The Social Performance and Distributional Consequences of Contract Farming: An Equilibrium Analysis of the *Arachide de Bouche* Program in Senegal

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Summary. — This paper is an empirical analysis of the impact of a contract-farming program in Senegal. We examine the access of poorer community members to contracts and the effect of the program on the income of participants. The program performs very well on both counts: participants and nonparticipants are indistinguishable by wealth measures and farmers increase their income substantially by participating in the program. We attribute the former to the program's mobilization of local information through its use of village intermediaries, permitting the substitution of social collateral for physical collateral and making the program more accessible to the poor. © 2002 Elsevier Science Ltd. All rights reserved.

Key words — Africa, Senegal, contract farming, impact assessment, income distribution, local information

1. INTRODUCTION

Contract farming is playing an increasingly important role in many developing countries. A contract-farming arrangement typically obliges a firm to supply inputs, extension, or credit, in exchange for a marketing agreement that fixes a price for the product and binds the farmer to follow a particular production method or input regimen. The liberalization of agricultural markets and the removal of trade barriers have accelerated the formation of these vertical relationships between growers and agroindustrial firms.

The growth in contract farming has sparked controversy over its social and economic impact in agrarian communities. [1] On one hand, contract farming has the potential to raise significantly the income of growers and may enhance rural development by serving as a source of information about new cropping technologies. In addition, contracts frequently provide the credit, inputs, information, and services

smallholders need to cultivate and market lucrative nontraditional crops (Glover, 1984; Goldsmith, 1985; Morrissy, 1974; Williams & Karen, 1985). Contract farming may also create positive multiplier effects for employment, infrastructure, and market development in the local economy. As economic reforms reduce public expenditures for credit programs, staple crop price supports, input subsidies, and government research and extension programs (Dirven, 1996; Schejtman, 1996), agroindustrial firms may not only provide these services to farmers without government resources, they may be able to take advantage of local information unavailable to traditional governmental institutions.

While contract farming offers the potential for significant benefits to growers, recent studies have highlighted circumstances in which members of the rural population have been

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directly or indirectly harmed by contract farming or have realized only limited gains (e.g., Glover & Kusterer, 1990; Little & Watts, 1994). In the African context, contract farming has been observed to disrupt power relations and increase tensions within farm households—especially between male household heads and their wives and children (Carney & Watts, 1990). Contract farming has also been criticized as being a tool for agroindustrial firms to exploit an unequal power relationship with growers. When farmers invest in specific assets or alter their cropping patterns and become overly dependent on their contract crops, they may lose bargaining power *vis-à-vis* the firm, forcing them to accept less favorable or exploitative contract terms. Overreliance on cash crops can also make households more vulnerable to food shortages and price fluctuations. At the macroeconomic level, collusion between the state and powerful agroindustrial firms may skew policies and state resources away from, or against, the best interests of the peasant class (Watts, 1994).

In many environments, the impact of contract farming on rural development depends importantly on the types of growers with whom the agroprocessing firms contract. If firms choose to contract primarily with wealthier growers, then poorer members of the rural population will fail to benefit directly from contract arrangements. Hence contracting farming has the potential to affect the way income is distributed within a rural community, and can exacerbate existing patterns of economic stratification (Key & Runsten, 1999; Korovkin, 1992).

In this paper, we undertake an empirical case study of the impact of a contract-farming scheme on a rural community. Smallholders in Senegal's Peanut Basin contract with the *Arachide de Bouche* (ARB) program to provide confectionery peanuts for the international market. ARB contracting farmers receive seeds, fertilizer, pesticides and herbicides on credit and are required to sell their production to the program. ARB contracts are significantly more profitable than the traditional alternatives and the demand for contracts is high. We measure the impact of the ARB program on project villages by (a) determining the "social performance" of the program, i.e., the access of less well off farmers to the contracts; and (b) estimating the impact of the program on the income of participants. We pay particular attention to the fact that unobservable factors

may cause contracting farmers to earn higher incomes than noncontracting farmers, resulting in an overestimation of the program's effect (Greene, 1993). We control for possible sample selection bias by separately considering the farmer's participation decision in the estimation of the impact of the project on income. While recent research has focused attention on the importance of participation in microfinance programs for household behavior and income (e.g., Morduch, 2000; Pitt & Khandker, 1998), few studies have examined the importance of participation in contract-farming schemes. We discuss a simple framework for empirical analysis of contract farming and apply this framework to a specific case study.

2. THE *ARACHIDE DE BOUCHE* PROGRAM

(a) *History*

Peanuts have been the mainstay of the Senegalese economy since the colonial period and the focus of development policy since independence. The bulk of peanut production has been processed into peanut oil and peanut cake for sale, initially to France, and later to the rest of Europe.

After Senegal gained independence in 1960 the state began a major campaign to improve value added in the agricultural sector. The government recognized an appealing option in the production and export of confectionery peanuts destined for direct consumption rather than processing into oil. Confectionery peanuts differ from oil peanuts in both their larger size and the more rigid quality standards applied to them. Accordingly, they command a significantly higher price on international markets. Recognizing the potential of confectionery peanuts, in 1963 the government began testing their feasibility in the Peanut Basin, the traditional peanut-growing region in south central Senegal. In 1969, the European Fund for Development provided support to begin commercial production in the Kaolack region and by 1975 over 20,000 ha were under cultivation. Marketed production increased from 4,800 tons in 1969 to 17,000 tons in 1975 and confectionery peanuts emerged as an important diversification crop in the country's primary peanut growing region. Despite the notable production gains in this period, however, the institutional environment proved unstable, with

control over the program shifting between no fewer than five public institutions during 1965–85.

(b) *Program operation*

In 1990, a private firm, NOVASEN, assumed control of the confectionery peanut program. Senegalese and French investors hold 91.7% of NOVASEN's capital. SONACOS, the semi-autonomous entity that has primary responsibility for oil peanut production, processing and export, holds the remainder. NOVASEN works with 32,000 contracting farmers who produce approximately 40,000 tons of peanuts annually. In contrast to its predecessors, NOVASEN handles all aspects of the confectionery peanut production, including selection and training of contracting farmers, provision of inputs, collection and processing of the harvest, and export of the product. Local sales account for less than 20% of production and nearly all exports are sent to the European Union.

NOVASEN's confectionery peanut program, known locally as *arachide de bouche* or ARB, distinguishes itself from oil peanut production not only in the variety of peanut cultivated, but also in the cultivation practices required. The ARB program employs a large number of local agents, drawn from the communities they serve, to monitor these practices. The agents' duties include:

— choosing the contracting farmers and organizing them into village groups;
— providing, on credit, seeds, fertilizer, and agro-chemicals (to be repaid with 13% interest at the harvest);
— examining the fields proposed for cultivation;
— monitoring agricultural practice throughout the season and verifying that the contracting farmers follow the program requirements;
— monitoring the harvest and the handling of the product, and
— enforcing debt repayment.

While the program reserves the right to enforce contracts through the legal system, most contract enforcement actually occurs through a repeated-game approach in which delinquent contracting farmers are denied future participation in the program.

Local growers find the ARB program appealing for a number of reasons. With the provision of inputs and the close monitoring of agricultural practice, ARB yields are substantially higher that those for oil peanuts: 1300 kg/ha versus 800 kg/ha, respectively. Data from the French agronomic research organization, CIRAD, indicate profits for ARB are also substantially higher than those for oil peanuts (Gaye, 1999). [2] In addition, Structural Adjustment reforms and the disengagement of the state from agricultural input credit provision have made the credit aspect of the ARB program even more appealing. Nevertheless, the risk inherent in taking out agricultural loans in an unpredictable environment such as the Sahel makes some farmers unwilling to participate in the program.

The profitability of the ARB contracts and close monitoring and enforcement by the ARB agents have led to high repayment rates: 98–100% in normal agricultural years and generally above 80% in years of poor harvests. This compares quite favorably with the 57.7% average repayment recorded during 1990–95 for state-sponsored oil-peanut credit program (Gaye, 1999).

3. EMPIRICAL ANALYSIS

(a) *The study area and sample*

This research relies on data we collected in 1992–94 for a study of credit allocation in Senegal's oil-peanut program. Warning and Sadoulet (1998) present the results of that study along with a detailed description of the study area. The ARB program operates in Passy, one of the three zones of the previous study. Passy lies near the primary road connecting the capitals of Senegal and Gambia and thus benefits from relatively good transportation and communication infrastructure. Annual rainfall in the zone averages approximately 800 mm and a rainfed rotation of peanuts and millet predominates. The use of animal traction is widespread due to a liberal program for purchasing draft animals and equipment that existed prior to 1980.

Our data concern only household heads because only these household members had access to the ARB program. This limits our ability to analyze the program's impact on the intrahousehold distribution of resources. In addition, because the ARB program operates in only one of the three zones from the previous study, our sample includes only 26 of the 95 households from that study. While our proposed methodology is better suited to larger

samples, we believe our analysis of this sample can both illustrate the application of the methodology and provide informative results in itself. We look forward to applying this framework to larger data sets when they become available.

Most of our data are standard measures of characteristics and activities collected in household studies. But, we took a somewhat innovative approach to the collection of information on reputation ("social collateral"). We interviewed village leaders to elicit their assessments of the "honesty," "work habits," and "borrowing habits" of the members of our survey. [3] In each case the interviewer had private discussions with several village leaders about the reputations of the individuals in the sample. The interviewer then translated these assessments into numerical scores. To avoid the problem of cross-interviewer differences, a single interviewer was responsible for all the individuals in the sample.

Nineteen of the surveyed individuals requested ARB contracts and 15 of them were awarded contracts. ARB contracts are awarded in discrete, "one-hectare" units, corresponding to the amount of inputs that would be appropriate for cultivating 1 ha of land in confectionery peanuts. Thus, a 1-ha contract includes 65 kg of seeds, 150 kg of fertilizer, and associated agro-chemicals. At harvest the contracting farmer pays the value of these inputs plus 13% interest (a total of 30,800 FCFA). The average amount of seeds received by contracting farmers in the sample was 77 kg, or slightly more than a 1-ha contract. This was due to the fact that several individuals received 2 ha contracts.

(b) *Comparison of means*

Table 1 presents a comparison of the mean values of several key variables for the 15 ARB participants and the 11 nonparticipants in the sample. Participants and nonparticipants do not differ significantly in their endowments of labor (a weighted sum of household members over the age of 10), the number of their draft animals, the value of their livestock, or the area of land they cultivate. But the value of agricultural equipment belonging to ARB participants is significantly greater than that belonging to nonparticipants. As regards "social collateral," participants and nonparticipants differ significantly in terms of their "honesty," "work habits," and "borrowing habits" rankings, but they do not differ signif-

icantly in terms of age. Participants and non-participants do not differ significantly in terms of their nonagricultural income, remittances, or total income. Participants in the ARB program do earn significantly more agricultural income, despite the fact that they do not cultivate significantly more land than nonparticipants.

(c) *Sample selection and treatment effect bias*

Although the agricultural income of ARB participants is significantly higher than that of nonparticipants, we cannot necessarily attribute this difference to the impact of the ARB program. To measure the agricultural income benefits of participating in the program it is necessary to take into account the fact that individuals that participate might have earned a higher income even if they had not participated. That is, there may be unobservable factors (entrepreneurial ability, management ability, etc.) that increase the likelihood of participating in the program *and* increase income. When this is the case, the impact of the program would be overestimated by simply regressing income on a dichotomous variable that indicates participation in the ARB program.

To control for this sample selection bias we use a standard treatment effects model:

$$Y_i = \beta X_i + \delta I_i + u_i, \tag{1}$$

$$I_i^* = \alpha Z_i + e_i, \tag{2}$$

$$I_i = 1 \quad \text{if } I_i^* > 0, \quad \text{otherwise } I_i = 0,$$

where Y_i is the value of agricultural output, X_i the variables thought to affect output, I_i a dummy for ARB participation, and Z_i the variables determining participation. Note that we cannot simply estimate (1) because the decision to participate may be determined by unobservable variables that may also affect output. If this is the case, the error terms in (1) and (2) will be correlated, leading to biased estimates of δ, the impact of contracting on income. We can correct for the selection bias by assuming a joint normal error distribution, and using a two-step procedure. In the first step, we use a probit model to estimate program participation. Using the probit results, we compute the inverse Mill's ratio for each observation. In the second step, we linearly regress income on the explanatory variables and the inverse Mill's ratio (Greene, 1993, pp. 713–714).

Table 1. *Comparison of mean values for ARB contracting farmers and noncontracting farmers*

Variable	Noncontracting farmers	Contracting farmers	t-Stat.	$P > |t|$
Physical asset				
Labor endowment (adult equivalents)	8.09	7.48	0.31	0.76
Number of draft animals	2.64	2.47	0.24	0.81
Value of agricultural equipment (FCFA)	28,182	37,000	−1.85	0.08
Value of livestock (FCFA)	304,161	295,713	0.07	0.94
Land cultivated (*tremis*[a])	113.91	117.53	−0.19	0.85
Social collateral				
Honesty	3.45	3.87	−2.41	0.02
Work habits	3.64	3.94	−1.96	0.06
Borrowing habits	3.18	3.93	−4.34	0.00
Age of household head	51.73	48.20	0.78	0.44
Income				
Total income (FCFA)	535,368	713,466	−1.14	0.27
Nonagricultural income + remittances (FCFA)	162,454	139,105	0.29	0.77
Agricultural income (FCFA)	372,913	574,361	−1.91	0.07

Source: Author survey.

[a] One *tremis* equals approximately 0.08 ha.

The exchange rate at the time of the survey was approximately 250 FCFA/$US.

(d) *The probit model*

In the probit model, we explain program participation using several variables expected to determine household demand for peanut seeds and household ability and willingness to meet its contractual obligations. As shown in Table 2, the probit model is highly significant and correctly predicts 77% of the observed outcomes. As expected, possessing a greater value of agricultural equipment increases the probability that a household will participate in the program. More agricultural equipment may be associated with greater productivity and hence better ability to repay the loan.

Nonagricultural income is negatively associated with contracting. In a separate Tobit analysis we found that nonagricultural income is also significantly negatively associated with the amount of seeds *sought* (as distinct from *received*) from the ARB program. [4] This fact suggests that higher nonfarm income provides an alternative source of funds with which to purchase peanut seeds, which reduces the demand for an ARB contract.

Contrary to our expectations, a household's endowment of labor was negatively associated with receiving an ARB contract. We expected that larger households would be *more* likely to receive a contract because peanut cultivation is labor intensive and labor markets in the study area are characterized by high transactions

costs. Thus, this result is somewhat surprising. We found, however, that larger households were also less likely to *seek* a contract. Further research will be required to illuminate the underlying economic and social dynamics that produce these results.

The "honesty" variable was significantly positively associated with contracting. [5] A high value of the honesty variable is likely correlated with a household's willingness to meet its contractual obligations given that it has the ability to do so. We do not expect honesty to be correlated with income hence it functions as an identifying variable in the sample selection model.

(e) *The impact of participation on agricultural income*

Explanatory variables in the second part of the selection model include a dummy for ARB program participation, several indicators of the household production technology (labor endowments, draft animals, and the value of agricultural income per unit of area), area cultivated, and the inverse Mill's ratio. The production technology is measured on a per unit of area basis to capture the intensity of input use. The area cultivated is included in the regression to control for differences in the scale of agricultural production.

Table 2. *Binomial probit model*[a]

Variable	Coefficient	S.E.	$P[|Z| > z]$
Dependent variable: dummy for ARB participation			
Labor endowment (adult equivalents)	−0.312	0.196	0.11
Age of household head	$7.50E-02$	$5.63E-02$	0.18
Number of draft animals	−0.953	0.738	0.20
Value of agricultural equipment (FCFA)	$2.55E-04$	$1.45E-04$	0.08
Nonagricultural income + remittances (FCFA)	$-8.22E-06$	$3.97E-06$	0.04
Honesty	3.91	1.98	0.05
Constant	−20.06	10.31	0.05

$\chi^2 = 19.85$
Significance level $= 0.0029$

			Predicted		Total
			0	1	
Actual		0	8	3	11
		1	3	12	15
	Total		11	15	26

Source: Author survey.
[a] The exchange rate at the time of the survey was approximately 250 FCFA/$US.

Ideally, our dependent variable would be *net* agricultural income. Unfortunately, accurate data on the value of inputs to production are difficult to obtain in this environment. This is particularly true of inputs for which markets are not well developed, such as animal manure and labor. As a consequence, we use *gross* agricultural income as our dependent variable and then adjust our results to reflect the approximate impact on net agricultural income.

As shown in Table 3, the *F*-test for the regression is highly significant, and the adjusted *R*-squared equals 0.42. Only two coefficients in the agricultural income regression are significant: the area cultivated and the dummy variable indicating whether the household contracts with the ARB. The coefficient associated with the inverse Mill's ratio is not significant, indicating that the correction for selectivity bias is not significant in this model.

The model results indicate that accepting a contract with ARB results in an increase in gross agricultural income of 207,000 CFA. The cost of inputs for the average ARB participant is 36,500 FCFA. [6] An approximate lower bound on the impact on net agricultural income is thus 170,500 FCFA or $US680.

Table 3. *Effect of ARB participation on agricultural income: regression results*[a]

Variable	Coefficient	S.E.	$P[|Z| > z]$
Dependent variable: gross agricultural income			
Dummy for ARB participation	207,007	$1.07E+05$	0.05
Labor endowment per cultivated area (adult equivalents/*tremis*[b])	295,081	$1.20E+06$	0.81
Draft animals per cultivated area	−1,283,007	$3.01E+06$	0.67
Value of Ag equipment per cultivated area (FCFA/*tremis*[b])	321.04	311.89	0.30
Cultivated area (*tremis*[b])	4,396.7	1,059.7	0.00
Constant	−236,903	$2.18E+05$	0.28
Inverse Mills ratio	−35,928	95,884	0.71

Adjusted $R^2 = 0.42$
$F[6, 19] = 4.03$
Probability value $= 0.0090$

Source: Author survey.
[a] The exchange rate at the time of the survey was approximately 250 FCFA/$US.
[b] One *tremis* equals approximately 0.08 ha.

Table 4. *Comparison of predicted gross agricultural income of contracting farmers and noncontracting farmers assuming no ARB participation*[a]

Variable	Noncontracting farmers	Contracting farmers	t-Stat.	P > |t|
Predicted agricultural income with no ARB participation (FCFA)	358,576	377,862	−0.26	0.79
Predicted total income with no ARB participation (FCFA)[b]	521,030	516,968	0.03	0.977

Source: Author survey.

[a] The exchange rate at the time of the survey was approximately 250 FCFA/$US.

[b] Total income is calculated as predicted gross agricultural income plus actual nonagricultural income and remittances.

Our model results allow us to compare ARB contracting farmers and noncontracting farmers in a conterfactual experiment. We predict the gross agricultural income of the ARB contracting farmers had not they participated in the program, i.e., we predict their income using their actual values for all of the regression variables except ARB, which we set to zero, and compare this with the predicted income of noncontracting farmers. The results, presented in Table 4, suggest that the gross agricultural income of the two groups would not differ significantly had the contracting farmers not participated in the program. Further, we compare predicted total income of contracting farmers and noncontracting farmers in the absence of the ARB program by adding actual nonagricultural income and remittances to the agricultural income figures just calculated. As Table 4 shows there is no significant difference between the two groups. This reinforces our notion that the program participants were not selected on the basis of income or, as we found earlier, wealth characteristics.

4. CONCLUSIONS

The results of the sample selection model indicate that the ARB program significantly increases the incomes of contracting farmers. Higher income not only raises the standard of living of growers, but may also create positive multiplier effects for employment, infrastructure, and economic growth in the region. In addition to raising income, the program exposes growers to new cropping technologies.

The social performance of the ARB program appears to be quite good. As shown in Table 1, contracting farmers cannot be distinguished statistically from noncontracting farmers in the principle measure of wealth (the value of live-

stock), nor in most measures of productive assets (number of draft animals, labor endowment, or area cultivated). Similarly, the two groups cannot be statistically distinguished by their nonagricultural or total income. Hence, in terms of most measures of endowments and income, the ARB program does not appear to favor "larger" or wealthier growers.

The reason the ARB program does not appear to favor wealthier growers may be because it involves a familiar production technology. Unlike many contract-farming schemes that require the cultivation of a nontraditional crop with a limited local market, the ARB program involves the production of a traditional cash crop. Because all farmers in the zone have grown peanuts, the program does not require growers to make new investments in fixed capital—most farmers already possess the necessary agricultural inputs. Since smallholders do not need to make large fixed capital investments in order to participate in the program, they are not at a disadvantage in this regard compared to larger growers. Another consequence of the farmers' familiarity with peanut cultivation is that the uncertainty associated with the ARB contract is low. Low uncertainty means that poorer households are more willing to contract with ARB than they would with programs involving less familiar crops. Finally, because the peanut cropping system is well known, extensive training of growers is not required. This reduces the program's transactions costs of working with many small growers.

(a) *Local information*

The ARB program appears to make effective use of local information. As the results of the probit selection equation showed, the perceived honesty of a potential contracting farmer

figured importantly into the selection decision. Harnessing local information is an important objective that has been central to the design of credit schemes such as the Grameen Bank. The results of the empirical analysis suggest that NOVASEN's use of local agents drawn from the communities in which they serve mobilizes the agents' knowledge of their fellow community members, effectively overcoming the asymmetric information problem that plagues most attempts to work with members of rural communities (Warning & Sadoulet, 1998). This use of social collateral has important implications for the impact of the ARB program. When social collateral can take the place of physical collateral in determining participation in income-generating activities, poorer individuals are more able to take part. When an activity such as ARB becomes available to the poor, it has the potential to reduce poverty and income inequality.

(b) Power imbalances

Little and Watts (1994) assert that contract farming becomes exploitative when severe power imbalances exist between firms and contracting farmers. The power relationship between NOVASEN and the ARB contracting farmers in the ARB program appears to be more balanced than many of the schemes cited in the literature. The relatively strong bargaining position of the contracting farmers can be attributed to a number of factors. First, asset specificity for the ARB program is low: growers use the same assets for growing confectionery peanuts—in particular agricultural equipment and draft animals—that they have long used for growing oil peanuts. This means they can easily redirect their assets away from the ARB program should they find the contract terms unsatisfactory.

Second, a viable alternative market exists for the peanuts produced from an ARB contract. Contracting farmers can sell their production on the oil-peanut market if NOVASEN attempts to manipulate the terms of the contract. While confectionery peanuts command a higher price from NOVASEN (74 FCFA/kg) than they do in the oil market (70 FCFA/kg), the difference is not sufficient to give NOVASEN substantial monoposonistic power over the contracting farmers.

An example of another contract-farming scheme in Senegal illustrates the importance of alternative markets to the welfare of growers.

In the years in which we undertook this survey, a firm contracted with small farmers near the survey zone to grow melons for the Dakar market. The firm's inputs to production were relatively low, consisting primarily of seeds and fungicide. By contrast, the farmers devoted a large amount of their limited land and labor resources to growing the melons. While the firm had agreed to buy the production at a set price, a plentiful harvest depressed melon prices across the region. The firm apparently found it more profitable to buy melons on the spot market and did not return to purchase the production of its contracting farmers. The farmers were thus left with a highly perishable, bulky product of low value, and most chose to let the melons rot in the fields rather than sink more labor into their harvest, transport and sale.

Finally, the relative power of NOVASEN is constrained by the availability of other sources of similar inputs. While NOVASEN is the only source of seeds for confectionery peanut cultivation, a variety of sources exists for oil peanut seeds, fertilizer, and agro-chemicals, including SONAGRAINE (a division of SONACOS) and private merchants as well as friends and relatives.

(c) Further research

By most of the measures considered above, the ARB program performs remarkably well, however, the limitations of our data prevent us from addressing a number of crucial issues. The exclusion of women from participation in the program is of central concern. In the survey area, women typically obtain peanut seeds through their husbands: household heads who receive SONAGRAINE seed loans commonly pass a portion to their wives and dependent male household members. Thus, it may be that the program's benefits are more widely shared than the selection process would suggest. But, by fixing control of the benefits in the hands of the household head, the program likely exacerbates the existing imbalance of power between the head and dependent household members. The struggle over domestic resources can be particularly intense in these households and the renegotiation that must accompany changing resource control is a likely source of intrahousehold tension. Understanding how the benefits and costs of the ARB program are distributed within the household is an important area for further research.

NOTES

1. In this paper we do not discuss the determinants of the decision to produce via contract farming (as opposed to vertically integrating or relying on spot markets). Key and Runsten (1999) treat this subject in considerable detail.

2. The exchange rate was approximately 250 FCFA/US$ when this research was undertaken.

3. See Warning and Sadoulet (1998) for a more detailed description of these measures.

4. While the selection equation requires that we use a discrete variable for a contract, in the Tobit we are able to use the continuous variable quantity of seeds sought to include a measure of intensity.

5. We use only one of our social collateral variables here because of our small sample size and collinearity among these variables. We chose to use the "honesty" variable because the contract involves a wide variety of unmonitored tasks that the firm must trust the contracting farmer to undertake correctly.

6. The input costs for a 65-kg contract are 30,800 FCFA. Thus, the input cost for the average contracting farmer—who receives 77 kg of seeds—would be $(77/65) * 30,800 = 36,486$ FCFA.

REFERENCES

Carney, J., & Watts, M. (1990). Manufacturing dissent: work, gender and the politics of meaning. *Africa*, 60(2), 207–241.

Dirven, M. (1996). *Agroindustry and small-scale agriculture: A comparative synthesis of different experiences: report LC/R. 1663*. Santiago, Chile: Economic Commission for Latin America and the Caribbean.

Gaye, M. (1999). *La filiere arachide de bouche au senegal*. Kaolack, Senegal: L'institut senegalais de recherches agricoles (Unpublished manuscript).

Glover, D. (1984). Contract farming and smallholder outgrower schemes in less-developed countries. *World Development*, 12(11/12), 1143–1157.

Glover, D., & Kusterer, K. (1990). *Small farmers, big business: Contract farming and rural development*. New York: St. Martin's Press.

Goldsmith, A. (1985). The private sector and rural development: can agribusiness help the small farmer? *World Development*, 13(10/11), 1125–1138.

Greene, W. (1993). *Econometric analysis*. Englewood Cliffs, NJ: Simon and Schuster.

Key, N., & Runsten, D. (1999). Contract farming, smallholders, and rural development in Latin America: the organization of agroprocessing firms and the scale of outgrower production. *World Development*, 27(2), 381–401.

Korovkin, T. (1992). Peasants, grapes, and corporations: the growth of contract farming in a Chilean community. *Journal of Peasant Studies*, 19(2), 228–254.

Little, P., & Watts, M. (Eds.). (1994). *Living under contract: Contract farming and agrarian transformation in sub-Saharan Africa*. Madison: University of Wisconsin Press.

Morrissy, J. D. (1974). *Agricultural modernization through production contracting*. New York: Praeger.

Morduch, J. (2000). The microfinance schism. *World Development*, 28(4), 617–629.

Pitt, M., & Khandker, S. (1998). The impact of group-based credit programs on poor households in Bangladesh: does the gender of participants matter? *Journal of Political Economy*, 106(5), 958–996.

Schejtman, A. (1996). *Agroindustry and small-scale agriculture: Conceptual guidelines for a policy to encourage linkage between them: report LC/R. 1660*. Santiago, Chile: Economic Commission for Latin America and the Caribbean.

Warning, M., & Sadoulet, E. (1998). The performance of village intermediaries in rural credit delivery under changing penalty regimes: evidence from Senegal. *Journal of Development Studies*, 35(1), 115–138.

Watts, M. (1994). Life under contract: contract farming, agrarian restructuring, and flexible accumulation. In P. Little, & M. Watts (Eds.), *Living under contract*. Madison: University of Wisconsin Press.

Williams, S., & Karen, R. (1985). *Agribusiness and the small-scale farmer: A dynamic partnership for development*. Boulder, CO: Westview Press.