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# Transaction Costs, Institutional Arrangements and Inequality Outcomes: Potato Marketing by Small Producers in Rural Peru

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**Summary.** — We explore the distributional effects of lowering transaction costs to allow access to improved market opportunities for small farmers in the Peruvian Highlands. We find that when new marketing opportunities arise, those that have more land, are better educated and are well organized are able to deal with the complexities that the new contractual arrangements entail. Although this on average implies an increase in net income for small farmers, it also affects the distribution of earnings, generating a more polarized small farmer economy. To counteract this effect and reduce inequality in the opportunities of less endowed small farmers, complementary policies need to be put in place.


*Key words* — market integration, transaction costs, income distribution, potatoes, latin America, Peru

## 1. INTRODUCTION

Peruvian national statistics indicate that the country has enjoyed sustained economic expansion in recent times (annual growth averaging over 5% during the last 15 years). However, this growth has not been accompanied by a substantial reduction in poverty, especially in rural areas. Further, within rural areas, growth-to-poverty elasticities are substantially higher in the better endowed coastal areas and lower in the highlands where poverty conditions affect two of every three inhabitants.

Although structural reforms and sound macroeconomic policies have improved prospects for long term growth in Peru, there is an urgent need for complementary policies to assure that growth will not enhance the already acute disparities in endowments, opportunities, and income that Peru has. Expanding local demand and increasing exports has open opportunities for new forms of contracting that link small farmers to rapidly increasing markets. These agroindustrial markets offer higher returns to small farmer's investments in comparison to traditional markets. However is not easy for poor farmers to overcome the transaction costs that these more complex markets entail. In mountainous areas, where access to public infrastructure (i.e., electricity, roads, telecommunication, etc.) is low, the transportation and transaction costs to reach regional and national markets are high. This may be one important reason why expansion in aggregate demand has not helped much to connect the small producers in the country's mountainous areas with more profitable markets.

In this context, the need to integrate small, poor producers into agroindustrial markets is quite pressing. One important question here is what constraints must small farmers overcome for this to come about? To address this question, this study draws on information provided by a sample of small potato producers from the Mantaro Valley in the rural highlands of Peru who sell to markets of differing complexity. In particular, we contrast the costs and benefits of selling potatoes to the industry to process them into chips, vis-à-vis selling potatoes to the traditional markets for direct consumption. [1] Although the chip market is very dynamic, in the sense that demand for potatoes is rapidly growing and prices growers receive for the varieties that go into this market are much higher than the prices they received for traditional varieties, this market demands specific skills, fixed investments, and higher working capital that may constitute barriers to entry for the less endowed small farmers. Given the characteristics of the market for processed potatoes (very few firms with important local bargaining power) it is not surprising that the marketing channel decision and the decision around the adoption of the new potato variety needed to access this market are necessarily subordinated to the capacity of the farmers to establish some contractual relationship with the industry.

Focusing on the first segment of the marketing chain (farmer to industry), this paper provides evidence that some small farmers can overcome the barriers to produce and sell to this agroindustrial market. However, we also show that not everybody can access this new market opportunity. We show that high transaction costs can operate as an exclusion mechanism, restricting access to agroindustrial markets of the poorest farmers, generating unintended distributional outcomes.

The paper is organized as follows. In Section 2 we give a brief account of the literature around how transaction costs shape the capabilities of producers to engage in new and more profitable income opportunities. We also show how these transaction costs can be linked with how these gains are distributed among producers. To the best of our knowledge, this is the first empirical research that explores this link. Section 3 describes the area under study and the survey conducted. Next, in Section 4 we use this survey and secondary information to characterize potato marketing in the Mantaro Valley. Section 5 presents the relative net benefits of accessing agroindustrial and traditional markets and constructs a

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counterfactual scenario to explore the distributional impact of gaining access to more complex albeit more profitable markets. Finally Section 6 summarizes the findings and discusses complementary policies that may be needed to enhance equality of opportunities for a larger portion of small farmers in rural Peru.

## 2. BRIEF LITERATURE REVIEW

As agricultural products become more specialized, there is an increasing need for coordination along the value chain. As Sykuta and James (2004) and Menard and Valceschini (2005) highlight, under these circumstances transactions usually shift from traditional spot markets to more complex contractual or hierarchical arrangements.

A large body of empirical literature discusses the effects of transaction costs on the choice of marketing channels or the type of contracting arrangements that should be expected. Macher and Richman (2008) provide an overview of this literature with emphasis on marketing, finance, law, and political science. For agriculture economics, Masten (2000) reviews a number of cases studies that highlight the fact that locational and temporal specificities play an important role in shaping agricultural transactions. In particular, perishability generates contractual hazards that shape governance structures while geographical disparities between contracting parties generates coordination problems. The work of Boerner and Macher (2002) and to a lesser extent that of Macher and Richman (2008) presents a number of empirical papers that address the determinants of choosing different governance structure in agricultural marketing.

Taking into consideration that backward integration from processors into farming generates incentive problems for farmers and poses high supervision costs; and forward integration out of farms into processing is impossible in most situations due the inability of an individual farm to achieve the efficient scale, the room for alternative governance structures clearly exists. Collective organizations could fill that space, developing forward integration from production into processing and distribution (Williamson, 2003). Nongovernmental organizations (NGOs) may also fill that space and, under certain circumstances, may be considered the most efficient governance structure.

Hudson and Lusk (2004) show that both risk and transactions cost play a role in contracting decisions in agriculture. As the uncertainties affecting specific types of transactions increase, spot market becomes increasingly costly. Under this circumstance contractual arrangements that incorporate contingency contracting may be preferable (Cook, Iliopoulos, & Chaddad 2004). The literature on contract farming has shown the potential positive impact of this governance structure on small farmer incomes and their capacity to innovate when market failures are substantive (Key & Runsten, 1999). Contract farming can improve the linkages of small farmers with agroindustrial markets allowing them to get technical assistance, credit, or access to key inputs (Glover 1984; Goldsmith, 1985; Morrisy, 1974).

Hobbs (1997) studies the supply channel of the meat processors industry of the UK and shows that transaction costs (specifically monitoring costs) are an important factor to determine the governance structure and particularly the choice of vertical coordination. Jaffee (1992) and Masten (2000) show that in context where high asset specificity, high uncertainty, or noncompetitive markets prevail, vertical integration through direct planting or contract farming should develop. Verhaegen and Van Huylenbroeck (2001) show how transaction costs are critical to understand the farmer's likelihood of switching from a common to an innovative marketing channel in Belgium. Contractual relationships that reduce uncertainties are shown as critical to induce farmers into these agroindustrial markets. As Schejtman (1998) has shown, contractual arrangements can help to by-pass imperfect markets and the lack of assets that small-scale farmers face.

Contract farming, however, can also generate undesirable outcomes. Possible negative effects may include market segmentation and exclusion (Glover & Kusterer, 1990; Little & Watts, 1994). Wu (2006), in the context of agriculture contracting, identifies at the theoretical level how inefficiencies associated with contractual arrangements—specifically, ways in which incomplete contracts can lead to sub-investment at the prior stage, or trigger rent-seeking behavior at the later stage at the expense of the farmer, who tends to be the weak party in the marketing chain.

As contractual inefficiencies in a market increases transaction costs, they may discourage farmers from entering that market. de Janvry, Fafchamps, and Sadoulet (1991) shows that many rural households avoid certain agricultural markets because of the existence of high transaction costs. The likelihood of overcoming such transaction costs may be affected by human capital constraints, physical and social factors – including capabilities for collective action, and the characteristics of the commercial relationships typical of each market.

Fixed transaction costs—those that are invariant to the quantity of the good traded—may be critical in determining the distributional impact of small farmer contracting opportunities. The importance of fixed as opposed as variable transaction costs has been highlighted as an important factor that explains also affect farmer's decision to participate in markets. Goetz (1992) has estimated a switching regression model in the context of buying, selling, or staying autarchic in the coarse grain markets in Sub-Saharan Africa showing that the higher the transaction costs the less likely that farmer will engage in market transactions. Key, Sadoulet, and Janvry (2000) has also shown that if some of the transactions costs are fixed, there are discontinuities in responding to market incentives. The implication of these results is that those that are not able to surmount these transaction costs may not participate in the market. Clearly high transaction cost can operate as an exclusion mechanism, affecting poorest farmers the most.

Chong and Calderon (2000) argue that an institutional reform may impose high transaction costs on the poorest and consequently may generate unintended distributional outcomes. As de Janvry and Sadoulet (2005) indicate, the fact that the poor have limited access to productive assets and they operate in unfavorable contexts where high levels of risk aversion and credit market failures prevail is not surprising that poverty is hard to escape. Guiso, Jappelli, and Terlizzese (1996) will indicate that if there are transaction costs needed for engaging in a more profitable activity, uninsurable income risk in the presence of credit constraints will induce individuals to keep a lower proportion of their wealth in the form risky assets. Fafchamps and Pender (1997) further show that under credit constraints uncertainty will further deter poor farmers from investing in more profitable albeit more risky options.

Despite the fact that the literature clearly shows that high transaction costs can deter poor farmers from entering more complex but at the same time more profitable agricultural markets, the literature has not provide empirical evidence on how contract farming under these circumstances—and without complementary interventions—may polarize a small farmer economy. This paper tries to overcome this deficiency by

modeling the distributional effects of accessing the agroindustrial potato market in rural Peru.

## 3. THE AREA UNDER STUDY AND THE SAMPLE

This study is based on information collected from 360 potato growers located in the Mantaro Valley, located in the Peruvian central highlands, one of the country's main centers of potato production and marketing. Potato marketing is a very important subject of study as it plays a significant role in Andean rural economy, being traditionally the most important source of income for small farmers in the Peruvian Andean region.[2]

The sample was drawn for the provinces of Chupaca, Huancayo, Concepción, and Jauja, which are in the Junín region and belong to the central Mantaro Valley.[3] This is an interesting research area because, although it is a poor region, it is representative of those areas of Peru's agricultural highland that are best connected to regional and national markets. It is a strategically located in the Andean valley, with favorable ecological and climatic conditions for farming, and with good connections to various markets—most importantly, to markets in Lima and to the valleys of the central coastal area.

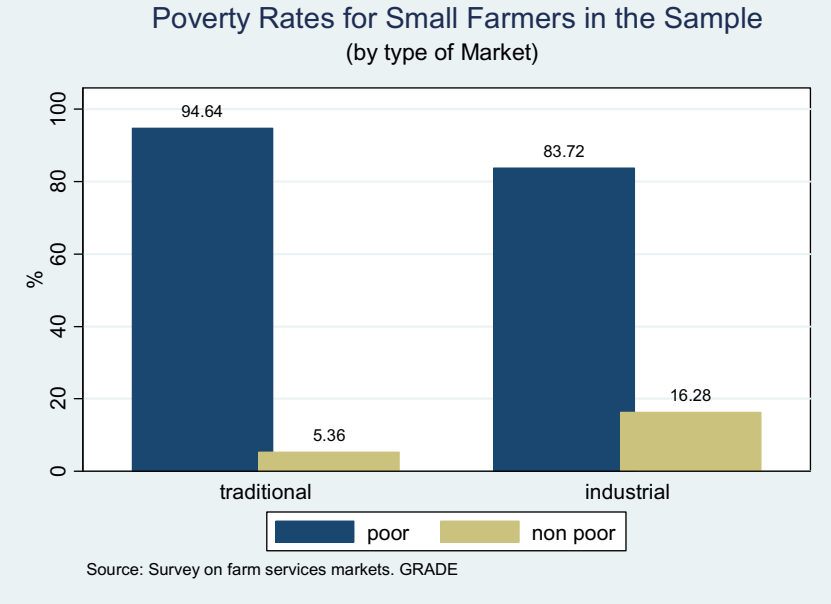


Figure 1. *Poverty rates for small farmers in the sample (by type of market).*

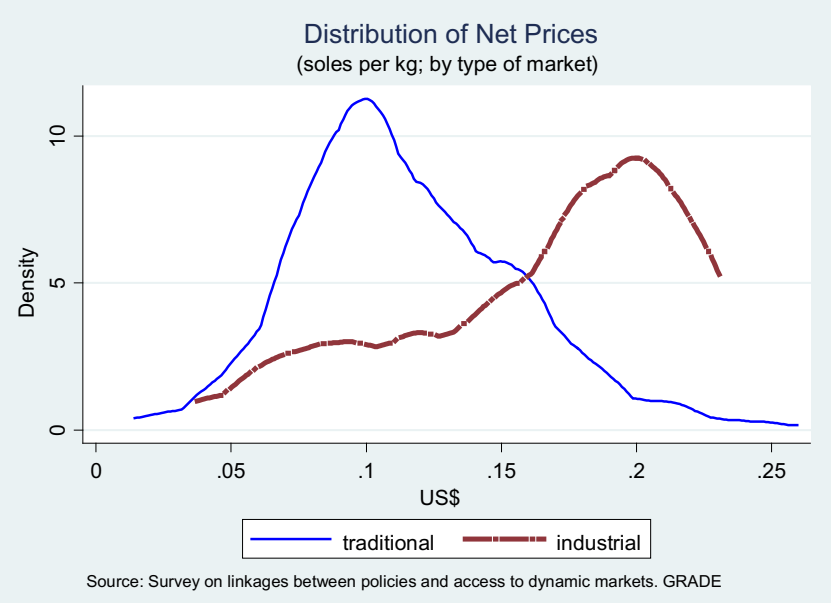


Figure 2. *Distribution of net prices (soles per kg; by type of market).*

In the Mantaro Valley small farmers that use traditional technologies to produce crops for local and regional markets coexist alongside with more modern and specialized small to medium farmers aiming to agroindustrial markets.[4]

The sample was stratified by the type of markets producers were aiming at. One fifth of the sample was randomly drawn within the segment of growers that produce potatoes for agroindustrial markets (agroindustry) while the remaining was randomly drawn from those producers that market their potato in the traditional consumption market. Using information coming from the 1994 Agriculture Census, post stratification weights were built in order to rebalance the sample and assure that results were representative of small potato farmers in the study area.

Our sample mimics reasonably well the living conditions of rural producers living in the central highlands of Peru. The incidence of monetary poverty is close to 93% for the sample[5] (See Figure 1). This rate coincides closely with figures based on the percentage of individuals with unsatisfied basic needs as reported by official statistics. It is interesting to note that there is a significant negative correlation between the incidence of poverty and the complexity of marketing arrangements: growers of potatoes targeting the direct consumption market show the highest incidence of both extreme poverty (91%) and total poverty (95%) as compared to producers aiming to the agroindustrial market.

The sample also reflects other key characteristics of those farmers producing potatoes in the Mantaro Valley. One important feature of the sample is the fact that it mimics the plot size profile of this region, where small plot holdings are the norm. Although differences in plot size between markets cannot be clearly determined, there is a marked concentration in terms of small land area under cultivation for potato aiming at the traditional and the agroindustry market. Finally, the sample reflects the heterogeneity of the prices that producers received depending on the markets for which they produce. Here there is a clear difference between the relatively lower prices that are paid to those aiming at the traditional

Table 1. *Characteristics of potato producers by market (standard errors in parentheses)*

| | Traditional | Agroindustrial |
|---|---|---|
| *Private assets and capital* | | |
| Gender of head of household (1 = male) | 0.96 | 0.84*** |
| | (0.20) | (0.37) |
| Age of head of household | 48.04 | 46.88 |
| | (13.56) | (11.32) |
| Average years of schooling—head of household | 10.45 | 11.74** |
| | (3.75) | (3.75) |
| Maximum number of years reached by any household member | 12.46 | 13.63*** |
| | (2.64) | (2.23) |
| Total area of land owned (in hectares) | 2.60 | 5.55*** |
| | (4.64) | (7.25) |
| At least one plot has a secure property title (1 = yes) | 0.26 | 0.47*** |
| | (0.44) | (0.50) |
| Productive assets (valued at median prices) (US dollars) | 1,753 | 4,709*** |
| | (3,155) | (6,612) |
| Household assets (valued at median prices) (US$) | 617 | 807 |
| | (984) | (1,454) |
| Median value of farm stock (US$) | 1,072 | 2,371*** |
| | (1,472) | (4,564) |
| Maximum credit available (US$) | 2,113 | 5,444*** |
| | (2,370) | (5,939) |
| Number organizations that the farmer belongs to | 0.74 | 1.93*** |
| | (1.27) | (1.82) |
| *Production and sale characteristics* | | |
| Technical assistance was provided (1 = yes) | 0.22 | 0.77*** |
| | (0.41) | (0.43) |
| Total value of potato sales (US$) | 3,248 | 7,140*** |
| | (6,474) | (13,450) |
| Total volume of potato sales (kg) | 13,145 | 22,198 |
| | (38,471) | (58,772) |
| Price, net of transportation cost (US$ per kg) | 0.12 | 0.17*** |
| | (0.04) | (0.05) |
| Production cost per hectare (US$) | 782 | 1076*** |
| | (571) | (680) |
| Net income per hectare (US$) | 1,039 | 1,886*** |
| | (907) | (1,552) |
| Sample size | 317 | 43 |

*Note: Source:* Survey on farm services markets and survey on linkages between policies and access to dynamic markets GRADE. Exchange rate used: 1 dollar = 3.47 soles.

* $p < .1$.
** $p < .05$.
*** $p < .01$.

consumption market and the higher prices that are paid to those selling to the agroindustry market. As Figure 2 shows, the net price distribution (i.e., net of transportation costs) for those selling to the agroindustry market lies to the right of the distribution of those selling to the traditional spot market. The net price distribution also reflects the risk that producers face as a function of quality requirements in the market for premium goods. It is interesting to note that small producers that are not successful in selling their produce to the agroindustry may even end up receiving prices lower than prices for potatoes aimed to the final consumption market, despite having made greater investment than growers of potatoes aiming to the final consumption market.

The survey used in this study provides information on individual market transactions, as well as on farmers' socioeconomic characteristics. Table 1 summarizes the average characteristics of those selling to the spot or traditional market and those selling to the agroindustry or agroindustrial market. This information helps us to characterize both contractual arrangements and transaction costs that surround the main marketing arrangements these producers engage with. According to this information, it is more likely that more complex marketing arrangements be associated with higher returns. Those that have been able to access the agroindustry market face higher production cost but the price of their produce is considerably higher. On average net agricultural income per hectare is significantly higher (160%) if the farmer sells potatoes to the agroindustry instead of selling it to the traditional spot market.

To characterize these contractual arrangements it is important to highlight the fact that the agroindustry market for potatoes is dominated by just a few firms. This is even more evident in the Mantaro Valley, where the bulk of the potato going to the potato chip industry is dominated by one firm that is able to impose conditions to farmers. Under these circumstances having some sort of contractual relationship with the agroindustry is the only way to move away from the traditional spot market channel and adopt the new potato variety that is required to access this market.

However not everybody can engage in some form of contract the agroindustry. As we will see in the next section the characteristics and quality of potato in both markets are very different and the fixed cost and human capital requirement needed to produce potatoes for the agroindustry are higher than those needed to engage in the traditional market. As seen on Table 1, on average farmers selling into the agroindustrial market have two more years of education, have larger plots of land and a greater asset base. In addition they are more likely to belong to a farmer organization and they are more likely to have access to credit.

## 4. POTATO MARKETING IN THE MANTARO VALLEY

According to Peruvian Ministry of Agriculture, the potato production in the Mantaro Valley represents approximately 50% of the total output produced in the Junín region, which in turn is the third largest potato producer area in the country.

Depending on usage we could classify the potato market in three: the traditional direct- consumption market, the certified seed potato market, and the agroindustrial market (potato for chips). Since the seed market is a very distinct product we have concentrated the study in the traditional and agroindustrial markets. From the producers' point of view, one essential difference between the traditional and agroindustrial market is the degree of complexity of the productive processes (greater investment, technology, and product differentiation for the agroindustrial markets), as well as the complexity of their marketing arrangements.[6] The other essential difference for producers is that there is more potential for profit in the agroindustrial markets, since these markets offer higher prices and potentially more capacity to absorb increasing quantities of output. It is important to note that, although the seed variety used for cultivating potatoes for the chip market has lower yield variability than several traditional seed varieties in demonstration plots under a controlled environment, its yield variability is much larger in actual farmer plots.

Technical assistance in the Mantaro Valley area plays a dominant role in producers' decisions to enter these market outlets. As Escobal and Torero (2006) have indicated, technical assistance in the areas studied is provided mainly by two NGOs: FOVIDA and ECOSER, with FOVIDA concentrating in the technical assistance required for entering the agroindustry market. These NGOs established themselves as providers of extension services after participating in the publicly funded Peruvian Farm Innovation and Competitiveness Program (Programa de Innovación y Competitividad para el Agro Peruano, or INCAGRO).[7] They offer technical assistance and training for potato growers, who seek help to increase productivity and move into more complex markets.

Next we will briefly describe the characteristics of both the traditional or spot market and the agroindustrial market.

### (a) *Traditionallspot market for potatoes*

Though there are no accurate statistics on the final destiny of potato production, estimates from the Ministry of Agriculture show that the major outlet for the country's potato produce is direct human consumption. The agroindustry production outlet is a recent development and represents a smaller but rapidly increasing share of the market.

Potato growing for the traditional market of direct consumption involves a longstanding system of production, which is the most widespread in the Mantaro Valley. Producing for this market is substantially cheaper than producing for the agroindustrial market. The cost per hectare of producing potatoes for the agroindustry is about 40% higher than the cost involved in producing potatoes for spot market (Table 1).

One advantage for farmers that produce potato oriented to the spot market is that they can sell different varieties of potatoes, since the demand is characterized by heterogeneous household's preferences and uses. This feature is important because diversifying the crop varieties reduces the risk of a negative climatic shock on yields without affecting market access. Diversifying over varieties also allows producers some control over the price risk in the spot market, taking advantage that some varieties may be more profitable than others when allocated to the spot market.

Since this market outlet trades mainly fresh potato (i.e., potato with no industrial processing), it can be sold through several marketing arrangements, which are carried out in the farm gate, at local fairs, wholesale markets, and also through more formal arrangements like contract with supermarkets.[8] In the case of the Mantaro Valley, and particularly in our sample, most of the transactions in the area under study occur in the farmgate or at wholesale markets. The latter is the most attractive outlet for traditional market producers, since greater quantities of product can be placed, while retaining the profit margin that may be appropriated by intermediaries when sales are made through other arrangements.

As the traditional market is mainly a spot and open market, prices are the principal coordinating mechanism (Schejtman

Table 2. *Transaction characteristics by market*

| | Variables | Traditional | Industrial |
|---|---|---|---|
| Contracts | % who signed contract with merchant (only firms for industrial market) | 4.4% | 50.6%*** |
| | % with access to the industry through FOVIDA | 0.0% | 49.4%*** |
| Negotiation and Monitoring costs | Hours spent for negotiating | 1.35 | 0.66 |
| | Number of visits for monitoring | 0.41 | 0.88*** |
| | Monetary costs of monitoring (US$) | 1.84 | 7.02*** |
| Transportation and Delivery | deterioration of merchandise in transport is a problem important or very important (1 = yes) | 0.17 | 0.36*** |
| | Average Transportation Costs (US$ × metric ton) | 8.89 | 15.67*** |
| Relationship of Trust | Average years merchant known | 5.83 | 4.17*** |
| | Level of trust in merchant (7 = total trust) | 5.52 | 5.88** |
| Availability of Liquidity | % of transaction paid in cash (1 = yes) | 97.7% | 74.1%*** |
| | Average days taken to pay | 0.83 | 12.31*** |

*Note:* Exchange rate used: 1 dollar = 3.47 soles.
*$p < .1$
**$p < .05$.
***$p < .01$.

1998). Prior commitments as to quality are not made, nor need producers commit to specific investments in order to sell under this arrangement. There are generally no formal contracts or documents associated with the delivery of the produce under this arrangement (See Table 2).

### (b) *The agroindustry potato market*

According to estimates from the Ministry of Agriculture, the share of the national potato crop absorbed by the agroindustrial market is about 3%.[9] Although this share is quite small, the agroindustry potato market has big possibilities to continue expanding since potato chip industry has increased sales substantially in domestic markets and also has begun new marketing opportunities in foreign markets. Agroindustrial market channel is mostly made up by the dynamic and growing potato chip industry, in which the Valley is the most important supplier.[10]

There are no historical statistics on potato chip production, but Bernet, Lara, Urday, and Devaux (2002) estimates that the main agroindustry enterprises (small and big firms) purchases approximately 330 tons per week. Bernet *et al.* (2002) also shows that the structure of agroindustrial potato market is highly concentrated. The most important firm, Frito-Lay, concentrates at least 50% of the market, followed by Laurel with 7%. The remaining of the market includes about 25 small size firms.

To enter this market, producers must adapt their production systems and quality standards to the requirements of the industry, which imply additional investments and requires technical assistance. One of the important quality requirements (related to sugar content and water content) restricts production to one variety of potato "Diacol Capiro", which is the only one able produced in the valley that could meet the relevant standards for frying.[11] Some of the specific investments needed to enter the agroindustrial market include soil analysis, investment in specific soil nutrients, and technical assistance aimed to evaluate the sugar content of the potato and determine the optimal timing for harvesting

As we have mentioned the costs per hectare (and per metric ton) of producing potatoes for the agroindustry is considerably higher. In order to cover this additional cost financing is required in most of cases. Input costs are higher, entailing for example using of certified seeds and improved agronomic practices, which often require technical assistance.

### (c) *Institutional issues and contract-based agroindustry arrangements*

Contractual arrangements in agriculture involve grower-firm relationships of an intermediate type, lying between vertical integration schemes and open-market contexts. In the area under study we found that the most important outlet for the agroindustrial potato is the agroindustry of chips, handled mainly through contractual relations. These contractual relations include direct contracts with medium-size growers, and also contracts with small producers. The latter is in charge of the NGO FOVIDA. An important activity this NGO performs is to act as an intermediary that reduces the monitoring costs for the main industry firm [12] while providing at the same time access to technical assistance for producers. This type of small farm contracting has open new market opportunities for small farmers in the region.

At the same time contracting with small farms through this NGO has allowed the agroindustry to access potatoes of high quality, under predictable conditions of security, stability, and delivery times. It is important to note that the potato chip industry has been confronting high storage costs in order to assure a continuous flow of potatoes through the year, as their other source of supply of potatoes (the coastal region) cannot produce potatoes between February and July. Although the Mantaro Valley is strategically located to deliver high quality potatoes during this season, the highly fragmented and disperse nature of farm land in this area adds huge costs to vertical integration. Under these circumstances the presence of FOVIDA allows for the construction of mutually beneficial arrangement.

This arrangement has become the most important source of income for those growers that have been able to enter into this type of agreement. This market outlet is more profitable for growers because of the higher prices paid, which provides an incentive to meet the higher quality and standards required by the firm. In addition, it offers the possibility of guaranteed sales, predictable time horizons of production sales and the

stability of a formal commercial relationship either directly with firms or trough FOVIDA.

However, industrial market involves higher production and transaction costs than the spot market, since it is a higher quality demanding market, requiring technical assistance most of the times and also needs overcoming institutional barriers such as the fulfillment of contractual agreements as well as to become a formal business. [13] In addition, risks are a constant threat in producing for this market, as the variety Diacol Capiro is particularly sensitive to climatic anomalies.

Some of the high quality requirements imposed by firms can be tested at the time of delivery. These requirements are set forth in detail in the contracts. They include sugar levels, percentages of dry material; pulp and peel color etc. These requirements are assessed by means of fry tests and raw tests applied to a random sample of the potato entering the agroindustrial plant. If the producer is unable to meet these standards producer's crop is rejected and the producer must absorb all losses.

Since the agroindustry potato market is not highly developed, and demand is extremely concentrated in a very few formal firms, growers prefer formal contractual arrangements than selling on the spot market. [14] However, there exist higher institutional costs associated with the contractual arrangements. An alternative to a direct contractual arrangement is to use the NGO FOVIDA as an intermediary that assures that the same contractual obligations are met. As can be seen in Table 2 approximately half of the farmers have signed contracts with the agroindustry while the other half maintains formal contractual relationships through the intermediary NGO.

As can be inferred from Table 2 is evident the agroindustrial market has more complex institutional structures than those required in the spot market. However, there are inefficiencies associated with contractual arrangements, since contracts are incomplete and market failures like asymmetry of information prevail. Under these circumstances marketing arrangements associated with agroindustrial markets are more costly for producers.

According to the transaction cost theory, the principal source of inefficiency is due to the existence of actions not subject to contractual provisions because of the incomplete nature of contracts. In the context of the Mantaro Valley and agroindustry arrangements, an incomplete contract is the one which is signed by the firm but does not place controls on its assessment of quality at the time of delivery. Thus the margin of discretion that it leaves to the firm may be interpreted by producers as increasing risk, regardless of whether the feared rent seeking behavior actually occurs. This threat becomes a part of a transaction cost that the producer needs to face.

On the other side, under the incentive's theory framework, inefficiencies in the Mantaro Valley contractual arrangements may occur when supervision costs for the firm appear. The fact that the firm rejects the product when it claims it is below its quality standards, may generate incentive problems, as the firm may have failed in designing an appropriate incentive scheme to encourage the producer to invest adequately in the production process.

Table 2 summarizes the main differences between transactions aimed to the traditional and the agroindustry markets. Here it is evident that monetary transaction costs tend to be higher when selling to the agroindustrial market. These costs are associated to negotiation and monitoring (more visits) and transportation costs. In contrast, transactions aimed to the traditional spot market will require more hours spent in negotiation and, as a result of the informal relationship with merchant, will be more likely to have conflicts. While the contractual arrangement associated with the agroindustry is based on formal written contracts (directly or indirectly through FOBIDA), transactions occurring in the traditional market are more likely to be cash transactions and linked to merchants that have a long relationship with the farmer. The share of potato producers who sign a contract is up to 4% on sample.

Finally it is important to highlight that in the interviews we made to both firms and farms it was evident that the bargaining power was higher on the part of the processing firms. Given this, the farmers need to reach the requirements imposed by the firms (some minimum efficient scale, either by themselves or through FOVIDA; some level of education, some minimum capital to face the fixed costs associated with technology adoption) in order to be chosen as a partner to enter the new marketing channel. Although the firm is interested in establishing some formal contractual arrangement with farmers (either directly or through FOVIDA) to assure timely delivery of potatoes, the ability to store potatoes and eventually import them gives the industry room for maneuver in order to impose its conditions.

## 5. MODELING THE ACCESS TO THE AGROINDUSTRIAL POTATO MARKET

In order to assess the net benefit of accessing the agroindustrial market and to evaluate what may be the distributional effects at level of the valley, we need to construct a proper counterfactual scenario so as to estimate what the net income would have been if those who access the agroindustrial market would chose not to, accessing instead the traditional spot market. As is well known (White, 2005) mean-based comparison can give us a misleading picture, as we cannot simply compare those that have access to the agroindustrial market with those that have chosen to sell to the traditional spot market as they were not randomly assigned to these marketing channels and as we have shown, on average those that sell to the agroindustrial market have different characteristics from those selling to the traditional market.

The conceptual base chosen to construct the counterfactual scenario is the strategy proposed by Williamson (1979), which circumvents the need to directly evaluate the transaction costs associated with different marketing arrangements. The methodology requires reformulating the arguments of the transaction cost theory regarding the effects of certain observable attributes on the costs of carrying out transactions in different markets.

More formally, if an agent is choosing between two marketing channels ($T^1$ and $T^2$) in quest of the one that renders lower observable costs plus transaction costs ($CT$) and consequently higher returns, we may state that the observed transactions follows:

$$\begin{aligned} T^* &= T^1, if\ OC^1 + TC^1 \leqslant OC^2 + TC^2 \\ &= T^2, if\ OC^1 + TC^1 \geqslant OC^2 + TC^2 \end{aligned} \quad (1)$$

where $TC^1$ and $TC^2$ are the transaction costs involved in these two transaction arrangements, and $OC^1$ and $OC^2$ are the additional observed costs. Although $TC^1$ and $TC^2$ are not directly observable, we may derive them from the observable characteristics reflected in the vector $X$, as an expression of the attributes of or constraints facing the individuals. If we assume that there is a linear relationship between transaction costs and the vector of the parameters associated with certain inherent attributes of the producer:

$$TC^1 = X\beta_1 + \upsilon_1$$
$$TC^2 = X\beta_2 + \upsilon_2 \quad (2)$$

This conceptual strategy provides a basis for the theoretical construct that we use to evaluate a potato producer's decision to participate in a given market because of its lower transaction costs and consequently its higher net incomes.

(a) *Constructing the counterfactual*

Formally, we can characterize the behavior of those accessing agroindustrial markets and those left behind and selling to the traditional spot market in a three-equation model following Dutoit (2007):

$$Y_i^A = X_i\beta_1 + \varepsilon_{1i} \quad (3)$$
$$Y_i^T = X_i\beta_2 + \varepsilon_{2i} \quad (4)$$
$$Y_i^* = (Y_i^A - Y_i^T)\delta + Z_i\gamma - \varepsilon_{3i} \quad (5)$$

Where $Y_i^A(Y_i^T)$ is the net expected income of producing for the agroindustrial (traditional) market, $X$ is the set of transaction costs faced for farmer $i$'s, $Z_i$ is a matrix including other farmer $i$'s characteristics (e.g., regional characteristics) affecting the net income, $\gamma_1$ and $\gamma_2$ are vectors of coefficients and $\varepsilon_{1i}$ and $\varepsilon_{2i}$ are error terms.

Eqn. (5) is the selection equation, which explains how the choice to be in one market or the other is done. It is assumed here that the occupational choice is based on the difference in the expected net income in each market $(Y_i^A - Y_i^T)\delta$ and some other characteristics $(Z_i)$ that influence the decision of selling to the agroindustrial market or to the traditional one. So, $(Y_i^*$, which is unobserved, can be interpreted as the inherent advantage of being in the agroindustrial market *versus* the traditional one.

Then, clearly:

$$Y_i = \begin{cases} Y_i^A \; if \; i = 1 \\ Y_i^T \; if \; i = 0 \end{cases} \quad (6)$$

$Y_{i,}$ the observed net income, corresponds to $Y_i^A$ if it is worth being in the agroindustrial market $(Y_i^* \geqslant 0)$ and to $Y_i^T$ otherwise. Now, as we can observe to which regime each farmer belongs $(I)$, it is possible to know whether $Y_i^*$ is larger or smaller than zero and hence, we can apply the endogenous switching regression with known sample separation, which is simple to implement. Indeed, defining

$$I_{\mathrm{i}} = \begin{cases} 1 \; if \; Y_i^* \geqslant 0 \\ 0 \; if \; Y_i^* < 0 \end{cases} \quad (7)$$

We apply the following likelihood function to estimate for (4)–(6), so we can estimate the net income traditional farmers could have if they were in the industrial market:

$$L = \prod_{i=1}^{n} [f(Y_i|I_i = 0)\mathrm{Pr}ob(I_i = 0)]^{1-I_i}[f(Y_i|I_i = 1)\mathrm{Pr}ob(I_i = 1)]^{I_i} \quad (8)$$

For the purpose of the estimation $\boldsymbol{X}$ is a subset of $\boldsymbol{Z}$. $\boldsymbol{X}$ includes: characteristics of the producer (gender and education), farm characteristics (farm size, plot fragmentation, land title, altitude). In addition we capture endowment factors (stock of capital) and regional characteristics that may affect the probability of engaging in agroindustrial markets (availability of irrigated land in the district, density of social capital) as these two variables were mentioned in our interviews with small farmers and with the potato processing firms. Note that $\varepsilon_1$, $\varepsilon_2$, and $\varepsilon_3$ are normal i.i.d. disturbances with zero means, $\varepsilon_1$ and $\varepsilon_2$ are not correlated $(\sigma_{12} = 0)$, the equation describing each regime (3), (4) and the sorting eqn. (5) are not independent since the switch is endogenous $(\sigma_{13} \neq 0, \sigma_{23} \neq 0)$ and finally the variance for $\sigma_3 = 1$ for identification purposes, since $\gamma$ is only estimable up to a scale factor).

In addition to these variables that also affect the probability of being able to enter into agroindustrial markets, $\boldsymbol{Z}$ should include some variables that may help to identify the decision to engage into the agroindustrial market. In this case these instruments are associated to restrictions coming from demand-side in the market which may deter or encourage farmers to enter into more complex contracting relationships but will not affect the size of the transaction or its profitability once the decision to enter or not the market has been taken. As is common in the literature the quest for finding a proper instrument is difficult as it should affect the net income per hectare only through lowering transaction costs and shifting the small farmer from the traditional markets to an industrial market. In our empirical model we consider as instruments two variables associated with demand-side in the market: number of producers in the district with plot sizes over 5 hectares and number of formal credit institutions in the district as plausible instruments.

In our interviews with the processing firms, having some minimum level of education, being organized, having a minimum land size (typically over 5 hectares), and having access to credit, were repeatedly mentioned as barriers to entry to the agroindustry market. We have used this knowledge when considering alternative instruments. Education clearly affects both the probability of entering the agroindustrial market and the net income a farmer can obtain in that market. Because of this it cannot be used as an instrument. In the case of membership in an organization (either for production or marketing purposes) it became clear from the interviews with producers that they can associate themselves if needed in order to increase the likelihood of entering the agroindustry market. This been the case, potential endogeneity can be a problem as the potential for accessing the agroindustrial market may induce some farmers to get organized. To avoid this problem we can use as an explanatory variable density of membership at the district level, which can be proxy of collective action in the district. However we acknowledge that this can be a weak instrument.

Considering the fact that there is very little market for selling and buying land in the area we can safely assume that land ownership is exogenous. In the case of land size having more than 5 hectares is considered by the agroindustry as a signal that the farmer can absorb the fixed costs that are associated with more complex contracting schemes. Although land size can affect both access and net income, we use the prevalence of relative large plots in the district as a demand-size indicator that will only affect net income through its effect in changing the context in which the farmers operate. A similar argument can be made regarding the density of credit institutions in the area.

The probability of accessing the agroindustrial market depends on the net utility gained by trading in the agroindustrial market relative to the utility of trading in the traditional market, as reflected in the additional fixed costs associated with trading in the potato chip market. Fixed transaction costs are resumed to determine whether or not a small farmer engages in a more complex contracting scheme but does not affect net income per hectare (up to a constant factor captured by the constant). Here we use the knowledge that firms

preferably offer contracts to areas with higher concentration of medium /big sized plots to assure availability of supplies. In addition we control for the presence of other formal institutions in the district that offer other services.

To estimate the model depicted in (8) we use a switching regression technique (mixture model) with known sample separation. These models work under assumption that the relationship between a variable of interest and a set of explanatory variables varies across discrete regimes (Dutoit, 2007) We used actual decision of each producer as the starting point of the algorithm to maximize the log likelihood function (6), giving estimates of $\beta_1$, $\beta_2$, $\varepsilon_1$, $\varepsilon_2$, $\sigma_{13}$, $\sigma_{23}$, and $\gamma$.

It is important to stress that the model depicted in (5) is not a full model that could help us capture the causal effects of reducing transaction costs. Its purpose is just to provide a consistent estimate of the probability of accessing an industrial market and an estimate of the profitability per hectare of such being in such market. This estimate is crucial to allow us to construct the counterfactual distribution of the net income per hectare that those selling to the agroindustrial market would have earned if they have decided instead to sell to the traditional spot market.

Table 3 shows the estimation of both the selection equation (the likelihood that the farmer selects the agroindustrial or the traditional potato market) and, conditioned in the selected channel, the main determinants of the net income per hectare that farmers obtained in each market. There are a number of regularities that are worth mentioning.

The education level of head of household as well as the education squared affects the net income per hectare once the regimen is selected. These coefficients imply a nonlinear relationship between human capital and the net income obtained in the agroindustrial market. This implies that an increase on education level has positive effects on net income per hectare but this effect is marginally decreasing as education increases, becoming negative once the producers have over 10 years of formal education.

Gender seems to be a factor affecting the selection of the market outlet, however, it is not a significant variable affecting the returns that farmers may obtain in each market. Here it is interesting to note that female headed households are not associated with the loss of the partner due to terrorism as is common in other regions of the highlands. In this area is more common to observe that the male is employed in nonfarm waged activities, which generate higher incomes to the household, leaving the farm to their female partner. Under these circumstances, higher household income coming from these other activities can finance the fixed costs required to enter

Table 3. *Net income per hectare according to market outlet*

| | Selection equation | Industrial market | Traditional market |
|---|---|---|---|
| Education level attained by head of household | −0.119 | 0.487* | 0.021 |
| | (0.12) | (0.27) | (0.07) |
| Squared years of education attained by head of household | 0.011* | −0.024* | 0.0004 |
| | (0.01) | (0.01) | (0.003) |
| Gender of head of household | −1.467*** | −0.599 | −0.088 |
| | (0.32) | (0.51) | (0.35) |
| % of producers who belong to any organization in the district | 2.421*** | −1.802 | −0.308 |
| | (0.86) | (1.84) | (0.37) |
| Land fragmentation index | −1.86*** | −0.518 | 0.732 |
| | (0.65) | (0.88) | (0.52) |
| Land owned under 1 ha (hectares) | −0.399 | −1.762* | 0.369 |
| | (0.41) | (0.94) | (0.23) |
| Land owned over 1 ha (hectares) | 0.038* | 0.002 | −0.004 |
| | (0.02) | (0.02) | (0.02) |
| Segment intercept for land owned over 1 ha | 0.555 | 1.185 | −0.137 |
| | (0.34) | (0.74) | (0.17) |
| % of land owned that has a secure property title | 0.267 | 1.38*** | 0.06 |
| | (0.26) | (0.35) | (0.15) |
| % of irrigated land in the district | 1.511** | 0.153 | 0.275 |
| | (0.59) | (1.21) | (0.25) |
| Dwelling altitude | 0.001 | 0.002 | −0.002** |
| | (0.00) | (0.00) | (0.00) |
| Household has a truck (1 = yes) | 0.646** | 0.254 | 0.172 |
| | (0.27) | (0.31) | (0.13) |
| Presence of credit institutions in the district (1 = yes) | 1.329*** | | |
| | (0.41) | | |
| Number of producers in the district with plot sizes over 5 ha | 27.218*** | | |
| | (9.21) | | |
| Constant | −5.037 | 0.303 | 12.789*** |
| | (6.63) | (8.92) | (2.49) |

Sample size: 360.
Wald test of independent equations: $\chi^2$ (1) = 0.06 Prob > $\chi^2$ = 0.8025.
Dependent variable for selection equation: access to industrial regime (1 = yes).
Dependent variable for regression equation: log of net income.
Robust standard errors in parentheses.
* $p < 0.1$.
** $p < 0.05$.
*** $p < 0.01$.

the agroindustrial market. Given this, is not surprising that most female headed household in our sample sell potatoes in the agroindustrial market.

Other key variables affecting the likelihood of entering the agroindustrial market are the number of organizations that farmers belong to at the district level, and the value of capital. (household has a truck) In the case of the number of organizations that farmers belong to at the district level, which is an indicator of social capital, the results confirm the evidence obtained in our interviews, as firms tend to target areas where it is more likely to find small farmers that are organized. FOVIDA, the NGO in charge of bridging small farmers with agroindustry is located in this same district and the higher level of organization is precisely an outcome generated by this NGO. In the case of capital, which is an indicator of wealth in this economy, the variable may be capturing the fact that there is a minimum level of wealth needed to finance the fix investments that are required to produce potatoes for the agroindustrial market.

Finally, we capture the existence of a threshold in land assets using a piecewise method. Our bonds are derived from the knowledge that very small farm plots (lower than 1 hectare) are assumed by FOVIDA, which in turn deals with small farmers, as farms that are unable to cover these fixed costs and consequently are likely to have loses. Given this threshold we use the area if the farmer owns less than 1 hectare of farmland for the first segment of the piecewise and the area if the farmer owns 1 hectare or more for the second segment of the piecewise. It is interesting to note a differentiated effect for area under 1 hectare and different effects at higher areas. The latter correlates positively with the likelihood of entering industrial markets, while the former correlates negatively with net income on industrial market once the regimen is selected.

Following Hahn, Ham, and Moon (2011) we evaluate a version of the Hausman test that is valid even in the presence of weak instruments. The estimated test obtained is 20.63 ($p < 0.01$), which suggests that we may have confidence in the collective validity of the instruments.

It is interesting to note that although the variables that are shown to be significant (like capital costs or minimum efficient scale) are not transaction cost specific, we have used our knowledge about the way this market operates, where the marketing channel decision and the decision around the adoption of the new potato variety are subordinated to the contractual choice decision.

### (b) *Estimating the impact of selling to the Agroindustrial Market*

Having estimated the model's parameters, it is possible to simulate the net income per hectare for those that are more likely to sell to the agroindustrial potato market and at the same time, construct the counterfactual scenario and estimate what the net income per hectare would have been if these small farmers decided not to sell to the agroindustrial market but instead sell to the traditional spot market. Table 4 presents such simulation. In panel A. we compare the estimated and the counterfactual for those that are more likely to sell to the agroindustrial market. Here we confirm that the net income per hectare is almost three times higher (US$ 2071 *versus* US$ 728 per hectare) if a small farmer sells to the agroindustrial potato market.

To evaluate what is the impact of these new contractual opportunities at the aggregate level (for the Central Mantaro Valley) we estimate the net income per hectare using the expansion factors constructed when the sample was designed. Panel B in Table 4 shows the average net income per hectare at the valley level for the full sample comparing the estimated income with the counterfactual. In this case for those that are selling to the traditional spot market the income per hectare remains unchanged in both regimes. The average estimated income at the valley level shows a gain of 76% (US$ 809 *versus* US$ 927 per hectare, which is statistically significant) due to the existence of these new contractual arrangements with the agroindustry.

We have also estimated how contracting with agroindustry affects the net income distribution in the central valley. Panel B in Table 4 shows that the Gini coefficient raises significantly from 0.27, if the new markets opportunities associated the agroindustrial market did not exist, to 0.42 when contracting with agroindustry is available in the valley. This abrupt increase in the Gini coefficient evidences that the benefits of contract farming are being captured by a small fraction of small farmers in the valley.

Yet another way of showing the distributional outcome of agroindustry contracting is to graph the distribution of net income per hectare for those that are likely to sell to the agroindustrial market and its corresponding counterfactual distribution. Figure 3 shows precisely this comparison and clearly reflects that those selling to the agroindustry are able to generate a net income that is typically much higher than similar farmers selling to the traditional spot market.

Table 4. *Simulated returns by market*

| | Estimated | Counterfactual for agroindustrial market | Counterfactual for traditional market |
|---|---|---|---|
| *PANEL A: Effect of accessing the agroindustrial market*[a] | | | |
| Net income—agroindustrial market (US$ per ha) | 2,071.7 | 727.80 | – |
| Net income—traditional market (US$ per ha) | 729.3 | – | 1,378 |
| | | Estimated | Counterfactual |
| *PANEL B: Average treatment effect Mantaro Valley (weighted)* | | | |
| Average net income (US$ per ha) | | 1,426.0 | 808.9 |
| Gini of net income | | 0.42 | 0.27 |
| Atkinson | | 0.28 | 0.13 |
| Theil | | 0.29 | 0.15 |
| Generalized entropy (GE −1) | | 0.57 | 0.13 |

*Note:* All differences between estimated and counterfactual values are statistically significant for $p < 0.01$.
[a] Based on predicted market decision.

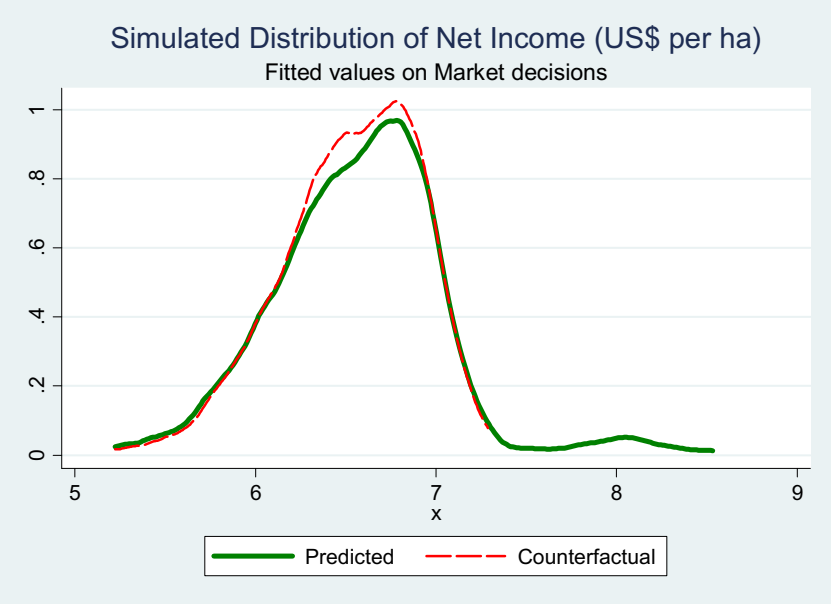


Figure 3. *Simulated distribution of net income (US$ per ha) fitted values on market decision.*

## 6. CONCLUSIONS AND POLICY IMPLICATIONS

This study shows clearly that there is a group of small producers capable of making strategic investments to gain access to agroindustrial markets where their produce is more profitable. We have also shown that these producers are capable of establishing more complex contractual arrangements with potential purchasers. Describing the transactions that small producers carry out in these markets, the study suggests that when producers move into more distant markets, they establish more complex marketing arrangements—arrangements that are likely to be more impersonal and subject to greater transaction costs.

We have shown what factors are most relevant to small agricultural producers' decisions to enter agroindustrial markets, that is markets that can absorb increasing quantities of crop providing higher returns for producers. It is evident that their degree of organization, educational level and training, and their land farm scale are constraints that need to be overcome in order to access the agroindustry potato market. The household educational level is a variable that distinguishes between those who succeed in selling to more complex markets, and those who do not. The producers selling to the agroindustry have on average two more years of schooling than those selling their crop elsewhere. Also, their average land holding is also greater (more than double), as well as the average value of their productive assets.

Failures of the market are common in rural Peru, due to problems such as deficient infrastructure, market segmentation, problems in fulfilling contracts, imperfect information, and high risk or uncertainty in terms of the State's fulfillment of its regulatory role. In this context, it is unrealistic to expect agroindustry by itself to succeed in bringing small growers into product markets. A noncompetitive market situation and lack of private initiative may be a rationale for intervention by the government and/or NGOs, but such intervention should be approached cautiously, so as to avoid magnifying existing problems and delaying—or, worse yet, impeding—the development of efficient and competitive markets.

Where thin markets are predominant, NGOs may provide the "social capital" needed to successfully link small producers who face high marketing and transaction costs with processors and agroindustry firms facing high levels of uncertainty and supervisory costs. In such environments, NGOs can provide information on access to the market through their networks of contacts. They can also reduce the transaction costs associated with negotiating contracts, and help build trust on both sides of a transaction. Furthermore, they can help develop a capacity for collective action by small and dispersed producers.

However, even with the help of an external actor that helps to develop coordination between small farmers and reduces the transaction costs that affect the likelihood that the agroindustry contracts with small farmers, the evidence presented here indicates that only a few of the small farmers will be able to overcome the barriers that impede that they successfully sell to agroindustrial markets.

As Dirven (2006) indicates if governments want to truly level the economic playing field they may need to directly subsidize some of the transaction costs small farmers face, in addition to the needed investments in education and infrastructure, and other policies aimed to the improve their connections with markets. This can be achieved either by helping directly farmer organizations or through some conditional transfer mechanism directed to agents downstream in the value-chain, in order to compensate them for including a larger numbers of small farmers as their regular suppliers.

Lowering transactions costs through promoting producer organizations, will not only make more likely that the less endowed small farmers enhance their opportunities to access to agroindustrial markets but also increase their net incomes once they are able to access these markets.

There are critical public goods and services issues that affect potato producers' opportunity to connect with agroindustrial markets. One is credit. Here, government is pressured to replace the private sector, rather than deal with the underlying problem of an undeveloped credit market. Here, a microfi-

nance scheme, supplemented by a second-tier bank to manage the risk inherent in local credit entities that absorb covariate risk, is an alternative worth exploring.

Research and technology-transfer policy is another example of what the government can do to level the playfield. Obviously, this area generates public goods and services that the private sector has little interest in developing. However, in Peru, public spending in this area has been minimal, dispersed, and totally lacking in consistency. Furthermore, the issue of public spending tends to be confused with direct execution of such spending by governmental entities. This is an exemplary area for the public sector to call for bids from the private sector for high-priority research and technology-transfer projects.

## NOTES

1. Although the possibility to simultaneously engage in transactions with both markets exists, only a very small fraction of the sample (15 farmers) was linked to traditional and agroindustrial markets at the same time. This number is too small to allow any rigorous analysis for this subgroup.

2. The national potato production averaged 3.1 million tons per year between 2001 and 2005. The production is basically concentrated in highland regions being Puno (14%), Huánuco (14%) and Junín (11%) the largest producer areas.

3. The survey was conducted in two visits in July and November 2003 and collected information for the 2002–2003 cropping season.

4. Following local criteria, small farmers may be defined as farmers owning plots of 10 hectares or less, while medium farmers own plots in the range 10 to 20 hectares. In the Mantaro Valley 93% of farmers owning 62% of the land can be considered small farmers (Trivelli et.al., 2006: p.255).

5. Poverty line is about 2 US dollars per day per person.

6. Potato for chips requires specific humidity levels and sugar content.

7. This project provides a competitive subsidy fund to increase the supply of technical assistance and to strengthen services markets that encourage innovation. Funds from the Fondo de Tecnología Agraria (FTA, or Farm Technology Fund) and the Fondo para el Desarrollo de Servicios Estratégicos (Fund for the Development of Strategic Services, or FDSE) partially underwrite the cost of these services, leaving the rest to be assumed by producers in the area in exchange for the services they use.

8. The present study did not explore this market, since there was little occurrence of it in the sample.

9. This estimate includes craft processed products like "chuño potato" (dehydrated frozen potato) and other dried potatoes as well as the higher value-added agroindustrial products (pre-cooked and frozen potatoes, strips and potato chips).

10. According to Frito-Lay, which is the largest firm in the field, purchases from the Mantaro Valley represented 50% of total purchases prior to 2003.

11. In the coastal valleys growers could also use the "Canchan" variety. This variety does not grow at high altitudes.

12. Small producers are eligible for the FOVIDA technical assistance and marketing program, which helps them meet this market's more stringent requirements. The marketing side of the program helps them locate sales opportunities with the various agroindustrial firms, as well as providing a waiver of the requirement to provide invoices for each transaction.

13. A taxpayer identification number (RUC) and the ability to provide an invoice are requisites for dealing with formal enterprises.

14. The probability of selling this type of potato on the spot market is minimal, and the profits are unattractive in comparison with sales to formal firms.

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