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Working Paper

Small Farmers in High Value Chains: Binding or Relaxing Constraints to Inclusive Growth?

PIDS Discussion Paper Series, No. 2014-23

Provided in Cooperation with:

Philippine Institute for Development Studies (PIDS), Philippines

Suggested Citation: Briones, Roehlano M. (2014) : Small Farmers in High Value Chains: Binding or Relaxing Constraints to Inclusive Growth?, PIDS Discussion Paper Series, No. 2014-23, Philippine Institute for Development Studies (PIDS), Makati City

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Small Farmers in High Value Chains: Binding or Relaxing Constraints to Inclusive Growth?

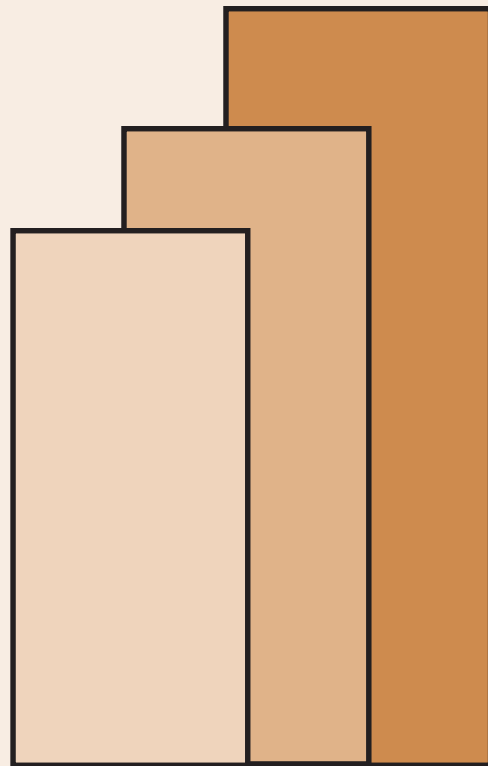
Roehlano M. Briones

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April 2014

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**SMALL FARMERS IN HIGH VALUE CHAINS:
BINDING OR RELAXING CONSTRAINTS TO INCLUSIVE GROWTH?**

Roehlano M. Briones¹

Abstract

Linking small farmers to modern markets, whether domestically or for export, increasingly entails participation in modern *supply chains* coordinated by contract farming. Concerns have been raised regarding the possible disadvantages from contract farming facing small farmers. Most empirical work points to a positive correlation between participation in contract farming and net farm income. Such a correlation fails to correct for endogeneity of participation; few studies have performed multivariate analysis with such a correction. This case study, based on a survey of smallholders in the tobacco industry, seems to be the first such application for the Philippines. The study finds that, correcting for endogeneity, participation in contract farming causes a sizable increase in farm profitability; moreover participation appears to be biased towards smaller farm sizes. The findings are robust to the econometric method used and even definition of participation. This is further evidence to confirm that supply chains linking agribusiness with small farmers via contract schemes are a viable model of value addition and inclusive growth in rural areas. Policies should be implemented to support an enabling environment for expansion of supply chains.

Keywords: supply chain, contract farming, smallholders, treatment effect, instrumental variable.

Acknowledgement

The study was funded entirely by the Philippine Institute for Development Studies (PIDS). The author acknowledges assistance in the field from Universal Leaf Philippines Inc., headed by Winston Uy; the National Tobacco Administration, headed by Edgardo Zaragoza; Mariano Marcos State University (MMSU), headed by Miriam Pascua, and the Directorate of Extension, MMSU, headed by Marivic Alimbuyugen; and Melanie Aldeon. He is likewise grateful for outstanding research assistance of Ivory Myka Galang. He alone is responsible for errors, omissions, and views expressed in this paper.

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1. INTRODUCTION

Issues

The development of agriculture continues to play a key role in the transformation of economies in Asia Pacific (ADB, 2013). In the developing world, particularly in middle income countries undergoing urbanization and diet transformation, agricultural development involves the diversification of smallholder farming towards expansion of high value activities (World Bank, 2009). Linking small farmers to modern markets, whether domestically or for export, increasingly entails participation in organized value chains, here called *supply chains*.

In supply chains, traditional arms-length transactions are replaced by coordinated buyer-supplier networks. A typical form of coordination is contract farming, in which agricultural production is carried out based on an agreement between buyer and farmers, which establishes conditions for the production and marketing of farm products. Such conditions may expose farmers to risks: buyers may renege on terms of purchase (e.g. paying a lower than agreed price); more insidiously, the buyer may use their bargaining power to extract the most favorable terms to the detriment of smallholders (FAO, 2014). Another problem raised is the potential for contract farming to perpetuate or aggravate rural inequalities; buyers may prefer farmers with greater landholdings or asset endowments, excluding the smallest and poorest farmers from high value chains (Minot, 2007).

A first and essential step to assessing the impact of contract farming is to examine the differences in incomes of smallholders who are contract farmers, and those who are not. Empirical work typically shows farm incomes of contract farmers are higher, whether reckoned per ha of farmland or per kg of farm output (Reardon et al, 2009). However such a comparison is prone to a well-known endogeneity problem: the set of factors that determine a farmer's participation in contract farming may be correlated with farm income. If pro-participation factors are positively related with income then the difference in income will exaggerate the impact of contract farming. For example, if farm income per ha rises with landholding (due to economies of scale), and buyers prefer contract farmers with larger farm sizes, then the difference in income is only partly (if at all) due to participation in contract farming. Conversely, if pro-participation factors are negatively related with income, then the difference in income will understate the true impact of contract farming.

Aims, scope, and significance of the study

The aims of the study are: first, to characterize contract farming for a major value chain in Philippine agriculture; second, to determine the impact of contract farming on the farm incomes of smallholders; and third, to assess the degree to which participation in contract farming is biased towards farmers with larger endowments. A corollary aim of the study is to draw implications for policy. Assessment will be applied to the case of the tobacco industry in the Philippines. This is a useful test case as the tobacco is a cash crop serving a high value chain, with supplies intended for export or as raw material for domestic manufacturers. Tobacco farming is done mostly by small farmers, either for sale under contract schemes with either exporters or manufacturers, or for sale to traditional tobacco traders, who in turn supply, directly or to intermediaries, the same exporters and manufacturers.

Impact assessment will incorporate a combination of methods, from simple comparison of means, to econometric analysis with correction for endogeneity of participation in supply chains. Several recently published studies have assessed impact of contract farming with correction for endogeneity; a few of these examine the bias of contract farming towards better-off farmers. This study appears to be the first application of this kind to Philippine agriculture.

The application is of great relevance to the policy context of the Philippines and many other developing economies. The Philippine Development Plan 2011 – 2016 (NEDA, 2014) pursues inclusive growth, defined as "sustained growth that creates jobs, draws the majority into the economic and social mainstream, and continuously reduces mass poverty (p. 18)" The Plan recognizes agricultural development as critical to inclusive growth, and highlights "increasing investments and employment across an efficient value chain" as a strategy towards improved food security and increased incomes of farmers (p. 115).

The rest of the paper is organized as follows: the background of the study is elaborated further in Section 2. The study methods are presented in Section 3, while results are presented in Section 4. Section 5 concludes and draws some policy implications.

2. BACKGROUND

Impact of contract farming: past research

Polemics against modern agro-industrial chains is best typified by the "political economy of agrarian change", a school of thought influential in the 1970s and 1980s (Prowse, 2012). Contract farming is seen as an instrument of exploitation of capital against the peasant class. Even in the 2000s this school of thought remains vocal: Singh (2002) claims that contract farming shifts risks onto farmers, reduces them into pauperised land laborers, and undermines food security by reducing food crop production. These concerns are shared by the out-going UN Special Rapporteur on the Right to Food (De Schutter, 2011). Borras and Franco (2010) deny that contract farming leads to win-win situations in many diverse settings, contending rather that resulting processes and outcomes mainly favor transnational companies.

Such denial though appears too pessimistic in view of the literature on agribusiness and agricultural economics on the impact of contract farming. Numerous studies reviewed in Minot (2007) confirm the positive correlation between farm earnings and contract farming. In the Philippines, a number of studies tried to characterize and explain contract farming schemes (De la Cruz, 2007; Digal, 2007; Nozawa, 2012); only a few have compared net farm income between contract and non-contract farmers. One of these is Costales et al (2007), which covered smallholder hog farming in Southern Luzon. Based on purposive sample of survey sites (and random sampling within a site), they collected data arriving at 123 respondents, of whom 50 (41%) were contract farmers. They find that profit per kg of output was higher for contract farmers, by around 44%, with the difference being statistically significant.

Attribution though is more difficult to establish, given the endogeneity of contract farming participation noted above. A Heckman selection model applied to farmers growing poultry, maize seed, and rice seed in Bali and Lombok, Indonesia, finds that contract farming results in improved returns to capital for poultry and maize seed, but not for rice seed (Simmons, Winters, and Patrick, 2005). Setboonsarng et al (2007) analyze data on contract and noncontract farmers

growing organic rice in Thailand; based on a switching regression or treatment effects model, they find that profitability of contract farmers would fallen by 31% had they opted out of contract farming, whereas profitability of non-contract farmers would risen by 47% had they opted into contract farming.

More recently, Miyata, Minot, and Hu (2009) compared contract and non-contract growers of apples and green onions in Shandong, China; using a treatment effects model, they regress per capita household income against explanatory variables and binary variable for contract participation; where participation is determined in a first stage regression with *distance of household to farm of village head* used as an instrument. This is hypothesized to reflect the social distance between the farmer and village leader, and the interest of the buyer to concentrate production in a small area.

For Madagascar, Bellemare (2012) applies a treatment effects model to a sample of contract and noncontract farmers; controlling for contract participation, contract farming leads to a 10.4% increase in household income. In his model, the key feature of a farming contract is a fixed price; the farmer's decision to participate is determined by his or her degree of risk aversion. A contingent valuation experiment is implemented among the sample farmers to arrive at a proxy for the degree of risk aversion, which is then used as an instrument for the first stage binary regression.

Again in Indonesia, Caihyadi and Waibell (2013) examine the impact of contract farming on farm income for a sample of 245 oil palm farms in Jambi using a treatment effects model. The first stage uses a pair of time period dummy variables as instruments; again, contract farming has a positive effect on farm income. The most recent study (Narayan, 2014) shows that contract participation is not always a positive factor in farm incomes; for a sample of 474 farmers in four commodity sectors (gherkins, papaya, marigold, and broilers), an endogenous switching model is applied on net profit. Contracting offers net gains for papaya and broiler, but is ambiguous for gherkins and reduces net incomes for marigold farmers.

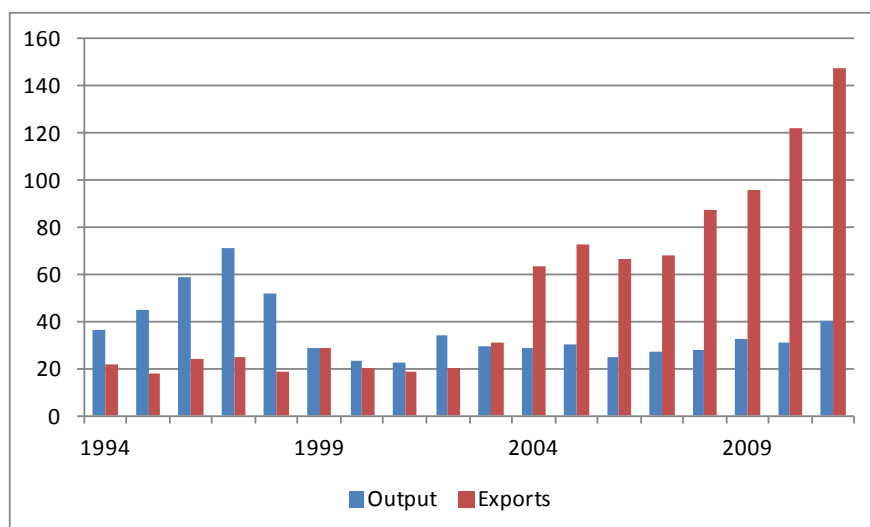
The Philippine tobacco industry

The tobacco industry in the Philippines began in the Spanish colonial era. In 1782 the colonial government established a tobacco monopoly centering in Northern Philippines where the climate was drier and more suitable to tobacco growing. The area was already populated by smallholders; rather than setting up large plantations, the government compelled farmers to plant the crop. Each farmer was assigned a quota; this involved hundreds of separate contracts and a staff of administrators. Subsequently during the American colonial period the industry continued to grow, especially with the introduction of Virginia tobacco in the late-1920s, with tobacco becoming one of the important sources of agricultural export earnings after independence. Currently the industry is regulated by the National Tobacco Administration (NTA) under the Department of Agriculture (NTA, 2014a).

By 2011, the industry output at the farm level was valued at \$91 million (FAOStat, 2014). The same year, tobacco exports alone reached \$331 million (BAS – PSA CountryStat, 2014). In 2013 there were about 54,000 tobacco farmers farming 37,000 ha of tobacco farms, for an average farm size of just 0.69 ha (NTA, 2014b). Whereas domestic output has been growing at a fairly rapid clip, averaging 6% growth in 2000 – 2011, exports have boomed in recent years, growing

an average of 22.9% annually over the same period (see Figure 1). The main export destinations are in Southeast Asia (Thailand, Indonesia, Vietnam, Singapore, and Malaysia), as well as South Korea, United States of America, Taiwan, Belgium, and Germany.

Figure 1: Value of output and exports, in \$ millions (1985 prices)



Sources: FAOStat for output; CountryStat for exports.

The traditional marketing system of tobacco involves farmers selling cured tobacco leaves to traders, who then sell the produce to institutional buyers. Prices are settled on the spot and farmers are free to choose traders, except under tied credit, explained below. The traditional system has increasingly been displaced by farmers selling directly to institutional buyers, often under a contract growing arrangement. This typically involves buyer specifying plant variety, management practice, while providing technical and other support by providing advances of inputs and even cash. The farmer is formally obligated to sell to the contract buyer, though side selling is common (and legal recourse by either buyer or seller rarely observed.) Traditional traders also offer credit, to be recovered from the purchase price from the harvest of the borrower; however, they place no conditions on production method, quantity targets, or pricing; such credit – output interlinkage is not classified here under contract farming.

In the Philippines, as in many other countries, tobacco consumption and advertising is tightly regulated. There are no quantitative restrictions on imports, though imports are levied a 7% tariff (10% for processed tobacco products). The NTA administers a floor price policy, where price is adjusted every two years following tripartite consultation between farmers, institutional buyers (both manufacturers and exporters), and government. Typically the minimum price is set below the prevailing market price, but should allow farmers a healthy return (about 25%).

The most serious intervention in the market however is the country's tax regime. Aside from the 12% value added tax (VAT), cigarettes and cigars are subject to excise taxes. Increases in excise taxes began in 2005 with a "sin tax" law. The current version provides as follows: for net retail prices (i.e. excluding excise and VAT) below Php 11.50, the excise tax is Php 17 per pack; for net retail prices above Php 11.50, the excise tax is Php 25.00 per pack. (In 2013, the exchange

rate was Php 42.45 per USD.) Excise taxes are programmed to increase annually up to Php 30 per pack by 2017, and 4% annually thereafter (keeping pace with the inflation rate). The NTA (2014b) reports excise tax collection of Php 32.2 billion, dwarfing value of tobacco production the same year (Php 4.63 billion). As a political concession to the industry, by law 15% of the proceeds of excise taxes are remitted to the provincial governments of large tobacco-growing provinces for tobacco development projects and related infrastructure, e.g. farm-to-market roads. It is no coincidence that domestic production began to shift dramatically towards exports from the mid-2000s with the change in domestic tax regime, as exports are not levied domestic taxes, nor are levied export taxes.

3. METHOD OF ASSESSMENT

Conceptual framework

Spot markets, vertical integration, and contract farming. The standard economic model of the spot market represents interaction of supply and demand as an equilibrium of decisions by agents interacting anonymously. For agro-processors or exporters the buying decision arises from derived demand; under profit-maximization, buyers set marginal product value equal to input price, whereas sellers set price to marginal cost.

In an agricultural setting the standard theory may not apply. Available suppliers for specialized products may be too thinly spread out to realize economies of scale for the buyer. Quality requirements may be stringent (particularly in export markets), whereas farm production may be inadequately standardized; there may be asymmetric information and capability in deploying production technology to meet quality and quantity targets to the detriment of the farmer.

These problems could be addressed by straightforward vertical integration, with lands consolidated under buyer's ownership (or at the very least under leasehold). However this may not be suitable solution. First, in the Philippine setting, agrarian reform laws restrict agricultural farm size to not more than five ha; while land leasing is allowed, this is officially discouraged and outright restricted for foreign-owned companies. Second, even in the absence of land reform restrictions, vertical integration may not address the procurement problem as argued cogently by Hayami (2010). He notes that where communities of indigenous smallholders have already been established (as in the case of tobacco farming in the Philippines), family farms tend to be competitive producers of tropical export crops relative to large plantations, owing to low supervision cost of family as opposed to hired labor.

The contract. The contracting decision involves an offer from the buyer and acceptance by the supplier. The offer promises benefits to farmers by payment, provision of inputs, provision of technical assistance, provision of technology (embedded in the inputs and extension service), and provision of cash advances to cover up front cash expenses (such as hired labor). Acceptance of the offer involves obligations on the part of the farmer to produce the expected output using the specified inputs, technology, and deliver to the contractor.

Some buyers prefer contracts with grouped rather than individual farmers; this effectively shifts the burden of monitoring individual farmers onto the group. Other buyers opt for detailed contracts with individual farmers, in which case the buyer absorbs the monitoring cost, which can be intensive. In a Madagascar vegetable supply chain, the buyers impose quality and quantity

standards at the farm-level, supported by training and close monitoring, performed by a large staff of inspectors and technicians (Minten et al, 2009).

Note that payment may incorporate a fixed price or some variant, some as a fixed floor price, fixed premium above the market price, etc., so as to offer a hedge against price risk – another feature in the menu of benefits offered to the farmer. Price risk hedging can also apply to inputs; in fact, Abene et al (2009) find that output risk reduction is less important compared to input risk reduction. Similarly, Wang, Zhang, and Wu (2011) find that for Chinese farmers, the primary motivation for contracting is not price risk management, but rather seeking better price offers and reducing marketing costs.

Determinants of the farm performance and participation. The data observations are at the level of the farmer in relatively similar agro-climatic and market conditions. Therefore the factors that determine agricultural performance cover those that differentiate farmers, namely: location; demographic characteristics; and endowments. Location could be village level area characteristics related to physical accessibility and transport/transaction cost. Demographic characteristics are human and social capital variables, namely: educational attainment, age, years of farming experience, and sex, farm production assets, and farm size.

As buyers prefer to contract with better performers, the same factors may affect participation in contract farming. In addition, in a rural setting with high transaction cost, buyers may prefer to contract with consolidated sets of contractors, i.e. clusters of contract growers, rather than visiting dispersed plots over a wider area. Note that there is no strong reason to expect farm performance at the individual level to be measurably affected by clustering of contract farmers.

The factor of farm size is of particular policy interest particularly in developing countries seeking a more inclusive growth. There is no consensus on the direction of effect of farm size on participation. Huang and Reardon (2008), synthesizing a set of multi-country case studies of agribusiness supply chains, find that evidence on the role of farm size is at best mixed; rather non-land assets, including human capital, are a more common determinant of inclusion, with farm production assets having the clear edge over human capital. Rural transportation and market infrastructure have also played important roles in facilitating participation of farmers in supply chains.

Data

The case study is based mainly on primary data collected from farmers interviewed in the Ilocos Region, the country's main tobacco growing area which accounts for 68% of the country's tobacco output. The reference period is the planting season of 2013 (starting around February - March and ending in April - May.) The survey was conducted in Ilocos Sur, the top tobacco growing province of the country, and neighboring province of Ilocos Norte (third largest tobacco growing province in the Ilocos Region).

While the NTA maintains a registry of farmers, there is unfortunately no convenient and reliable master list with addresses; nor was the extent of contract growing among tobacco farmers well-documented. Given this and the need to collect a reasonable-size sample inclusive of contract growers, the study opted for a purposive approach. The survey relied on contacts of a cooperating institutional buyer, as well as direct contacts of extension workers of the NTA. The

survey first targeted municipalities with high concentration of contract growers of the cooperating buyer; NTA extensionists then referred the enumerators to other tobacco farmers in comparable locations in nearby villages. The other tobacco farmers turn out to be, for the most part, contract growers of other institutional buyers, as described below.

Analytical method

Aside from summary statistics, the study applies multivariate analysis to isolate the impact of contract farming. The performance indicator is profitability or net farm income per ha. It turns out that some farmers sell to both traders and contract buyers; in this case, participation can be a continuous variable. This leads to two types of measures: *Contract*: a binary variable, equals zero when all output is sold to traditional trader, and 1 when some or all output is sold under contract; and *Contract share*: a continuous variable in the interval [0,100], equals percentage of output sold under contract.

Explanatory variables are as described in the Conceptual framework. First we fit a "naive" linear regression model relating profitability to the explanatory variables, including the measure of participation in contract farming. Following the literature, to correct for endogeneity of participation, the multivariate analysis adopts a treatment effects procedure in case of binary variable of participation. A novelty adopted in this study is to adopt a continuous variable as a measure of participation, to check for robustness of the analysis; in this case the analogous procedure is the instrumental variable regression.

4. RESULTS

Characteristics of the sample

The typical tobacco farmer in the sample is in his or her mid-40s or thereabouts; typically has reached (but not completed) high school; has been farming just under a quarter century; and is usually male (Table 1). The typical farmer needs just under forty minutes to reach the nearest market place, with the maximum as much as two hours. Many of the villages in tobacco areas have been linked to markets via farm-to-market roads funded by excise taxes.

Table 1: Summary statistics of key variables in the sample (N = 316)

	Mean	Standard deviation	Minimum	Maximum
Age, in years	46.3	12.5	19.0	81.0
Schooling attainment, in years	8.3	2.8	0.0	14.0
Farming experience, in years	23.1	13.9	1.0	66.0
Sex dummy (female omitted)	0.83	0.38	0.00	1.00
Typical travel time, in minutes	37.3	24.6	3.0	120.0
Cluster dummy (no cluster omitted)	0.72	0.45	0.00	1.00
Size of tobacco farm, in ha	0.61	0.42	0.13	4.00
Farm assets, in Php/ha	284,664	415,870	0	3,305,000
Contract dummy (no contract omitted)	0.77	0.42	0.00	1.00
Contract share (%)	73.6	41.8	0.0	100.0
Profitability of tobacco farming, in Php/ha	68,540.7	84,996.5	-154,600.0	433,440.0

Source: Author's data.

On average a typical tobacco farming village in the sample has a cluster of contract farmers. Farm sizes are very small, averaging less than one ha, though with large variation, ranging from just 0.13 ha up to 4.00 ha. Farm assets are sizable, the average being about two-and-a-half times the national income per capita, with high standard deviation (46% more than the mean); farm assets range from zero to as much as Php 3.3 million.

Most of the sample farmers are contractors. Somewhat surprisingly, it turns out that the overwhelming majority of farmers have shifted to a contract rather than traditional system. On average farmers sell close to three-fourths of output to a contract buyer. Sample data shows high profitability of tobacco farming; the average returns is about three times that of irrigated rice, the most common crop in the country based on area harvested (BAS-PSA CountryStat, 2014). However profitability is highly variable, gauging from the standard deviation (24% greater than the mean); the range is also very wide, from up to Php 433,000 per ha, down to a loss of almost Php 155,000 per ha.

Next to be examined is the motivation for farmers in joining contract schemes (Table 2); see the Note explaining the alternative methods for aggregating rankings across farmers. The set of reasons farmers were asked to rank are: Favorable price; Protection from price risk; Input support (i.e. advances in-kind); Financial support (i.e. advances in cash); and Technical assistance.

Table 2: Most important reasons for engaging in contract farming, based on subjective responses of participants

<i>Ranking</i>	<i>Based on average score</i>	<i>Based on frequency of score</i>
1	Financial support	Favorable price
2	Favorable price	Financial support
3	Input support	Input support
4	Technical assistance	Technical assistance
5	Protection from price risk	Protection from price risk

Note: a score is assigned based on the ordinal ranking of the factor (i.e. if input support is ranked first, input support is assigned a score of 1.)

Source: Author's data.

For farmers, the least important feature of the contract is protection from price risk. This is somewhat surprising given the literature's emphasis on the price risk reduction of contract farming; in the Philippine context, it may be due to the superfluity of this contract function due to the floor price policy of the government. Both buyers and suppliers stated that the only guaranteed price is the mandatory minimum price; at harvest time the market price is almost always higher than the floor price.

The fourth most important reason is provision of technical assistance. Visits by the contract buyer staff were conducted frequently, averaging 14 times over a 120-day cropping cycle though there is wide variation; the standard deviation of visits is 16, ranging from 0 visits to as often as daily.

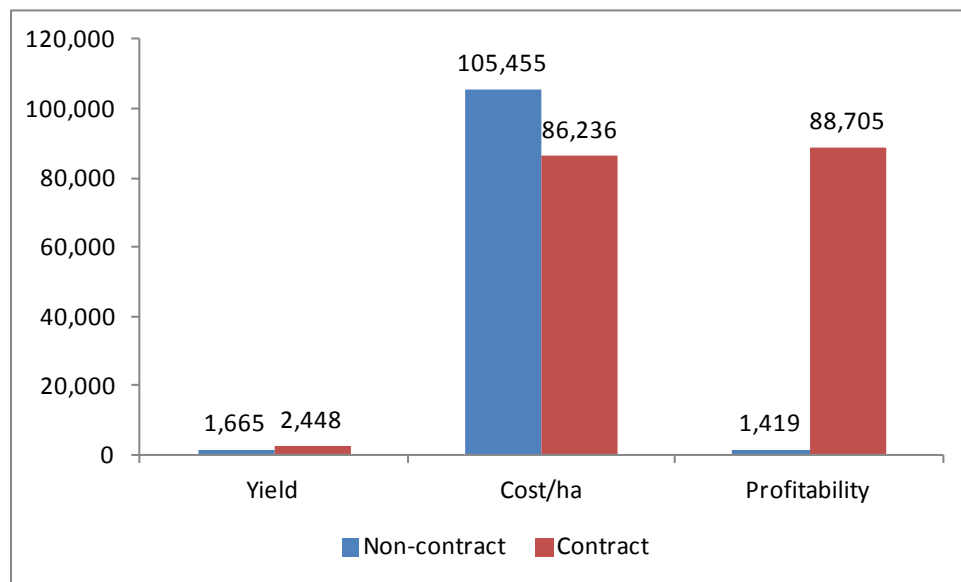
The third most important reason is input support, in the form of seeds, chemicals, and most

importantly, fertilizers. About 188 (60%) of the farmers confirmed they receive input support. The average cost of the support received is Php 43,074 per ha, which is about 48% of the average cost per ha for the whole sample.

The first and second top reasons depend on whether ranking is based on average score, or frequency in which a ranking is assigned. "Favorable price" is ranked first by most respondents, followed by "Financial support"; however "Favorable price" receives an average score that is lower than "Financial support". Farmers do receive cash advances, a feature that is ranked of great importance as a reason for participating in contract schemes; in this case contract farming matches (or even exceeds) the amount of offered by traders to farmers. Lastly, fetching a relatively high price is deemed very (or most) important by farmers; one reason for high prices is premium quality of the planted crop, made possible by the input and extension support from the contract buyer.

Simple comparison highlights sharp differences in economic performance between contract and non-contract farmers (Figure 2). Tobacco yields are much higher for contract farmers. Meanwhile, costs per ha are much lower. The combination of these leads to enormous difference in net tobacco farm income per ha for contract farmers, compared to non-contract farmers.

Figure 2: Difference in tobacco farming outcomes, non-contract and contract farmers



Source: Author's data.

There do appear to be differences in farm performance and contract participation depending on individual and farm characteristics (Table 3). Interestingly, female farmers tend to earn more net tobacco farm income per ha than male farmers; they are also more likely to be contract farmers, and to sell a somewhat greater share of output under contract.

Younger farmers (on average in their mid-30s) however earn slightly less than older farmers (on average in their mid-50s). There is little difference in contract participation by age group of the farmer. Less educated farmers (on average a mere primary school graduate) surprisingly earn

more than their more educated counterparts (on average a 2nd year high school graduate).² More educated farmers are somewhat less likely to participate in contract farming. Less experienced farmers tend to earn less than more experienced farmers, but are only slightly less likely to participate in contract farming.

Table 3: Differences between profitability and frequency of contract growing between groups of farmers

	Average of that group	Profitability (Php)	Share of contract farmers	Average share sold under contract (%)
Sex				
Female	na	74,906	0.815	80.6
Male	na	67,229	0.760	72.2
Age (years)				
Younger	36.1	66,552	0.785	73.3
Older	56.5	70,529	0.753	73.9
Educational attainment (years)				
Less educated	6.0	81,977	0.823	80.1
More educated	10.6	55,105	0.715	67.1
Farming experience (years)				
Less experience	11.9	64,274	0.753	71.4
More experience	34.3	72,807	0.785	75.8
Farm size (ha)				
Smaller	0.3	76,567	0.8	74.0
Larger	0.9	60,515	0.8	73.2
Assets (Php)				
Less assets	48,735	53,492	0.7	68.4
More assets	520,592	83,589	0.8	78.8

Note: Except for Sex, in each category farmers are grouped depending on whether they fall below the median or above the median.

Source: Author's data.

As for farm size, smaller farmers (average of only 0.3 ha farm size) earn more on a per ha basis than larger farmers (average of 0.9 ha farm size). There is practically no difference in likelihood of participating in contract farming. This pattern tends to contradict the notion that contract buyers prefer farmers with larger farm sizes and exclude smaller farmers.

Meanwhile farmers with smaller endowments of farm assets earn less than those with greater endowments. Those with smaller endowments are somewhat less likely to participate in contract schemes. Either contractors prefer farmers with more farm assets, or that a contract relationship allows farmers to accumulate more assets (or both).

² At the time of the survey, primary schooling and secondary schooling lasted 4 and 6 years, respectively.

Multivariate analysis

As discussed previously, multivariate analysis is needed to account for numerous factors simultaneously impinging on profitability and participation choice. First the analysis proceeds with a least squares regression of profitability against the pre-identified explanatory variables (Table 4); participation is included as a binary variable in one regression, and as continuous variable in another. In the following, regressions are conducted using STATA.

Table 4: Results of least squares regression of net farm income per ha (N = 316)

	With binary measure			With continuous measure		
	Coefficient	t-value	P > t _c	Coefficient	t-value	P > t _c
Age	731.815	1.24	0.22	702.641	1.19	0.235
Farm size	0.014	1.26	0.21	0.015	1.33	0.185
Farm assets	1,966.618	0.18	0.86	1,650.422	0.15	0.881
Experience	-796.738	-1.49	0.14	-798.727	-1.49	0.136
Schooling	-2,224.592	-1.29	0.20	-1,993.417	-1.16	0.246
Sex	-2,788.466	-0.24	0.81	-100.039	-0.01	0.993
Transport time	-440.417	-2.38	0.02	-434.357	-2.36	0.019
Contract	93,766.610	8.72	0.00	-	-	-
Contract share	-	-	-	954.032	8.81	0.00
Constant	12,858.750	0.41	0.68	11,763.380	0.38	0.708

Note: Adjusted R² = 0.1963 and F(8,307) = 10.6 in both regressions.

Source: Author's calculation.

The coefficient of the contract dummy implies that a contract farmer will, other factors constant, enjoy 94,000 peso boost in profitability; such an increase is statistically significant. The income gain is consistent with the most important motivation behind participation in contract farming noted above, i.e. contract farming enables producers realize higher prices, higher yields, and lower costs.

If instead a continuous version of participation is used, then each percentage point increase in share of output sold under contract raises profitability by about 954 pesos; the coefficient likewise is statistically significant. The only other statistically significant coefficient is the one for Transport time (with negative sign) in both regressions.

Such a regression, while multivariate, is "naive" in the sense that one of the regressors, i.e. contract participation is endogenous. Table 5 juxtaposes two regressions, a probit for the binary participation measure, and a tobit for the continuous measure. The models are each jointly significant based on the Chi²-test; statistically significant predictors (at 10%-level) of binary participation are Age, Farm size, Farm assets, and Cluster. Farm asset has a positive coefficient, but Farm size has a negative coefficient, i.e. contract participation favors smaller rather than bigger farmers. For the continuous measure only Cluster is statistically significant (goodness-of-fit is poor, with pseudo-R² of 0.10).

Table 5: Results of regressions of contract participation measures

	Probit for binary measure			Tobit for continuous measure		
	Coefficient/ value	t-value	P > t _c	Coefficient/ value	t-value	P > t _c
Age	-0.029	-1.89	0.058	-0.654	-1.06	0.289
Farm asset	4.86E-07	1.79	0.073	0.000	1.06	0.290
Farm size	-0.668	-2.22	0.027	-17.638	-1.65	0.100
Experience	0.018	1.34	0.180	0.491	0.89	0.373
Schooling	-0.039	-1.01	0.313	-2.032	-1.2	0.232
Sex	0.027	0.09	0.931	-18.374	-1.41	0.159
Transport time	0.006	1.23	0.220	0.315	1.58	0.116
Cluster	2.343	10.03	0.000	110.034	10.79	0.000
Constant	0.723	0.96	0.339	86.632	2.75	0.006
P > Chi ²	0.00			0.00		
Pseudo-R ²	0.490			0.095		

Source: Author's calculation.

Applying the correction for endogeneity of the treatment yields results reported in Table 6. The coefficient of *Cluster* in the binary participation equation is statistically significant and the expected positive sign; contract buyers prefer to deal with clusters of contract farmers.

Table 6: Treatment effects regression of net farm income per ha, maximum likelihood (N = 316)

	Dependent variable: net farm income per ha			Dependent variable: contract dummy		
	Coefficient/ value	z-value	P > t _c	Coefficient/ value	z-value	P > t _c
Age	863.751	1.46	0.144	-0.030	-1.95	0.052
Farm asset	0.012	1.09	0.275	0.000	2.06	0.039
Farm size	4,133.109	0.38	0.707	-0.719	-2.43	0.015
Experience	-865.200	-1.62	0.105	0.018	1.29	0.196
Schooling	-1,884.877	-1.1	0.271	-0.040	-1.04	0.298
Sex	-1,689.716	-0.15	0.883	0.007	0.02	0.982
Transport time	-572.007	-3.05	0.002	0.005	1.12	0.264
Contract	121,511.300	9.33	0.00	-	-	-
Cluster	-	-	-	2.386	10.46	0
Constant	-12,555.190	-0.39	0.695	0.793	1.060	0.291

Note: Chi² of likelihood ratio test is 11.06, P > Chi² = 0.0009.

Source: Author's calculation.

The endogeneity correction is appropriate as suggested by the likelihood-ratio test. Note that in the treatment equation, coefficient of farm asset is positive while that of farm size is negative; both are statistically significant, consistent with Table 3. Contrary to some previous studies on

contract farming, in the case of the tobacco supply chain in the Philippines, contract farming favors smaller farmers.

Being a contract farmer raises net farm income per ha by Php 121,511; the coefficient is statistically significant, and is much larger than its counterpart in the naive regression. That is, failure to correct for endogeneity of the treatment, leads to an *underestimate* of the effect of treatment. Aside from the treatment, the other significant coefficient is for Transport time, which has a negative sign.

To check for robustness, an alternative method of treatment effects is applied in Table 7, which is based on Heckman's two-step estimator. The coefficient of treatment remains statistically significant, and its value rises further up to Php 133,000.

Table 7: Treatment effects regression of net farm income per ha, two-step estimator (N = 316)

	Dependent variable: net farm income per ha			Dependent variable: contract dummy		
	Coefficient/value	z-value	P > z _c	Coefficient/ value	z-value	P > z _c
Age	920.033	1.54	0.124	-0.029	-1.89	0.058
Farm asset	0.012	1.00	0.315	0.000	1.79	0.073
Farm size	5057.304	0.45	0.65	-0.668	-2.22	0.027
Experience	-894.404	-1.66	0.098	0.018	1.34	0.18
Schooling	-1,739.959	-1.00	0.316	-0.039	-1.01	0.313
Sex	-1,221.003	-0.11	0.916	0.027	0.09	0.931
Transport time	-628.142	-3.25	0.001	0.006	1.23	0.22
Contract	133,346.800	8.75	0.00	-	-	-
Cluster	-	-	-	2.343	10.03	0.00
Constant	-23,396.440	-0.71	0.48	0.723	0.96	0.339

Source: Author's calculation.

Finally the last set of estimates relate to contract participation as a continuous variable (Table 8). Two sets are presented, pertaining to least information maximum likelihood, and the Generalized Method of Moments (Robust) estimator, which yields identical coefficients but with corrected standard errors. The instrumental variable estimates obtains results similar to that using the treatment effect estimates. Transport time likewise has a significant coefficient with negative sign; Experience has a significant coefficient (at 10% level) under LIML, but the significance disappears using robust standard errors.

Most importantly, the instrumented Contract percentage measure has a statistically significant and positive coefficient; it implies that every percentage point increase in share of output under contract raises net farm income by 1,400 pesos.

Table 8: Instrumental variables regression of net farm income per ha, two-step estimator (N = 316)

	Coefficient	Least information maximum likelihood		Generalized Method of Moments, Robust	
		z-value	P > z _c	z-value	P > z _c
Contract share	1,433.518	8.66	0.000	8.47	0.000
Age	912.079	1.51	0.130	1.4	0.161
Farm assets	0.012	1.04	0.297	1.04	0.298
Farm size	5,171.425	0.46	0.645	0.38	0.701
Experience	-916.0122	-1.68	0.092	-1.59	0.112
Schooling	-1,300.204	-0.74	0.459	-0.71	0.477
Sex	3,117.430	0.27	0.79	0.3	0.762
Transport time	-654.827	-3.35	0.001	-3.77	0.000
Constant	-31,954.320	-0.95	0.345	-0.89	0.371

Source: Author's calculation.

5. CONCLUSION

To summarize: the analysis confirms that contract farming causes a demonstrable and sizable increase in profitability for the tobacco farmer. The effect is robust to various corrections for endogeneity of contract participation; moreover, the effect holds even when contract participation is defined by degrees, i.e. share of output sold under contract. The analysis further shows that participation in contract farming is positively related to farm assets and negatively related to farm size. This refutes the notion that contract farming tends to exclude the smallest farmers, at least for the case under consideration. The analysis fails to confirm the relationship between contract participation and human capital, though the link to physical capital may raise some concern about equity.

The findings have several important implications for policy and for stakeholders in agricultural development. The study contributes further evidence to confirm that supply chains linking agribusiness with small farmers via contract schemes are a viable model of agricultural development, economic diversification, and value addition in rural areas. Moreover it shows that contract farming favors participation of producers with smaller farms. It therefore allays fears that contract farming is somehow harmful for smallholders, or may worsen inequalities by favoring larger farmers. However, transport cost and inadequate physical accessibility tends to undermine profitability as well as the likelihood of contract participation.

Implications of the study should not be overstretched, say by advocating land reform policies to force further fragmentation of farms. As Hayami (2010) has pointed out, coercive reforms aimed at breakdown of farms could be disruptive and inefficient. Instead, the efficiency of small farms favors supporting the initiative of private agribusiness to increasingly move to a decentralized system involving contract farming with smallholders.

It would appear that, in view of the large gains to smallholders, the latter would be keen on shifting from traditional to modern organized chains. In fact the constraint appears to be the willingness and/or ability of agribusiness firms to source their raw materials from contract farmers, hence the need to encourage their shift towards expanding their contract scheme. Note

that such support may involve, advocacy and information to ease apprehensions of the private sector regarding the potential risks of relying increasingly on contract suppliers. Policy should also support providing an enabling environment for expansion of supply chains. This involves two key elements. The first element is developing a widespread and reliable transport infrastructure in rural areas, to reduce transport cost and improve accessibility especially in the more remote villages. The second element is providing an institutional and regulatory framework to facilitate contract preparation, information, and enforcement. Many agribusiness firms are reluctant to expand their contract schemes owing the side selling and other enforcement issues. On the other hand, farmers also need some information and education to check against potential abuse. The public sector must provide a functional and credible system of governance over organized agricultural value chains.

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