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# A Financial Contracting Approach to the Role of Supermarkets in Farmers' Credit Access

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# A Financial Contracting Approach to the Role of Supermarkets in Farmers' Credit Access

Philippe Marcoul<sup>1</sup> and Luc Veyssiere<sup>2</sup>

## Abstract

In developing countries, moneylenders who lend to farmers monitor them to make sure that their investment is not diverted. Similarly, modern production contracts offered by supermarkets or agro-export firms entail a loan component under the form of input advances and, like traditional moneylenders, supermarkets also want to make sure that this investment is not diverted. However, unlike moneylenders, supermarkets do care about the attributes of the product (form, quality, food safety, etc.). Whether such attributes are present in the harvested product is largely influenced by the advice and the extension services received by the farmer. We built a financial contracting model where we show that supermarkets, choosing to forgo specialization, optimally delegate to a multi-tasking agent both the monitoring and the advisory missions. This contract is shown to potentially enhance credit access for small farmers and sometimes to involve excessive monitoring. Finally, when involved in production, small farmers are shown to benefit the most, even though the supermarket has all bargaining power when making the contract offer.

**Keywords:** Financial Contracting, Development, Financial Intermediation, Food Standards, Organization of Production, Supermarket

*JEL classification:* O17, O33, O50, Q12, Q13

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# Introduction

In the last two decades, we have witnessed an impressive development of supermarket chains in developing countries. Saturation and intense competition in retail markets of developed countries, together with substantial margins offered by investing in developing markets, have largely contributed to the emergence of supermarket chains.<sup>3</sup> In countries where a substantial portion of the population lives in rural areas, the rise of supermarkets, that arguably affect the livelihood of farmers, is a sensitive issue. Although they represent a source of investment in local economies, their real welfare impacts are hard to assess and remain controversial. On the one hand, many empirical studies have found that supermarkets tend to leave behind or exploit small growers, preferring to concentrate their procurement of fresh agricultural products in larger scale operations (Dolan and Humphrey 2000; Dolan, Humphrey and Harris-Pascal 2001 and Trail 2006).<sup>4</sup> On the other hand, although many growers successfully work with supermarkets, it is not clear whether growers who fail to enter a business relationship with them are worse off relative to the period preceding their entry. In addition, other recent case studies have somewhat challenged the view that supermarkets have only a negative impact on small growers. In particular, these studies show that in niche markets small growers perform remarkably well and remain an attractive supply source for supermarket chains (Boselie, Henson and Weatherspoon 2003; Henson, Masakure and Boselie 2005 and Minten, Randrianarison and Swinnen forthcoming). However, while arguments on both sides are compelling, it is somewhat difficult, in light of these (rather) contradictory observations, to forge a clear understanding of the impact of supermarkets on grower activity. The objective of this paper is to contribute to this debate by providing a theoretical framework to analyze the impact that supermarkets have on growers' credit

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<sup>3</sup>For instance, Carrefour, a French-based supermarket chain, earned on average three times higher margins in its Argentine operations than in those located in France (Reardon et al., 2003).

<sup>4</sup>While the local demand for food is globally increasing, supermarket chains established in developing countries also export a substantial portion of their production to developed countries (Dolan and Humphrey 2000). Thus, supermarket production will only exclude a portion of the growers that remains uninvolved with the supermarket.

access.

There exists an important descriptive literature on supermarkets in developing countries. This literature describes and discusses what these retail chains are trying to accomplish and how they achieve their goals. First, it must be noted that besides the growing (local) demand for fresh food products that they try to meet, supermarkets or their affiliated grocers demand a substantially higher quality in the products they procure. Thus, supermarkets not only need to sell more in local markets, but they need to offer safer and higher quality products, as well. Therefore, the natural response of supermarkets has been to develop their own standards in countries where public food quality standards are often inadequate and lack proper enforcement.<sup>5</sup> However, the quest for higher quality and safer food products cannot be achieved without innovative procurement practices. These practices revolve around the creation of vertical relationships with growers through the establishment of tighter procurement contracts. Although the specific form of the contractual relationship between the grower and the supermarket can vary greatly depending on the context, there is arguably a common denominator.

Typically, supermarkets require their growers to make a substantial up-front investment in their operations. This investment ranges from new equipment purchases to the establishment of quality control and coordination systems. The literature analyzing supermarket procurement practices also reports that supermarkets are playing new roles in the production process. These roles essentially consist of a combination of intense production monitoring and advising, sometimes using the support of public partners (Boselie, Henson and Weather-spoon 2003). In practice, the advising is performed on the spot, when supermarket employees visit producers and discuss with them problems encountered during the growing cycle. The typical advice ranges from the proper way to apply fertilizers to the safe handling of pesticides. In addition, supermarkets also take on a monitoring role that essentially protects

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<sup>5</sup> As pointed out by an anonymous reviewer, even with stringent domestic requirements in terms of food standards, supermarkets may still develop their own private standards for two reasons. First via product differentiation, the supermarket can lessen price competition. Second, by imposing high standards requirements, supermarkets may prevent the entry of new competitors.

their investment in the growers' operations. Indeed, the relationship between farmers and supermarkets features a strong moral hazard component. For instance, to certify that product standards are met, but also that procured quantities are sufficient, supermarkets must make sure growers follow specific procedures and do not cheat or misrepresent their efforts and/or actions.<sup>6</sup>

Finally, although supermarkets rarely provide cash credit to farmers, they extend loans in the form of input advances that are reimbursed later when the crop is sold.<sup>7</sup> These input loans, which range from seeds to fertilizers and pesticides, cover most of the necessary inputs and their amount can be substantial relative to expected crop payments.<sup>8</sup> Supermarkets also attempt to absorb some of the growers' risks related to market conditions. This is usually achieved by committing to input and output prices prior to planting. Such commitments arguably result in lower liquidity needs for growers and are, in that sense, equivalent to additional loans. Overall, supermarkets' objectives seem to ensure that the financial and production risks faced by their grower base are sustainable and compatible with a long-term dedication to safe and high-quality products (Henson, Masakure and Boselie 2005).

The organization of production by supermarkets, nevertheless, raises several questions. For instance, it is not clear from a theoretical standpoint why supermarkets should provide such a bundle of services. It is conceivable that advising services could be provided independently of input loans. Farmers could finance, possibly using moneylending services, the purchase of the inputs necessary to carry out the production process.<sup>9</sup> Supermarkets would then purchase the crop, provided that it met a certain quality threshold. The mere fact

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<sup>6</sup>The most common form of cheating faced by supermarkets is one in which farmers sell part of their crop (for a higher price) to other grocers or local markets and, therefore, do not deliver the quantity that was agreed upon (Gow and Swinnen 2001 and Minten, Randrianarison and Swinnen forthcoming).

<sup>7</sup>Cash advances are, in fact, widespread in transition countries (Gow and Swinnen 2001).

<sup>8</sup>For instance, Boselie, Henson and Weatherspoon (2003) report that it takes a number of plantings for producers to achieve a net overall profit.

<sup>9</sup>In developing countries, credit loans extended by traditional moneylenders use growers' crops as collateral. To make sure that the grower repays his loan, the moneylenders closely monitor him during the crop cycle to make sure that he does not secretly side-sell and then default on their loan by pretending to have a bad harvest (See Aleem 1990 and Hoff and Stiglitz 1998). Unlike advising, the monitoring exerted by the supermarket is very similar to that of traditional moneylending (See Conning 2000 and Minten, Randrianarison and Swinnen forthcoming, for the case of supermarket monitoring.)

that such organization of production does not prevail in practice suggests that substantial benefits exist in bundling these tasks. In particular, to the extent that supermarkets are keen to have a large grower base for, say, smooth risks, it is possible that this organization of production will allow more farmers to access credit. More generally, we wonder how the emergence of supermarkets will modify credit access for small growers.

Our definition of the supermarket procurement process is very similar to that of contract farming. Production financing in contract farming usually involves technical advising *and* monitoring. As described by Conning (2000), contract farming, apart from the advising part, is not different from traditional moneylending. In particular, it possesses all the informal aspects of moneylending. This type of lending has become prevalent in many developing countries. For instance, Conning (2000) reports that during the last 20 years production finance has become dominant in Chile. While we rely essentially on the survey of Lecofruit in Madagascar by Minten, Randrianarison and Swinnen (forthcoming), Table 1 below based on Boselie, Henson and Weatherspoon (2003) summarizes characteristics of other cases studies.

In the table, the mechanisms for control and compliance, which either involve contract farming or out-grower schemes, all entail some input lending to farmers. Moreover, in all cases the standard to be achieved by farmers in terms of production are quite stringent. For instance the EUREP-GAP certification corresponds to the standard followed by European supermarkets.<sup>10</sup> Arguably, this is one of the most stringent standards in terms of quality and safety of food products. The last column of Table 1 describes how in practice these standards are met. Note that in most of the cases, company extension services are in charge of following and guiding farmers during the production cycle. In other cases (Alice and TOPS), advising services are provided by public organizations either for free or for reduced fees.

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<sup>10</sup>It should be noted that some local supermarkets do not always use contract farming, but merely buy standard product at the procurement center back door.

Name of the Company and Country	Nature of the Business	Mechanism for Control and Compliance	Number of Smallholders Involved	Advising
Alice, South Africa	Vegetable producer group supplying domestic supermarkets	Out-grower scheme, EUREP-GAP certification within 2 years	300–400	Public Private Partnership (PFID, AgriLink) Pick n' Pay supermarket chain
TOPS, Thailand	Domestic supermarket chain	Preferred suppliers with national public certification scheme	500–600	Affiliation with input provider Public Private Partnership (KLICT)
Thai Fresh United, Thailand	Exotic fruit and vegetable packer/exporter	Contract farming, EUREP-GAP certification	30	Company extension services Public Private Partnership (PSOM)
Hortico, Zimbabwe	Vegetable packer/exporter to European supermarkets	Out-grower scheme	4,000	Company extension services USAID
Homegrown, Kenya	Exporter nontraditional vegetables to European supermarkets	Out-grower scheme, company code of practice	150	Company extension services
Freshmark, South Africa (Owned by Shoprite)	Fruit and vegetables	Out-grower scheme, EUREP-GAP certification	300	Company extension services Public Private Partnership
<b>Lecofruit, Madagascar</b>	<b>Exporter high value vegetable</b>	<b>Contract farming, EUREP-GAP certification</b>	<b>9,000</b>	<b>Company extension services</b>

Table 1: Main Characteristics of supermarkets supply chains.

In this paper, we analyze the market for loans to growers by using a simple model of financial contracting. In our framework, growers need to make a financial investment before they can produce for the supermarket. In addition, during the production process, proper monitoring and advising of growers enhances the likelihood of crop success. We show that an organization in which the supermarket extends a loan and delegates advising *and* monitoring to the same agent is preferred by the supermarket, and also by growers. More precisely, bundling these tasks in the financial contract results in an organization in which motivation costs or agency rents are reduced. This rent contraction results in more poor growers obtaining loans. Our multitasking approach provides a new perspective to apprehend this type of contract and can explain its relative superiority with respect to bank financing or traditional moneylending.

Furthermore, we show that supermarkets have a preference for wealthy farmers. However,

this preference is not strictly monotonic and is subordinated to the assumption that the supermarket can make a take-it-or-leave-it offer to the farmer. When hired, small farmers are shown to derive strictly positive rents from their relationship with supermarkets. Finally, from a social standpoint, contracts offered by supermarkets might be suboptimal in the sense that they entail excessive monitoring.

In what follows, we briefly present the existing literature on lending in developing countries that is relevant to our work. We also relate our paper to the corporate finance literature on advising and venture capital. The model developed in the main section formalizes the basic idea of bundling advising and monitoring tasks in the same financial contract. We then study growers' incentives in this setup. Finally, we study how standards affect competition in the final market, and thereby influence growers' access to loans.

## Relation to the literature

The literature on moneylending in developing countries starts with the premise that borrowers in developing countries usually have weak balance sheets, and therefore have difficulty accessing financing. Most of the contributions in this field describe mechanisms by which borrowers are able to commit to repay their loans.<sup>11</sup> In the spirit of this literature on financial contracting in developing countries, our main result is to show that, by combining these two tasks, the supermarket allows poorly collateralized growers to obtain a loan; a loan that they would otherwise not obtain. This result is, to the best of our knowledge, novel. Indeed, a few contributions have dealt with contract farming but these contributions remain descriptive in nature (Key and Runsten (1999)). An exception is Swinnen and Vandeplas (2007) who model contact farming as a two-sided moral hazard bilateral relationship. Like us, they show that the farmer can derive a rent from this relationship. However, unlike us they do not discuss credit access as a function of farmer's wealth.

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<sup>11</sup>For a good review of the literature on financial contracting in developing countries, we refer the reader to Armendáriz de Aghion and Morduch (2005).

In developing countries, production contracts between exporters or supermarkets on one side and farmers on the other side usually involve loans in the form of an input advance. In this relationship, the supermarkets not only behave as external consultants that provide production advice as to what should be done with the product, but also play the role of conventional moneylenders.

As investigated by Aleem (1990) and Hoff and Stiglitz (1998), the informal lending activity in developing countries is usually performed by local agents who can easily monitor borrowers. Hoff and Stiglitz (1998), especially emphasize the fact that the moneylending activity is an informationally intensive activity characterized by monopolistic competition. Similarly, our work assumes that supermarkets employ well-informed local agents to perform the monitoring activity.<sup>12</sup> This monitoring activity of supermarket employees is very close in nature to that of moneylenders.<sup>13</sup>

Our work also shares common features with the literature on venture capital. Casamatta (2003) studies under which conditions an entrepreneur (in fact, a borrower) should hire an advisor. Similar to the supermarket agent in our model, when the venture capitalist advises diligently, the probability of a successful project increases. Casamatta (2003) provides a rationale for the existence of venture capitalists by showing that these advisors have to provide funds, as well.

Although the investment scale of the project is quite different, most agro-industries like supermarkets play a role that is, arguably, qualitatively identical to that played by venture

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<sup>12</sup>For instance, Minten, Randrianarison and Swinnen (forthcoming) describe the organization of the procurement activity by retail chains in Madagascar. They write (p. 11):

Every extension agent, the chef de culture, is responsible for about thirty farmers. To supervise these, (s)he coordinates five or six extension assistants (*assistant de culture*) that live in the village itself. The chef de culture has a permanent salary paid by the firm.

<sup>13</sup>Minten, Randrianarison and Swinnen (forthcoming) also describe the frequency and purpose of the monitoring (p. 12):

During the cultivation period of the vegetables under contract, the contractor is visited on average more than once (1.3 times) a week. This intensive monitoring is to ensure correct production management as well as to avoid ‘side-selling’

capitalists. Indeed, supermarket employees do not limit their activity to monitoring growers; they continuously advise them on best production practices. Moreover, it is well documented that supermarket agents have a specific and substantial knowledge of horticulture and, in that sense, are valuable advisors.<sup>14</sup>

From a purely theoretical standpoint, our contribution also relates to recent work on the design of contracts involving multitasking agents. Laux (2001) shows how, in a limited-liability contracting environment, wage cost can be reduced by assigning several independent projects to a single agent rather than to several agents. By paying the agent only when all projects succeed, the principal can relax the agent's limited liability constraint by punishing the agent for a given project by taking away payment on another.

More recently, Hueth and Marcoul (2007) model producer cooperatives by assuming that members provide not only work (as input providers), but also monitor managerial activity (as directors). The resulting multitasking structure is shown to strictly lower motivation costs.

In the next section we develop a sequential model in which every organization choice affects financial contracting outcomes. The financial contract model that we use is similar in spirit to Holmstrom and Tirole (1997).<sup>15</sup> However, unlike the former, our model features an additional advisory task as a key ingredient for project success.

## Procurement organization: a model

Consider a rural economy made up of a population of farmers, an agrifood sector and a financial sector. All the agents of this economy are assumed to be risk neutral. While

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<sup>14</sup> Again, Minten, Randrianarison and Swinnen (forthcoming) write:

The second constraint is human capital and long duration required for training of the *assistants de culture* which organize and supervise the contracting farmers in the field. It is estimated that it takes on average two or three years until the firm will be able to give him/her full responsibility in the field. This slows down growth and expansion.

<sup>15</sup> For applications of this framework to developing countries, see Conning (1999).

the agrifood sector involves a supermarket/exporter and a procurement agent, the financial sector involves a bank and a moneylender.

**Farmers.** Farmers are assumed to be heterogenous in their level of financial capacity,  $A$ . The presence of the supermarket provides farmers with the opportunity to develop a production project whose success is stochastic. More precisely, if the project is undertaken, it yields a verifiable income stream of  $R > 0$  in case of success and 0 if it fails. From the farmer's perspective, this project requires two inputs: his effort and a fixed-size investment  $I$ . When the farmer works diligently, the probability of crop success is raised by  $p_H$ . However, diligence by the farmer is subject to moral hazard, as he may decide to shirk to enjoy a private benefit  $B$ .<sup>16</sup> In this case the farmer does not raise at all the likelihood of crop success.

To make the problem non trivial, we assume that  $I > A$ , so that, in order to operate farmers need to borrow  $I - A > 0$  from a financial investor.

**The bank.** The bank can provide  $I - A$  to farmers. The bank is a passive but rational investor; it extends a loan as long as it can recoup it in expectation. It is passive in the sense that it does not have the capacity to supervise borrowing farmers. As a result, banks rely primarily on collateral-based enforcement of their loans. The bank, when accepting farmers' loan applications, cannot observe whether farmers will exert effort or not. In line with Innes (1990) and all of the literature on financial contracting, farmers are assumed to be protected by limited liability; i.e. investors can at most seize the realized outcome. Thus, farmers need to make a credible commitment to the bank on their supply of effort in order for their loan applications to be accepted.

Financing can also be eased by using the services of a procurement agent and a moneylender.

**The moneylender.** The moneylender is a member of the rural community working for the bank, whose function is to monitor farmers. He has an informational advantage and the

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<sup>16</sup>Based on a survey of Ivory Coast agricultural producers, Biais, Azam, Dia and Maurel (2001) estimate that this opportunity cost of effort is important. Specifically, they report a value for  $B$  as large as 40 percent of the investment.

bank cannot ascertain whether the monitoring is carried out seriously or not. Therefore, diligent monitoring must be induced through contingent payments. Effective monitoring by the moneylender implies that he privately incurs a cost  $m > 0$ . Similar to Holmstrom and Tirole (1997), the impact of monitoring is to reduce the farmers' opportunity costs of misbehaving by reducing the benefit of shirking to  $b$ , with  $B > b$ . To make the demand for the moneylender service a viable option, we make the following assumption.

### Assumption 1

$$B - b \geq m.$$

This assumption simply states that the reduction in the private benefit of the farmer,  $B - b$ , is greater than the private cost of monitoring,  $m$ . Under this assumption, it will be shown later that the compensation left to the moneylender to induce proper monitoring is less than the reduction in the farmer's private benefit. It is intuitive that under this assumption monitoring improves the feasibility of the crop project.<sup>17</sup>

**The procurement agent.** The procurement agent is also a member of the rural community possibly trained by the supermarket in delivering production advice. This advice helps to bring the product in conformity with the supermarket's specific standards. Effective advising from the procurement agent will raise the probability of success of the project by  $p_A$ . In other words, when the advisor and the farmer are both diligent, the probability of crop success is  $p_A + p_H$ . The advising activity is itself subject to moral hazard, as the procurement agent may prefer shirking on his advising mission to avoid a private cost  $c$ . To guarantee a positive demand for service from the procurement agent we make the following assumption.

### Assumption 2

$$p_A R \geq \frac{(p_A + p_H) c}{p_A}.$$

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<sup>17</sup>Note that undertaking monitoring implies that the social value of the project is reduced by  $m$ . Therefore, from a social standpoint it is a pure loss, and monitoring should be undertaken only if it improves project feasibility.

This assumption implies that the value of the project is increased by incurring the advising motivation costs of the agent. Thus, whoever makes the production contract offer always find it optimal to hire a procurement agent. The procurement agent could also be trained by the supermarket in monitoring. Like the moneylender, he may decide to shirk to avoid incurring a private cost  $m$ .

**The supermarket.** The agrifood company has to decide the scope of its activity. The company can hire a procurement agent whose task is simply to advise the farmer. In that case, the financing part is left to the conventional banking sector (here, the bank and the moneylender). The company can also choose to “integrate these tasks under the same roof” by hiring an agent who will both advise and monitor the farmer. In this organizational choice, the monitoring role is assumed by the supermarket agent. As such, the supermarket will replace the bank as a passive investor. For simplicity, the opportunity cost of funds is normalized to 1 for both the bank and the supermarket.

Finally, we make the following assumption on the parameters:

### Assumption 3

$$\max \{p_H R + c, p_A R - c + B\} - I < 0,$$

$$(p_H + p_A) R - c - m - I > 0.$$

In words, the first condition states that operating the project with a low effort in at least one moral hazard dimension is ruled out. This assumption implies that, in equilibrium, no loan contract that gives one agent incentives to misbehave will be granted. The second condition implies that projects involving monitoring generate a strictly positive surplus.

Summarizing a bit: in the crop production process, diligence in both advising and farming generates a probability  $p_H + p_A$  of success, but when shirking on advising and diligence in farming occurs (respectively, diligence in advising and shirking on farming occurs), the

probability of success is then  $p_H$  (resp.  $p_A$ ).<sup>18</sup> When shirking occurs on both tasks, crop failure is certain. Lastly, the purpose of monitoring is to lower the farmer's private benefit from  $B$  to  $b$ .

The interaction between the agents described above is modeled as a four stage sequential game. The timing of events is as follows.

*Organizational choice.* In the first stage, the supermarket decides between two types of production organization: one in which it hires an agent whose task is solely to advise the farmer on the operation and another in which it hires an agent not only for the advising but also for the monitoring tasks.

*Contracting.* The agent who holds the bargaining power, the farmer *or* the supermarket, makes a take-it-or-leave-it offer to all the parties involved in the production cycle. More specifically, the offer is a loan agreement specifying a sharing rule according to which, in case of success, the revenue  $R$  is divided among all participants. In case of failure, limited liability implies that all participants receive 0.<sup>19</sup> If the contract is accepted, the game proceeds to investment; otherwise it ends at this point and all participants are free to consume their initial endowment.<sup>20</sup> Immediately after the contract is signed, the farmer invests  $A$  while the bank (or the supermarket, pending on the chosen organization of production in the first stage) delivers  $I - A$ .<sup>21</sup>

*Effort choice.* The advisor and the monitor (if one is involved) move first.<sup>22</sup> They simultaneously decide to monitor (or not) and advise (or not) the farmer. The farmer then

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<sup>18</sup>This additive specification implies that effort by the farmers and the advisor are not complementary. Instead, each contributes separately to improve the project success likelihood. This assumption certainly simplifies our computation. Introducing some complementarity between the advising and farming tasks would reinforce our main results.

<sup>19</sup>The farmer's net payoff in case of failure is thus  $-A$ , while it is  $-(I - A)$  for the investor.

<sup>20</sup>In the event of the contract being turned down, the farmer would consume  $A$  and his net payoff would be 0.

<sup>21</sup>We assume that once  $I$  is invested, it is sunk and it has no recovery value in case of failure. This may be the case if the investment is highly specific to the agroindustrial firm or if we are dealing with input advances that are consumed during the growth cycle. However, it is possible to assume that the investment has a salvage value if the project fails. Making a "redeployability" assumption would ease credit access but would not qualitatively modify our results.

<sup>22</sup>For the monitor, this might involve, for instance, observing the farmer's habits or determining before they occur when and where "pirate sales" are likely to happen.

observes the outcome of the game and, in turn, decides to be diligent or not during the growth cycle.

*Production outcome.* The production outcome is realized and the return of the project is shared according to the agreement signed at the contracting stage.

The contract design problem consists in optimally sharing the project return,  $R$ , without destroying incentives for diligent behavior by the farmer, the moneylender and the procurement agent.

To understand the rationale behind the supermarket's choice of the production organization, the game is solved by backward induction. In the next sections, the optimal contract is systematically established for each potential organization of production; i.e. an organization where the bank finances farmers, the moneylender monitors and the procurement agent advises and an organization where the supermarket finances farmers while the procurement agent monitors and advises farmers. The comparison of the (privately) optimal contracts under alternative organization of production will determine the organization preference of the supermarket. We first begin with the case in which the farmer has all the bargaining power at the contracting stage.

## **Monitoring and advising by separate agents: the farmer makes the offer**

We consider an organization of production where the supermarket hires the procurement agent to advise, and where financing and monitoring are performed by the bank and the moneylender, respectively. While, according to Assumption 2, farmers always have an interest in requiring an advisor, it is by no means guaranteed that farmers will find it optimal to hire a moneylender. However, for the sake of exposition, we focus on the most general case, where the four parties are involved in production. The farmer has to share the project return with the moneylender, the procurement agent and the bank when formulating the financial

contract. This optimal sharing rule can be established by solving the following program

$$\max_{R_f} \{U_f = (p_H + p_A) R_f - A\}$$

$$R = R_f + R_m + R_p + R_b, \quad (1)$$

$$(p_H + p_A) R_f \geq p_A R_f + b \quad (2)$$

$$(p_H + p_A) R_p - c \geq p_H R_p \quad (3)$$

$$(p_H + p_A) R_m - m \geq p_A R_m \quad (4)$$

$$(p_H + p_A) R_b \geq I - A. \quad (5)$$

Here,  $U_f$  denotes the farmer's expected net return from the project, while  $R_f$ ,  $R_p$ ,  $R_m$  and  $R_b$  denote the success-contingent stakes of the project obtained by the farmer, the moneylender, the procurement agent and the bank, respectively.

The first constraint (1) states that the project return  $R$  is divided among the contracting parties. The following expressions (2), (3) and (4) denote the incentive constraints of the farmer, the procurement agent and moneylender, respectively. As usual in agency models, each constraint requires that the agent earns at least as much from being diligent (i.e. produce effort for the farmer, advise for the procurement agent and monitor for the moneylender) than from shirking. The left-hand sides of (2), (3) and (4) represent the expected net return assuming diligence of the farmer, the procurement agent and the moneylender, respectively. The right hand side of these expressions denotes their expected net returns when shirking.<sup>23</sup>

Finally, the last expression denotes the bank participation constraint. The banking sector is assumed perfectly competitive, and in order to accept a loan application the bank should

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<sup>23</sup>Note that the sequential nature of the game is important in interpreting the constraints. For instance, when the farmer deviates from "diligence" in expression (2), it is taken into account that the monitor and the advisor have been induced to be diligent. Indeed, when the farmer shirks, his private benefit is  $b$  (monitoring is effective) and the probability of success is  $p_A$  (the farmer has been advised).

at least break-even. The left-hand side of (5) refers to the expected benefits from lending, while the right-hand side is the market value of the fund supplied by the local bank. Recall that the opportunity cost of funds is normalized to 1.

The solution of the above program is given in the following Proposition.

**Proposition 1 (Monitoring and advising by separate agents)** *When the organization chosen by the supermarket is such that the bank finances farmers, the procurement agent advises while the moneylender monitors, there exist two thresholds of financial capacity, given by  $A_a = I - (p_A + p_H) (R - c/p_A - B/p_H)$  and  $A_{am} = I - (p_A + p_H) [R - c/p_A - (b + m)/p_H]$  such that the optimal contract has the following features:*

- if  $A \geq A_a$ , farmers borrow solely from the bank. Their expected net return is given by  $U_f^a = (p_A + p_H) [R - c/p_A] - I$ ,
- if  $A_a \geq A \geq A_{am}$ , farmers borrow from banks and hire a moneylender. Their expected net return is given by  $U_f^{am} = (p_A + p_H) [R - c/p_A - m/p_H] - I$ ,
- if  $A < A_{am}$ , farmers do not have access to credit.

This Proposition states that wealthy farmers have an advantage in obtaining loans, as they can bypass the services of the moneylender. In essence, monitoring allows poorer farmer to obtain credit. Finally, very poor farmers simply cannot access credit, even though according to Assumption 3, these projects are socially worthwhile. The existence of credit rationing in our context is driven by informational frictions. Indeed, moral hazard, together with limited liability, implies that agency rents have to be distributed to implement the project. This creates a wedge between the social value of the project and the total motivation costs that must be incurred to implement it.

The proof for this result conveys important intuitions useful to understanding the rest of the paper. We therefore give it in the text. Consider first the contract when the farmer decides to hire the supermarket's procurement agent but not the moneylender. Since there is

no moneylender, we can set  $R_m$  equal to 0 and drop the constraint (4). Without monitoring, the private benefit of the farmer when shirking is  $B$ . Thus, the farmer's incentive constraint (2) is rewritten as

$$R_f \geq \frac{B}{p_H}. \quad (6)$$

Likewise, the procurement agent's incentive compatibility constraint (3) can be rewritten as

$$R_p \geq \frac{c}{p_A}. \quad (7)$$

Substituting back (6) and (7) into the sharing rule (1), the maximum share that can be pledged by the farmer to the bank while applying for a loan is given by

$$R_b^a = R - \frac{B}{p_H} - \frac{c}{p_A}. \quad (8)$$

$R_b^a$  is referred to as the pledgeable income. The pledgeable income is the maximum amount that can be credibly promised to investors, i.e. the bank, without destroying the incentives of the agents involved in the financial contract (here, the farmer and the procurement agent).

If the farmer were to pledge more than  $R_b^a$ , then the incentive constraint of the farmer (6) and/or the procurement agent (7) would not be satisfied. As a consequence, the project prospect would be jeopardized and the bank would optimally reject the loan application. More importantly, the pledgeable income creates a lower bound on the level of financial capacity that the farmer must hold to obtain credit. Indeed, substituting back (8) into (5) leads to

$$A \geq A_a = I - (p_A + p_H) \left[ R - \frac{c}{p_A} - \frac{B}{p_H} \right]. \quad (9)$$

Thus, farmers with wealth  $A < A_a$  cannot convince a bank that they will reimburse the loan entirely, for the latter knows that at least one incentive constraint will be violated.

Recalling that the farmer is residual claimant on the contract, constraints (3), (4) and (5) must be binding, which implies that

$$U_f^a = (p_A + p_H) \left[ R - \frac{c}{p_A} \right] - I. \quad (10)$$

Not surprisingly, because the moneylending sector is competitive, the farmer captures the surplus of the project *less* the share given to the procurement agent.

Finally, farmers with a level of finance lower than  $A_a$  can ask for the supervision of a moneylender to obtain a loan from the bank. Under the supervision of a moneylender, his private benefit from shirking equals  $b$ . Hence, assuming proper monitoring by the moneylender, the incentive compatibility constraint of the farmer is rewritten as

$$R_f \geq \frac{b}{p_H}. \quad (11)$$

In a sense, by hiring a moneylender, the borrower commits to curtail his share in the project to raise his pledgeable income. However, for the moneylender to effectively monitor, according to (4) he should be provided a share of the project such that  $R_m \geq \frac{m}{p_H}$ .

Following the same logic as before, the pledgeable income, when a moneylender is involved, is

$$R_b^{am} = R - \frac{b}{p_H} - \frac{m}{p_H} - \frac{c}{p_A}. \quad (12)$$

Given Assumption 1,  $R_b^{am} > R_b^a$  and therefore by hiring a moneylender, the farmer raises his pledgeable income. Substituting (12) into (5) leads to

$$A \geq A_{am} = I - (p_A + p_H) \left[ R - \frac{c}{p_A} - \frac{b+m}{p_H} \right]. \quad (13)$$

As expected, by raising the farmers pledgeable income, monitoring reduces the minimum level of financing necessary to obtain a loan.

The expected net return of a farmer under the supervision of the moneylender are then computed as

$$U_f^{am} = (p_A + p_H) \left[ R - \frac{c}{p_A} - \frac{m}{p_H} \right] - I. \quad (14)$$

Given that a share of the project now has to be forfeited to the moneylender to guarantee proper monitoring, we have  $U_f^{am} \leq U_f^a$ . Therefore, when given the choice between hiring the services of a moneylender or not (i.e. farmers with a level of finance  $A \geq A_a$ ), a farmer will always prefer *not* to hire a moneylender.

Finally, note that the moneylender and the procurement agent will both enjoy a positive expected net return of  $\Gamma_{ml} = (p_A + p_H) R_m - m = mp_A/p_H$  and  $\Phi_a = (p_A + p_H) R_p - c = cp_H/p_A$  respectively. These positive expected net returns guarantee their participation in the project. This concludes the proof of Proposition 1.

## Monitoring and advising by the procurement agent

In this section, we now explore the possibility that the supermarket decides to play the role of the financial sector. To do so, it provides loans to farmers, instructs the procurement agent to monitor the reimbursement of these loans and also trains him to advise farmers on crop matters. In practice, the loan often takes the form of an input advance on seeds, pesticides or fertilizers.<sup>24</sup>

Unlike the previous case, the multitasking nature of the procurement agent now generates several incentive constraints. First, the procurement agent must be given reward  $R_p$ , such that he does not want to work on the monitoring task alone. His incentive constraint is

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<sup>24</sup>The fact that the supermarket offers inputs rather than cash has several rationales. First, there are economies of scale in procurement; supermarkets or grocers often serve several thousand growers. Second, there is arguably less scope for diversion of physical inputs, although it is still possible that farmers may try to resell them in a secondary market.

written as  $(p_A + p_H) R_p - m - c \geq p_H R_p - m$ ,

$$R_p \geq \frac{c}{p_A}. \quad (15)$$

Conversely, he should not want to shirk on the monitoring task while working on the advising. Using the same logic, we have

$$R_p \geq \frac{m}{p_H}. \quad (16)$$

Finally, the procurement agent can decide to shirk on both tasks, in which case the incentive constraint is written as  $(p_A + p_H) R_p - m - c \geq 0$  or

$$R_p \geq \frac{m + c}{p_A + p_H}. \quad (17)$$

Overall, the procurement agent will be diligent in performing both tasks if constraints (15), (16), and (17) hold true. Thus, the minimum stake consistent with procurement agent diligence is

$$R_p \geq \max \left\{ \frac{c}{p_A}, \frac{m}{p_H}, \frac{m + c}{p_A + p_H} \right\}. \quad (18)$$

Furthermore, with the procurement agent performing both monitoring and advising, production will involve three agents: the procurement agent, the farmer and the supermarket. In this organization of production, to obtain financing from the supermarket, the contract proposed by the farmer should solve the following program

$$\max_{R_f} \{U_f = (p_H + p_A) R_f - A\} \quad (19)$$

subject to

$$\begin{aligned}
R &= R_f + R_p + R_s, \\
R_f &\geq \frac{b}{p_H}, \\
R_p &\geq \max \left\{ \frac{c}{p_A}, \frac{m}{p_H}, \frac{m+c}{p_A+p_H} \right\}, \\
(p_H + p_A) R_s &\geq I - A.
\end{aligned}$$

Here,  $R_s$  denotes the share of the project received by the supermarket. Solving the program above gives the following result.

**Proposition 2 (Monitoring and advising by the same agent)** *When the organization chosen by the supermarket is such that the supermarket finances farmers and the procurement agent advises and monitors, there exist two thresholds of financial capacity,  $A_a$  and  $A_{am}^S = I - (p_A + p_H) \left[ R - \frac{b}{p_H} - \max \left\{ \frac{c}{p_A}, \frac{m}{p_H}, \frac{m+c}{p_A+p_H} \right\} \right]$ , such that the optimal contract offered by the farmer to the supermarket and the procurement agent has the following features:*

- if  $A \geq A_a$ , farmers borrow solely from the supermarket. Their expected net return is given by  $U_f^a$ .
- if  $A_a \geq A \geq A_{am}^S$ , farmers borrow from the supermarket, which hires a multitask procurement agent.

Their expected net return is given by  $U_f^S = (p_A + p_H) \left[ R - \max \left\{ \frac{c}{p_A}, \frac{m}{p_H}, \frac{m+c}{p_A+p_H} \right\} \right] - I$ .

- if  $A < A_{am}^S$ , farmers do not have access to credit.

As in Proposition 1, the farmer will not require supervision by the procurement agent if  $A \geq A_a$ .<sup>25</sup> However, when the farmer has insufficient wealth (i.e., when  $A < A_a$ ), he will accept monitoring by the supermarket agent. Unlike the moneylender, the procurement agent agrees to perform two tasks: monitoring and advising. As previously mentioned, for

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<sup>25</sup>In this case, we assume that the loan is extended by the supermarket. In fact, nothing prevents the farmer from borrowing from a bank to finance the inputs necessary for the project.

the procurement agent to be diligent in both monitoring and advising, expression (18) should be verified. This implies the following pledgeable income

$$R_s^S = R - \frac{b}{p_H} - \max \left\{ \frac{c}{p_A}, \frac{m}{p_H}, \frac{m+c}{p_A + p_H} \right\}. \quad (20)$$

Thus, to obtain credit a farmer's level of finance should be such that

$$A \geq A_{am}^S = I - (p_A + p_H) \left[ R - \frac{b}{p_H} - \max \left\{ \frac{c}{p_A}, \frac{m}{p_H}, \frac{m+c}{p_A + p_H} \right\} \right]. \quad (21)$$

Furthermore, by the same reasoning as in Proposition 1, it can be shown that the expected net return of the farmer having access to credit can be expressed as:

$$U_f^S = (p_A + p_H) \left[ R - \max \left\{ \frac{c}{p_A}, \frac{m}{p_H}, \frac{m+c}{p_A + p_H} \right\} \right] - I. \quad (22)$$

Finally, it is easy to check that  $\Phi_a^S = (p_A + p_H) R_p - m - c \geq 0$  for  $R_p = \max \left\{ \frac{c}{p_A}, \frac{m}{p_H}, \frac{m+c}{p_A + p_H} \right\}$ .

Therefore, it is confirmed that the procurement agent always want to participate.

Having established Propositions 1 and 2, it seems natural to inquire about the relative merit of both organizational forms. The next Proposition is the main result of this paper.

**Proposition 3 (Monitoring and Advising)** *At the first stage of the game, the supermarket (weakly) prefers an organization, in which it finances farmers and hires a procurement agent who both advises and monitors. In this organization, the number of farmers who obtain loans strictly increases in comparison to an organization where advising and monitoring tasks are left to distinct agents.*

**Proof.** According to Proposition 1, when advising and monitoring are performed by separate agents, farmers should have a minimum level of finance at least equal to  $A_{am}$  to obtain a loan (equation (13)). According to Proposition 2, when monitoring and advising are performed by the procurement agent, farmers should then have a minimum level of finance at least equals to  $A_{am}^S$  (equation (21)). Comparing these two expressions yields  $A_{am} > A_{am}^S$ . ■

When the farmer has all bargaining power, the supermarket is indifferent between the two types of organization. However, two (unmodelled) arguments can justify a preference by the supermarket for having a large supply base. First, a supply base of numerous farmers who are geographically dispersed acts as an effective mechanism to reduce the risk of widespread crop failures due to disease and (to a lesser extent) weather. It thus safeguards the ability of the supermarket to fulfill customer orders (Henson, Masakure and Boselie 2005). Second, a large supply base can act as a switching cost reduction mechanism thereby decreasing the search costs for new farmers.

The intuition behind the second part of the Proposition is as follows. Heuristically, by contracting with the same agent on both tasks the supermarket creates an incentive complementarity between the two tasks. For instance, it is possible that the agent derives a substantial rent by, say, monitoring diligently. Bundling and rewarding the two tasks in a single payment enhances incentives, in the sense that the prospect of losing this rent makes the agent less likely to overlook his advising duties. In other words, in this case, the agent is essentially a free advisor. Conversely, the agent could derive a substantial rent in advising and the fear of losing this (advising) rent would essentially make him a free monitor.

Arguably, such a feedback loop does not exist when both tasks are performed by distinct agents. To see this formally, note that the minimum motivation cost necessary to insure proper incentives when advising and monitoring are exerted by separate agents is

$$MS = \frac{c}{p_A} + \frac{b}{p_H} + \frac{m}{p_H}.$$

$MS$  is the sum of the farmer, moneylender and procurement agent payments consistent with proper incentives. When both tasks are performed by the same agent, this sum reduces to

$$MB = \frac{b}{p_H} + \max \left\{ \frac{c}{p_A}, \frac{m}{p_H}, \frac{m+c}{p_A + p_H} \right\} < MS.$$

Our result points to a beneficial role of supermarkets *for* farmers. However, it is important to note that the occurrence of such contracts results in the disappearance of “traditional” moneylenders in our model. In fact, as already noted by Conning (2000) in the Chilean context, the expansion of contract farming by supermarkets or agroindustrial firms has essentially resulted in the removal of traditional moneylending.

**Corollary 4** *Farmers prefer an organization of production where the tasks of advising and monitoring are performed by the same agent.*

**Proof.** We compare the expected returns of the farmer under alternative organization. While farmers only requiring advising to receive funding (i.e., with a level of finance such that  $A \geq A_a$ ) are indifferent between the two organizations of production. For farmers requiring monitoring, we have  $U_f^S > U_f^{am}$ . Therefore, farmers will prefer an organization of production where monitoring and advising are performed by the same agent. ■

This result is also a direct consequence of the fact that the bundling of both tasks reduces the minimum rent necessary to insure proper incentives. This rent reduction leaves a larger share of the project to be captured by farmers.

## The supermarket holds the bargaining power

So far, all the bargaining power in the contractual relationship was in the hands of the farmers. In reality, the balance of power between farmers and supermarkets arguably leans toward the latter. We now study a situation in which the supermarket holds all the bargaining power and proposes a sharing rule to the farmers and the procurement agent, in order to maximize its expected profits,  $\pi$ . In this contractual relationship, not only should farmers be willing to exert effort, but also to participate. The participation constraint of a farmer is given by

$$U_f = (p_H + p_A) R_f - A \geq 0,$$

or  $R_f \geq A/(p_H + p_A)$ . Thus, for the farmer to participate and exert effort it should be that

$$R_f \geq \max \left\{ \frac{b}{p_H}, \frac{A}{p_H + p_A} \right\}. \quad (23)$$

The problem of the supermarket is expressed as

$$\max_{R_s} \{ \pi = (p_H + p_A) R_s - (I - A) \}$$

subject to

$$\begin{aligned} R &= R_f + R_p + R_s, \\ R_f &\geq \max \left\{ \frac{b}{p_H}, \frac{A}{p_H + p_A} \right\}, \\ R_p &\geq \max \left\{ \frac{c}{p_A}, \frac{m}{p_H}, \frac{m+c}{p_A + p_H} \right\}, \\ (p_H + p_A) R_s &\geq I - A. \end{aligned}$$

Before we proceed, it is useful to define  $R_p^S = \max \left\{ \frac{c}{p_A}, \frac{m}{p_H}, \frac{m+c}{p_A + p_H} \right\}$  and  $A_I = (p_H + p_A) (R_p^S - c/p_A - b/p_H)$ , that are used in the following result.

**Proposition 5** *In the second stage of the game, the contract proposed by the supermarket to the farmers and the procurement agent has the following features:*

- if  $R_p^S = c/p_A$ , the farmer accepts a production contract that stipulates monitoring and advising by the procurement agent. The latter earns expected net return  $\Phi_a^S$ . If
  - $A \geq (p_H + p_A) b/p_H$ , the supermarket earns  $\pi = (p_H + p_A) [R - c/p_A - b/p_H] - I$ , while the farmer has no rent, i.e.  $U_f = 0$ .
  - $(p_H + p_A) b/p_H > A \geq A_{am}^S$ , the farmer's net return is  $U_f = (p_H + p_A) b/p_H - A > 0$ , while the supermarket's expected profit is  $\pi = (p_H + p_A) [R - c/p_A - b/p_H] - (I - A)$ .
- if  $R_p^S \neq \frac{c}{p_A}$ , then the farmer accepts a production contract. If

- $A \geq (p_H + p_A) B/p_H$ , the farmer's net return is  $U_f = 0$  and the contract only stipulates advising by the agent who earns  $\Phi_a$  while  $\pi = (p_H + p_A) [R - c/p_A] - I$ .
- $(p_H + p_A) B/p_H > A \geq A_I$ , the farmer's net return is  $U_f = (p_H + p_A) B/p_H - A > 0$ . The contract only stipulates advising by the agent who earns  $\Phi_a$  while  $\pi = (p_H + p_A) [R - c/p_A - B/p_H] - (I - A)$ .
- $A_I > A \geq (p_H + p_A) b/p_H$ , the farmer's net return is  $U_f = 0$ . The contract stipulates monitoring and advising by the agent who earns  $\Phi_a^S$ . The supermarket's expected profit is  $\pi = (p_H + p_A) [R - R_p^S] - I$ .
- $(p_H + p_A) b/p_H > A \geq A_{am}^S$ , the farmer's net return is  $U_f = (p_H + p_A) b/p_H - A > 0$ . The contract stipulates monitoring and advising by the agent who earns  $\Phi_a^S$ . The supermarket's expected profit is  $\pi = (p_H + p_A) [R - R_p^S - b/p_H] - (I - A) > 0$ .
- if  $A < A_{am}^S$ , the farmer does not obtain a production contract, i.e.,  $U_f = 0$ .

One of the main findings of Proposition 5 is that loan extension is not influenced by whoever holds the bargaining power. Indeed, as in Proposition 2, loan extension is up to a finance level  $A = A_{am}^S$ . Thus, this result stems from the delegation to a single agent of the monitoring and advising tasks, *not* from the bargaining power allocation. In our model, the bargaining position of each player only determines how the surplus is allocated among all participants but has no bearing on how many farmers are potentially entitled to produce.

This Proposition also provides insights on a focal issue in the empirical literature on supermarkets, namely the fate of small farmers in the emergence of these agroindustrial companies. Figure 1 illustrates Proposition 5 in the case where  $\max \{c/p_A, m/p_H, (m + c) / (p_A + p_H)\} = m/p_H$ .

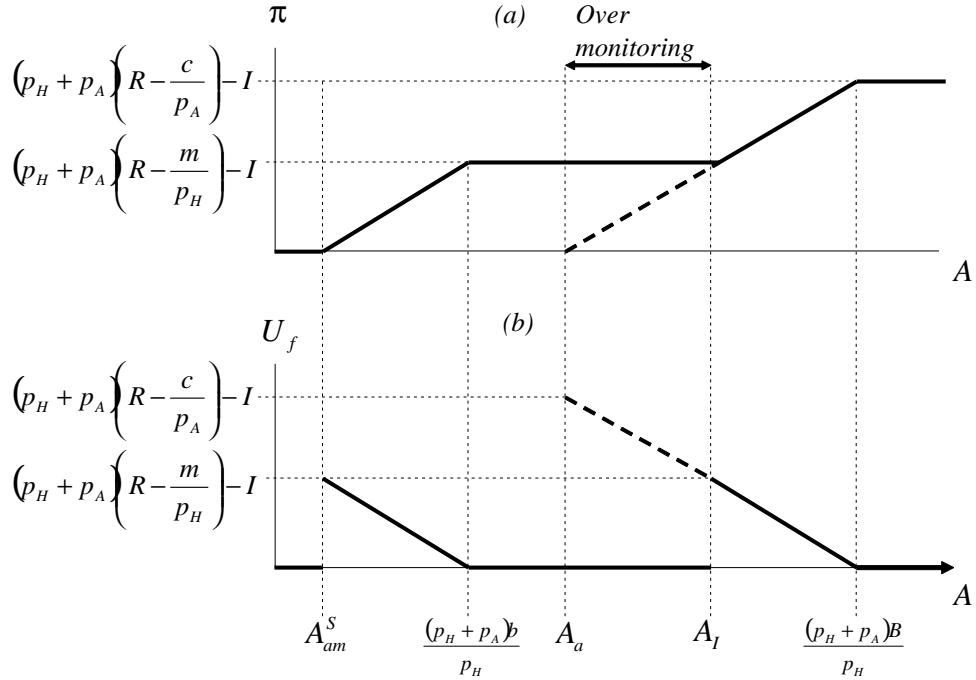


Figure 1: (a): supermarket expected net return. (b): farmers' expected net return.

The equilibrium net returns of the farmer and the supermarket are represented as a function of farmers' wealth  $A$ . From panel (a), it seems clear that the supermarket has a monotonically increasing preference for well-capitalized farmers. The nature of the relationship explains this result. Indeed, in this relationship, the supermarket is essentially trying to extract diligent care from farmers, using a combination of monitoring services and incentive payments. When misbehaving, relatively wealthy farmers lose their initial outlay  $A$  and this is sufficient to keep them on their toes and insure their diligence. With lower initial outlays, poorer farmers stand to lose less from shirking, and the supermarket must insure diligence by relying relatively more on incentive payments, which are costly. This result provides argument for the empirical literature describing the emergence of supermarkets in developing countries, which has forcefully argued that supermarkets tend to contract with large, wealthy farmers, while poorer farmers are left behind (see for instance, Dolan and Humphrey 2000 and Dolan, Humphrey and Harris-Pascal 2001).

Keeping in mind that, after rewarding the agent, the residual project surplus is shared

between the supermarket and the farmer, panel (b) is in fact a negative image of panel (a). It shows that even though the supermarket designs the contract, some farmers do obtain a positive surplus from their business relationship with the supermarket. For the reasons explained above, this, in fact, benefits less capitalized farmers. Therefore, the existence of strictly positive rents should attract more farmers. In fact, the long waiting list to enter into the supermarket procurement system observed in many developing countries is at least consistent with this result (on this issue, see Henson, Masakure and Boselie, 2005). If we speculate that a supermarket tries to extend its grower base, then the upper hand of the poorest farmers (i.e., those with level of finance such that  $A > A_{am}^S$ ) should benefit from the implementation of the supermarket arrangement. These findings also seem consistent with recent empirical evidence (Hernández, Reardon and Berdegué 2007).

Although the implementation of such contracts by the supermarket seems to have socially attractive properties, it is by no means clear that they are optimal in the sense that they implement the highest possible surplus.

**Corollary 6 (Excessive monitoring)** *When  $R_p^S \neq \frac{c}{p_A}$  then the supermarket over monitors farmers with a level of finance such that  $A_a < A < A_I$ . This implies a social loss.*

**Proof.** The pledgeable income of the farmers with a level of finance such that  $A_a < A < A_I$  is sufficient for them to obtain financing without monitoring. If this were the case, the social surplus would be  $S = (p_H + p_A) \left( R - \frac{c}{p_A} \right) - I$ . However, to maximize its net return, the supermarket finds it optimal to monitor these farmers, which reduces the social surplus to  $S = (p_H + p_A) [R - R_p^S] - I$ . ■

Such supermarket's behavior arises because monitoring effectively transfers a rent from the farmer to it. For a small additional payment, the supermarket assigns the agent an additional monitoring task that ultimately results in (much) smaller incentive payments made to farmers. Here, monitoring is not motivated by feasibility issues, but is just a socially costly rent extraction mechanism. Figure 1 features in thick dashes what the returns would be, had the supermarket behaved like a social surplus maximizer. In the light of this theoretical

finding, several recent puzzling empirical results may, perhaps, find a natural explanation. For instance, Bellemare (2006) who analyses production contracts between supermarkets and farmers, fails to find strong empirical support for monitoring by supermarkets as a means to raise farmer productivity. Such an observation seems consistent with the result stated above.

Before concluding this section, we must note that an important assumption of our baseline model is arguably the absence of specialization costs. Indeed, we assume that the supermarket agent privately bears cost  $m + c$  when performing both tasks. Although it could be argued that synergies might exist between the two tasks, one could also argue that there is convexity in effort cost as the agent performs two tasks. In the appendix, we show that the choice by the supermarket of this type of organization is robust to the introduction of such convexity; that is, socially worthwhile projects that would otherwise be infeasible are undertaken, even though the choice of a single agent is cost inefficient. The supermarket tolerates some inefficiency in the performance of the two tasks, as long as, the reduction in agency costs results in a higher profit.

## Conclusion

This paper explores the peculiar relationship between supermarkets and farmers that exists in developing countries. This relationship is modeled as a financial contract, where the farmer provides effort to the supermarket in exchange not only for technical assistance, but also for credit and infrastructure support. By doing so, we open the "black box" of the supermarket procurement system.

The motivation of the supermarket to provide not only input credits, but also technical assistance in the framework is as follows. By combining monitoring and advising of farmers, supermarkets reduce the agency cost and gain some advantage with respect to conventional moneylenders. This agency cost reduction in turn may widen the scope for financing farmers.

This result holds true whether the supermarket or farmers hold the bargaining power. Even more, if the multiplication of the tasks performed entails additional motivation costs, such procurement organization will still be favored by the supermarket and remains potentially conducive to credit extension to smaller farmers. Moreover, this result also provides a rationale for recent empirical evidence that shows that the spread of supermarkets, far from leading to the exclusion of poorer farmers, improves their credit access.

However, the allocation of the bargaining power in the contractual relationship will determine the distributional effects of the spread of supermarkets. In particular, if the bargaining power remains in the hands of the supermarket, we show that the supermarket will prefer targeting the wealthiest producers. The intuition behind this result is as follows. Wealthier farmers make substantially higher investments in the supermarket project. Thus, no financial compensation is necessary to guarantee their diligence, unlike with poorer farmers. It is, thus, more profitable for the supermarket to contract with wealthier farmers. Nevertheless, our results show no reasons, for the supermarket, against the involvement of smallholders in its procurement system. As it can still be profitable for the supermarket to contract with them.

Finally, when given sufficient bargaining power, we find that the supermarket endorses monitoring as a socially costly rent extraction mechanism.

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## Appendix

**Proof of proposition 5.** Let us first consider the subgame where monitoring and advising remain in the hands of the procurement agent in the organization of production. Irrespective of who (the supermarket or the farmer) is formulating the sharing rule, an organization of production that assigns both the tasks of monitoring and advising to the procurement agent will minimize motivation costs, as shown in Proposition 3. Alike farmers, this rent reduction allows the supermarket to capture a larger share of the project and, thereby, the supermarket prefers this organization of production. Furthermore, given that the pledgeable income by farmers is determined by the incentive constraints of each agent (which is also unaffected by varying degrees of bargaining power), their pledgeable incomes also remain unchanged. Hence, as shown in Proposition 2, farmers with a level of finance such that  $A_{am}^S \leq A$  will have access to credit.

*Procurement agent.* As previously shown, when only advising, the procurement agent should receive at least  $R_p = \frac{c}{p_A}$ . Otherwise, when advising and monitoring, he should receive  $R_p^S = \max \left\{ \frac{c}{p_A}, \frac{m}{p_H}, \frac{m+c}{p_A+p_H} \right\}$ .

*Farmer.* With monitoring by the procurement agent, the share received by the farmer should verify (23). Hence, we have to distinguish two cases. First, if  $A < \frac{(p_A+p_H)b}{p_H}$ , the farmer's incentive constraint is binding, which implies that  $R_f = \frac{b}{p_H}$  and  $U_f = \frac{(p_H+p_A)b}{p_H} - A$ . Second, if  $\frac{(p_A+p_H)b}{p_H} \leq A$ , the farmer's participation constraint is now binding, which implies that  $R_f = \frac{A}{p_H+p_A}$  and  $U_f = 0$ . By the same reasoning, without monitoring by the procurement agent, the minimum share of the project received by the farmer becomes  $R_f = \max \left\{ \frac{B}{p_H}, \frac{A}{p_H+p_A} \right\}$ . If  $A < \frac{(p_A+p_H)B}{p_H}$ , the farmer's incentive constraint is binding and  $U_f = \frac{(p_H+p_A)B}{p_H} - A$ , while if  $\frac{(p_A+p_H)B}{p_H} \leq A$ , the farmer's participation constraint is binding  $U_f = 0$ .

*Supermarket.* To maximize its share of the project, the supermarket will have to minimize the share received by both the procurement agent and the farmer. When farmers are monitored, again there are two cases. If  $A_{am}^S \leq A < \frac{(p_A+p_H)b}{p_H}$ , the supermarket

ket earns  $\pi = (p_H + p_A) \left[ R - R_p^S - \frac{b}{p_H} \right] - (I - A)$ , while for  $A > \frac{(p_A + p_H)b}{p_H}$  it earns  $\pi = (p_H + p_A) \left[ R - R_p^S \right] - I$ . Similarly, in absence of monitoring, the supermarket earns  $\pi = (p_H + p_A) \left[ R - \frac{c}{p_A} - \frac{B}{p_H} \right] - (I - A)$  for  $A < \frac{(p_A + p_H)B}{p_H}$  and  $\pi = (p_H + p_A) \left[ R - \frac{c}{p_A} \right] - I$ , otherwise. Finally, the supermarket will prefer farmers to be monitored as long as it earns a higher net return. Clearly, if  $R_p^S = \frac{c}{p_A}$ , the supermarket always imposes monitoring to farmers, else it will prefer farmers not to be monitored as long as  $A > A_I = (p_H + p_A) \left[ R_p^S - \frac{c}{p_A} - \frac{B}{p_H} \right]$ .

■

**Robustness to convexity in effort costs.** Let us define  $\phi$  as being the additional cost of motivation when two tasks (monitoring and advising) have to be performed by the same agent. So as to be diligent on monitoring and advising, the procurement agent should receive at least

$$R_p \geq \max \left\{ \frac{c}{p_A}, \frac{m}{p_H}, \frac{m + c + \phi}{p_A + p_H} \right\}. \quad (24)$$

Furthermore, when monitoring and advising are left to separate agents, the supermarket's expected net return corresponds to

$$\pi = (p_H + p_A) \left[ R - \frac{b}{p_H} - \frac{c}{p_A} - \frac{m}{p_H} \right] - (I - A). \quad (25)$$

At the opposite, when the procurement agent monitors and advises the supermarket's expected net return is given by

$$\pi = (p_H + p_A) \left[ R - \frac{b}{p_H} - \max \left\{ \frac{c}{p_A}, \frac{m}{p_H}, \frac{m + c + \phi}{p_A + p_H} \right\} \right] - (I - A). \quad (26)$$

**Corollary 7** *If performance of two tasks by the same agent entails an additional cost, then, as long as this cost is not too high, the supermarket still favors an organization, that assigns these tasks to the same agent and access to credit will be maximized with such organization of production.*

**Proof.** According to (25) and (26), as long as  $\phi < (p_A + p_H) \left( \frac{(1-p_A)c}{p_A} + \frac{m(1-p_H)}{p_H} \right)$  then the

expected returns of the supermarket will be greater when the procurement agent advises and monitors. Furthermore, it is straightforward to show that it also implies that  $A_{am}^S < A_{am}$ .

■