

As You Sow, So Shall You Reap: The Welfare Impacts of Contract Farming

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Rising incomes and falling trades barriers over the last 60 years have made consumers in the industrialized world value greater food diversity and availability.

Likewise, with rising incomes in the developing world, supermarkets are expected to play an increasingly important role in providing consumers with a stable supply of a greater number of commodities.



Instead of relying on farm-gate sales and spot markets, supermarkets rely on supply chains in which commodities are produced under contract (Reardon and Berdegué, 2002; Reardon et al., 2003).

If the US offers any guidance as to what's in store for developing countries, 36% of all commodities in this country are produced under contract (IATP, 2010).



In addition, the growing popularity of Fair Trade labeling means that industrialized-country consumers are increasingly linked to developing-country producers – one can purchase Fair Trade commodities at Whole Foods, Tesco, Loblaws, and Carrefour.

Thus, contract farming – wherein a processing firm contracts its production of agricultural commodities out to smallholders – is playing a role of increasing importance in developing countries.



What are the impacts of contract farming on the welfare of smallholders?

Much has been written about the institution (Bijman, 2008; Barrett et al., 2010), but little is known about its welfare impacts.

Some perceive contract farming as a means of fostering industrial development driven by integrating smallholders in supply chains (Grosh, 1994), others view it as a means of labor exploitation by capitalists (Watts, 1994; Porter and Phillips-Howard, 1997).



This paper studies the impact of participation in contract farming on household welfare.

The main issue is that participation in contract farming is nonrandom, so naïve estimates of the impacts of contract farming on welfare are almost surely biased.

For example, suppose we want to know whether drinking orange juice daily has health benefits.



Those who drink orange juice daily are more likely to have adopted other healthful habits, which the researcher may not know about.

This would overestimate the health benefits of drinking orange juice daily. To get the true impact of orange juice consumption on health, we need an *instrumental variable*.

That is, we need a variable that is (i) uncorrelated with health outcomes but which is (ii) correlated with the consumption of orange juice.



Back to contract farming, this means that one must find a variable that

- 1. Is correlated with participation in contract farming, but
- 2. Which is also uncorrelated with welfare.

Without such a variable, estimated welfare impacts are biased, and policy recommendations are unlikely to be right.



Previous studies of this kind have used as IVs

- 1. Respondent trustworthiness (Warning and Key, 2002),
- 2. The number of organizations a respondent belongs to (Simmons et al., 2005), and
- 3. The distance between a respondent's and the village chief's farms (Miyata et al., 2007).



In all three cases, one can come up with credible reasons for why the IVs used are not exogenous.

The contribution of this paper lies in the way it identifies the impact of participation in contract farming on welfare.

The IV used in this context is a household's willingness to pay (WTP) to participate in contract farming, which is derived from a simple price experiment that conducted in the field.



The main problem is that participation in contract farming is not randomly distributed across individuals and households.

It could be that individuals who participate in contract farming own more land or they are wealthier, which one can easily control for.

But it could also be that more risk-averse or less entrepreneurial individuals could be the ones selecting into contract farming, which one cannot easily control for.



As was alluded to earlier, the identification of the welfare impacts of contract farming rests on an IV.

In this case, the IV is a nonparametric lower bound on each respondent's WTP for contract farming, which was elicited as follows.



Each respondent was asked:

"Would you be willing to enter a contract farming agreement for a crop that would necessitate an initial investment of [25,000-50,000-75,000-100,000-125,000-150,000 Ar.] but which would increase your income by 10% with certainty?,"

Where the initial investment was randomly generated by the throw of a die and covered the US\$12.50 to US\$75 range.



A respondent who says "Yes" to the above question is assigned a WTP equal to the random bid stated in the question.

A respondent who says "No" to the above question is assigned a WTP equal to zero.

In this sense, the WTP measure used here makes no distributional or functional form assumption.



- 1. This is a direct measure of respondent marginal utility for contract farming, so it controls for risk aversion, entrepreneurial ability, technical ability. It also controls for whether contract farming is a normal, inferior, luxury, etc. good.
- 2. A test of whether WTP is dependent on income indicates that it is not (p-value of 0.80) and that even if it were, the marginal impact of income on WTP is about five thousandths of a cent, or US\$0.00005.



3. Does the WTP measure suffer form cognitive dissonance? Perhaps, but it is unlikely given recent research at the intersection of psychology and economics that has invalidated almost every study that had previously found evidence in favor of the hypothesis that choices affect (rather than reflect) preferences (Chen, 2008).

In short, there are good reasons to believe WTP only affects welfare through participation in contract farming.



Collected between July and December 2008. Six regions were visited, three chosen from commune census data for their relatively high density of contract farming, the other three chosen on account of their being classified as highpriority "growth poles" by the World Bank.

In each region, the two communes with the highest density of contract farming were retained. Within each commune, 50 households were interviewed who participated in contract farming, and 50 households were interviewed who did not, for a total of 1200 households.



How is welfare defined in this context?

This paper first looks at total household income, household income per capita, and household income per adult equivalent both directly (i.e., mean) and indirectly (i.e., variance). It then looks at income net of contract farming revenues so as to capture potential spillover effects.

It finally looks at the duration of the hungry season experienced by the household as well as dummies for whether the household has received a formal (i.e., bank or MFI) and an informal loan.



Figure 1. Map of Madagascar. Numbers Denote Regions and Colors Denote Provinces. (Source: Per Johansson/Wikimedia Commons.)



Figure 2. Kernel Density Estimation of Household Income by Participation Regime with Epanechnikov Kernel and Bandwidth Set Equal to 0.5.



Figure 3. Kernel Density Estimation of Household Income Per Capita by Participation Regime with Epanechnikov Kernel and Bandwidth Set Equal to 0.5.



Figure 4. Kernel Density Estimation of Household Income Per Adult Equivalent by Participation Regime with Epanechnikov Kernel and Bandwidth Set Equal to 0.5.



Figure 5. Kernel Density Estimation of Household Income Net of Contract Farming Revenue by Participation Regime with Epanechnikov Kernel and Bandwidth Set Equal to 0.5.

Table 1. Regions, Communes, and Crops

Main Crops under Contract

Region	Commune	Primary	Secondary
Alaotra Mangoro (11)	Bejofo	Rice	-
	Feramanga North	Rice	Tomatoes
Analamanga (4)	Amboasary North	Rice	-
	Mangamila	Rice	Cassava
Anosy (22)	Ebelo	Rice	Cassava
	Andranobory	Maize	-
Diana (1)	Ambodibonara	Cotton	Sugarcane
	Anketrakabe	Rice	-
Itasy (3)	Miarinarivo I	Green Beans	Leeks
	Soavinandriana	Green Beans	Leeks
Vakinankaratra (5)	Morarano	Rice	Potatoes
	Betafo	Barley	Onions

Note: Numbers between parentheses in the first column refer to the region numbers on the map in figure 1.

Variable	Mean	(Std. Err.)
Contract Farming Participant Dummy	0.492	(0.015)
Household Demographic Characteristics		
Household Size (Individuals)	5.678	(0.068)
Dependency Ratio	0.447	(0.006)
Household Head Characteristics		
Female Dummy	0.080	(0.008)
Single Dummy	0.115	(0.009)
Migrant Dummy	0.130	(0.010)
Age (Years)	43.396	(0.363)
Education (Completed Years)	5.989	(0.098)
Agricultural Experience (Years)	20.363	(0.369)
Member of Peasant Organization Dummy	0.216	(0.012)
Forbidden Days	25.110	(1.030)
Household Welfare and Financial Characteristics		
Income (100,000 Ariary)	23.058	(1.583)
Income Per Capita (100,000 Ariary)	4.394	(0.282)
Income Per Adult Equivalent (100,000 Ariary)	5.421	(0.330)
Income Net of Contract Farming (100,000 Ariary)	21.006	(1.377)
Duration of Hungry Season (Months)	3.394	(0.062)
Obtained Formal Loan Dummy	0.140	(0.010)
Working Capital (100,000 Ariary)	6.508	(0.733)
Household Assets (100,000 Ariary)	14.334	(0.816)
Household Landholdings		
Total Landholdings (Ares)	169.276	(9.635)
Contingent Valuation (CV) Question		
Yeasayer (Answers "Yes" to CV Question) Dummy	0.732	(0.013)
Nonparametric Lower Bound on WTP (US Dollars)	28.215	(0.693)

 Table 2. Descriptive Statistics (n=1178)

Note: See section 3 for a discussion of how the WTP measure was estimated.

	Does Not Participate in Contract Farming (n=599)		Partic Contrac (n:	ipates in et Farming =579)	
Variable	Mean	(Std. Err.)	Mean	(Std. Err.)	Difference
Household Demographic Characteristic	:s				
Household Size	5.539	(0.095)	5.822	(0.095)	**
Dependency Ratio	0.448	(0.009)	0.445	(0.009)	
Female	0.102	(0.012)	0.057	(0.010)	***
Single	0.147	(0.014)	0.083	(0.011)	***
Migrant	0.124	(0.013)	0.136	(0.014)	
Age	44.225	(0.536)	42.539	(0.485)	***
Education	5.953	(0.139)	6.026	(0.138)	
Agricultural Experience	20.661	(0.555)	20.055	(0.485)	
Peasant Organization	0.154	(0.015)	0.280	(0.019)	***
Forbidden Days	26.676	(1.513)	23.491	(1.391)	*
Household Welfare and Financial Char	acteristics				
Total Income	17.352	(1.341)	28.961	(2.889)	***
Income Per Capita	3.459	(0.250)	5.360	(0.509)	***
Income Per Adult Equivalent	4.285	(0.310)	6.597	(0.587)	***
Income Net of Contract Farming	17.335	(1.340)	24.805	(2.427)	***
Duration of Hungry Season	3.591	(0.088)	3.191	(0.087)	***
Obtained Formal Loan	0.088	(0.012)	0.193	(0.016)	***
Working Capital	4.107	(0.502)	8.992	(1.392)	***
Assets	12.085	(1.114)	16.659	(1.188)	***
Total Landholdings	134.190	(10.514)	205.575	(16.181)	***
Contingent Valuation Question					
Yeasayer	0.674	(0.019)	0.791	(0.017)	***
Nonparametric WTP Lower Bound	25.292	(0.969)	31.239	(0.977)	***

Table 3. Descriptive Statistics by Participation Regime (n=1178)

Note: The acronyms AE and CF are short for "adult equivalent" and "contract farming", respectively. For each row, the last column presents the results of a *t*-test of the null hypothesis that the means are equal in both samples. The symbols ***, **, and * respectively denote a difference in means that is significant at the 1, 5, and 10 percent levels.

		(1)		(2)				
Variable	Coefficient		(Std. Err.)	Coefficient		(Std. Err.)		
	Exclue	ling Ir	ncome	Includ	ling In	come		
Dependent Variable: = 1 if	Participates in	Cont	ract Farming	; = 0 Otherwis	e.			
Household Size	0.031		(0.021)	0.029		(0.021)		
Dependency Ratio	-0.157		(0.211)	-0.142		(0.212)		
Single	0.096		(0.202)	0.105		(0.202)		
Female	-0.468	**	(0.234)	-0.466	**	(0.234)		
Migrant	0.081		(0.138)	0.080		(0.138)		
Age	-0.020	***	(0.007)	-0.020	***	(0.007)		
Education	-0.004		(0.014)	-0.007		(0.015)		
Experience	0.012	*	(0.007)	0.012	*	(0.007)		
Member of Peasant Organization	0.532	***	(0.110)	0.529	***	(0.110)		
Forbidden Days	-0.002		(0.002)	-0.002		(0.002)		
Income				0.003		(0.002)		
Working Capital	0.005		(0.004)	0.003		(0.004)		
Assets	0.001		(0.002)	0.001		(0.002)		
Landholdings	0.001	**	(0.000)	0.000	**	(0.000)		
Nonparametric WTP for Contract Farming	0.008	***	(0.002)	0.008	***	(0.002)		
Intercept	0.381		(0.271)	0.372		(0.270)		
District Fixed Effects		Yes			Yes			
p-value (Joint Significance)		0.000			0.000			
Pseudo R-square		0.075			0.076			

Table 4. Estimation Results for the First Stage of the Treatment Regressions (n=1178)

Note: These estimation results correspond to equation 3 in the body of the paper. Estimation results are probability-weighted. The symbols ***, **, and * respectively denote significance at the 1, 5, and 10 percent levels.

		(1)			(2)			(3)		
Variable	Coefficient		(Std. Err.)	Coefficient		(Std. Err.)	Coefficient		(Std. Err.)	
			Treatment	Regression			OLS			
	Depende	ent Va	riable:	Depend	ent Va	riable:	Depend	ent Va	ariable:	
	= 1 if Partici	pates i	in Contract]	Log of		Log of			
	Farming;	= 0 Ot	therwise	Income			Ι	9		
Household Size	0.033		(0.021)	0.046	***	(0.016)	0.054	***	(0.015)	
Dependency Ratio	-0.156		(0.212)	-0.093		(0.161)	-0.146		(0.148)	
Single	0.132		(0.205)	-0.159		(0.144)	-0.150		(0.140)	
Female	-0.491	**	(0.238)	-0.226		(0.174)	-0.338	**	(0.163)	
Migrant	0.087		(0.140)	0.008		(0.103)	0.026		(0.096)	
Age	-0.020	***	(0.007)	0.010	**	(0.005)	0.004		(0.004)	
Education	-0.007		(0.015)	0.069	***	(0.010)	0.068	***	(0.010)	
Experience	0.011		(0.007)	-0.004		(0.004)	-0.001		(0.004)	
Member of Peasant Organization	0.518	***	(0.108)	0.030		(0.094)	0.174	**	(0.072)	
Forbidden Days	-0.002		(0.002)	0.001		(0.001)	0.001		(0.001)	
Working Capital	0.006		(0.005)	0.007	***	(0.002)	0.007	***	(0.002)	
Assets	0.001		(0.003)	0.007	***	(0.002)	0.007	***	(0.002)	
Landholdings	0.001	**	(0.000)	0.000		(0.000)	0.000	*	(0.000)	
Contract Farming				1.038	***	(0.305)	0.362	***	(0.061)	
Nonparametric WTP for Contract Farming	0.008	***	(0.002)							
Intercept	0.370		(0.267)	0.268		(0.281)	0.773	***	(0.175)	
District Fixed Effects			Y	es				Yes		
Log Pseudo-Likelihood			-109	6.159				-		
p-value (Joint Significance)			0.0	000			0.000			
p-value (Test of Independent Equations)			0.0)33				-		
R-square				_				0 5 1 4		

Table 5. Treatment Regression and OLS Estimation Results for Household Income (n=1178)

Note: The estimation results in column 2 correspond to equation 1 in the body of the paper. Estimation results are probability-weighted. The symbols ***, **, and * respectively denote significance at the 1, 5, and 10 percent levels. Results in the first column are marginal effects.

		(1)			(2)		(3)			
Variable	Coefficient		(Std. Err.)	Coefficient		(Std. Err.)	Coefficient		(Std. Err.)	
			Treatment	Regression			OLS			
	Depend	ent Va	riable:	Depend	lent Va	riable:	Dependent Variable:			
	= 1 if Partic	ipates i	n Contract	Log	of Inc	ome	Log of Income			
	Farming	= 0 Ot	therwise	Pe	r Capi	ta	Per Capita			
Household Size	0.033		(0.021)	-0.133	***	(0.016)	-0.126	***	(0.015)	
Dependency Ratio	-0.161		(0.214)	-0.304	*	(0.162)	-0.350	**	(0.151)	
Single	0.122		(0.207)	0.052		(0.151)	0.060		(0.147)	
Female	-0.485	**	(0.240)	-0.379	**	(0.180)	-0.476	***	(0.167)	
Migrant	0.083		(0.140)	0.016		(0.101)	0.033		(0.095)	
Age	-0.020	***	(0.007)	0.009	**	(0.005)	0.005		(0.004)	
Education	-0.006		(0.015)	0.071	***	(0.010)	0.070	***	(0.010)	
Experience	0.011	*	(0.007)	-0.003		(0.004)	-0.001		(0.004)	
Member of Peasant Organization	0.518	***	(0.109)	0.048		(0.094)	0.172	**	(0.070)	
Forbidden Days	-0.002		(0.002)	0.001		(0.001)	0.001		(0.001)	
Working Capital	0.006		(0.005)	0.007	***	(0.002)	0.008	***	(0.002)	
Assets	0.001		(0.003)	0.006	***	(0.002)	0.007	***	(0.002)	
Landholdings	0.001	**	(0.000)	0.000		(0.000)	0.000	*	(0.000)	
Contract Farming				0.933	***	(0.331)	0.349	***	(0.061)	
Nonparametric WTP for Contract Farming	0.008	***	(0.002)							
Intercept	0.373		(0.268)	-0.228		(0.297)	0.209		(0.177)	
District Fixed Effects			Y	es				Yes		
Log Pseudo-Likelihood			-109	5.322				-		
p-value (Joint Significance)		0.000 0.000								
p-value (Test of Independent Equations)			0.0)86				-		
R-square				-				0.511		

Table 6. Treatment Regression and OLS Estimation Results for Household Income Per Capita (n=1178)

Note: Estimation results are probability-weighted. The symbols ***, **, and * respectively denote significance at the 1, 5, and 10 percent levels. Results in the first column are marginal effects.

		(1)			(2)		(3)			
Variable	Coefficient		(Std. Err.)	Coefficient		(Std. Err.)	Coefficient		(Std. Err.)	
			Treatment	Regression				OLS		
	Depend	ent Va	riable:	Depend	ent Va	riable:	Dependent Variable:			
	= 1 if Partic	1 if Participates in Contract			useholo	d Income	Log of Household Income			
	Farming;	Farming; = 0 Otherwise			ılt Equi	ivalent	Per Adult Equivalent			
Household Size	0.033		(0.021)	-0.127		(0.016)	-0.120	***	(0.015)	
Dependency Ratio	-0.158		(0.213)	0.235		(0.159)	0.189		(0.148)	
Single	0.122		(0.207)	0.053		(0.150)	0.061		(0.147)	
Female	-0.485	**	(0.240)	-0.368	**	(0.179)	-0.466	***	(0.167)	
Migrant	0.083		(0.140)	0.022		(0.101)	0.039		(0.095)	
Age	-0.020	***	(0.007)	0.008	*	(0.005)	0.003		(0.004)	
Education	-0.006		(0.015)	0.071	***	(0.010)	0.070	***	(0.010)	
Experience	0.011	*	(0.007)	-0.004		(0.004)	-0.001		(0.004)	
Member of Peasant Organization	0.519	***	(0.109)	0.052		(0.093)	0.177	**	(0.070)	
Forbidden Days	-0.002		(0.002)	0.001		(0.001)	0.000		(0.001)	
Working Capital	0.006		(0.005)	0.007	***	(0.002)	0.008	***	(0.002)	
Assets	0.001		(0.003)	0.006	***	(0.002)	0.007	***	(0.002)	
Landholdings	0.001	**	(0.000)	0.000		(0.000)	0.000	*	(0.000)	
Contract Farming				0.940	***	(0.323)	0.351	***	(0.061)	
Nonparametric WTP for Contract Farming	0.008	***	(0.002)							
Intercept	0.370		(0.268)	-0.197		(0.291)	0.243		(0.176)	
District Fixed Effects			Y	es				Yes		
Log Pseudo-Likelihood			-1094	4.555				-		
p-value (Joint Significance)		0.000 0.000								
p-value (Test of Independent Equations)			0.0)77				-		
R-square				-				0.493		

Table 7. Treatment Regression and OLS Estimation Results for Income Per Adult Equivalent (n=1178)

Note: Estimation results are probability-weighted. The symbols ***, **, and * respectively denote significance at the 1, 5, and 10 percent levels. Results in the first column are marginal effects.

		(1)			(2)		(3)		
Variable	Coefficient		(Std. Err.)	Coefficient		(Std. Err.)	Coefficient	Coefficient (S	
			Treatment	Regression				OLS	
	Depend	ent Var	iable:	Depend	ent Va	riable:	Depende	ent Va	riable:
	= 1 if Partici	= 1 if Participates in Contract			[ncome	Net of	Log of Income Net of		
	Farming;	Farming; = 0 Otherwise			armin	g Revenue	Contract F	arming	g Revenue
Household Size	0.031		(0.021)	0.057	***	(0.018)	0.067	***	(0.016)
Dependency Ratio	-0.152		(0.211)	-0.047		(0.183)	-0.116		(0.160)
Single	0.153		(0.224)	-0.246		(0.200)	-0.234		(0.184)
Female	-0.512	**	(0.251)	-0.088		(0.231)	-0.232		(0.198)
Migrant	0.087		(0.141)	-0.003		(0.120)	0.021		(0.109)
Age	-0.020	***	(0.007)	0.013	**	(0.006)	0.006		(0.004)
Education	-0.007		(0.015)	0.075	***	(0.011)	0.074	**	(0.010)
Experience	0.011	*	(0.007)	-0.005		(0.005)	0.000		(0.004)
Member of Peasant Organization	0.512	***	(0.111)	-0.031		(0.133)	0.154	*	(0.083)
Forbidden Days	-0.002		(0.002)	0.001		(0.001)	0.001		(0.001)
Working Capital	0.006		(0.005)	0.007	***	(0.002)	0.008	***	(0.002)
Assets	0.001		(0.003)	0.007	***	(0.002)	0.007	***	(0.002)
Landholdings	0.001	**	(0.000)	0.000		(0.000)	0.000	*	(0.000)
Contract Farming				0.854	*	(0.521)	-0.016		(0.069)
Nonparametric WTP for Contract Farming	0.007	***	(0.002)						
Intercept	0.391		(0.271)	-0.075		(0.454)	0.576	***	(0.203)
District Fixed Effects			Y	es				Yes	
Log Pseudo-Likelihood			-115	2.29				-	
p-value (Joint Significance)		0.000 0						0.000	
p-value (Test of Independent Equations)			0.1	13				-	
R-square			-					0.461	

 Table 8. Treatment Regression and OLS Estimation Results for Household Income Net of Contract Farming Revenue (n=1178)

Note: Estimation results are probability-weighted. The symbols ***, **, and * respectively denote significance at the 1, 5, and 10 percent levels. Results in the first column are marginal effects.

		(1)			(2)		(3)			
Variable	Coefficient		(Std. Err.)	Coefficient		(Std. Err.)	Coefficient		(Std. Err.)	
			Treatment	Regression				OLS		
	Depend	ent Var	riable:	Depend	ent Va	riable:	Depend	ent Va	riable:	
	= 1 if Partic	ipates iı	n Contract	Duration	n of Ho	usehold	Duration	of Ho	usehold	
	Farming	= 0 Ot	herwise	Hung	gry Sea	ason	Hungry Season			
Household Size	0.029		(0.021)	0.071	**	(0.036)	0.050		(0.036)	
Dependency Ratio	-0.158		(0.211)	0.444		(0.388)	0.576		(0.365)	
Single	0.110		(0.203)	-0.053		(0.361)	-0.078		(0.338)	
Female	-0.500	**	(0.234)	0.442		(0.430)	0.723	*	(0.400)	
Migrant	0.055		(0.140)	0.079		(0.246)	0.033		(0.216)	
Age	-0.020	***	(0.006)	0.010		(0.011)	0.024	**	(0.009)	
Education	-0.006		(0.015)	-0.071	***	(0.024)	-0.069	***	(0.022)	
Experience	0.012	*	(0.006)	-0.023	**	(0.010)	-0.032	***	(0.010)	
Member of Peasant Organization	0.531	***	(0.110)	0.463	*	(0.257)	0.104		(0.185)	
Forbidden Days	-0.002		(0.002)	-0.004		(0.002)	-0.003		(0.002)	
Income	0.004	**	(0.002)	-0.004	**	(0.002)	-0.004	**	(0.002)	
Working Capital	0.003		(0.003)	0.003		(0.003)	0.002		(0.003)	
Assets	0.001		(0.003)	-0.012	***	(0.003)	-0.013	***	(0.003)	
Landholdings	0.000	**	(0.000)	0.000		(0.000)	0.000		(0.000)	
Contract Farming				-1.988	**	(0.787)	-0.294	**	(0.142)	
Nonparametric WTP for Contract Farming	0.007	***	(0.002)							
Intercept	0.372		(0.268)	4.799	***	(0.749)	3.533	***	(0.433)	
District Fixed Effects			Y	es				Yes		
Log Pseudo-Likelihood			-1577	7.523				-		
p-value (Joint Significance)			0.0	00				0.000		
p-value (Test of Independent Equations)			0.0	37				-		
R-square			-					0.197		

Table 9. Treatment Regression and OLS Estimation Results for Hungry Season Duration (n=1178)

Note: Estimation results are probability-weighted. The symbols ***, **, and * respectively denote significance at the 1, 5, and 10 percent levels.

	_	(1) (2)					(3)			
Variable	Coefficient		(Std. Err.)	Coefficient		(Std. Err.)	Coefficient		(Std. Err.)	
			Treatment	Regression				OLS		
	Depend	ent Vai	riable:	Depend	ent Va	riable:	Depend	ent Va	riable:	
	= 1 if Partici	l if Participates in Contract			sehold	Received	= 1 if Household Received			
	Farming;	Farming; = 0 Otherwise			an; = 0	Otherwise	a Formal Loan; = 0 Otherwise			
Household Size	0.031		(0.021)	0.000		(0.005)	0.003		(0.004)	
Dependency Ratio	-0.128		(0.209)	-0.020		(0.046)	-0.039		(0.041)	
Single	0.121		(0.191)	-0.017		(0.041)	-0.013		(0.039)	
Female	-0.488	**	(0.228)	0.028		(0.050)	-0.012		(0.045)	
Migrant	0.098		(0.138)	0.003		(0.035)	0.010		(0.032)	
Age	-0.018	***	(0.007)	0.004	**	(0.002)	0.002		(0.002)	
Education	-0.010		(0.015)	0.014	***	(0.004)	0.014	***	(0.003)	
Experience	0.010		(0.007)	-0.003		(0.002)	-0.002		(0.002)	
Member of Peasant Organization	0.536	***	(0.110)	0.032		(0.029)	0.082	***	(0.028)	
Forbidden Days	-0.003	*	(0.002)	0.000		(0.000)	0.000		(0.000)	
Income	0.005	**	(0.002)	0.001		(0.001)	0.001		(0.001)	
Working Capital	0.005		(0.005)	-0.002	**	(0.001)	-0.002	**	(0.001)	
Assets	0.000		(0.002)	-0.001		(0.000)	0.000		(0.001)	
Landholdings	0.000	*	(0.000)	0.000	***	(0.000)	0.000	***	(0.000)	
Contract Farming				0.311	***	(0.063)	0.071	***	(0.019)	
Nonparametric WTP for Contract Farming	0.007	***	(0.002)							
Intercept	0.339		(0.267)	-0.312	***	(0.079)	-0.133	**	(0.058)	
District Fixed Effects			Y	es				Yes		
Log Pseudo-Likelihood			-456	.922				-		
p-value (Joint Significance)			0.0	000				0.000		
p-value (Test of Independent Equations)			0.0	000				-		
R-square				-				0.24		

Table 10. Treatment Regression and OLS Estimation Results for the Likelihood of Receiving a Formal Loan (n=1178)

Note: Estimation results are probability-weighted. The symbols ***, **, and * respectively denote significance at the 1, 5, and 10 percent levels.

Variable	ATE		(Std. Err.)
Income (US\$)	119.23	***	(1.871)
Volatility of Income (Percent)	-0.16	***	(0.057)
Income Per Capita (US\$)	30.35	***	(1.674)
Volatility of Income Per Capita (%)	-0.16	***	(0.058)
Income Per Adult Equivalent (US\$)	42.42	***	(1.651)
Volatility of Income Per Adult Equivalent (%)	-0.16	***	(0.058)
Income Net of Contract Farming Revenue (US\$)	91.20	***	(1.620)
Volatility of Income Net of CF Revenue (%)	0.025		(0.061)
Duration of Hungry Season (Months)	-1.99	**	(0.787)
Likelihood of Receiving a Formal Loan (%)	0.31	***	(0.063)
Note . The symbols *** ** and * respectively deno	te signific:	ance at	t the 1 5 and

Table 12a. Synthesis of Estimated ATEs on Welfare Outcomes (n=1178)

Note: The symbols ***, **, and * respectively denote significance at the 1, 5, and 10 percent levels.

Table 12b. Estimated ATEs for Growth Areas vs. Other Regions (n=1178)

		(1)		(2)			(3)
	Other Regions Growth Areas				Significance of		
			(Std.			(Std.	
Variable	ATE		Err.)	ATE		Err.)	(1) - (2)
Income (US\$)	126.899	***	(2.663)	111.020	***	(2.583)	***
Income Per Capita (US\$)	36.918	***	(2.372)	23.485	***	(2.327)	***
Income Per Adult Equivalent (US\$)	48.950	***	(2.333)	35.547	***	(2.301)	***

Note: The symbols ***, **, and * respectively denote significance at the 1, 5, and 10 percent levels. The results in column 1 (column 2) are for regions 3, 4, and 11 (1, 5, and 22) in figure 1.



Key Findings

Participation in contract farming directly increases welfare by increasing household income by 10%, income per capita by 14%, income per adult equivalent by 16%, and income net of contract farming revenue by 9%. This is in sharp contrast this with previous studies, which found estimates in the 32 to 48% range.

Participation in contract farming also increases the likelihood of receiving a formal loan, and it shortens the hungry season.



Key Findings

Lastly, participation in contract farming decreases the (crosssectional) volatility income by about 15%, with no such effect on income net of contract farming revenue. This suggests that the institution also has indirect impacts on welfare.

It also looks as though the welfare impacts of contract farming are positive. It also appears as though it is the (income-) poor who select into the institution.



Policy Implications

These findings indicate that policies that provide incentives for (i) processing firms to delegate their production of commodities to smallholders and (ii) smallholders to participate in agricultural value chains may contribute to alleviating poverty in this context.

These findings, however, say nothing about expanding contract farming activities to other regions, but a withinsample comparison of "growth poles" and areas where contract farming is common offers some hope.



Policy Implications

More concretely, policy makers could offer subsidies for processing firms to expand their contracting activities.

Policy makers could also target households headed by females, older individuals, less experienced individuals, and individuals who are not members of peasant organizations.

In Madagascar and elsewhere, many of these characteristics are associated with chronic poverty.

	(1)			(2)			
Variable	Coefficient		(Std. Err.)	Coefficient		(Std. Err.)	
	Exclud	ling Iı	ncome	Including Income			
Dependent Variable: = 1 if Participates in Contract Farming; = 0 Otherwise.							
Household Size	0.031		(0.021)	0.030		(0.021)	
Dependency Ratio	-0.187		(0.209)	-0.177		(0.209)	
Single	0.048		(0.203)	0.055		(0.203)	
Female	-0.457	*	(0.236)	-0.455	*	(0.236)	
Migrant	0.089		(0.137)	0.089		(0.137)	
Age	-0.021	***	(0.007)	-0.021	***	(0.007)	
Education	-0.002		(0.014)	-0.004		(0.015)	
Experience	0.012	*	(0.007)	0.012	*	(0.007)	
Member of Peasant Organization	0.528	***	(0.111)	0.527	***	(0.111)	
Fady Days	-0.002		(0.002)	-0.002		(0.002)	
Income				0.002		(0.002)	
Working Capital	0.004		(0.004)	0.003		(0.004)	
Assets	0.001		(0.002)	0.001		(0.002)	
Landholdings	0.001	**	(0.000)	0.000	**	(0.000)	
Nonparametric WTW for Contract Farming	0.106	**	(0.045)	0.104	**	(0.045)	
Intercept	0.500	*	(0.269)	0.499	*	(0.269)	
District Fixed Effects		Yes			Yes		
p-value (Joint Significance)		0.000			0.000		
Pseudo R-square		0.066			0.067		

Table A1. Estimation Results for the First Stage of the Treatment Regressions (n=1178)

Note: These estimation results correspond to equation 3 in the body of the paper. Estimation results are probability-weighted. The symbols ***, **, and * respectively denote significance at the 1, 5, and 10 percent levels.

	(1)			(2)		
Variable	Coefficient		(Std. Err.)	Coefficient		(Std. Err.)
			Treatment	Regression		
	Depend	lent Va	riable:	Depend	ent Va	riable:
	= 1 if Partic	ipates	in Contract]	Log of	
	Farming	; = 0 O	therwise	I	ncome	•
Household Size	0.033		(0.021)	0.044	***	(0.016)
Dependency Ratio	-0.169		(0.212)	-0.083		(0.165)
Single	0.087		(0.205)	-0.161		(0.147)
Female	-0.480	**	(0.240)	-0.204		(0.175)
Migrant	0.092		(0.139)	0.004		(0.105)
Age	-0.020	***	(0.007)	0.011	**	(0.005)
Education	-0.003		(0.014)	0.069	***	(0.010)
Experience	0.010		(0.007)	-0.005		(0.004)
Member of Peasant Organization	0.501	***	(0.109)	0.002		(0.091)
Forbidden Days	-0.002		(0.002)	0.001		(0.001)
Working Capital	0.005		(0.005)	0.006	***	(0.002)
Assets	0.000		(0.003)	0.007	***	(0.002)
Landholdings	0.001	**	(0.000)	0.000		(0.000)
Contract Farming				1.170	***	(0.234)
Nonparametric WTW for Contract Farming	0.131	***	(0.040)			
Intercept	0.424		(0.266)	0.170		(0.251)
District Fixed Effects			Y	es		
Log Pseudo-Likelihood p-value (Joint Significance of All Coefficients)			-1098	8.905 000		
p-value (Test of Independent Equations)			0.0	001		
R-square				_		

Table A2. Treatment Regression and OLS Estimation Results for Household Income (n=1178)

Note: The estimation results in column 2 correspond to equation 1 in the body of the paper. Estimation results are probability-weighted. The symbols ***, **, and * respectively denote significance at the 1, 5, and 10 percent levels. Results in the first column are marginal effects.

		(1)			(2)		
Variable	Coefficient		(Std. Err.)	Coefficient		(Std. Err.)	
			Treatment F	Regression			
	Dependent Variable: Dependent Variable						
	= 1 if Partic	ipates i	in Contract	Log	of Inco	me	
	Farming;	= 0 O	therwise	Pe	r Capit	a	
Household Size	0.034		(0.021)	-0.135	***	(0.016)	
Dependency Ratio	-0.176		(0.213)	-0.292	*	(0.166)	
Single	0.076		(0.209)	0.049		(0.153)	
Female	-0.475	*	(0.244)	-0.354	**	(0.178)	
Migrant	0.088		(0.139)	0.012		(0.103)	
Age	-0.020	***	(0.007)	0.011	**	(0.005)	
Education	-0.003		(0.015)	0.071	***	(0.010)	
Experience	0.011		(0.007)	-0.004		(0.004)	
Member of Peasant Organization	0.501	***	(0.109)	0.016		(0.088)	
Forbidden Days	-0.002		(0.002)	0.001		(0.001)	
Working Capital	0.005		(0.005)	0.007	***	(0.002)	
Assets	0.000		(0.003)	0.006	***	(0.002)	
Landholdings	0.001	**	(0.000)	0.000		(0.000)	
Contract Farming				1.086	***	(0.233)	
Nonparametric WTW for Contract Farming	0.129	***	(0.041)				
Intercept	0.430		(0.267)	-0.342		(0.251)	
District Fixed Effects			Yes	5			
Log Pseudo-Likelihood			-1098.	103			
p-value (Joint Significance)			0.00	0			
p-value (Test of Independent Equations)			0.00	3			
R_square			_				

Table A3. Treatment Regression and OLS Estimation Results for Household Income Per Capita (n=1178)

R-square - **Note:** Estimation results are probability-weighted. The symbols ***, **, and * respectively denote significance at the 1, 5, and 10 percent levels. Results in the first column are marginal effects.

		(1)		(2)			
Variable	Coefficient		(Std. Err.)	Coefficient		(Std. Err.)	
			Treatment	Regression			
	Depend	Dependent Variable: Dependent Variable:					
	= 1 if Partic	ipates	in Contract	Log of Ho	ousehold Income		
	Farming;	= 0 O	therwise	Per Adı	ılt Equ	ivalent	
Household Size	0.033		(0.021)	-0.129	***	(0.016)	
Dependency Ratio	-0.172		(0.213)	0.246		(0.163)	
Single	0.077		(0.209)	0.051		(0.152)	
Female	-0.476	*	(0.244)	-0.344	*	(0.178)	
Migrant	0.088		(0.139)	0.018		(0.103)	
Age	-0.020	***	(0.007)	0.009	**	(0.005)	
Education	-0.003		(0.015)	0.071	***	(0.010)	
Experience	0.011		(0.007)	-0.004		(0.004)	
Member of Peasant Organization	0.502	***	(0.109)	0.022		(0.088)	
Forbidden Days	-0.002		(0.002)	0.001		(0.001)	
Working Capital	0.005		(0.005)	0.007	***	(0.002)	
Assets	0.000		(0.003)	0.006	***	(0.002)	
Landholdings	0.001	**	(0.000)	0.000		(0.000)	
Contract Farming				1.083	***	(0.231)	
Nonparametric WTW for Contract Farming	0.129	***	(0.041)				
Intercept	0.428		(0.267)	-0.304		(0.249)	
District Fixed Effects			Y	es			
Log Pseudo-Likelihood			-1097	7.384			
p-value (Joint Significance)			0.0	000			
p-value (Test of Independent Equations)			0.0	003			
R_square							

Table A4. Treatment Regression and OLS Estimation Results for Income Per Adult Equivalent (n=1178)

R-square - **Note:** Estimation results are probability-weighted. The symbols ***, **, and * respectively denote significance at the 1, 5, and 10 percent levels. Results in the first column are marginal effects.

		(1)			(2)			
Variable	Coefficient		(Std. Err.)	Coefficient		(Std. Err.)		
	_		Treatment	Regression				
	Depend	Dependent Variable: Dependent Variab						
	= 1 if Partic	ipates	in Contract	Log of I	Net of			
	Farming;	; = 0 O	therwise	Contract F	armin	g Revenue		
Household Size	0.030		(0.021)	0.054	***	(0.017)		
Dependency Ratio	-0.164		(0.210)	-0.033		(0.187)		
Single	0.123		(0.223)	-0.248		(0.205)		
Female	-0.514	**	(0.251)	-0.059		(0.229)		
Migrant	0.095		(0.140)	-0.008		(0.123)		
Age	-0.019	***	(0.007)	0.014	**	(0.006)		
Education	-0.004		(0.014)	0.075	***	(0.011)		
Experience	0.010		(0.007)	-0.005		(0.005)		
Member of Peasant Organization	0.494	***	(0.111)	-0.068		(0.111)		
Forbidden Days	-0.002		(0.002)	0.001		(0.001)		
Working Capital	0.005		(0.005)	0.007	***	(0.002)		
Assets	0.001		(0.003)	0.007	***	(0.002)		
Landholdings	0.001	**	(0.000)	0.000		(0.000)		
Contract Farming				1.029	***	(0.338)		
Nonparametric WTW for Contract Farming	0.122	***	(0.038)					
Intercept	0.450	*	(0.266)	-0.206		(0.352)		
District Fixed Effects			Y	es				
Log Pseudo-Likelihood			-1155	5.163				
p-value (Joint Significance)			0.0	000				
p-value (Test of Independent Equations)			0.0	005				
P squara								

Table A5. Treatment Regression and OLS Estimation Results for Household Income Net of Contract Farming Revenue (n=1178)

R-square - **Note:** Estimation results are probability-weighted. The symbols ***, **, and * respectively denote significance at the 1, 5, and 10 percent levels. Results in the first column are marginal effects.

	(1)			(2)			
Variable	Coefficient		(Std. Err.)	Coefficient		(Std. Err.)	
			Treatment	Regression			
	Depend	ent Va	riable:	Dependent Variable:			
	= 1 if Partic	ipates	in Contract	Duration	of Ho	usehold	
	Farming;	= 0 O	therwise	Hung	gry Sea	ason	
Household Size	0.028		(0.020)	0.078	**	(0.037)	
Dependency Ratio	-0.191		(0.209)	0.401		(0.404)	
Single	0.069		(0.202)	-0.045		(0.377)	
Female	-0.508	**	(0.234)	0.351		(0.435)	
Migrant	0.052		(0.139)	0.094		(0.260)	
Age	-0.020	***	(0.006)	0.005		(0.011)	
Education	-0.002		(0.015)	-0.071	***	(0.026)	
Experience	0.012	*	(0.006)	-0.021	**	(0.011)	
Member of Peasant Organization	0.513	***	(0.109)	0.580	**	(0.236)	
Forbidden Days	-0.002		(0.002)	-0.004		(0.003)	
Income	0.004	**	(0.002)	-0.004	**	(0.002)	
Working Capital	0.002		(0.003)	0.003		(0.003)	
Assets	0.001		(0.003)	-0.012	***	(0.003)	
Landholdings	0.000	**	(0.000)	0.000		(0.000)	
Contract Farming				-2.540	***	(0.483)	
Nonparametric WTW for Contract Farming	0.132	***	(0.039)				
Intercept	0.436		(0.266)	5.211	***	(0.608)	
District Fixed Effects			Ye	es			
Log Pseudo-Likelihood			-1579	9.731			
p-value (Joint Significance)			0.0	00			
p-value (Test of Independent Equations)			0.0	00			
R-square			-				

Table A6. Treatment Regression and OLS Estimation Results for Hungry Season Duration (n=1178)

Note: Estimation results are probability-weighted. The symbols ***, **, and * respectively denote significance at the 1, 5, and 10 percent levels.

	(1)			(2)				
Variable	Coefficient		(Std. Err.)	Coefficient		(Std. Err.)		
			Treatment	nt Regression				
	Depend	Dependent Variable:			Dependent Variable: = 1 if Household Has			
	= 1 if Partici	pates	in Contract	Received				
	Farming;	= 0 O	therwise	a Formal Loa	an; = (Otherwise		
Household Size	0.033		(0.021)	0.000		(0.005)		
Dependency Ratio	-0.164		(0.207)	-0.019		(0.047)		
Single	0.079		(0.193)	-0.017		(0.041)		
Female	-0.482	**	(0.231)	0.030		(0.051)		
Migrant	0.114		(0.138)	0.003		(0.035)		
Age	-0.018	***	(0.007)	0.004	**	(0.002)		
Education	-0.008		(0.015)	0.014	***	(0.004)		
Experience	0.009		(0.007)	-0.003	*	(0.002)		
Member of Peasant Organization	0.537	***	(0.111)	0.029		(0.030)		
Forbidden Days	-0.002		(0.002)	0.000		(0.000)		
Income	0.005	**	(0.002)	0.001		(0.001)		
Working Capital	0.005		(0.005)	-0.002	**	(0.001)		
Assets	0.000		(0.002)	-0.001		(0.000)		
Landholdings	0.000	*	(0.000)	0.000	***	(0.000)		
Contract Farming				0.324	***	(0.063)		
Nonparametric WTW for Contract Farming	0.081	*	(0.043)					
Intercept	0.470	**	(0.267)	-0.323	***	(0.080)		
District Fixed Effects			Y	es				
Log Pseudo-Likelihood			-461	.067				
p-value (Joint Significance)			0.0	000				
p-value (Test of Independent Equations)			0.0	000				
R-square				-				

Table A7. Treatment Regression and OLS Estimation Results for the Likelihood of Receiving a Formal Loan (n=1178)

Note: Estimation results are probability-weighted. The symbols ***, **, and * respectively denote significance at the 1, 5, and 10 percent levels.

Variable	ATE		(Std. Err.)
Income (US\$)	134.54	***	(2.111)
Income Per Capita (US\$)	35.50	***	(1.949)
Income Per Adult Equivalent (US\$)	49.05	***	(1.904)
Income Net of Contract Farming Revenue (US\$)	110.00	***	(1.954)
Duration of Hungry Season (Months)	-2.54	***	(0.483)
Likelihood of Receiving a Formal Loan (%)	0.32	***	(0.063)

Table A9. Synthesis of Estimated ATEs on Welfare Outcomes Using WTW as an IV for Participation in Contract Farming (n=1178)

Note: The symbols ***, **, and * respectively denote significance at the 1, 5, and 10 percent levels.

Table A10. Synthesis of Estimated ATEs on Welfare Outcomes Using WTP as an IV for Participation in Contract Farming but Assigning a WTP of -\$20,000 to Naysayers (n=1178)

Variable	ATE		(Std. Err.)
Income (US\$)	132.73	***	(2.083)
Income Per Capita (US\$)	34.40	***	(1.889)
Income Per Adult Equivalent (US\$)	47.90	***	(1.859)
Income Net of Contract Farming Revenue (US\$)	108.48	***	(1.927)
Duration of Hungry Season (Months)	-1.79	**	(0.483)
Likelihood of Receiving a Formal Loan (%)	0.30	***	(0.063)

Note: The symbols ***, **, and * respectively denote significance at the 1, 5, and 10 percent levels. As per footnote 11 in the paper, these results were estimate using WTP as an IV for participation in contract farming but assigning a WTP of -\$20,000 instead of zero to naysayers.