

Contracting Out of Poverty in Peru: Some Experimental Approaches

Report on First Year Activities, 2008-2009

Marco Castillo
Interdisciplinary Center for Economic Science (ICES)
George Mason University

Ragan Petrie
Interdisciplinary Center for Economic Science (ICES)
George Mason University

Maximo Torero
International Food Policy Research Institute (IFPRI)

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Abstract: Poor, rural farmers are often left out of the market. They may not be able to compete with large farmers who can provide firms, such as grocery store chains or exporters, a consistent and high quality product. These barriers to entry may be an outcome of the scale of production but also of small farmers' inability to commit to a contract. At the time of sale, if market prices are higher than contracted prices, farmers may renege and sell in the open market. While a farmer who reneges on a contract will probably pay the price of doing so by not having his contract renewed, the empirical evidence suggests that this is not a strong enough deterrent. There is also evidence that firms renege on the contract at the point of sale. To address this problem, we designed an experiment that manipulated the amount of collateral that a firm and a producer would pledge. The firm provided money in advance to a rural credit union for amounts of credit that farmers would receive at random. Firms also committed to purchase farmers' products at prices that would incentivize increases in productivity. By randomizing the amounts of credit given, we alter the level of liability that both the firm and farmers experienced. Due to a weather shock and the corresponding fear of large losses, however, the credit union abandoned the experiment after selection into the program and randomization into treatments had occurred. Nonetheless, the firm decided to provide credit and inputs, with only the farmer's reputation as collateral, to a subgroup of producers in the selected group and a subgroup of producers in the rejected/uninterested group, in a year in which demand for the product was unusually high. This provided a natural experiment on the effect of the hold-out problem underlying contractual arrangements in economies with weak legal systems. Our analysis shows that regardless of selection issues, producers receiving help from the firm benefitted by increased production as well as higher prices at the time of harvest. Both the firm and the farmers seem to be engaged in a risk-sharing agreement with limited liability.

Introduction

Contract farming has been shown to be an effective way to integrate farmers into expanding domestic and international markets. It also continues to grow even after the initial stages of product development. Nonetheless, contract farming and its benefits have been concentrated in a small segment of farmers, mainly medium-sized and relatively more educated. It is not clear why smaller and less educated farmers are excluded from these kinds of arrangements. The most commonly cited explanations are size limitations and fixed costs. The small farmer is often unable to make such an investment profitable, or cannot afford to make such an investment at all. In addition, there is evidence to suggest that small farmers are unable to commit to a contract. Our research agenda is to open up markets to small farmers by designing contract mechanisms that are incentive-compatible and that improve the welfare of small farmers.

Interestingly, while there is a tendency for contracts to be given to large farmers, research shows that contracts with small farmers might be advantageous to a firm, mainly because they increase the firm's capacity to respond to market conditions. Technological barriers to small farmers entering contract farming are real and important, but evidence shows that incentive problems are also partially responsible for the failure of contract farming among small holders. A misalignment of incentives might prevent gains from trade from being realized; this is much less likely to be the case for large farmers. Large farmers are easier to monitor and catch cheating. Also, the gains from trade (or losses from no trade) with large farmers might be substantial enough for repeated interaction to be viable (or might provide a good disciplining device) given the probability of renewed interaction.

This report presents results from our first year of activities in which we implemented an experiment with mango farmers in northern Peru. The experiment provides an example of the limitations imposed by firms and by field conditions on contract design and implementation. Despite these limitations, our exercise shows how economic forces can strongly affect the relationship between exporting firms and small producers. Due to changing conditions in the field and in world markets, we faced a natural experiment that allows us to distinguish between selection into contractual arrangements and the effect of contracts on behavior. We show that cash-constrained producers benefited significantly from inputs provided by firms. They increased production and productivity and commanded higher prices. Importantly, contractual arrangements seem to affect bargaining power as well. These effects remain even when we control from production in previous seasons.

The report first presents the basic framework of contract farming, project design, implementation of the study and then results of the experiment.

Basic Framework of Contract Farming

The strategic environment in which the farmer and firm interact is one in which small farmers are at a disadvantage relative to large farmers. Because contract farming typically occurs in the production of high-value export crops, small farmers often need help with the initial investment in inputs to produce such a crop (e.g. seeds or technical assistance). Without the firm's help, small farmers cannot enter this lucrative market. Large farmers, however, do not need this assistance. The concern is that both small farmers and firms have an incentive to renege on the agreed-upon contract. In Figure 1, we outline the basic strategic game that is the basis for our experimental contract design.

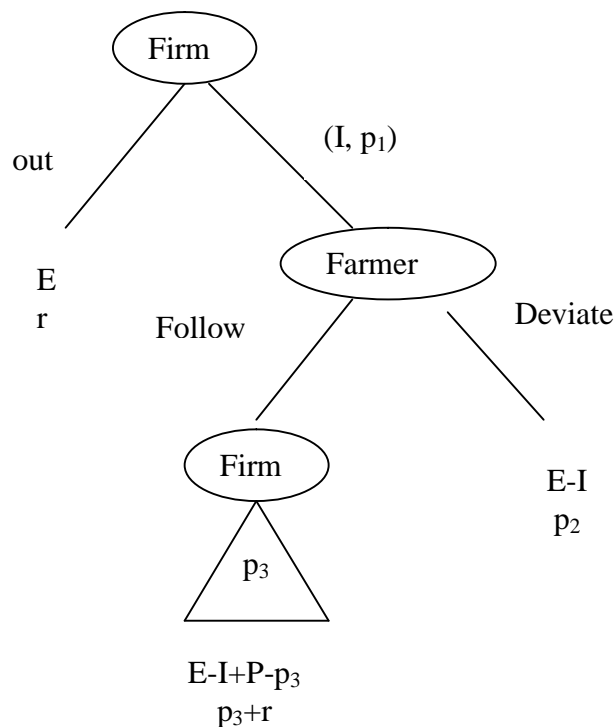


Figure 1: Structure of Interaction between Firms and Farmers

Figure 1 presents a representation of the strategic situation that firms and farmers face. Firms have available resources E that can be partially invested with a farmer for the production of a new product. Farmers have an amount r of available resources. These resources might be time, money or favors. A typical contract includes an investment by the firm (I) and a price promised (p_1) to the farmer. The description of the game implicitly assumes that farmers cannot undertake the investment in the product on their own. This is a realistic assumption since the production of high-value products normally requires technical assistance, special seeds, or working capital, little of which small farmers have. Firms also have an information advantage that farmers do not have in terms of knowledge of what the market demands.

After investment has taken place and production is realized, farmers must decide whether to sell the crop back to the firm or sell it independently to an alternative buyer at price p_2 , as long as price p_2 is higher than p_3 . Price p_2 already includes the implicit cost of cheating, such as hiding production or transportation costs. In case the farmer decides to sell the crop to another buyer, the firm incurs a loss equivalent to the original investment I .

If the farmer sells the crop back to the firm, the firm has the opportunity to renegotiate the selling price p_3 . Renegotiation of the final price by the firm takes several forms. The most common form is to discount quantity by quality. In this scenario, the firm claims that the quality of the product is not up to its standards, so it buys each unit at a lower price.

While stylized, the simple game gives a framework to think about how contracts would need to be designed in order to address the issue of cheating on a contract arrangement, both by the farmer and by the firm. The next section discusses changes to the contract structure that would minimize cheating.

Alternative Contract Designs that Align Incentives

The following modification of Figure 1 shows that contracts can be written to diminish incentive problems. Figure 2 present an incentive compatible contract.

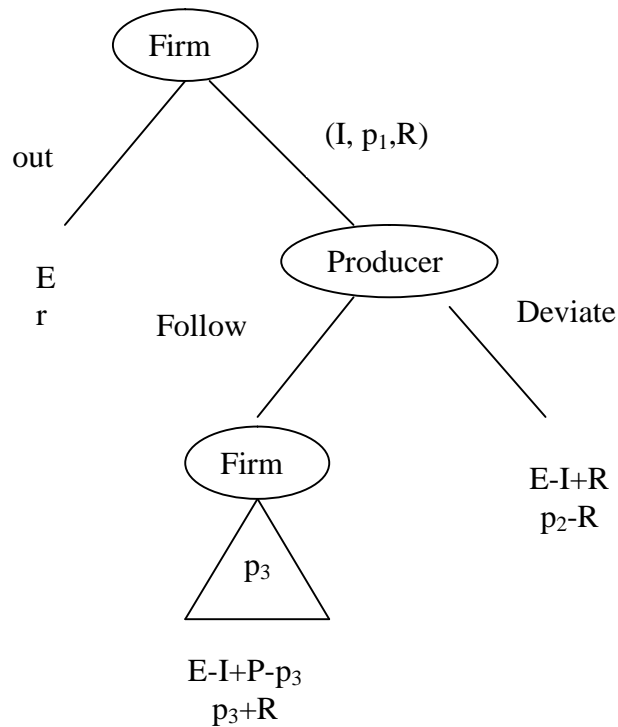


Figure 2: An Incentive Compatible Contract

Figure 2 shows how a simple modification of the original contract can be obtained by the introduction of a ransom, R , in which farmers pay a collateral up front. The introduction of the ransom relaxes the constraint imposed by the incentive for farmers to defect. The ransom makes it costly for the farmer to renege on the original contract. This modification of the game encompasses other contracts such as joint ventures, warranties, and linked markets. The idea can also be used to discipline firms by making it costly to deviate from originally agreed-upon prices. That is, firms too can put up a collateral that is forfeited in the case of default on the contract.

The challenge for the implementation and design of contracts lies in identifying what can be used as a ransom and in creating a way for farmers to access a ransom. The next sections describe how the study was implemented, the design that was agreed upon between the company and the researchers, the implementation of contracts, and the limitations of the research results.

Study Area

The study took place in the mango-producing area of northern Peru. Farms were located in the province of Tambogrande in Piura and the province of Motupe in Lambayeque.

This area has several production characteristics that make it attractive for the study of contract farming with small farmers. Ninety percent of the production is contracted and 80 percent of the contracts are with farmers owning between 1 and 2 hectares. The production of small farmers accounts for 22 percent of total mango production in the region, with each firm producing between 10 and 15 tons per hectare. Producers do not necessarily keep a long-term relationship with a firm. Our analysis of the contract records of a major firm in the area shows that over a period of three mango-growing seasons, 215 farmers had a contract every year, 139 had contracts for two of the seasons, and 320 farmers had a contract only one season. These contracts tend to be signed in August and apply to the harvest that takes place between late November and April of the following year. Contracts typically include the advance of inputs, which should increase production. While companies have substantial purchasing power in the area of study, the evidence suggests that reneging by farmers is still a problem and firms have not resolved this issue.

The study was conducted with the collaboration of the firm Sunshine, a mango processing and exporting firm. Sunshine is a large mango exporter in northern Peru, in Piura, especially in the areas of Tambogrande and Motupe. The firm owns a process plant that meets all the import requirements imposed by countries in Europe and the U.S. The firm is a direct link between local supply and external buyers. Farmers can sell directly to Sunshine without the need of intermediaries. The firm usually contracts with a pool of 300 to 400 small farmers and 10-15 large farmers. Contracts are typically signed with farmers in August, setting benchmark prices and quality standards. There is a large variety in mango quality and size, and the firm pays different prices depending on the classification of the mango. The firm has three quality classifications, first, second and third (for processed and frozen mango sold for juices), and several certifications, organic, Fair Trade and Euro Gap, all of which garner a small bonus per kilo.

The firm allowed us access to detailed records of purchases and prices paid for seasons 2005-06, 2006-07 and 2007-2008, and the data reveal several important patterns about market concentration. The top five farmers account for 28 percent, 38 percent and 26 percent, respectively by year, of total mango purchased in those three seasons. This is not, however, the case with the production of organic mango where the concentration of production is smaller. While these records do not allow us to see which farmers were approached or which signed a contract with the company, it allowed us to create a list of producers to survey and later approach for the experimental study. This method gave us a sample of producers for whom we had a history of production sold to Sunshine prior to the implementation of the experiment.

Analysis of the company's records suggests a great deal of variability in prices and quality, the main components in contracts. For instance, the average price per kilogram in the 2005-06 season was \$0.23 (s.d. \$0.04), while average prices were \$0.31 (s.d. \$0.06) in the 2006-07 season, \$0.22 (s.d. \$0.05) in the 2007-08 season, and \$0.30 (s.d. \$0.11) in the 2008-09 season (calculated from our own survey data). This variability occurs in quality as well. For instance, in the 2006-08 season, 73 percent of production was considered first class, but in the 2006-07 season, only 54 percent of production was considered first class. In the data we collected early in 2009, we find that 79 percent of products purchased was considered first class.

These data also illustrate the considerable gap between prices predicted to be paid in contracts signed with farmers and actual prices paid at the time of harvest. For example, contracts signed in the 2007-08 season predicted prices of \$0.25 per kilo for first class conventional mango and \$0.34 per kilo for first class organic mango. While first class organic mango was bought at \$0.34, conventional first class mango was bought at as low as \$0.18 and as high as \$0.28. Similarly, the contract for the 2008-09 season offered a price of \$0.20 per kilo, while observed prices in our survey were around \$0.35 a kilo.

Project Implementation

The project implementation section contains three main sub-sections: the characteristics of the experimental contracts, sampling and implementation, and results.

Experimental Contract Characteristics

An agreement between the firm and the researchers was reached in May 2008 to implement a series of experiments in which various contract designs would be randomly offered to farmers. The basic idea of the contracts was two-fold. First, farmers would be given access to formal credit through a local credit union (with a guarantee from the firm to the credit union); second, farmers would be given a price incentive for increasing their production of high-quality mangos from the previous season. The agreement between the firm and the credit union was that the firm would provide 11 percent of the total amount of credit provided to the farmers as a reserve fund in case farmers defaulted on the loans. In other words, the firm was willing to offer a costly signal of its own willingness to follow through on the contracts. Farmers who agreed to the contract had to accept the money to buy inputs through the credit union, i.e. they were obliged to accept credit equal to the amount of inputs necessary for production. Note that this contract does not ensure that farmers will sell their product to the firm since their commitment is mainly with the credit union.¹

The contract approved by the firm stipulated that: (1) All the production of export quality should be sold to the firm. The contract is explicit as to what first, second, and third quality means in terms of weight, size, and Brix (sugar content). (2) The mango should not have fruit fly larvae. If it does, production would be destroyed at the farmer's expense. (3) The firm will harvest all the production that qualifies for export and will not harvest from distant fields in case of heavy rain. (4) The fruit will be classified at the firm to determine the precise characteristics of the fruit. (5) The firm commits to announce prices at the beginning of the harvest. The firm projected that prices would be \$0.20 per kilo for first class mango, \$0.16 per kilo for second class mango, and \$0.10 per kilo for third class.² The contract makes clear that

¹ At the time of designing the experimental contracts with the firm, the main concerns of the firm were that all farmers perceived that they were being treated equally and that they did not want to commit to fixed or restricted prices. The experimental design reflects those concerns.

² First class mangos have a caliber between 8 and 6 (490gr to 680gr), at least 20 percent of red color on the mango skin, and are absent of blemishes, scars, and scratches. The mango should have a degree of Brix between 7 and 9.5. Mangos of caliber between 12 and 9 that satisfy these characteristics are also considered first class if there is enough demand for them. This contingency clause was added in 2008 as a reaction to the protest of producers

the firm has degrees of freedom in classifying the quality of mango. (6) The firm will pay \$0.02 per kilo more for first class production if the producer is able to increment its production of first class mango by 10 percent with respect to the previous season. This bonus would be calculated using only the amount of first class mango of caliber 6, 7, and 8. (7) The firm agrees to pay 50 percent of the value of the harvest from the previous month on the 15th of each month. The remaining 50 percent will be paid at the end of the season, which is around April 30. (8) A bonus of \$0.01 per kilo is awarded to producers certified with TNC. (9) Producers are prohibited from using inputs not approved by the company. They must adhere to the regulation of the Ministry of Agriculture, pay back any loans if the production is expected to fail due to natural disasters, and assume any costs accrued for the use of prohibited inputs detected after export. (10) Both parties accept local authorities and judges as arbiters of disputes.

As the contract makes clear, farmers promise to sell their production to the firm at a price to be determined in the future and under strict conditions of quality with enough flexibility to protect the firm from market conditions. Importantly, the contract does not mention penalties for either party's deviation from the current agreement nor does it mention a procedure to resolve disputes expeditiously. At face value, it is hard to see what the value of the contract is and why it is even signed. In practice, the firm has bargaining power to make signing a contract attractive to producers. As mentioned in the introductory section, mango producers are small and cash-constrained. They have limited capacity to adapt consumption and income over the year. The firm can therefore attract producers who commit to sell production by offering money advances or production inputs. Similarly, producers can use these contracts to secure funds from financial institutions.

In our study, four basic contract treatments were to be implemented: (1) a contract with the quality bonus and full financing through the credit union, (2) a contract with the quality bonus and half financing through the credit union, (3) a contract with the quality bonus and no credit, and (4) no contract. The control group (treatment 4) was to be taken from the population of producers who were not aware of the study.

Sampling and Implementation

After the agreement on the incentive schemes, the firm agreed to invite all producers with whom they interacted in recent years to participate in the program. The protocol called for company employees to inform producers of the price incentive and the possibility to obtain credit through a local credit cooperative. The procedure was designed such that all producers were invited. No producer was excluded from the invitation. Producers were not told that they were part of a study. Moreover, producers did not know of the presence of the research team. Producers who expressed interest in the program were evaluated by the company and by the

that considered that the classification of export quality was arbitrary. Second class mangos have a caliber between 6 and 12 (300gr to 790gr) and degree of Brix between 7 and 9.5. Mangos that cannot be classified as first class but are of export quality are classified as second class. This mango might have no less than 10 percent of red color on the mango skin and can be only of calibers 8, 9, and 10. Third-class mangos weigh at least 400gr (caliber 10), should not be sunburned, should have a soft tip, and have a degree of Brix between 7 and 11. This quality of fruit can have blemishes since it will be cut up and sold frozen for juices.

credit union for credit-worthiness. The list of approved farmers was generated in late May 2008. From the list, farmers were assigned to the full credit treatment (66 percent) or the half credit treatment (34 percent). The asymmetric proportional assignment to treatments was done at the request of the company because it was afraid that too little financial support for producers might affect production. The firm also agreed to offer price incentives to a randomly chosen group of producers, but in the end, the firm did not pay the price incentive because it was swamped by high market prices (the reasons for which are described below).

In order to create a large enough comparison group, we surveyed all small producers who had done business with the company in the previous three seasons. Table 1 shows the distribution of our sample across locations and across treatments. The disparity in the distribution across departments reflects the fact that most mango production occurs in Piura. Figure 3 shows the location of the farm in relation to road accessibility (left panel) and market accessibility (right panel).

Table 1. Sample Distribution			
	Location		
	Piura	Lambayeque	Total
Treated	73	33	106
Control	235	99	334
Total	208	132	440

We conducted three surveys between August 2008 and March 2009. A short survey was conducted in October 2008 with 327 producers to have a record of who was informed of the new contracts. The larger sample of 440 producers was surveyed in August 2008 and March 2009. These surveys collected detailed living standard survey data and detailed data on the management of mango production. In addition, the risk preferences of the household head and spouse were elicited using incentivized economic experiments. Finally, we collected detailed data on the history of sales and prices that producers had with the company and other buyers. The March 2009 survey also collected data on advanced inputs and informal credit.

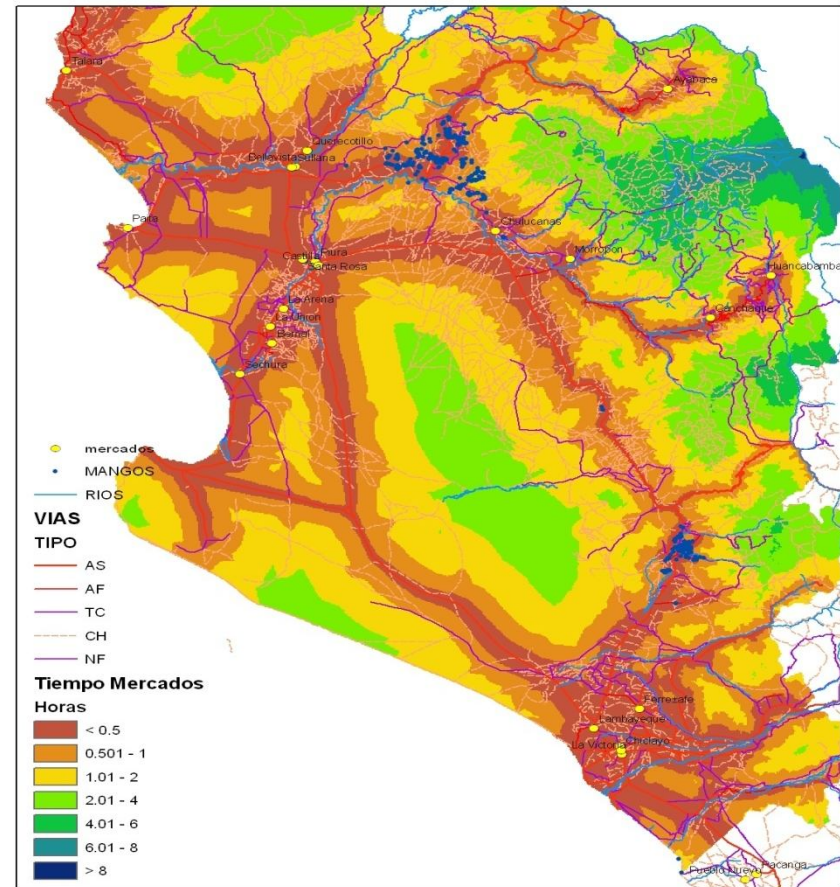
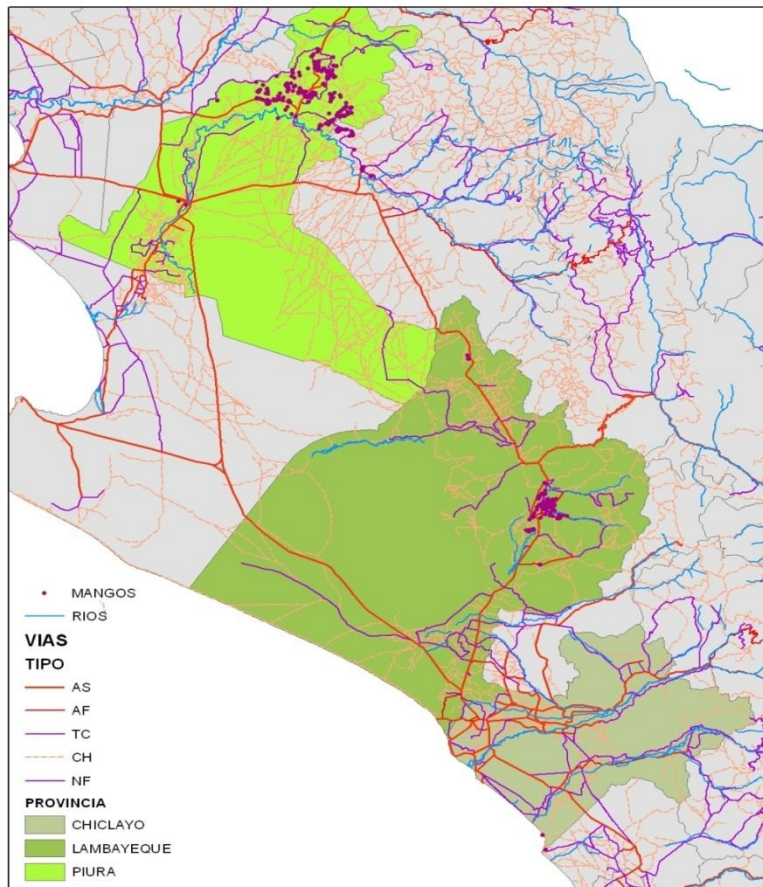


Figure 3: Maps of Surveyed Households (left panel) and Accessibility to Roads (right panel)

It is important to note that the experiments were not implemented as originally designed due to an unexpected change in the supply of production. Between the time we designed the contracts (May 2008) and the date that credit would be made available (August 2008), it became clear that the mango trees were not flowering as they normally would and that mango production would be very low that season. We will argue, however, that this shock provided us with a unique natural experiment. The final treatment randomization took place in early June 2008 and was based on the list of qualified producers provided by the company and the credit union. Qualified producers were assigned to a full credit treatment and to a half credit treatment, signed a contract, and submitted a formal application to the credit union. This means that, while the producers were conditionally approved to receive a full amount of credit, some were randomly assigned to a treatment in which only half the amount of credit was made available. All producers in this first group were offered the price incentive.

When it became clear that the mango trees were not flowering, the credit union backed off of the original commitment. This implied that the 2008-09 season was going to be one of low production, regardless of input use, thus making loans a risky prospect for the credit union. Our understanding is that the company made several attempts to secure loans from the credit union with little success. In August 2008, the company decided to give inputs directly to producers as a way to secure enough production to cover its commitments with foreign buyers. Importantly for us, inputs were given not only to people who originally qualified for the study but also to some producers who either self-selected out of the contracts or who did not qualify according to either the credit union or the company.

This means that we are able to observe not only the selection process utilized by firms but also the effect of the company's intervention on economic outcomes. This change in policy has identifying power and reduces issues of selection bias. With respect to our research question, we mentioned previously that neither producers nor firms can hold each other hostage in the absence of guarantees and collaterals. In particular, the firm, facing higher prices for local mango, put itself at a disadvantage vis-a-vis producers by advancing inputs without the guarantees provided by the credit union. The company weakened its bargaining position with respect to those producers who received inputs. In the absence of a mechanism that prevents farmers from taking advantage of this situation, as would be the case if firms and farmers engaged in long-term relationships, we should expect that *ceteris paribus* prices paid to producers receiving inputs will be higher.

The next section presents data regarding who participated in the study and how they were affected by the company's policy.

Results

This section discusses selection into the study and the impact of the company's help on production, productivity, and prices. The analysis restricts the sample to those

producers for whom we have information regarding their knowledge of the program. All the tables use information from two surveys: the short survey conducted in October 2008 with 327 producers and the survey conducted in March 2009 with about 440 producers. Finally, we rely on the list of people who were chosen to be in any of the treatments in May-June 2008.

We classify people into three mutually exclusive groups. People in the group called "Treated" come from two sources. Those who were acceptable to the company and to the credit union to enter into a contractual relationship as of June 2008 are counted as "treated." Also, those who, in October 2008, said they were invited to participate and participated in the incentives offered by the firm are counted as "treated." People in the group "Selected Out" are those who, in October 2008, said that they were invited to participate in the program but either decided against it or were rejected. People in the group "No Knowledge" are those who declared having no knowledge of the program as of October 2008.

Table 2 shows sample characteristics across the three groups. We observe some differences in terms of socio-economic background (although the differences are small). Those selected into the program are more educated, consume more, and possess more assets. Also, people in the "treated" and "selected out" group were more likely to say, in the March 2009 survey, that they applied for a loan. This is to be expected since people in the "selected out" group might have been rejected and therefore were not part of the "treated" group. The fact that only 48 out of the 78 treated producers say that they asked for credit in March 2009 suggests problems with recall or non-responsiveness.

Also, those in the treatment and selected-out groups are more likely to have submitted credit applications and received help from the company. As of March 2009, those in the study area are less likely to have other sources of formal credit than those that did not know about the program. Those in the treated and no-knowledge groups are more likely to get some sort of credit. This suggests that there are selection effects. Those who still value a relationship with the company are less likely to obtain credit on their own, and those who the company favors are more likely to do better as well.

As described in the implementation section, the credit program through the credit union collapsed in July-August 2008. The credit union pulled out and the company abandoned the study design. Importantly for us, the company decided to advance inputs to a group of producers. About 40 percent of the producers who we know were contacted for the program got some sort of help by the company. For reasons unknown to us, the company advanced inputs and money to people selected into the program as well as to people rejected from the program. In other words, the company reversed its assessment that some producers were not good enough to receive credit.

Extra evidence in favor of selection effects can be seen in the amount of credit received across groups. Those in the treatment and those not currently in a relationship with the company tend to receive larger amounts of credit. Differences in productivity seem to

be a factor in selection since these producers are able to raise more money, despite the fact that differences in land size and number of trees is similar across groups.

Table 3 presents regression results on selection effects. We find that despite the difference in characteristics across groups, the main reason for a farmer to be invited or selected into the program is commercial interactions with the firm in previous seasons. This suggests that long-term relationships are an important component of the relationships between the company and farmers. This is not surprising given that organic production is provided mainly by small producers and that stability of supply is important for large exporters. Interestingly, this relationship has not prevented the large variation in mango prices paid by the company across years.

As mentioned before, the company and the credit cooperative went through the effort of selecting producers to receive credit and aid. The self-selection of producers into the program and screening by the firm and credit cooperative were later abandoned. Finally, the firm decided to offer inputs and cash without the backing of the credit cooperative (i.e. without formal collateral) to a subset of those producers who qualified and a subset of the producers who did not qualify. In other words, this change of policy allows us to test not only the effect of inputs on production and productivity, but also whether the inputs have an effect on prices paid.

If the effect of help from the company is all due to self-selection, we should find that, controlling for selection, receiving help should be not significant. Regarding prices paid at harvest time, this experiment also can reveal whether the firm has informal mechanisms to discipline producers. If the firm can exercise control over producers with whom it has a long-term relationship, we should expect that prices are not affected by having advanced inputs once we control for the previous production of farmers.

To evaluate the effect of having received help from the company, we create a dummy variable that equals 1 if the farmer received money or inputs from the company. Table 4 shows the parameters associated with this variable on volume traded, production per tree, value traded, and average price paid (by any firm). These are median regressions that also control for selection into treatments. We find that those receiving help traded more, were more productive, and received higher prices (one-sided test). This is true even after controlling for the amount of credit received (from all sources), the value of production in the previous two seasons, and whether the firm sold to the company in previous seasons. Table 5 shows the results when we do not control for either previous production or previous relations with the company. We find that the results are similar.

We find these results remarkable. First, selection into treatments suggests that long-term relationships are important. While we observe a great deal of price variation in year-to-year contracts, this might be a reflection of optimal contracts under limited liability. Second, we find that prices commanded by those who received inputs from the company but did not provide a guarantee (the hold-up problem) are generally higher even when we control for farmers' previous production and relationship with the

company. It is therefore possible that the existing contracts, if optimal, require that significant advantage is taken from the party in a weaker bargaining position. We include analysis of price variability and experience by producers in and out of contractual relationship with the company. Finally, our results corroborate that farmers face significant credit constraints and that production and productivity are significantly affected by accessibility to resources.

Table 2: Sample Characteristics

	No Knowledge	Selected Out	Treated
N	172	77	78
Household head is female	8.7%	5.2%	9.0%
Household head age	58 (14)	57 (11)	56 (13)
Household head education	5.0 (4.2)	5.8 (4.7)	7.2 (4.8)
Household consumption	763 (642)	807 (442)	818 (404)
Food consumption share	61 (18)	60 (19)	58 (18)
Trees	457 (510)	544 (464)	617 (581)
Land (mean, p50, sd)	28, 2.3, 303	21, 3.0, 141	3, 2.8, 3
Asked for credit (Sipan)	10 (6)	37 (48)	48 (62)
Sunshine helped	2 (2)	32 (42)	38 (49)
Got credit (Sipan)	3 (2)	3 (4)	10 (13)
Success rate with Sipan			
Other formal credit	57 (33)	17 (22)	19 (24)
Got other credit	53 (31)	16 (21)	17 (22)
Ask informal credit	15 (9)	7 (9)	9 (12)
Got informal credit	14 (8)	7 (9)	9 (12)
Got some form of credit	61 (35)	22 (29)	31 (40)
Bad year ahead			
Asked for inputs?	11 (6)	29 (38)	35 (45)
Got inputs?	7 (4)	31 (40)	36 (46)
Not with Sunshine	101 (59)	8 (10)	5 (6)
Asked money?	12 (7)	27 (35)	30 (38)
Got money?	10 (6)	31 (40)	30 (38)
Got technical assistance	21 (12)	60 (78)	61 (78)
Informed incentives?	8 (5)	25 (32)	26 (33)
Offered incentives?	5 (3)	17 (22)	24 (31)
Advanced money? (mean, p50, sd, N)	1175, 900, 846, 10	1892, 900, 2119, 31	2439, 900, 7638, 29
Total Credit	2263, 4959	1432, 3468	2339, 4041
Production (mean, median, sd)	6505, 1540, 12266	6536, 2300, 8755	9881, 2872, 26967
Production per tree	19, 6, 31	14, 7, 15	17, 8, 32
Total trade (mean, median, sd)	131912, 31500, 237925	148230, 51382, 220290	234622, 90000, 758663
Traded with Sunshine	17%	56%	62%

**Table 3: Probit Regression on Selection into Treatment
(marginal effects)**

VARIABLES	Offered Contract	Invited to Apply
HH female	0.063 (0.559)	-0.121 (0.379)
HH Age	0.001 (0.653)	-0.002 (0.665)
HH Education	0.006 (0.271)	0.008 (0.453)
No. Trees	0.000 (0.171)	0.000 (0.628)
Land (Ha.)	-0.025** (0.037)	-0.000 (0.834)
Mango Sales in 2007	0.000 (0.202)	-0.000 (0.902)
Mango Sales In 2008	0.000 (0.404)	-0.000 (0.967)
Company's seller In 2007	-0.080 (0.102)	0.192* (0.061)
Company's seller In 2008	0.084* (0.055)	0.637*** (0.000)
Log-likelihood	-85.9	-121.7
Observations	139	294

in parentheses

*** p<0.01, ** p<0.05, * p<0.10

Table 4: Median regression of the effect of company's help

VARIABLES	Production	Productivity	Sales	Sale Price
No. Trees	-0.232 (0.554)	-0.005** (0.002)	0.979 (9.274)	0.002 (0.004)
Land (Ha.)	-0.584 (0.417)	0.000 (0.002)	616.449*** (7.009)	0.169*** (0.002)
Credit obtained	0.545*** (0.056)	0.001*** (0.000)	6.881*** (0.921)	-0.000 (0.000)
Sales in 2007	0.170*** (0.009)	0.000*** (0.000)	5.884*** (0.144)	-0.000 (0.000)
Sales in 2008	0.013 (0.012)	0.000 (0.000)	0.832*** (0.194)	0.000 (0.000)
Company's seller In 2007	-1,379.996* (708.248)	-1.824 (2.729)	-37,255.121*** (11,850.596)	2.092 (4.063)
Company's seller In 2008	35.406 (810.035)	-1.608 (3.217)	2,128.087 (13,737.218)	0.085 (4.987)
Selected into Treatment	-499.805 (807.881)	-1.546 (3.121)	-8,026.873 (13,721.723)	-2.322 (4.768)
Selected out of Treatment	141.029 (743.781)	0.222 (2.883)	501.644 (12,518.385)	-0.877 (4.427)
Received help from company	2,328.738*** (687.155)	7.700*** (2.702)	57,391.235*** (11,493.096)	6.264 (4.315)
Constant	402.756 (411.672)	5.586*** (1.593)	-347.367 (6,935.301)	19.697*** (2.665)
Observations	294	293	294	241

standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.10

Table 5: Median regression of the effect of company's help

VARIABLES	(1) Production	(2) Productivity	(3) Sales	(4) Sale Price
No. Trees	-0.329 (0.328)	-0.004** (0.002)	-2.201 (4.774)	0.002 (0.003)
Land (Ha.)	-0.835*** (0.211)	0.001 (0.001)	607.576*** (3.025)	0.169*** (0.002)
Credit obtained	0.600*** (0.033)	0.001*** (0.000)	7.841*** (0.481)	-0.000 (0.000)
Sales in 2007	0.177*** (0.005)	0.000*** (0.000)	6.152*** (0.076)	-0.000 (0.000)
Sales in 2008	0.006 (0.006)	0.000 (0.000)	0.031 (0.102)	0.000 (0.000)
Received help from company	1,762.028*** (319.086)	5.023*** (1.822)	46,892.457*** (4,582.829)	6.984** (2.911)
Constant	245.008 (235.019)	4.529*** (1.333)	-343.412 (3,360.565)	19.044*** (2.320)
Observations	294	293	294	241

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.10

Summary and Conclusions

We set out to investigate the relative effectiveness of input provision and price incentives on quantity and quality produced within long-term contractual relationships between an exporter firm and small mango producers. To do this, and with the initial help of the company, we design a randomized evaluation of the impact of credit and price incentives. Treatments were randomly assigned to a list of producers who selected into the program and were judged acceptable by the firm and a local credit union. This procedure allows us to directly observe selection into programs.

Due to a weather shock, and after selection and randomization had taken place, the credit union abandoned its promise to provide credit. Luckily for the researchers, the company stepped in and offered credit and inputs to a subsample of producers in the selected-in and selected-out groups. Since inputs were provided without collaterals and since mangos were in extremely high demand at the time of harvest, this gave us a unique opportunity to assess the importance of hold-out problems in contract farming.

We find that producers benefitted greatly from the inputs provided by the firm. Producers receiving help from the company produced more, were more productive, sold more, and received higher prices. These results do not appear to be due to selection or unobservable factors. Given the large fluctuation of prices paid by the company across

years and the relative stability of contractual relationships, our study suggests that the firm and producers are engaged in a long-term risk sharing agreement subject to limited liability.