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Farmer's risk attitude, supply chain and perceived benefits in contract farming: The case of tobacco growers in Pakistan

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ABSTRACT

The transformation of agriculture systems into high-value supply chains implies a renewal of grower-processor relations in developing countries. This study investigates the supply chain differentiation that the farmers come across during tobacco cultivation in Pakistan and farmer's risk attitude which affects their perceived benefits of contract farming and subsequently their participation's decision by using the survey data collected from Khyber Pakhtunkhwa and Punjab, Pakistan. Results from the probit model show that risk attitude of the farmers along with their household size, land ownership status and total monthly income affect the participation of tobacco growers in contract farming agreement, significantly. Similarly, price protection is the major motivation behind participation in contract farming as far as perceived benefits of contract farming in this study are concerned. Insights obtained from the ordered logit results highlight the criteria that planners should consider in order to better design contractual arrangements so as to satisfy the specific needs of the tobacco growers. The findings of this study will help to improve the understanding of farmers' behavior and encouragement of risk seeking farmers by anticipating the benefits in term of reduction in production cost, decreasing marketing costs and focusing more on quality improvements for tobacco crop.

INTRODUCTION

The development of agriculture continues to play a key role in the transformation of economies in Asia Pacific. This shift towards the adoption of high-value supply chains implies a renewal of grower- processor relations in developing countries (Boselie et al., 2003; Reardon et al., 2003). There is an emerging body of literature analyzing how smallholders can be linked successfully to modern supply chains (e.g., Asfawet al., 2009; Henson et al., 2005; Huang et al., 2007; Maertens and Swinnen, 2009). There are also numerous studies which discussed the benefits related to adoption of contract farming practices (Glover, 1987; Gow, 2001; Mangala and Chengappa, 2008; Peterson et al., 2001; Simmons et al., 2005; Singh, 2002). The consequences and impacts of supply chain differentiation may also be different in developed and developing economies. While, in developed countries, farmers are concerned about losing their independence and important business decision skills (Schulze, Spiller and Theuvsen 2006); however, farmers in developing countries may acquire better production technology and receive a higher return to improve their welfare (Miyata, Minot and Hu 2009; Tripathi, Singh and Singh 2005). For developing countries, there are some potential benefits associated with contract farming. Since, the farm scale tends to be small, farmers being less educated with less efficient production and management technologies, therefore contracting with a large agribusiness firm may be the only way farmers can access higher-end markets and receive higher returns (Barrett et al. 2012). For instance, contracts imposed by modern retailers often involve a number of requirements, such as minimum quantities to be delivered or certain quality specifications, which are difficult to meet by smallholder farmers. Moreover, lack of credit or delayed payment in contract schemes may deter small farms from participating. Depending on the availability of other marketing options, smallholders may also simply be reluctant to commit themselves to a certain buyer. Although, contract farming may lead to improvements in quality and safety for consumers and reduced risk and increased productivity for farmers, however, the potential importance of contract farming in developing countries raises important issues for governments regarding their policy to promote, regulate, or prevent the development of contract farming (Wang et al. 2014).

The tobacco crop is of high economic significance in terms of valuable foreign exchange as about Rs.2334.3 million (US$ 24 million) worth of tobacco and cigarettes were exported by Pakistan during 2010-11. It is also a high value cash crop for the farmers of Khyber Pakhtunkhwa. Being a highly labor intensive crop, it provides farm level employment to nearly 80,000 people, around 50,000 people in cigarette factories and one million people in the marketing of tobacco and its products (Ali et al, 2014).

Ministry of commerce (2016) in exercise of the powers conferred by section 30 of Pakistan tobacco board ordinance 1968 has made different rules for intimation regarding purchase targets, execution of contractual agreement, payment of dues to the growers, commencement of purchase season, record of purchases and the weighted average price to be paid to the growers.

The traditional marketing system of tobacco involves farmers selling cured tobacco leaves to traders, who then sell the produce to institutional buyers. Prices are settled on the spot and farmers are free to choose traders, except under tied credit, explained below. This traditional system has increasingly been replaced by farmers selling directly to institutional buyers, often under a contract-growing arrangement. This typically involves the buyer specifying plant variety and management practice, while providing technical and other support in the form of advances of inputs and even cash. The farmer is formally obligated to sell to the contracted buyer, though side selling is rampant (and legal recourse by either buyer or seller is rarely encountered.)

According to the institutional buyers interviewed, such opportunism is a major constraint in expanding the number of farmers engaged by contract. Traditional traders also offer credit, which entails compulsory sale of the borrower’s harvest to the lender, with credit and interest charges

deducted from the sale. However, such traders otherwise place no conditions on production method, quantity targets, or pricing; such credit – output interlinkage is therefore not classified here under contract farming (Briones, 2015).

The aim of the research paper is to demonstrate contract farming for tobacco being one of the major cash crops in Pakistan agriculture. This paper examines the extent to which the risk attitudes of the farmers have influenced the respondents' participation in contract farming. The findings in this research paper give an insight in highlighting and ranking different components of perceived benefits of contract farming. A novelty adopted in this paper is to pin down and differentiate among different components of perceived benefits of contract farming as far as participation in contract farming practices and the risk attitude of tobacco farmers is concerned. A corollary purpose of this research is to draw implications of the study.
The rest of the paper is organized as follows: Section 2 highlights the conception and methodology; section 3 specifies study area and survey data; while results and discussions are presented in section 4. Section 5 concludes and suggests some policy implications.

Conception and methodology
The measurement of risk perception and risk attitudes, and their link to actual risk behaviors have been extensively discussed and being labeled as the most significant achievements in risk research in the past decade (Renn, 1998). For instance, perceptions and preferences have been used most often to explain the adoption decisions for different risk management tools. (Hansson and Lagerkvist 2012; Petrolia, Landry, and Coble 2013; Wang et al. 2012). However, the potential impact of perception of risk management instruments on the decision to use those instruments has rarely been addressed (Ye et al. 2017). How do risk bearers perceive risk management instruments, and how does this perception influence the adoption of risk management instruments e.g. the perceived benefits and costs of using those instruments (Soane, Dewberry, and Narendran 2010)?
In supply chains, a common coordination scheme is contract farming, in which agricultural production is carried out based on agreement between the buyers and farmers, which establishes conditions for the production and marketing of farm products (Briones, 2015). The new agricultural economy is characterized by the rising influence of contract farming (Opera, 2003) and there is a continuous switch from buying through spot-market transactions to contractual agreements with farmers, often through specialized intermediaries (Balsevich et al.2006; Berdegué et al., 2005; Neven et al., 2009; Rao and Qaim, 2011). With few exceptions (Blandon et al., 2009; Guo et al., 2007; Masakure and Henson, 2005), available studies explain farmers' participation in modern supply chains through farm, household, and contextual characteristics, without explicitly accounting for subjective attitudes. This implicitly assumes that all farmers would sell in modern supply chains, if they were able to. In reality, this may not always be the case. Using the example of tobacco growers in Pakistan, this article addresses these research gaps by analyzing supply chain differentiation, farmers risk attitude and their behavior towards perceived benefit of contract farming.

Risk attitude
A Farmer exhibits risk-averse behavior and the risk attitude is related to a series of socioeconomic characteristics (Picazo and Wall, 2011). The risk attitudes of the farmers were figured out using utility function and the most commonly used method to elicit utility from an economic agent is the Equally Likely Certainty Equivalent (ELCE) model (Hardaker et al, 2004) where certainty equivalents (CE) are derived for a sequence of risky outcomes and matches them with utility values (Binici et al., 2003). For instance, the respondent was asked to specify the monetary value of a sure

outcome that makes him indifferent to the two risky outcomes of PKR (Total Household Income in Pakistani Rupee, say 50,000 PKR and 0 PKR with equal probability. Suppose the response was 26,400 PKR, the respondent was again asked to specify the monetary value of a sure outcome that makes him indifferent to the two risky outcomes of 26,400 PKR and 0 PKR with equal probability. Suppose the response was 14,500 PKR.

This process continued till sufficient data points were collected. For the other half of the income distribution, the farmer was asked to specify the monetary value of a sure outcome that makes him indifferent to 26,400 PKR and 50,000 PKR each with 0.5 probabilities. In this way, several CE points were obtained and matched with their respective utility values. The utility value attached with the lower outcome (PKR 0) is 0 and with the higher outcome (50,000 PKR) is 1. The farmer's response of PKR 26,400 was his CE for uncertain payouts of 50,000 PKR and 0 PKR with equal probabilities (0.5 each) and the utility value for this CE is calculated as;

U (26,400) = 0.5u (0) + 0.5u (50,000) = 0.5(0) + 0.5(1) = 0.50 (1)

Similarly the utility values for all the CE points are calculated and are presented in Appendix 1 (for this example).

After deriving several certainty equivalents and matching them with utility values, a cubic utility function was used to estimate the utility of each individual respondents. The cubic utility function can be written as;

$u(w) = \alpha_1 + \alpha_2 w + \alpha_3 w^2 + \alpha_4 w^3$ (2)

The cubic utility function is consistent with risk aversion, risk preferring and risk indifferent attitudes (Binici et al., 2003). The utility is generally measured on an ordinal scale; however, the shape of the utility function on an ordinal scale can be transformed into a quantitative measure of risk aversion called absolute risk aversion (Pratt, 1964; Arrow, 1964). The absolute risk aversion is mathematically defined as;

$$r_a(W) = -\frac{U^1(W)}{U^2(W)} \quad (3)$$

$r_a(W)$ is the coefficient of absolute risk aversion, U^1 and U^2 are first and second order derivatives of wealth (W) respectively. Here, income is substituted for wealth for the purpose of this analysis (Olarinde et al., 2007).

1.1. Empirical specification and probit model

In the descriptive statistic table 1, participation in contract farming serves as the dependent variables for probit model, while socio economic characteristics along with risk attitude of the farmers and off-farm diversification strategy adopted by them are taken as independent variables. Probit regression is a type of regression where the dependent variable can only take two values. The purpose of probit regression is to estimate whether a tobacco grower having particular characteristics are influencing their probability to participate in contract farming or not? For this we treated contract farming as a dichotomous variable, based on their engagement in contract farming (Y=1) or non-contract farming (Y=0) and estimated the probability of contract farming through pobit model (Gujrati, 2003). The probit model is given as

$$Y = \alpha + \sum X_i\beta + \epsilon \quad (4)$$

Where Yi is the dichotomous dependent variable, in our case Yi represents the farmers who participated in contract farming practices. Xi is a vector of independent variables used in the analysis (such as socio-economic characteristics of the farming households, risk attitude of the farmers and adoption of off-farm diversification), βi is the vector of unknown parameter (to be estimated) and εi

is the error term. The resulting coefficients are interpreted by presenting marginal effects, which explain the change in dependent variable given a unit change in independent variables (Table 2).
The socio economic and demographic factors included in this paper are the age of respondent, education level, household size, farm size of the household with tobacco farm size, farming experience of the respondent, land ownership status; and monthly household income (also bifurcated into farm income and off-farm income). Age, education and farming experience of the household representing number of years are continuous variables, the household income is the total monthly income of the household from farm and off-farm sources in Pakistani Rupee (PKR), the household size is measured as headcount of family members in the household, the total farm size and tobacco farm size is measured as number of hectares that a household operates, and the land ownership status is represented by 1, if the farming household is owner of the land and 0, otherwise. Off-farm diversification strategy is chosen in our sample because it is the most frequently adopted tool by tobacco growers parallel to contract farming. Moreover, data was collected on the perceived benefit of contract farming and the details are presented in part B of table 1.

Contract farming perceived benefits

Following Guo et al. (2007), the tobacco growers were asked to rank the individual components of perceived benefits from contract farming using a three-point Likert scale i.e. none, somewhat or significant. The data extracted with three-point Likert scale was then utilized to estimate an ordered logit model for establishing the association among tobacco growers regarding their behavior related to perceived benefits of contract farming.
Following McCullagh & Nelder (1989), the data was used by a proportional Odds cumulative logit model with five dummy variables to distinguish among the six reported components of the perceived benefits. The model used has two intercepts (one for each of the logit equations) and 5 slopes, for a total of 7 free parameters. By comparison, the saturated model, which fits a separate 3-categories multinomial distribution to each of the six contract farming perceived benefit components, has 6 x (3-1)= 12 parameters to be estimated. Therefore, the overall goodness-of-fit test will have 12 – 7 = 5 degree of freedom.
The Logit equation would be then;

$$L_1 = Log \frac{P(Y \leq 1)}{P(Y > 1)} = \alpha_1 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 \quad (5)$$

$$L_2 = Log \frac{P(Y \leq 2)}{P(Y > 2)} = \alpha_1 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 \quad (6)$$

$$\vdots$$

$$L_n = Log \frac{P(Y \leq n)}{P(Y > n)} = \alpha_1 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 \quad (7)$$

Study area and survey data

This study focuses on farmers' risk attitude, their perceived benefits of contract farming and supply chain differentiation for tobacco growing in Pakistan. It is grown in all provinces of Pakistan (with 75% of the share in the total production by KP, 21% by Punjab, 3 % by Sindh and only 1 % by Balauchistan) but KP is the only province which leads in production with a high margin (Ali et al., 2015).

Figure 1: Map of Pakistan with Khyber Pakhtunkhwa Province and Study Districts

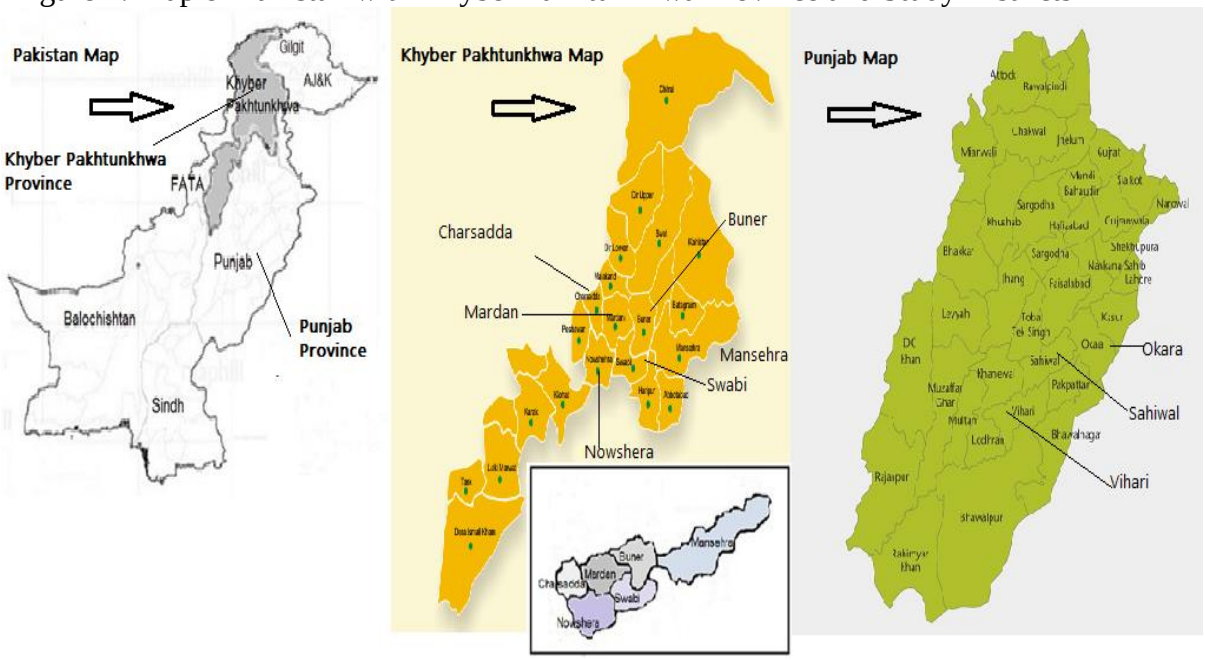


Figure 1: Map of Pakistan with Punjab and Khyber Pakhtunkhwa Province.
Note: Study Districts pointed out in Individual Province Map

A multistage sampling technique was used while selecting the study area and the respondents. In the first stage, KP was selected as the main study area owing primarily to the fact that around 78% of Pakistan's entire tobacco crop and nearly all of the FCV tobacco is produced in KP province. The yield/ hectare of tobacco produced in KP province is 14% higher than the global average and 22 % higher than the national average (Pakistan Tobacco Board, 2013). Similarly, as Punjab produces 20 % of the Pakistan entire tobacco crop (Ali et al., 2015), therefore was being selected for its major share in Dark Air Cured (DAC) tobacco production. In the second stage, major tobacco producing districts for FCV tobacco (namely, Swabi, Mardan, Charsadda, Nowshera, Buner and Mansehra) and DAC tobacco (namely Okara, Sahiwal and Vehari) shown in Figure 1 were selected based on their major contribution to the overall tobacco (FCV and DAC) production. In the third stage, a sample size of 302 tobacco growers (including 202 FCV farmers and 100 DAC farmers) was drawn using the Yamane (1967) formula from a total of more than 22,500 tobacco growers reported by Pakistan tobacco board in the target area.

The formula used to calculate the sample size is given as;

$$n = \frac{N}{(1 + N.e^2)} \qquad (8)$$

Where "n" is the sample size, "N" is the total number of farming household in the study area and "e" is the margin of error set at 7% i.e. 0.07 (Hussain & Thapa 2012; Saqib et al., 2016). The data was collected from the sampled respondent through a comprehensive interview schedule including all the relevant information regarding socio economic characteristics of the farm household; income sources; indicators to assess farmers risk attitude and various components of perceived benefits from contract farming.

Table1: Characteristics of tobacco farmers.

(A): Descriptive statistics of sampled respondents			
Variables **Mean (SD)**	**Total sample** **(n= 302)**	**Contractor** **(n= 258) 85.4%**	**Non contractors** **(n=44) 14.6%**
Age (years)	**43.81** (11.01)	**44.34** (10.96)	**40.70** (10.88)
Education (years)	**6.28** (4.98)	**6.04** (4.98)	**7.75** (4.79)
Farming experience (years)	**30.54** (11.11)	**31.22** (10.99)	**26.52** (11.08)
Total income (PKR)	**52050** (37492)	**50171** (37700)	**63068** (34627)
Farm income (PKR)	**41570** (27684)	**40810** (28396)	**46023** (22838)
Family size (head count)	**8.45** (2.89)	**8.54** (2.94)	**7.90** (2.54)
Farm size (ha)	**2.71** (3.39)	**2.62** (3.39)	**3.24** (3.41)
Tobacco farm size (ha)	**1.43** (1.09)	**1.38** (1.03)	**1.73** (1.41)
Land ownership	**0.467** (0.747)	**0.434** (0.74)	**0.65** (.69)
Off-farm income (PKR)	**10447** (16480)	**9322** (15798)	**17045** (18903)
Risk averse (%) Risk seekers (%)	**77.2** **22.8**	**80.60** **19.40**	**56.8** **43.2**

(B): Contractual agreements by tobacco growers.		
Name of Contracting company	Frequency	Percentage
Pakistan Tobacco Company (PTC)	120	39.7
Philip Morris International (PMI)	55	18.2
Other companies (Local)	08	2.6
Both PTC and PMI	65	21.5
Multinational (any) and local company	10	3.3
No agreement (Free market sellers)	44	14.6

(C): Distribution of farmers based on their perceived benefits from contract farming (for only contract farmers)				
Components of perceived benefits	None	Somewhat	Significant	Mean (SD)
(i) Reducing production cost	179	70	09	1.34 (.543)
(ii) Quality improvements	31	184	43	2.04 (.534)
(iii) Increase sale price	26	158	74	2.18 (.595)
(iv)Price protection	1	20	237	2.91 (.293)
(v) Reducing marketing cost	172	81	05	1.35 (.517)
(vi)Engage family labor	91	152	15	1.70 (.570)

Source: Derived from the survey data.

From the survey data, descriptive statistics of different variables used in this study are generated and presented in table 1 to compare similarities and differences between contract and non-contract farmers. The average tobacco farmer in our sample is in his mid-40s with an average of six years of educations and has been farming for more than thirty years. The descriptive statistics show that contract farmers are more in age with greater farming experience and less education level than the non-contract farmers. On average, almost 86% of the farmers are cultivating tobacco under contract farming agreement with cigarette manufacturing companies. Among these contract farmers, 40% of the tobacco growers were in contract with British American Tobacco (locally known as Pakistan

Tobacco Company), 18% with Philip Morris International (locally known as Lakson Tobacco Company), while 21% were in contractual agreement with both of the above mentioned multinational companies. Similarly, 2.6% of the tobacco growers have contractual arrangements with local companies, 3.3% with both local and multinational companies, while almost 14.6% of the sampled respondent reported that they prefer to sell tobacco in the open market without any formal contract. All the tobacco purchasing companies are bound to buy the pre-determined quantity of tobacco as mentioned in the contract agreement.

The total farm size of tobacco farmers is less than 3 hectares with more than half of the farm allocated for production of tobacco crop. The family size of the contract farmers exceeds by one person on average than the non-contract farmers for each of the household in our sample. In the overall study sample, tenant farmers are inclined more towards growing tobacco under contract agreement than owner farmers. The total income of the sampled respondent comprises 79% of farm income and 21% of the income through non-farm activities. Similarly, more than 77% of the total respondents are risk averse with a degree of risk aversion more in contract farmers than the non-contract farmers.

Results and discussion:

Risk attitude

The risk attitude of the farmers is included in the analysis as 1, if individual reflect risk averse nature and 0, otherwise. The $r_a(W)$ calculated by using equation (3) is positive if individual is risk averse, negative if individual prefers risk and zero if individual is indifferent to risk. Appendix 2 shows risk aversion coefficient and regression analysis results calculated for farmer 1. Following the same methodology, a regression analysis was conducted independently for 302 farmers to calculate risk aversion coefficient for further analysis of risk attitude exhibited by tobacco growers in the study area.

Probit model results

Using farmers and farm characteristics, a probit model was estimated to determine the likelihood of independent farmers to engage in contract farming.

The probit analysis was used to estimate the extent to which socio-economic or demographic characteristics and attitudes influenced tobacco farmers' willingness to participate or engage in contract farming. The interpretation of the estimated coefficients of the probit model is a bit tricky. The signs of parameter estimates and their statistical significance indicate the direction of the response associated with the presence or level of a particular variable and the marginal effects specify the change in dependent variable given a unit change in independent variables. Table 2 shows the econometric results including regression coefficient and marginal effects with their significance level. The pseudo-R^2 equals 0.1693, indicating a goodness-of-fit for cross-sectional data of this kind. Some socio-economic variables in this study are statistically insignificant suggesting that these variables are not determinant factors in contract farming participation decisions. However, the results suggest that participation or non-participation of farmers in contract farming is explained by other factors, most by farmers' household size with their land ownership status and total income of the household.

Table 2: Parameter estimates from probit model for contract farming with marginal effects

Independent variables	Coefficient	Marginal effects (dy/dx)
Socio-economic characteristics (FCV tobacco growers)		
Age	.0092	.0016
	(.0190)	(.0032)
Education	.0099	.0017
	(.0269)	(.0046)
Household size	.1259**	.0217**
	(.0521)	(.0084)
Farm size	.1951	.0337
	(.1761)	(.0302)
Tobacco farm size	.1628	.0281
	(.3323)	(.0572)
Farming experience	.0025	.0004
	(.0183)	(.0031)
Land ownership status	-.5695**	-.1010**[1]
	(.2616)	(.0476)
Total income	-.00001*	-.000029*
	(.000094)	(.00000)
Risk Attitude		
Risk aversion	.1130*[1]	.0202*[1]
	(.3835)	(.0713)
Off-farm diversification	.3047[1]	.0520[1]
	(.3480)	(.0584)
Log Likelihood value	-69.03	
Wald Chi^2 (10)	**28.14*** **	
Prob > Chi^2	0.001	
Pseudo-R^2	0.1693	
Total observations	302	

Note: Figures in parentheses are standard errors. *,** and *** represent statistical significance at 10%, 5% and 1% level respectively. ([1]) dy/dx is for discrete change of dummy variables from 0 to 1.

The age of the farmers has a positive effect on their decisions to participate in contract farming practices which is in consistence with the findings of Katchova and Miranda (2004) for soybean farms in United States but deviate from Simmons and Patrick (2005) who reported a significantly negative effect of age for seed corn growers in Indonesia.

For Education, our analysis suggest a positive but insignificant results and is strengthened by a number of studies showing that education level of the household head is not significantly related to contract farming participation decisions (Bellemare 2012; Wang, Zhang and Wu 2011; Wang, Yu and Li 2013).

Similarly, our results suggest an insignificant positive effect of farming experience for the tobacco growers in their decisions to adopt contract farming buttressed by Arumugam, Arshad and Mohammad (2011) who also uncovered a non-significant effect of farming experience on Fresh fruits and vegetable farmers' participation in contract farming but Zhu and Wang (2007) find a

negative effect, indicating that more experienced farmers are less likely to contract. These conflicting findings for relationship between farmers experience and contracting are due to commodity-specific effects (Birthal, Joshi and Gulati 2005).

Our findings conclude that the effect of farm size along with the relative increase in tobacco farm size is seen positive on farmers' decision to sign a contract for marketing tobacco crop. The effect of land acreage has shown a significantly positive relationship with contract participation in a large number of studies (Arumugam, Arshad and Mohammad 2011; Wang, Yu and Li 2013; Hu 2012). This positive relationship may be due to the common belief that the farmers with larger farm size are more likely to be offered a contract by the processor in their view for transaction cost-saving benefits. This is not surprising considering that households with larger landholdings are less likely to be constrained by land availability in deciding whether to participate in contract farming.

Table 3: Parameter estimates from proportional Odds cumulative logit model

Perceived benefits (Rating)	**Overall sample**		**Risk averse**		**Risk seekers**	
	Coefficient	Wald	Coefficient	Wald	Coefficient	Wald
(A) Reduce production cost	-1.380***	56.91	-1.461*** (.205)	50.684	-1.064** (.406)	6.870
(B) Improve quality	1.212***	42.10	1.154*** (.210)	30.264	1.428*** (.413)	11.954
(C) Increase sale price	1.727***	80.66	1.704*** (.217)	61.861	1.833*** (.422)	18.911
(D) Price protection	5.104***	333.42	5.291*** (.325)	264.62	4.483*** (.555)	65.144
(E) Reduce marketing cost	-1.281***	50.01	-1.323*** (.202)	42.759	-1.125** (.408)	7.590
(F) Engage family labors	0^A		0^A		0^A	
Threshold parameters						
μ_1	-.589	22.171	-.641*** (.140)	20.823	-.393 (.278)	1.999
μ_2	2.681	272.017	2.734*** (.184)	220.50	2.505*** (.350)	51.313
Log Likelihood	64.73		56.73		49.162	
LR $Chi^2(5)$	1182.28***		933.71***		188.734***	
Goodness-of-Fit						
Pearson $Chi^2(5)$	8.314		3.837**		9.897**	
Deviance $Chi^2(5)$	7.213		4.211		8.077	
Pseudo R^2						
Cox and Snell Nagelkerke McFadden	.514 .582 .336		.527 .597 .349		.467 .527 .290	
No. of observations	258		208		50	

Note: The parameter is automatically set to zero for comparison purpose in SPSS. *,** and *** represent statistical significance at 10%, 5% and 1% level respectively.

The results further suggest that household with more family members significantly encourage the adoption of contract farming and as the large family size means more labor force and working hand, it encourages the use of off-farm diversification to maximize their household income. Which are consistent with Cahyadi and Waibel (2013) and yahya (2016). Households in developing countries often have underemployed family labor and a benefit of contracting may be to utilize underemployed family labor but in analysis unexpectedly, family size did not affect contract participation (Hayami and Otsuka, 1993).

The land ownership status significantly discourage the adoption of contract farming as the owner farmers in general can take more risk than the tenants and can sell their tobacco crop in the open market without signing any contract. Inconsistent with yahya (2016) who identified a positive but insignificant relation.

The increase in total monthly income of farmers discourage them to use contract farming. Our results are in contrast with those of Wainaina et al., (2012) who reported that a farmer's financial endowment increases the probability of participating in contract farming but in line with the findings of Rehima et al, (2013). And the general belief is that if his wealth increases, he becomes less risk averse and is less likely to accept a crop-share contract Huffman and Fukunaga (2008).

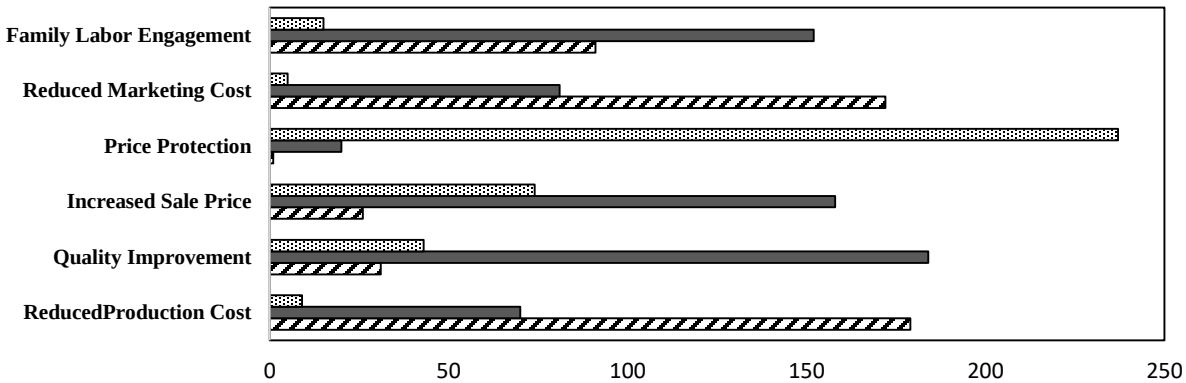
Our results conclude that the risk-averse nature of the farmers has a significantly positive impact on their decision to use contract farming, a result that is consistent with the findings of Kouame (2010) and Wainaina et al., (2012). Martin (1995) reported risk reduction as one of the main objectives of contract farming.

Perceived benefits of contract farming

The different components of perceived benefits from contract farming were included on the basis of initial information collected from all the stakeholders involved in tobacco production in Pakistan. The major perceived benefits as per tobacco stakeholders were reduction in production cost for tobacco, improving quality of tobacco crop, yearly increase in sale price for tobacco, price protection due to contract agreement, reduction in marketing costs and engaging family labor in tobacco contract farming practices. The tobacco growers were asked to quantify the potential components of perceived benefits from contract farming, using a Likert scale on scale with three parameters. The details of the individual responses by the tobacco growers for each component of the perceived benefits is given in part B of the table 1 and Figure 2.

From table 1 part B that records the number of tobacco growers who rated a particular perceived benefit of contract farming on Likert scale, we can easily see that Price Protection was the most important perceived benefit component in contract farming, while reduction in marketing cost is the least important perceived benefit component. Ton et al. (2018) also reported the protection from price risk as one of the important motivations for the contracting farmers. However, for the other components the hierarchy of perceived benefit is not quite straight forward. Therefore, for our comparison purpose as being mentioned in section 2.3, the saturated model, which fits a separate 3-categories multinomial distribution to each of the six contract farming perceived benefit components, has 6 x (3-1)= 12 parameters to be estimated and the overall goodness-of-fit test would have 12 – 7 = 5 degree of freedom.

Figure 2: Distribution of farmers based on their perceived benefits from contract farming (only Contract Farmers)



	ReducedProduction Cost	Quality Improvement	Increased Sale Price	Price Protection	Reduced Marketing Cost	Family Labor Engagement
Significant	9	43	74	237	5	15
Somewhat	70	184	158	20	81	152
None	179	31	26	1	172	91

A positive β indicates that a higher value of *X* leads to greater perceived benefit. Noting that (F) being set as the reference perceived benefit component and looking at all the five coefficients (i.e. β_1 =-1.380, β_2 = 1.212, β_3 = 1.727, β_4 = 5.104, β_5 = -1.281), we see that the implied ordering of perceived benefits from contract farming for the tobacco growers on overall basis is D>C>B>F>A>E.
Similarly, the overall data for tobacco growers was bifurcated on the basis of risk attitude into two categories i.e. risk averse farmers and risk seeker farmers and was again used by proportional Odds cumulative logit model. Although the order for ranking different components of the perceived benefit from contract farming are same for both the categories of risk averse and risk seekers farmers but the difference in individual components coefficients gives an insight for perceived benefits of contract farming on the basis of risk attitude of the farmers. It conclude that for the risk seeking farmers the considerations for tobacco's production cost(-1.064), quality improvement (1.428), increased sale price (1.833) and reduction in marketing cost(-1.125) is more in comparison to risk averse farmers while the emphasis of risk averse farmers for price protection (5.291) and engagement of family labor components are more than the risk seeker farmers. This difference in perceived benefits of contract farming based on risk attitude of the farmers is presented in table 3.

Conclusions

This paper analyzes the marketing behavior of tobacco growers in Pakistan in the light of ongoing supply chain differentiation. This study helps in explaining the association between different variables and the farmers' decisions to participate in contract farming by examining contractual arrangements and unfolding farmers' decision regarding supply chain choice. The detailed analysis of contract farming for tobacco growers conclude that the risk attitude along with their household size, land ownership status and total monthly income (both on-farm and off-farm activities) significantly affect their decision to participate in contract farming practices. Through ordered logit regression analysis of perceived benefit from contract farming, several important insights have been made clear. Additionally, different components of perceived benefits from contract farming were ranked in this research concluding that price protection is the most significant components while reduction in marketing cost is the least important component for both the contract and non-contract

farmers and also for the risk averse and risk seeking farmers. But, this degree of importance for each

of the individual components of perceived benefits from contract farming practices is not the same if the individual risk attitude of farmer is taken into consideration. Risk seeking farmers weigh production cost, quality improvement, increased sale price and marketing cost more in comparison to risk averse farmers while the emphasis of risk averse farmers on price protection and engagement of family labor components is more than the risk seeker farmers as far as the analysis of perceived benefit from contract farming is concerned.

The information from this research paper will assist the policy makers in understanding farmers' behavior towards contract farming practices that influences the structure of tobacco farming in the ongoing supply chain markets. The results of this paper suggests that the government should focus on methods of production which may improve the quality of tobacco with parallel decrease in production cost rather than concentrating only on price protection. Similarly, establishing convenient procurement mechanism at farm gate can help in decreasing the marketing cost. These changes in the existing contract design will help increase the attractiveness of contracts and thus ensure the positive role of contract farming supporting inclusive growth for both the risk averse and risk seeking growers.

Appendix 1

Example for elicitation of certainty equivalents and computation of utility values

Step	Elicited CE	Utility calculation
	Income Scale	U (0) = 0 and U (50,000) = 1
1	(26,400; 1.0) ~ (0, 50,000; 0.5, 0.5)	U (26,400) = 0.5u (0) + 0.5u (50,000) = 0.5
2	(14,500; 1.0) ~ (0, 26,400; 0.5, 0.5)	U (14,500) = 0.5u (0) + 0.5u (26,400) = 0.25
3	(8,300; 1.0) ~ (0, 14,500; 0.5, 0.5)	U (8,300) = 0.5u (0) + 0.5u (14,500) = 0.125
4	(5,000; 1.0) ~ (0, 8,300; 0.5, 0.5)	U (5,000) = 0.5u (0) + 0.5u (8,300) = 0.0625
5	(34,200; 1.0) ~ (50,000, 26,400; 0.5, 0.5)	U (34,200) = 0.5u (50,000) + (0.5u (26,400) = 0.75
6	(41,700; 1.0) ~ (50,000, 34,200; 0.5, 0.5)	U (41,700) = 0.5u (50,000) + (0.5u (34,200) = 0.875
7	(47,900; 1.0) ~ (50,000, 41,700; 0.5, 0.5)	U (47,900) = 0.5u (50,000) + (0.5u (41,700) = 0.937

Authors calculations.

Appendix 2

Regression analysis for calculation of absolute risk aversion.

Y	w	w2	w3
0	0	0	0
0.5	28000	784000000	2.1952E+13
0.25	16000	256000000	4.096E+12
0.125	12000	144000000	1.728E+12
0.0625	7000	49000000	3.43E+11
0.75	35000	1225000000	4.2875E+13
0.875	45000	2025000000	9.1125E+13
0.937	49000	2401000000	1.17649E+14
1	50000	2500000000	1.25E+14
averages	26888.89	1042666667	4.49742E+13

a1	a2	a3	a4
-0.001670302	3.41022E-06	8.57E-10	-1.07579E-14

U2 (2a3 + 6a4W)	-2.1262E-11
U1 (a2 +2a3W + 3a4W^2)	1.58564E-05
Absolute Risk Aversion	1.34091E-06
Relative Risk Aversion	0.036055647
if U2 in negative, risk averse nature	

a1 **Constant**
a2 **parameter associated with w**
a3 **parameter associated with w2**
a4 **parameter associated with w3**

Certainity Equivalent (CE) points

CE Lower	*CE1*	*CE2*	*CE3*	*CE4*	*CE5*	*CE6*	*CE7*	*CE Upper*
0	28000	16000	12000	7000	35000	45000	49000	50000

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.99759
R Square	0.9952
Adj R^2	0.99232
Standard E	0.03515
Observatio	9

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regressio	3	1.282444992	0.427482	345.8460531	3.23952E-06
Residual	5	0.00618023	0.001236		
Total	8	1.288625222			

	Coefficients	*Standard Erro*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*
a1	-0.0016703	0.03343862	-0.04995	0.962095235	-0.08762701	0.084286	-0.087627011
a2	3.4102E-06	6.13101E-06	0.556226	0.602029431	-1.235E-05	1.92E-05	-1.235E-05
a3	8.5717E-10	2.94779E-10	2.907853	0.033483236	9.94203E-11	1.61E-09	9.94203E-11
a4	-1.076E-14	3.8448E-15	-2.79804	0.038081538	-2.0641E-14	-8.7E-16	-2.06413E-14

Note: Appendix 2 shows risk aversion coefficient for farmer 1. Similarly, individual regression analysis was conducted for 302 tobacco farmers for the calculation of risk aversion coefficient and 75 percent of the farmers exhibited Risk averse attitude.

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