AGRICULTURAL ECONOMICS

Agricultural Economics 33 (2005) supplement 513–525

An analysis of contract farming in East Java, Bali, and Lombok, Indonesia

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Received 23 September 2003; received in revised form 2 August 2004; accepted 7 January 2005

Abstract

This article examines the emergence and benefits of contract farming in East Java, Bali, and Lombok, Indonesia. After a general review of contract farming in these regions, three contracts, for seed corn in East Java, seed rice in Bali, and broilers in Lombok are described and analyzed using key informant interviews and household survey data. A review of the contracts suggest that there is a wide array of contract types and this is related to the technical requirements of production and the associated costs. Probit analysis is used to identify factors contributing to smallholder participation in farm contracts and a two-stage estimation process used to measure the effects of farm contracts on gross margins and labor use. Results indicate participation in contracts is influenced by farm size and other factors such as smallholder's age, education, and participation in farm groups. Contracts increased returns to capital for the seed corn and broiler contracts but not for the seed rice contract. All three contracts influenced the types of labor used; however, none of them influenced total farm employment.

JEL classification: O10, O13

Keywords: Contract farming; Smallholders; Transaction costs; Asia; Indonesia

1. Introduction

Over the last two decades market liberalization has profoundly influenced agriculture in both developed and developing parts of the world. Market liberalization, driven by WTO and earlier GATT Rounds, new technology, and changing food habits has resulted in deregulation of domestic food markets and opening and expansion of international markets (Jaffee, 1994). A series of studies in developing countries have shown that market liberalization is changing the pattern of agricultural production in terms of on-farm crop and livestock mixes, increasing total production in physical and value terms, and changing the types of food products entering international markets. For example, Ponte (2000) examines the economic and social impacts of liberalization and associated microeconomic reform on African agriculture under new conditions where there is less government credit, less parastatal production in food markets, and the removal of price supports and input subsidies. Marsh and Runsten (1995) report various microeconomic reforms in Mexico such as the 1989 deregulation of trucking and exports. Goodman and Watts (1997) provide a broader picture of effects of international trade expansion in food products on the economic and social environments in developing countries. In addition to highlighting the agricultural transformations induced by liberalization, these studies show that traditional values and habits in agriculture are being replaced by transactions that increasingly reflect a "cash culture."

Contract farming is an integral part of this process of market liberalization and agricultural transformation, often bringing together a curious combination of multinational corporations (MNCs) and smallholders. While investment by multinationals is generally welcomed by host countries, the net effect of contract farming on the welfare of smallholders has been controversial. A number of authors express concern that contractors favor larger growers and hence poorer growers may be left out of the development process (CDC, 1989; Little and Watts, 1994; Runsten, 1992). Other noted hazards of contract farming are the potential for "capture" of smallholders within contracts, the negative social effects of the "cash economy" in rural areas, the narrowing of local markets as contracted production squeezes out local food production, the possible deterioration of contract terms as contracts mature, and general concerns about how multinational corporations behave in developing countries (Clapp, 1988; Little and Watts, 1994; Singh, 2000; Torres, 1997; Wilson, 1990). On the positive side, evaluations

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of contract farming generally indicate farmers either benefit from contracts in terms of enhanced profits or get out of them. Benefits from contract participation result from improved access to markets, credit and technology, better management of risk, improved family employment and, indirectly, empowerment of women and development of a successful commercial culture (Eaton and Shepherd, 2001; Glover and Kusterer, 1990; Key and Runsten, 1999; Runsten, 1992).

In this article, we report results from a study of contract farming in the provinces of East Java, Bali, and Lombok, Indonesia. As part of the study, a general review of contract farming between agribusiness and smallholders was conducted and three specific contract systems were identified in each province for detailed analysis. For each of the selected systems, specific information on the contract details obtained through interviews with key informants was collected, and household surveys were administered in the area in which contracts were being offered. In total, 800 smallholders were surveyed; 300 from around Malang in East Java, 300 from Bali, and 200 from Lombok. Both contract participants and nonparticipants were surveyed in each area. The East Java smallholders were contracted to an American MNC, Pioneer, for hybrid seed corn, the Bali farmers were contracted to an Indonesian government firm, PT Pertani, for seed rice, and the Lombok smallholders were contracted to a Thai MNC, Nusantara Unggasjaya, for broiler (chicken) production.

The objective of this article is to summarize the results of this overall study of contract farming in Indonesia while providing insights into the various types of impacts contracting has on the smallholders who participate in them. Toward this end, the article is organized into five sections. Section 2 briefly examines why contract farming occurs considering the perspective of both agribusiness and smallholders. This discussion provides the necessary background for understanding the contracts highlighted in this study. Section 3 describes the three selected contract types in detail and, based on interviews of key informants, discusses the firms' motivation for using contract farming. Section 4 examines contract farming from the smallholders' perspective, reporting the results of empirical analysis of factors influencing contract participation and the effects of the contract on capital returns and farm employment patterns. Finally, Section 5 provides conclusions.

2. Why contract farming?

Transaction cost economics, associated with the work of Oliver Williamson (1985), posits that the structure of economic institutions evolve in a way that reflects attempts by management to minimize overall costs including, especially, the costs of transacting (Dietrich, 1994; Williamson, 1985). While there may be a plethora of structures possible for organizing production, the one that emerges minimizes the costs of assembling the resources necessary to meet demands emanating from markets. These costs include the standard production costs of producing output but also the transaction costs which are defined as the costs of running the system. *Ex ante* transaction costs are the costs of drafting, negotiating, and safeguarding the agreement and *ex post* transaction costs are maladaption costs, negotiation costs associated with dealing with maladaption, setup and running costs of governance structures, and bonding costs of securing commitments. In this section, we want to consider the conditions under which contract farming is the structure that minimizes such costs.

In understanding transactions costs associated with the organization of production three factors need to be considered: bounded rationality, opportunism, and asset specificity (Dietrich, 1994). *Bounded rationality* describes differences in information between contracting parties. For example, the firm may have excellent knowledge of markets while smallholders may have little market knowledge and hence may benefit from a contract. *Opportunism* may occur when there are opportunities for taking advantage of situations to the detriment of the other party in an agreement. For example, smallholders may be concerned that the firm could, by virtue of its market domination, offer a very low price in the spot market or, alternatively, the firm may worry that sellers could collude to drive up prices. Writing contracts clearly spelling out obligations can reduce these types of concerns. Finally, *asset specificity* reflects the risks associated with protecting "sunk costs" in processing plants, logistical systems, or market development or, for smallholders, costs of protecting investments in specialized machinery and knowledge. Both firm and smallholders may protect these investments through contracting which secures inputs for the firm and a market for the smallholder (Dorward, 2001). With these factors in mind, we consider when contract farming might be in the interest of agribusiness and smallholders.

2.1. Agribusiness firms and contracting

In expanding their operations, agribusiness has a number of options for organizing access to the inputs it requires. One option is to source products from the open market. This is the usual arrangement with staples such as cereals and standard livestock products. Using the open market, however, is more difficult when nontraditional or specialized products are involved. Food processors and exporters of nontraditional crops usually face tight quality requirements and often need products in a timely fashion. These requirements reflect technical aspects of preserving, packaging, freezing, and transporting nontraditional products and, also, meeting consumer requirements for uniformity. This is particularly so in developed country markets where labeling ensures quality and consumers view product uniformity as a quality indicator for both eating experience and safety (Goodman and Watts, 1997). Ensuring quality and a timely supply through open markets may involve significant transaction costs that limit the appeal of this option. Farmers may have limited knowledge of quality requirements and, even if signaled through higher market prices, may be unable

to meet standards due to technical limitations (bounded rationality). Firms and farmers may also be reluctant to invest in the necessary technology and information without a guaranteed market (asset specificity). Finally, firms may find it costly to coordinate the timing of activities of different farmers.

The decision by an agribusiness firm to undertake expansion through contract farming reflects the view that the total production and transactions costs of contracting are less than the costs associated with alternatives such as open market operations or vertical integration through plantations. Of course, contract farming also incurs transaction costs for agribusiness firms including (Dietrich, 1994): (i) costs of drafting, negotiating, and enforcing contracts; (ii) maladaption costs when contract specifications are not met; (iii) setup and running costs associated with governance; and (iv) bonding costs of effecting secure commitments. Contract farming may have high transaction costs for firms yet still represent the "best bet" for expansion of the firm when compared to alternatives because it offers the highest net benefit to the firm relative to other options. Even in choosing this option, the firm will seek farmers to participate that will minimize total production and transaction costs.

2.2. Smallholders and contracting

From a smallholder's perspective, markets for credit, information, technology, etc. are often "missing" in the sense that transaction costs of accessing them on a small scale are effectively infinity. Through contracting, agribusiness firms may provide access for smallholders to new markets using their market knowledge and experience, technical know-how, legal expertise, economies of scale in processing, and transport and financial muscle necessary for sustaining international trade relationships. Agribusiness firms have several strategic advantages over banks and traditional lenders in borrowing that can be conferred on smallholders through contracts. The contract confers lending advantages on the agribusiness firm through monitoring of input use, control over crop management decisions that might jeopardize repayment, specification of how cash advances are to be repaid, and control over the output market for specialized crops. Also, contracts require delivery to the firm so that cash advances can be deducted from post-harvest cash settlements (Key and Runsten, 1999). The ability to use mechanisms to ensure repayment allows firms to extend credit to smallholders who often are unable to obtain credit otherwise or can only do so at high rates of interest.

Contracting may also allow smallholders to cope with uncertainty about income by improving access to insurance, information, or credit and by increasing production diversity. Nontraditional crops have higher production costs hence more income is at risk in the event of crop failure. In addition, prices of nontraditional crops are more volatile due to thinly traded markets, yield is more uncertain than with traditional crops and such crops are often more perishable (Marsh and Runsten, 1995). These risks may be addressed through a farm contract in a number of ways. Subsidies may be provided when farmers first enter contracts to reduce the risks of setting up the new enterprise, and cash assistance with operating costs and extension and management input from the firm may reduce yield risk. Glover and Kusterer (1990) report smallholders with contracts were subsidized in the early years of their participation and extension from the contracting firms was important in reducing yield risk.

Finally, information can be expensive to gather and is not depleted by use. Hence, an agribusiness firm spreading information over many contracts has advantages for smallholders in providing crop-specific information over paying the cost of obtaining the information themselves. Most contracts described in Glover and Kusterer (1990) included visits by firm extension officers to either individual farmers or farm groups several times during the first year of the contract but often less in later years. Additional specialized information provided by firms may concern chemical restrictions related to food safety requirements in specific markets, timing of planting and harvest to meet markets, management of product quality, and other information.

Farmers in developing countries vary in their ability to access markets and overcome transaction costs. Smallholders, in particular, are likely to find contracting desirable if they have difficulty in accessing key markets. The incentives to participate by a farm household are more likely than for those households facing greater limitations in market access.

2.3. The emergence of contract farming

The choice of how to organize production is the result of firms and smallholders making a benefit-cost calculation, where costs includes both production and transaction costs, across the range of options. Contract farming emerges when the net benefits for the firm and for participating smallholders exceed the other production options. Contracts will vary depending on the production and transaction costs associated with production of the commodity under local conditions. While the firm initiates the contract, the design of the contract will be done considering the production and economic situation of local farmers. The design will seek to minimize costs but ensure an adequate level of participation by farmers with desirable characteristics, such as access to irrigation, management ability, etc. The characteristics of smallholders that participate, however, is likely to be a combination of traits deemed desirable by the firm and traits that reflect a desire to participate in a contract. Whether selection of participants depends more on firm criteria or self-selection will depend on the commodity and local conditions. Similarly, the benefits of contracting to these participants will depend on these factors.

3. Contract descriptions and motivations

To obtain an overall perspective on the extent and diversity of contract farming between agribusiness and smallholders in East

Java, Bali, and Lombok, a general review of contract farming was conducted in conjunction with Indonesian research partners. The review suggested that there is a wide array of contract farming relationships in the study region. Contracts between agribusiness and smallholders varied in terms of (i) the *contracting party*, which included multinationals, national companies, parastatal companies, and intermediaries that were contracted by hotels and then contracted out to farmers; (ii) the *crops being contracted out* including traditional crops such as sugar cane, tobacco, broiler chickens, and milk as well as nontraditional crops such as ginger, rice and corn seed, horticultural crops, and mangostene fruit; (iii) *contract details* such as the degree of technical services, inputs, and credit provided, as well as the mechanism for determining price; (iv) the *level of formality* ranging from signed contracts with individuals and contracts with groups to informal relationships; and (v) the *number of smallholders participating*. The selection of contracts to study in detail in each sample area followed investigations based on the local knowledge of the Indonesian research partners and detailed interviews with key informants at four contracting firms in East Java, four in Bali, and two in Lombok. From these, the three firms were selected for in-depth study.

The three contracts considered varied greatly in the degree of horizontal and vertical integration they implied for smallholders, power of the contracting firms in input and output markets, extent that contracts seemed to depend on economies of scale for profits, apparent effects of the contract on smallholder exposure to risk, and on the types of firms undertaking the contracting. In East Java, the Pioneer contract was chosen because the contract required considerable cooperation among smallholders. Pioneer had considerable power in the hybrid corn seed market both nationally and internationally, and the viability of the processing plant appeared to depend on economies of scale in processing the seed. There was no suggestion that the contract affected smallholder risk exposure. In Bali, PT Pertani was chosen because it seemed to be in stark contrast to the Pioneer contract. The firm is owned and operated by the government on a "breakeven" basis: it has virtually no power in either input or output markets and there was no evidence of economies of scale in processing the seed. Firm representatives claimed the contract provided smallholders with reduced exposure to risk. In Lombok, the Nusantara Unggasjaya contract for broilers involved vertical integration of production to the extent that, as with the seed corn contract, grower guidelines were paramount and the firm exercised a high degree of technical control over contract participants. However, in contrast to the seed corn contract, the contract does not depend on cooperation between smallholders for its success. Nusantara Unggasjaya is a Thai MNC that effectively monopolizes the broiler market in Lombok and arguably has a quasi-monopoly over the chemically intensive production techniques used and over the chemicals themselves. In contrast to contractors for seed corn and seed rice, participation for the broiler contract required a considerable "up-front" investment resulting in increased risk exposure for contract participants.

3.1. East Java seed corn contract

Pioneer is a multinational corporation growing a range of high value agricultural products in numerous countries. In Indonesia, Pioneer grows only hybrid seed corn which is produced solely in East Java. Hybrid seed (60–70%) is sold domestically while 30–40% is exported, primarily to the Philippines with small amounts sold in Thailand and Japan. Pioneer first offered contracts for production of hybrid seed corn to East Java smallholders in 1986. At present, there are between 40 and 50 grower groups participating in the contract each year with a total of about 10,000 contracted growers. Average plantings are around 0.2 ha and total plantings by Pioneer contractors last year were around 2,001 ha. In 2000, the production of seed corn was around 7,000 tons (with an additional 5,000 tons rejected on quality grounds) which was cleaned, screened, sized, tested, and packaged in the Pioneer plant in Malang for sale in small packs (1,5, and 40 kg) and jumbo packs of 1,000 kg.

There is only one quality standard although different varieties are grown. Only 40–50% of seed delivered to the factory meets the standard and seed not reaching this standard is sold as consumption corn by Pioneer. All seed delivered to the plant is accepted regardless of quality, and quality issues are dealt with by excluding poor performers from future contracts and by spotting problems in the field prior to harvest. The Pioneer representative said "if growers follow guidelines then quality problems are "bad luck" and costs will be borne by the company." This policy reduces the risk to the grower.

The price paid to growers was 130% over the prevailing spot price for consumption corn. At the time of this study, the price[1] for consumption corn was around Rp. 500 per kg compared to a contract price of around Rp. 1,150 per kg. Yield from contracted corn is around 6 tons per ha compared with 12 tons per ha for consumption corn. Inputs provided by Pioneer include foundation seed, money for land preparation, physical inputs (chemicals) and extension services. The costs of these inputs (except extension services) are deducted from the post-harvest payment for the crop, with Pioneer organizing funding through a commercial bank.

Negotiation, for single season contracts only, occurs at grower group level between Pioneer and the ketua kelompok tani (head of the grower group, HGG) who represents the interests of growers in his group. Negotiations also involve the kepala desa (village mayor), local politicians, and government extension officers. These parties do not actively negotiate; rather, their roles are first to legitimize the outcome of the negotiations and, second, to act as intermediaries or "referees" if a dispute arises. There is a written agreement at the group level signed by the HGG, politicians and extension officers, and verbal agreements

[1] Consumption corn refers to grain while corn is delivered to the Malang plant is 'on the cob' with husk and usually the stem intact. As a rule of thumb, approximately half of the mass weight of such corn is grain hence the 'grain equivalent' price paid to contractors is Rp. 2300 per kg, considerably higher than the consumption price.

between the HGG and growers. Thus, the contract selection problem for Pioneer is primarily at grower group level with the selection decision taking into account the group's distance from the plant, irrigation, previous corn experience, and disease and rodent problems. The group written agreement does not explicitly spell out the firm's growing guidelines; however, it makes adherence to "grower guidelines" a requirement of contract participation for the village.

Pioneer provides one extension officer for every one or two villages. These officers provide advice to growers on husbandry, monitor the crop, and provide feedback to Pioneer. The staff member is likely to have an undergraduate degree in agriculture and come from a farming background. These are company people who move around geographically during their careers and have performance assessed on the basis of contract success.

Cross-pollination with other corn crops can contaminate hybrid corn seed and render it unregisterable as certified seed. Thus, Pioneer insists that all corn grown by a smallholder group (a specified geographical area) must be Pioneer hybrid seed corn. Since a neighboring village or farmer group is a potential source of contamination, Pioneer may need to also capture their production, resulting in clusters of contracting groups. Individuals belonging to the group but not participating in the contract may receive a payment from the company for not growing corn if they have a previous history of growing corn. In this situation, the grower surrenders use of the land for the growing season and a hybrid corn crop is planted by another grower. The compensation, called "rent," is set at the gross margin for consumption corn. Usually, at most only three or four growers in the group are affected by this arrangement.

Pioneer employs around 30 full-time staff at the Head Office in Malang in management and administrative positions in the office and processing facility. There are an additional 300 people employed in the processing facility on a part-time basis, of whom around half are female. In addition, hybrid seed corn husbandry is labor intensive. For example, it takes 60 people one day to de-tassle 1 ha and day laborers are employed casually at specific points in the growing cycle. Pioneer faces competition for grower groups to produce seed corn from Monsanto and PC, both multinational corporations, but it is not clear how strong this competition is. These firms are more diversified than Pioneer.

Given the technical requirements for growing hybrid seed corn and the risks associated with its production, it is unlikely that Pioneer could have secured a regular, high quality supply of seed on the spot market. Pioneer could have attempted to vertically integrate and setup a plantation but that would have been difficult given the costs of supervising the labor for production where product quality is so important. Furthermore, securing the amount of land required would have involved a significant up-front investment and posed political and economic problems in acquiring such a large tract of land in Indonesia's agricultural heartland. Under the contracting system, each group—and through the group each farmer—is monitored and contracts can be terminated if the output quality is too low. Contractees are also paid based on yield. Thus, Pioneer can use the contracting system to monitor output level and yield quality.

From the smallholder's perspective, the contract provides a low-cost way for them to access seed corn markets using Pioneer's well-established international marketing network. Without this network, and the processing facility in Malang that supports it, it seems unlikely this product would be produced on a large scale, if at all, by these smallholders. The contract provides a credit facility in cash and kind, and as such it allows the constraints faced by smallholders in credit markets to be overcome with collateralization of future production and reduced borrowing costs resulting in credit at commercial bank rates. The contract also allows production diversification, reduces risk associated with high cost farm inputs, and provides a guarantee of price regardless of quality. No evidence was found of contracts dominating farm plans and reducing diversification, and high levels of entry to and exit from the contract indicated there was little if any dependence on the contract in meeting basic income needs. Finally, growers participating in the contract receive information on how to grow a technically complex crop in a situation in which it is unlikely the same type of technical help could come from government extension services.

3.2. Bali seed rice contract

PT Pertani is a government-owned agribusiness firm centered in Jakarta. It was established by the Indonesian government in the Sukarno era to provide seed to farmers. It produces seed in all provinces for crops including soybean, corn, rice, and peanuts. Production of seed rice by PT Pertani (Bali) was about 2,000 tons in 2002, with about half sold in Bali and the remainder distributed in East Java. As well as producing and selling seed under contract it sells fertilizer and pesticides to farmers. PT Pertani is government owned but not subsidized and is expected to break even at both national and provincial levels.

Since the start of the rice seed contract in Bali in 1988, the number of smallholders under contract has varied between 200 and 300. All growers must be certified seed producers to participate in the contract. Certification is undertaken by the government organization Balai Pengawasan Sertifikasi Benih (BPSB), which requires farmers to undertake training prior to certification. About 5% of Bali farmers are certified for seed rice production, and PT Pertani faces considerable competition from private producers of seed rice.

The PT Pertani contract terms are relatively simple. Farmers are provided with free foundation seed and extension advice and must deliver at least 75% of production to PT Pertani. Up to 25% of production can be retained for the farmer's own use and diversion to other markets is forbidden. Payments are made in cash by PT Pertani to the head of the grower group (Pakaseh) and no advances of farm inputs or cash are provided. This was different in 2001 when the contract was altered to take advantage of special government credit provisions according to which Bank Madiri provided credit for farm inputs. The bank

advanced money to PT Pertani which then advanced farm inputs to the Pakaseh for distribution to growers. There were no cash advances prior to harvest to the Pakaseh or growers.

Farmers usually receive four visits during the growing season from BPSB extension officers who are paid to undertake an advisory and monitoring role. Visits occur at land preparation, 30 days after sowing, then at 40–60 days at the pre-flowering stage, and then a week prior to harvest. Quality is important and about 15% of contracted production is rejected following visual inspection prior to harvest. Rejected production is subsequently sold as consumption rice. Husbandry for seed rice is similar to that for consumption rice in terms of water use and weeding; however, it is more labor intensive and more and better fertilizer is used resulting in a yield premium of around 20%. Crops usually harvest 6–7 tons per hectare and farmers receive the spot consumption price plus 5%, which was Rp. 1,400/kg during the survey period. Other private firms and individuals produce seed rice, and the price for seed rice in the spot market for the survey season was Rp. 3,000/kg. Although prices paid to PT Pertani farmers were lower than this, PT Pertani reported that farmers saw the costs of the price discount being offset by other benefits provided by company and associated government agencies. These include free foundation seed, seed processing and drying (producers did not have to own their own drying equipment), a guaranteed market, and provision of extension advice. The cost of these services was Rp. 2,250/ha, a token charge.

Understanding the role of the Pakaseh, who is in charge of each irrigation area, is critical in understanding this contract. PT Pertani contracts only with the Pakaseh who represents the interests of 50 to 60 farmers in his area participating in the contract. PT Pertani negotiates with the Pakaseh over which paddies it wishes to use and the desired hectarage. The contract is signed only by the Pakaseh and not by growers themselves, and payments for delivery under the contract are made in cash to the Pakaseh who distributes them to the growers. The manager at PT Pertani said the Pakaseh chose the cropping allocation for the whole irrigation area (subak) in terms of hectarage of seed rice, consumption rice, and soybean, leaving only minor production decisions to individual farmers. He also expressed the view that many contracted smallholders did not actually know who they were contracted to. It was clear to us there was a high level of coordination among growers and, in some senses, the subak could be viewed as a single decision-making unit. The motivation for PT Pertani to use contracts rather than the spot market or vertical integration is most likely similar to Pioneer. There were two advantages in using the Pakaseh system. First, it allows economies of scale in negotiation since terms need only be struck with a small number of group leaders rather than several hundred growers. Second, the Pakeseh system allows PT Pertani to access and take advantage of local information. The Pakaseh can select participants and land that is most conducive to fulfilling the needs of the contract, something that would be difficult for the company to do itself.

From the smallholders' perspective, the primary welfare gains from contracting are in risk management and improved access to markets. The seed rice market is a mature market in which the only barriers to entry are the requirement for certification as a seed producer and access to drying facilities. Except in 2001 when contractors could use the contract to access government subsidized credit, only foundation seed is advanced under the contract which makes little contribution to overcoming credit constraints. The contract provides extension and could overcome problems associated with lack of information; however, since husbandry for seed rice is similar to that for consumption rice and because the certification process includes a training component, the benefits here are limited. The major advantages of the contract for smallholders are in reducing risk. They receive an assurance that their product will be purchased at harvest and, also, contracted production constitutes a form of diversification.

3.3. Lombok broiler contract

Nusantara Unggasjaya Mataram is owned by a Thai MNC that produces poultry and pigs under contract and participates in livestock feed markets in Thailand, Indonesia, Malaysia, and China. It has over 70 enterprises throughout Indonesia. Nusantara Unggasjaya Mataram operating in the Lombok broiler market is its smallest with only 20 staff. Nusantara Unggasjaya Mataram currently uses contracts with smallholders to produce around 10,000 broilers per day on Lombok. It has operated on Lombok since 1998 and since starting operations has carved out a stable market niche for broilers. When the firm was established in Lombok, daily consumption of kampong chickens was around 5,000. After five years of competition from contracted broiler production this figure has not changed indicating strong market segmentation. An examination of prices for the two products supports this conclusion since kampong chickens, favored in the local market for their tastiness, leanness, and low chemical content, currently bring around Rp. 18,750/kg compared to broilers bringing around Rp. 5,000/kg. The firm claims the major competing product in consumption is wild fish, produced on a seasonal basis. All Lombok broiler production is consumed locally and the firm claims the market is "mature" with little scope for expansion. Prices of fish and broilers appear to be interdependent and fluctuate quite widely. Interestingly, at the time of the study Nusantara Unggaasjaya Mataram's broiler production was operating at a loss with producers receiving around Rp. 7,000/kg under the contract.

There are around 250 farmers participating in the contract with around 2,500 birds each at any point in time, giving a total broiler production around 600,000 birds in each cycle of production. To enter the contract the farmer must provide Rp. 20 million in capital and a chicken coop built to company specifications. Once in the contract they receive day-old chicks to rear to 1.8 to 2.0 kg live-weight, which takes 35 to 38 days depending on target weight. Production must follow the firm's guidelines with regard to input use, and the firm provides extension and advice, day-old chicks (imported from nearby Bali), feed, veterinary products and other chemicals on a credit basis.

No cash advances are made. Upon reaching their target weight the chickens are delivered to the firm, which sells them live directly to consumers. The firm does not process the broilers.

At the time of the survey, growers received about Rp. 7,000/kg according to a cost-based formula in which feed costs are the dominant item. The firm is dominant in its output market in Lombok and can doubtless exercise some market power; however, it would be constrained in this activity by competition from Bali broiler and local fish production. It was not clear what type of power the firm could exert in the feed market and whether this was a source of monopoly rents for the firm. Growers are required to purchase feed from the firm; however, they would be aware of feed prices in nearby Bali. This introduces an element of contestability since if the firm were too "out of line" with Bali feed markets, experienced contractors could, presumably, undertake ex-contract broiler production by sourcing feed from Bali. Final payments to farmers are made 14 days after delivery, after the value of inputs advanced has been deducted. Farmers receive a check that they convert to cash in an "over the counter" transaction at a bank. There appear to be few issues about product quality since apparently "every chicken has its price." That is, underweight or otherwise defective birds can be sold at a discount with the discount passed back to the producer under the terms of the contract.

The firm claims contract participation is stable: there is a queue of farmers wishing to participate, and exits are restricted to about 3% of participants per year who are asked to exit because of malfeasance. The major problems reported by the firm are technical ones such as unreliable electricity and keeping temperature constant. It also reported issues about consistency of management.

The contract is negotiated directly between the firm and the grower who is usually literate. The contract is not signed or witnessed by third parties. Contractors do not belong to any special groups specializing in broiler contracting, and the only meeting of contractors is when the firm's extension officers talk to groups of 16 to 20 contracted farmers.

Contracting represents several advantages over buying from the spot market for the firm. The firm can ensure its feed and chemical products are used in production, that its distribution system captures all production, and that quality is in line with company guidelines. This presumably allows the firm to achieve economies of scale in the provision of inputs and distribution, resulting in both rents and reduced contestability of the market.

The benefits smallholders derive from contract participation are considerable and fall neatly into three of the categories of benefits associated with contracts outlined previously. Feed costs are high and farmers receive advances of both feed and other inputs that are deducted from the settlement price. This probably allows farmers to overcome credit constraints. The contract is a major form of diversification for farmers as production risk is low and price risk is born by the firm. The firm representative stated that the firm is concerned about continuity of supply and when prices fall on a seasonal basis (related to fish catch) the firm takes losses on production rather than lose contractors. The firm provides guidelines for production which is fairly chemical intensive, and it is unlikely that contractors could easily acquire this type of expertise without participating in a contract. A possible negative associated with the contract is the possibility of "capture" within the contract. Smallholders make large investments to get into the contract, which would not easily be written off if contract terms were to sour. However, we found no evidence of deteriorating contract terms.

4. Contracting and smallholders: empirical results

Household surveys were conducted in each of the three provinces to examine the effects of contract farming on smallholders. In each of the provinces, the survey was administered by Indonesian research partners with the authors assisting in training enumerators, testing the survey and supervision of enumerators. All surveys were administered in 2002. The surveys included detailed information on crop production, including input use and costs, household demographics, income generating activities, asset ownership, credit use and access, and organizational affiliation. For the seed corn contract, 10 dusun (hamlets) were chosen from seven desa (villages) within the two kecamatan (districts) of Tajinan and Sumber Pucung where Pioneer operated in East Java. A total of 300 households were surveyed including 150 contracted to Pioneer for hybrid seed production. For the seed rice contract, the sample covered eight subaks (irrigation areas) within two kabupatens (regencies). The 300 smallholders in the seed rice survey included 150 contracted to PT Pertani for seed rice production. The survey for analyzing broiler production included 200 smallholders, with 80 contracted to Nusantara Unggasjaya Mataram. Respondents were selected from all four kabupatens in Lombok. A statistical description of the variables used in the analysis is provided in Table 1.

4.1. Empirical results for contract participation

If reducing production and transactions costs are the motivation for contract farming then, as noted in Section 2, firms can be expected to include farmers in a manner that minimizes such costs. In particular, it was hypothesized that contracting firms preferred selection of larger farmers with lower unit costs reflecting economies of scale. On the other hand, the firm may not dictate who participates and smallholders may self-select into contracts to reduce their own transaction costs. While it is unclear which of these factors is dominant, both suggest that differences between contract participants and nonparticipants may emerge. To evaluate these differences, a probit analysis was conducted to determine factors contributing to the likelihood of smallholders participating in the contracts in each sample area (Judge et al., 1982).

Participation was expressed as a function of ownership of land, physical, human, community, and "other" capital. Land capital was captured using both hectares of dry and irrigated land under management. Human capital was captured using years of education of the household head, and the age of the

Table 1
Mean values of variables used in analysis by contract and by participation

	Seed corn (East Java)			Seed rice (Bali)			Broiler (Lombok)		
	Contractors	Noncontractors	Mean	Contractors	Noncontractors	Mean	Contractors	Noncontractors	Mean
Farm gross margin (Rp.000)	6,888	3,099	5,000	3,692	2,882	3,287	16,177	3,455	8,453
Age of household head (years)	50.0	52.5	51.3	47.9	48.1	48.0	37.7	42.7	40.7
Household head education (years)	6.76	6.65	6.70	6.21	5.96	6.10	11.57	5.47	7.87
People in household 14–65 yrs	3.18	3.06	3.12	3.85	3.73	3.79	2.77	2.95	2.88
Dry land owned and operated (ha)	0.17	0.19	0.18	0.04	0.04	0.04	0.28	0.24	0.25
Irrigated land owned and operated (ha)	0.59	0.36	0.48	0.41	0.33	0.37	0.32	0.16	0.26
Value of agricultural assets (Rp.000)	367	201	284	412	357	394	542	226	350
Value of nonagricultural assets (Rp.000)	5,015	4,039	4,529	15,753	12,351	14,052	12,526	3,191	6,859
Value of livestock[a] (Rp.000)	2,428	2,061	2,245	4,425	3,583	4,004	761	2,476	1,802
Credit constrained (percent)	16	20	18	49	46	47	87	84	85
Number of loans in previous 12 months	0.56	0.40	0.48	0.39	0.42	0.41	0.77	0.22	0.44
Number of groups household participates in	2.40	1.89	2.15	2.73	2.62	2.68	0.61	0.55	0.58
Number of agricultural groups	0.50	0.92	0.71	0.39	0.52	0.45	0.43	0.12	0.17
Expenditures on chemicals (Rp.000)	103.2	50.6	77.0	21.0	20.8	20.9	15.7	20.2	18.4
Family labor use (days per year)	115	105	110	327.3	264.7	296.0	109.8	46.2	84.8
Nonfamily labor use (days per year)	114.5	54.2	84.4	22.5	20.9	21.7	109.0	66.0	82.9
Female labor use (days per year)	74.1	46.5	60.3	56.3	51.9	54.1	30.4	58.6	47.6
Off-farm work (days per year)	186.8	159.9	173.3	388.7	388.2	388.5	152.8	124.1	135.3

[a] excludes contracted broilers.

household head was included as a proxy for experience and lifecycle effects. Household labor was also included as a measure of labor availability with the assumption that given transaction costs associated with obtaining off-farm employment, a higher return may be had by utilizing labor on-farm through contracts. Community capital was approximated using two variables: (1) membership of the head of household in agricultural groups, excluding the contract group, and (2) membership of household members in various village groups. Ownership of "other capital" invested in (nonland) agricultural and nonagricultural assets were also included and measured by the total value in rupiah of each set of assets. A variable for expenditures on chemicals was included in the expectation that cash constrained farmers would find access to farm inputs provided in contracts attractive. As noted in Section 2, contracts may help households overcome high transaction costs associated with borrowing, so smallholders who were credit constrained might self-select for the contract. Variables included borrowing history and a dummy variable for whether the smallholder was "credit constrained."

Table 2 reports the marginal contribution of each variable to contract participation in each of the three contracts. In East Java smallholders with more irrigated land were more likely to participate in the seed corn contract, as were those who were younger and attended more agricultural groups. It was necessary to have irrigated land to meet the growing guidelines issued by the company, so irrigated land was effectively a precondition for participation in the seed corn contract. Also, those with more irrigated land are likely to benefit from economies of scale and have lower production costs. Lower production costs may make them more attractive to the contracting firm and may make them more able to benefit from the contract. Younger farmers may be more entrepreneurial than older ones and less likely to be put off by the technical complexity of seed corn production. Education was not statistically significant in selection for the seed corn contract. For the seed rice contract, ownership of irrigated land was also important, presumably for the same reasons noted above for seed corn. Age was not statistically significant in selection, but contract participants were more likely to be literate without being more likely to be educated beyond year three. As in the seed corn sample, membership in agricultural groups meant a greater chance of contract participation.

For broiler production, participation in the contract was negatively influenced by ownership of irrigated land indicating that the contract may be more attractive to smaller farmers who have limited potential for crop production. Since the broiler enterprise is strongly separable in production from other farm enterprises, any economies of scale from land ownership should not influence costs of producing broilers and hence selection for the contract. Higher education levels, beyond year three, also favored participation in the contract as did credit constraints and strong borrowing histories. Livestock ownership favored participation while membership in agricultural groups worked against participation. The contract appeared to appeal

Table 2
Profit results for contract participation

Dependent variable: contract participation	Seed corn Marginal effect	Seed rice Marginal effect	Broiler Marginal effect
Age of household head (years)	−0.0077**	−0.0049	−0.004
	(0.009)	(0.132)	(0.420)
Household head education only year 3	−0.033	−0.1761**	0.151
	(0.698)	(0.021)	(0.350)
Household head education > year 3	−0.0727	−0.1426	0.523**
	(0.473)	(0.131)	(0.000)
People in household 14–65 years	0.02955	0.0051	0.060
	(0.263)	(0.836)	(0.163)
Dry land owned and operated (ha)	−0.0787	0.0522	0.130
	(0.462)	(0.850)	(0.183)
Irrigated land owned and operated (ha)	0.2512**	0.8609**	−0.421**
	(0.006)	(0.000)	(0.014)
Value of agricultural assets (Rp.000)	0.0002	0	0.00005
	(0.252)	(0.482)	(0.232)
Value of nonagricultural assets (Rp.000)	0	0	0.000
	(0.668)	(0.159)	(0.159)
Value of livestock (Rp.000)	0	0	−0.00004**
	(0.336)	(0.474)	(0.008)
Credit constrained (yes = 0)	0.109	0.0372	−0.201**
	(0.197)	(0.556)	(0.125)
Number of loans in previous 12 months	0.0395	−0.0102	0.430**
	(0.420)	(0.855)	(0.000)
Number of groups household participates in	0.005	0.0027	0.067
	(0.791)	(0.918)	(0.259)
Number of agricultural groups	0.2565**	0.0709**	−0.349**
	(0.000)	(0.174)	(0.003)
Expenditures on chemicals (Rp.000)	0.0007	−0.0104	0.0004
	(0.116)	(0.004)	(0.730)
Status:	0		1
% predicted correctly			
Seed corn	70.14%		67.59%
Seed rice	68.67%		59.33%
Broiler	87.29%		79.22%

*Significant at the 5% level.
**Significant at the 1% level.
Bracketed term is probability of coefficient being 0.

to less well capitalized smallholders who were well educated, currently credit constrained but with strong borrowing histories.

In summary, participation was driven in the two seed contracts by ownership of irrigated land and participation in more agricultural groups. There was no conclusive evidence of transaction costs in labor and credit markets playing a significant role in encouraging smallholders to participate in the contract except possibly for broiler production where farmers who had difficulty getting credit were more likely to participate. The results support a general conclusion that farmers for the seed corn and seed rice contracts were likely to be selected for the contract by the firm, or self-selecting because they have lower costs of production. That is, the selection process favored larger, lower unit cost farmers. For broilers the opposite occurred, with farmers with small holdings being more likely to participate. The broiler firm reported farmers approached them for contracts indicating some self-selection, and this possibly explains the importance of credit constraints for the broiler participation equation. Differences in the results indicate that participation in contract farming is dependent on the commodity being produced.

4.2. Effect of contracts on gross margins

One of the difficulties in evaluating the welfare effects of contract farming on smallholders is measuring the benefits of a new crop, such as seed corn, seed rice, or broilers, when it is only produced by participant households. There is no clear comparison that can be made since no equivalent noncontract form of crop production exists. To overcome this difficulty, we use the detailed information collected on all household agricultural activities to compare the returns to household resources tied to agriculture. This information allows the calculation of total gross margins and the comparison of total returns to agricultural production for contractors and noncontractors. The methodology also avoids another potential problem associated with comparing contractors and noncontractors across a single crop. Such comparisons may suggest that contracting is profitable for the crop, but it is possible that the gains may have come from shifting resources from other crops or activities. In this article, we avoid this problem by analyzing how contracting has affected total gross margins for all agricultural production.

Equations for total farm gross margins were specified to test whether contract participation led to increased capital returns. Total farm gross margins were calculated for each household for an entire year using the individual gross margins for all agricultural activities. The total farm gross margin then represents the returns to all fixed factors of production. Farm gross margins were expressed as functions of land, physical, livestock, human and community capital plus (i) access to credit which, if constrained, could reduce returns, and (ii) household size, which could affect returns if off-farm work was difficult to obtain. Contract participation was included as a dummy variable.

Including a dummy variable to measure the effect of contract participation on gross margins is potentially problematic since the variable may capture other characteristics of contract farmers such as management ability that are not controlled for elsewhere. To consider the possibility that contract participation and gross margins were jointly determined and to avoid simultaneity bias, a two-stage estimation procedure was used (Angrist, 2000). A linear probability model of contract participation using the same variables as in the probit analysis was estimated and forecasts from it were used in second-stage estimation of the linear gross margin equations. Hausman's test for endogeneity was conducted and, where the hypothesis of endogeneity was rejected, gross margin equations were reestimated using ordinary least squares with an exogenous dummy variable for contract participation (Doran, 1989). It turned out that the contract dummy in the gross margin equation for seed corn was endogenous while those for the seed rice and broiler equations were exogenous. The exogeneity of the dummy variable used

Table 3
Regression results for gross margins analysis[a]

Dependent variable: gross margins	Seed corn	Seed rice	Broiler
Contract participation (zero-one)	3540.4**	−178.1	13500**
	(0.039)	(0.612)	(0.000)
Age of household head (years)	−30.18	−11.31	−63.11
	(0.307)	(0.492)	(0.239)
Household head education only year 3	964.3	−958.9*	−356.5
	(0.114)	(0.045)	(0.739)
Household head education > year 3	−250.5	−947.9*	−171.1
	(0.823)	(0.077)	(0.869)
People in h/hold 14–65 years	−215.7	−139.9	104.97
	(0.344)	(0.271)	(0.797)
Dry land owned and operated (ha)	1044.2	646.4	3875**
	(0.397)	(0.645)	(0.015)
Irrigated land owned and operated (ha)	8402.4**	6357.6**	7796**
	(0.000)	(0.000)	(0.000)
Value of agricultural assets (Rp.000)	2.9937**	−0.1302*	0.2504
	(0.000)	(0.071)	(0.589)
Value of nonagricultural assets (Rp.000)	0.1439	0.0069	0.0668
	(0.175)	(0.657)	(0.350)
Value of livestock (Rp.000)	0.1127	0.3687**	0.0631
	(0.244)	(0.000)	(0.526)
Credit constrained (yes = 0)	−1339	546.9	1428.7
	(0.129)	(0.138)	(0.163)
Number of loans in previous 12 months	−254.15	−271	−1153.7
	(0.664)	(0.291)	(0.308)
Constant	−519.53	1042.3	1223.8
	(0.809)	(0.290)	(0.622)
R^2	0.492	0.400	0.352

*Significant at the 5% level.
**Significant at the 1% level.
Bracketed term is probability of coefficient being 0.
[a]2SLS for seed corn and OLS for seed rice and broiler (see text).

to denote contract participation for seed rice and broilers was not surprising given that firms held positions of considerable power in contract selection and, given the strong interest in contracts from smallholders, had plenty of "would be" contractors to choose from. The endogeneity of contract selection for seed corn, indicating some selection bias, may indicate competition among contracting firms for smallholders or reflect, in some unexplained way, negotiation being undertaken at group level by the firm and then being translated to individual contracts by the head of the grower group. The results, based on 2SLS for seed corn and OLS for seed rice and broilers, are reported in Table 3.

The contracts for seed corn and broilers made significant contributions to capital returns while the contract for seed rice did not significantly influence returns. This is unsurprising given the nature of the contracts. Both seed corn and broiler contracts are in niche markets in which there is little competition and significant rents, a portion of which can be expected to go to contractees to ensure contract compliance and renewal. The contracts have high set-up costs and noncompliance or failure to renew contracts is costly for the contracting firm. In contrast, markets for seed rice in Bali are competitive and do not generate significant rents. Experienced, certified rice seed growers are plentiful, so replacing contractors who do not renew contracts or comply with contract terms is not especially costly. Another possible reason why the seed corn and broiler contracts increased capital returns is that seed corn and broiler production are technically difficult and necessarily involve exposure to company extension officers. This may lead to productivity enhancing flow-on effects from contracted production to other farm activities.

Other variables in the gross margin equations are noteworthy. In all three subsamples, gross margins are strongly influenced by the amount of land under management. The coefficients on these variables are relatively large suggesting an additional hectare of irrigated land substantially increases returns. The age of the household head does not significantly influence profitability, suggesting that life-cycle effects are minimal, and education, except for seed rice where its influence was negative, appears also to have no significant effect. The seed rice result may reflect the high opportunity value of educated smallholders' time in off-farm work and that farm production becomes less factor intensive when off-farm work is undertaken. Ownership of agricultural assets such as handheld tractors positively influenced gross margins for seed corn and negatively influenced them for seed rice. Larger producers of seed rice are more likely to contract out field work than for seed corn. This may reflect cultural or economic factors, while the negative coefficient on the seed rice machinery variable presumably reflects the efficiency gains from outsourcing. Credit constraints appear to have no significant effect on farm productivity in any of these farming systems.

4.3. Employment effects of contracts

Because of transaction costs and associated labor market imperfections, households in developing countries often have underemployed family labor and a benefit of contracting may be to utilize underemployed family labor (Hayami and Otsuka, 1993). If family labor is not available, households may seek outside help by hiring in labor resulting in "linkage" effects between the contract and rest of the community. If more labor is being used, there is also an issue of whether the burden of this increased labor falls more fully on male or female labor. In this section, further empirical results are reported on the effects of contracting on labor use for the seed corn, seed rice, and broiler samples in four labor categories: family labor, nonfamily labor, female labor, and off-farm work by household members. Conditional factor demand equations for each category of labor in each sample, 12 equations in all, were specified with off-farm work being treated conceptually as a "farm activity." Labor demands were specified as functions of the same explanatory variables used in the gross margin equations (Varian, 1992) and estimated using the procedure from Angrist (2000) and the Hausman test discussed above. Results indicated that contract participation was endogenous in the nonfamily labor equations for seed rice and broilers, which were subsequently estimated using 2SLS and exogenous in the other 10 labor equations, estimated using OLS. Results are presented in Table 4.

Table 4
Regression results for labor use[a]

	Seed corn				Seed rice				Broiler			
Dependent variable: labor use	Family labor use	Nonfamily labor use	Female labor use	Off-farm work	Family labor use	Nonfamily labor use	Female labor use	Off-farm work	Family labor use	Nonfamily labor use	Female labor use	Off-farm work
Contract participation (zero-one)	0.3454	30.29**	14.65**	−28.72	26.93*	29.8	−0.2248	−3.049	−15.17	−80.15	−5.988	−17.14
	(0.976)	(0.004)	(0.027)	(0.130)	(0.104)	(0.176)	(0.951)	(0.894)	(0.363)	(0.377)	(0.368)	(0.577)
Age of household head (years)	−0.3544	−0.6267	−0.459	0.3358	−2.144**	−0.055	0.1085	2.996**	0.4706	−0.4980	−0.1424	0.2224
	(0.410)	(0.229)	(0.218)	(0.652)	(0.033)	(0.798)	(0.561)	(0.016)	(0.603)	(0.242)	(0.670)	(0.794)
Household head education only year 3	18.2	12.06	13.18*	27.73	−52.56**	7.415	−0.0004	21.25	−14.95	−8.955	−21.06*	49.71*
	(0.174)	(0.226)	(0.052)	(0.212)	(0.011)	(0.224)	(1.00)	(0.465)	(0.545)	(0.496)	(0.043)	(0.099)
Household head education > year 3	−5.5	−0.1984	−1.786	36.13	−64.86**	1.196	−4.428	78.55**	−7.560	58.49*	0.5995	87.18**
	(0.711)	(0.988)	(0.839)	(0.200)	(0.029)	(0.848)	(0.445)	(0.034)	(0.718)	(0.100)	(0.939)	(0.005)
People in household 14–65 years	8.59*	−0.1987	−1.099	50.89**	5.272	2.338	1.101	77.17**	3.887	1.642	3.193	14.69*
	(0.068)	(0.961)	(0.638)	(0.000)	(0.381)	(0.159)	(0.421)	(0.000)	(0.547)	(0.721)	(0.169)	(0.086)
Dry land owned and operated (ha)	−13.76	21.16	4.669	−46.22*	−0.7877	8.412	−11.62	148.73	8.193	66.25**	30.84**	−60.14**
	(0.317)	(0.525)	(0.782)	(0.093)	(0.992)	(0.536)	(0.374)	(0.269)	(0.612)	(0.000)	(0.003)	(0.001)
Irrigated land owned and operated (ha)	14.73	88.92**	42.78**	−61.04**	98.08**	30.29**	33.8**	−73.68*	19.78	98.47**	84.16**	−34.27
	(0.236)	(0.002)	(0.006)	(0.005)	(0.019)	(0.006)	(0.000)	(0.120)	(0.492)	(0.000)	(0.000)	(0.198)
Value of agricultural assets (Rp.000)	−0.01	0.0177*	0.0017	0.0084	0.0008	0.0005	0.0008	0.002	−0.00003	0.0041	0.0066**	0.0213
	(0.492)	(0.083)	(0.532)	(0.232)	(0.910)	(0.407)	(0.349)	(0.618)	(0.994)	(0.501)	(0.033)	(0.162)
Value of nonagricultural assets (Rp.000)	−0.002**	0.0049*	0.0021	0.0038**	−0.0003	−0.0001	0	0.002**	−0.0011**	0.0014	−0.0005**	0.0003
	(0.013)	(0.084)	(0.113)	(0.001)	(0.567)	(0.285)	(0.974)	(0.017)	(0.006)	(0.282)	(0.017)	(0.704)
Value of livestock (Rp.000)	0.0134**	0.0028	0.0005	−0.0043**	0.0249**	−0.0007	0.0015**	−0.0034	0.011**	−0.001	0.0032*	0.0041
	(0.023)	(0.486)	(0.531)	(0.012)	(0.000)	(0.191)	(0.016)	(0.329)	(0.006)	(0.377)	(0.074)	(0.106)
Credit constrained (yes = 0)	17.52	−5.802**	−20.86	−13.3	−9.212	−1.153	−0.6504	−2.752	−13.65	−20.59**	−1.074	40.17*
	(0.287)	(0.712)	(0.012)	(0.577)	(0.568)	(0.749)	(0.862)	(0.904)	(0.568)	(0.209)	(0.899)	(0.069)
Number of loans in previous 12 months	9.428	−2.518	2.969	39.77**	−31.79*	0.3748	−6.609*	28.11	−22.17**	30.42	−10.15**	10.05
	(0.290)	(0.784)	(0.591)	(0.006)	(0.060)	(0.899)	(0.051)	(0.204)	(0.020)	(0.148)	(0.021)	(0.614)
Constant	62.14**	18.86*	44.28	−1.584	289.97**	−8.853	31.01**	−84.03	69.63	54.05**	20.93	22.15
	(0.042)	(0.594)	(0.059)	(0.977)	(0.000)	(0.638)	(0.009)	(0.295)	(0.146)	(0.040)	(0.229)	(0.692)
R^2	0.3343	0.4412	0.2786	0.2550	0.3889	0.1557	0.1475	0.2882	0.3181	0.0637	0.4848	0.1662

*Significant at the 5% level.
**Significant at the 1% level.
Bracketed term is prob. of coefficient being 0.
[a]Nonfamily equations for seed rice and broilers estimated using 2SLS; all others with OLS.

The results from the seed corn contract suggest that the contract had no significant effect on the use of family labor. However, employment of nonfamily labor increased with contract participation indicating that the contract had some multiplier effects on the villages in which it was extant. The contract also led to increased use of female labor, probably reflecting that cropping activities, including seed corn, traditionally make greater use of female labor than noncropping activities. The contract had no significant effect on off-farm work undertaken by household members, suggesting that households did not self-select for the contract to avoid high transaction costs associated with working off the farm. Family members were more likely to do off-farm work when families were larger, the farm was smaller, or owned less livestock, or when the household owned more nonagricultural assets or undertook less borrowing. The major type of off-farm work was as day laborers in the agricultural sector and, from these results, appears to be a response by larger farm families to lower farm income.

The seed rice contract in Bali had a small though significant effect on the use of family labor on the farm and no significant effect on the use of nonfarm or female labor or the amount of off-farm work undertaken by family members. These results are not surprising since seed rice contract production displaces ordinary rice production and, while being somewhat more labor intensive, uses similar technology. The major determinants of demand for family labor were capital items such as the number of irrigated hectares and the value of livestock. Education and age reduced use of household labor, and smallholders with more human capital were more likely to undertake off-farm work. The major alternatives to agricultural work for these smallholders are in the service, tourism, and construction industries and, as expected, off-farm work was positively influenced by the number of adult household members and inversely related to farm size. The significance of age in the off-farm work equation possibly reflected cohort effects since the children of older farmers were more likely to be of working age. Demand for nonfamily labor was positively influenced by farm size, and for female labor by farm size and the value of household livestock.

Participation in the broiler contract in Lombok did not significantly effect use of family labor or off-farm work by family members, possibly reflecting strong technical separability between broiler production and other farm activities. Use of on-farm family labor was negatively related to ownership of nonagricultural assets and previous borrowing, with both factors positively influencing off-farm work by household members. Demand for nonfamily labor was driven by ownership of dry and irrigated land, reflecting that dryland production is more prominent in Lombok than in the East Java and Bali sample areas where it is of little importance. The value of livestock owned, literacy of the household head, and whether the household was credit constrained also led to more off-farm work. Use of female labor decreased with education of the household head and increased with land ownership, the value of agricultural assets and livestock, and previous borrowings. Off-farm work was positively related to the education of the household head, the number of adults in the household, and negatively related to land ownership. That is, better educated farmers with small holdings and large families were more likely to be found working off the farm.

5. Conclusions

The general review of contract farming in East Java, Bali, and Lombok suggests there is a wide array of contract farming relationships in the region, with variation in the contracting parties, crops being contracted, details of contracts, level of formality, and the number of smallholders participating. Analysis of the three selected contracts indicates that the variation in contracts is the result of the technical requirements of production and the associated production and transaction costs. That is, the contract that emerges for the production of a specific commodity is designed to minimize the costs associated with the production and transaction of that particular commodity. In evaluating participation and the benefits of a particular contract, it is therefore important to understand the details of the contract and why it has been designed in a particular manner.

The success of the three contracts selected for in-depth analysis, in terms of their persistence over time, meant that costs of negotiating contracts, maladaption costs, running costs, and maintaining relationships with farmers were low enough to allow satisfactory margins for the agribusiness firms involved. It is evident that contracting firms favored larger farms in the corn and rice contracts and this supports the major conclusion that unit production and transaction costs are of central importance in the selection process. Other aspects of the role of transaction costs in contract farming were that the seed corn and broiler contracts resulted in smallholders gaining access to markets that were technically demanding and where economies of scale in processing and marketing would usually prevent access. All three contracts provided some access to credit or inputs and reduced smallholder risk by providing assurances that the firm would purchase outputs.

The empirical results show that reasons for contract participation varied widely across the contracts. Unexpectedly, family size did not effect contract participation and credit constraints were not influential in selection, except for the broiler contract. The seed corn contract enhanced female labor demand, while neither of the other two contracts had any effect and only the rice contract effected demand for family labor. In the same vein, the results for age of the household head and for education were different across the three samples. This reflects, in our view, the ultimate importance of local conditions and technical considerations in understanding the impacts of these types of contracts.

Finally, the contracts positively affected welfare and no evidence was found for any of the pernicious effects of contracting discussed earlier. The contracts for seed corn and broilers resulted in improved returns to capital and left participants better off. For the seed rice contract, the contract did not increase

returns to capital but did confer other benefits such as secure market access. From a development perspective, all three contracts reduced absolute poverty. However, given that the agribusiness firms contracting for seed corn and seed rice favored larger producers, the latter contracts probably increased relative poverty. In contrast, selection favored smaller farmers for broilers and probably reduced both absolute and relative poverty.

Acknowledgments

The authors are grateful to the Australian Centre for International Agricultural Research, Canberra, for funding for the survey and analysis of data and to the Food and Agricultural Organization, Rome, for supporting earlier conceptual work on contract farming undertaken by Phil Simmons.

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