joint organic fair trade farmers if they were organic as the difference between (3)(3) - (3)(2) and if they were conventional as the difference between (3)(3) - (3)(1). The counterfactual differential outcomes of organic farmers in case they were conventional is represented as (3)(3) – (3)(2). ATU refers to the average treatment effect on the untreated. It refers to the counterfactual outcomes of conventional farmers in case they were joint organic fair trade or only organic as (1)(3) - (1)(1) and (1)(2) - (1)(1) respectively. The counterfactual outcome of organic farmers in case they adopted fair trade is calculated as difference between (2)(3) - (2)(2). Drawing from CARTER and MILON (2005) and DI FALCO, VERONESI and YESUF (2010), we expand their binary counterfactual analysis model to calculate heterogeneity effects to a multinomial context. This is to understand if for example farm households that were certified may have produced more than conventional households not because they were certified but because of unobservable characteristics like farming management skill and efficiency. $BH_{3(A)}$ and $BH_{3(B)}$ denotes the base heterogeneity effects for the farm households that decided to adopt joint organic fair trade as the difference between {(3)(3) - (2)(3) } and {(3)(3) - (1)(3)} respectively. $BH_{3(C)}$ refers to the difference in base heterogeneity effects of organic and conventional farmers in case they were joint organic fair trade certified. It is calculated as the difference between {(2)(3) - (1)(3)}. Likewise, $BH_{2(A)}$ and $BH_{2(C)}$ refer to BH effects for joint organic fair trade certified and conventional households in case they were organic as the difference between {(3)(3) - (2)(2)} and {(2)(2) - (1)(2)} respectively. $BH_{2(B)}$ denotes the BH effects of joint organic fair trade certified households and conventional households in case they were organic as the difference between {(3)(2) - (1)(2)}. Equally, $BH_{1(B)}$ and $BH_{1(C)}$ refer to the BH effect for conventional households in case they were joint organic fair trade certified and only organic certified as the difference between {(3)(1) - (1)(1) } and {(2)(1) - (1)(1)} respectively. Also $BH_{1(A)}$ estimates the BH effects for joint organic fair trade certified households and only organic certified households in case they were conventional as the difference between {(3)(1) - (2)(1)}. We also finally estimate Transitional Heterogeneity (TH) effects to investigate if the effect of certification on yield and cost is larger or smaller for farm households that were certified or for those who were conventional in the counterfactual case they were certified as the difference between ATT and ATU. TH_1 shows the difference between the ATT of joint organic fair trade farmers in case they were only organic and the ATU of organic farmers in case they were joint organic fair trade certified as (a) – (d). TH_2 shows the difference between the ATT of joint organic fair trade farmers in case they were conventional and the ATU of conventional farmers in case they were joint organic fair trade certified as (b) – (e). TH_3 shows the difference between the ATT of organic farmers in case they were conventional and the ATU of conventional farmers in case they were organic certified as (c) – (f).

4 Results

The net revenue details from black pepper are presented in table 2. In terms of black pepper land the certified farmers have significantly larger land size compared to conventional farmers. The joint organic fair certified farmers are able to sell black pepper at a significantly better price in contrast to the other two categories. As found by BEUCHELT and ZELLER (2011) higher prices do not necessarily translate to high net revenues as yield and costs also play important roles. Organic farmers have significantly higher yields even in comparison to the joint organic fair trade certified farmers. This could be because during the survey year there was a severe pest attack in the region. But, organic farmers who have been practicing organic farming for less than a decade but more than 5 years appear to have been more resistant against the pest attack. Also as most of the organic farms were surrounded by other organic pepper farms or conventional coffee and tea farms the intensity of attack was probably lower. Whereas, the joint organic fair trade farms were mostly surrounded by conventional pepper farms which increased their exposure to pest attack. Although, ALTIERI and NICHOLLS (2003) find that organic farming can lead to better plant resistance against pest, we find that the joint organic fair trade farmers who have been committed to organic for more than a decade (table 2) seem to have been less resistant to pests. Literature is mixed regarding whether organic farming is associated with lower pest levels. CROWDER et al. (2010) based on potato field enclosure experiments claim that organic agriculture provides strong pest control and thereby lead to increased yields. But, they also suggest that these results may change outside field enclosures. On the contrary, MACFADYEN et al. (2009), find that there is no significant difference in pest control between organic and conventional agriculture among arable crops. Likewise, BENGTSSON et al. (2005) support the perception that pest damage is not different between organic and conventional farms. Our results indicate that organic farming with time may be less resistant to pest attacks and need more quantities of bio pesticides. Also farmers need adequate fertilizers and manure to maintain yield levels. All categories of farmers spent more on manure than fertilizers because they have a greater influence in increasing soil biological activity and thereby nutrients in the soil as found by EDMEADES (2003). Conventional farm´s reduced consumption of manure and fertilizers in comparison to certified category do not necessarily point to low levels of nutrient requirements in chemical agriculture. It signifies the possibility that these farmers may not have the means to buy adequate quantities of these inputs to increase yields and hence maybe rationing fertilizer and manure application (DUFLO et al., 2009). This also indicates that conventional farmers who also have smaller farm size may be considerably poorer than the certified groups. With regard to certified farmers, manure is an important ingredient to help improve soil quality in sustainable agriculture (KUMAR et al., 2005). As the joint organic fair trade farmers were facing severe pest attack they needed more manure to increase supply of nutrients to soil. But as our sampled farmers were smallholders, they did not have adequate capacity for producing sufficient quantities of own compost heaps (BRANCA et al., 2011). Hence, as most of this manure, bio fertilizers and bio pesticides were procured outside the farm it proved expensive and reduced net revenue from black pepper for the joint certified category. Total labor days are almost the same for conventional and organic farmers compared to the joint organic and fair trade farmers indicating that the joint certified category may be relatively more mechanized than the other groups. Nevertheless, all the categories of farmers reported labor shortage and increasing labor costs as found in other studies like UEMATSU and MISHRA (2012). This made it increasingly difficult especially for the certified farmers to make sufficient quantities of own composting heaps, making them dependent on external farm inputs.

Overall, organic farmers have the highest net revenue in spite of receiving the lowest selling price per kilogram of pepper. This can be attributed to high yields and low costs of organic pepper. Nevertheless, the higher yields of certified farmers in comparison to conventional can be attributed to the technical support and training provided by the NGO. It has made the farmers in the region aware and knowledgeable on the workings of alternative agriculture.

4.1 ATT, ATU and Heterogeneity effects: Yield

The treatment and heterogeneity yield effects are presented in table 3 following the methodology described in table 1. Columns (3)(3), (2)(2) and (1)(1) show the actual log quantity produced per hectare by the joint organic fair trade certified, the organic certified and the conventional farmers respectively. All other columns depict counterfactual outcomes. Columns (a), (b) and (c) present ATT effects and columns (d) (e) and (f) show ATU effects. As we express the quantity of black pepper produced per hectare in log form, we can interpret the results in percentage (Amare et al., 2012). ATT results show that the log yield of the joint certified organic fair trade farmers will significantly decline by 82% (column (b)) if they become conventional and by 103% (column (a)) if they drop fair trade certification. This confirms that those farmers who have chosen joint certification schemes have maximized their yield prospects through their farming strategy. In the case of organic farmers, ATT findings in column (c) indicate that their yield will fall by 68% if they start using chemical methods of farming. With regard to the ATU results of conventional farmers, we find that conventional farmers will increase their yield by 35% and 70% (column (e), (f)) by choosing a joint organic fair trade and organic methods of farming respectively. This indicates that conventional farmers will benefit from certified farming systems.
The Base Heterogeneity results $BH_{3(A)}$, $BH_{3(B)}$ and $BH_{3(C)}$, indicate that organic farmers under the counterfactual setting of adopting fair trade certification will perform better than existing joint certified farmers and conventional farmers if they adopted joint organic and fair trade certification in terms of yield. However, their current yield will decline as pointed out by the ATU results in column (d) though not significantly. $BH_{2(A)}$, $BH_{2(B)}$ and $BH_{2(C)}$ indicate that conventional farmers will gain the most if they venture into organic farming. They have some unobservable characteristics like faming skill that enable them to become more productive under the counterfactual setting in case they were organic. This is also confirmed by the ATU results in column (f). $BH_{1(A)}$, $BH_{1(B)}$ and $BH_{1(C)}$ depict that organic and conventional farmers have some unobservable characteristics that make them better farmers in comparison to the joint certified category. It also highlights that choosing a joint organic and fair trade certification has benefited the joint certified farmers in terms of yield outcomes. Transitional heterogeneity effect for TH_1 and TH_2 is positive indicating that the effects are significantly higher for the joint certified category in comparison to organic and conventional farmers respectively. Also, TH_3 is negative implying that the effect is smaller for organic farmers in comparison to conventional farmers though not significant. Overall, these results indicate that certified farming increases yield. Also, it needs to be noted that there are some important sources of heterogeneity that makes the joint certified farmers less productive under the counterfactual settings, in case they were organic or conventional. Hence, by opting for the joint certified farming system they seem to have made the right decision in terms of yield performance.

4.2 ATT, ATU and Heterogeneity effects: Cost

The material cost treatment and heterogeneity effects are depicted in table 4 following table 1. Similar to yield effects, column (3)(3), (2)(2) and (1)(1) show the actual log material input costs per hectare by the joint organic fair trade certified, the organic certified and the conventional farmers respectively. All other columns depict counterfactual outcomes. Columns (a), (b) and (c) present ATT effects and columns (d) (e) and (f) show ATU effects. As we also express input costs per hectare in log form, we interpret the results in percentage (Amare et al., 2012). ATT results show that the costs of the joint certified organic and fair trade farmers will significantly increase by 81% (column (b)) if they become conventional. However if they opt out of fair trade and retain organic their costs will decline (column (a)). This could be because as joint certified farmers have been practicing organic for a longer time period, with increasing years of practicing organic their yields may decline and to maintain their yields they need to invest more in manure, bio fertilizers and pesticides. In the case of organic farmers, ATT findings in column (c) indicate that their costs will fall by 120% if they start using chemical methods of farming. It indicates that bio fertilizers and pesticides if bought from outside can be expensive. With regard to the ATU results of conventional farmers, we find that conventional farmers can decrease their costs by choosing organic (column (f)) and significantly decrease costs by 150% (column (e)) by choosing a joint organic fair trade certification. This denotes that conventional farmers will benefit from certified farming systems but more so from a joint organic fair trade certification in terms of cost reduction. With regard to organic farmers, the ATU results indicate that their costs may increase if they venture into fair trade networks and it is currently favorable for them if they remain organic.

The Heterogeneity results $BH_{3(A)}$, $BH_{3(B)}$ and $BH_{3(C)}$, show that conventional farmers under the counterfactual setting of adopting joint organic fair trade certification will perform better than existing joint certified farmers and organic farmers if they adopted joint organic fair trade certification. Hence, it is conducive for conventional farmers to choose a joint organic fair trade certification if they want to decrease their costs of inputs. $BH_{2(A)}$, $BH_{2(B)}$ and $BH_{2(C)}$ indicate that conventional farmers will also gain if they venture into organic farming. However as indicated by the ATT results they will have a further significant decrease in costs if they venture into a joint organic fair trade system. $BH_{1(A)}$, $BH_{1(B)}$ and $BH_{1(C)}$ depict that organic and conventional farmers have some unobservable characteristics that make them better farmers in comparison to the joint certified category. It also highlights that choosing a joint organic and fair trade certification has benefited the joint certified farmers to reduce costs to a certain extent. Transitional heterogeneity effect for TH_1 is positive indicating that the effects are significantly higher for the joint certified category in comparison to organic farmers. It is also higher in comparison to conventional farmers though not significant (TH_2). Also, TH_3 is positive implying that the effect is larger for organic farmers in contrast to conventional farmers. To sum up, base heterogeneity results show that conventional farmers have some unobservable characteristics that enable them to produce at lower input costs in comparison to the other two groups even under a counterfactual setting. Also the positive transitional heterogeneity effects indicate that both the categories of certified farmers have chosen strategies that have helped them to minimize costs in comparison to a counterfactual setting.

5 Conclusions

The objective of this study was to examine whether a joint organic and fair trade certification can provide a light at the end of the tunnel. In this context, we investigated whether organic and fair trade systems can help to increase black pepper yields and lower material input costs to combat domestic pepper crisis in India. We use a cross-sectional household survey data of 277 smallholder black pepper farmers in Kerala, India to examine yield and cost effects of certification. We apply a multinomial endogenous switching regression that controls for selection bias along with a counterfactual analysis expanded to include heterogeneity effects to investigate certification impacts.

The main finding is that, contrary to conventional expectations, organic farming can increase yields and if combined with fair trade can also reduce costs. An interesting finding as revealed by the counterfactual analysis is that organic and fair trade adoption by conventional farmers would lead to higher yield gains and cost savings compared to the loss of organic and joint organic fair trade farmers had they not adopted their respective certifications. This suggests that both the categories of certified farmers, organic and the joint organic fair trade farmers have chosen agricultural strategies that would maximize their quantity of black pepper produced per hectare. Both these categories of farmers would have been less productive under a counterfactual setting. A key outcome of this article based on heterogeneity analysis is that the impact of certification on yield and material cost is larger for the joint organic and fair trade certified farmers implying that joint organic fair trade certified agriculture is more essential for those farm households who have less competence to produce. Therefore, joint organic fair trade certification can be used as a farming strategy by vulnerable households to close the gap with more productive smallholder households. Furthermore, overall results combining yield and costs effects indicate that conventional farmers can increase yields and reduce material input costs if they adopt a joint organic and fair trade certification. These yield results are in line with RUBEN and FORT (2012), VALKILA and NYGREN (2009) and BARHAM et al. (2011) and cost effects similar to VALKILA (2009) and BOLWIG et al. (2009). The major lesson learnt is that although organic black pepper farming in the initial years is resistant to pests and helps in increasing yields nevertheless with time it may become less resistant to pest attack leading to increasing input costs to maintain yields. Although conventional wisdom dictates that organic farming will build up the ecosystem with natural control and resilience, it is possible as suggested by PIMENTAL (1993) and PIMENTAL et al. (2005) that pest control under organic farming may be crop dependent and certain crops may be more susceptible to pests under chemical free agriculture. KLONSKY and TOURTE (1998) argues that although conventional and organic farms have the same amount of pests, organic farmers are better able to control diseases using biological pest control and bio pesticides. Also, organic farming increases the use of bio fertilizers manure and bio pesticides (KLEEMANN and ABDULAI, 2013). As the inputs when procured from outside the farm can be expensive, smallholder organic farmers with an added fair trade certification may be better equipped to meet these expenses with improved access to credit facilities under fair trade networks. Hence, conventional farmers may witness a moderate increase in yields and significant reduction in material input costs, as bio pesticides may be cheaper than synthetic, if they venture into joint organic fair trade regimes in the long run. Also, the yield increase and cost decline among certified producers can be perhaps attributed in this study to the technical assistance and guidance on alternative agricultural systems provided by the NGO.

Therefore, we submit that a joint organic fair trade certified agriculture does have the potential to help India increase its pepper productivity. Nevertheless, it is possible that certain crops are more suitable for organic cultivation than others (SINKKONEN, 2002). Therefore, crop specific studies may give different results. But farmers should have adequate knowledge of unconventional methods of farming and accessibility to necessary training and support to make organic and fair trade schemes a success for any crop. These findings are also relevant for designing effective strategies and programmes to promote certified organic and fair trade management regimes in other developing countries. Developing policies can be crucial in promoting implementation of such sustainable practices that help in increasing yield at reduced input costs. Furthermore, developing joint organic and fair systems as a strategy for the less productive farmers can play a critical role towards contributing to food security in the less developed world.

Table 1: Counterfactual Analysis: Treatment and Heterogeneity Effects

	Farm Management Regimes	(3) **OFT**	(2) **ORG**	(1) **CO N**	**ATT**	
					(a) *OFT to ORG*	(b) *OFT to CON*
(3)	**OFT**	$E(P_{h3} \mid P_h = 3) = X_h\alpha_3 + \delta_3 g_3$	$E(P_{h2} \mid P_h = 3) = X_h\alpha_2 + \delta_2 g_3$	$E(P_{h1} \mid P_h = 3) = X_h\alpha_1 + \delta_1 g_3$	(3)(3) - (3)(2)	(3)(3) - (3)(1)
						(c) *ORG to CON*
				$E(P_{h1} \mid P_h = 2) = X_h\alpha_1 + \delta_1 g_2$		(2)(2) - (2)(1)
					ATU	
(2)	**ORG**		$E(P_{h2} \mid P_h = 2) = X_h\alpha_2 + \delta_2 g_2$		(d) *ORG to OFT*	
		$E(P_{h3} \mid P_h = 2) = X_h\alpha_3 + \delta_3 g_2$			(2)(3) - (2)(2)	
					(e) *CON to OFT*	(f) *CON to ORG*
(1)	**CON**	$E(P_{h3} \mid P_h = 1) = X_h\alpha_3 + \delta_3 g_1$	$E(P_{h2} \mid P_h = 1) = X_h\alpha_2 + \delta_2 g_1$	$E(P_{h1} \mid P_h = 1) = X_h\alpha_1 + \delta_1 g_1$	(1)(3) - (1)(1)	(1)(2) - (1)(1)
	Heterogeneity Effects	$BH_{3(A)}$ = (3)(3) - (2)(3)	$BH_{2(A)}$ = (3)(2) - (2)(2)	$BH_{1(A)}$ = (3)(1) - (2)(1)	TH (ATT - ATU) TH_1 = (a) - (d) TH_2 = (b) - (e) TH_3 = (c) - (e)	
		$BH_{3(B)}$ = (3)(3) - (1)(3)	$BH_{2(B)}$ = (3)(2) - (1)(2)	$BH_{1(B)}$ = (3)(1) - (1)(1)		
		$BH_{3(C)}$ = (2)(3) - (1)(3)	$BH_{2(C)}$ = (2)(2) - (1)(2)	$BH_{1(C)}$ = (2)(1) - (1)(1)		

Note: OFT: Organic and Fair Trade, ORG: Organic, CON: Conventional, ATT: Average Treatment Effect on the Treated, ATU: Average Treatment Effect on the Untreated, BH: Base Heterogeneity and TH: Transitional Heterogeneity
Source: Adapted from Di Falco et. al. (2011), Modified

Table 2: Net Revenue from Black Pepper

Particulars	**Conventional**	**Organic**	**Conventional - Organic** (Mean Difference)	**Organic and Fair Trade**	**Conventional - Organic and Fair Trade** (Mean Difference)	**Organic - Organic and Fair Trade** (Mean Difference)
Pepper area (in ha)	0.276	0.419	- 0.143***	0.590	- 0.314***	- 0.171**
Average price /kg (in INR)	366.233	264.469	101.764***	387.348	- 21.115***	- 122.879***
Yield	642.933	1644.194	- 1001.261**	699.427	- 56.494	944.767**
Gross revenue / ha (in ´000 INR)	233.47	413.28	- 179.81*	267.45	- 33.98	145.83*
Variable costs						
Manure / ha (in ´000 INR)	3.01	22.97	- 19.96***	118.76	- 115.75***	- 95.79***
Fertiliser /ha (in ´000 INR)	0.15	0.12	0.03	3.42	- 3.27*	- 3.30*
Insecticide /ha (in ´000 INR)	3.25	0.01	3.24	3.77	- 0.52	- 3.76*
Fungicide / ha (in ´000 INR)	0.05	0.01	0.04	0.60	- 0.55	- 0.59
Total material input cost/ha (in ´000 INR)	6.46	23.11	-16.65**	126.55	-120.09***	-103.44***
Total labor days /ha	143.745	144.974	-1.229	62.805	80.940***	82.169**
Family labor days	132.487	132.917	-0.430	56.984	75.503***	75.933**
Hired labor cost (in ´000 INR)	10.83	8.58	2.25	5.11	5.72	3.47
Total variable cost (in ´000 INR)	17.29	31.69	- 14.40*	131.66	- 114.37***	- 99.97***
Net revenue from black pepper / ha (in ´000 INR)	216.18	381.59	- 165.41	135.79	80.39	245.80***
Years of organic farming	-	6		10		

Note: ***, ** and *significance at 1%, 5% and 10% respectively. Material inputs of certified farmers refer to organic fertilizers and pesticides.
Source: Own calculation based on household survey 2012

Table 3: Yield Effects from Counterfactual Analysis

	Farm Management Regimes	(3) **OFT**	(2) **ORG**	(1) **CO N**	**ATT**	
					(a) OFT to ORG	**(b) OFT to CON**
(3)	**OFT**	6.254 (0.060)	5.222 (0.109)	5.434 (0065)	1.032 *** (0.205)	0.820 *** (0.070)
						(c) ORG to CON
				5.876 (0.065)		0.687 *** (0.070)
(2)	**ORG**		6.563 (0.096)		**ATU**	
					(d) ORG to OFT	
		6.454 (0.058)			- 0.109 (0.073)	
					(e) CON to OFT	**(f) CON to ORG**
(1)	**CON**	5.927 (0.093)	6.273 (0.122)	5.569 (0.064)	0.358 *** (0.112)	0.704 *** (0.085)
	Heterogeneity Effects	$BH_{3(A)}$: - 0.200 ** (0.083)	$BH_{2(A)}$: - 1.341 *** (0.145)	$BH_{1(A)}$: - 0.442 *** (0.092)	TH (ATT - ATU)	
		$BH_{3(B)}$: 0.327 ** (0.111)	$BH_{2(B)}$: - 1.051 *** (0.164)	$BH_{1(B)}$: - 0.135 (0.091)	TH_1 : 1.141 *** (0.090) TH_2 : 0.462 *** (0.133) TH_3 : - 0.017 (0.110)	
		$BH_{3(C)}$: 0.527 *** (0.110)	$BH_{2(C)}$: 0.290 * (0.155)	$BH_{1(C)}$: 0.307 *** (0.091)		

Note: CON – conventional, ORG – organic and OFT – organic and fair trade. Standard errors in parenthesis. ***significant at 1%, **significant at 5% and * significant at 10% level (Follows table 1)
Source: Own calculation based on household survey 2012

Table 4: Cost Effects from Counterfactual Analysis

	Farm Management Regimes	(3) OFT	(2) ORG	(1) CO N	ATT	
					(a) OFT to ORG	**(b) OFT to CON**
(3)	**OFT**	9.379 (0.442)	8.181 (0.454)	10.194 (0.505)	1.198 *** (0.223)	- 0.815 * (0.442)
						(c) ORG to CON
				4.780 (0.482)		1.207*** (0.308)
(2)	**ORG**		5.987 (0.574)		**ATU**	
					(d) ORG to OFT	
		6.549 (0.522)			0.562 ** (0.183)	
					(e) CON to OFT	**(f) CON to ORG**
(1)	**CON**	0.555 (0.575)	1.721 (0.639)	2.062 (0.494)	- 1.507 *** (0.324)	- 0.341 (0.319)
	Heterogeneity Effects	$BH_{3(A)}$: 2.830 *** (0.684)	$BH_{2(A)}$: 2.194 ** (0.731)	$BH_{1(A)}$: 5.414 *** (0.699)	TH (ATT - ATU)	
		$BH_{3(B)}$: 8.824 *** (0.725)	$BH_{2(B)}$: 6.460 *** (0.783)	$BH_{1(B)}$: 8.132 *** (0.707)	TH_1 : 0.636 ** (0.288) TH_2 : 0.692 (0.548) TH_3 : 1.548 *** (0.444)	
		$BH_{3(C)}$: 5.994 *** (0.776)	$BH_{2(C)}$: 4.266 *** (0.860)	$BH_{1(C)}$: 2.718 *** (0.690)		

Note: CON – conventional, ORG – organic and OFT – organic and fair trade. Standard errors in parenthesis. ***significant at 1%, **significant at 5% and * significant at 10% level. (Follows table 1)
Source: Own calculation based on household survey 2012

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