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Choice of Contract Farming Strategies, Productivity, and Profits: Evidence from High-Value Crop Production

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This study examines the impact of the choice of contract farming (CF) conditions on the productivity and profitability of ginger growers. Using farm-level data from Nepal and the selectivity-corrected multinomial endogenous switching regression (MESR) method, we found that ginger growers increased yields by 16%, 19%, and 15% by participating in CF with input conditions (IC), with output conditions (OC), and with input and output conditions (BC), respectively. Ginger growers also increased profits by participating in CF. Price difference in spot and contract markets, distance to market and transportation facilities, and farm location are important factors affecting participation in any form of CF.

Key words: endogenous switching regression, multinomial endogenous switching regression, Nepal, profitability

Introduction

In recent years, contract farming (CF) has gained considerable interest from policy makers and development agencies, especially in developing countries, as a mechanism to administer linkages between smallholders and agribusiness firms.[1] Several studies have discussed CF's advantages for the income, wealth, and economic well-being of farm families (Wang, Wang, and Delgado, 2014; Bellemare and Novak, 2017; Bellemare and Bloem, 2018; Bellemare and Lim, 2018; Mishra et al., 2018d,a). CF can result from market failure and develop when the government's role in the agricultural sector is limited or absent (Singh, 2002). Allen and Lueck (1995) note that CF can be used to manage production and marketing risk—major risks that smallholder households face in developing and emerging economies (DEE)—reduce transaction costs (Williamson, 1979; Runsten, 1992), and manage supply chains (Swinnen and Maertens, 2007). Several studies (Tollens et al., 2013; Lamboll et al., 2018) have pointed out that institutional agreements like CF in DEE could respond to consumer preferences for improved quality, newer food products, and reduced market

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[1] Factors leading to the rapid rise in CF include increased income and urbanization, technological innovation (GinÃl' and Yang, 2009), skill transfer, economic liberalization, and upgrading of domestically produced commodities for international markets to earn valuable foreign currency (Glover and Kusterer, 1990; Eaton and Shepherd, 2001; Simmons, Winters, and Patrick, 2005).

uncertainty for inputs (Abebe et al., 2013) and food products.[2] On one hand, CF can lead to higher yields, higher incomes, higher profits, and reduced production costs.[3] On the other hand, CF could lead to self-exploitation (in cases of monopsonists and large buyers) and loss of control of land and labor for smallholders in DEE.[4] Therefore, the net effect of CF on the welfare of smallholders is debatable.In Nepal, a low-income developing country, the CF system is still developing. The agricultural sector, which employs more than 70% of workers, is crucial to Nepal's economy. The majority of the rural population works in agriculture, with smallholdings (<0.8 hectares), mostly using traditional technologies. The government of Nepal is keen on increasing the welfare of smallholder households and is also seeking to reduce its role and increase the presence of private companies in increasing the productivity and income of smallholder households. The government emphasizes the private sector's help in expanding vertical linkages, increasing food security, and increasing competitiveness of the agricultural sector. CF, through private firms, can help accomplish many government goals.

Nepal has a comparative advantage in producing high-value crops because of its comparatively low labor costs and varied agroclimatic conditions. Recent studies (Mishra et al., 2016, 2018b,c) have investigated CF's impact on yield, revenue, profitability, and labor usage in both high- and low-value crops. However, most research in CF, including in Nepal, has not investigated the impact of different forms of CF on smallholder households' productivity and profitability in a low-income economy like that of Nepal. Specifically, studies have failed to examine the choice and impact of conditions attached to contracts on outcome variables.[5] Agribusiness firms tend to attach conditions on input (IC), output (OC), or both input and output (BC). Smallholders choose the contract strategy (no CF, IC, OC, or BC) that best suits their profit-maximizing goals.

This study investigates the determinants of contract strategy (no CF, IC, OC, or BC) among ginger growers in Nepal. We then evaluate the impact of the choice of contract strategy (IC, OC, or BC) on the productivity and profitability of smallholder ginger growers. This study's contribution to the literature is twofold. First, recalling that smallholders self-select into one of the three types of CF strategies (IC, OC, or BC), we control for the self-selection problem. Second, we account for both observable and unobservable heterogeneity by using the endogenous switching regression method (ESRM), which allows for a better understanding of the specific benefits if a smallholder chooses to switch from independent farming (no CF) to CF with an IC, OC, or BC choice. To the best of our knowledge, no previous study has investigated the choice of CF forms and impacts on smallholders' production and profitability performance.

Literature Review

Multiple studies have investigated CF's impact on the income, yields, profitability, revenue, and food security among small and large farms in DEE. Recent studies by Wang, Wang, and Delgado (2014), Bellemare and Lim (2018), and Mishra et al. (2018d) provide an extensive review of the CF literature. We highlight some of the main findings in the literature for studies in South and Southeast Asia—the focus of this study. There are three strands of literature. The first focuses on the drivers of CF. Studies have included several socioeconomic, demographic, economic, farm-scale, and climatic conditions factors in their analysis (Wang, Wang, and Delgado, 2014; Zhu and Wang, 2007). However, depending on the area of study, there is a lack of consensus on both the sign and the significance of the variables included in the model (Arumugam et al., 2011; Mishra et al., 2018d).

[2] The authors found that input market uncertainty was one of the reasons for farmers participating in CF.

[3] CF enables processors to procure the necessary raw materials in the right quantity and quality and in a timely fashion with least cost (Ahuja and Punjabi, 2001; Kirsten and Sartorius, 2002).

[4] Several studies have expressed concern that contractors favor larger growers (Runsten, 1992; Little and Watts, 1994; Dolan and Humphrey, 2000; Singh, 2002) and smallholders could be left behind.

[5] Specifics related to the input and output conditions are provided in the data section.

The second strand of literature shows positive outcomes of CF on the economic performance (e.g., income, yields, revenues, and employment) of smallholder farms for high-value commodities (Birthal, Kunwar, and Parajuli, 2005; Miyata, Minot, and Hu, 2009; Sriboonchitta and Wiboonpoongse, 2014; Briones, 2015; Mishra et al., 2018d,b). Recent studies by Mishra et al. (2016, 2018a) show that, contrary to common belief, CF increases yield and profitability of smallholders in Nepal, even in cases of low-value or storable commodities. The above studies find that small farms benefited more from CF than large farms. However, in the case of China (Guo, Jolly, and Zhu, 2005) and India (Singh, 2002), small farms were less likely than large farms to participate in CF. There are several reasons for this conflicting evidence on the impact of farm size and CF, including both physical and institutional factors that prevent smallholders' participation in CF. Others have investigated CF's effect on the farmers' welfare via a two-step procedure (Simmons, Winters, and Patrick, 2005; Mishra et al., 2016, 2018a). Most of the above studies conclude that CF improves marketing, enhances access to technology for poor farmers, and provides inputs and extension services at a lower cost than independent farming.

The third strand of literature highlights CF's adverse effects on smallholder households (Singh, 2002; Guo, Jolly, and Zhu, 2005).[6] These studies argue that contractors gain more from contracts while farmers end up with debt, skewed income distribution, food insecurity, and family tensions. Focusing our attention on the developing economies, Minot (1986) finds that CF improved the incomes of participants but notes that the failure rates of CF schemes were very high. Several studies found that contracts in DEE having an unequal relationship between contractors and smallholders gives rise to imbalanced bargaining power (Eaton and Shepherd, 2001; Warning and Key, 2002; Cai et al., 2008; Sivramkrishna and Jyotishi, 2008), exclusion of small farms from CF (Glover and Kusterer, 1990; Key and Runsten, 1999; Baumann, 2000; Sartorius and Kirsten, 2007; Cai et al., 2008), excess accumulation of debt (Glover, 1984; Glover and Kusterer, 1990; Eaton and Shepherd, 2001), and lower employment of rural people (Mishra et al., 2018d) than before such contracts. However, it should be noted that none of the above studies investigated the factors affecting the farmers' choice of CF with IC, OC, or BC and the impact on yield and profitability of the high-value crop in Nepal, a low-income developing country.

A Conceptual and Empirical Framework

We used the selectivity corrected multinomial endogenous switching regression (MESR) method and computed average treatment effects. Based on the survey response in this study, ginger growers can decide on the engagement of four different forms: no CF, CF with input conditions , CF with output conditions, and CF with both input and output conditions. When the contracting firm attaches "input conditions" (IC) to the contract, the contracting firm offers inputs—such as seeds, fertilizer, and extension services—to the smallholder, the costs of which are deducted from farmers' final payments. When the contracting firm attaches "output conditions" to the contract, the contracting firm specifies conditions on the price, quantity, and quality of output of ginger. Ginger growers can also engage in CF in which the contracting firm attaches both "input and output conditions" (BC) to the contract. Table 1 outlines the conditions under IC and OC in the case of ginger.

Farmers may endogenously self-select participation in contracts, so decisions are likely to be influenced systematically by both observed and unobserved characteristics that may be correlated with outcomes (yield and profitability). To estimate the real impact of the choice of CF strategy (no CF, IC, OC, or BC), we corrected for sample selection using a selectivity corrected multinomial logit model (Bourguignon, Fournier, and Gurgand, 2007). The parameter estimates from this approach are consistent and efficient, even if the assumption of the independence of irrelevant alternatives is not fulfilled (Bourguignon, Fournier, and Gurgand, 2007). The estimation is performed simultaneously

[6] Other studies on this topic are in Africa and Latin America (Little and Watts, 1994; Key and Runsten, 1999; Opondo, 2000).

Table 1. Contract Farming in Ginger: Input Conditions and Output Conditions

Contracts with Input Conditions (IC)	Contracts with Output Conditions (OC)
The contractor provided input conditions in the contract, including	The contractor provided output conditions in the contract, including
(i) seeds supplied on credit;	(i) fixing prices in advance for a stated quantity and quality of produce;
(ii) extension for improved cultivation practices, including mechanization;	(ii) penalizing for a substandard product;
(iii) extension for increased post-harvest practices;	(iii) adjusting the cost of credit and other services in the final prices received by farmers;
(iv) provision for irrigation;	(iv) requiring farmer to clean produce before supply;
(v) fertilizer supplied on credit;	(v) requiring farmer to sort/grade produce before supply.
(vi) pesticides supplied on credit;	
(vii) financial credit for operation purposes.	

Source: IFPRI-Nepal survey.

Table 2. Participation in Contract Farming in Ginger Production, Different Contract Conditions and Combinations, Nepal

		Contract with Input Conditions (I)		Contract with Output Conditions (II)		
Choice (j)	**Combination**	I_1	I_0	O_1	O_0	**Frequency (%)**
1	I_0O_0		✓		✓	47.46
2	I_1O_0	✓				10.96
3	I_0O_1			✓		18.17
4	I_1O_1	✓		✓		23.40

Notes: Each element in the combination is a binary variable for contract: with input condition (I) or with output conditions (O). Subscript 1= participation, and 0= otherwise.

in two steps. In the first step, we model farmers' decision choices about individual CF strategy and combined CF strategy (outlined in Table 2) using the multinomial logit selection model, while accounting for interlinkages between them. In the second stage, we estimate the impact of each strategy and combined CF strategies on yield and profitability using least-squares regressions with selectivity correction terms.[7]

We assume that farmers choose a form of CF that can provide maximum utility. Consider a latent model describing the ith farmer's behavior in choosing the type of CF set j ($j = 1, 2, \ldots, 4$):

$$I_{ji}^{*} = \beta_j X_{ji} + \varepsilon_{ji}, \tag{1}$$

where X represents the vector of observed exogenous variables—such as demographic, socioeconomic, and household-level characteristics—and ε represents error term. The utility to the farmer of choosing a form of CF is not observable, but the decision is observable. Following Kassie et al. (2015) and Bourguignon, Fournier, and Gurgand (2007), a farmer's choice of CF j (IC, OC, BC) with respect to any other form of CF, k, can be expressed as

[7] Several studies (Di Falco, Veronesi, and Yesuf, 2011; Di Falco and Veronesi, 2013; Teklewold, Kassie, and Shiferaw, 2013; Abdulai and Huffman, 2014; Kassie et al., 2015, 2018) have evaluated impact using this endogenous switching regression (ESR).

$$I = \begin{cases} 1 \; if \; I_{ji}^{*} > \max_{k \neq 1} \left(I_{ki}^{*}\right) \text{ or } \eta_{1i} < 0 \\ \vdots \qquad\qquad\qquad\qquad \forall \; k \neq j \\ J \text{ if } I_{ji}^{*} > \max_{k \neq j} \left(I_{ki}^{*}\right) \text{ or } \eta_{Ji} < 0 \end{cases} \tag{2}$$

where $\eta_{Ji} = \max_{k \neq j} \left(I_{ki}^{*} - I_{ji}^{*}\right) < 0$. Equation (2) shows that farmer i chooses a CF form, j, to maximize his or her expected benefit if it provides greater expected utility than the alternative choice k, $k \neq j$ if $\max_{k \neq j} \left(I_{ki}^{*} - I_{ji}^{*}\right) < 0$. Under the assumption that ε is independent and identically distributed, the probability of smallholder i with a set of characteristics X choosing CF form j can be expressed as by a multinomial logit model (McFadden, 1973):

$$p_{ji} = \Pr\left(\eta_{Ji} < 0 | X_{ji}\right) = \frac{\exp\left(\beta_j X_{ji}\right)}{\sum_{k \neq 1}^{j} \exp\left(\beta_k X_{ij}\right)}. \tag{3}$$

The impact of the choice of CF form (IC, OC, BC) on the profit function is estimated for CF participants and nonparticipants separately, controlling for the endogenous nature of a participation decision. The base category—no participation in CF ($I_0 O_0$)—is denoted as $j = 1$. In the remaining set ($j = 2,3,4$), at least one form of CF is adopted. Specifically, profit implications due to CF participation in each regime j are expressed as

$$\begin{cases} \text{Regime 1}: \; R_{1i} = \delta_1 Z_{1i} + \vartheta_{1i} \text{ if } I = 1 \\ \vdots \qquad\qquad\qquad\qquad j = 2,3,4\,, \\ \text{Regime J}: \; R_{Ji} = \delta_J Z_{Ji} + \vartheta_{Ji} \text{ if } I = J \end{cases} \tag{4}$$

where R represents smallholder household i's farm performance (profit per hectare) in regime j; Z represents a set of variables representing demographic, socioeconomic, information and market access, cost of production, and resources; and ϑ is an error term. Since there could be unobserved correlated factors between the first- and second-stage regression, ε and ϑ are not independent. In such a case, the consistent estimation of δ should be obtained by correcting for selectivity (i.e., including additional selection correction terms of alternative choices λ) (Bourguignon, Fournier, and Gurgand, 2007). Equation (4) can now be expressed as

$$\begin{cases} \text{Regime 1: } R_{1i} = \delta_1 Z_{1i} + \sigma_1 \hat{\lambda}_{1i} + \mu_{1i} \text{ if } I = 1 \\ \vdots \qquad\qquad\qquad\qquad j = 2,3,4\,, \\ \text{Regime J: } R_{Ji} = \delta_J Z_{Ji} + \sigma_J \hat{\lambda}_{Ji} + \mu_{Ji} \text{ if } I = J \end{cases} \tag{5}$$

where λ is the inverse Mills ratio predicted and computed from the probability estimates in equation (3), μ is an error term with an expected value of 0, and σ is the covariance between ε and ϑ.

.Estimates and predictions from equation (5) enable us to estimate counterfactual and treatment effects and compute exact individual impacts (yield and profitability per hectare) due to the choice of CF form (IC, OC, BC). This approach not only corrects for selection bias due to unobserved heterogeneity but also controls for selection bias due to observed heterogeneity. Following Kassie et al. (2015), average treatment effects for treated (ATT) and average treatment effects for untreated (ATU) are computed and expressed in terms of conditional expectation.

CF participants with some form of CF (actual):

$$E[R_{ji} | I = j, Z_{ji}, \hat{\lambda}_{ji}] = \delta_j Z_{ji} + \sigma_{j\varepsilon} \hat{\lambda}_{ji}. \tag{6}$$

Nonparticipants without participating in any form of CF (actual):

$$E[R_{1i}|I=1,Z_{1i},\hat{\lambda}_{1i}]=\delta_1 Z_{1i}+\sigma_{1\varepsilon}\hat{\lambda}_{1i}. \tag{7}$$

Participants had they decided not to participate in any form of CF (counterfactual):

$$E[R_{1i}|I=j,Z_{ji},\hat{\lambda}_{ji}]=\delta_1 Z_{ji}+\sigma_{1\varepsilon}\hat{\lambda}_{ji}. \tag{8}$$

Nonparticipants had they decided to participate (counterfactual):

$$E[R_{ji}|I=1,Z_{1i},\hat{\lambda}_{1i}]=\delta_j Z_{1i}+\sigma_{j\varepsilon}\hat{\lambda}_{1i}. \tag{9}$$

Equations (6) and (7) represent actual expected productivity (yield) and profitability (net returns) actually observed in the sample for CF participants and nonparticipants, respectively, and equations (8) and (9) represent their respective counterfactuals. Using conditional expectations from equations (6)–(9), the average participation effect of CF (impact on yield and profitability) on participants (ATT) is defined as the difference between equation (6) and equation (8):[8]

$$ATT=E[R_{ji}|I=j,Z_{ji},\hat{\lambda}_{ji}]-E[R_{1i}|I=j,Z_{ji},\hat{\lambda}_{ji}]=Z_{ji}(\delta_j=\delta_1)+\hat{\lambda}_{ji}(\sigma_j-\sigma_1). \tag{10}$$

Data

We use farm-level survey data collected from December 2014 to August 2015 for ginger growers (both contracted and noncontracted) from the hill districts of Pyuthan, Palpa, and Arghakhanchi, located in the western and midwestern regions of Nepal. These regions were selected because of a high concentration of contract farmers and the presence of Annapurna Organics Ltd., a contracting firm that underwrites contracts and procures ginger for processing. Annapurna Organics is the lone processor of ginger in Nepal, and the company had contracted 3,000 cultivators from eight districts in the western and midwestern development region of Nepal, namely Pyuthan, Palpa, Arghakhanchi, Salyan, Dang, Gulmi, Rolpa, and Rukum. However, contracts were limited to approximately 700 farmers, located predominantly in Pyuthan district, followed by Arghakhanchi and Palpa districts. In total, 611 ginger farmers were surveyed in this study, considering the adequate sample for representing the ginger grower population,[9] chosen randomly from 53 wards under 14 village development councils in the three sample districts. The share of sample size allocated to the three respective sample districts was in proportion to the number of contract farmers in those districts. The number of farmers identified for the ginger survey from Pyuthan, Arghakhanchi, and Palpa districts were 313, 205, and 93, respectively.

The survey was collected by the International Food Policy Research Institute of South Asia (New Delhi) under the Policy Reform Initiative Project in Nepal (PRIPN), funded by the U.S. Agency for International Development (USAID). The survey collected information on farm and operator attributes, crops cultivated, crop yield, costs, profits, grower's participation in CF, use of marketing channels, and adoption of good agricultural practices. Private companies engage in a formal written contract with ginger growers.

Table 2 reports the choices of contract conditions available to ginger growers. For instance, I_0O_0 represents no CF, and 47.46% of the ginger growers chose this option (i.e., did not participate in

[8] Similarly, the average effect of CF (impact on yield and profitability) on nonparticipants (ATU) is defined as the difference between equations (7) and (9).

[9] The target study population is small ginger growers in the area with the availability of CF options. The presence of distinct contractors that underwrite contract with farmers or with direct farmer-owned co-operatives were present in the districts we studied. Moreover, the districts under this study are classified as pocket areas of ginger production by Prime Minister Agriculture Modernization Project (PMAMP), a project from Nepal Government's direct initiative (Government of Nepal, Ministry of Agricultural Development, 2017). PMAMP implementation began around 1 year after the survey of this study was done.

any form of CF). I_1O_0 represents CF with "input conditions only," and about 11% of ginger growers participated in this form of CF. I_0O_1 represents CF with "output conditions only," and about 18% of ginger growers opted for this form of CF. Finally, I_1O_1 represents CF with "both input and output conditions," and around 23% of growers opted for this form of CF. Table 3 presents definitions and descriptive statistics of the variables used in this study.

Results and Discussion

Table 4 reports multinomial logit regression results for factors influencing different forms of CF decisions (IC, OC, and BC). With a base of "no contract or independent farming," we have presented results for decision equations into IC, OC, and BC. results suggest that household heads with farming experience and households with a member of the family who has migrated to urban area or another country are more likely to choose CF with BC (Table 4, column 3). Findings here suggest that experienced smallholders better understand the contractual arrangements but perhaps are constrained in their resources (inputs, extension services, and credit). The smallholders probably like the convenience of CF with BC, as they can get their inputs and clear guidelines on output requirements. Another plausible reason could be that relatively older and experienced farmers may want to avoid uncertainties and minimize risk in the marketing and production of agricultural commodities and are more likely to choose CF with BC with the expectation of stabilizing farm incomes.

Table 4 shows that male heads of households are less likely than the female-headed households to participate in CF with OC. Note that CF with OC to some extent insures against market and price risks. Therefore, our finding may indicate that male-headed households perhaps have a higher tendency than female-headed households to take chances in the spot market from direct sales—expecting higher returns from risky behavior. This finding is consistent with general findings of gender differences in risk attitude and risk preferences that females are relatively more risk averse than males (Jianakoplos and Bernasek, 1998; Croson and Gneezy, 2009; Castillo and Freer, 2018). Several studies have found similar gender differences specific to agricultural risks.[10] Female-headed households were more susceptible than male-headed households to a shock like a rise in agricultural (food) prices (Kumar, 2014), and women care more than men for household agricultural insurance mechanisms (Kumar and Quisumbing, 2014; World Bank, 2017). Our finding is also consistent with Wainaina, Okello, and Nzuma (2012) and Wang, Zhang, and Wu (2011).

Results in Table 4 also indicate that households with a family member with high school or college-level education are less likely than households with primary-level education (base) to participate in CF with IC. Findings perhaps indicate that educated members in the family help gather information and secure inputs at prices better than those offered by contracting companies. Additionally, knowledgeable members are more likely to understand and analyze contractual arrangements and the price-setting mechanism. Interestingly, one of the crucial determinants of the choice of CF types, significant across all forms of CF, is the price premium (the difference between the contract price and market price). Positive and significant coefficients on the price premium variable in all forms of CF suggest that price difference is one of the significant motivating factors in participation in CF, regardless of the type of CF. The likelihood of CF with IC, OC, and BC increases with increased price premiums (Table 4).

Table 4 shows that smallholder households with a member who has migrated are more likely to participate in CF with BC than smallholder households with no members who have migrated. This finding could be interpreted in two ways. First, the migration of relatively younger family members for off-farm employment, typically to bigger cities or abroad, results in a shortage of family labor for agriculture. Second, in the case of Nepal, households with a member who has migrated perhaps

[10] Based on a lottery game with agricultural transaction, Clarke and Kumar (2016) found that women are more risk averse than men.

Table 3. Definitions and Summary Statistics of Variables Used in the Analysis, Ginger Growers, Nepal, 2014–2015 (N = 602)

Variable	Description	Mean	Std. Dev.
Contract farming conditions and outcomes			
IC	Contract farming with input conditions only	11%	
OC	Contract farming with output conditions only	18%	
BC	Contract farming with both input and output conditions	23%	
Outcome variables			
Yields	Yield per hectare (kg/hectare)	9,081	3,525
Profits	Net returns per hectare, (in NPRthousands)	234	208
Household characteristics			
Gender	Male (=1 if head of the household is male, 0 otherwise)	0.75	0.43
Experience	Farming experience of head of household	26.59	13.38
Primary educ	Education level of the highest educated member in the household, primary	0.05	0.22
Middle school	Education level of the highest educated member in the household, middle school	0.17	0.37
High school	Education level of the highest educated member in the household, high school	0.60	0.49
College	Education level of the highest educated member in the household, college and beyond	0.17	0.37
Migrated	Households with a member who has migrated	0.58	0.49
Family size	Number of members in household	6.35	3.62
Owned land	Total land owned by household (hectares)	0.76	0.64
Occupation	=1 if farming is the main occupation, 0 otherwise	0.94	0.23
Phone ownership	=1 if household has a phone owned, 0 otherwise	0.47	0.50
Caste, general	=1 if household belongs to general caste , 0 otherwise	0.38	0.49
Caste, scheduled	=1 if household belongs to scheduled caste, 0 otherwise	0.19	0.39
Caste, tribe	=1 if household belongs to scheduled tribe caste, 0 otherwise	0.43	0.50
Contract premium[a]	Difference between contract price and market price of fresh ginger (absolute value in kg)	8.80	8.88
Wealth[b]	Wealth owned by HH, excluding land (in NPR)	1,332	1,141
Distance	Distance to market or transportation facility, (km)	3.07	2.52
Regional variables			
District Palpa	=1 if household is located in Palpa district, 0 otherwise	0.15	0.36
District Argha	=1 if household located in Argakhanchi district, 0 otherwise	0.34	0.47
District Pyuthan	=1 if household is located in Pyuthan district, 0 otherwise	0.51	0.50

Notes: [a] Based on the questionnaire, we treated the price of ginger reported by contract farmers as the contract price and the price reported by noncontract farmers as the spot price. Spot price for contract farmers and price for noncontract farmers are unavailable, but we imputed these values from the above information, specific to location and district.

[b] Includes the sum of the values of harvester, tractors, threshing machine, plow, and bullocks.

Table 4. Multinomial Logit Regression for Factors Influencing CF Decisions with IC, OC, BC, Nepal

	IC Only	OC Only	BC
Variables	**1**	**2**	**3**
Constant	−6.017**	−11.621***	−12.396***
	(2.473)	(2.207)	(2.025)
Farming experience of household head	−0.014	0.014	0.025**
	(0.013)	(0.011)	(0.010)
Head of household is male	−0.495	−0.791**	−0.512
	(0.375)	(0.325)	(0.312)
Education level, middle school	−0.735	−0.585	−0.501
	(0.626)	(0.676)	(0.613)
Education level, high school	−1.709***	−0.356	−0.499
	(0.592)	(0.618)	(0.569)
Education level, college	−1.736**	−0.526	−0.489
	(0.722)	(0.721)	(0.658)
Households with a member who has migrated	0.782**	0.453	0.551**
	(0.337)	(0.279)	(0.266)
Farming as a main occupation	−0.035	0.607	0.566
	(0.605)	(0.630)	(0.589)
Household belongs to scheduled tribal caste	0.379	0.200	1.432***
	(0.426)	(0.381)	(0.361)
Household belongs to scheduled caste	−1.231**	−0.716	0.565
	(0.581)	(0.453)	(0.432)
Phone ownership	0.497	0.026	0.649**
	(0.392)	(0.320)	(0.290)
Total owned land (hectare)	0.075	−0.346	0.168
	(0.295)	(0.269)	(0.213)
Household wealth, excluding land (log)	0.480	1.172***	1.113***
	(0.352)	(0.298)	(0.272)
Family size (number)	−0.014	−0.083*	−0.043
	(0.042)	(0.049)	(0.035)
Contract premium (contract price-spot price)	0.118***	0.126***	0.144***
	(0.023)	(0.021)	(0.019)
Distance to transportation/market facility	0.307***	0.240***	0.097*
	(0.076)	(0.064)	(0.057)
District Palpa	0.860	0.370	0.209
	(0.540)	(0.506)	(0.438)
District Pyuthan	1.169**	2.050***	1.370***
	(0.559)	(0.498)	(0.405)

Notes: Numbers in parentheses are standard errors. Single, double, and triple asterisks (*, **, ***) indicate significance at the 10%, 5%, and 1% level.

[a] Base group is no contract farming.

receive remittance income and want to choose less labor-intensive and less risky mechanisms in production agriculture.

Estimates in Table 4 also reveal that social castes classified as scheduled tribes (ST) are more likely than other castes to participate in CF with BC. On the other hand, smallholder ginger growers belonging to social castes classified as scheduled caste (SC) are less likely to engage in CF with IC than are independent farmers in the general caste category. The two social classes—ST and SC, similar to those in India (see Mishra et al., 2018d)—are likely to be poor and resource constrained. Findings here suggest that contracting firms could target scheduled tribes and castes (low-caste, poor farmers) through CF by providing a contract with BC that includes access to land, inputs, and educational material (Sugden, 2009) and, in turn, alleviate poverty among that class of people.

Estimates in Table 4 show that the wealth of a smallholder household has a positive and significant effect on the likelihood of participating in CF with OC and BC. Note that wealth in this study includes the sum of the values of harvester, tractors, threshing machine, plow, and bullocks but does not include the value of land. Findings here reveal that wealthy smallholders are more likely than poor smallholder households to participate in CF that provides them with either OC or BC. Perhaps wealth enables smallholder ginger growers to take a risk in meeting the contractor's quality and quantity standards, and wealthy growers can hire labor that specializes in crop production and good agricultural practices and can manage farms and communicate with extension agents from the contracting firm.

Finally, results in Table 4 show that the effect of distance to market/transportation facility is positive and statistically significant across CF with IC, OC, and BC. This result is not surprising as Nepalese farmers face hard farming terrain and limited accessibility to roads and market due to the country's mountainous landscape. A positive coefficient indicates that increased distances to the market or transportation facility increase the smallholder's participation in CF. This finding is consistent with Mishra et al. (2018d), who found that smallholder onion growers with greater distances to output markets and collection centers were more likely to adopt CF than those with shorter distances to markets and collection centers.

We now turn our attention to the impact of CF with IC, OC, and BC on the yield and profitability of smallholder ginger producers. We estimated conditional equations (equations 6–9) and ATT (see Table 5). Overall, Table 5 suggests a significant positive impact of participation in CF with any form of conditions (IC, OC, BC) attached to the contract. We compare the expected productivity (yield, kg/hectare) under the actual case that the smallholder ginger growers adopted a particular combination of CF conditions (IC, OC, BC) and the counterfactual case that they did not. Column 2 of Table 5 shows the counterfactual cases. Significant lower yields on column 2 for each form indicate that smallholder ginger growers who adopted would have had lower ginger productivity (yield/hectare) if they had not adopted. Column 3 of Table 5 presents the impact of each combination of CF conditions on ginger yield, which is the ATT, calculated as the difference between column 1 and column 2. Recall that to arrive at these estimates, we controlled for the effects of several covariates and the selection bias stemming from both observed and unobserved variables on average yield. The adoption of CF with any attached condition (IC, OC, BC) is associated with significant gains in yield of about 16%–19%. Interestingly, the highest yield (1,341 kg/hectare, a 19% increase) is obtained from participation in CF with only OC (I_0O_1). Our findings are consistent with the literature (Masakure and Henson, 2005; Simmons, Winters, and Patrick, 2005; Tripathi et al., 2005; Kalamkar, 2012; Mishra et al., 2016, 2018a).

Similarly, Table 6 suggests a significant positive impact of participation in CF on profitability with any form of conditions (IC, OC, BC) attached to the contract. We compare the expected profitability (net returns/hectare) under the actual case that the smallholder ginger growers adopted a particular combination of CF conditions (IC, OC, BC) and the counterfactual case that they did not. Specifically, we compare columns 1 and 2 of Table 6. Column 3 presents the impact of each combination of CF conditions on ginger farming profitability (net returns/ha), which is the ATT,

Table 5. Average Expected Productivity (yield per hectare) with CF Conditions (IC, OC, BC), Nepal

Contract Farming Set	Actual Outcome (yield per hectare if household participates in contact set choice *j*) 1	Counterfactual Outcome (yield per hectare if household does not participate in contract set choice *j*) 2	Average Treatment Effects for Treated (ATT) Yield (kg per hectare) 3	Percentage (%)
I_1O_0	9,044	7,802	1,242***	15.92
	(280)	(180)	(332)	
I_0O_1	8,532	7,191	1,341***	18.65
	(150)	(141)	(206)	
I_1O_1	9,218	7,984	1,233***	15.45
	(105)	(177)	(206)	

Notes: Numbers in parentheses are standard errors. Single, double, and triple asterisks (*, **, ***) indicate [statistical] significance at the 10%, 5%, and 1% level. ATT estimates are computed using the selectivity-corrected yield equations (multinomial ESR). Detailed equations under each contract condition can be obtained from the authors upon request.

Table 6. Average Expected Profitability (net returns per hectare) with CF Conditions (IC, OC, BC), Nepal

Contract Farming Set	Actual Outcome (total profit per hectare if household under contact set choice *j*) 1	Counterfactual Outcome (total profit per hectare if household not under contract set choice *j*) 2	Average Treatment Effects for Treated (ATT) Nepalese Rupees (NPR) 3	Percentage Change (%)
I_1O_0	274,575	187,554	87,021***	46.39
	(20,959)	(11,469)	(23,892)	
I_0O_1	258,981	158,977	100,004***	62.90
	(11,596)	(89,632)	(14,656)	
I_1O_1	301,431	215,141	86,291***	40.11
	(9,201)	(9,880)	(13,501)	

Notes: Numbers in parentheses are standard errors. Single, double, and triple asterisks (*, **, ***) indicate [statistical] significance at the 10%, 5%, and 1% level. ATT estimates are computed using the selectivity-corrected profit equations. Detailed equations under each contract condition can be obtained from the authors upon request; With an exchange rate of 1 USD=111 NPR (June 2019), ATT estimates of 86,000–100,000 NPR profit per hectare are nearly equivalent to $314–$365 profit per acre.

calculated as the difference between column 1 and column 2. The adoption of CF with any attached condition (IC, OC, BC) is associated with significant gains in yield of about 40%–63%.

The highest profitability (100,004 NPR/hectare), or a 63% increase (column 3 of Table 6), is obtained from participation in CF with only OC attached to the contract (I_0O_1). Recall that in Table 5, the adoption of CF with OC produced the highest gains in yield per hectare. Consistently, the effect of the adoption of CF with OC on profit is greater than the impact of adopting CF with IC (I_0C_1) or BC I_1O_1. Higher yield per hectare and profitability effects due to CF participation is consistent with previous literature: Mishra et al. (2018a) found similar estimates in assessing the overall impact of CF participation; Kumar et al. (2016) found that CF among lentil farmers in Nepal increased profits by 81%; and Bhandari, Kunwar, and Parajuli (2015) reported that the share of profit in value of production ranged from 30% to 60% in Nepal and the Indian state of Bihar.

Finally, column 2 of Table 6 shows the counterfactual cases: Smallholder ginger growers who actually adopted would have had lower profitability (NPR/ha) in ginger farming if they had not adopted. Column 3 shows the increased profit that is attributable to the choice of different forms of CF. For instance, by choosing CF with IC or with BC, smallholder ginger growers' profits increased by 87,021 NPR/ha and 86,291 NPR/ha, respectively, over nonparticipants in any CF. This gain by adopters would not have been achieved had they not chosen these contract sets.

Conclusions and Policy Implications

Nepal is one of the poorest countries in South Asia. A large share of the population (75%) resides in rural areas, where they tend to make a living from agriculture and remittances from urban and foreign employments. The average farm size is less than 0.8 hectares and the trend in farm size has been in decline for many years. The Terai area (in the lower foothills of the Himalayan range and close to the northern border of India) is fertile, with wide-ranging agroclimatic conditions. Vegetables are considered a high-value commodity in Nepalese agriculture. Ginger is an important vegetable crop, having high market potential. However, smallholders are hampered by variable market prices and lack of access to credit, inputs, and extension services. The government of Nepal has initiated market reforms that have opened doors for private-sector intervention in production agriculture.

In that vein, this study investigated the impact of CF with conditions (IC, OC, BC) in ginger production. In particular, the study examined the factors affecting smallholders' choice of CF with input conditions (IC), output conditions (OC), and both IC and OC (BC). We used farm-level data from three villages in the Terai region collected by the IFPRI South Asia office. A multinomial endogenous switching regression model (MESR) was employed to account for self-selection bias in ginger growers' choice to participate in any combination of CF choices with IC, OC, or BC.

Findings from this study showed that the likelihood of ginger growers participating in CF—regardless of the choice of contract condition (IC, OC, or BC)—increases with higher price premiums (contract price minus spot price), greater market/transportation distances, and grower wealth. The study also found that CF growers with more experience and higher price premiums and who belong to scheduled tribes and own phones are more likely to adopt CF with BC (combined IC and OC) than those with less experience and, low or no premiums, and who do not belong to a scheduled tribe or own a phone. Compared to independent growers, growers having household members with higher education and those belonging to a scheduled caste are less likely to adopt CF with IC. Finally, we found that male-headed households and large families are less likely to choose CF with OC than female-headed households and small families. In sum, these findings can inform policy makers in designing and implementing policies that encourage the adoption of CF with choices of conditions attached to the contract.

The study found that yield per hectare and profitability of ginger growers increase with any form of CF participation, but the magnitudes differ with the choice of contract conditions. Projections from this study showed that adopters of CF realize higher yields (19%) than nonadopters when they choose CF with OC, which is the highest among contract form choices. Similarly, the study found that ginger growers also would achieve higher profitability (63%) than nonadopters when they turn to CF with OC. Thus, we draw three main conclusions from the results of this study. First, smallholders, who adopted CF with conditions had systematically different attributes than independent ginger growers. Second, the adoption of CF increased food security (increased yield and profitability) among smallholders. Third, with the highest magnitude of impact among contract sets, the adoption of CF with OC may prove to help increase income and yield of resource-constrained smallholder ginger growers in Nepal.

Results from this study may inspire policy makers to design incentives to encourage the adoption of CF with OC. Ginger growers' adoption of CF with OC could also lead to improvements in the income and food security of smallholders and the export quality of ginger from Nepal. Facilitation of access to credit and other services, good agricultural practices, and grading and sorting through

CF are of principal rank in determining the implementation of CF and the choice of CF conditions (IC, OC, BC), which could result in higher yield per hectare and profitability, regardless of their unobservable attributes.

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References

Abdulai, A., and W. Huffman. "The Adoption and Impact of Soil and Water Conservation Technology: An Endogenous Switching Regression Application." *Land Economics* 90(2014):26–43. doi: 10.3368/le.90.1.26.

Abebe, G. K., J. Bijman, R. Kemp, O. Omta, and A. Tsegaye. "Contract Farming Configuration: Smallholders' Preferences for Contract Design Attributes." *Food Policy* 40(2013):14–24. doi: 10.1016/j.foodpol.2013.01.002.

Ahuja, V., and M. Punjabi. "In Search of a New Paradigm for Agriculture Extension in India." CMA Monograph Series 195, Indian Institute of Management, Ahmedabad, India, 2001.

Allen, D. W., and D. Lueck. "Risk Preferences and the Economics of Contracts." *American Economic Review* 85(1995):447–451.

Arumugam, N., F. M. Arshad, F. C. E. Chiew, and Z. Mohamed. "Determinants of Fresh Fruits and Vegetables (FFV) Farmers' Participation in Contract Farming in Peninsular Malaysia." *International Journal of Agricultural Management and Development (IJAMAD)* 1(2011):1–7.

Baumann, P. "Equity and Efficiency in Contract Farming Schemes: The Experience of Agricultural Tree Crops." Working Paper 139, Overseas Development Institute, London, UK, 2000.

Bellemare, M. F., and J. R. Bloem. "Does Contract Farming Improve Welfare? A Review." *World Development* 112(2018):259–271. doi: 10.1016/j.worlddev.2018.08.018.

Bellemare, M. F., and S. Lim. "In All Shapes and Colors: Varieties of Contract Farming." *Applied Economic Perspectives and Policy* 40(2018):379–401. doi: 10.1093/aepp/ppy019.

Bellemare, M. F., and L. Novak. "Contract Farming and Food Security." *American Journal of Agricultural Economics* 99(2017):357–378. doi: 10.1093/ajae/aaw053.

Bhandari, N. B., M. Kunwar, and K. Parajuli. *Average Production Cost and Profit Margin of Pulse, Oilseed, Spice and Commercial Crops*. Hariharbhawan, Lalitpur, Nepal: Ministry of Agriculture Development, Department of Agriculture, Agribusiness Promotion and Marketing Development Directorate Market Research and Statistics Management Program, 2015.

Birthal, N. B., M. Kunwar, and K. Parajuli. "Vertical Coordination in High Value Food Commodities: Implication for Small Holders." MTID Discussion Paper 85, International Food Policy Research Institute, Washington, DC, 2005.

Bourguignon, F., M. Fournier, and M. Gurgand. "Selection Bias Corrections Based on the Multinomial Logit Model: Monte-Carlo Comparisons." *Journal of Economic Surveys* 21(2007):174–205. doi: 10.1111/j.1467-6419.2007.00503.x.

Briones, R. M. "Small Farmers in High-Value Chains: Binding or Relaxing Constraints to Inclusive Growth?" *World Development* 72(2015):43–52. doi: 10.1016/j.worlddev.2015.01.005.

Cai, J., L. Ung, S. Setboonsarng, and P. Leung. "Rice Contract Farming in Cambodia: Empowering Farmers to Move Beyond the Contract toward Independence." ADBI Discussion Paper 109, FAO, Rome, Italy, 2008.

Castillo, M., and M. Freer. "Revealed Differences." *Journal of Economic Behavior & Organization* 145(2018):202–217. doi: 10.1016/j.jebo.2017.10.017.

Clarke, D. J., and N. Kumar. "Microinsurance Decisions: Gendered Evidence from Rural Bangladesh." *Gender, Technology and Development* 20(2016):218–241. doi: 10.1177/0971852416639784.

Croson, R., and U. Gneezy. "Gender Differences in Preferences." *Journal of Economic Literature* 47(2009):448–474. doi: 10.1257/jel.47.2.448.

Di Falco, S., and M. Veronesi. "How Can African Agriculture Adapt to Climate Change? A Counterfactual Analysis from Ethiopia." *Land Economics* 89(2013):743–766. doi: 10.3368/le.89.4.743.

Di Falco, S., M. Veronesi, and M. Yesuf. "Does Adaptation to Climate Change Provide Food Security? A Micro-Perspective from Ethiopia." *American Journal of Agricultural Economics* 93(2011):829–846. doi: 10.1093/ajae/aar006.

Dolan, C., and J. Humphrey. "Governance and Trade in Fresh Vegetables: The Impact of UK Supermarkets on the African Horticulture Industry." *The Journal of Development Studies* 37(2000):147–176. doi: 10.1080/713600072.

Eaton, C., and A. Shepherd. *Contract Farming: Partnerships for Growth*. No. 145 in FAO Agricultural Services Bulletin. Rome, Italy: FAO, 2001.

GinÃl', X., and D. Yang. "Insurance, Credit, and Technology Adoption: Field Experimental Evidence from Malawi." *Journal of Development Economics* 89(2009):1–11. doi: 10.1016/j.jdeveco.2008.09.007.

Glover, D., and K. Kusterer. *Small Farmers, Big Business: Contract Farming and Rural Development*. Hampshire, UK: Macmillan, 1990.

Glover, D. J. "Contract Farming and Smallholder Outgrower Schemes in Less Developed Countries." *World Development* 12(1984):1143–1157. doi: 10.1016/0305-750X(84)90008-1.

Government of Nepal, Ministry of Agricultural Development. "Project Document of Prime Minister Agriculture Modernization Project (PMAMP)." 2017. Available online at https://pmamp.gov.np/.

Guo, H., R. Jolly, and J. Zhu. "Contract Farming in China: Supply Chain or Ball and Chain?" 2005. Paper presented at the Minnesota International Economic Development Conference (MIDC05), University of Minnesota, Minneapolis, MN.

Jianakoplos, N. A., and A. Bernasek. "Are Women More Risk Averse?" *Economic Inquiry* 36(1998):620–630. doi: 10.1111/j.1465-7295.1998.tb01740.x.

Kalamkar, S. S. "Inputs and Services Delivery System under Contract Farming: A Case of Broiler Farming." *Agricultural Economics Research Review* 25(2012):515–521.

Kassie, M., P. Marenya, Y. Tessema, M. Jaleta, D. Zeng, O. Erenstein, and D. Rahut. "Measuring Farm and Market Level Economic Impacts of Improved Maize Production Technologies in Ethiopia: Evidence from Panel Data." *Journal of Agricultural Economics* 69(2018):76–95. doi: 10.1111/1477-9552.12221.

Kassie, M., H. Teklewold, P. Marenya, M. Jaleta, and O. Erenstein. "Production Risks and Food Security under Alternative Technology Choices in Malawi: Application of a Multinomial Endogenous Switching Regression." *Journal of Agricultural Economics* 66(2015):640–659. doi: 10.1111/1477-9552.12099.

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(1999):381–401. doi: 10.1016/S0305-750X(98)00144-2.

Kirsten, J., and K. Sartorius. "Linking Agribusiness and Small-Scale Farmers in Developing Countries: Is There a New Role for Contract Farming?" *Development Southern Africa* 19(2002):503–529. doi: 10.1080/0376835022000019428.

Kumar, A., D. Roy, P. K. Joshi, G. Tripathi, and R. Adhikari. "Impact of Contract Farming on Profits and Yield of Smallholder Farms in Nepal: An Evidence from Lentil Cultivation." 2016. Paper presented at the annual meeting of the Agricultural and Applied Economics Association, July 31–August 2, Boston, Massachusetts.

Kumar, N. "Agricultural Insurance: A Gender Perspective from Rural Bangladesh." Unpublished, International Food Policy Research Institute, Washington, DC, 2014.

Kumar, N., and A. Quisumbing. *Gender, Shocks, and Resilience*. Washington, DC: International Food Policy Research Institute, 2014.

Lamboll, R., A. Martin, L. Sanni, K. Adebayo, A. Graffham, U. Kleih, L. Abayomi, and A. Westby. "Shaping, Adapting and Reserving the Right to Play: Responding to Uncertainty in High Quality Cassava Flour Value Chains in Nigeria." *Journal of Agribusiness in Developing and Emerging Economies* 8(2018):54–76. doi: 10.1108/JADEE-03-2017-0036.

Little, P. D., and M. J. Watts. *Living under Contract: Contract Farming and Agrarian Transformation in Sub-Saharan Africa*. Madison, WI: University of Wisconsin Press, 1994.

Masakure, O., and S. Henson. "Why Do Small-Scale Producers Choose to Produce under Contract? Lessons from Nontraditional Vegetable Exports from Zimbabwe." *World Development* 33(2005):1721–1733. doi: 10.1016/j.worlddev.2005.04.016.

McFadden, D. "Conditional Logit Analysis of Qualitative Choice Behavior." In P. Zarembka, ed., *Frontiers in Econometrics,* Economic Theory and Mathematical Economics. New York, NY: Academic Press, 1973, 105–142.

Minot, N. "Contract Farming and Its Effect on Small Farmers in Less Developed Countries." Food Security International Development Working Papers 54740, Michigan State University Department of Agricultural, Food, and Resource Economics, Ann Arbor, MI, 1986.

Mishra, A. K., A. Kumar, P. K. Joshi, and A. D'souza. "Impact of Contracts in High Yielding Varieties Seed Production on Profits and Yields: The Case of Nepal." *Food Policy* 62(2016):110–121. doi: 10.1016/j.foodpol.2016.05.005.

Mishra, A. K., A. Kumar, P. K. Joshi, and A. D'Souza. "Cooperatives, Contract Farming, and Farm Size: The Case of Tomato Producers in Nepal." *Agribusiness* 34(2018a):865–886. doi: 10.1002/agr.21563.

———. "Impact of Contract Farming on Yield, Costs, and Profitability in Low-Value Crop: Evidence from a Low-Income Country." *Australian Journal of Agricultural and Resource Economics* 62(2018b):589–607. doi: 10.1111/1467-8489.12268.

———. "Production Risks, Risk Preference and Contract Farming: Impact on Food Security in India." *Applied Economic Perspectives and Policy* 40(2018c):353–378. doi: 10.1093/aepp/ppy017.

Mishra, A. K., S. Shaik, A. R. Khanal, and S. Bairagi. "Contract Farming and Technical Efficiency: Evidence from Low-Value and High-Value Crops in Nepal." *Agribusiness* 34(2018d):426–440. doi: 10.1002/agr.21533.

Miyata, S., N. Minot, and D. Hu. "Impact of Contract Farming on Income: Linking Small Farmers, Packers, and Supermarkets in China." *World Development* 37(2009):1781–1790. doi: 10.1016/j.worlddev.2008.08.025.

Opondo, M. M. "The Socio-Economic and Ecological Impacts of the Agro-Industrial Food Chain on the Rural Economy in Kenya." *AMBIO: A Journal of the Human Environment* 29(2000):35–41. doi: 10.1579/0044-7447-29.1.35.

Runsten, D. "Transaction Costs in Mexican Fruit and Vegetable Contracting: Implications for *Asociación en Participación*." 1992. Paper presented at the XVIII International Congress pf the Latin American Studies Association, March 10–12, Atlanta, Georgia.

Sartorius, K., and J. Kirsten. "A Framework to Facilitate Institutional Arrangements for Smallholder Supply in Developing Countries: An Agribusiness Perspective." *Food Policy* 32(2007):640–655. doi: 10.1016/j.foodpol.2007.03.001.

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. doi: 10.1111/j.1574-0864.2005.00096.x.

Singh, S. "Contracting Out Solutions: Political Economy of Contract Farming in the Indian Punjab." *World Development* 30(2002):1621–1638. doi: 10.1016/S0305-750X(02)00059-1.

Sivramkrishna, S., and A. Jyotishi. "Monopolistic Exploitation in Contract Farming: Articulating a Strategy for Grower Cooperation." *Journal of International Development* 20(2008):280–296. doi: 10.1002/jid.1411.

Sriboonchitta, S., and A. Wiboonpoongse. "Overview of Contract Farming in Thailand: Lessons Learned." In S. Setboonsarng and P. Leung, eds., *Making Globalization Work Better for the Poor Through Contract Farming,* Manila, Philippines: Asian Development Bank, 2014, 27–52.

Sugden, F. "Neo-Liberalism, Markets and Class Structures on the Nepali Lowlands: The Political Economy of Agrarian Change." *Geoforum* 40(2009):634–644. doi: 10.1016/j.geoforum.2009.03.010.

Swinnen, J. F. M., and M. Maertens. "Globalization, Privatization, and Vertical Coordination in Food Value Chains in Developing and Transition Countries." *Agricultural Economics* 37(2007):89–102. doi: 10.1111/j.1574-0862.2007.00237.x.

Teklewold, H., M. Kassie, and B. Shiferaw. "Adoption of Multiple Sustainable Agricultural Practices in Rural Ethiopia." *Journal of Agricultural Economics* 64(2013):597–623. doi: 10.1111/1477-9552.12011.

Tollens, E., M. Demont, M. Sié, A. Diagne, K. Saito, and M. C. S. Wopereis. "From WARDA to AfricaRice: An Overview of Rice Research for Development Activities Conducted in Partnership in Africa." In M. C. S. Wopereis, D. E. Johnson, A. Nourollah, E. Tollens, and J. Abdulai, eds., *Realizing Africa's Rice Promise,* London, UK: CAB International, 2013, 1–23. Journal Abbreviation: Realizing Africa's Rice Promise.

Tripathi, R., R. Singh, S. Singh, R. Tripathi, R. Singh, and S. Singh. "Contract Farming in Potato Production: An Alternative for Managing Risk and Uncertainty." (2005). doi: 10.22004/AG.ECON.58460.

Wainaina, P. W., J. J. Okello, and J. M. Nzuma. "Impact of Contract Farming on Smallholder Poultry Farmers' Income in Kenya." 2012. Paper presented at the meeting of the International Association of Agricultural Economists, August 18–24, Foz do Iguaçu, Brazil. doi: 10.22004/ag.econ.126196.

Wang, H., Y. Wang, and M. S. Delgado. "The Transition to Modern Agriculture: Contract Farming in Developing Economies." *American Journal of Agricultural Economics* 96(2014):1257–1271. doi: 10.1093/ajae/aau036.

Wang, H. H., Y. Zhang, and L. Wu. "Is Contract Farming a Risk Management Instrument for Chinese Farmers?: Evidence from a Survey of Vegetable Farmers in Shandong." *China Agricultural Economic Review* 3(2011):489–505. doi: 10.1108/17561371111192347.

Warning, M., and N. Key. "The Social Performance and Distributional Consequences of Contract Farming: An Equilibrium Analysis of the Arachide de Bouche Program in Senegal." *World Development* 30(2002):255–263. doi: 10.1016/S0305-750X(01)00104-8.

Williamson, O. E. "Transaction-Cost Economics: The Governance of Contractual Relations." *Journal of Law and Economics* 22(1979):233–261. doi: 10.1086/466942.

World Bank. "Gender and Agricultural Risk: A Gendered Approach to Agricultural Risk Assessments and Management Strategies." Agriculture Global Practice Discussion Paper, World Bank, Washington, DC, 2017.

Zhu, H., and X. Wang. "An Analysis on the Influencing Factors of Tomato Growers' Participation in Contract Farming in Xinjiang Autonomous Region." *Chinese Rural Economy* 7(2007):67–75.