УДК 330, 338.23

ТАДЖИЕВ АБДУСАМЕ АБДУХАМИДОВИЧ
аспирант кафедры «Агроэкономики и бухгалтерского учета»
Самаркандского Института ветеринарной медицины,
e-mail: abdusame1983@yahoo.com

ДЕТЕРМИНАНТЫ ФЕРМЕРСКОГО СОТРУДНИЧЕСТВА В ИРРИГАЦИИ: ПРИМЕР САМАРКАНДСКОЙ ОБЛАСТИ, УЗБЕКИСТАН

Аннотация. Цель работы. *В этом исследовании мы фокусируемся на изучении детерминант сотрудничества фермерских хозяйств в ирригации, отвечая на главный вопрос исследования: «Каковы факторы, влияющие на решение фермеров сотрудничать в ирригации?».* ***Метод или методология проведения работы.*** *Мы используем пробитную модель, которая является одной из моделей бинарных решений, для оценки сотрудничества. Общая формула модели приведена в литературе следующим образом*

$$P(y = 1|x) = G(\beta_0 + \beta_1 X_1 + \cdots \ldots \beta_k X_k) = G(\beta_0 + X\beta)$$

Где G - функция, принимающая значения строго между нулем и единицей: 0 <G (z) <1 для всех действительных чисел z. ***Результаты.*** *Полученные данные свидетельствуют о том, что уровень образования руководителей хозяйств имеет значение при принятии решения о сотрудничестве фермеров. Более того, наши результаты показывают, что управляющие ферм среднего возраста влияют на сотрудничество в области ирригации. Мы обнаружили, что «фермеры, выращивающие хлопок» негативно влияют на «сотрудничество в области орошения», которое было статистически значимым. Кроме того, плодородие участков негативно влияет на сотрудничество в области ирригации. Результаты нашей модели показывают, что если фермер выступил с собственными инициативами по участию в неформальной мобилизации рабочей силы (хашар) и неофициальных соглашениях с домашними хозяйствами и другими фермерами, он имеет положительную динамикам на сотрудничество в области ирригации. Кроме того, существует положительная тенденция между режимом орошения рек или каналов (без насосов) и сотрудничеством в ирригации в области.* ***Область применения результатов.*** *Результаты исследования могут быть широко использованы в развитии сотрудничества между фермерами Самаркандской области.* ***Выводы.*** *Фермеры, выращивающие хлопок в Самаркандской области, реже сотрудничают в принятии решений о распределении воды с другими водопользователями. Если фермер орошает свое поле из канала, он с большей вероятностью будет сотрудничать с другими водопользователями в Самаркандской области. Расположение фермерского поля в ирригационной системе имеет значение для решения фермеров о сотрудничестве.*

Ключевые слова: *кооперация, пробит-модель, характеристики фермы, сельскохозяйственные активы, хашар, режим орошения*

TADZHIYEV ABDUSAME ABDUKHAMIDOVICH
graduate student of department "Agroeconomy and accounting"
Samarkand Institute of veterinary medicine,
e-mail: abdusame1983@yahoo.com

DETERMINANTS OF FARMERS' COOPERATION IN IRRIGATION: THE CASE OF SAMARKAND PROVINCE, UZBEKISTAN

Abstract. Objectives. *In this study, we focus on learning determinants of farm cooperation in irrigation by answering main research question that "what are the factors influencing farmers' decision to cooperate in irrigation?". **Methodology.** We use probit model, which is the one of the binary decision models, to estimate cooperation. General formula of the model given as follows in the literatures*

$$P(y = 1|x) = G(\beta_0 + \beta_1 X_1 + \cdots \ldots \beta_k X_k) = G(\beta_0 + X\beta)$$

*Where G is a function taking on values strictly between zero and one: $0<G(z)<1$, for all real numbers z. **Results.** The findings suggest that education level of farm managers matters in farmers' cooperation decision. Moreover, our findings show that middle age farm managers impact on cooperation in irrigation. We uncovered that "cotton growing farmers" perform negatively in "irrigation cooperation" which the relationship was statistically significant. Furthermore, fertility of plots has negative impact on irrigation cooperation. Our model results show that if a farmer took own initiatives in participation in informal labor mobilization (hashar) and informal agreements with households and other farmers, it has a positive association with irrigation cooperation. Moreover, there is a positive relationship between river or canal irrigation regime (without pumps) and irrigation cooperation in the province. **Scope of results.** The results of the research can be widely used in the development of cooperation between farmers in Samarkand province. **Findings.** Cotton-growing farmers in Samarkand province are less likely to cooperate in water allocation decisions with other water users. if a farmer irrigates its field from canal, he/she is more likely to cooperate with other water users in Samarkand province. Location of the farm field within the irrigation system matters in farmers' decision to cooperate.*

Keywords: *cooperation, probit model, farm characteristics, farm assets, hashar, irrigation regime*

Introduction. After the collapse of Soviet Union decentralizing irrigation system management was the main problem in all Central Asian (CA) countries. Furthermore, lack of financial support on repairing irrigation canals lead to less supply water to the tail water users [8]. Establishing water user associations (WUA) was one the main water reforms in CA countries. First WUA was established in 1999 in Uzbekistan [17] [14]. Followed by the farm restructuring, the government of Uzbekistan took efforts to decentralize the agricultural water supply and improve the role of WUA in water management. Yet, the outcome of this reform has been disappointing. As many scholars and observers reported, the water management in Uzbekistan failed to organize around WUA and farmers' cooperation in water use.

There is a substantial literature describing water use problems from farmers' cooperation perspective in various parts of the region, particularly in Ferghana and Khorezm provinces of Uzbekistan (e.g., [1]; [16]; [5]; [13]; [3]). Furthermore, in the case of Zerafshan valley (Samarkand) one of the few sources, Zinzani (2015) studied WUAs in selected three districts of Samarkand province. General ideas of the most scientists are to decrease the role of government, should be bottom-up approach in water distribution. As well as, most studies emphasized that WUAs have difficulties on supporting finance [12].

In this study, we focus on learning determinants of farm cooperation in irrigation by answering main research question that "what are the factors influencing farmers' decision to cooperate in irrigation?".

Material and Methods. Our study is based on farm survey data collected within the AGRICHANGE[1] project. In total 450 individual farms were surveyed from Paiarik, Pastdargom

[1] Institutional change in land and labour relations of Central Asia's irrigated agriculture (AGRICHANGE). Project duration 1 July 2015 – 30 June 2018

and Jambai districts of Samarkand province. In our study we test age of farm manager, female farm, education of farm manager, farm size, crop type variables that tested by several researchers ([11]; [6]; [2]; [10]; [4]; [7]) before. Furthermore, we are going to test additional variables that assuming to impact on cooperation (Table 1). We use cooperation in irrigation as a dependent variable which is binary variable.

Based on farm questionnaire, we picked up first five questions which could represent activities related to cooperation in irrigation such as (1) irrigation of fields, amelioration of the farm land; (2) control of water distribution for irrigation; (3) repair and cleaning of irrigation canals; (4) repair and cleaning inter-farm irrigation or drainage canals; (5) joint maintenance, utilization, and repair of irrigation equipment (hashar); (AGRICHANGE farm survey, 2017). For each participation in collective action, farmer response is recorded as 1 and non-participation as 0. These responses are then aggregated into 1 if farmer participated in one of those, and zero a farmer responded about nonparticipation. We gave a value zero if a farmer chose "Do not carry out such kind of activity" response.

In our case, the independent variables are divided into three groups: (1) Farm manager characteristics; (2) Farm characteristics and (3) Farm assets. We use farm size which indicated total land area variable. Here, we get farms that have irrigated land area. Furthermore, we use district dummy variable to estimate attitudes cooperation of districts.

Based on data collected via the AGRICHANGE farm survey we identify a list of possible variables to be used as determinants of farmer's participation in cooperation in irrigation. These determinants as well as dependent variables are summarized in Table 1.

Table 1

Descriptive statistics of farmers from the survey data

			Samarkand		
Variables	**Units**	**Obs**	**Mean**	**Min**	**Max**
Dependent variables					
Cooperation in irrigation (ircoop)	Dummy	406	0.14	0	1
Independent variables					
Farm manager characteristics					
Age of farm manager (age)	Year	406	46.30	27	63
Female farmer	Dummy	406	0.09	0	1
Education of farm manager (Edu)	categorical	406	5.29	1	6
Risk aversion (riskaversion)	categorical	406	2.59	0	9
Farm manager is likely to punish for unfair behavior to him (punish)	categorical	406	5.06	0	10
Farm characteristics					
Total farm size (landsum)	ha	406	23.40	1	200
Average size of plots (avsizeplt)	ha	406	17.78	0.5	170
Family labour input (family_ft)	persons	406	4.72	0	59.5
Hired labour input (hired_fte)	persons	405	4.34	0	61.8
Farmer grows cotton (y_cot)	Dummy	406	0.35	0	1
Farmer grows high value crops (y_hvc2)	Dummy	406	0.31	0	1
Average fertility of plots (sfertil)	categorical	406	2.57	1	4
Farm assets					
Number of tractors (tractor)	Dummy	406	0.76	0	1
Decisions about informal agreements made by farmer himself (infvolt)	Dummy	406	0.34	0	1
Self-interested people in the village (selfint)	categorical	406	3.27	1	5
Average irrigation regime (river or canal = 1, other=0 watsce)	Dummy	368	0.65	0	1
Location of first plot (locat)	categorical	368	2.14	1	3

Source: *Author's calculation based on the AGRICHANGE farm survey data.*

We use probit model, which is the one of the binary decision models, to estimate cooperation. General formula of the model given as follows in the literatures

$$P(y = 1|x) = G(\beta_0 + \beta_1 X_1 + \cdots \ldots \beta_k X_k) = G(\beta_0 + X\beta)$$

Where G is a function taking on values strictly between zero and one: 0<G(z)<1, for all real numbers z [15].

Results. We have identified the following results according to (1) Farm manager characteristics; (2) Farm characteristics and (3) Farm assets.

First, the findings suggest that education level of farm managers matters in farmers' cooperation decision. Moreover, our findings show that middle age farm managers impact on cooperation in irrigation. (Table 2);

Table 2

The impact of farm manager characteristics on irrigation cooperation

	Irrigation cooperation
	Marginal effects
Farm manager characteristics	
Age of farm manager	0.044** (0.018)
Age square	-0.0005** (0.0002)
Education of farm manager	0.025*** (0.009)
Risk aversion (riskaversion)	-0.001 (0.005)
Farm manager is likely to punish for unfair behavior to him (punish)	-0.0002 (0.004)
Pseudo R2	0.730
Chi2 (p-value)	69.63 (<0.0000)
N	**364**

*Note: *p<0.1; **p<0.05; ***p<0.01 standard error (se) in parentheses*
Source: *Author's calculation based on the AGRICHANGE farm survey data.*

Second, we uncovered that "cotton growing farmers" perform negatively in "irrigation cooperation" which the relationship was statistically significant. High value crop producing farms correlated positively with irrigation cooperation, although the relationship was not statistically significant. Furthermore, fertility of plots has negative impact on irrigation cooperation (Table 3);

Table 3

The impact of farm characteristics on irrigation cooperation

	Irrigation cooperation
	Marginal effects
Farm characteristics	
Total farm size	0.001 (0.001)
Average size of plots	-0.001 (0.001)
Family labour input	0.001 (0.003)
Hired labour input	-0.005 (0.003)
Farmer grows cotton	-0.088** (0.039)
Farmer grows high value crops	0.003 (0.031)
Average fertility of plots	-0.080*** (0.013)
Pseudo R2	0.730
Chi2 (p-value)	69.63 (<0.0000)
N	**364**

*Note: *p<0.1; **p<0.05; ***p<0.01 standard error (se) in parentheses*
Source: *Author's calculation based on the AGRICHANGE farm survey data.*

Third, our model results show that if a farmer took own initiatives in participation in informal labor mobilization (hashar) and informal agreements with households and other farmers, it has a positive association with irrigation cooperation. Moreover, there is a positive relationship between river or canal irrigation regime (without pumps) and irrigation cooperation in the province (Table 4).

Table 4

The impact of farm assets on irrigation cooperation

	Irrigation cooperation
	Marginal effects
Farm assets	
Number of tractors	0.014 (0.023)
Decisions about informal agreements made by farmer himself	0.285*** (0.026)
Self-interested people in the village (selfint)	-0.029*** (0.009)
Irrigation regime	0.071*** (0.021)
Location of first plot (locat)	-0.040** (0.017)
Pseudo R2	0.730
Chi2 (p-value)	69.63 (<0.0000)
N	**364**

*Note: *p<0.1; **p<0.05; ***p<0.01 standard error (se) in parentheses*
Source: Author's calculation based on the AGRICHANGE farm survey data.

Conclusion. By our study we conclude that education level of farm manager matters in farmers' cooperation decision. This can be explained by the manner of land distribution. In Uzbekistan, land was distributed through auctions where applicants' education levels, including in agriculture-related studies, where given certain points. Cotton-growing farmers in Samarkand province are less likely to cooperate in water allocation decisions with other water users. This can be explained by the organization of water distribution through cotton procurement system where cotton growers are prioritized in water access. if a farmer irrigates its field from canal, he/she is more likely to cooperate with other water users in Samarkand province. Location of the farm field within the irrigation system matters in farmers' decision to cooperate. Further away are the farm fields, more likely is the farmer to cooperate in irrigation. When a farmer took own initiatives in participation in informal labor mobilization (hashar) and informal agreements with households and other farmers, he/she would have higher chances to cooperate in irrigation

References

1. Abdullaev Iskandar; Jusipbek, Kazbekov; Hearth, Manthritilake; Kahramon, Jumaboev (2009): Participatory water management at the main canal: A case from South Ferghana canal in Uzbekistan. In Journal of Agricultural water management 96, pp. 317–329.
2. Araral, E. (2008): What explains Collective action in the Commons? Theory and Evidence from the Philippines. World Development 37 (3), 687-697.
3. Anik, Bhaduria; Julia, Kloos (2013): Getting the Water Prices Right Using an Incentive-based Approach: An Application of a Choice Experiment in Khorezm, Uzbekistan. In Journal of European Journal of Development Research, pp 1–15.
4. Bardhan, P. (2000). Irrigation and cooperation: An empirical analysis of 48 irrigation communities in South India. Economic Development and cultural change, 48(4), 847-865.
5. Djanibekov N., Kristof, van Assche., Ihtiyor, Bobojonov & John P.A. Lamers (2012): Farm Restructuring and Land Consolidation in Uzbekistan: New Farms with Old Barriers, Europe-Asia Studies, 64:6, 1101 -1126.
6. Fujiie, M., Hayami, Y., & Kikuchi, M. (2005). The conditions of collective action for local commons management: the case of irrigation in the Philippines. Agricultural economics, 33(2), 179-189.
7. Garnevska, E., Liu, G., & Shadbolt, N. M. (2011). Factors for successful development of farmer cooperatives in Northwest China. International Food and Agribusiness Management Review, 14(4).
8. Gunchinmaa, T., & Yakubov, M. (2010). Institutions and transition: does a better institutional environment make water users associations more effective in Central Asia?. Water Policy, 12(2), 165-185.
9. Ricks, J. I. (2016). Building participatory organizations for common pool resource management: Water

user group promotion in Indonesia. World Development, 77, 34-47.
10. Takayama, T., Matsuda, H., & Nakatani, T. (2018). The determinants of collective action in irrigation management systems: Evidence from rural communities in Japan. Agricultural Water Management, 206, 113-123.
11. Horinkova, V., & Abdullaev, I. (2003). Institutional aspects of water management in central Asia water users associations. Water international, 28(2), 237-245.
12. Veldwisch, Gert Jan A.; Mollinga, Peter P. (2013): Lost in transition? The introduction of water users associations in Uzbekistan. In Water International 38, pp. 758–773.
13. Wegerich, K. (2008). Blueprints for water user associations' accountability versus local reality: evidence from South Kazakhstan. Water International, 33(1), 43-54.
14. Wooldridge, J.M. (2013); Introductory Econometrics: A Modern Approach, Fifth Edition.
15. Yakubov, M. & Ul-Hassan, M. (2007): Mainstreaming rural poor in water resources management: preliminary lessons of a bottom-up WUA development approach in Central Asia. In Journal of Irrig. and Drain.56, pp. 261–276.
16. Zinzani, Andrea (2015): Hydraulic bureaucracies and Irrigation Management Transfer in Uzbekistan: the case of Samarkand Province, Journal of Water Resources Development, DOI: 10.1080/07900627.2015.1058765.