Vulnerability and risk management among Turkmen leaseholders

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Abstract

High risk is inherent to agriculture in Turkmenistan, a post-socialist desert country where the political uncertainties of transition exacerbate natural unpredictability. This study examines risk coping strategies of Turkmen farmers based on a survey of 1100 respondents carried out in 2002 in all five provinces. We propose a new composite index of vulnerability, which includes human capital indicators and geographic location. The analysis relies on a single independent variable, which nevertheless incorporates the effect of criteria interactions.

Using survey data, we analyze income smoothing as a mechanisms of risk management across vulnerability groups. Consistently with theoretical expectations, the most vulnerable households seem prefer a smaller, but safer outcome over a larger but uncertain one: the most vulnerable households tend to specialize in wheat, which is less risky (and less profitable) than cotton, while less vulnerable households emphasize cotton. However, contrary to expectations and findings in other countries, Turkmen farmers do not follow many of the common risk coping strategies. The more vulnerable households do not readily diversify their income generating activities: they seldom take off-farm employment; rarely engage in cottage industries; do not diversify the production mix on their household plot. Nor is there evidence that the more vulnerable families show greater reliance on their subsistence household plot. The results seem to suggest that the more vulnerable households are trapped in a deep vulnerability trap, lacking initiative and probably resources to break out through income diversification strategies.

JEL classifications: D1, J2, Q12

Key words: agriculture, Turkmenistan, transition, vulnerability, income smoothing.

Introduction

Uncertainty and risk are essential features of agricultural activities and have important consequences for the agents involved, as well as for society at large. Farming in a post-socialist desert country, such as Turkmenistan, is particularly risky, as the political uncertainties of transition are added to natural unpredictability. The importance of risk in everyday lives is probably one major difference between poor and rich countries (Besley 1995), and models that include risk may provide a better prediction of farmers' behavior as they adapt to the new conditions in transition countries.

This study examines risk coping strategies among Turkmen farmers. A large volume of literature deals with farmer risk aversion, but most of it is restricted to developed economies. Few systematic farm-level studies of production under uncertainty in less-developed countries are available [Kurosaki 1997 (Pakistan), Maatman *et al*. 2002 (Burkina Faso), Brennan 2002 (Vietnam)]. To the best of our knowledge, this is a first analysis of the behavior of Turkmen farmers, or of any of Central Asia's post-socialist farmers, with respect to production, consumption and time allocation decisions in a risk framework.

Turkmenistan is a poor country, though it has large reserves of natural gas and oil. Farmers' low incomes and high share of the labor force, primitive and often inaccessible health care, outdated technology, and harsh climate expose rural households to three out of the five risk types defined by Hardaker *et al.* (1997): production, personal and institutional. *Production risk* is mainly caused by rainfall variability and access to water: Turkmen agriculture is highly dependent on irrigation as 80% of Turkmenistan is desert. *Personal risk* is high, first, due to hard living conditions in rural regions and the highly polluted water and soil; and, second, due to the sharp reduction of the healthcare system, particularly in rural regions. *Institutional risk* includes the corruption of the Turkmen state and the

unpredictability of its legislation; obliged to produce under state orders, leaseholders depend on the arbitrary decisions of government bureaucrats. The other two risk types, market (price) risk and financial risk, are less relevant for Turkmen agriculture. Price risk is not relevant as farmers are subject to state orders, meaning that procurement prices for cotton and wheat as well as subsidized prices for inputs are fixed by the state. Financial risk is not particularly relevant because investment financing and working capital are provided through government programs at deeply negative real interest rates and with high levels of credit targeting.

After 1996, the dominant form of land use in Turkmenistan is family-based leaseholding, with leaseholders organized into 592 peasant associations that replaced the traditional collective and state farms (90% of agricultural land). Collective land holdings were divided into plots and leased to families, while the overall collective structure and state ownership of land were retained, resulting in more state control than in other post-soviet republics. In addition to leaseholds, almost all rural families have small household plots for subsistence purposes; they occupy 7% of agricultural land (Lerman and Brooks 2001; Lerman and Stanchin 2004).

In Soviet days farmers used to be salaried workers in collectives, while now they are responsible for production on their leaseholds. Thus, the risk levels they face have substantially grown. A bad wheat or cotton crop may put them in serious trouble. Moreover, a bumper crop does not, by itself, ensure a family's food supply, as there may be substantial delays (up to 5 months) between harvest and payment. Household plots remain important as a source of food and cash income, especially for more vulnerable families.

Official statistics about Turkmen agriculture are often unavailable or unreliable. The present study is based on unique data from a survey of leaseholders in Turkmenistan, undertaken in 2002 by the Hebrew University of Jerusalem with local counterparts as part

of a USAID/CDR funded research project (for survey details see Lerman and Stanchin 2004). The survey included 1100 households in all five provinces.

We use the survey data to examine how farmers' vulnerability affects their risk management strategies. We expect that the higher the vulnerability, the higher the risk avoidance as expressed in the farmer's use of income smoothing strategies. Vulnerability is defined as "the exposure to uninsured risk leading to a socially unacceptable level of well-being" (Hoogeveen et al. 2004), but there is no accepted measure of vulnerability in the literature. Vulnerability is usually quantified by various proxy indicators and households are classified into vulnerability groups by a single factor (McKenzie 2003; Rubio and Soloaga 2004). We propose a new composite index of vulnerability, taking into account age, education, the number of dependents, and geographic location. This still gives one independent variable for analysis, but it takes into account the effect of criteria interactions.

Quantifying vulnerability

A farmer's response to risk depends on his objective situation (vulnerability). The first step is to quantify the farmer's vulnerability according to the following criteria, chosen on the basis of existing literature and Turkmen specificity.

Age of the household head – Age is related to vulnerability for several reasons (Sung and Hanna 1996): health, chances of finding a job, and the investment horizon all decline with age, increasing vulnerability; experience, on the other hand, grows with age, reducing vulnerability.

Education of the household head – Households with better educated heads are less vulnerable (Glewwe and Hall 1998), because better education improves the chances to get an outside job. Moreover, better education could foster better agricultural performance.

Percent of dependents – Since children do not work, households with more children are more vulnerable (Glewwe and Hall 1998). We defined dependents as younger than 12 and 60+. The age limits are determined by life expectancy (61 years) and by the practice of making young children work.

Region suitability for agriculture – In the regions where soils and climate are less suitable for agriculture, production risk is higher and farmers are more vulnerable. We used *velayat* (province) as the regional variable reflecting both climatic conditions and land quality.

Based on the literature, we scored the vulnerability effect of each variable as shown in table 1, using values from 1 for lowest vulnerability to 5 for highest.

Table 1. Quantifying vulnerability parameters

Vulnerability score for the parameter	Parameter			
	Age of household head	Education of household head	Percent of dependents	Region suitability (velayat)
1 (least vulnerable)	23-37	Higher complete and incomplete	0-20	Mary, Lebap
2	17-22, 38-46	Technical and special secondary	21-40	Akhal, Dashoguz
3	47-55	General secondary	41-60	Balkan
4	56-64	Incomplete secondary	61-80	
5 (most vulnerable)	65-77	No education	81-100	

The composite vulnerability score is the sum of scores of the four components; it ranged from 4 to 15. The small extreme vulnerability groups were merged with their

neighbors, reducing the total number to seven – from group 1 for least vulnerable to group 7 for most vulnerable (table 2).

Table 2. Leaseholder distribution by vulnerability in the survey

Vulnerability group	Number of respondents	Percent of respondents
1 (least vulnerable)	41	3.7
2	116	10.5
3	254	23.1
4	321	29.2
5	251	22.8
6	75	6.8
7 (most vulnerable)	42	3.9
Total	1100	100.0

Our composite vulnerability score is based entirely on human capital and environmental variables. Wealth and physical capital are excluded, because in our analysis they are treated as decision variables for farmers in different vulnerability groups. Nevertheless, family income is observed to decrease significantly from the least vulnerable to the most vulnerable groups, suggesting that our score is consistent with the standard view of vulnerable populations as poor (the coefficient of correlation between family income and vulnerability score in the survey is -0.113, $p = 0.000$).

Risk coping strategies and vulnerability

We correlated the composite vulnerability scores with one of the main risk management strategies – income smoothing (Morduch 1995). Under this strategy, households can counteract high vulnerability by several techniques: (1) diversify income sources, including

mixed farming, cottage industries, and off-farm jobs; (2) shift production into more conservative, though possibly less profitable, modes ; (3) rely to a greater extent on the subsistence plot, allocating more labor to ensure food supply for the household.

We use regression to test how leaseholders in different vulnerability groups apply these three income smoothing techniques. Each variable representing an income smoothing technique is used as the dependent variable in one of the tests and the vulnerability score is taken as a continuous independent variable. When the dependent variable is binary (a yes/no dichotomy for households with and without off-farm jobs), we run a logistic regression of this binary variable on the numerical values of the variability scores. When a dependent variable is continuous (the area of the household plot or the percent of output consumed by the family), we run a simple bivariate regression of this variable on the variability scores. In both settings, the sign of the regression coefficient and its significance show how the observed data fit the theoretically expected variation across vulnerability groups.

1) *Diversification*

Households can diversify their income by augmenting commercial (leasehold) farming with off-farm jobs and cottage industries (embroidery, carpentry, pottery, carpet making, etc.). Table 3 (column 1) shows the percentage of households with off-farm earned income. Contrary to expectations, off-farm income is much more widespread among the less vulnerable groups (1 to 4). Simple logistic regression estimating the probability of having off-farm income as a function of the vulnerability group shows that participation in off-farm occupation decreases as vulnerability increases (the regression coefficient is negative, $p = 0.000$).

Mixed farming – whether producing crops and livestock or growing wheat and cotton – is another diversification technique for coping with risk. Table 3 (column 2) shows that farmers practicing mixed crop and livestock farming on their leasehold plot fall in the least vulnerable groups (groups 1 and 2), whereas farmers in the most vulnerable groups (groups 5-7) do not take advantage of this diversification technique. The same pattern is observed for livestock on subsistence-oriented household plots: most families keep animals, but the proportion of household plots with livestock is the highest (100%) for the least vulnerable groups, declining to 71% for the most vulnerable ones.

On the other hand, column 3 in Table 3 shows that the proportion of farms growing both wheat and cotton significantly increases with increasing vulnerability. While the more vulnerable apparently cannot afford to diversify into relatively capital intensive livestock production, they instead can and do grow two commercial crops.

The tentative indication that farmers diversify into more than one crop for commercial (leasehold) production prompted us to check the crop diversification patterns on the household plot. Here the results again are contrary to theoretical expectations. The higher the vulnerability, the smaller the number of crops grown on the household plot (Table 3, column 4). The more vulnerable families probably stick to essentials – potatoes and vegetables – on their household plot, whereas less vulnerable families additionally grow wheat for the animals they keep (see above) as well as some luxury foods, such as grapes, melons, and fruit.

2) Specialization of the commercial farm – selecting less risky policy

Among the farmers surveyed, commercial (leasehold) production is generally monoculture: most leaseholders grow only wheat or only cotton on their leasehold plot. Allocation of land is conditional on growing at least one of these "strategic" crops, but the leaseholders

Table 3. Income smoothing by diversification and specialization

Vulnerability group	Diversification of income sources				Farm specialization, % of farmers growing	
	% of house-holds with off-farm earned income*	% of mixed crop and livestock farms*	% of mixed wheat and cotton farms*	average number of crops on the household plot*	only wheat*	only cotton*
	(1)	(2)	(3)	(4)	(5)	(6)
1	68	7.3	2	3.7	39	54
2	54	2.6	3	3.1	52	44
3	53	0.4	6	2.8	48	43
4	52	0.3	9	2.5	50	37
5	39	–	14	2.0	56	24
6	23	–	13	2.4	52	31
7	33	–	7	2.1	64	21
Total	47	0.7	9	2.6	52	36

* The differences across vulnerability groups are statistically significant at $p \leq 0.1$ for all columns (by logistic regression for columns 1-3 and bivariate regression for columns 4-6).

are free to decide what commodity to specialize in. Wheat is known to be less risky than cotton when assessed by variability of yields (FAOSTAT, 2005). Cotton is much more input-intensive and requires large quantities of fertilizers to maintain soil fertility over time (Ahmed and Kuhlmann 2004), which also makes it riskier than wheat. Theory accordingly suggests that the most vulnerable households will tend to specialize in the less risky wheat, even though it is less profitable than cotton (Guchgeldiev 1999) shows that in Turkmenistan one hectare of cotton yields cash revenue six times higher than wheat). This is indeed

demonstrated by columns 5-6 in Table 3, where the proportion of wheat farmers is much higher among the high vulnerability groups.

3) *Reliance on subsistence production from the household plot*

Reliance on subsistence production can be analyzed by looking at the size of the household plot and the allocation of labor (Table 4). Household plot size shows a clear trend – farmers with higher vulnerability have larger household plots (column 2). The labor pool of the more vulnerable groups is also larger, as is evident from the larger family size, especially in groups 6-7 (column 1). Thus, given the larger land and labor endowments, there is a potential for more subsistence production in the more vulnerable groups. However, contrary to expectations, more vulnerable households use fewer workers and provide fewer working hours on the household plot than less vulnerable ones (columns 3-4). Measures of labor allocation – the share of workers or hours devoted to the household plot out of the family's total – do not show significant differences across vulnerability groups (Table 4, columns 5-6). The more vulnerable households may be unable to realize the potential of greater land and labor endowments because of the higher average age of the household head and the higher proportion of people not of working age (i.e., dependents).

The household plot is intended to supplement the family's food supply. Only surpluses remaining after the family needs are satisfied may be sold for cash. We accordingly expect the more vulnerable families to consume a higher proportion of their output than the less vulnerable ones. The data in Table 5 indeed show that the most vulnerable families (groups 6-7) consume more of the milk and meat they produce than the least vulnerable families (groups 1-2; the difference is statistically significant). The pattern with regard to vegetables, potatoes and eggs is not conclusive: there are no statistically significant differences across vulnerability groups for these products.

Table 4. Land and labor on the household plot

Vulnerability group	Family size*	HHP size* (ha)	Workers on HHP*	Working hours per year on HHP	Share of HHP labor input	
					workers	hours
	(1)	(2)	(3)	(4)	(5)	(6)
1	5.61	0.18	4.27	1395	53	31
2	5.32	0.17	3.84	1330	51	31
3	5.45	0.18	3.69	1133	49	27
4	6.02	0.20	3.39	1020	50	27
5	5.91	0.20	3.02	1245	49	28
6	6.32	0.21	3.87	979	49	32
7	6.67	0.21	2.79	1092	52	31

* The differences across vulnerability groups are statistically significant at $p \leq 0.1$ for columns 1-3 (bivariate regression); no statistically significant differences for columns 4-6.

Table 5. Consumption of household plot products (% of output consumed by the family)

Vulnerability group	Vegetables	Potatoes	Meat*	Milk*	Eggs
	(1)	(2)	(3)	(4)	(5)
1	87	86	35	67	87
2	73	81	51	76	80
3	78	82	72	82	88
4	82	82	73	78	85
5	80	86	90	79	89
6	79	77	75	89	88
7	66	81	96	87	84
Total	79	82	72	80	86

* Differences in meat and milk consumption across vulnerability groups significant at $p \leq 0.1$ (bivariate regression).

Contrary to theoretical expectations, the share of the household plot in family income (value of consumption plus cash revenue from sales) is lower for the more vulnerable groups (Table 6), although the difference is not statistically significant. This is the ultimate proof that the vulnerable households do not exploit their potential advantages as reflected in larger plot size and greater availability of labor. The share of income from off-farm occupation is of course low for the most vulnerable households, because they do not readily diversify into off-farm jobs (see above). Yet the most vulnerable households receive nearly 30% of their income from pensions and other social transfers, almost as much as from the leasehold farm. It is quite possible that the high level of welfare support takes off some of the pressure for better achievements in household plot farming and off-farm work.

Table 6. Share of various sources in total family income (%)

Vulnerability group	Lease plot	HHP	Pension*	Off-farm sources*
1	42	40	1	16
2	39	40	3	17
3	48	37	3	11
4	44	38	6	13
5	49	36	6	10
6	36	41	15	8
7	34	28	28	8
Total	44	37	6	12

* Differences in share of pension and off-farm sources across vulnerability groups significant at $p \leq 0.1$ (bivariate regression).

Conclusion

Having derived a composite vulnerability score based on human capital and environmental factors, we expected to find that Turkmen farmers use income smoothing to manage risk and counteract vulnerability. Contrary to our expectations and the findings in other countries, Turkmen farmers do not follow many of the common risk coping strategies.

Thus, the more vulnerable the household, the less it diversifies its income generating activities. Members of the more vulnerable families seldom take off-farm employment and do not engage in cottage industries. While underdeveloped labor markets may prevent older people and people with lower educational attainments (i.e., members of high vulnerability groups according to our classification) from finding off-farm jobs even if they try, it is difficult to understand the failure to take advantage of cottage industries, in which even the old and the uneducated can participate. Perhaps the more vulnerable families lack the money for the required investment (a furnace to burn pottery, weaving equipment, wood working instruments, etc) and perhaps they simply lack the initiative.

The more vulnerable farmers do not tend to diversify their agricultural production either: fewer among them keep livestock and they grow a smaller number of crops on the household plot than the less vulnerable groups. Again, the failure to practice livestock production may be due to lack of investment funds, while lack of animals may rule out the need for adding wheat (staple livestock feed) to crops on the household plot.

Finally, there is no evidence that the more vulnerable families rely to a greater extent on household plot production. We expected that more vulnerable households would devote more time to the safer subsistence plot. This does not appear to be true – the labor input in the household plot is actually less among the more vulnerable families. It seems that the more vulnerable families fail to take advantage of their larger land and labor endowments

as risk management tools. Instead, they appear to rely to a significant extent on pensions and social transfers.

Consistently with theoretical expectations, the most vulnerable households seem to prefer a smaller, but safer outcome over a larger but uncertain one. This is evident in the greater specialization of the more vulnerable households in wheat, which is less risky (and less profitable) than cotton. However, this appears to be just one glimmer of light in the long saga of failures to manage risk through income smoothing.

We come out of this study with the depressing feeling that the more vulnerable groups among Turkmen farmers are somehow caught in a deep vulnerability trap. They cannot or will not adopt the practices that could help counteract vulnerability.

Further research is needed to see if the composite vulnerability indicator proposed in this article can be applied to study the risk behavior of farmers in other countries and possibly to compare the risk behavior of Turkmen farmers to that of farmers in other post-socialist countries with different economic and social conditions.

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