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Factors Affecting Turkish Farmers' Satisfaction with Agricultural Credit*

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Abstract: *Access to and adequacy of credit financing is extremely important to the sustainability of agricultural production as well as the longevity of the relationship between farmers and credit granting institutions. In this study, we sought to identify the factors that determine satisfaction of Turkish farmers related to agricultural credits offered. Data used in the study was obtained through a survey of 550 randomly selected farmers in Antalya, Konya, Ankara, Karaman and Eskisehir provinces, using a detailed questionnaire. The significant variables were sorted and combined into10 groups using Factor Analysis. Satisfaction with credit usage was considered a categorical dependent variable and other factors affecting it were estimated through Ordered Probit model. Results revealed that such socio-economic factors as age and educational level of farmers, along with the size of the farm, family labor, financial ratios, willingness to purchase insurance, sources of agricultural credit, types of credit, and usage of credit card all significantly influenced credit satisfactions among Turkish farmers.*

Keywords: *Agriculture, credit, farmer satisfaction, factor analysis, ordered probit model.*

1. INTRODUCTION

Agriculture is an important sector in the economy of many countries. It contributes to the economic development since it provides raw materials to the manufacturing sector, generates employment in rural areas and promotes exports. A strong and efficient farming sector enables a country to feed its growing population, earn foreign exchange, generate employment and provide raw materials for expanding industries (Ogen 2007).To use better inputs and to implement new technologies, farmers require finances which come either from their own savings or from obtaining loans (Iqbal et al, 2003).

Turkish agricultural sector enjoys unique characteristics such as a suitable climate, fertile soil and production diversity, ultimately leading to its self-sufficiency. On the other hand, it has also faced such problems as small size of farms, inadequate use of modern agricultural technologies and a variety of risks - ecological, economic, regulatory, social, and marketing among others. The potentials and challenges encountered by farmers have further enhanced their need for credit over time. In response, agricultural and commercial banks, cooperatives, and some local institutions have entered into the agricultural credit market. For many years, agriculture sector has been financed solely by the Agricultural Bank, founded in 1863, and the Turkish Agricultural Credit Cooperatives which conducted its activities under the directorship of Agricultural Bank for a long time. The share of Agricultural Bank in agricultural lending market, however, has in fact dropped to around 60% in spite of its monopoly in the disbursement of subsidized loans and agricultural subsidies (Yildiz and Kocoglu 2015). That is to say, while the total agri-loans disbursed by Agricultural Bank increased

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from 22 to 39 billion Turkish Lira (TL) during 2012-2015 period, the decline in their relative share of the total agri-loans resulted from the growth in agricultural portfolios of private banks from 10 to 19 billion TL during the same period (BBDK 2015).

Sustainability and profitability of farming are greatly affected by increased agricultural credit usage. That is why satisfaction with the level and terms of credit offerings are so highly important to both credit institutions and farmers. Aggelopoulos et al, (2009) analyzed farmers' satisfaction with agricultural credit, using Principal Axes Factor analysis. They identified the following ordered-factors as significant: financial terms of credit and costs, facilities and equipment, personal services linked to the terms of lending, and particular properties of agricultural credit. Etonihu et al, (2013) observed that education, distance to sources of credit and types of credit source were significant factors affecting farmers' access to agricultural credit. Ijioma and Osondu (2015) reported that the revealed age, household size, membership in cooperative societies, marital status, education level, and farm size were the significant predictors of the amount of agricultural credit acquired by farmers.

In this study, we sought to identify factors that determine satisfaction of Turkish farmers related to agricultural credits offered. To our knowledge, this is the first study of its type focused on Turkish farmers thus making its findings of vital importance to governmental agencies and private organizations in Turkey involved in the agricultural sector. The rest of this paper is organized as follows. The section on Material and methods provides details on sources of data for this study, selected characteristics of the respondents, and the statistical procedures used in the analysis of the collected data. The major findings of this study are described in data analysis and results and the conclusions and few areas for further research are outlined in conclusion and direction for the future.

2. MATERIAL AND METHODS

A. Data Collection and Descriptive Statistics

In the absence of farm level credit usage information, we conducted a primary, cross sectional, survey questionnaire research method to learn about farmers' use and attitude towards agricultural credit in Turkey. Data were obtained from 550 farmers in Antalya, Konya, Ankara, Karaman and Eskisehir regions during June to August, 2015. Many production systems such as field crops, greenhouse and orchard, vegetable and animal production were used in the regions selected. Farmers were randomly selected and equally distributed across these five provinces. The selected sample is representative of the Turkish farming system in regards to the credit usage and production varieties. Konya, Ankara and Antalya, in particular, were among the top 10 Turkish provinces with regard to agricultural credit usage; others are also important also for credit and production patterns. The five chosen regions accounted for 15.2 % of the total agricultural credit in 2014 in Turkey (http:// ebulten. bddk.org. tr/ finturk).

In design of the questionnaire, findings from the previous studies were taken into account. In the first part of the questionnaire, farmers were asked questions about their demographic and socio-economic characteristics as well as economic structure of their farms. The questions in the second part were about agricultural credit sources. In the last part, farmers were asked to respond to questions about their usage of agricultural credit. Likert-type scale ranging from 1 to 5 was used for some of the questions in the study such as the degree of satisfaction with credit usage, with 1 showing least and 5 denoting the most satisfaction.

Next, we'll focus on certain structural features and economic indicators of the farms surveyed. Farmers' owned and managed lands was a common pattern in the chosen research areas, with an average of around 92% of the land owned and operated by farmers themselves. The cultivated area of farms across the five provinces averaged between 8.5 to 34 hectares. Average farm land size was 18.6 hectares, of which 13.5 hectares was dry land and irrigated land made up around 5.1 hectares (Table 1).

In terms of educational attainment, which is critical to the adoption of agricultural innovations, farmers in our surveyed areas had mostly completed middle school and possessed the corresponding reading and writing skills. Agricultural production mix showed a wide diversity in the researched areas and included such commodities as wheat, barley, maize, sugar beet, cotton and animal products. Depending on climate and demand conditions, farmers were also growing many kind of vegetables and orchard such as grapes and some fruits. We observed that a large number of farms were managed by all family members, with average population per farm being 4.13. The percentages of female to

male farmers in these regions ranged between 46.4 to 53.6%, demonstrating the very important contribution that female workers made to the agricultural activities. In terms of family labor contribution, potential farm labor average was 2.81 and this varied between 2.28 and 3.36 across the five provinces.

The gross production value of farms was composed of 52.97% crop production and 47.03% from animal livestock. Most of livestock had small scale production. The average of agricultural and non-agricultural income was 84.8% and 15.2%, respectively. Agriculture is the second income sources for a few people. The average ratio of net profit to assets was 17.57%. Farm profitability coefficient varied between 14.87 % and 55.88 %, with the average value being 31.72%. Research results showed that the Current, Acid test and financial ratio were 3.5, 2.64 and 6.63 respectively.

It was found that farmers preferred mostly equity capital during the production period at an average rate of 90.8%. Equity capital is safer than others. Some farmers did not prefer external capital because of repayment obligations involved. Some of them also did not want to expand their scale of production. Research results showed that the financing mix across farms was composed of 67% fixed capital, 33% operating capital and 5.3% loan. In the researched areas, while The Agricultural Bank provided 52% of all the loans, private banks accounted for 30.5%, agricultural cooperatives offered 10.5%, agricultural sales and development cooperatives gave 6.3%, individuals, merchants, and dealers' share was 1.2%.

Table1. *Variable definitions and their descriptive statistics*

Variables	**Description of variables**	**Mean**	**St.dev.**
Province	1=Antalya,2=Konya, 3=Ankara, 4=Karaman, 5=Eskisehir	3.000	1.416
Farmer's educationlevel	1=Readerwriter,2=Primaryschool, 3=middleschool,4=Highschool, 5=College, 6=University	3.038	1.198
Farmer's age	1=19-30, 2=31-40, 3=41-50, 4=51-60 5=61-+	3.049	1.068
Manpower labor unit for perdecar	Continuous variable	164.780	147.507
Monthly income, ordinal (TL)	1=500-2000,2=2001-5000, 3=5001-10000, 4=10001+	1.891	0.884
Total farm land (decar)	Continuous variable	186.849	238.429
Irrigated land (decar)	Continuous variable	51.460	29.516
Percentage of owned land (%)	Continuous variable	92.094	13.747
Livestock production	1=Yes, 2=No	1.555	0.497
Vegetable production	1=Yes, 2=No	1.558	0.497
Orchard production	1=Yes, 2=No	1.611	0.488
Fixed capital (1000 TL)	Continuous variable	262.467	262.500
Total capital (1000 TL)	Continuous variable	387.104	298.965
Production value of leased and jointly held land (1000 TL)	Continuous variable	17.338	57.316
Loan as a % of passive capital	Continuous variable	5.323	8.462
Leased & jointly held as a % of passive capital	Continuous variable	3.045	8.468
Equity as a % of passive capital	Continuous variable	90.332	11.820
Crop production value (1000 TL)	Continuous variable	116.827	113.477
Livestock production value (1000 TL)	Continuous variable	103.957	235.213
Lease provision of building (1000 TL)	Continuous variable	2.852	1.553
Gross net product (1000 TL)	Continuous variable	223.947	258.311
Operating expenses (1000 TL)	Continuous variable	146.750	193.003
Net return (1000 TL)	Continuous variable	76.976	121.880
Gross return (1000 TL)	Continuous variable	139.602	188.461
Total variable cost (1000 TL)	Continuous variable	81.179	96.478
Total fixed cost (1000 TL)	Continuous variable	65.571	110.558
Return on equity (%)	Continuous variable	14.526	28.089
Return on assets (%)	Continuous variable	17.526	20.857
Coefficient of profitability (%)	1=30 more, 2=30 Less	1.456	0.499
Current ratio (Unit)	1=1.5 more, 2=1.5less	1.460	0.499
Acid test ratio (Unit)	1=1.5 more, 2=1.5less	1.564	0.496
Financial leverage ratio (%)	1=40 more, 2=40 less	1.489	0.500

Capital turnover (%)	Continuous variable	45.306	32.189
Agricultural insurance-willingness to purchase	1=Yes, 2=No	1.562	0.497
Usage of Agricultural credit (1000 TL)	Continuous variable	84.896	120.307
Agricultural credit- willingness to acquire	1=Yes, 2=No	1.565	0.496
Types of agricultural credit	1=Short term 2=Middle and long term 3=Both	1.565	0.711
Sources of agricultural credit	1=Agri. Bank, 2=Coop, 3= Agri. Bank +Coop, 4=Private banks, 5=Private banks+coop, 6= Agri. Bank +private Banks, 7=All	3.213	1.996
Agricultural credit card usage	1=Yes, 2=No	1.422	0.494

Note: 1 US Dollars is equal to 2.85 Turkish Liras.

Over the years, it is evident that institutional credit sources have become more diverse and crucial in their financing role. It is also certain that there will be more competition in the marketing of agricultural credit in the future. In the last three years, the credit usage among the investigated farms was mostly (68%) for short-term purposes, with the remaining 32% being medium and long-term credit on average. Middle and long term credit, however, should be further emphasized and increased to assure sustainability of agricultural production. In regards to the satisfaction score of credit usage, a little over half of the farmers surveyed (53.6%) seemed content. The bureaucracy involved and high interest rate were found as the most important reasons for dissatisfaction with the agricultural credit usage. According to farmers' responses, if the credit cost and interest rate were to decrease, they would use more agricultural credit. As such, there is more need for subsidized credit both in terms of amount as well as duration.

B. Statistical Methods Used

In this study, "Factor Analysis" and "Ordered ProbitModel" were used together. These model have been commonly used in different scientific subjects and studies. For example, Bocaletti& Moro (2000) used Ordered Probit model and found that in Italy, willingness to pay for food products was influenced by income and awareness. Erdem et al. (2010) developed an Ordered Probit model and investigated Turkish consumers' willingness to pay for hybrid automobiles. They found that higher education, income, and environmental sensitivity were the major determinants of preference for hybrid automobile (see Nayga et al, 2002; Hasegawa, 2010; Gunduz& Emir , 2010; Yayar et al, 2014; Gallardo et al, 2015 for additional examples).

In this study, all social and economic data were analyzed using Factor Analysis. It followed a two-step method due to the difficulty of processing the large number of variables (n=90) collected in the survey. The first stage, as applied in many areas of Factor Analysis, resulted in 39 variables which were grouped into 10 factors. In the second stage, the Ordered Probit Model was used to determine the effect of 10 factors on the farmer satisfaction with agricultural credit usage.

Factor Analytic techniques are designed to reduce the number of variables and to identify possible structure in the relationships between variables by classifying them into groups (Rennie 1997, Buyukozturk 2002).

The Ordered Probitmodelis based on theory of profit maximization (McFadden 1973). In this research, profit maximization refers to farmers' satisfaction with credit usage (see Appendix for detailed mathematical explanation of the Factor Analysis and Ordered Probit model).

3. DATA ANALYSIS AND RESULTS

Many variables thought to be related to each other are taken into consideration in this survey. Before data analysis, the relevance of data was tested. No relation was found based on a small number of variables using Factor Analysis. First, in order to apply Factor Analysis and obtain reliable results, sample sufficiency criteria must be established. Prior to the extraction of the factors, several tests should be conducted to assess the suitability of the respondent data for Factor Analysis. These tests include Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy (Kaiser 1970, Kaiser and Rice 1974, Williams et al, 2010) and Bartlett's Test of Sphericity.

Table 2 shows the Kaiser-Meyer-Olkin (KMO) measure and Bartlett sphericity test results for this study. Accordingly, KMO measure (0.756) and the corresponding chi-square values of Bartlett test (58012.48) proved significant at 1% (Table 2).

Table2. *Kaiser-Meyer-Olkin Measure of Sampling Adequacy and Bartlett's Test of Sphericity (SPSS Output)*

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.756
Bartlett's Test of Sphericity	Approx. Chi-Square	58012.483
	df	741
	Sig.	.000

Based on farmers' responses, 39 variables were grouped into 10 factors (Figure 1). After the tenth factor, eigenvalues lose substantial value of the vector. In this case, it is shown that all variables can be explained by 10 factors. Accepted variance value is 74.020 % based on the 10 factors.

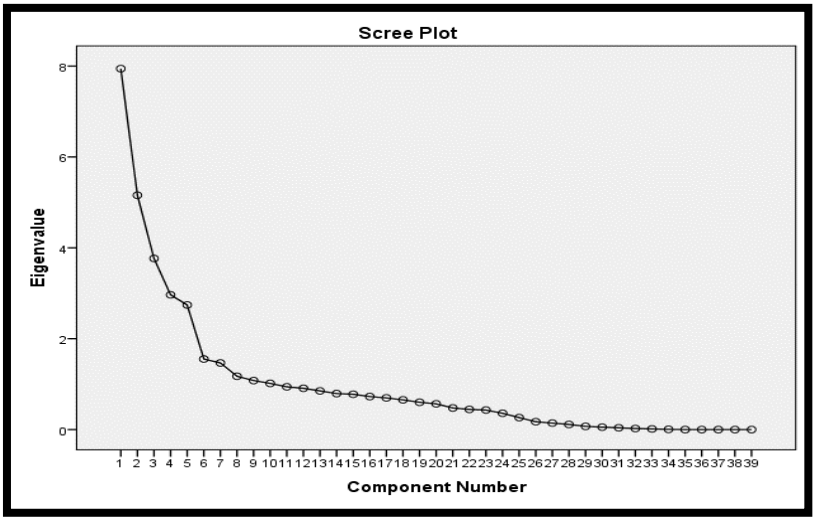


Figure1. *Screen test criterion*

Contribution to variance of the ten factors are 16.435 %, 11.601 %, 10.245 %, 8.897 %, 7.647 %, 4.674 %, 3.986 %, 3.826 %, 3.500 % and 3.209 %, respectively (Table 3).

Table3. *Total variance explained for farms*

Component	Initial Eigen values			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	7.944	20.370	20.370	6.410	16.435	16.435
2	5.157	13.224	33.594	4.524	11.601	28.036
3	3.767	9.658	43.252	3.995	10.245	38.281
4	2.965	7.603	50.855	3.470	8.897	47.178
5	2.742	7.030	57.885	2.982	7.647	54.824
6	1.554	3.985	61.870	1.823	4.674	59.499
7	1.467	3.762	65.632	1.555	3.986	63.485
8	1.175	3.012	68.644	1.492	3.826	67.311
9	1.079	2.768	71.412	1.365	3.500	70.811
10	1.017	2.608	74.020	1.252	3.209	74.020

The rotated factor loadings and extraction value of each factor are presented in Table 4. As noted, extraction values have high values (most of them are more than .700).

Table4. *Rotated component matrix and communalities for farms*

Variables	Component										Extraction
	1	2	3	4	5	6	7	8	9	10	
Livestock production value	0.975										.962
Total fixed cost	0.959										.934
Operating expenses	0.951										.974
Gross net product	0.899	0.306	0.270								.985
Gross return	0.820	0.486									.940
Total variables cost	0.804		0.479								.899
Capital turnover	0.769	0.511									.866

Livestock production	-0.565					0.354					.529
Return on assets		0.949									.927
Return on equity		0.899		-0.314							.929
Net return	0.398	0.807									.879
Coefficient of profitability		-0.717									.626
Irrigated land		-0.499							0.330		.473
Fixed capital			0.974								.972
Total Farmland			0.955								.955
Total capital	0.437		0.869								.964
Crop production value		0.553	0.720								.870
Rate of leased and jointly held land value				0.980							.969
Percentage of owned land				-0.958							.928
Value of leased and jointly held land				0.927							.895
Equity as a % of passive capital				-0.702	-0.679						.964
Loan as a % of passive capital					0.937						.914
Usage of Agricultural credit			0.323		0.842						.870
Financial leverage ratio					-0.574			-0.456			.641
Agricultural credit card usage						0.611				-0.324	.532
Agricultural credit willingness						0.608					.478
Provinces		-0.382				-0.517			0.315		.602
Types of agricultural credit						0.513		0.272		0.300	.547
Farmer's age							-0.794				.644
Farmer education level							0.747				.641
Man power labor unit per 100 decar						-0.271	0.441	0.342			.447
Acid test ratio								0.677			.498
Current ratio					0.507			0.535			.638
Agricultural insurance willingness to purchase			-0.305			0.292		0.333			.424
Lease provision of building									-0.742		.604
Monthly income ordinal								0.261	0.414		.348
Orchard production		-0.363							0.378		.424
Sources of agricultural credit										0.770	.689
Vegetable production		-0.267							-0.367	-0.457	.485
Extraction Method: Principal Component Analysis.											
a. Rotation converged in 9 iterations.											

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

All factors are combined based on rotated component matrix and extraction values. These factors and their associated names are as follow:

Factors	Explanations
FAC1	Livestock production and farm expenses
FAC2	Return on assets/equity and irrigated land
FAC3	Capital, farm land and plant production
FAC4	Owned, leased, or jointly held farm land and equity rate
FAC5	Debt and leverage ratio
FAC6	Agricultural credit type and tendency, credit card willingness and provinces
FAC7	Farmer's age, educational level and family labor
FAC8	Financial ratio and agricultural insurance willingness
FAC9	Orchard production, monthly income and the value of leasing provision of building
FAC10	Vegetable production and agricultural credit sources

Our Ordered Probit model is set up to examine whether the specified factors listed above have significant impact on the level of credit satisfaction. Model results are shown in Table 5. Accordingly, results of the LR test (53.9392) as well as the Mc Kelveyve Zavoina's R2 (0.7563) show the robustness of the model. All factors are statistically significant at different levels except FAC 3, FAC

5 and FAC 9.Meanwhile, FAC 2, FAC 4, FAC 6, FAC 7 and FAC 8 have positive effect on farmers' level of satisfaction with credit, while FAC 1 and FAC 10 have negative effects according to the results from Ordered Probit model.

FAC 2 represents farmers' profitability implying that credit has been used effectively and positively contributed to the growth of the farm and irrigated land size. FAC 4 emerges as a significant factor because during the loan review process, all financial institutions especially private banks prefer to give credit to the larger scale farms. As a result, cooperatives and some local financial institutions tend to focus on small scale farms. FAC 6 denotes the important role that credit types and terms as well as the use of agricultural credit cards play in farmers' credit use and satisfaction. Indeed, this relationship is very important in establishing a sustainable credit structure.

Table 5. *Ordered Probit results of the farmers' satisfaction with agricultural credit*

Factor Variables	Coefficients	Standard error	Z-static	P-values
FAC1	**-0.10401****	0.045265	-2.29776	0.0216
FAC2	**0.16294***	0.046348	3.51563	0.0004
FAC3	-0.05908	0.045318	-1.30356	0.1924
FAC4	**0.10554****	0.046233	2.28277	0.0224
FAC5	-0.0224	0.045572	-0.49163	0.6230
FAC6	**0.17263***	0.046114	3.74347	0.0002
FAC7	**0.08388*****	0.045843	1.82965	0.0673
FAC8	**0.096698****	0.045813	2.11072	0.0348
FAC9	-0.03903	0.045759	-0.85293	0.3937
FAC10	**-0.13546***	0.045934	-2.94904	0.0032
Pseudo R-squared		0.037489	Log likelihood	-692.438
Akaike info criterion		2.568925	Restr. log likelihood	-719.407
LR (10) statistic		53.93922	Prob(LR statistic)	0
McKelvey and Zavoina's R2		0.756337	Avg. log likelihood	-1.25898
Hannan-Quinn criter.		2.611736		

Coefficient are significant at * α=0.01 ** α=0.05 *** α=0.10

FAC 7 and FAC 8 also contribute in important ways to credit satisfaction, thus farmer's socio-economic and financial status affect credit decisions and level of credit satisfaction.

The marginal effects of the ten factors in explaining farmers' satisfaction with credit usage are shown in Table 6 below. Based on these results, increasing livestock production and farm expenses (FAC 1) is associated with credit satisfaction level. Similarly, FAC 10 shows inverse relation between vegetable production and credit satisfaction. In addition, different agricultural credit sources have a negative effect on the credit satisfaction level. In Turkey, apart from Agricultural Bank which has long offered subsidized credit to farmers, other banks have generally charged high interest rates in their agricultural loans.

Table6. *Marginal effects of all factors over satisfaction of credit usage*

Factors	Degree of farmers' satisfaction with credit usage				
	Prob (Y=1)	Prob (Y=2)	Prob (Y=3)	Prob (Y=4)	Prob (Y=5)
FAC1	0.0077	0.0155	0.0181	-0.0269	-0.0144
FAC2	-0.0120	-0.0244	-0.0284	0.0422	0.0225
FAC3	0.0044	0.0088	0.0103	-0.0153	-0.0082
FAC4	-0.0078	-0.0158	-0.0184	0.0273	0.0146
FAC5	0.0017	0.0033	0.0039	-0.0058	-0.0031
FAC6	-0.0127	-0.0258	-0.0300	0.0447	0.0239
FAC7	-0.0062	-0.0125	-0.0146	0.0217	0.0116
FAC8	-0.0071	-0.0145	-0.0168	0.0250	0.0134
FAC9	0.0029	0.0058	0.0068	-0.0101	-0.0054
FAC10	0.0100	0.0202	0.0236	-0.0351	-0.0187

4. CONCLUSIONS & DIRECTIONS FOR FUTURE RESEARCH

Results of this research, demonstrated by Factor Analysis method and Ordered Probit Model, shed light on how Turkish agricultural banks' strategies and decisions are viewed by their target audience, farmers, and their satisfaction on credit usage. Accordingly, it is determined that that the factor with

the highest marginal effect is credit card usage and credit willingness (FAC 6). In this research, agricultural credit card is significantly related to credit satisfaction. Nowadays, the usage of agricultural credit card, which is a debit card possessing the properties of both revolving and spot credit with its diversified utilities and maturity structure, is increasing. The main function of these cards is to facilitate the purchase of agricultural inputs and cover the short-term financing needs of farmers (Yildiz&Kocoglu2015).Currently, all banks have introduced agricultural credit card in Turkey.

The return on assets/equity and irrigated land (FAC 2) has emerged as the second most important factor related to credit satisfaction. This is understandable as farmers who have experienced more profitability during any given production season would express increased satisfaction from the use of credit, which enables them to improve their productivity along with expanded irrigated facilities.

There are similar relation ship between livestock and vegetables production (FAC 1 and 10). They have typical character as small scale system and their credit satisfaction level is lower than others. Increased number of owned farms, besides the leased/jointly held land, is associated with increased credit satisfaction levels. This means that farm land size and rate of irrigated land also directly affect the credit usage satisfaction. Our research found age as well as increasing educational level of farmer and their family labor (FAC 7) to have significant effects on agricultural credit satisfaction. Many studies, referred to earlier, have arrived at similar conclusion and their results reveal the importance of further experience, education and entrepreneurial spirit in effective use of credit.

Our findings have important implications for investments and marketing strategies of banks who can use these results for active segmentation, targeting and positioning strategies. Banks are well advised to concentrate on the specific factors that are significant to farmers' satisfaction with agricultural credit as discussed before.

Indeed, there is a need for more communication and coordination in the implementation of credit facilities between farmers and banks. Agricultural development needs financial support and finance sector wants to be more active in the agricultural sector. Both sectors still struggle to meet halfway and search for new strategies to overcome traditional resentments (Wegner 2016). A new platform or dialogues is needed, the form of which varies from countries to countries. In order to develop such platforms, the socio-economic structure of the agriculture sector needs to be taken into account.

To our knowledge, this is the first study of Turkish farmers' satisfaction with agricultural credit based on survey of five provinces. More research focusing on other provinces would validate the generalizability of our findings. Similar research in other emerging economies would also help shed further light on usage and effectiveness of agricultural credit programs. Given the crucial role of the agriculture sector in the economies of many such countries in terms of value added to their GDP and employment, results of additional research would help improve current programs and help with the design of the new policies by publican private sector lending institutions.

APPENDIX

Factor Analysis posits that x_j is a combination of p unobserved factors (Härdle and Simar 2015):

$$x_j = \sum_{\ell=1}^{k} q_{J\ell} f_\ell + \mu_j, \quad j = 1, \dots\dots\dots, p.$$

Where the q terms are factor loadings to be estimated and μ is special factor. To do a Factor Analysis, we need to select an "extraction method" and a "rotation method". There are a number of methods for determination of factors and we used Principal Component Analysis and "Varimax" method in this research (Johnson and Wichern 1992).Most of the Factor Analyses in published literature use a Varimax rotation method (Kleinbaum et al, 2013). Varimax rotation, first developed by Thompson, is the most common rotational technique used in Factor Analysis (Thompson 2004) which produces factor structures that are uncorrelated (Costello and Osborne 2005). Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy and Bartlett's Test of Sphericity are used for extraction of the factors. The KMO index ranges from 0 to 1 and this range was considered suitable for Factor Analysis. The Bartlett's Test of Sphericity should be significant ($p<.05$) for this analysis to be suitable (Barlett 1950,

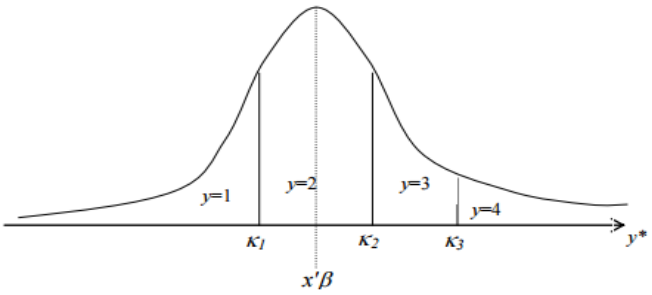
Kaiser 1970, Kaiser and Rice 1974, Norusis 1992, Albayrak 2003, Hair et al. 2006, Williams et al, 2010, Selim et al, 2011, Kline 2016).

In statistics, Ordered Probit is a generalization of the popular Probit analysis in the case of more than two outcomes of an ordinal dependent variable. Similarly, the popular Logit method has a counterpart Ordered Logit. In Ordered Probit model, in addition to observed, exact and ranked categories (y), there is a continuous, but unobserved dependent variable. The unobserved latent dependent variable (y*) is explained by explanatory variables vector and error term. Error term is assumed to have normal distribution (Chen et al, 2002, Grene 2002, Akbay et al, 2007, Grene 2012, Wooldridge 2016). The model cannot be estimated consistently using Ordinary Least Squares; it is usually estimated using Maximum Likelihood. An index model for a single latent variable y* (which is unobservable, we only know when it crosses thresholds) is as follows (Kors 2011, Grene 2012):

$$Y^* = x\beta' + \varepsilon\varepsilon \sim N[0,1]$$

where y* is the exact but unobserved dependent variable (perhaps the exact level of improvement by the patient); x is the vector of independent variables, and β is the vector of regression coefficients which we wish to estimate.

Y^* is unobservable variable and it is assumed that observed Y variables are derived from Y^* variables. Note that the mean ($x'\beta$) of y* depends on the explanatory variables contained in the vector x, and therefore the whole distribution shifts when the value of one such variable changes, in a direction dictated by the sign of the corresponding β-coefficient. It is clear from the diagram below that such a shift causes a change in the distribution of responses, since the cut-points are fixed (Daykin and Moffatt 2002).



In this model, the probability of choosing one to five alternatives (y observed value) are as follows. In order for the probabilities to be positive, $0<\mu_1<\mu_2<\mu_3$condition must be realized.In Ordered Probit model, probabilities for farmers to select one of the five alternatives are calculated as follows, using logarithmic maximum likelihood function (Maddala 1983, Chen et al, 2002, Grene 2012):

$$Prob(y=0) = \Phi(-\acute{\beta}X)$$

$$Prob(y=1) = \Phi(\mu_1 - \acute{\beta}X) - \Phi(-\acute{\beta}X)$$

$$Prob(y=2) = \Phi(\mu_2 - \acute{\beta}X) - \Phi(\mu_1 - \acute{\beta}X)$$

$$Prob(y=3) = \Phi(\mu_3 - \acute{\beta}X) - \Phi(\mu_2 - \acute{\beta}X)$$

$$Prob(y=4) = 1 - \Phi(\mu_3 - \acute{\beta}X)$$

Here, Φ is cumulative normal distribution function. The model is solved through Maximum Likelihood Method. Direct explication of variables coefficient of ordered profit estimates using Maximum Likelihood Method is inconvenient (Akbay et al, 2007, Gunduz et al, 2010). To determine the effects of explanatory variables on probabilities, marginal effects need to be estimated. Marginal effects of five probabilities can be estimated using the following equations via the help of derivation. (Greene, 2002, Greene, 2012):

$$\frac{\partial P(y=j)}{\partial x_k} = \left\{ \phi\left(\mu_{j-1} - \sum_{k=1}^{k} \beta_k x_k\right) - \phi\left(\mu_j - \sum_{k=1}^{k} \beta_k x_k\right) \right\} \beta_k$$

Here, $\frac{\partial P}{\partial x_k}$ is the derivation of probability based on $x_{k,}$ Φ is cumulative normal distrubution function, estimation of ordered maximum likehood*β,* x_k. Response categories for each respective point scale on marginal effect can be observed. Among these categories response, the sum of marginal effects of different possibilities are equal to zero. While positive X_k means favorable effect, negative marginal effect shows the opposite (Foltz et al. 1999, Akbay et al, 2007, Chen et al, 2002).

The log-likelihood function shall now be constructed. Let *Pi(y)* be the probability that the i-th response is *y*. This probability is:

$$P_i(y) = P(\kappa_{y-1} < y_i^* < \kappa_y) = \Phi(\kappa_y - x_i'\beta) - \Phi(\kappa_{y-1} - x_i'\beta)$$

where $\Phi(.)$ is the standard normal cumulative distribution function. Based on a sample (*yi*, *xi*, *i=1,…, n*), the log-likelihood function is therefore:

$$LogL = \sum_{i=1}^{n} \ln[P_i(y_i)] = \sum_{i=1}^{n} \ln[\Phi(\kappa_{y_i} - x_i'\beta) - \Phi(\kappa_{y_i-1} - x_i'\beta)]$$

The log-likelihood is maximized with respect to the elements of β along with the cut-points $\kappa_1, \kappa_2, \ldots, \kappa_{J-1}$ by an iterative procedure give maximum likelihood estimates (MLEs) of both sets of parameters. Also shown in the second section of output is the *Pseudo-R2*, which is defined as:

$$Pseudo - R^2 = 1 - \frac{LogL_u}{LogL_R}$$

and may be useful as a model selection criterion (Daykin & Moffatt 2002).

McKelvey & Zaviona R2, which is one of the most widely used measure of goodness of fit model, has been developed for ordered model (McKelvey & Zavoina 1975). Forecast results of Factor Analysis and Ordered Probit model are calculated using SPSS and E views statistical program.

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