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Protein Consumption of Farmers Growing Only Cotton: A Case from Tajikistan

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Abstract: In 2004 cotton accounted for 17.3% of total export revenue; cotton has a considerable impact on the overall economic growth of Tajikistan. However, farmers growing only cotton do not necessarily benefit from this growth. This study uses data collected by Oxfam Great Britain from five districts of Khatlon Province of Tajikistan (N=1835) in June 2007 to analyze protein consumption of farmers who grow only cotton and other farmers who are able to diversify their yield. Logistic regression was utilized to determine the odds of farmers growing cotton and other farmers consuming protein, and what factors impact protein consumption. The result shows that protein consumption is 22% lower for farmers growing only cotton when economic and asset variables are not controlled for. Once these controls are added the effect of growing only cotton becomes insignificant, implying that farmers are better off not because they grow cotton but of other factors.

Key words: Tajikistan; cotton; farmers; Central Asia; protein; consumption

Introduction

Following the Bolshevik overthrow of Imperial Russia, territories controlled by the Russian Empire, such as the area now known as the Republic of Tajikistan, became part of the Union of Soviet Socialist Republic (USSR). During the 1920s when the Soviet government took control, the farm lands were seized from nobles and private land owners, and collective farms (kolkhozes) and state farms (sovkhozes) were established. Kolkhozes were managed by administration elected by farmers and approved by the regional party committee, and sovkhozes were directly managed by the state government.

Like all the farmers in the Soviet Union, Tajik farmers did not own land; rather they were employed by the government to work on it (Porteous, 2003). After the collapse of the Soviet

Union, the government decided to reform the structure of kolkhoz/sovkhoz and establish small, efficient, privately-owned farms, known as dekhan farms. In 1992 the first law "On land reform" passed that allowed local authorities to distribute the land not used by kolkhoz/sovkhoz to people to establish these dekhan farms (Porteous, 2003).

The land reform was meant to improve the living condition in rural areas; however, most of the people were not aware of the land reform and as a result not everyone was able to get land and establish dekhan farms. From 1992 to 1997 Tajikistan was in a civil war between two political groups. By the end of the war, the government conducted another land reform, decree 522 on "Reconstructing Agricultural Enterprise and Organization" (Porteous, 2003). The aim of this law was to reconstruct all the kolkhozes and sovkhozes farms, which were already heavily in debt, into dekhan farms by 2005. Seed production farms, livestock breeding farms, and research centers were exempt from this reform, so they remained under the control of the state (Porteous, 2003).

The land redistribution seemed to do little to assuage poverty as it was 81% in 1997 and 64% in 2005 (WB, 2005). However, there is no evidence to show that this reduction in poverty was the result of the land reforms as other factors such as the end of the civil war, economic growth, and the beginning of the use of remittances most likely were the main important contributors to positive changes in the Tajik economy. There were many reasons why redistribution of land did not help with poverty, which included flaws in the process such as corruption, local authority negligence, unemployment, population was not informed on land reform, civil war, etc. In addition, the most important problem was that the new dekhan farmers also inherited the debt of kholkhoz/sovkhoz farms when they received their new lands, and they

also had to put up with interferences in their business from the Tajik government (Porteous, 2003).These problems greatly impacted the cotton growing sector of Tajikistan.

In Tajikistan cotton is the main cash crop and is the second largest export product after aluminum (WB, 2005). The government officially maintained full control over the main cash crop until 1997, but to this day continues to unofficially maintain full control over this cash crop product (WB, 2005). Starting in the mid-1990s, private investors started investing in Tajik cotton. Kolkhozes/sovkhozes borrowed money from the investors in the beginning of the season then planned to pay back the loan from the harvest at the end of the season. If the cotton production would be more than the amount invested, then kolkhoz/sovkhoz would make a profit or otherwise they would be in debt. Kolkhoz/sovkhozes took out these loans and in most cases were not able to meet the cotton production plan and became deeper in debt. The interest rate on the loan increased and according to the first deputy of Ministry of Agriculture, Ismonqul Subhonov, the debt of cotton growing farmers in Tajikistan in 2006 was $227 million (Kondrashova, 2006).

In 1997 when the government decided to restructure the kolkhoz/sovkhoz system, the issue of their debt was raised. As the government was not able to pay back these debts, it was given to the households that established dekhan farms. The amount of debt each dekhan farm received depended on the size of the land. In most of the cases, the debt was over $1,000 per hectare (Porteous, 2003).

Another major issue of dekhan farms is that even though the farmers own the land, the government still controls what crops are grown. The government requires farmers to grow cotton, and if they disobey, their land, last hope of livelihood, may be seized from them. In

addition to their inherited debt, farmers have to take out additional loans to be able to grow cotton against their will.

Although cotton's contribution to Tajikistan's gross domestic product (GDP) was 8.2% (Baffes, 2005) the consumption level is lower in cotton farmers' families than in families of farmers growing other crops (WB, 2005).

The aim of the current research is to determine the well-being of Tajik cotton farmers and compare the well-being of Tajik cotton farmers to Tajik farmers that grow other crops. Following this introduction will be the literature review, then the research method, findings, discussion, limitations, and conclusion.

Literature Review

Economic Growth and Well-being

There is a lack of empirical literature available in academic journals that discuss the well-being of cotton farmers in Tajikistan. However, the World Bank and UN reports do discuss the overall economic growth and human development growth in Tajikistan (UNDP, 2005; WB, 2005). The World Bank poverty assessment shows that since the end of the civil war, Tajikistan has made large economic progress, most of which is a result of aluminum and cotton trade (WB, 2005). Despite this progress, the report indicates that half of the population does "not feel as if their situation has improved" (WB, 2005). This finding raises the question of whether the economic growth has really improved the well-being of people.

Firebaugh and Beck (1994) have studied the effect of economic growth on the well-being of people in 62 less-developed countries. Their study demonstrates that the economic growth has a significant positive effect on the well-being of the people (Firebaugh & Beck, 1994). However, Firebaugh and Beck's (1994) study was questioned by Brady, Kaya, and Beckfield (2007) who

replicated their work with 109 countries and added additional dependent variables that were indicators of well-being.

Firebaugh and Beck (1994) had three dependent variables caloric consumption, infant survival probability, life expectancy at age 1 (for male and female) and five predictors: GNP per capita, percentage enrolled in secondary school, export as percentage of GDP, and raw material export as percentage of all. Brady eta al. (2007) replicated added the following variable: one-to-five year survival probability, female life expectancy, and male life expectancy, and additional five independent variables: total fertility rate, urbanization, debt service as percentage of GNI, year, and interaction of year and GDP. In addition to that, Firebaugh and Beck's (1994) study was only across two points in time whereas Brady et al. (2007) work was across six points in time.

Brady et al. (2007) found some facts that support the belief that growth in GDP can improve the well-being of the citizen and some facts that do not support it. They found that growth in GDP had robust significant effects on average calories, female life expectancy, and male life expectancy and had weak significant effects on fertility, urbanization, and debt service. GDP becomes less effective over time, and the fertility rate has greater impact on all the dependent variables except average calories than GDP (Brady et al. 2007). Brady et al. (2007) have also highlighted that growth in GDP may only benefit the "upper income households while lower income households may not experience income growth" (p. 24). This finding suggests that the growth in GDP can not be generalized to the overall well-being of the population as each household could be affected differently, depending on the country's level of inequality.

Development specialists argue that the well-being measurement should go beyond the metric measurement and include physical condition of the individual (Morris, 1979; Sumner

2007; Tiwari, 2009). Different methods and approaches were used by specialist to measure the overall development of the countries, among them Morris's (1979) physical quality of life index; Sen's (1982) capability approach; adding health and autonomy to basic needs approach (Doyle & Gough, 1991); and Sen's and Haq's Human Development Index (HDI) (Tiwari, 2009). The most recent one is the HDI used by UNDP to report on countries' human development. The index combines three basic dimensions 'life expectancy at birth', 'illiteracy rate', and 'standard of living' that describe well-being. Tajikistan HDI in 2005 was 0.673, ranked 122nd out of 177 countries (UNDP, 2005).

However, the HDI has also been criticized by different scholars as it does not capture the issues of gender, inequality, participation and political freedom (UNDP, 2005). To better understand households' well-being, one should look beyond the three dimensions of HDI (Tiwari, 2009). Gasper (2004) highlights that well-being is a term that embraces subjective and objective measures. To understand human well-being, development specialists should look both at the factors of subjective and objective well-being.

Subjective and Objective Well-being

Gasper (2007) highlights the differences in well-being measures by dividing them into subjective well-being (SWB) and objective well-being (OWB). SWB is focused on feeling attributes whereas OWB is focused on externally approved non-feeling attributes. The two states of well-being may or may not have a relationship with each other; one does not necessarily promote the other (Gasper, 2007; Tiwari, 2009).

SWB is more concerned with factors related to health, impacts on the well-being of individuals. Empirical evidence shows that the level of SWB differs between people who suffer from physical and psychological health conditions and those who do not have such conditions.

The differences are mainly observed in their personal well-being, particularly related to health, achievements in life, and community connectedness (Cummins, Eckersley, Lo & Okerstrom, 2004). SWB explains more of the personal well-being, but there is currently no literature that discusses SWB at household or community level.

As for OWB, Gasper (2007) compounds it from several components such as consumption, capabilities, long and healthy life, and eudemonia. Each of these components can be examined separately as well, but Gasper (2007) groups them together to observe the general pattern of OWB.

Households' Livelihood Strategies

Development specialists in the 1980s put the household strategies together and developed a framework that was named Sustainable Livelihood Framework, although sometimes it is called Sustainable Livelihood Approach (SLA), which is composed of a combination of different elements that are interrelated (Brocklesby & Fisher, 2003). The approach is very useful in developing programs to reduce poverty; it was employed by governments in low-income countries to develop Poverty Reduction Strategy Papers (PRSP). The uniqueness of the sustainable livelihood approach is that it involves external and internal stakeholders to develop programs to help the community or countries at large.

In brief, according to the Brocklesby and Fisher (2003), the SLA is based on four main components vulnerability, capital, livelihood strategy, and policy, institutions and process. *Vulnerability context* explains what kind of social, economic or political risks, shocks, and trends do people face while building their livelihood. C*apital* looks into the assets that people rely on to improve their livelihood. Capital consists of (i) social capital (network, group membership, relationship of trust), (ii) natural capital (natural resources), (iii) financial capital (savings, credit,

remittances, pension), (iv) physical capital (transportation, energy, water, and communication), (v) human capital (skills, knowledge, education, labor). These five forms of capital are used to assess assets that people use on a daily basis. People use these assets to develop their *livelihood strategies* (such as migration) that help them to improve their livelihood. *Policies, institutions and processes* is a component that affects people's livelihood, shapes access to assets and livelihood activities, and impacts people's vulnerability (Brocklesby & Fisher, 2003).

Households adopt different strategies to improve their living conditions. Most rural households' livelihood strategies are connected to agriculture activities. Development specialists highly recommend diversification of livelihood strategies for the best long-term outcomes. Ellis (1998) defined livelihood diversification "as a process by which rural families construct a diverse portfolio of activities and social support capabilities in order to survive and improve their standards of living" (p.1).

By diversification Ellis (1998) meant that people living in rural areas should be engaged in on-farm, off-farm and non-farm activities to increase their income. Off-farm activities mainly refer to wage and labor exchanges with other farms. Non-farm activities are out of farm income (money from rent, employment, remittances, etc). Incomes from non-farm and off-farm activities are highly important during the seasons with poor or no harvest. Households may sometimes fail to yield enough harvest from their land to meet their food consumption needs, but their non-farm and off-farm activities can provide income security (Ellis, Kutengule, & Nyasulu, 2003; Orr, Mwale, & Saiti, 2001).

Cash crops play a vital role in building the livelihood of rural households. More than 10 million people depend on cotton in central and western Africa (Oxfam, 2002). In Tajikistan 70% of people work in the agricultural sector; most of them work in cotton fields and most cotton

farmers are limited to growing only cotton. Practically, this restriction affects not only the consumption of cotton farmers, but also people working for them too (Porteous 2003; WB, 2005). Cotton farmers in Tajikistan are at a disadvantage situation because they do not have direct access to credit (Porteou, 2003), lack of potential agricultural and structural reforms (Baffes, 2005; WB, 2005), subsidies for cotton farmers in developed countries (Oxfam, 2002), etc. This is why it is important for diversity in households' livelihood strategies even when farmers are growing cash crops..

Cash Crops versus Food Crops

Cash crops are defined as crops used by households to generate income. Therefore, development specialists consider cash crop production to be a mechanism to help alleviate poverty in developing countries. Cash crops differ by country and mainly depend on the countries' climate, but the most common cash crops are coffee, sugar cane, bananas, cotton, wheat, maize, and oil-yielding crops (Brown, & Kennedy, 2005; Masanjala, 2006).

Some cash crops such as cotton, wheat, coffee etc, are produced in large quantities and contribute to the GDP of the country. For example, in Tajikistan, the main cash crop is cotton and it contributes 8.2% to the GDP (Baffes, 2005); however, the benefit of it to the cotton farmers is low (Porteous, 2003; WB, 2005). In Tajikistan and Uzbekistan, cotton growing farmers are treated unjustly as the government forces them to grow cotton, but in return, does not pay them fairly for their work (Baffes, 2005; Porteous, 2003; WB, 2005). This kind of system makes farmers vulnerable to poverty and increases inequality. Masanjalana (2006) stressed the importance of cash crop liberalization, as it can have a significant impact on improving the well-being of rural areas. In the case of Tajikistan, Poreous (2005) suggests that farmers should be given access to credit, the government should improve the land reform process, the government

should reconsider the current cotton production plan, and give farmers more opportunity for development. Lifting restrictions on farmers by allowing them to choose what crops to produce or at least pay them fairly. Lifting the restriction on farmers to grow only cotton can improve their well-being.

The other factor that can lead to the economic development of cotton farmers is cash crop diversifications. For example, allowing farmers to grow other cash crops in addition to cotton, such as tobacco, sugar beets, and soybeans, etc would reduce the dependence on one crop. Similarly, Orr, Mwale, and Saiti (2001) recommended a similar plan for Malawian farmers. They proposed the new crops such as soybeans and paprika be added to farm production to improve the food security of Malawi rural households (Orr et al. 2001).

Brown and Kennedy's (2005) study in Nepal found that farmers growing different varieties of crops have 50% higher gross margins than farmers growing only one variety. The study also found that the gross margin is related to land ownership and household food security. The lower the gross margin, the smaller the land size (Brown & Kennedy, 2005).

Land Ownership

By 1997 the level of poverty rose to 81% and the government decided to make amendments to the land law in 1995 and 1997. The President signed a decree that allowed households to own land from kolkhoz/sovkhoz farms; this land was named as presidential land. The purpose was to improve food security at the household level. The size of the presidential land depended on household size and kitchen plot (garden) available to household (Giovarelli, 2004; Porteous, 2003). Presidential land did result in an increase of household food consumption (WB, 2005), but the situation was different for farmers who owned dekhan farms and could grow only cotton. At the same time, local authorities constantly violate the cotton farmers' right by

interfering and limiting their business if they disagree with the local authorities (Land Committee [LC], 2004).

During Kay's (2005) study of Latin American poverty, he stressed the importance of profound agrarian reform, and used South Korea and Taiwan as examples of countries that used the process of development to eliminate poverty. The key to South Korea and Taiwan was agrarian reform, particularly land reform, which was implemented before these countries began industrialization and economic relationship with other countries (Kay, 2005).

United States Agency for International Development (USAID) (2004) have recommended to the Tajik government to give more freedom to farmers, access to direct financing/ credit, and organize trainings and seminars for farmers across the country in order to increase their knowledge about the land reform and their rights.

Asset Ownership

Most farmers in Tajikistan do not possess tangible assets such as cash or equipment, so they depend on investors to purchase agricultural inputs (seeds, fertilizers, etc) and must also hire and pay for machinery to cultivate the land. During the Soviet Union, the cotton sector was funded by the government, but after the collapse, funding stopped. Since 1991 a foreign investor, Paul Reinhart, started investing his money in Tajik cotton (Porteous, 2003). The lending system that was set up could be described as a stepping stone system, wherein the foreign investor, Paul Reinhart, gives money to Agroinvest Bank. The local investors then take the money and give it to Dehkan Farms Association, and then the Association gives the money to the farmers. The farmer does not receive the money in the form of cash, but in the form of inputs such as fuel or other agricultural inputs at double the price (Porteous, 2003; WB, 2004). In each of these stages, participants raised the interest rate; in the end, depending on broker, the interest rate ranged

between 19% and 25% (WB, 2004). Thus, in 2006 the dept of cotton growing farmers was accounted for $227 million (Kondrashova, 2006). The situation could be changed if farmers could have direct access to credit.

The other issue that affects farmers includes machinery problems, problems with workers, and the quality of the cotton grown. Most of the people that work in Tajikistan cotton fields pick the cotton by hand, which takes more time than collecting by combines. Porteous (2003) in his study found that 26.3% of the cotton field workers were paid a salary of less than $10 per month. In addition to monetary payment, 94.7% of cotton field workers received in-kind payment in the form of dried cotton sticks at the end of the cotton season, which can be use as a fuel for cooking and heating houses in winter (Porteous, 2003).

According to the law, after the reform of the kolkhoz/sovkhoz system, all the property of the kolkhoz/sovkhoz, including machinery, should be handed to dekan farms shareholders. However, the presidential audit conducted in summer 2004 shows that in some areas local authorities abused their power and violated this law by selling the machinery, without the consent of the farmers to private people or companies (LC, 2004).

Now the farmers are highly dependent on privately owned cotton gin machines and whose owners are monopsonist purchasers of cotton in a designated area. The cotton farmers have no choice but to go to the only cotton purchaser in the region who has the power to dictate the service price. The other issue is that the gin machinery was inherited from the Soviet Union and is now outdated resulting in processing the cotton takes 200 days in Tajikistan compared to 90 days in other countries. The outdated machinery also impacts the quality of the cotton, because it does not clean the cotton as well as modern machineries, resulting in lower quality cotton, and lower profit (WB, 2005).

Methods

Data

The data are cross sectional and collected in June 2007 by Oxfam Great Britain (Oxfam GB) in Tajikistan. They were collected from 137 villages located in eight districts of the Khatlon Province, the southern part of Tajikistan. The total sample size is 4242 households; however, the selection criteria for this study excluded non-cotton growing regions, and those households that do not farm. Thus, 1835 observations from five districts and 74 villages meet the exclusion criteria to be analyzed in this study. The project model is attached see Appendix A and the study areas is attached in Appendix B.

Selection of Villages and Households

For the selection of villages, a transect approach was applied in order to cover the maximum diversity in terms of land use within the district. Generally 5% of the total households of the district were included in the assessment, and within the selected villages, 20% of households (every 5th house) were interviewed. This approach permits a deeper understanding of the living conditions and coping strategies of the population of the selected villages.

Dependent Variables

The project's dependent variable is households' meat consumption in the winter time, which was used as an indicator for households' protein consumption. The variable was collected as a scale method, in which 0 indicates that households never consumed protein and 7 indicates that households consumed protein every day. The variable was skewed and transformation was not possible. Thus, the variable was converted into a dummy variable where 0 indicates households never consumed protein during a week and 1 indicates households consumed protein at least once a week.

Independent Variables

The project's main independent variable is farmers/households growing only cotton, which is measured as a dummy variable with a value of 1 if farmers/households grow only cotton and 0 if households/farmers grow other crops, including cotton. In the 0 category there could be farmers/households who grow cotton and other crops or only other crops.

Control Variables

The project has nine control variables which can be grouped into demographic, agricultural, and economic/asset variables. Demographic variables include household heads' gender with a value of 1 for female headed households and 0 for male headed households; household heads' marital status measured as married with a value of 1 and previously married with a value of 0. Household size is a continuous variable measured by the total number of people living in the household and the final demographic variable is the presence of children under 6 years old in the household which is a dummy variable where 1 indicates that the household has a child or children under 6 years old and 0 indicates that there are no children under 6 years old in the household.

The agricultural variables include land size, livestock, and farmers selling their own products. The land size includes both irrigational and rain-fed land that the household owns. The continuous land size variable was converted into three level categorical variables where 1 indicates that households have land below 0.99 hectares (ha), 2 indicates households' land size is above 1ha or below 1.99ha, and 3 indicates that the households have land above or equal to 2ha. Later, each of these categories was coded into a dummy variable and the households having land below 0.99ha were selected as a reference group. The asset or economic variables are remittances, farmers selling own product, household's loans situation, and livestock worth.

Remittance is a dummy variable coded 1 if the household has received any remittances and 0 otherwise. Remittance is a three level categorical variable where 1 indicates household received no remittances, 2 indicates household received less than $299 in the last 12 months, and 3 indicates if the household received above $300. For the logistic regression, each of these categories was converted into a dummy variable and the household that had no remittances in the last 12 months was used as a reference group.

Farmers selling their own product is a dummy variable which is coded 1 if farmers reported that they sell their own agricultural product in the market and 0 if they don't. Household loans is also a dummy variable, 1 indicating if household got any loans and 0 if household have no loans. The variable loan was constructed from nine different variables that household reported took loan for which were loans for small business, buying livestock, planting, agricultural inputs, celebrating ceremonies, clearing debt, migration, treatment, and for other purposes. Household that took any of these loans was coded 1 and 0 if household did not take any loans.

The final control variable is the worth of household livestock which was created by multiplying the number of cows, calves, sheep, goats, and poultry to their cost. The cost of each livestock and poultry for the month June 2007 was obtained from Oxfam GB community mobilizer Kamoliddin Abdulloev and converted to US dollars according to the exchange rate of June 2007 (1 Tajik Somoni = 3.5 US Dollars) (personal communication, April 18, 2009). The variable was further transformed to square root in order to meet the logistic regression assumption.

Analysis

In the analysis of the data, chi-square, t-test, and logistic regression were used. Hosmer-Lemshow goodness of fit test was used to test the model. The goodness of fit test is a chi square

statistic with a desirable outcome of non-significance. Chi-square analysis was used to observe the relationship between the dependent and independent variables. T-test was used to observe the differences in the mean of the independent and dependent variables. Logistic regression was used to determine the effect of independent variables on the dependent variable.

The project has four models. In the first model, the effect of the main independent (farmers growing only cotton) variable on the dependent variable was observed. In the second model demographic control variables were added to observe their effect both on main independent variable and the dependent variable. The third model observes the effect of the land size on the previous variables and the dependent variable. The final model observes the effect of economic and square rooted worth of livestock variable on the main independent variable, previous control variables, and dependent variable.

Findings

Descriptive Statistics

Dependent variable. Table 1 presents the descriptive statistic for the dependent variable of the project. The first column discusses the variable and its attributes. The other two columns discuss the frequencies of each attribute and the percentage in each group. Table 1 shows that the total number of observations is 1835, of them 701 (38.4%) reported that they have no protein consumption at all whereas 1123 (61.6%) consume protein at least once a week.

Table 1: Descriptive statistics for dependent variable

Protein consumption	N = 1835	
	Freq.	%
No	701	38.4
Yes	1123	61.6

Independent variable. Most of the independent variables are dummy variables except for household size, and the worth of livestock, which are continuous variables. Table 2 presents the

descriptive statistics of the independent variables. In order to observe the household demographic characteristics other variables such as number of families in the households, number of children under 6 years old in the households, number of children between the age of 7 to 18 in the households, and migration in households were included into the descriptive statistics. However, these variables were not used in bivariate and logistic regression analysis.

The results show that the sample size is predominantly male headed households (88%, n=1616), only 12% of the sample are female headed households, 87.3% (n=1601) of the respondents reported that they are married and 12.7% (n=233) reported that they were previously married. Each household on average has almost two families (m=1.9, SD =1) in the household. The average number of people living in household is almost ten (m=9.7, SD =3.9). Most of the respondents (70.4%) reported that they have children under six years old in the household, the mean is 2.2 (SD=1.4). Ninety two percent of the respondents reported that they have children of age 7 to 18 years old, with the mean of 3.2 (SD=1.7) children in the household.

The level of migration in the sample size is high as 59.6% of the household reported that they have someone in migration whereas 40.4% said that they have no one migrated. From the overall sample size (n=1835), 45.4% have received remittances, 17.3% of them received below $299 and 28.1% of them received above $300.

As for farmers selling their own products 60.7% (n=1114) reported that they do not sell their own products and only 39.3% (n=721) reported that they are selling their own product. Their own product includes could be potatoes, vegetables, dairy products, meat, grains, fodder, oil, fresh fruits, processed or dried fruits, silk/cocoon, raw cotton or cotton by-products, processed cotton, and others. The descriptive statistics for selling raw and processed cotton

showed that only $$ households was selling these products and due to low number of observation it was not possible use them in the regression analysis separately.

Table 2: Descriptive statistics

Variables	Freq.	%	Mean	Mode	SD
Household gender					
Male	1616	88.0			
Female	219	12.0			
Marital status					
Married	1601	87.3			
Previously married	233	12.7			
Number of families living in the household	1835	100	1.9	1	1
Number of people living in the household	1835	100	9.7	8	3.9
Number of children <6 y. o. in household	1291	70.4	2.2	1	1.4
Number of children 7 – 18 y. o. in household	1688	92.0	3.2	3	1.7
Migration					
No	741	40.4			
Yes	1094	59.6			
Land size					
0.1 – 0.99 ha	1174	64.0			
1 – 1.9 ha	376	20.5			
2 ha+	285	15.5			
Farmers selling own product					
No	1422	77.5			
Yes	413	22.5			
Remittances received by households					
$0	969	54.6			
<$299	308	17.3			
$300+	498	28.1			
Household loans					
No	1291	70.3			
Yes	544	29.7			
Livestock worth	1739	94.7	714.4	393	592.1

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All the households had either irrigational or rain-fed land and the majority 64% (N=1174) reported that they have land below 1 hectare, and only 20.5% (n=376) have land between 1 and 1.9 hectares, and 15.5% (N=285) have land above 2 hectares. Almost 30% (n=544) of the households reported that they obtained loans/credit for different purposes and from different agencies, which includes banks, NGOs, community based organizations or private people. Two and hundred sixty seven (14.5%) households reported that they obtained the loan for agricultural purposes such as planting and purchasing agricultural inputs; however, due to multicoliniarity it was not possible to separate the agricultural loan from the other loans. Thus, the loans variable include loans taken for small business, buying livestock, planting agricultural inputs, ceremonies, clear debt, migration, and treatment.

Almost 90% (n=1649) of the households reported that they keep livestock at home, which include cattle, calves, sheep, and goats, and 60% of households reported that they keep poultry.

Bivariate Analysis

Chi-square and t-test were used to assess the relationship between the dependent and independent variables. The result of the bivariate analysis for the protein consumption is presented in Table 3.

Table 3. The result of bivariate analysis of independent variables on protein consumption

Variables	Protein consumption				t or χ^2
	No (N = 701)		Yes (N=1123)		
	N	%	N	%	
Farmers growing only cotton					
No	534	37.2	901	62.8	$\chi^2_{(1)} = 4.22$*
Yes	167	42.9	222	57.1	
Household head gender					
Male	597	37.2	1009	62.8	$\chi^2_{(1)} = 9.00$**
Female	104	47.7	114	52.3	
Marital status					
Married	604	42.0	988	58.0	$\chi^2_{(1)} = 1.39$
Previously married	97	37.9	134	62.1	
Number families living in households					
Mean (SD)	9.7(4.1)		9.8(3.9)		$t_{(1821)} = -0.06$
Children under 6 years old					
No	216	40.0	325	60.0	$\chi^2_{(1)} = 0.72$
Yes	485	37.8	798	62.2	
Land size					
0.1 – 0.99ha	477	40.8	692	59.2	$\chi^2_{(2)} = 9.92$**
1 – 1.99ha	137	36.6	237	63.7	
2 ha+	87	31.0	194	69.0	
Remittances received					
$0	383	56.3	581	53.5	$\chi^2_{(2)} = 12.2$**
$<299	136	20.0	171	15.8	
$>300	161	23.7	333	30.7	
Farmers selling their own product					
No	589	41.7	823	58.3	$\chi^2_{(1)} = 28.45$***
Yes	112	27.2	300	72.8	
Loans taken					
No	366	34.5	695	65.5	$\chi^2_{(1)} = 16.60$***
Yes	335	44.0	428	56.0	
Square root livestock worth	21.7(10.3)		25.8(11.4)		$t_{(1821)} = -7.83$***

*p<.05, **p<.01, ***p<.001

Table 3 shows that there are statistically significant differences in the protein consumption with regard to farmers growing only cotton ($\chi^2_{(df=1)}$=4.22, p<0.05), household head gender ($\chi^2_{(df=1)}$=9.00, p<0.05), land size ($\chi^2_{(df=2)}$=9.92, p<0.05), farmers selling their own products ($\chi^2_{(df=1)}$=28.10, p<0.05), loans ($\chi^2_{(1)}$ = 16.60, p<0.05), and square rooted livestock worth ($t_{(1821)}$ = -7.83, p<0.05).

The bivariate analysis result revealed that in the sample size of 1824, farmers growing only cotton are more likely to have less protein consumption (42.9%) than other farmers (37.2%). The similar result was observed in female headed households where 47.7% of them reported they had less protein consumption compared to 37.2% of male headed households. The land size variable shows that farmers possessing land below 0.99ha are more likely to have less protein consumption (40.8%) than farmers possessing 1 to 1.99ha of land (36.6%) and above 2ha of land (31%). The result is better for farmers that sell their own products; they are more likely to have protein consumption (72.8%) than farmers who do not sell their own product (58.3%) and the households who have taken loans (44%) are also likely to have less protein consumption than household who did not take loans (34.5%).

Logistic Regression

Protein Consumption

The result of the logistic regression is presented in Table 4. The table has four models, the first model in Table 4 shows that farmers growing only cotton have a significant negative effect on protein consumption. The odds of protein consumption are 22% lower for farmers growing only cotton than other farmers. The second model, after including demographic control variables, shows farmers growing only cotton and female headed households have a significant negative effect, while marital status, number of people, and the presence of children under 6

Table 4 Logistic regression of protein consumption and other variables

Outcome: Protein consumption	Model I OR (CI 95%)	Model II OR (CI 95%)	Model III OR (CI 95%)	Model IV OR (CI 95%)
Predictors:				
Farmers growing only cotton	0.78 (0.62 to 0.98)*	0.77 (0.62 to 0.98)*	0.77 (0.61 to 0.97)*	0.85 (0.66 to 1.08)
Head of household (female)		0.60 (0.42 to 0.85)**	0.61 (0.43 to 0.86)**	0.72 (0.50 to 1.03)
Marital status (married)		0.88 (0.62 to 1.24)	0.86 (0.61 to 1.23)	0.89 (0.62 to 1.27)
Household size		0.99 (0.96 to 1.01)	0.99 (0.96 to 1.01)	0.97 (0.94 to 1.00)
Children under 6 y. o. (yes)		1.11 (0.88 to 1.38)	1.11 (0.88 to 1.38)	1.07 (0.84 to 1.35)
Land size 1 – 1.9ha			1.19 (0.93 to 1.51)	1.14 (0.88 to 1.47)
Land size 2ha and above			1.53 (1.15 to 2.03)**	1.31 (0.97 to 1.76)
Remittances less than $299				0.94 (0.72 to 1.24)
Remittances above $300				1.35 (1.06 to 1.72)**
Farmer selling own products (yes)				1.77 (1.37 to 2.29)***
Households taken loans (yes)				0.66 (0.54 to 0.81)***
Square root livestock worth				1.02 (1.01 to 1.03)***
N	1824	1822	1822	1763
χ^2	χ^2 (1)= 4.19*	χ^2 (5)= 14.43**	χ^2 (7)= 24.33***	χ^2 (11)= 75.57***
Pseudo R^2	0.001	0.013	0.010	0.046
Goodness of fit test, Prob. > χ^2	χ^2 (0)= 0	χ^2 (184)= 189.73	χ^2 (340)= 328.14	χ^2 (1713)= 1719.58

*p<.05, **p<.01, ***p<.001

years old in the households are not significant. The odds for farmers growing only cotton are 23% lower than for other farmers, and for female headed households the odds are 40% lower than for male headed households, in the second model.

In the third model, after including the land size variable, the odds for farmers growing only cotton is still 23% lower than for other farmers, and the odds are 39% lower for female headed households that for male headed households. Marital status, number of people, and the presence of children under 6 years old in the households are not significant. The land size is positively significant, but only for farmers possessing land above 2ha. The odds of protein consumption are 53% higher for the farmers who have land above 2ha than farmers who have less than 0.99ha, the reference group.

The final model shows that after controlling for economic/asset variables, farmers growing only cotton, female headed households, and land size above 2ha that were significant in the previous models are no longer significant. This could be because the economic/asset variables explain most of the variations in the model.

The final model shows that households who received remittances above $300 in the last 12 months, farmers selling their own product, and square rooted livestock worth have positive significant effect on protein consumption whereas households who have loans have negative significant effect on protein consumption.

The result revealed that the odds of protein consumption are 35% higher for households receiving remittances above $300 than for households who did not receive any remittances in the last 12 months, the control group. The odds of protein consumption are 77% higher for farmers who sell their products than for farmers who do not sell, and the odds are 2.8% higher for households who have any kind of livestock (cows, calves, sheep, or goat) and poultry, and the

odds of protein consumption are 34% lower for households who have taken loans, than for household who did not take loans.

Discussion

The study found that farmers growing only cotton have lower protein consumption than other farmers in the first three models. However, after controlling for their economic and asset variables, farmers growing only cotton were no longer significant, but the coefficient is still negative. The findings particularly support the assumption that it is not the income from cotton, but other factors, which have impact on the protein consumption of farmers growing only cotton.

The insignificance in protein consumption for farmers growing only cotton was mainly caused by the two independent variables of the model: households' loan condition and the worth of livestock. The result of the bivariate analysis of farmers growing only cotton and households' loan condition revealed that out of 768 households that took loans 23.7% of them were famers growing only cotton and the rest (76.3%) were other farmers. This finding shows that the majority of the households that are in debt are other farmers. The debt they owe reduces their protein consumption and makes them as equal to low protein consumption as farmers growing only cotton. That's one of the main explanations to how the households' loan condition impacted the protein consumption in the last model.

The effect of the livestock on protein consumption could be explained by the fact that farmers having more livestock might use their domestic animals (cows, calves, sheep, goat, and poultry) to cover their protein consumption needs. At the same time, it was not possible to determine this with the current data as it did not contain variables in regard to whether the household used their livestock to cover their consumption needs or not.

Female headed households were also disadvantaged as cotton farmers and became insignificant only after controlling for economic and asset variables. This finding was consistent with previous research, which particularly highlights the vulnerability of female headed households to poverty, discrimination, and inequality (Falkingham, 2000; WB, 2005). In the last model, female headed households become insignificant mainly because of the robust effect of livestock on protein consumption. This is a similar situation to farmers growing only cotton where most of the variations are explained by the livestock variable and loans. To understand why female headed households have lower protein consumption it would be important to look at other factors such as inequality, access to productive resources, employment, and education that can explain this phenomenon; however, due to the data limitation the current study was not able to look at these factors.

The other important finding was that the demographic variables, particularly the number of people and the presence of children under six years old in the household, were not consistent with previous research. Falkingham's (2000) study revealed that there is strong correlation between number of children in the household and poverty. Although this research did not look at poverty, it still expected that the number of people in the living household and the presence of children under six years old would have a negative effect on protein consumption. However, that was not the case. This could be due to economic growth that happened in Tajikistan since 1999 (the year that Falkingham data were collected), which improved the living conditions of rural households. This was also highlighted in World Bank (2005) reports that the overall average consumption in Tajikistan has grown by 4% since 1999.

The land size above 2ha in the third model has positive significant effect on protein consumption and in the fourth model, it is insignificant. The study expected that it would have a

negative effect on protein consumption because previous studies and reports show that farmers who possess larger land size are mainly forced to grow cotton and have less freedom of crop selection which presumably would affect their consumption (Porteous, 2003). In the fourth model, the land size is insignificant which might mean that it does not have a robust effect on protein consumption as the loan and livestock variable.

Farmers selling their own product have the highest odds of protein consumption, which indicates that income generating activities can have a positive effect on protein consumption of the households. However, it is important to conduct further research to determine what crop has more effect on consumption in order to concentrate resources to grow that crop.

Based on the research findings there are some recommendations for policy makers and program development specialists. One of the main policies that should be put in place is to allow farmers to grow other crops in addition to cotton so that they will be able to trade them and increase their income. In addition to that, it is important to improve the infrastructure such as road and markets where farmers will be able to sell their products. It is also important to enhance farmers' business and agricultural skills that will enable them to generate more revenue. It would also be useful to develop methods or mechanisms that will stimulate farmers' saving rate, build their assets, connect them to the economic mainstream so that they will be able to save, generate more income, be able pay their loan and invest in their future development. In the development of any intervention, female headed households have to be in the center of the discussion. Any program has to guarantee an equal access to the resources for both female and male headed households.

Limitations

There were two main limitations in the project. The first is that there was lack of empirical literature to describe the socio-economic conditions of farmers. Most of the available literature was based on descriptive statistics which does not give enough information about their situation.

The second and most important limitation was the data. They did not contain important information about the households, such as household age, education, income, source of income, health condition other than infectious diseases which are very important to control for. Also the household consumption was collected by date, but not by kilo calories or kilograms, which made it difficult to use all the consumptions data collected in the survey. Also World Bank, Asian Development Bank (ADB), UNDP and other financial institutions constantly mention farmers' debt; unfortunately, the data did not contain any information about the farmers' debt in regard to cotton. However, it is important to mention that this survey was not developed to study the cotton farmers' condition. Maybe that's why some of the above mentioned factors were not considered in the process of the instrument development.

Conclusion

Cotton is the main cash crop of the country. One would think that farmers who grow it will have a higher level of consumption. The current research looked at the protein consumption of farmers growing only cotton and found that they have lower odds of protein consumption than other farmers unless they have livestock. Unfortunately, depending on their livestock is also not reliable as they might consume it and will have to depend on their land production, which is limited to cotton and makes the household vulnerable to malnourishment. At the same time, the

data limitation does not allow for making a strong conclusion, which leaves a gap for future study of the issue.

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