

Contract Farming, Loan Repayment Performance and Access to Credit of Small Farmers in Pakistan

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Abstract: While small farmers need credit to produce high value commercial crops, asymmetric information about the farmers, among other factors, often limits their access to the rural credit markets. In this study we investigate whether access to better crop market, in the form of a written contract with agro-processing companies for sale of produce, could improve farmers' ability to repay their loans. We also see if the contract farmers have better access to credit in the credit market. Using instrumental variable approach, we find that contract farmers pay back their loan more quickly as compared to non-contract farmers. However, we do not find evidence that the contract farmers have better access to credit in the credit market.

Key words: contract farming, loan repayment performance, Pakistan

1. Introduction

Because of a gap of a few months between input application and output generation in agriculture, farmers either use their own savings or borrow from the credit market to organize production (Bell, 1988). In developing countries, however, the rural credit market does not function well, due to the prevalence of information asymmetry and high volatility of farming income arising from weather risk (Bastiaensen & Marchetti, 2011). Inadequate information about the repayment ability of small farmers was one of the reasons behind failure of a large number of agricultural development banks in developing countries (Yaron, 1994). Reducing the information asymmetry about the repayment potential of small farmers would improve the accuracy of credit market in predicting credit repayment ability of farmers and, therefore, strengthen the rural credit markets.

Recently, agro-processing firms are increasingly operating in rural areas to produce standardized agricultural products through contracting with individual farmers (Reardon & Timmer, 2007). For instance, about 75 percent of poultry production in Brazil, 90 percent of cotton and fresh milk production in Vietnam and 60 percent of tea and sugar in Kenya takes place under contract farming (UNCTAD, 2009). Contract farming refers to an agreement (mostly written) between a farmer and an agro-processing firm whereby the farmer commits to sell the output to that firm and the company in return commits to purchase the output from the farmer in a specific quantity and subject to other predetermined conditions on output prices, production process, etc. Such a contract ensures farmers' access to the output market with assured liquidity at the harvest time. The assured liquidity at the time of harvest can have implications for the loan repayment ability of the contract farmers which, in turn, can enhance their access to credit.

We thus attempt to answer two specific questions in this paper: first, does contract farming enable farmers to repay their credit more quickly, and second does contract farming improve farmers' access to credit in the credit market? For this purpose, we study tobacco contract farmers in Pakistan. Notable features of the study site are the small size of land holdings per farmer and the highly commercialized nature of tobacco crop, which necessitates the small farmers to participate in the markets for both crop inputs and output.

2. Literature

A host of studies in the literature of contract farming observe its positive effect on income and productivity of participating farmers (Bellemare, 2012; Khan et al., 2019; Miyata et al., 2009). Contract farming has also been shown to have positive association with household food security (Bellemare & Novak, 2017), household asset accumulation (Michelson, 2013) and employment of skilled labor on farms (Khan et al., 2019). To the best of our knowledge, only one

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study, Ashraf et al. (2009), relates contract farming with credit and observes that the contracting firm's offer of credit alongside the output contract significantly increases farmers' participation in contract farming for exports market. There is no study, however, about the impact of participation in contract farming on loan repayment performance and access to credit in the credit market.

3. Data and Study Site

3.1 Data

The household level data used in this study was collected in September 2018, primarily in Swabi District, Pakistan, but a small fraction from the adjoining Buner District. Tobacco is the major cash crop of Swabi; accounting for about 55 percent of the total tobacco grown in the country. Due to the large amount of tobacco grown here, a number of international and local tobacco processing companies are located in Swabi. The major international companies are Pakistan Tobacco Company (PTC, which is a subsidiary of British American Tobacco) and Philip Morris International (PMI). PTC is the biggest player in the cigarettes market of the country and therefore we focus on its contract farming scheme.

The survey sample consists of 286 farmers. Among them 123 are contract farmers and 163 are non-contract farmers. However, we found that 67 non-contract farmers had sold to PTC, because, in 2018, tobacco production was below average, due to rain shortage, and PTC had to purchase from non-contract farmers also to meet its requirements. For analysis we dropped these 67 non-contract farmers, resulting in the sample of 219 farmers – 123 contract farmers and 96 non-contract farmers. Contract farmers were randomly selected in two stages (villages and then farmers) from the contract farmers' list of PTC. 18 villages were selected from a total of 75 villages. Non-contract farmers were selected by first listing about 20 non-contract farmers in each village and then randomly selecting about 10 for the survey.

3.2 Contract Farming Scheme and Structure of the Tobacco Market

The tobacco contract farming scheme under study has been in operation since 1959. Compared to local companies, PTC produces higher quality cigarettes. Therefore, to ensure the quality requirements, it undertakes contracts with individual farmers so that the production of tobacco could be monitored and supported. Before cultivation begins, the company officials sign contracts with farmers whereby farmers agree to cultivate the variety recommended by the company and the company commits to buy the produce given that certain quality parameters are fulfilled. Quantity of tobacco is specified, and price is left to be decided as per prevailing market situation at the time of harvest. As in-kind credit, PTC provides seed of the high-quality tobacco as well as about 6 sacks of DAP fertilizer. Other inputs are arranged by farmers themselves. As we would explain later, we exclude the value of in-kind credit from our credit calculations in order to focus exclusively on the credit from the credit market and not on the in-kind credit from the company.

Non-contract farmers generally have two options to market their tobacco i.e. tobacco traders in the market or local companies. Local companies accept all varieties of tobacco from non-contract farmers. In case of sale to a local company, farmers take their produce to the gate but if it is not accepted, they take it to another local company. Although the price difference between PTC and other outlets is small, the payments from tobacco traders and local companies are often delayed or split into multiple payments, due to which the liquidity of the non-contract farmers remain unpredictable even after the sale of their tobacco crop.

4. Methodology

Before analyzing the impact of contract farming on farmers' access to credit and loan repayment ability, we estimate a probit model to investigate the determinants of participation in contract farming. The dependent variable of this model is a dummy variable that takes value of 1 if the farmer has a contract and 0 otherwise. The independent variables include farmer's age, education, family size, amount of land owned, number of farm assets, number of livestock animals and non-farm income of the farmer.

We then analyze the impact of contract farming on access to credit and loan repayment ability. First, we run OLS regression of the following form:

$$Y_{ij} = \alpha + \beta C_{ij} + \gamma X_{ij} + V_j + \varepsilon_{ij}$$

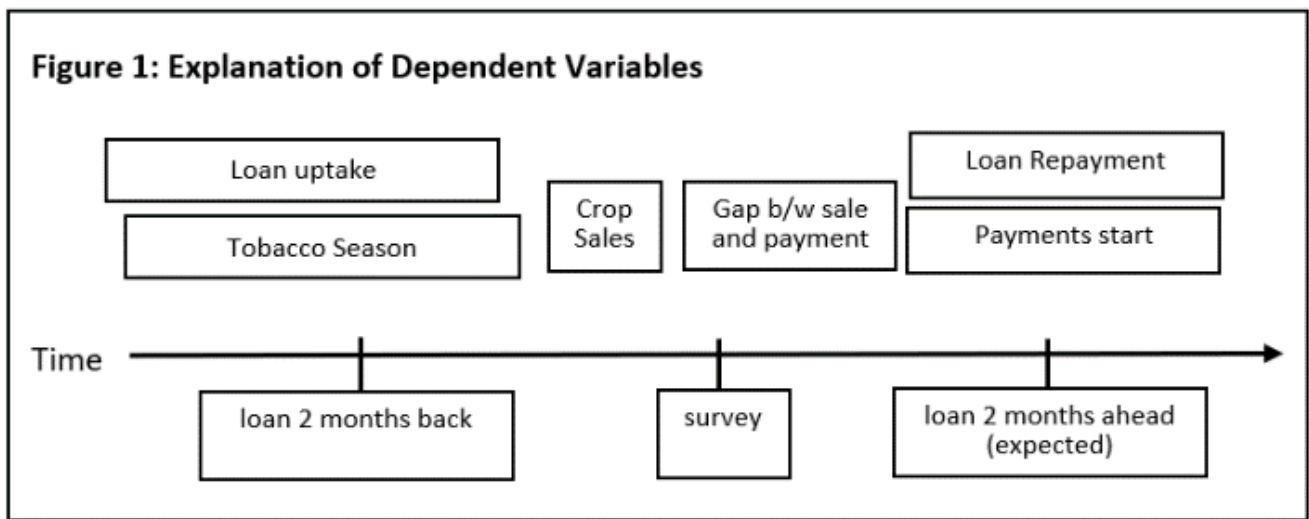
where, Y_{ij} represents the outcome variables for household i in village j ; C_{ij} is a dummy variable indicating participation in contract farming; X_{ij} is a vector of the household and farm level characteristics mentioned above and V_j represents village-specific fixed effects. While C_{ij} is the main variable of interest, it is likely that in OLS setup β is biased due to typically unobservable characteristics, such as entrepreneurial ability and risk aversion, which might be correlated with both participation in contract farming and the outcome variable.

Therefore, to address the issue of endogeneity due to selection into contract farming, we use two-stage least squares (2SLS) approach to address the issue of heterogeneity. Here we use two instruments for participation in contract farming i.e.

birth order of the farmer and number of contract farmers known to the farmer. The relevance and exclusion condition for validity of IV could be argued in the following way. While the birth order of a farmer is exogenously determined, it is possible to be linked with contract farming because in the context of Pakistan, elder brothers are more likely to be engaged in farming and thus inherit more land as compared to younger brothers, while younger brothers are often compensated with other kinds of assets. Since literature of contract farming reports the bias of companies towards the participation of larger farmers (for instance, Otsuka et al., 2016) birth order is likely to be related with participation in contract farming. As far as the number of contract farmers known to the farmer is concerned, it is possible that farmers who know about more contract farmers would be motivated to join the contract. Knowing more contract farmers, however, is not likely to be related directly to a farmer’s access to credit or repayment ability because most of the farmers in the area are small farmers who are not able to support other farmers with credit.

The dependent variables used in the analysis are explained in Figure 1. The survey was conducted about one week after tobacco crops in the area were sold by most of the farmers. During the survey, the farmers were asked about the “total outstanding loan of the household (for agricultural as well as other purposes, irrespective of the sources of loan) two months back (i.e. during the tobacco season)” and “the expected amount of loan two months ahead (i.e. two months after the sale of their tobacco crop)”. Since the tobacco market is small and concentrated in the area, the overall sale takes place in about two weeks. After the sale, the payments to the farmers start at least after a gap of about two or three weeks, including in the case of PTC. However, at the time of crop delivery, the PTC specifies the payment date, which is highly reliable. Tobacco traders and local companies also mention an expected date of payment, but mostly their quoted dates are not completely reliable.

We, thus, measure the outstanding credit of a farmer at two time periods: (a) two months back during the tobacco season, and (b) two months ahead.



We analyze the loan repayment performance of farmers in two different ways. One is by calculating the *amount of loan repaid* in the 4 months period, which is the difference between outstanding credit two months back and outstanding credit two months ahead. We expect this difference to be positively affected by contract farming. The other direct way is to compare the amount of *outstanding loan two months ahead* between contract and non-contract farmers. We expect that contract farming would have a significant negative impact on the amount of outstanding credit two months ahead.

Furthermore, to see the impact of contract farming on access to credit, we proxy the access to credit by two variables. One is *outstanding loan two months back* during the tobacco season. For this variable we assume that during the tobacco season farmers are always in need for more credit. This, however, might not be a strong assumption because, in rural areas, demand for credit is much higher than supply of credit (Gill, 2003) and that about 77 percent of the farmers in our sample have a positive amount of outstanding loan. Second proxy variable for access to credit is a dummy variable indicating if a farmer has taken loan or not. While the former measures the intensive margin, the later measures the extensive margin of the impact.

Additionally, and importantly, to ensure that the in-kind credit from company in the form of NPK fertilizer is not included in our credit measurements, we subtract the value of NPK fertilizer given to the contract farmers by the company from the stated amount of outstanding loan two months back by the contract farmers.

Table 1: Descriptive statistics

Variable	Total	Contract	Non-Contract	t-test
Age of farmer	46.00 (13.76)	47.42 (13.54)	44.17 (13.89)	3.25**
Education of farmer	4.79 (5.06)	5.36 (5.36)	4.05 (4.58)	1.31**
Family size	12.83 (7.12)	13.89 (7.69)	11.48 (6.08)	2.41***
Land owned (Acres)	3.04 (13.33)	3.24 (10.00)	2.79 (16.69)	0.54
Land under tobacco (Acres)	3.83 (3.00)	4.55 (3.39)	2.90 (2.04)	1.65***
Livestock owned	3.49 (4.43)	3.93 (5.28)	2.93 (2.94)	1.00**
Number of farm assets	1.84 (2.41)	2.34 (2.61)	1.21 (1.96)	1.13***
Annual non-farm income (USD)	2,624 (6,984)	2,574 (5,565)	2,689 (8,495)	-115
Loan 2 months back ¹ (in USD)	2,091 (3,229)	2,397 (3,837)	1,698 (2,177)	699*
Loan 2 months ahead (in USD)	1,155 (2,398)	1,173 (2,839)	1,133 (1,687)	40
Loan repaid (in USD)	935 (2,141)	1,224 (2,599)	565 (1,266)	659**
Taken loan	0.77 (0.42)	0.76 (0.43)	0.78 (0.41)	-0.02
N	219	123	96	

1: Value of in-kind credit in the form of six sacks (50kg) of NPK fertilizer is excluded from the amount of loan 2 months back stated by the farmer. Although company also provide seed to farmers, the cost of seed is negligible in tobacco crop. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

5. Results

5.1 Descriptive Analysis

Table 1 presents the descriptive summary of basic household and farm characteristics and farmers' credit behavior. It can be observed that, as compared to non-contract farmers, contract farmers are older, have higher education, and have larger family size. Although contract farmers, on average, have higher amount of land, the difference is not statistically significant. Contract farmers, however, have significantly higher amount of land under tobacco crop. It should also be observed that farmers in both categories are small farmers given that they own less than 4 acres of land, on average. Moreover, contract farmers are better endowed in terms of livestock and farm assets as compared to non-contract farmers in our sample. As far as the amount of credit is concerned, contract farmers have significantly higher amount of loan two months back (i.e. during the tobacco season). Although there is no significant difference in amount of loan two months ahead, contract farmers the amount of loan repaid is significantly higher for contract farmers as compared to non-contract farmers. Moreover, about 77 percent of the farmers in the sample have reported positive loan amount during the tobacco season, whereas, the remaining 23 percent have not taken any loan during the tobacco season.

Table 2: Probit model results for participation in contract

VARIABLES	(1)	(2)
	Contract farming	Contract farming
Age of farmer	0.018** (0.007)	0.013* (0.008)
Education of farmer	0.054** (0.021)	0.044** (0.022)
Family size	0.025* (0.014)	0.024* (0.014)
Land owned	-0.011 (0.016)	-0.010 (0.017)
Livestock owned	0.007 (0.023)	-0.005 (0.024)
Number of Farm assets	0.122*** (0.041)	0.117*** (0.043)
log non-farm income	0.042 (0.027)	0.045 (0.028)
Birth order of farmer		-0.129* (0.072)
Contract farmers known		0.018*** (0.005)
Constant	-1.683*** (0.441)	-1.462*** (0.488)
Observations	219	219
Pseudo R-squared	0.103	0.163

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

5.2 Determinants of Participation

Table 2 presents the estimation results of probit model for participation in contract farming. We find that senior and more educated farmers are likely to participate in the tobacco contract farming scheme might reflect the preference of companies to contract with more trustworthy and educated farmers. Similarly, family size is positively related to participation in contract farming which may indicate the importance of family labor in producing high quality crops. Moreover, farm assets i.e. machines and bullocks, are also a significant correlate of having contract which shows that contract farmers are comparatively better endowed than non-contract farmers.

We also observe that the two instrumental variables i.e. birth order of the farmer and number of contract farmers known to the farmer are significantly correlated with participation in contract farming. As per our expectation, higher *birth order* is negatively associated with participation in contract farming and the number of *contract farmers known* is positively associated.

5.3 Impact of Contract Farming on Loan Repayment Performance and Access to Credit

Table 3 presents the results obtained for the impact of contract farming on loan repayment ability and access to credit. Column 1 and 2 show that results for the amount of outstanding loan two months after the sale of tobacco crop and column 3 and 4 show the results for the amount of loan repaid during the four months period under analysis. For each of these two dependent variables, the first column reports OLS results and the second column reports the 2SLS results. The sample size in these regressions is 169 because we only consider those farmers who have taken a positive amount of loan during tobacco season (50 farmers who have not taken any loan are not included). In almost all the 2SLS regressions, the instrumental variable (IV) used fulfills the criterion of strong IV i.e. the F-statistic from the first stage regression should be greater than 10 (see Appendix Table 1A for detailed results of the first stage regressions in 2SLS).

The OLS regression in column 1 does not show any impact of participation in contract farming on the outstanding loan amount two months after the sale of tobacco crop. However, the 2SLS estimates in column 2 shows that participation in contract farming significantly reduces the amount of outstanding loan two months after the sale of tobacco crop. Similarly, the 2SLS results for the second indicator of the loan repayment performance i.e. amount of loan repaid, in column 4, also point towards a significant and positive impact of contract farming on the amount of loan repaid during the four months period under analysis. Therefore, we can conclude on the basis of these results that participation in contract farming significantly improves the loan repayment ability of the farmers. Regarding the magnitude of the effect, based on the 2SLS

coefficients, contract farming, on average, decreases farmer's outstanding credit two months after the sale of tobacco crop by about 1900 USD. Similarly, contract farming increases the amount of loan repaid by about 2500 USD.

Next, to see whether participation in contract farming improves farmers' access to credit, column 5 and 6 report the results for the impact of contract farming on the amount of loan two months back i.e. during the tobacco season, whereas, column 7 and 8 report the results for the impact of contract farming on the probability of taking loan during the tobacco season. We see that participation in contract farming does not have any impact on either the amount of loan taken during the tobacco season or the probability of taking loan during the tobacco season. This, therefore, may indicate that participation in contract farming does not improve farmers' access to credit.

Among explanatory variables other than contract farming, we find that age of farmer is significantly and negatively correlated with the loan repayment ability of farmers indicating that young farmers might have higher ability to repay their credit. Large family size also reduces the ability to quickly repay the loan. Surprisingly, we also find that non-farm income is significantly negatively correlated with loan repayment ability. This is contrary to our expectation, but it may be possible if income from non-agricultural sources gives room to the farmer for not performing well in the credit market.

6. Conclusion and Policy Implications

Using primary data from Pakistan, we demonstrated that contract farming significantly improved small farmers' loan repayment performance. However, while contract farming significantly improves the loan repayment ability of the farmer, we do not find evidence that this ability translates into enhanced access of contract farmers to the credit.

Based on these findings, we would encourage formal credit institutions to consider partnering with contracting companies for loan disbursements to small scale farmers. The contract signed between the company and the farmer could reduce asymmetric information problems associated with non-collateralized credit.

Table 3: Impact of contract farming on loan repayment performance and access to credit

Model	(1) OLS	(2) 2SLS	(3) OLS	(4) 2SLS	(5) OLS	(6) 2SLS	(7) OLS	(8) 2SLS
	----- Loan repayment performance -----				----- Access to credit -----			
Dep. Variable	<i>Outstanding loan two months ahead</i>	<i>Outstanding loan two months ahead</i>	<i>Loan repaid</i>	<i>Loan repaid</i>	<i>Loan two months back</i>	<i>Loan two months back</i>	<i>Taken loan</i>	<i>Taken loan</i>
Age of farmer	27.7* (16.4)	32.7* (16.7)	-10.0 (12.1)	-16.9 (14.2)	17.6 (20.1)	15.8 (20.0)	-0.0016 (0.0023)	-0.0012 (0.0024)
Education of farmer	27.0 (55.3)	35.2 (55.1)	41.6 (40.9)	30.3 (46.0)	68.6 (67.6)	65.5 (64.4)	0.0055 (0.0069)	0.0070 (0.0078)
Family size	94.7* (54.6)	108** (53.2)	41.8 (35.4)	24.0 (34.2)	137* (74.7)	132* (70.4)	0.0016 (0.0040)	0.0019 (0.0038)
Land owned	-1.44 (67.5)	-24.1 (68.4)	27.3 (83.1)	58.4 (73.5)	25.8 (105)	34.3 (97.3)	-0.0082** (0.0036)	-0.0091** (0.0041)
Area under tobacco	138 (118)	243* (140)	69.3 (146)	-74.2 (140)	207 (174)	168 (161)	-0.011 (0.014)	-0.0071 (0.015)
Farm assets	-138* (76.8)	-73.2 (81.6)	141 (85.6)	51.3 (88.6)	2.37 (110)	-21.9 (115)	-0.010 (0.0085)	-0.0084 (0.0091)
log non-farm income	98.6 (62.0)	131** (63.2)	19.1 (54.4)	-25.6 (55.4)	118* (71.0)	106 (64.6)	-0.011 (0.014)	-0.0083 (0.015)
Contract farming	-238 (412)	-1,881* (1,063)	224 (303)	2,481* (1,315)	-14.0 (476)	599 (1,486)	0.062 (0.063)	-0.022 (0.21)
Constant	-3,027* (1,542)	-3,029** (1,475)	-377 (1,149)	-374 (1,281)	-3,404* (1,921)	-3,403* (1,790)	0.74*** (0.24)	0.74*** (0.23)
First stage <i>F</i> -statistic	-	10.1	-	10.1	-	10.1	-	9.8
Observations	169	169	169	169	169	169	219	219
R-squared	0.298	0.235	0.250	0.099	0.333	0.328	0.221	0.214

Village fixed effects are included in all the regressions.

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

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Appendix

Appendix Table 1A: 2SLS first stage results

	(1)	(2)
Corresponding columns in Table 3	2, 4, 6	8
<u>Dep. Variable: Contract farming</u>		
Age of farmer	0.0016 (0.0029)	0.0029 (0.0026)
Education	0.000034 (0.0088)	0.013* (0.0070)
Family size	0.0091* (0.0052)	0.0021 (0.0045)
Land owned	-0.014 (0.012)	-0.0100* (0.0054)
Area under tobacco	0.061*** (0.018)	0.040*** (0.013)
log non-farm income	0.018* (0.010)	0.020** (0.0090)
Farm assets	0.041** (0.016)	0.032** (0.014)
Contract farmers known	0.0052*** (0.0015)	0.0044*** (0.0014)
Birth order of farmer	-0.068*** (0.026)	-0.053** (0.023)
Constant	-0.061 (0.28)	0.058 (0.23)
First stage F-statistic	10.1	9.8
Observations	169	219
R-squared	0.413	0.361

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1