Commercializing smallholder's through interlinked contracts: prospects and challenges in the rift valleys of Ethiopia

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Abstract

Smallholders who strive to transform from subsistence to commercialization, face many challenges that ranges from the inevitable natural disasters to unnecessary institutional hurdles. This paper investigates the prospects and challenges of commercializing smallholders through interlinked contracts. It tests the hypothesis that the role of interlinked contracts in accessing credit and hedging risk thereby enhancing commercialization is undermined by the presence of skewed bargaining power and double delegation problems. The hypothesis was empirically tested using multinomial and switching regressions. We used pooled household survey data collected in 2006 from the central rift valley of Ethiopia. The result confirmed that smallholders' contract choice appears to depend on risk and information access but not on marketing costs. The extent of commercialization measured by marketed surplus and area allocated to marketable grain is significantly influenced by bargaining power and discretionary incentive in grain markets. Controlling resource endowments, the comparison of mean marketed surplus under different interlinked contracts revealed that relational contract impacts commercialization better than cooperative contract implying the discretionary effect is stronger than the bargaining power effect. The major implication of the findings is that interlinked contracts have to be reorganized in order to capitalize their benefits to smallholders.

Introduction

Economists have long advocated commercialization[1] as part of a broader strategy of comparative advantage. The underlying premise is that markets allow households to increase their incomes by producing that which provides the highest returns to land and labor, and then use the cash to buy household consumption items, rather than be constrained to produce all the various goods that the household needs to consume (Pingali, 1997, Timmer, 1997). While this concept of comparative advantage is well accepted under the assumption of well functioning markets, the process of commercialization involving cash crops is impeded by risks and high transaction costs in the food marketing system. There is a growing interest to tackle these impediments through empowering value chains and arranging interlinked contracts in which smallholders benefit and contribute to the growing national and international bent of market liberalization (WDR, 2008).

Interlinked contracts that tie credit (both in cash and in-kind) to the delivery of product at harvest are a long time tradition among local grain traders and farmers in Ethiopia. Many local traders lend money to smallholders during wet seasons when farmers are out of stock. Farmers usually pay in-kind during harvest. The money could be used either for consumption or production depending on the specific purpose of the transaction. It is also common that grain buyers provide inputs such as improved seeds, fertilizers and pesticides prior to harvest to farmers with an agreement that farmers would supply grain to the trader. Such type of interlinked contract is considered as informal and relational in the sense that the transacting parties have no formally written agreements rather their social relations help to enforce agreements.

Parallel to the informal interlinked contract, formal interlinked contracts are being developed through organizing cooperatives and promoting farmers to borrow credit or inputs and sell their grain to cooperatives. The purpose of this arranged contract is to increase bargaining power and get access to credit and technical supports. Cooperatives, unlike individual farmers, can easily get access to credits from formal financial markets

[1] Commercialization may refer to the process which involves a transformation from production for household subsistence to production for markets. It may be measured by the proportion of production supplied to markets or the proportion of cash crop produced relative to total production or total crop area.

and provide this credit to members with the same level of interest rate. Farmers' agreement to supply grain at harvest is used as collateral. These contracts are organized by market oriented agricultural production and value chain networking programs (sometimes called commercialization program). The objective of the program is to transform subsistence production to market oriented production through interlinking access to inputs, technologies and output markets (FDRE, 2005). With the advent of this program, interlinked markets are expanded to include wheat, barley, spices, soybean, haricot bean, chickpea, tomato, and dairy products. Haricot bean interlinked cooperative markets is relatively performing better than the others in the rift valleys of Ethiopia.

While the issue in relational interlinked contracts revolves around the power of farmers to negotiate with the buyers, the issue in cooperative interlinked contract is the power of members, collectively, to monitor and observe the action of the management responsible for buying, processing and reselling. Buyers in relational contract own the entire bargaining power but they design a discretionary incentive that helps to encourage growers to supply more quality and quantity grains. The cooperative interlinked contract, on the other hand, adopts uniform pricing system in which the same price is paid to all members irrespective of quality and quantity of supply. The uniform pricing system presents an opportunity of avoiding bargaining power problem but it does not create discretionary incentive. The skewed bargaining power in relational contract and non-discretionary incentive in cooperative contract posit empirical puzzles on whether bargaining power and discretionary incentive are significant in farm households' production and marketing decision. Such an understanding helps to know whether organized formal contracts are the better way of commercialization than informal contracts.

The literature is very rich in explaining the move towards production contracts(Key and Runsten, 1999, Masakure and Henson, 2005, Sartoriusa and Kirsten, 2005, Simmons, et al., 2005). However, these studies did not capture the bargaining power aspects of interlinked transactions. There are also ample literatures that explain the move towards cooperatives and their effect on smallholder commercialization (Bernard, et al., 2007, Holloway, et al., 1999). The studies are done out of contractual perspective so that unable

to capture the disincentive effect of cooperatives associated to rigid contractual arrangements.

The paper is, therefore, motivated to see if improvement in market conditions translates to improvement in smallholders' commercialization through assessing the effect of bargaining power and discretionary incentive on farmers' contract choice; and examining the impacts of these contracts on marketed surplus. We employed multinomial and switching models to test the role of interlinked contracts within the context of haricot bean[2] marketing in the rift valleys of Ethiopia. The paper wishes to contribute to the ongoing policy debate on strategic choice of agricultural commercialization in developing countries.

The rest of the paper is organized as follows. Section two provides contextual and conceptual backgrounds. This section also presents the theoretical hypotheses to be tested in subsequent sections. Section three presents the estimation models, which is followed by data description in section four. The results are discussed in section five. Conclusions and implications are made in the final section.

[2] Haricot bean is chosen due to its special marketing system in which spot, contract and cooperative markets are operating side by side. This helps for comparison of the relative importance of these institutions.

2. Theoretical Framework

Within the Ethiopian haricot bean market context, we hypothesize that smallholders' response to market choice and commercialization is challenged by bargaining power and discretionary incentives. Discretionary incentive is a term widely used in relational contract literatures (Hviid, 1998, Wu and Roe, 2007) . It refers to a subjective incentive or bonus paid to the agent depending on the buyer's discretion. In agricultural commodity market, it refers to an additional payment for grain suppliers based on the traders' subjective assessment of grain quality and quantity. To explain the hypothesis, we first explain how price is determined in spot markets and relational and cooperative contracts. Then, we build a model of farm household's production and marketing decision given prices from each market.

Pricing in spot market

Price in haricot bean spot market in the refit valley areas of Ethiopia is determined by the interplay of demand and supply. It, however, exhibits extreme volatility over years and months. Apart from the natural aggregate supply fluctuation, the volatility is partly related to the partial integration of the market to world market. Because of this partial integration the domestic market has two equilibriums that yield different outcomes for growers and marketers alike. Fig.1. is used to explain this claim. As we see from the figure, prices are formed based on local demand, the efficiency of the export sector and the world price. The effective demand function is different below and above an aggregate level of supply, R_s^0 , above which export marketing is profitable and below which export is not profitable due to economies of scale in the export sector. When $R_s < R_s^0$, the average cost is above the world price, making export less lucrative so that the market demand comprises only domestic demand and the equilibrium price holds at p_s^L . If the minimum supply holds at R_s^0 , the market enjoys the derived demand from world market and local price increases to p_s^* , where it corresponds with the intersection of the exporters marginal cost and the world price.

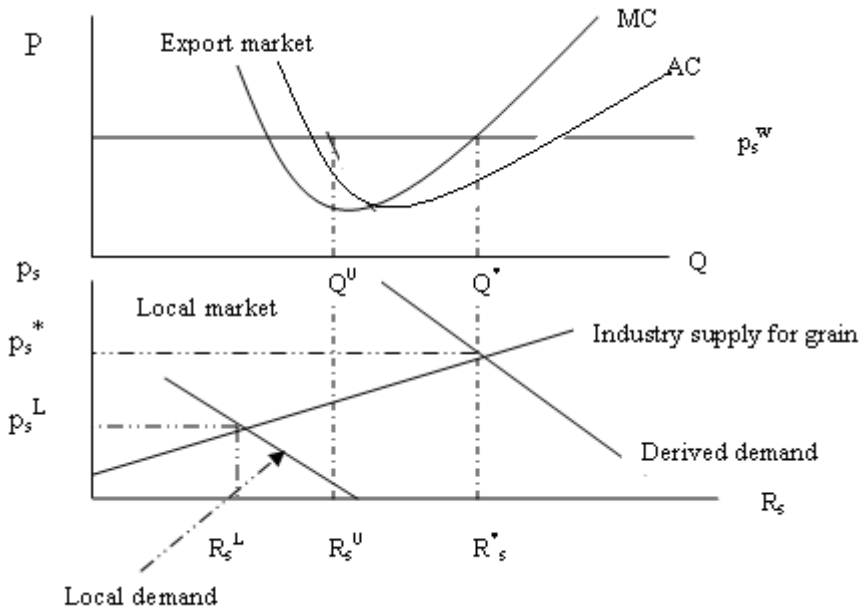
An increase in local grain supply, therefore, brings substantial price increase depending on the elasticity of supply and domestic demand. Perturbing the market to

surpass the threshold supply and achieve Pareto optimal price requires institutional innovation that increases either the number of farmers who produce bean or production and productivity of each producer. We thus predict that price without such innovation, p_s, exhibits strong volatility following total supply within the range of p_s^L and p_s^*. That is,

$$p_s = \begin{cases} p_s^L & if \quad R_s < R_s^0 \\ p_s^* & if \quad R_s > R_s^0 \end{cases}$$

Such volatility risk should explain participation to interlinked contracts where collective actions are enforced to bring more farmers to the production of bean.

Fig1. Haricot bean pricing in the spot market of Ethiopia



Pricing in relational contract

Principal-agent framework is used to determine the optimal contract price, where the buyers (traders/seed firms) are represented as principal and the sellers (farmers) as

agents. The principal plays as a single buyer but it takes in to account price signal from the spot market while setting the contract price. The principal also discriminates price depending on the seller's type assuming that the seller's type in terms of risk aversion and resource endowment is known to the buyer because of repeated interaction and informal relation between the buyer and the seller. The entire bargaining power in this market belongs to the buyer and hence the principal is modeled as a Stackelberg leader who offers a take-it-or-leave it contract which the agent must either accept or reject. Such relationship is represented as a sequential game where the principal decides first and the agent moves next[3]. The benefit of contracting for the buyer is securing maximum grain supply at a cost close to the sellers' reservation price. The buyer will achieve these benefits through setting a contract price to each seller conditional to its reservation. To show how it works, let us assume the principal's production[4] is represented by a fixed proportion production function as

$$Q = \alpha R \tag{1}$$

where Q is the final product supplied to the world market, R is the primary grain collected from farmers and α is the conversion factor of R to Q and its value ranges from zero to one depending on the quality of R. The higher the quality will be closer to one. We further assume the principal's cost function of transforming R to Q, M, is decreasing return to scale with respect to R to signify economies of scale in grain marketing and inversely related to the conversion factor to show lower quality grain costs more labour and material for cleaning[5].

$$M = M(R, \alpha) \tag{2}$$

[3] Sequential game is solved through backward induction where the agents' response function is derived first and then the principal makes decisions considering this response function. Since price is determined by the buyer, we formulated the response function and se it as participation constraints similar to the traditional principal-agent model.

[4] It includes cleaning, processing and packing of the primary grain obtained from the farmers before it is supplied to the international market

[5] Empirical observation in our study area show that exporters cost highly related to how pure is grain from external materials and how the bean is timely harvested. Hundreds of labors are hired to clean the seed everyday.

We assume credit market is either missing or imperfect in the study area. Farmers can get credit only from their buyer through interlinked transaction. The buyer, however, limits the amount of credit contingent upon the supply of primary product, that is,

$$k = \lambda(p_c s_c + p_o s_o) \tag{3}$$

where s_i is part of the total quantity of grain (q) the agent supply for market i, p_i is net grain producer price after interest rate at market i, $i = s, c, o$, the subscript s stands for spot market, c for relational contract and o cooperative contract. $\lambda \in [0,1]$ is the proportion of total value of supply that the buyer is willing to lend and the seller is willing to borrow. The seller demand depends on owned capital, k_0. The higher the owned capital, the lower will be the demand for credit and so the proportion. When $s_c = s_0 = 0, \quad k = k_0$. Equation (3) makes production and marketing decisions non-separable.

Given these assumptions, a risk neutral principal maximizes the following expected profit to set a contract price for the j^{th} agent

$$Max_{\{P_c\}} \pi = P\alpha_c R_c - p_c s_c - p_e(R_c - s_c) + (i - r)k - M_c(R_c, \alpha_c) \tag{4}$$

where R_c denotes the total grain demand of the principal, r represents the opportunity cost of capital out-funded for the farmers, which could be equal to the formal finical market interest rate if the principal has full access to these markets, i represents the interest rate charged from farmers, P the whole sale price received by the trader derived from the world market.

The first order condition of (4) gives us equilibrium price at which marginal cost and marginal benefit of increasing contract price for the j^{th} agent are equal

$$P\alpha_c - \lambda p_c(i - r) = p_c + M_{Rc} + s_c / e \tag{5}$$

where $e = \partial s_c / \partial p_c > 0$ is the farmers supply response to price change. Its magnitude is obtained from the response function of individual farmer (12). M_{R_c} is the trader's marginal cost. The contract price depends up on farmer's response to price change (e), world price, the conversion factor, bank's interest rate and the marginal cost of

processing grains. Except banks interest rate, marginal cost and whole sale price, all other parameters are endogenous to individual farmer. Since e depends on individual seller characteristic, discriminatory contract price is made to each participating farmer. A responsive farmer receives better price than less responsive farmer.

Pricing in cooperative contract

Cooperative contracts are formed to conceal bargaining power inequality and reduce marketing cost through economies of scale. Thus, price is made through cooperative negotiation where the principal (coop) acts as representative of the agents and behaves like a competitive buyer. On behalf of all members the cooperative management sets uniform price[6] applicable to all farmers through pooling contract in which incentive compatibility is not binding but participation constraint (Laffont and Martimort, 2002). The cooperative (principal) optimizes the total profit to set a competitive price by choosing the total quantity of grain collected from members instead of choosing the contract price. The problem is expressed as

$$\max_{\{R_o\}} E(\pi_o) = P\alpha_o R_0 - p_o R_o - rk(R_0) - M_o(R_o, \alpha_o) \qquad (6)$$

[6] Since cooperative contract is a formal contract in which agreements are written prior to exchange and the agreements are enforceable under the law, it is less flexible for creating incentives to members Bolton, P., and M. Dewatripont. *Contract Theory* London: Massachusetts Institute of Technology 2005.. Cooperative contracts are formal and rigid because monitoring the action of an agent delegated to buy grain from agents (which we call double delegation problem) under flexible and discretionary system is very costly. Moreover, buyers in cooperative contract lack the experience as well as the incentive to form a price that is incentive compatible. Thus, we observe the same per unit price is paid to all farmers irrespective of quantity and quality. This feature in fact is common to most agricultural cooperative marketing where grading and standardization is not well developed Akwabi-Ameyaw, K. "Producer Cooperative Resettlement Projects in Zimbabwe: Lessons from a Failed Agricultural Development Strategy. ." *World Development* 25(1997): 437-456..

All the symbols imply similar variables as in equation(4), except that the subscript o denotes cooperative contract. Since the cooperative borrow money from banks to give service for members without any top up payment, farmers pay an interest rate equals to bank's interest rate.

The first order condition of (6) gives us the inverse derived demand function of the cooperative organization

$$p_o = \alpha_o P - M_{R_o}(R_o, \alpha_o) \tag{7}$$

where M_{R_o} is the marginal cost of the cooperative for processing and marketing a unit of grain. Unlike the contract case, all participants receive the same, exogenous and competitive price determined based on world price, the average conversion factor and the marginal cost of marketing. A properly organized cooperative formation avoids imperfections and makes price exogenous. But this uniform price is inflexible to quality and quantity due to the hidden action problem discussed in the previous sections.

Smallholders' marketing decision

Contract decision is made prior to production decision due to pre-harvest agreement to borrow money for input purchase. A rational farmer decides where and how much to sale considering all the constraints and incentives from each contractual arrangements. Suppose farm level production is represented as:

$$q = q(k, A, L), \qquad q'(k) = q_k > 0\ ,\ q''(k) = q_{kk} < 0 \tag{8}$$

where $q(.)$ is twice differential farm level production function, expressed as a function of capital, k, and other inputs like labor, L. To make the analysis simple, let the farm level marketing cost, m, linearly related to the size of grain supplied in each market

$$m = \sum \eta_i s_i \tag{9}$$

where $m(.)$ is farm level marketing costs including transportation, searching potential buyers, and malpractices. η_i is unit cost of marketing at market i.

The agent faces certain price in interlinked contracts and stochastic price in spot market that is derived either from the domestic market or from the world market depending on

the size of market supply. These possibilities are built in the model through pre-determined relational contract market price, p_c cooperative contract price, p_o, and stochastic spot price p_s distributed with mean p_s^e and variance σ^2. Given these prices, the agent maximizes expected utility of income (y) to decide how much to supply to each market, q_i. Following (Andersson, 1995, Sadoulet and Janvry, 1995), a risk-averse agent maximize expected utility as

$$Max_{\{s_i\}} E(u(y)) = u(p_s^e s_s + p_c s_c + p_o s_o - \eta_s s_s - \eta_c s_c - \eta_o s_o) - \frac{\psi}{2}\sigma^2 s_s^2 \quad (10)$$

Subject to $s_s = q - s_c - s_o$ (11)

where ψ denotes the absolute risk aversion of the agent, The first-order necessary conditions of maximizing (10) with respect to s_i are

$$s_c : p_c + q_k \lambda p_c^2 + (\eta_s - \eta_c) + \psi\sigma^2 s_s - p_s^e - \eta_c q_k \lambda P_c = 0 \quad (12)$$

$$s_o : p_o + q_k \lambda p_o^2 + (\eta_s - \eta_o) + \psi\sigma^2 s_s - p_s^e - \eta_o q_k \lambda P_o = 0 \quad (13)$$

where q_k is the marginal productivity of borrowed capital. Equations (12) and (13) construct the optimality condition for efficient allocation of farmer's output to the different markets. The equilibriums state that the marginal costs and the marginal benefits of a unit supply to each market have to be the same. The marginal cost consists of the forgone spot market marginal revenue (p_e), and an additional marketing cost incurred for increased produce due to access for capital. The marginal benefit consists of four terms; the marginal revenue of a unit supply of grain to each market, the marginal values of additional capital, the gain from a reduction in marketing cost and the risk premium obtained due to shifting a unit of grain from risky to less risky market. The two equations basically differ in terms of decision prices and per unit marketing/transaction costs. The optimal supply to the i^{th} market is generalized by the following explicit function:

$$s_i^* = f_i(p_i^*, p_h^*, \eta_i, \eta_h, \psi, \sigma^2, k_0, \lambda,) \qquad i \neq h \in (s, c, o) \quad (14)$$

Research Hypothesis

Preposition1: price risk and cash constraint in spot market causes farmers to participate and supply more grains in contract markets. However, due to bargaining problem in grain pricing, the effects of risk aversion and cash constraint in relational contract market is lower than in cooperative contract.

The proof of this preposition follows comparative statistics for a change in risk aversion and cash constraint in each market:

Risk aversion behavior

$$\frac{\partial s_c}{\partial \varphi} = \frac{\partial s_c}{\partial \varphi}\bigg|_{p_c=cons} + \frac{\partial s_c}{\partial p_c}.\frac{\partial p_c}{\partial \varphi} = \frac{-\sigma^2 s_s}{D_c} + \frac{s_c}{e(\lambda r+1)}.\frac{\partial e}{\partial \varphi} = (+)+(-)?? \quad [7] \tag{15}$$

where $D_i = (q_{kk} - \eta_i)\lambda^2 p_i^3 + \psi\sigma^2(q_k \lambda p_i - 1) < 0$, Since price in relational contract depends on the individual's risk behavior, risk aversion would have supply effect and price (bargaining) effect. So long as production function is concave (8), the supply effect is always positive because the more risk-averse seller supply more grains to contract market where risk is lower. The bargaining effect is a product of the buyer's responsiveness to the sellers' price response, which is positive and the sellers' responsiveness to risk, which is negative. In general, the bargaining effect is always negative implying more risk-averse farmer receives less favorable price and tends not to participate in relational contract, if participate, supply very low grain. As a result, the effect of risk behavior on relational contract choice and extent of commercialization depends up on the magnitude of the bargaining effect.

$$\frac{\partial s_o}{\partial \varphi} = \frac{\partial s_o}{\partial \varphi}\bigg|_{p_c=cons} + \frac{\partial s_o}{\partial p_o}.\frac{\partial p_o}{\partial \varphi} = \frac{-\sigma^2 s_s}{D_o} \geq 0 \tag{16}$$

In cooperative contract the individuals risk behavior has no effect on pricing. Thus, only supply effect will guide the seller's decision. Provided that the farmers' production function is concave, a more risk-averse farmer prefers to supply his grain to cooperative market to hedge price risks.

[7] $e = \dfrac{-(1+q_k\lambda(2p_c - \eta_c))}{D_c}$

Liquidity constraint

When credit market is imperfect, production depends on the level of owned liquid capital. The more endowed farmer needs less external capital, while those who are liquidity constrained farmers need to borrow higher proportion of advance payment, i.e, $\frac{\partial \lambda}{\partial k_0} < 0$

$$\frac{\partial s_c}{\partial k_0} = \frac{\partial s_c}{\partial \lambda} . \frac{\partial \lambda}{\partial k_0} \bigg| p_c = cons + \frac{\partial s_c}{\partial p_c} \frac{\partial p_c}{\partial \lambda} . \frac{\partial \lambda}{\partial k_0} = \frac{-q_k p_c (p_c - \eta_c)}{D_c} \frac{\partial \lambda}{\partial k_0} + \frac{s_c}{e(\lambda r + 1)} \frac{\partial e}{\partial \lambda} \frac{\partial \lambda}{\partial k_0} = ?? \quad (17)$$

Since $\frac{\partial e}{\partial \lambda} < 0$ the last term in (17) is unambiguously positive that demonstrates the positive effect of cash availability on producer's price. Those farmers who are liquidity constrained receive unfavorable price and the positive effect of cash constraint on choosing relational contract will be undermined by the negative effect of the unfavorable price. Cash availability may increase commercialization in relational contract if the bargaining effect is higher than the production effect.

$$\frac{\partial s_o}{\partial k_0} = \frac{\partial s_o}{\partial \lambda} . \frac{\partial \lambda}{\partial k_0} = \frac{-q_k p_o (p_o - \eta_o)}{D_0} \frac{\partial \lambda}{\partial k_0} \leq 0 \quad (18)$$

A reduction in k_0 increases s_o implying cash constraint unambiguously encourages farmers to join cooperative contract where their capital demand does not derive the price received down. The effect of cash constraint effect on the size of grain to be supplied to market, however, will disappear once they join cooperative where cash will easily be accessible.

Preposition 2: Those farmers who produce quality or more quantity grain prefer to engage in relational contract than cooperative contract as a result of uniform price that does not create discretionary incentive to enforce higher efforts.

The proof this statement depends on the assumption that quality of grain is related to labor endowment where more labor endowed farmers tend to produce high quality grain[8]. Here we show how labor endowment affects market choice.

$$\frac{\partial s_i}{\partial L} = \frac{\partial s_i}{\partial q}.\frac{\partial q}{\partial L} + \frac{\partial s_i}{\partial p_i}.\frac{\partial p_i}{\partial \alpha}\frac{\partial \alpha}{\partial L} = q_L + e(p - \frac{\partial M_{R_c}}{\partial \alpha_c}) > 0 \qquad (19)$$

Since $\frac{\partial M_R}{\partial \alpha} < 0$, both the production (q_L) and price $e(p - \frac{\partial M_R}{\partial \alpha})$ effects are positive. The production effect implied that more endowed farmers produce more grain and supply more grain to any of the markets. The price effect is observable if price is contingent up on quality or quantity of grain. This is typically true in contract sometimes in spot markets due to discretionary pricing. More labor endowed farmers receive better price and supply more grains. Both the production and price effects are positive and hence the total effect is unambiguously positive.

The second term in (19) is zero in cooperative market as a result of non-discretionary pricing, that is $\frac{\partial p_o}{\partial \alpha_{oj}} = 0$. Thus $\frac{\partial s_c}{\partial L} > \frac{\partial s_o}{\partial L}$

[8] The assumption is not unrealistic if one looks at it from the study area context. In the study area we found that quality of bean grain is related to frequency of weeding and timely harvesting. Late harvesting causes the seed to shatter while early harvesting causes seeds to shrink and loose their natural color. In an environment labor market is thin, frequency of weeding and timely harvesting depends on household's labor endowment.

4. Estimation methods

4.1. Multinomial Response models

The decision how to sell involves more than two choices. Smallholders have at least three options that include spot, relational and cooperative contracts. If there are m markets, then contract choice is modeled as

$$Y_i = x_i'\beta + u_i, \tag{20}$$

where Y takes a value of $1, 2, ...m$, x a vector of explanatory variables that include both continuous and dummy variables, β vector of parameters to be estimated and u is a random error assumed to have zero mean and constant variance. Since the dependent variable is categorical and the categories are more than two, estimating (20) with OLS or simple binary models gives inconsistent estimates (Maddala, 1983). As a result, we used multinomial logit. The model assumes a logistic probability distribution for the error term and hence the market choice model (20) is rewritten as

$$P(Y_i = j) = \frac{\exp(x_i'\beta_j)}{1 + \sum_{k=1}^{m-1} \exp(x_i'\beta_k)} \qquad (j = 1, 2, ...m-1) \tag{21}$$

where P is i^{th} individual probability of choosing j^{th} market. The standard multinomial-logit is a family of polycotomus logit models particularly applicable when attributes (explanatory variables) are individual specific rather than choice specific[9], the multiple choices are made simultaneously, the odds ratio are independent of the irrelevant alternative (IIA) (Greene, 2003, Maddala, 1983). The IIA assumption is statistical and hence testable. (Hausman and McFadden, 1984) test is used to test the `IIA` assumption in multinomial logit. The test is based on the idea that if the model is true, β_j can be consistently estimated by multinomial logit by focusing on any subset of the alternatives.

The simultaneity assumption of multinomial models emanates from the behavior of the agent's decision making. If respondents make choice consecutively, multinomial models would provide less incisive result. For example, if farmers choose markets sequentially in such a way that first they choose between spot and contract market and

[9] If the attributes are choice specific, conditional logit is an appropriate procedure to estimate multiple choice problems

then between formal and informal contracts, then *sequential-logit* gives more incisive and robust estimation (Maddala, 1983). Sequential logit is a repeated binary logit when responses are made stepwise. To show how it works, suppose $Y_i = 1$ If the i^{th} individual choose to sell his grain in contracts , $Y_i = 2$ if the i^{th} individual choose to sell his grain to formal contract, then the probability of choice is such that

$$P_1 = F(x'\beta_1)$$
$$P_2 = F(x'\beta_2) \qquad (22)$$

The parameters β_1 are estimated from the entire sample by dividing it into two: spot market and arranged market participants. The parameters β_2 are estimated from the sub-sample of farmers who sold their grain in contract markets by dividing them into informal and formal contracts participants. The good thing with sequential logit model is that it enables us to identify different determinants of choice at different stages and it also eliminates the problem of `IIA` if the choice at each stage remains dichotomous. However, its validity depends on the independence of the random factors influencing responses at various stages.

4.2. Switching models

Once contract choice is made, the next issue is how commercialization could be estimated. Commercialization may be measured either in terms of proportion of output supplied to the market or proportion of area allocated to crops grown for market. To measure the structural as well as the mean impacts of institutional choice on commercialization we used switching regression models. We assume market innovations bring structural change on the supply response of farmers. Since contracts are meant to minimize market imperfections and access resources, the overall structural relationship between resource endowments and market supply may generally break and leads to separability of household's decisions. The structural effect alters both the slope and the mean of market supply response. The effect was captured using switching regression in which three separate regressions are made for each market. That is,

$$y_i = \beta_j' x_{ji} + u_{ji} \quad iff \quad \tau_j' Z_{ji} \geq u_i \qquad (23)$$

Where j stands for spot, contract and cooperative markets or regimes, y_i is marketed surplus, x_i is a vector of exogenous regressors that include both continuous and discrete variables $\tau_j' Z_{ji} \geq u_i$ is a criteria function that determine which of the three regimes is applicable. If u_{ji} and u_i are uncorrelated, the switching to each regime is exogenous and hence the β parameters in equation (23) can be consistently estimated using OLS on the sub-samples of each markets.

Very often, farmers' select a market that best suits to their characteristics, which are not always observable so that u_{ji} and u_i are likely to be correlated. To check this, two-stage endogenous switching regression is employed. The estimation procedure for endogenous switching model with only two regimes is well documented (Maddala, 1983). Following similar reasoning, we present an estimation method for three regimes /markets. Unlike for two regime case, we shall define a dummy variable for each regime as

$I_{ij} = 1$ *if* $\tau_j' Z_{ji} \geq u_i$

$I_{ij} = 0$ *otherwise*

Since the sample separation is observable, we generate three dummies one for each market and estimate the parameters τ_j using probit model. Then we estimate three inverse mills ratios as $w_{ji} = \frac{\phi(\tau_j' Z_{ji})}{\Phi(\tau_j' Z_{ji})}$ and rewrite equation (23) as

$$y_i = \beta_j' x_{ji} + \alpha_j w_{ji} + e_{ji} \qquad (24)$$

Similar to the Heckman's selection bias test, the significance of α_j implies and controls the endogenity of switching. e_{ji} is tested for possible heteroscedasticity and equation **(24)** is estimated separately for each market using sub-samples.

5. The data

The data was collected from the central rift valley areas of Ethiopia where lowland pulses are widely grown for export. The study focuses on haricot bean for the simple reason that its marketing system constitutes different interlinked contractual arrangements. Haricot

bean is considered as a cash crop and hence it is mainly produced for market as an export commodity. It is a lucrative enterprise in the lowland areas where it can easily grow with very short rainy season at lower costs than other crops. As a result it covers more than 23 % of the total cultivated area in the central and southern parts of the rift valley. At national level, it generates substantial amount of foreign earnings. Together with other pulse crops, it shares about 6% of the total value of the country's foreign export earnings, which is higher than the export values of flower. Since 2004, pulse export value shows an annual growth of more than 90% percent (NBE, 2007). The spot market is characterized by high transaction cost and extreme price volatility. The annual and monthly price variability[10] reaches as large as 44% and 85% respectively.

Of the vast central rift valleys, we chose *Digdabora (Meki) woreda* from Oromia region and *Borcha woreda* from Southern Nations, Nationalities and Peoples (SNNP) region to collect farm level data. *Meki* and *Borhca* are located about 110 and 300 km south of Addis Ababa respectively. *Meki* has relatively good access for markets. It lies on the high way that runs from Addis Ababa to *Moyale*. It has also very plain topography and fertile soils that best suit for cultivation. Some few farmers have access to irrigation. However, the *woreda* is typical dryland and has very short rainy season. The major crops grown here include maize, *tef* and haricot bean on rain fed lands and tomato and onion on irrigated lands. *Borcha* is one of the dryland and food insecure areas of SNNP. Its topography is highly undulated. Access to markets is relatively poor. The major crops grown are maize, haricot bean and potato. Coffee also grows in some villages for generating cash income.

The data was collected in 2006 from 200 farm households. It covers production and marketing information for 2005 and 2006 production seasons. Samples were selected from ten villages, five from each woreda. They were interviewed using structured questionnaire (Annex 2) that includes basic household and farm level characteristics, production and marketing of haricot bean, and household's involvement in contract and cooperative marketing. Since we have got two seasons information, the data was pooled over years that makes the sample size as large as 400.

[10] Annual variability indicates the maximum of the annual mean price growth while seasonal variability indicates the maximum of the difference between a year maximum and minimum prices from Addis Ababa market.

Table 1 shows the definition and summary statistics of major variables used for analyzing contractual choice and commercialization. 85% of the total sample farmers grow haricot bean in 2005 and 2006. About 15% of them do not supply to the market. A farm household could supply as large as 2.8 ton per season that amounts about 7560 ETB (1 ETB=0.11USD). Out of the total farmers who supply haricot bean to market, 54% sold to spot market, 14% to relational contract market and the rest 32% to cooperative contract market. Cooperative contracting is sharply increasing over time while relational contracting is declining.

6. Results and Discussion

Contract choice

The estimates of multinomial models are reported in Table 2. Multinomial logit assumes market choices are made simultaneously implying that farmers must choose one market out of spot, relational contract and cooperative contract markets at a time. Sequential logit assumes decisions are made consecutively in such away that farmers first decide to participate in contract market and then they choose among the contracts. Estimates under the fourth column of Table 2 shows the first stage decision of choosing between spot market and contract market and estimates under the fifth column shows the second stage decision of choosing among contracts, where the reference choice is informal contract.

An overview of Table 2 shows that education, leadership role, distance to spot market, total cultivated land, livestock size and cash endowment are statistically significant factors for market choice. Surprisingly, distance to market is related negatively to the choice of interlinked contracts. Farmers near to the market prefer to sale their grain through contracts. This must be, however, explained contextually. The distance to market may imply both transaction cost and information access. Those near to the market have lower transaction cost that may not encourage them to search for any institutional involvement to reduce cost. But they have also better access to information about new market innovations and hence they are likely to adopt such innovation prior to

those who do not have access to the information. Some institutional innovations are exogenous in the sense that they are initiated by governmental and nongovernmental organization so that they may be well organized around centers than distant places. As a result those who are near to the market are very likely to involve to contract markets.

The major interest in this paper relies on the effects of livestock size, cash and adult labor endowment on contract participation and choice. This is because livestock size and cash availability serve as proxy for bargaining power effect and labor for discretionary pricing effect. The explanation for such representation at least for labor and cash must be clear from previous sections. With regard to livestock, it represents risk behavior through representing household wealth. In areas where land belongs to the public and other capitals are less developed, livestock unit remains the only indicator of household wealth status. This claim is in line with the local people's wealth ranking. Wealth in turn measures the household's risk behavior. Many empirical studies (Binswanger, 1981, Hagos and Holden, 2003, Wik and Holden, 1998) have reported an indirect relationship between risk aversion and household's wealth.

All the models consistently showed that livestock size has very significant effect on the probability of choosing cooperative contract than other markets. As we see from the sequential model, livestock ownership in fact is a strong determinant of engaging in any of the arranged markets. This implies that risk-averse farmers would like to minimize risk through marketing arrangements prior to planting. A further examination of how risk matters in choosing between contracts and cooperatives clearly shows that those who are risk-averse tend to prefer cooperatives than contracts because the bargaining power of a risk-averse seller will be compromised in contract markets. We also observed that farmers with lower cash availability prefer cooperative than contract marketing. All these together indicates that the bargaining effect that undermines the net price received by risk averse and cash constrained farmers forces farmers to refrain from involving on contract though it augments capital and hedges risks. This is consistent with our theoretical predication that unless buyer and seller are on the same foot, contract *per se* may not attract smallholders.

Though labor endowment is not statically significant on contractual choice, it seems those who have higher male[11] adult labor prefer relational than cooperative contract. The last column of table 2 shows that male labor endowment has negative effect on cooperative contract choice implying those who produce quality grain tend to sale in relational contract where they receive quality premium unlike the cooperative contract where there is no discretionary pricing.

Determinants of commercialization

In this section we discuss how bargaining power in informal contract market and non-discretionary pricing in formal contract market is affecting commercialization via cash availability and labor use respectively. The results of exogenous and endogenous switching models estimations for marketed surplus, share of marketed surplus and area share[12] are presented in Tables 3, 4 and 5 respectively. As indicated in the tables, weak endogenity of switching is detected in most of the equations. We controlled the endogenity of switching using distance to market place and livestock size as instruments. We assume that these variables are important for market choice but not for commercialization. This is because once the seller makes a choice to engage in contract markets supply to the market will no more be dependent on information access or risk-aversion.

The underlining premise is that interlinked contracts minimize factor and product markets imperfections and increase commercialization. But the empirical result revealed that cash constraint remains an important determinant of commercialization in spot and informal contract markets. The very essence of interlinked contract to access credit for smallholders did not realized. In a situation where credit is accessible, farmers' decision should have been separated from the farmers' cash endowment (Holden, 1998). Unfortunately this could not happen in informal contract market. Unlike those farmers

[11] In the study area males are responsible for all farm operations including weeding, plowing, harvesting and threshing with small assistance from adult females. Thus, male adult labor is a better indictor of farm labor endowment.

[12] Since the dependent variable for share equations has a value in between zero and one, we used GLM estimation.

who participated in relational contract, farmers who participate in cooperative contract market do not base their commercialization decision on their own cash endowment. The extent of commercialization in this contract is independent of households' liquidity constraint. This indicates that properly organized cooperative contract in fact can help to eliminate credit imperfections. The result generally reconfirms the theoretical prediction that bargaining power in informal contract market undermines the impacts of interlinked contract in eliminating capital constraint and integrating smallholders to markets.

The negative effect of cash on area share both in either type of contract markets may be associated with factors other than bargaining power (table 5). As the farm household owns enough cash capital, non-farm activities (mainly trade) may generate better cash than haricot bean production and divert more land to food crops for own consumption. In the study areas it is not uncommon to observe farmers who engaged on trading of coffee and vegetables.

Households' male labor endowment significantly explains farm households' variation in commercialization (marketed surplus and area share) in spot and contract markets but not in cooperative markets. As indicated by the high elasticity values the effect is higher in contract than sport market. A percentage increase in male adult labor increases commercialization as high as 70%. We also observe that male adult labor has consistently insignificant effect on all dependent variables in cooperative contract (Tables 3, 4, 5). An important implication of this observation is that the production effect of labor endowment[13] is superseded by its price effect. As explained in equation (19), the price effect which is only observable in relational contract is found to be significant in commercializing smallholders. The price effect is an effect that encourages growers to enforce higher effort through providing discretionary price contingent upon observable quality and quantity indicators. In our field study, we observed relational contract buyers provide as high as 15% higher price than the market price contingent up on the size and quality of grain. As a result farmers who involve in relational contract are expected to use more labor than who involve in cooperative marketing. The mean comparison of mean labor use under each marketing arrangements shows that farmers under relational

[13] We assume that labor market is imperfect in the area and hence the use of labor in production is directly proportional to the size of family labor.

contract use 14% higher labor than those farmers who involve in cooperative contract (table 1). Thus, despite the problem of bargaining power that rationed out small growers from the market, relational contracting renders opportunity for relatively better of farmers to integrate in to markets and generate better cash income.

The explanation for the insignificance of labor endowment on commercialization in cooperative contract possibly lies on double delegation problem where the market fails to enforce discriminatory price. Cooperative marketing is carried out by collectively delegated personnel who are responsible to grade and determine subjective prices. However, thesis assignment allows incentive for the person to be corrupted and colluded with sellers. It is not uncommon to see many failed cooperatives in Africa due to incentive problem (Akwabi-Ameyaw, 1997, Janvry, et al., 1993). In order to prevent this incentive problem, cooperatives adopts non-discretionary price that all sellers have to be paid irrespective of the quality and quantity of grain supply. This has encouraged growers to supply lower quality grain. It also undermines the incentive of boosting cash crop (haricot bean) production and productivity.

Beans quality is an important issue when it comes to grain export market. Lower quality beans overrates the costs of marketers and reduces the net price received from the world market. The size, color and purity of seeds are important attributes to fetch better price and better demand. However, Ethiopian pulse exporters repeatedly complain on lower quality of smallholder's supply that would undermine the long term competitiveness in international market. The institutional innovations such as contracting and cooperatives were initiated partly to improve the quality of grain through optimum use of weeding and harvesting time. But it seems that such promises are not met as a result of organizing cooperatives.

Impacts of interlinked contracts on commercialization

The summary statistics in table 1 shows that while mean marketed surplus is higher in relational contracts; the area of bean is higher in cooperative contract. Since resource endowed farmers likely to involve in relational contract, supplying more grain to the market is not surprising. The share of marketed surplus out of the total bean production

is still larger in relational contract indicating the positive impact of relational interlinked contract on commercialization. Farmers who involve in cooperative contract tend to optimize the gain from bean production through expanding the area coverage rather than increasing yield or quality. As we can see from table 1, the average yield of growers under cooperative is lower than other growers. Since farmers receive uniform price, they have less incentive to allocate land intensifying resources to the production of bean. As a result, it seems they opt for area extensification. Unfortunately, the area expansion does not sufficiently translate in to increased market supply.

However, understanding the actual impacts of interlinked contracts on commercialization requires controlling the resource endowment of growers. The literature on impact analysis is very wide and many procedures are evolving over time. Here we apply a parametric evaluation method in which the mean grain supply (marketed surplus and area share of the grain) values are predicted to all sample households using the parameter estimates of the switching regressions. Then, the predicted means are compared to see how an individual farmers' market supply is different in different markets. The results are reported in table 6.

The result showed that relational contract outperforms spot marketing. It causes statistically significant difference both in terms of marketed surplus and area allocation to haricot bean. Farmers who are in relational contract supply grain about 27% higher than their counterparts in spot markets. Comparison between cooperative contract and the spot market showed that it in fact helps smallholders to supply grains to the market more than spot marketing where farmers are subjected to risky price. But when the marketed surplus is compared to the total production, it did not help at all. The result is consistent with previous study (Bernard, et al., 2007) that uses non-parametric method to evaluate the impact of cooperative on commercialization. Comparison among interlinked contracts also shows that relational contract impacts commercialization better than cooperative contract. Farmers in relational contracts supply 23% higher than those in cooperative contract. The explanation could be related to the presence and absence of discretionary incentive to enforce higher effort for the production of haricot bean. As we discussed before, on one hand, cooperative contract adopt uniform price while relational contract uses discretionary price. On the other hand, price is made through negotiation in

cooperative contract unlike in relational contract where the buyer has a prime power. Given this context, the message is that discretionary effect overwhelmed the bargaining power effect. The finding supports the incomplete contract hypothesis that suggests if once some aspects of performance are unverifiable; it is optimal to leave other verifiable aspects of performance unspecified (Bernheim and Whinston, 1998). If the quality and quantity of grain are not enforceable, it seems rational to leave the price to be optional.

7. Summary and Implications

In this study we theorized that the role of interlinked contracts in accessing credit and hedging risk thereby enhancing commercialization is undermined by the presence of skewed bargaining power in relational contract market and uniform pricing system in cooperative contract. To test this, we investigated the effects of resource endowment, risk aversion and other explanatory variables on smallholders' market choice and extent of commercialization. We applied multinomial logit and sequential logit models to capture the multiple and sequential choices. Controlling the possible switching bias, the extent of commercialization in each market (spot, contract and cooperative) is regressed against village, farm, and household level explanatory variables.

The result confirmed that smallholders' market outlet choice appears to depend significantly on risk and information access but not on marketing costs. Those who are risk averse and have better access to information are likely to choose cooperative contract. Unequal bargaining power in grain selling and buying makes contract less attractive to hedge risk.

Cash constraint remains an important determinant of commercialization even after contracting in relational contract but not in cooperatives. Unlike cooperative contract, variation in commercialization is also explained by labor endowment in relational contract. These two findings imply that the extent of commercialization measured by the marketed surplus and area allocated to marketable grain is indeed significantly influenced by bargaining power and non-discretionary pricing in grain markets.

To evaluate the relative impacts of interlinked contracts on commercialization after controlling resource endowment, we compared the predicted mean values of marketed surplus and area share for participant and non-participant in each market. The result revealed that given the current circumstances, relational contract impacts commercialization better than cooperative implying the discretionary effect is stronger than the bargaining power.

In general, there exists strong evidence that bargaining power in relational contract and uniform pricing in cooperative are challenging farmers' integration to markets. This implies that there is a need to reorganize these institutions. The ever existed attitude of

considering relational contract as exploitation mechanism and discouraging its existence shall be reconsidered. Linking agro processors and small scale growers through informal contract do much better than organizing incentive incompatible formal cooperative. Organizing cooperative by itself has little to do on realizing the long-waited goal of commercialization and economic transformation. It requires designing an incentive structure that enforces higher effort and discriminates free riders. From long term perspective when sustaining competence in seed quality and heterogeneity in world bean market is essential, the pricing system of the current cooperatives needs to be revisited.

References

Akwabi-Ameyaw, K. "Producer Cooperative Resettlement Projects in Zimbabwe: Lessons from a Failed Agricultural Development Strategy. ." *World Development* 25(1997): 437-456.

Andersson, H. "Primary and Secondary Producers: Economic Implications of Contracts in the Food Marketing Chains " *European Review of Agricultural Economics* 22(1995): 310-320.

Bernard, T., E. Gabre-Madhin, and A. S. Taffesse. "Smallholders' Commercialization through Cooperatives: A Diagnostic for Ethiopia." IFPRI.

Bernheim, D. B., and M. D. Whinston. "Incomplete Contracts and Strategic Ambiguity." *The American Economic Review* 88, no. 4(1998): 902-932.

Binswanger, H. "Attitudes Towards Risk. Theoretical Implications of an Eperiment in Rural India " *Economic Journal* 91(1981): 867-890.

Bolton, P., and M. Dewatripont. *Contract Theory* London: Massachusetts Institute of Technology 2005.

FDRE (2005) Plan for Accelerated and Sustained Development to End Poverty. Addis Ababa., Federal Democratic Republic of Ethiopia

Greene, W. H. *Econometric Analysis* 5ed. New Jersey: Prentice Hall 2003.

Hagos, F., and S. T. Holden. "Farm Input Use Intensity of Smallholders in Northern Ethiopia: Do Risk Preference Matter? ." Department of Economics and Social Science

Hausman, J. A., and D. L. McFadden. "A Specification Test for the Multinomial Logist Model." *Econometrica* 52(1984): 1219-1240.

Holloway, G., C. Nicholson, and C. Delgado. "Agro-Industrialization through Institutional Innovation: Transactions Costs, Cooperatives and Milk-Market Development in the Ethiopian Highlands ". International Food Policy Research Institute.

Janvry, A. d., E. Sadoule, and E. Thorbecke. "Introduction to a Special Section, State, Market, and Civil Organizations: New Theories, New Practices, and Their Implications for Rural Development." *World Development* 21, no. 565-75(1993).

Key, N., and D. Runsten. "Contract Farming, Smallholders, and Rural Development in Latin America: The Organization of Agroprocessing Firms and the Scale of Outgrower Production." *World Development* 27, no. 2(1999): 381-401.

Laffont, J.-J., and D. Martimort. *The Theory of Incentives : The Principal-Agent Model* Princeton University Press, 2002.

Maddala, G. S. *Limited-Dependent and Qualitative Variables in Econometrics* Cambridge University Press, 1983.

Masakure, O., and S. Henson. "Why Do Small-Scale Producers Choose to Produce under Contract? Lessons from Nontradational Vegetable Exports from Zimbabwe " *World Development* 33, no. 10(2005): 1721-1733.

Pingali, P. L. "From Subsistence to Commercial Production Systems: The Transformation of

Asian Agriculture." *American Journal of Agricultural Economics* 79, no. 2(1997): 628-634.

Sadoulet, E., and A. d. Janvry. *Quantitative Developemnt Policy Analysis* The johns hopkins University Press 1995.

Sartoriusa, K., and J. Kirsten. "The Boundaries of the Firm: Why Do Sugar Producers Outsource Sugarcane Production?" *Management Accounting Research* 16 (2005): 81–99.

Simmons, P., P. winters, and I. Patrick. "An Analysis of Contract Farming in East Java, Bali, and Lombok, Indonesia." *Agricultural Economics* 33(2005): 513-525.

Timmer, C. P. "Farmers and Markets: The Political Economy of New Paradigms." *American Journal of Agricultural Economics* 79, no. 2(1997): 621-627.

WDR. "World Development Report 2008: Agriculture for Development."

Wik, M., and S. T. Holden. "Experimental Studies of Peasant's Attitude toward Risk in Northern Zambia ". Department of Economics and Social Sciences

Table.1. Summary statistics

Variable* Name	Variables' description	Spot market	Relational Contract	Cooperative contract	Total
N	Observations	168	42	100	310
WOREDA	0= Borcha	29	7	15	51
	1= Meki	25	7	17	49
YER	0=2005	35	9	2	46
	1=2006	19	5	30	54
AGE	Age	40.16	40.69	41.21	40.57
EDU	Years of schooling	3.68	4.50	4.05	3.91
LDR	Community leadership role 1= if the household head has any role	47	50	58	56
PKA	The number of donkey, mule, camel and horse the household owned and used for transportation of grains	1.00	1.40	1.08	1.08
DMK	The household's home distance from the central market where grain is sold and Woreda administration is located (km)	5.41	5.23	4.23	5.01
DRD	The household's home distance from the nearest driving road	1.35	1.77	1.97	1.60
FAL	Female adult labor; the number of household members whose age is above 15 and below 65	1.90	2.14	1.84	1.91
MAL	Male adult labor; The number of household members whose age is above 15 and below 65	2.02	2.31	2.09	2.08
AEC	Adult equivalent consumers converted based adult consumer food requirement	1.72	1.74	1.78	1.74
OXN	The number of oxen the household owned and used for cultivation	2.78	3.00	2.90	2.85
LU	Animals owned by the household aggregated based on their values an indicator of household's wealth and risk aversion	11.22	11.48	11.18	11.24
TLS	Total owned land size	2.48	3.01	2.74	2.63
TCA	Total cultivated land in hectare includes both owned and rented-in lands	2.91	3.53	3.71	3.25
CSH	The amount of cash the household owned obtained from non-farm income and perennial cash crops and saving in 000'	3.14	3.95	3.06	3.23
Bean area in hectare		0.64	0.77	0.89	0.74
Bean area share		0.27	0.25	0.28	0.27
Mean bean production(100kg)		5.22	8.54	7.31	6.34
Marketed surplus in 100kg		4.66	7.88	5.72	5.42
Share of marketed surplus		0.87	0.88	0.83	0.86
Yield per hectare (100kg/ha)		9.15	11.62	8.07	9.14
Labor per hectare		51.06	51.33	45.08	49.04

*mean for continuous variables and percentage for categorical variables

Table.2. Determinants of smallholders' Contractual choice (coefficients (standard errors))

Explanatory Variables	Multinomial Logit			Sequential Logit	
	Relational Vs Spot	**Cooperative Vs spot**	***Cooperative Vs Relational***	***Contracts Vs Spot***	**Cooperative Vs Relational**
woreda	0.620	0.957	0.337	0.829	-0.189
	(0.78)	(0.62)	(0.76)	(0.53)	(0.79)
yeardumy	0.125	3.780***	3.655***	2.017***	4.258***
	(0.38)	(0.56)	(0.59)	(0.29)	(0.72)
AGE	0.010	0.008	-0.002	0.008	-0.059*
	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)
EDU	0.165**	0.077	-0.088	0.116*	-0.184
	(0.08)	(0.08)	(0.09)	(0.06)	(0.13)
LDR	-0.653*	-0.007	0.646	-0.297	0.846
	(0.37)	(0.37)	(0.43)	(0.30)	(0.54)
PKA	0.338*	0.007	-0.331	0.137	-0.269
	(0.19)	(0.17)	(0.22)	(0.14)	(0.26)
DMK	-0.117	-0.254***	-0.137**	-0.193***	-0.118*
	(0.07)	(0.06)	(0.06)	(0.06)	(0.07)
DRD	0.196	0.213	0.017	0.213	0.020
	(0.13)	(0.13)	(0.05)	(0.13)	(0.04)
FAL	0.122	0.031	-0.091	0.065	0.026
	(0.14)	(0.16)	(0.16)	(0.13)	(0.23)
MAL	0.187	0.135	-0.051	0.162	-0.113
	(0.20)	(0.19)	(0.24)	(0.15)	(0.31)
AEC	-0.028	-0.088	-0.060	-0.056	-0.064
	(0.12)	(0.13)	(0.15)	(0.11)	(0.19)
TCA	0.092	0.384***	0.291**	0.249***	0.427***
	(0.12)	(0.12)	(0.14)	(0.09)	(0.15)
OXN	0.003	0.144	0.142	0.079	0.264
	(0.15)	(0.14)	(0.16)	(0.12)	(0.18)
LU	-0.074	-0.102***	-0.028	-0.087***	-0.094
	(0.06)	(0.04)	(0.06)	(0.03)	(0.06)
CSH	0.023	-0.005	-0.028	0.006	-0.030*
	(0.02)	(0.01)	(0.02)	(0.01)	(0.02)
_cons	-2.567***	-3.719***	-1.152	-2.038***	1.079
	(0.96)	(1.06)	(1.27)	(0.75)	(1.92)

Table.3. Determinants of marketed surplus (coefficients (standard errors))

Explanatory variables	**Exogenous switching**			**Endogenous switching**		
	Spot	Relational Contract	Coop Contract	Spot	Relational Contract	Coop Contract
yeardumy	-0.093	0.125	-0.325**	0.092	-0.042	-1.660**
	(0.09)	(0.22)	(0.16)	(0.27)	(0.35)	(0.71)
woreda	-0.405***	-0.052	-0.91***	-0.45***	-0.205	-0.73***
	(0.12)	(0.21)	(0.17)	(0.14)	(0.28)	(0.20)
lnAGE	0.197	-0.781*	-0.126	0.185	-0.865**	-0.233
	(0.20)	(0.41)	(0.36)	(0.20)	(0.42)	(0.41)
lnEDU	0.136**	0.254**	-0.028	0.170**	0.300***	-0.098
	(0.06)	(0.10)	(0.13)	(0.07)	(0.11)	(0.14)
lnOXN	-0.251**	-0.104	0.079	-0.281**	-0.247	0.148
	(0.10)	(0.29)	(0.15)	(0.11)	(0.36)	(0.16)
lnPKA	0.277**	-0.185	-0.117	0.282**	-0.099	0.051
	(0.12)	(0.22)	(0.16)	(0.12)	(0.29)	(0.17)
lnDRD	-0.010	-0.051	-0.013	0.002	-0.021	-0.080
	(0.03)	(0.06)	(0.05)	(0.03)	(0.07)	(0.06)
lnMAL	0.212*	0.778***	0.174	0.242**	0.849***	0.116
	(0.11)	(0.20)	(0.14)	(0.12)	(0.23)	(0.14)
lnFAL	-0.172*	0.278	0.174	-0.193*	0.350	0.339*
	(0.10)	(0.19)	(0.17)	(0.10)	(0.22)	(0.17)
lnAEC	-0.109	-1.21***	-0.528	-0.087	-1.25***	-0.627*
	(0.17)	(0.37)	(0.33)	(0.17)	(0.39)	(0.35)
lnCSH	0.154***	0.138*	-0.159*	0.139***	0.123*	-0.061
	(0.05)	(0.07)	(0.09)	(0.05)	(0.07)	(0.11)
lnTCA	0.691***	0.679**	1.256***	0.770***	0.877**	0.904***
	(0.11)	(0.28)	(0.18)	(0.17)	(0.32)	(0.25)
imr0				-0.957		
				(1.26)		
imr1					2.668	
					(2.93)	
imr2						-4.452*
						(2.25)
_cons	0.322	5.272***	2.104	0.629	3.703*	6.242**
	(0.69)	(1.64)	(1.32)	(0.82)	(2.03)	(2.71)
r2	*.53*	*.75*	*.55*	*.53*	*.76*	*.57*
bic	*311.5395*	*80.70454*	*217.3686*	*316.1194*	*83.3293*	*217.3466*
N	*164*	*40*	*92*	*164*	*40*	*92*

Table.4. Determinants of share of marketed surplus- GLM estimation (coefficients (standard errors))

Explanatory variables	**Exogenous switching**			**Endogenous switching**		
	Spot	Relat. Contract	Coop Contract	Spot	Relat. Contract	Coop Contract
yeardumy	0.026	0.072	-0.038	0.103	-0.024	0.212
	(0.03)	(0.06)	(0.09)	(0.08)	(0.07)	(0.16)
woreda	0.079**	-0.003	-0.051	0.061	-0.092	-0.083
	(0.04)	(0.05)	(0.06)	(0.04)	(0.08)	(0.06)
lnAGE	0.068	-0.299**	0.034	0.063	-0.35***	0.054
	(0.07)	(0.12)	(0.12)	(0.07)	(0.12)	(0.12)
lnEDU	0.010	0.079**	-0.003	0.025	0.105***	0.010
	(0.02)	(0.03)	(0.04)	(0.02)	(0.04)	(0.04)
lnOXN	-0.043	-0.017	-0.112**	-0.055	-0.099	-0.124***
	(0.03)	(0.08)	(0.05)	(0.04)	(0.09)	(0.05)
lnPKA	0.030	-0.103	0.029	0.032	-0.054	-0.003
	(0.03)	(0.06)	(0.05)	(0.03)	(0.06)	(0.05)
lnDRD	0.019	-0.039*	0.015	0.024*	-0.022	0.027**
	(0.01)	(0.02)	(0.01)	(0.01)	(0.02)	(0.01)
lnMAL	0.004	0.238**	-0.015	0.017	0.278***	-0.003
	(0.03)	(0.10)	(0.04)	(0.03)	(0.09)	(0.04)
lnFAL	-0.053*	-0.032	0.081	-0.061*	0.009	0.050
	(0.03)	(0.06)	(0.06)	(0.03)	(0.07)	(0.06)
lnAEC	0.031	-0.349*	-0.203*	0.040	-0.371*	-0.185
	(0.06)	(0.19)	(0.12)	(0.06)	(0.19)	(0.12)
lnCSH	0.030*	0.020	-0.024	0.023	0.011	-0.042*
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
lnTCA	-0.020	0.088	0.176***	0.013	0.202*	0.241***
	(0.03)	(0.08)	(0.06)	(0.05)	(0.12)	(0.07)
imr0				-0.400		
				(0.41)		
imr1					1.537*	
					(0.91)	
imr2						0.835*
						(0.44)
_cons	0.573**	2.316***	1.008*	0.701**	1.412*	0.232
	(0.29)	(0.53)	(0.58)	(0.33)	(0.74)	(0.55)
bic	*-49.3478*	*5.836833*	*5.133296*	*-45.0686*	*7.194793*	*8.07487*
N	*164*	*40*	*92*	*164*	*40*	*92*

Table.5. Determinants of area share to beans-GLM estimation (coefficients (standard errors))

Explanatory variables	**Exogenous switching**			**Endogenous switching**		
	Spot	Relational Contract	Coop Contract	Spot	Relational Contract	Coop Contract
yeardumy	-0.009	0.064**	0.026	-0.084	0.079**	-0.186
	(0.02)	(0.03)	(0.04)	(0.06)	(0.04)	(0.12)
woreda	-0.056**	-0.012	-0.14***	-0.038	0.002	-0.11***
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
lnAGE	0.161**	0.000	0.065	0.165**	0.008	0.056
	(0.07)	(0.06)	(0.05)	(0.07)	(0.06)	(0.05)
lnEDU	0.049***	0.055***	0.020	0.036	0.051***	0.008
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.01)
lnOXN	-0.013	0.034	0.023	-0.000	0.046	0.037*
	(0.02)	(0.03)	(0.02)	(0.02)	(0.03)	(0.02)
lnPKA	0.039	-0.055**	-0.023	0.037	-0.063**	0.001
	(0.03)	(0.02)	(0.02)	(0.03)	(0.03)	(0.02)
lnDRD	-0.001	-0.018**	-0.003	-0.005	-0.021**	-0.014
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
lnMAL	0.058**	0.109***	0.037	0.047*	0.102***	0.028
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
lnFAL	0.025	-0.044	0.002	0.034	-0.051	0.029
	(0.02)	(0.03)	(0.02)	(0.02)	(0.03)	(0.03)
lnAEC	-0.09***	-0.138**	-0.076	-0.10***	-0.134**	-0.097*
	(0.03)	(0.06)	(0.05)	(0.03)	(0.06)	(0.05)
lnCSH	-0.008	-0.03***	-0.023**	-0.001	-0.025**	-0.007
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
lnTCA	-0.11***	-0.062*	-0.024	-0.140**	-0.080*	-0.085**
	(0.04)	(0.03)	(0.02)	(0.05)	(0.04)	(0.03)
imr0				0.388		
				(0.31)		
imr1					-0.239	
					(0.36)	
imr2						-0.709**
						(0.35)
_cons	-0.143	0.431*	0.195	-0.264	0.569*	0.835**
	(0.23)	(0.25)	(0.19)	(0.26)	(0.33)	(0.37)

Table 6. Mean Comparison of commercialization under different contracts (predicted means)

Measures of Commercialization	Mean			Mean differences		
	Spot (1)	Relational (2)	Cooperative (3)	(2)-(1)	(3)-(1)	(3)-(2)
Marketed surplus						
Exogenous switching	3.74	5.47	4.01	1.73***	0.27**	-1.46***
Endogenous switching	3.71	5.47	3.94	1.77***	0.23*	-1.54***
Share of marketed surplus						
Exogenous switching	0.87	0.9	0.83	0.03***	-0.04**	-0.07***
Endogenous switching	0.87	0.9	0.83	0.03***	-0.04**	-0.07***
Area share						
Exogenous switching	0.26	0.28	0.28	0.02***	0.02***	-0.002
Endogenous switching	0.26	0.28	0.27	0.02***	0.01***	-0.004

Each value is predicted mean for the whole sample