

Natural shocks and migration decision: the case of Kyrgyzstan¹

Eugenia Chernina
Centre for Labour Market Studies,
Higher School of Economics, Moscow, Russia
e-mail: echernina@hse.ru

Abstract

Previous research has shown that effects of natural shocks for household migration decision may go in different directions. This paper aims at exploring the impact of experiencing natural shocks (measured by self-reported shocks) on migration participation by members of Kyrgyz rural households. Employing panel dataset of Life in Kyrgyzstan Survey (2010-2013) we show that out of five studied shocks only droughts and floods negatively affect migration, while other shocks (cold winters, earthquakes and landslides) on average do not lead to any statistically significant change in migration participation. However, it turns out that available migration networks, household's financial capacity and involvement in agriculture are the sources of differential impact. Exploring the means of migration funding, we find that both liquidity and borrowing constraints are important for the poorest households. It turns out that help from friends and relatives for financing migration, if it comes, is sourced to the rich households.

Key words: labour migration, migration decision, Kyrgyzstan, natural disasters, financial constraints

Introduction

Households may face external shocks of a different nature (natural, technogenic, anthropogenic, etc.) that affect them through diverse mechanisms: reduce incomes, destroy their assets, change prices, etc. Shocks may also have a different scope: idiosyncratic - when affecting single households - or aggregate - when affecting the community as a whole. In the context of developed countries, households are able to

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prevent or overcome adverse consequences of shocks through the systems of social support, credit and insurance markets.

Options for households in developing countries, where such systems are not or only partly available, are different. Moreover, the less households invest in technology development, the more they become dependent on uncontrolled external factors (such as the temperature, precipitation, livestock epidemic, etc.). Households still can choose between a number of ex-ante and ex-post coping strategies: consuming part of assets or savings, formal and informal borrowing and transfers, reducing investments and redistribution of labour. The literature also distinguishes between individual and cooperative strategies; it is a question of interest if households help each other when shock arrives [Fafchamps, Udry, Czukas 1998; Kazianga, Udry 2006; Fafchamps, Lund 2003].

Migration of household members is one of several ways to cope with risk. New economics of labour migration (NELM) [Stark, Bloom 1985] suggests that a household might send migrants to insure against income shocks while facing insurance and borrowing constraints. Literature in the spirit of NELM has mostly described permanent migration and looks at remittance flows to support the theory. In the modern world, international migration shifts from permanent to temporary and circular forms. Hence, migration can also work as an ex-post coping strategy when economic conditions at home have deteriorated due to shock. Migration can also be viewed as a cooperative strategy if other households provide help for financing migration.

However, migration is rather costly, and it may not be feasible for affected households if their assets have been damaged. In case of an aggregate shock, borrowing funds to finance migration may also become impossible. Finally, in some cases, migration may become a less attractive option if there is a need to use labour at home. Thus, the effect of a natural shock on migration participation is an empirical question and is a result of the interplay of multiple mechanisms.

This paper aims at exploring effects of natural shocks on migration in the Kyrgyz Republic, where households face income fluctuations due to natural factors. Using Life in

Kyrgyzstan panel data² (waves 2010-2013), we investigate if there exist any effects of natural disasters, such as droughts, floods, cold winters, landslides and earthquakes, on migration participation by Kyrgyz rural household members. We use self-reported shocks aggregated at the community level as shock measures and find either negative or insignificant effects of the shocks on migration participation. Further, we try to uncover mechanisms through which natural shocks affect the households. To explore these mechanisms we add to the regressions various interactions of shocks with household and community characteristics that reflect household wealth, involvement in agriculture and the availability of migration networks.

We find little evidence that households more involved in agriculture (and possibly suffering more losses from climate variation) send more migrants in response to shocks. Thus, changing productivity in agriculture does not seem to be an important push factor for migration. Droughts seem to be the only exception when we can see such relation. Migration networks are important condition that rural residents respond to shock with more migration in case of non-climatic shocks: earthquakes and landslides. This might indicate that in case of climatic shocks households use migration as an ex-ante strategy, while in case of less anticipated shocks they use migration ex-post if there exists a proper network. Finally, we find evidence for financial constraints that restrain households from using migration as a coping strategy. While migration reduces for the poorest it increases for the wealthier.

To explore if financial constraints are constraints of liquidity or borrowing (or both), we inspect migration participation by the source of funding. It turns out that both types of constraints are active. More interestingly, not only are constraints of liquidity less binding for wealthier households but also borrowing constraints as rich households tend to increase migration financed by friends and relatives in response to shocks. This finding sheds light on how social networks operate in Kyrgyz society. Unlike their poor counterparts, rich households have better developed connections that help them to receive support in case of trouble, suggesting some risk-sharing within their network.

² Brück, T., D. Esenaliev, A. Kroeger, A. Kudebayeva, B. Mirkasimov and S. Steiner (2014): “Household Survey Data for Research on Well-Being and Behavior in Central Asia”. *Journal of Comparative Economics*, vol. 42, no. 3, pp. 819-35

This paper contributes to the growing literature on the impact of climate variability on international migration. Even though a large number of studies investigating how environmental events affect migration exist, our paper is one of few that compares the effects of several different natural shocks. This paper is also related to the research on households coping strategies as it questions whether migration is used as an ex-post risk coping strategy by Kyrgyz households. Finally, our results are in line with research on inter-household risk-sharing arrangements.

The rest of the paper is organised as follows: after a description of the current views on how natural shocks affect migration participation, our dataset is presented, followed by a discussion of the empirical strategy and a presentation of the statistical estimation results. In conclusion, we summarize our findings.

How natural shocks affect migration participation

In the face of climate change, scientific research has been paying growing attention to possible effects of natural disasters on human migration. The most general results on effects of climatic factors on long-term migration using macro data can be found in the paper by [Beine, Parsons 2015] and its extensions [Beine, Parsons 2017] and [Gröschl, Steinwachs 2017]. These papers analyse panel data of bilateral migration flows between 226 origin and destination countries for the period 1960-2000 [Özden et al. 2011]. They capture short-term environmental factors with such events as droughts, earthquakes, extreme temperatures, floods and many others. Results suggest that disasters on average have little effect on long-term international migration, while considerably stimulating internal migration. Although the effects are not that straightforward: it turns out that disasters spur migration to bordering countries. Also, the effect depends on the country's level of development: for middle-income countries, a push effect of disasters can be found.

Thus, it is not surprising that case studies of different countries and events report so much diversity in their results. Examples can be found of positive, negative or no effect of natural shocks on internal and international migration³. Obviously, results depend a lot on

³ Detailed reviews of recent evidence can be found in Mbaye and Zimmermann (2015), Belasen and Polachek (2013) and Berlemann and Steinhardt (2017).

a country's context, nature, strength and abruptness of experienced shock as well as the duration and directions of migration streams that are studied. Micro-level research provides more flexibility in defining migration type (both in terms of duration and destination) under study and also enables researchers to explore variability of shocks' effects arising from variation in households' characteristics such as income and wealth, pre-shock economic activities, access to migration networks and so on.

Natural shocks have diverse effects on households. A shock can alter incentive for labour migration through changing income at home. This may happen through local labour market wages and employment opportunities as well as through productivity in home production (as a result of destroyed capital or change in labour efficiency). A shock can also push up costs of living by increasing prices and damaging the infrastructure. Massive damage due to a shock may put a household in need for investments to recover from the losses, and migration could provide funds for such investments. Finally, migration may become less feasible due to loss of income and assets or borrowing opportunities needed to finance migration.

Previous literature reported that negative shocks of a different nature may have opposite impacts on the migration decision even within the same community as they awaken different mechanisms. Halliday (2006) shows that the loss of livestock and harvest had a positive effect on migration participation and remittance receipt by households in El Salvador, while an earthquake had a negative effect on migration. The author explains the observed negative effect of the earthquake on migration by "preference to retain labor at home". As a result of the shock, the marginal productivity of labour from home production had changed, making migration relatively less profitable [Halliday 2006, Halliday 2008]. Another possible mechanism is a need to ensure a minimum level of yield, which requires large labour resources in case of negative performance shocks [Halliday 2012]. Exploring the same case of the earthquake in El Salvador, Yang (2008) attributes the negative effect to financial constraints that arise if shock strikes the whole community and do not arise if a single household is affected. Households are unable to get support for financing migration when the whole network experiences a shock. Thus, Yang (2008) makes a distinction between the effects from idiosyncratic and communal shocks.

Another possible distinction can be made between anticipated and unanticipated shocks. As for anticipated shocks, a migration strategy could have been used ex-ante to insure against possible losses. It is shown that variability in natural conditions is an important migration push factor [Dillon et al. 2011; Bohra-Mishra et al. 2014]. In the case of unanticipated shock, the immediate migration response could be much more intensive.

The context of Kyrgyzstan

Economic situation

Kyrgyzstan is a predominantly mountainous country in Central Asia with considerable variation of climatic and socio-demographic conditions across the country. Its population is growing by 1-2% each year and has reached 6.3 million by 2018. The two large regions are the mountainous and more economically developed northern region and the flat, more populous and poorer southern region. According to the World Bank classification, before 2013 Kyrgyzstan was located in the low-income countries group and in the lower-middle-income economy group. Specifically, the GNP of Kyrgyzstan grew from \$860 in 2009 to \$1,220 in 2013⁴; the level of unemployment was just above 8%; the average per capita consumption in 2009 was \$5.6 in 2011PPP; and the poverty level according to the national poverty line was 31-38% (37-41% for the rural population) in 2009-2013.

Agricultural sector plays significant role in the Kyrgyz economy (21% and 17% of GDP in 2009 and 2013, respectively), with almost equal contribution of cattle breeding and farming. It makes up about 30% of the employment while about 65% of population live in rural areas. Arable lands occupy 7% of the country's territory, of which 85% are pastures. Crop production, which was less important than cattle breeding in the Soviet period, has become one of the main sources of economic growth from 1994 to the early 2000s. This included both the enhancement of Kyrgyzstan's own food production and the fodder base for livestock. In contrast to the Soviet period, when Kyrgyzstan was main producer of wool, at present, breeding of dairy cows and horses predominates. A large number of households in the country maintain a small number of livestock.

⁴ Here and hereafter: data from World Bank development indicators are available from <http://databank.worldbank.org/data/>

As a result of the reforms enacted in the 1990s, 90% of agricultural land is privately owned. About 85% of all farms are small farms up to 1 hectare, while the largest share of cultivated land (40%) is owned by farms with a size of 1 to 10 hectares. Having their own agricultural production allows many households to survive, but it is not always effective and often more exposed to natural risks. Smaller farms use fewer fertilizers, less crop rotation procedures and costly irrigation systems (irrigation farming occupies 75% of the land used) [Light 2007].

Migration

Starting from the beginning of 2000s, the Kyrgyz population is becoming more and more involved in labour migration: the share of migrant remittances in GDP rose from 20% in 2009 to 31% in 2013. According to estimates released by Kyrgyz authorities, in the time period from 2010-2014, 5 to 10% of the economically active population has been leaving the country yearly [IOM 2016]. For 2014 they estimate that 650 – 700 thousand Kyrgyz citizens are working abroad during the year. Main destinations for Kyrgyz migrant workers are Russia (about 80% of migrants' stock abroad) and Kazakhstan (about 10%). Migration strategies vary among Kyrgyz citizens working abroad. According to a survey by the Kyrgyz National Institute of Strategic Studies in 2013, cited in [FIDH 2016], “two-thirds of migrants work all year and one-third are seasonal”. Most Kyrgyz migrants come from the southern parts of Kyrgyzstan: Batken province (35% of migrants stock abroad as of 2014), Djalal-Abad province (28%), Osh (22%) [FIDH 2016]. Women play an important role in migration; according to some estimates they make up 53% of the migrant workers abroad [IOM 2012].

Migrants themselves indicate that migration is a strategy to support their families and improve material conditions [Schmidt, Sagynbekova 2008]. Although this livelihood strategy, being costly, might be not feasible for the poorest part of the population. In fact, evidence suggesting that migration increasing with size of owned land could be an indication of financial constraints to migration for poor households in rural areas [Atamanov, van den Berg 2012].

Natural disasters

The mountainous territory of Kyrgyzstan is subject to various natural shocks, such as landslides, rock falls, mudflows, floods, snow avalanches, earthquakes and other dangerous phenomena. All of them cause significant material damage to the country's economy. Different types of shocks can come together: for example, excessively heavy rainfall and earthquakes can cause landslides, which, in turn, can cause flooding. The territory of Kyrgyzstan is quite heterogeneous in climate and landscape, so different regions suffer from different types of disasters.

Annually, Kyrgyzstan experiences over 300 earthquakes [World Bank 2015]. As estimated by the [World Bank 2017], about 200 thousand people are affected annually by earthquakes, the annual affected GDP on average is \$200 million (in 2015 US dollars), the annual average number of fatalities is about 200 and capital losses caused by earthquakes are about \$100 million. About 66% of the population live in housing which is highly vulnerable to strong earthquakes [World Bank 2015]. Exceptionally strong earthquakes may cause considerable sudden damage. For example, the magnitude 6.6 Nura earthquake completely destroyed the Nura settlement and caused 74 deaths. Houses built of clay and straw were completely destroyed (152 constructions), whereas panel wooden houses were only slightly damaged [Kalmetieva et al. 2009].

According to [Kalmetieva et al. 2009], southern regions of the country are especially vulnerable to rockfalls, landslides and mudflows (Osh, Jalal-Abad and Batken provinces). The authors claim that “there are more than 5000 active landslides covering the territory of the Kyrgyz Tien-Shan. If ancient and stabilised rockfall-landslide blocks are taken into account, their number is even higher. These are large-scale landslides and rockfalls, which take place rarely, but their consequences are disastrous”. Landslides may be extremely dangerous: the deadliest landslide of 1988-2007 caused 238 deaths [World Bank 2015].

The Talas, Naryn and Osh provinces suffer from floods more than other provinces. The [World Bank 2017] provides estimates that on average 80 thousand people are annually affected by flooding, while the GDP loss is on average about \$70 million (in 2015 US dollars).

The interannual variation in temperature and precipitation in Kyrgyzstan is quite high, as well as in the whole region [Mirzabaev 2013]. Extreme weather conditions (droughts, extreme temperatures) are a serious threat to the welfare of households. A significant part of the produce is consumed by households themselves, so a decrease in yield and fodder base for livestock directly affects consumption levels. Weather shocks also affect the market food prices [Mirzabaev, Tsegai 2012]. Finally, droughts raise the cost of electricity, as about 90% of power in the country is provided by hydroelectric power plants.

Data description

To study the migration behaviour of Kyrgyz households, we use the data from the Life in Kyrgyzstan Survey (LIK) collected by the German Institute for Economic Research in cooperation with the Humboldt University of Berlin, the Center for Social and Economic Research (CASE-Kyrgyzstan) and the American University of Central Asia. The dataset derives from a panel survey conducted annually on a representative sample of Kyrgyz households in 2010 - 2013. The survey is representative of the country, the rural and urban population, as well as the south/north regions. The questionnaires include settlement, household and individual levels. An unbalanced panel contains information on more than 1,000 urban and more than 1,500 rural households. As we are going to control for pre-shock household characteristics, we are left with a sample of about 16,000 observations for rural working-age individuals.

There is a certain difficulty to determine a household in the panel dataset. Household is a dynamic structure, family composition changes, children leave their parents' home and create their own families. We choose to attribute to an individual the characteristics of the person's current household (or previous period's characteristics of the current household). Thus, we make an assumption that household members make their decisions based on their current household characteristics.

Descriptive statistics

Our main variable of interest is individual migration. We define several versions of this variable. We consider international migration, internal migration and any migration that combines the two. These indicators are created from questions on absent household

members and relocation experience during the previous 12 months of members present in the household. We consider to be migrants only those individuals who have left the household for work purposes. Individuals who are or were absent from the household for other reasons are excluded from the analysis, while their households are considered non-migrant households.

For a subsample of migrants now abroad (this group comprises about 3/4 of all migrants), a survey question queries their sources of funding for going abroad⁵. We can distinguish three groups of sources: own funds of the household (sale of a house, sale of land, sale of other assets, savings), help or informal loan from friends and relatives (assistance from family members abroad, assistance from family members in Kyrgyzstan, loan from relatives, loan from friends), and formal loan (loan from bank, financial institution or moneylender).

Table 1 presents migration participation by individuals in Kyrgyzstan for 2010-2013. During this time span, one clearly sees that international migration is much more common than internal. Nearly every 10th rural resident in the age range from 17 to 65 has worked abroad in the previous 12 months. These are low-bound estimates of migration from Kyrgyz republic as they do not capture migration of whole families. As for the sources of funding, the most common one is own funds which is used by 56% of migrants. Help from friends and relatives is less common (39% of migrants). Formal loan is the least popular source.

[Table 1]

Several groups of factors can be expected to affect individuals' migration decision. These are individual, household and community characteristics. At the individual level we would like to control individual's age, educational attainment, gender, marital status, ethnicity and relation to household head. Further, we consider households' demographic characteristics: size and age-gender structure as well as age and education of household head. It is also important to account for a wide range of pre-shock wealth and economic activities characteristics: household per capita income⁶ and income composition, household per capita consumption and the share of consumption that is home-produced,

⁵ The question has been asked about the two oldest absent migrants.

⁶ All per capita variables are adjusted according to the OECD equivalence scale.

asset index⁷, owned land, cultivated land, and market value of owned livestock. Finally, community level is also important. Apart from geographic location and community size, we need to proxy migration networks available for community members. To do this, we account for the pre-shock share of migrant households in the community. We also account for the major economic activity in the community and the major agricultural activity of its inhabitants.

Table 2 compares characteristics of migrant and non-migrant households in the pooled sample. The average migrant is 28 years old, 67% of them are men, and majority are of Kyrgyz and Uzbek ethnicities. Migrant households are larger, with a higher share of women and a lower share of children. Migrant households own and cultivate smaller land parcels but they own more livestock. They also have a lower share of income from the local labour market. There are no statistically significant differences between migrants and non-migrants in terms of household income and consumption, but migrants do have a lower asset index. Generally, migrants originate from larger settlements in the southern and western areas of Kyrgyzstan, with higher share of households participating in migration.

[Table 2]

The shock variables

One of serious methodological complications in the analysis of the effects of natural shocks on household behaviour is the choice of reliable shock measure. In this paper we utilise a subjective measure – self-reported experience of being affected by a shock – aggregated at the community level. Subjective measures have been frequently used in literature [Udry 1994a, 1994b; Halliday 2008; Gray and Mueller 2012].

Using a subjective shock measure certainly has its pros and cons. Among the former are the level of disaggregation and the ability to easily control for several shocks at a time, which is important because some of the experienced shocks might be correlated (e.g.

⁷ The asset index has been constructed using principle component analysis and includes the following household dwelling characteristics and assets: number of living rooms per household member, type of drinking water source, type of floor material, type of walls material, type of roof material, another house/apartment, garage, motorcycle, car, refrigerator, gas stove, microwave air conditioner, washing machine, vacuum cleaner, sofa, bed, kitchen furniture, complete music system, video/DVD player, video camera, photo camera, personal computer/laptop, satellite dish, mobile phone, internet connection.

floods and landslides or earthquake and landslides). The main disadvantage is a non-random measurement error which varies with exposure and vulnerability of the respondent to climatic shocks and many other personal characteristics (like age, educational attainment, psychological traits and other). This problem can be partly eliminated by properly conditioning on observed variables that explain climatic factors dependence (such as wealth and type of economic activities) and accounting for unobserved time-invariant heterogeneity.

Five different shocks are considered in our paper: drought, too much rain or flooding, very cold winters, earthquakes and landslides. The question used to measure the self-reported experience of being affected by the shocks is formulated as follows:

“Now I would like to ask about shocks your household as a whole or any member faced in the last 12 months. During the last 12 months, has your household been affected by the following shocks?”

In 2012 and 2013, households could answer “yes” or “no”. In 2011, households could indicate “yes, a little” or “yes, a lot” or “no”. To provide consistency between survey rounds we aggregate the first two answers.

Table 3 presents the proportions of rural households that experienced natural shocks among all households, migrant households and non-migrant households. As can be seen, there is considerable variation between the surveyed years. In all years except 2013, there are statistically significant differences in the responses of migrant and non-migrant households, although the sign (positive or negative) of difference varies between years. Strong unconditional correlation between shocks and migration status could have stemmed from systematic differences in shock exposure and applying migration as ex-ante coping strategy. This does not seem to be the case in our data.

[Table 3]

One possible check of shock question adequacy is the consistency between the answers of residents of the same community, as natural shocks usually strike the whole community. As can be seen in Figure 1, there is a large share of communities where no one reports experiencing specific shocks. The remaining densities are concentrated below

20% and above 80%. Thus, there is very strong correlation between the individual answers and the community-level measures.

[Figure 1]

Self-reported indicators are subject to measurement errors that might not be random. Thus, we might suspect that various household characteristics (e.g. economic activities, productivity, wealth, etc.) affect the participants' responses to this question.

The reported shock experience may not represent the strength of shock objectively but rather the extent of exposure to the shock (the extent to which household members, assets and economic activities are situated in the area that could be affected by the shock) and extent of vulnerability to the shock (the propensity of exposed elements to suffer adverse effects when impacted by hazard events [Cardona et al. 2012]). Both exposure and vulnerability could be managed by various ex-ante strategies. For example, by relocating the household (or a part of the household) to less risky territories (or territories with uncorrelated risks), diversifying economic activities, investing in risk-mitigating production technologies, etc. Therefore, we want to examine the extent to which households' observable characteristics can predict the reported shock experience. Unfortunately, we cannot investigate how time-variable unobserved characteristics affect the reported shocks, but in case we do not find any correlation with observable characteristics it is more likely that such unobservable characteristics do not exist.

Reported shocks aggregated at the community level are often said to reduce the endogeneity problem. Still, community-level measures are also not free from such concerns for several reasons: (1) Some of the risk-mitigating investments may be undertaken at the community level; (2) households with similar characteristics may self-select into the same community; and (3) there might exist a number of community-level characteristics that directly affect the extent to which a community would suffer from a natural disaster, for instance, the level of trust and cooperation among residents, the quality of governance, etc. Not all of these characteristics are time-invariant and are captured by fixed effects.

Results presented in Table 4 show how households' characteristics predict the experience of shock at the household and the community level. Notably, we do not see any considerable differences in the predictability of shocks reported by households and

shocks aggregated at the community level. Very few of households' pre-shock economic characteristics (including migration) help to predict experienced shocks. The head of household characteristics (age, education and ethnicity) do affect shock experience in many cases (we observe that the household head has changed in a number of households). This might be a concern as characteristics of household heads affect not only the reported shocks, which could have been a result of biased perceptions, but also the community-level shocks, which might indicate that the characteristics of household heads might be related to residing in a shock-exposed area.

[Table 4]

To explore the effects that natural shocks exert on migration and to try to uncover the underlying mechanisms, we need to understand the channels through which those shocks affect the households.

We can expect natural shocks to damage various aspects of households' wellbeing: assets, productive technology and associated incomes from home production, labour market opportunities, prices and currency exchange rate. Therefore, a set of regressions were run with various household outcomes⁸ as dependent variables and natural shocks among the explanatory variables. We detected few statistically significant effects. There is a negative effect of droughts and floods on income from household enterprises and a respective negative effect on total income. For the earthquakes, coefficients are negative as well, but not statistically significant. Money transfers from friends and relatives (both in Kyrgyzstan and abroad) respond significantly only to landslides. We find no statistically significant impact of shocks on household consumption. Thus, results suggest that households are able to smooth their consumption even if income and its composition is affected by shocks.

[Table 5]

Econometric specification

To investigate the effects of natural shocks on individuals' migration decisions, we estimated several model specifications. We might suspect the existence of persistent unobserved heterogeneity on the individual or household and community levels. Decision is affected by many unobserved characteristics that could be considered constant in a

⁸ All variables are measured in per capita terms adjusted for household size and age structure.

short-term horizon and common for members of a single household. These are motivation and aspirations, risk attitudes, and cognitive and non-cognitive skills. Not accounting for this unobserved heterogeneity will bias estimation results. Thus, we try to condition on unobserved heterogeneity at a household level. We estimate the following equation using a linear probability model (LPM) that is able to accurately predict the probability for values of variables close to the sample mean (Wooldridge 2010)⁹:

$$Mig_{it} = \alpha + \lambda'Z_{it} + \sum_{s=1}^S \beta_s'X_{sht-1} + \gamma_k shock_{kht} + \delta' shock_{kht} * X_{sht-1} + D_t + u_h + \varepsilon_{it} \quad (1)$$

Mig_{it} – migration status of individual i in year t ; $shock_{kht}$ – natural shock k experienced by household h in year t , $k=1..K$; X_{sht-1} – household pre-shock characteristic, $s = 1..S$; some specifications would also include an interaction term of a certain household characteristic X_{sht-1} and a natural shock $shock_{kht}$; Z_{it} – individual characteristics; D_t – year dummy, $t = 1..T$; u_h – household effect; ε_{it} – random error such that $E[\varepsilon_{it} | u_h, x_{1i}, \dots, x_{1T}] = 0$. Because our variables of interest are likely to have correlated effects at the community level, standard errors are clustered at the community level in all specifications.

To estimate model (1) we have to make an assumption about individual effect u_h . The assumption of a random effects model that unobserved heterogeneity is not correlated with our variable of interest (self-reported shock) seems too strong (consider, for example, household members' risk attitudes). The fixed effects model does not assume exogeneity, however, by employing a fixed effects model we should take care of heterogeneity, which is likely to be an issue in our case.

Similar to many other labour market outcomes, we can suspect state dependence in an individual decision to migrate (being a migrant today increases the probability of being a migrant tomorrow). Even in the case of circular migration where migrants incur fixed costs of migration (buying tickets, looking for job and accommodation, etc.) each period of migration, the overall costs will go down with their migration experience due to accumulating information and destination-specific human and social capital. Thus, the model of migration decision may contain a dynamic component. Moreover, as suggested by the NELM approach, family experience is relevant for making decisions.

⁹ As a robustness check, the calculations were replicated with a logistic model that did not introduce considerable changes in the results

Controlling for previous periods' migration experience (individual or family) in a household fixed effects model would break the exogeneity assumption due to the correlation between past experience and unobserved household effects. To avoid this problem, we estimate model (2) that controls for unobserved heterogeneity at a higher – community – level¹⁰:

$$Mig_{it} = \alpha + \xi_i Mig_{it-1} + \xi_h Mig_{ht-1} + \lambda' Z_{it} + \sum_{s=1}^S \beta_s' X_{sht-1} + \gamma_k shock_{kht} + \delta' shock_{kht} * X_{sht-1} + D_t + u_c + \varepsilon_{it} \quad (2)$$

Mig_{it} – migration status of individual i in year t ; Mig_{ht-1} – household migration experience in period $t-1$; $shock_{kht}$ – natural shock k experienced by household h in year t , $k=1..K$; X_{sht-1} – household pre-shock characteristic, $s = 1..S$; some specifications would also include an interaction term of a certain household characteristic X_{sht-1} and a natural shock $shock_{kht}$; Z_{it} – individual characteristics; D_t – year dummy, $t = 1..T$; u_c – community effect; ε_{it} – random error such that $E[\varepsilon_{it} | u_c, x_{1i}, \dots, x_{IT}] = 0$.

Results

Effects of shocks

Let us first look at the overall effect of shocks on international and internal migration. Table 6 presents estimation results for the pooled OLS model and models (1) and (2). Overall, we see strong and robust negative effects of the first two shocks – droughts and floods – on international migration. As for internal migration, there are no statistically significant effects.

We controlled for a wide range of individual, household and community characteristics in the regressions. As for determinants of migration decision other than shocks, we can note the negative correlation between migration and the size of cultivated land (which to some extent can illustrate that agriculture and migration are alternative livelihood strategies). A negative correlation with income is also observed, suggesting possible financial constraints to migration.

It is also remarkable how the migration participation in the community affects migration decision. Whereas more migration in a primary sampling unit (psu) correlates with higher migration probability in the pooled OLS model, when variation in a separate community

¹⁰ We are not applying any method to solve the initial condition problem as our panel is too short.

or household is concerned, more migration in a psu correlates with less migration probability for an individual. This probably illustrates a situation when “those who wanted to leave have already left” in high-migration communities.

[Table 6]

Mechanisms behind the effects

As we have discussed earlier, observed effects of natural shocks on migration result from the simultaneous work of various pushing and restricting mechanisms that can compensate each other. To uncover the underlying mechanisms, we add the multiple interactions of shocks with various household characteristics to the basic specification. We test the following mechanisms. By interacting shock with a measure of involvement in agriculture (size of cultivated land¹¹), we test if being more exposed to a shock that affects agricultural productivity is a push-factor for migration. The financial constraint hypothesis is tested by interacting a shock with a measure of household welfare. Three variables are applied: monetary income per capita, total consumption per capita and food consumption per capita. Each of these has a slightly different interpretation. Because liquid funds are needed to finance migration, monetary income seems to be a better measure to demonstrate liquidity constraint. Consumption and food consumption in particular seem to be more suitable characteristics to measure the quality of life for rural households with largely home-produced food and services. Finally, we interact a shock with a measure of migration network – a pre-shock share of households participating in migration in a psu. This shows us if costs reduction with growing network size is an important push-factor for migration.

Let us discuss the results presented in Table 7. Migrants’ networks turn out to be important for migration responses to earthquakes (see Panel D Table 7) and landslides (see Panel E Table 7). Communities with a high share of households participating in migration before the shock have a much stronger migration response to these shocks. We can hypothesise that networks are especially important for earthquakes and landslides

¹¹ Other measures (share of income obtained from household agricultural enterprises in total income, livestock value, monetary value of income obtained from household agricultural enterprises) have been also checked but do not lead to any considerably different results

because these shocks are more unpredictable, therefore households do not create migration networks to ensure against them in advance.

We find some evidence that migration response to disasters depends on the extent households are involved in agriculture. Migration response to droughts – the shock that had the strongest negative effect on incomes from home production – is stronger for individuals whose households cultivate more land (see Panel A Table 7). There is also a slightly significant interaction coefficient for the cold winters (see Panel C Table 7). A relation between agricultural activities and migration response to shocks is not that strong. That can be, probably, explained by ex-ante adjustments to climatic shocks that affect agricultural productivity the most. Climatic variation is known ex-ante and households adjust their production technology to risks and try to diversify income as well.

For the excessive rain and floods we find some, although weak, evidence of financial constraints for affected households (see Panel B Table 7). There are positive and slightly significant interactions of household monetary income per capita and food consumption per capita with shocks in the model with community fixed effects (there might be not enough between-year variation of income within a household for significance in the household fixed effects model). There is a positive interaction of the cold winter shock with per capita consumption (see Panel C Table 7). Finally, for landslides there is support for the financial constraint hypothesis as households with higher income respond to the shock with more migration (see Panel E Table 7). An alternative interpretation of these findings could be that richer households suffer more losses from the shocks, therefore, their response is stronger. Although, this interpretation is not supported by the results in Table 4 which showed that shock reports cannot be predicted by wealth indicators. We find no evidence of financial constraints for earthquakes and droughts.

As we see here, mechanisms beyond the observed average effect of each shock are quite different. While ex-ante adjustments may explain the variation in network and agriculture participation mechanisms, it is harder to explain how financial constraints operate. It remains quite puzzling why earthquakes and droughts do not give rise to financial constraints.

[Table 7]

Financial constraint hypothesis

To explore the mechanism of financial constraints in more detail, we estimated additional regressions. For a subsample of migrants who are now abroad, we have information about their source of migration costs funding. As discussed before, we aggregated the sources of funding into three groups: from own funds, using financial help of friends and relatives and formal credit. The third group was excluded from analysis because of the lack of observations. We estimate models (1) and (2) with binary dependent variable equal to 1 if a certain source was used and 0 if individual stayed at home for the whole year (return migrants are excluded from the analysis).

We are interested in the following questions. 1) Is it possible to find support for existing liquidity constraints? If households have a liquidity constraint, we expect to see a positive coefficient for interaction of household welfare with a shock in a regression for self-funded migration. 2) Are affected households able to replace one source of funding with another? Simultaneous decrease in one source and increase in the other one could be interpreted in line with this question. 3) Do poor households receive more help to finance migration? Poor affected households may be unable to finance migration from their own funds, so they are the ones in need of support. To explore this issue, we examined the coefficient of shock interaction with household welfare in the regressions of migration funded with the help of friends and relatives.

Table 8 presents the estimates of shock effects together with shock interactions with household welfare characteristics. On average, only floods reduce both self-financed migration and migration financed with the help of friends and relatives. Thus, on average, we see no support for Question 2: we do not find that households replace one source of funding with another.

[Table 8]

Self-financed migration response to shock varies with household wealth in case of droughts and landslides. We interpret this finding as an indication of liquidity constraint facing households.

Surprisingly, migration financed through the help of friends and relatives increases with the level of household wealth in response to floods, cold winters and landslides. This might indicate that shock-affected poor households are restricted by borrowing constraints from participating in migration. Indeed, wealthier households may have better developed social networks that are ready to help them in case of trouble. They are also more attractive as borrowers as they may appear to be more likely to repay the informal loan in the future.

Our finding is in line with the literature on risk-sharing networks. It is well-known that risk-sharing networks are formed endogenously with wealth being one important factor [De Weerd 2002]. As for the case of Kyrgyzstan, it has been reported that social connections are segregated in terms of wealth and that “the networks of the poor are shrinking and becoming more homogeneous, networks of the non-poor are expanding and diversifying” [Kuehnast and Dudwick 2004]. There is less chance that a more diverse network would experience a universal shock, so rich households will have better borrowing opportunities. Moreover, as networks in Kyrgyzstan (as elsewhere) play an important role in migration participation, it is natural to assume that monetary help comes together with information that helps migrant to choose proper destination and look for job abroad.

Our exploration of sources for migration funding show that borrowing constraints rather than liquidity constraints underlie previously reported financial constraints. The question remains, however, as to why borrowing constraints do not arise in the case of earthquakes and droughts, unlike other shocks.

Conclusion

Previous literature reported that effects of natural shocks on household migration decisions may go in different directions. Negative shock can be a push factor for migration when it suppresses economic incentives at home or creates a need to quickly recover damaged capital. Negative shock can also restrict migration as a result of liquidity or borrowing constraints that arise after the shock or if household has a preference to retain labour at home due to increased demand for workers in home production.

Our paper aimed at exploring the impact of experiencing natural shocks (measured by self-reported shocks questions) on migration participation by Kyrgyz households. Employing a panel dataset from the Life in Kyrgyzstan Survey (2010-2013) we show that droughts and floods negatively affect migration, while other shocks (cold winters, earthquakes and landslides) on average do not lead to any statistically significant change in migration participation by the rural population in Kyrgyzstan. We also explored mechanisms behind individuals' reaction to shocks. We find that migration response to shocks may depend on availability of migration networks, household welfare and involvement in agriculture. We also show that borrowing rather than liquidity constraints are mainly responsible for poor households being unable to use migration to cope with natural shocks ex-post. It turns out that help from friends and relatives to finance migration, if available, is sourced to wealthier households.

Our results demonstrate a unique set of mechanisms emerging as a result of each natural shock. This suggests that predicting possible migration outcomes of natural shocks is not an easy task. It is a matter of further research to determine what peculiarities of each shock make its effects so unique.

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Tables and figures

Figure 1 Share of households in the community experiencing shocks

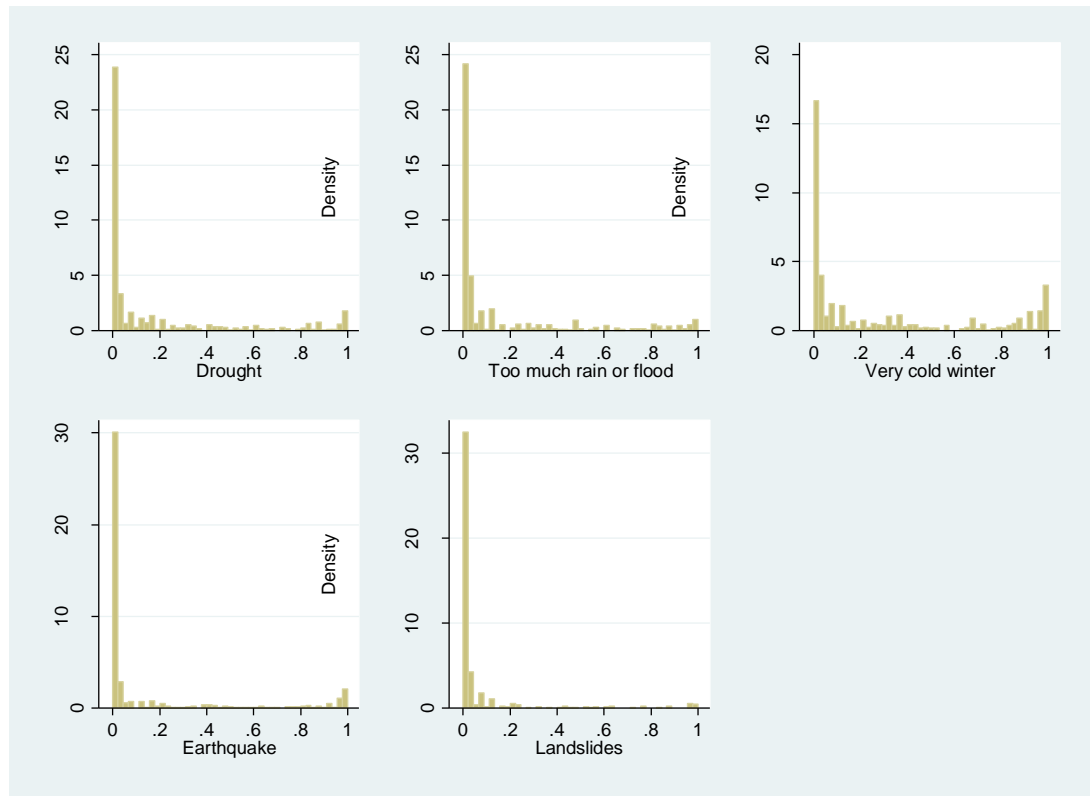


Table 1 – Migration participation rates

	Frequency	%
Migration participation (last 12 months)		
Non-migrant	18,794	88.1
Internal migrant	486	2.3
International migrant	2,056	9.6
Total	21,336	100
Source of funding international migration (migrants abroad)		
Self-financed	851	56.0
Help from friends and relatives	597	39.3
Other	72	4.7
Total	1,520	100

Table 2 - Descriptive statistics

	non-migrants	s.e.	migrants	s.e.
Individual characteristics				
Age	36.7	0.1	28.3	0.2
Gender, %	48	0.4	67.3	1
Married, %	70.3	0.3	44.4	1.1
Ethnicity				

	Kyrgyz, %	71.7	0.3	76.8	0.9
	Uzbek, %	12.4	0.2	18.2	0.9
	Russian, %	3.7	0.1	0.7	0.2
	other, %	12.2	0.2	4.3	0.4
Relation to hh head					
	Hh head	28	0.3	8.6	0.6
	head spouse	24.5	0.3	3.9	0.4
	head son/daughter	31.5	0.3	68.5	1
	other	16	0.3	18.9	0.9
Household characteristics					
	Number of hh members	6.1	0.0	6.9	0.1
	Share of pensioners, %	6.5	0.1	5.8	0.3
	Share of children under 14, %	25.3	0.2	20.6	0.4
	Share of women, %	32.2	0.1	34.8	0.4
	Hh head age	52.6	0.1	54.5	0.2
	Hh head education				
	Below secondary general	15.6	0.3	14.1	0.8
	Secondary general	56	0.4	60.3	1.1
	Basic vocational	6.5	0.2	5.3	0.5
	Secondary vocational	11.7	0.2	11.5	0.7
	Higher	10.3	0.2	8.8	0.6
	Owned land (ha)	1.3	0.02	0.9	0.03
	Cultivated land (ha)	1.1	0.03	0.6	0.04
	Per capita monetary income (som)	4475	35.3	4282.6	86.4
	Per capita consumption (som)	3913.2	33.4	4117.8	64.2
	Share of consumed food that is purchased, %	65.6	0.2	65.6	0.6
	Asset index	0.3	0.02	-0.1	0.05
	Livestock market value (thousand som)	119	2	142	14
	Share of wage income in total income, %	30.4	0.3	26.2	0.8
Community characteristics					
	Population size	6480	64.4	8298	237.8
	Share of households with international migrants in the psu, %	19.8	0.2	33.0	0.5
	Community has access to safe drinking water	80.7	0.3	80.8	0.9
	Agriculture is the major economic activity in the community	90.7	0.2	91.3	0.6
	Major agricultural activity				
	Cattle breeding	65.3	0.3	52	1.1
	Cotton crops	17.5	0.3	30.1	1
	Grain crops	74.1	0.3	73.4	1
	Potato crops	54.7	0.4	47.2	1.1
	Fruit crops	20.3	0.3	22.8	0.9
Province					
	Issyk-Kul	8.9	0.2	2.4	0.3
	Jalal-Abad	19.4	0.3	30	1
	Naryn	5.1	0.2	0.5	0.2
	Batken	8.3	0.2	13.4	0.8
	Osh	31.3	0.3	44.1	1.1
	Talas	5	0.2	4.5	0.5

Note: hh – household; psu – primary sampling unit

Table 3 – Proportion of rural households affected by natural shocks

	All households		Households with migrants		Households without migrants	
	%	s.e.	%	s.e.	%	s.e.
2010						
Drought	4.5	0.5	2.0***	0.9	4.9	0.6
Too much rain or flood	19.7	1.0	23.4	2.7	19.1	1.0
Very cold winter	22.5	1.0	17.7*	2.4	23.3	1.1
Earthquakes	6.9	0.6	10.1***	1.9	6.4	0.6
Landslides	9.8	0.7	14.5***	2.2	9.0	0.7
2011						
Drought	40.7	1.2	46.6*	3.0	39.5	1.3
Too much rain or flood	21.9	1.0	16.3***	2.2	23.1	1.1
Very cold winter	22.1	1.0	11.0***	1.9	24.3	1.1
Earthquakes	43.9	1.2	54.1***	3.0	41.8	1.3
Landslides	8.2	0.7	7.4	1.6	8.3	0.7
2012						
Drought	34.0	1.2	31.8	2.7	34.6	1.3
Too much rain or flood	15.7	0.9	26.8***	2.5	13.1	0.9
Very cold winter	56.6	1.2	65.6***	2.7	54.6	1.4
Earthquakes	3.0	0.4	4.0	1.1	2.8	0.4
Landslides	8.6	0.7	16.2***	2.1	6.9	0.7
2013						
Drought	15.4	0.9	16.0	2.1	15.3	1.0
Too much rain or flood	16.2	0.9	17.3	2.2	15.9	1.0
Very cold winter	27.6	1.1	25.7	2.5	28.1	1.3
Earthquakes	11.9	0.8	12.4	1.9	11.8	0.9
Landslides	4.5	0.5	2.6*	0.9	4.9	0.6

Note – Difference between migrant and non-migrant households *** p < 0.01, ** p < 0.05, * p < 0.1

Table 4 - Predictors of shock experience, linear regression with household fixed effects

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	drought	too much rain or flood	very cold winter	earthquake	landslides					
	share of	share of	share of	share of	share of					
	househol	househol	househol	househol	househol					
	ds in the	ds in the	ds in the	ds in the	ds in the					
	individual	individual	individual	individual	individual					
	ly	ly	ly	ly	ly					
	psu	psu	psu	psu	psu					
	reported	reported	reported	reported	reported					
	shock	shock	shock	shock	shock					

Community characteristics

Agriculture is the most important activity for households in the

-0.07 -0.06 -0.00 -0.00 -0.04 -0.04 0.06 0.07 -0.03 -0.03

community (in previous round)	[0.113]	[0.110]	[0.097]	[0.095]	[0.138]	[0.136]	[0.068]	[0.067]	[0.060]	[0.059]
Community population size, log (in previous round)	0.29 [0.244]	0.28 [0.246]	0.16 [0.224]	0.16 [0.221]	0.17 [0.216]	0.17 [0.218]	0.32 [0.252]	0.32 [0.248]	0.19 [0.119]	0.19 [0.123]
Share of households in the community having migrants (in previous round)	-0.43* [0.219]	-0.43** [0.210]	0.12 [0.303]	0.08 [0.300]	-0.10 [0.274]	-0.06 [0.271]	0.21 [0.253]	0.20 [0.247]	-0.29 [0.201]	-0.27 [0.187]
Household characteristics (all as of previous survey round)										
Household had migrants (in previous round)	-0.02 [0.024]	0.01 [0.020]	-0.04 [0.024]	-0.03* [0.018]	0.05* [0.029]	0.03 [0.023]	0.01 [0.026]	-0.02 [0.017]	-0.01 [0.017]	-0.02* [0.011]
Asset index	-0.02 [0.016]	-0.01 [0.014]	-0.00 [0.013]	-0.01 [0.012]	-0.03 [0.018]	-0.01 [0.018]	-0.01 [0.012]	-0.02 [0.012]	-0.02** [0.008]	-0.01* [0.006]
Total consumption per capita, log	-0.02 [0.059]	-0.03 [0.057]	0.02 [0.055]	0.00 [0.053]	-0.03 [0.056]	-0.04 [0.052]	0.00 [0.041]	-0.00 [0.039]	-0.00 [0.022]	-0.02 [0.019]
Total income per capita, log	-0.02 [0.022]	-0.02 [0.021]	0.03 [0.021]	0.02 [0.018]	-0.00 [0.025]	-0.00 [0.023]	-0.01 [0.020]	-0.02 [0.019]	0.01 [0.011]	0.01 [0.009]
Share of hh income from home production	0.05 [0.044]	0.04 [0.045]	0.02 [0.045]	-0.05 [0.042]	-0.09 [0.068]	-0.10 [0.063]	0.01 [0.052]	-0.01 [0.045]	-0.00 [0.036]	-0.04 [0.033]
Share of hh income from wages	0.04 [0.051]	0.04 [0.045]	0.06 [0.038]	0.02 [0.034]	-0.05 [0.068]	-0.02 [0.056]	0.06 [0.046]	0.04 [0.040]	0.07* [0.036]	0.04* [0.024]
Estimated value of owned livestock, log	0.00 [0.003]	0.00 [0.003]	-0.01** [0.003]	-0.01** [0.003]	-0.00 [0.004]	-0.00 [0.003]	0.00 [0.003]	0.00 [0.002]	-0.00 [0.002]	-0.00 [0.001]
Cultivated land, log	-0.01 [0.011]	-0.01 [0.010]	0.02 [0.010]	0.01 [0.009]	0.01 [0.009]	0.01 [0.009]	-0.01 [0.007]	-0.00 [0.007]	0.00 [0.008]	0.00 [0.008]
Owned land, log	0.00 [0.008]	0.00 [0.008]	-0.02* [0.010]	-0.01 [0.010]	-0.01 [0.012]	-0.01 [0.012]	-0.00 [0.006]	0.00 [0.006]	-0.01 [0.007]	-0.01 [0.006]
Total number of hh members	-0.02	-0.02	0.01	0.01	-0.00	-0.01	-0.00	0.00	-0.00	0.00

Share of pensioners	[0.014]	[0.012]	[0.011]	[0.010]	[0.016]	[0.014]	[0.012]	[0.011]	[0.009]	[0.006]
	-0.06	0.10	0.05	0.03	0.02	-0.00	0.01	0.05	0.03	0.02
	[0.129]	[0.090]	[0.115]	[0.076]	[0.156]	[0.145]	[0.109]	[0.085]	[0.057]	[0.040]
Share of children under 14	0.10	0.11	-0.17	-0.08	-0.05	0.01	0.04	-0.12	-0.05	-0.11*
	[0.162]	[0.109]	[0.109]	[0.096]	[0.132]	[0.122]	[0.141]	[0.105]	[0.075]	[0.060]
Share of women	-0.10	-0.10	-0.08	-0.06	-0.13	-0.07	-0.15	-0.13	-0.03	-0.05
	[0.140]	[0.100]	[0.126]	[0.070]	[0.133]	[0.115]	[0.135]	[0.107]	[0.067]	[0.047]
Characteristics of hh head										
Education level (secondary general - base category)										
Below secondary general	0.23***	0.11*	0.22***	0.16***	0.11	0.12**	0.01	0.01	0.12**	0.09**
	[0.076]	[0.062]	[0.067]	[0.049]	[0.072]	[0.056]	[0.053]	[0.048]	[0.057]	[0.035]
Secondary special	-0.08	-0.13*	0.08	0.01	-0.11	-0.07	-0.05	-0.04	-0.01	-0.04
	[0.100]	[0.067]	[0.075]	[0.067]	[0.110]	[0.095]	[0.052]	[0.045]	[0.060]	[0.054]
Professional	-0.03	-0.07	0.05	-0.04	-0.08	-0.07	-0.02	-0.02	0.00	-0.00
	[0.069]	[0.057]	[0.059]	[0.036]	[0.065]	[0.058]	[0.043]	[0.038]	[0.031]	[0.019]
Higher	-0.04	-0.03	-0.07	-0.10*	-0.14	-0.09	-0.10	-0.12**	-0.02	-0.05
	[0.073]	[0.051]	[0.072]	[0.050]	[0.094]	[0.076]	[0.058]	[0.044]	[0.056]	[0.034]
Age	-0.00**	-0.00***	-0.00*	-0.00***	-0.00	-0.00	0.00	0.00	-0.00	-0.00*
	[0.002]	[0.001]	[0.002]	[0.001]	[0.002]	[0.002]	[0.002]	[0.001]	[0.001]	[0.001]
Ethnicity (Kyrgyz - base category)										
Uzbek	0.54***	0.55***	0.13	0.11	-0.23**	-0.14	0.42***	0.43***	0.43***	0.08*
	[0.073]	[0.072]	[0.090]	[0.081]	[0.094]	[0.088]	[0.084]	[0.079]	[0.049]	[0.043]
Russian	-0.28***	0.14	0.04	0.06	0.05	-0.05	0.05	0.15	0.02	0.03
	[0.100]	[0.186]	[0.078]	[0.070]	[0.130]	[0.091]	[0.383]	[0.321]	[0.082]	[0.079]
Other	-0.04	0.21	0.10	0.12	0.08	0.10	0.09	0.11	0.11	0.11
	[0.086]	[0.206]	[0.086]	[0.077]	[0.128]	[0.097]	[0.439]	[0.366]	[0.107]	[0.100]
Observations	4,546	4,546	4,546	4,546	4,546	4,546	4,546	4,546	4,546	4,546
R-squared	0.096	0.157	0.045	0.061	0.124	0.176	0.352	0.467	0.061	0.116
Number of households	1,690	1,690	1,690	1,690	1,690	1,690	1,690	1,690	1,690	1,690

Note: household, month and year of interview fixed effects included; standard errors clustered at primary sampling unit(psu) level reported in brackets; hh – household; psu – primary sampling unit

Table 5 - Effect of natural shocks on rural households' income, consumption and spending

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Aid from persons living in Kyrgyzstan (relatives/friends)	Income from wage employment	Money transfers from persons living abroad	Social transfers	Property income	Income from household enterprises	Other income	Total income	Total consumption	Spending on repair and construction
Drought	0.27	0.16	-0.03	0.08	-0.13	-0.83***	0.14	-0.18*	-0.08	-0.05
	[0.226]	[0.349]	[0.229]	[0.241]	[0.192]	[0.234]	[0.205]	[0.094]	[0.063]	[0.317]
Too much rain or flood	-0.00	-0.11	-0.32	0.01	-0.20	-0.85**	-0.15	-0.30**	0.01	-0.25
	[0.421]	[0.371]	[0.350]	[0.298]	[0.171]	[0.352]	[0.327]	[0.117]	[0.066]	[0.482]
Very cold winter	-0.27	0.16	-0.24	-0.00	0.17	0.36	0.21	-0.01	0.08	0.49
	[0.312]	[0.314]	[0.259]	[0.285]	[0.188]	[0.252]	[0.200]	[0.102]	[0.053]	[0.340]
Earthquakes	0.12	0.60	-0.02	0.06	0.03	-0.36	0.01	0.09	-0.02	0.10
	[0.259]	[0.412]	[0.248]	[0.235]	[0.144]	[0.251]	[0.271]	[0.101]	[0.089]	[0.330]
Landslides	0.89*	1.01	1.16**	0.40	-0.23	0.23	-0.51	0.39	-0.03	0.06
	[0.510]	[0.850]	[0.560]	[0.707]	[0.288]	[0.481]	[0.505]	[0.236]	[0.122]	[0.733]
Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Households fixed effects	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	3,898	3,901	3,901	3,898	3,898	3,901	3,898	3,898	3,909	4,131
R-squared	0.060	0.094	0.079	0.433	0.038	0.139	0.156	0.109	0.210	0.191
Number of households	1,594	1,595	1,595	1,594	1,594	1,595	1,594	1,594	1,596	1,607

Note: Shock measure – share of households in psu that report having shock; controls include: number of household members, share of children, women and pensioners, household head’s education, gender and age, total months employed per working age household member, value of owned livestock, size of owned and cultivated land, share of owned land that is irrigated, asset index, agriculture is the most important economic activity in the community(dummy), log of community population size, share of households that had migrants(previous year), interview month and year dummies ; standard errors clustered at psu level reported in brackets, *** p < 0.01, ** p < 0.05, * p < 0.1

Table 6 – Determinants of individual migration decision, linear probability model, 2011-2013

VARIABLES	(1)	(2)			(3)	(4)			(5)	(6)			(7)	(8)	(9)	(10)			(11)	(12)
	pooled OLS	International migration			HH FE	HH RE			pooled OLS	Any migration			HH FE	HH RE	pooled OLS	Internal migration			HH FE	HH RE
Share of hh in community that experienced:																				
drought	-0.03**	-0.04**	-0.04**	-0.03**	-0.04**	-0.05**	-0.05**	-0.04**	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
	[0.016]	[0.018]	[0.017]	[0.016]	[0.018]	[0.020]	[0.020]	[0.018]	[0.009]	[0.012]	[0.012]	[0.012]	[0.009]	[0.012]	[0.012]	[0.012]	[0.012]	[0.012]	[0.009]	[0.009]
too much rain or flood	-0.04**	-0.05**	-0.04*	-0.04**	-0.04*	-0.06**	-0.05**	-0.04*	-0.00	-0.01	-0.01	-0.01	-0.00	-0.00	-0.00	-0.01	-0.01	-0.01	-0.01	-0.00
	[0.018]	[0.021]	[0.023]	[0.018]	[0.020]	[0.024]	[0.024]	[0.020]	[0.012]	[0.014]	[0.014]	[0.014]	[0.012]	[0.012]	[0.014]	[0.014]	[0.014]	[0.014]	[0.012]	[0.012]
very cold winter	0.01	0.02	0.02	0.01	-0.00	0.00	-0.00	-0.00	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
	[0.013]	[0.014]	[0.015]	[0.013]	[0.016]	[0.018]	[0.018]	[0.016]	[0.011]	[0.014]	[0.014]	[0.014]	[0.011]	[0.011]	[0.014]	[0.014]	[0.014]	[0.014]	[0.011]	[0.011]
earthquakes	-0.02	0.01	0.01	-0.01	-0.02	-0.00	-0.00	-0.02	-0.01	-0.01	-0.01	-0.01	-0.02	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
	[0.018]	[0.018]	[0.017]	[0.017]	[0.019]	[0.020]	[0.019]	[0.018]	[0.009]	[0.009]	[0.009]	[0.009]	[0.009]	[0.009]	[0.009]	[0.009]	[0.009]	[0.009]	[0.009]	[0.008]
landslides	0.02	-0.04	-0.05	0.01	0.01	-0.04	-0.06	-0.01	-0.02	-0.01	-0.01	-0.01	-0.02	-0.02	-0.01	-0.01	-0.01	-0.01	-0.01	-0.02
	[0.027]	[0.041]	[0.038]	[0.027]	[0.028]	[0.045]	[0.043]	[0.029]	[0.014]	[0.018]	[0.018]	[0.018]	[0.014]	[0.014]	[0.018]	[0.018]	[0.018]	[0.018]	[0.018]	[0.013]
Person was an international migrant last year		0.44***																		
		[0.025]																		
hh had an international migrant last year		0.02*																		
		[0.010]																		
Person was an internal																				0.38***

or international
migrant last year

[0.024]

hh had an internal or
international migrant
last year

-0.00
[0.009]

Person was an internal
migrant last year

0.19***
[0.054]

hh had an internal
migrant last year

-0.01
[0.008]

hh characteristics (before shock)

Log per capita

consumption

0.04***	0.01	-0.00	0.03**	0.05***	0.01	-0.01	0.03***	0.01	0.00	-0.01	0.01
[0.013]	[0.011]	[0.013]	[0.012]	[0.013]	[0.013]	[0.015]	[0.013]	[0.006]	[0.006]	[0.008]	[0.006]

Log per capita
monetary income

-0.02***	-0.01*	-0.01*	-0.01***	-0.02**	-0.01**	-0.01*	-0.02**	-0.00	-0.00	-0.01	-0.00
[0.006]	[0.006]	[0.007]	[0.006]	[0.006]	[0.006]	[0.008]	[0.006]	[0.003]	[0.003]	[0.004]	[0.003]

Share of consumed
food that is purchased

0.03	0.00	0.01	0.02	0.03	0.00	-0.01	0.02	0.01	0.00	-0.02	0.00
[0.022]	[0.022]	[0.025]	[0.021]	[0.022]	[0.021]	[0.026]	[0.021]	[0.011]	[0.013]	[0.016]	[0.010]

Asset index

0.00	-0.00	-0.01	0.00	-0.00	-0.00	-0.01*	0.00	-0.00*	-0.00	-0.00	-0.00
[0.002]	[0.001]	[0.004]	[0.002]	[0.002]	[0.002]	[0.005]	[0.002]	[0.001]	[0.001]	[0.002]	[0.001]

Log livestock market
value

-0.00	0.00	0.00**	-0.00	-0.00	-0.00	0.00	-0.00	-0.00	-0.00	-0.00	-0.00
[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]

Share of wage income
in total income

-0.02*	-0.00	0.02	-0.01	-0.02	-0.01	0.02	-0.01	0.00	-0.00	0.00	0.00
[0.012]	[0.009]	[0.014]	[0.011]	[0.012]	[0.010]	[0.016]	[0.012]	[0.006]	[0.006]	[0.010]	[0.006]

Log owned land

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
[0.002]	[0.001]	[0.002]	[0.001]	[0.002]	[0.001]	[0.002]	[0.002]	[0.001]	[0.001]	[0.002]	[0.001]

Log cultivated land

-0.00***	-0.00***	-0.00***	-0.00***	-0.00***	-0.00***	-0.00***	-0.00***	-0.00	-0.00	-0.00	-0.00
[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.000]	[0.001]	[0.001]	[0.000]

Number of hh
members

0.00***	0.00	-0.01*	0.00**	0.01***	0.00**	-0.00	0.01***	0.00**	0.00**	0.01	0.00**
---------	------	--------	--------	---------	--------	-------	---------	--------	--------	------	--------

	[0.002]	[0.002]	[0.004]	[0.002]	[0.002]	[0.002]	[0.006]	[0.002]	[0.001]	[0.001]	[0.004]	[0.001]
Share of pensioners	0.03	0.04	0.05	0.03	0.05*	0.05*	0.09	0.05*	0.02	0.02	0.06	0.03
	[0.030]	[0.024]	[0.043]	[0.026]	[0.031]	[0.027]	[0.057]	[0.029]	[0.017]	[0.017]	[0.045]	[0.017]
Share of children under 14	-0.00	0.00	-0.00	-0.00	-0.02	-0.02	-0.00	-0.02	-0.02	-0.02	-0.01	-0.02
	[0.017]	[0.014]	[0.047]	[0.017]	[0.023]	[0.019]	[0.056]	[0.023]	[0.019]	[0.017]	[0.036]	[0.018]
Share of females	0.07***	0.06***	-0.03	0.07***	0.07**	0.05**	-0.08	0.06**	0.00	0.00	-0.05	0.00
	[0.025]	[0.020]	[0.051]	[0.023]	[0.028]	[0.023]	[0.064]	[0.028]	[0.017]	[0.017]	[0.041]	[0.017]
hh head education (Baseline - Secondary general)												
Below secondary general												
	-0.01	-0.01	-0.04	-0.02	-0.02	-0.01	-0.03	-0.02*	-0.00	-0.00	0.01	-0.00
	[0.011]	[0.007]	[0.036]	[0.012]	[0.011]	[0.008]	[0.028]	[0.012]	[0.006]	[0.005]	[0.015]	[0.006]
Basic vocational	0.01	0.01	-0.02	0.01	0.01	0.02*	0.00	0.01	0.00	0.01	0.01	0.00
	[0.013]	[0.011]	[0.042]	[0.015]	[0.013]	[0.011]	[0.040]	[0.015]	[0.007]	[0.007]	[0.014]	[0.007]
Secondary vocational	0.00	0.01	-0.02	0.00	0.00	0.01	-0.02	-0.00	-0.00	-0.00	-0.00	-0.00
	[0.012]	[0.009]	[0.023]	[0.012]	[0.012]	[0.010]	[0.022]	[0.012]	[0.004]	[0.004]	[0.009]	[0.004]
Higher or above	-0.01	0.00	-0.01	-0.01	-0.01	0.00	-0.03	-0.01	-0.00	-0.00	-0.03*	-0.00
	[0.012]	[0.008]	[0.041]	[0.012]	[0.012]	[0.009]	[0.040]	[0.012]	[0.005]	[0.004]	[0.015]	[0.005]
Hh head age	-0.00***	-0.00**	-0.00	-0.00***	-0.00***	-0.00**	-0.00	-0.00***	-0.00	-0.00	-0.00*	-0.00*
	[0.000]	[0.000]	[0.001]	[0.000]	[0.001]	[0.000]	[0.001]	[0.001]	[0.000]	[0.000]	[0.000]	[0.000]
Individual characteristics												
Age	0.00**	0.00	0.00	0.00*	0.00**	0.00	0.00	0.00*	0.00	0.00	0.00	0.00
	[0.000]	[0.000]	[0.001]	[0.000]	[0.000]	[0.000]	[0.001]	[0.001]	[0.000]	[0.000]	[0.000]	[0.000]
Gender	0.08***	0.05***	0.08***	0.08***	0.08***	0.05***	0.07***	0.07***	-0.00	-0.00	-0.00	-0.00
	[0.014]	[0.009]	[0.014]	[0.014]	[0.014]	[0.010]	[0.014]	[0.014]	[0.005]	[0.004]	[0.004]	[0.004]
Married	-0.06***	-0.04***	-0.06***	-0.06***	-0.07***	-0.05***	-0.06***	-0.07***	-0.01**	-0.01*	-0.01*	-0.01**
	[0.013]	[0.011]	[0.015]	[0.014]	[0.013]	[0.011]	[0.015]	[0.014]	[0.006]	[0.006]	[0.007]	[0.007]
Ethnicity (baseline - Kyrgyz)												
Uzbek	-0.03*	-0.01	-0.07*	-0.03	-0.04*	-0.02	-0.07**	-0.03	-0.02**	-0.03**	-0.01	-0.01**
	[0.018]	[0.016]	[0.035]	[0.018]	[0.021]	[0.020]	[0.035]	[0.020]	[0.007]	[0.011]	[0.007]	[0.007]
Russian	-0.01	-0.00	0.01	-0.01	-0.01	-0.01	0.04	-0.01	-0.00	-0.01*	0.02	-0.00
	[0.015]	[0.016]	[0.040]	[0.014]	[0.016]	[0.017]	[0.044]	[0.016]	[0.008]	[0.007]	[0.021]	[0.008]
Dungan	-0.03**	-0.01	0.01	-0.03**	-0.03**	-0.00	0.03	-0.03**	-0.00	0.00	0.01	-0.00
	[0.012]	[0.009]	[0.036]	[0.012]	[0.012]	[0.011]	[0.038]	[0.013]	[0.007]	[0.008]	[0.017]	[0.007]
Relation to hh head (baseline - hh head)												

Other	0.17***	0.10***	0.16***	0.16***	0.17***	0.11***	0.16***	0.16***	0.02	0.01	0.02	0.02
	[0.025]	[0.017]	[0.026]	[0.025]	[0.026]	[0.018]	[0.028]	[0.025]	[0.011]	[0.010]	[0.011]	[0.011]
Spouse	0.06***	0.03***	0.05***	0.06***	0.05***	0.03***	0.04***	0.05***	-0.00	-0.00	-0.01*	-0.00
	[0.012]	[0.009]	[0.012]	[0.012]	[0.012]	[0.009]	[0.012]	[0.012]	[0.005]	[0.004]	[0.005]	[0.005]
Son	0.16***	0.10***	0.16***	0.16***	0.18***	0.12***	0.17***	0.18***	0.04***	0.03***	0.04***	0.04***
	[0.023]	[0.016]	[0.024]	[0.022]	[0.024]	[0.017]	[0.027]	[0.024]	[0.012]	[0.011]	[0.013]	[0.012]
Community characteristics												
Share of households with international migrants in the psu												
	0.19***	-0.32***	-0.11*	0.13**	0.18***	-0.27***	-0.11	0.13**	-0.00	-0.00	-0.00	-0.00
	[0.056]	[0.058]	[0.062]	[0.057]	[0.056]	[0.065]	[0.067]	[0.057]	[0.016]	[0.027]	[0.027]	[0.016]
Size of community												
	-0.00	-0.02	-0.01	-0.00	-0.00	-0.01	-0.01	-0.00	-0.00	-0.01	-0.01	-0.00
	[0.008]	[0.051]	[0.050]	[0.008]	[0.008]	[0.051]	[0.051]	[0.008]	[0.003]	[0.013]	[0.012]	[0.003]
Drinking water access (dummy)												
	0.01	0.02	0.01	0.01	0.01	0.02	-0.00	0.00	-0.00	-0.01	-0.01	-0.00
	[0.010]	[0.022]	[0.023]	[0.011]	[0.011]	[0.024]	[0.026]	[0.011]	[0.006]	[0.014]	[0.017]	[0.006]
Agriculture is the major economic activity in the community												
	0.01	0.02	0.02	0.01	-0.00	0.01	0.00	-0.00	-0.01	-0.01	-0.01	-0.01
	[0.012]	[0.014]	[0.016]	[0.012]	[0.015]	[0.022]	[0.021]	[0.014]	[0.009]	[0.016]	[0.015]	[0.009]
Major activity by the people in community												
Cattle breeding												
	-0.02	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	0.00	-0.00	-0.00	0.00
	[0.010]	[0.012]	[0.011]	[0.010]	[0.011]	[0.013]	[0.013]	[0.011]	[0.006]	[0.009]	[0.009]	[0.006]
Cotton crops												
	0.01	-0.00	-0.01	0.01	0.01	0.01	0.01	0.01	-0.00	0.02	0.02	-0.00
	[0.017]	[0.023]	[0.024]	[0.018]	[0.019]	[0.026]	[0.027]	[0.019]	[0.007]	[0.014]	[0.013]	[0.007]
Grain crops												
	-0.01	-0.00	-0.00	0.00	-0.01	0.00	-0.00	-0.00	-0.01	-0.00	-0.00	-0.01
	[0.012]	[0.015]	[0.014]	[0.012]	[0.015]	[0.020]	[0.020]	[0.015]	[0.009]	[0.015]	[0.015]	[0.009]
Potato crops												
	-0.01	-0.01	-0.01	-0.01	-0.02	-0.01	-0.01	-0.02	-0.01*	-0.01	-0.01	-0.01*
	[0.014]	[0.015]	[0.015]	[0.014]	[0.014]	[0.019]	[0.018]	[0.014]	[0.005]	[0.012]	[0.011]	[0.006]
Fruit crops												
	-0.01	0.02	0.01	-0.01	-0.00	0.01	-0.01	-0.01	0.00	-0.01	-0.01	0.00
	[0.014]	[0.023]	[0.023]	[0.016]	[0.015]	[0.027]	[0.027]	[0.017]	[0.007]	[0.011]	[0.012]	[0.007]
Province (baseline - Jalal-Abad)												
Issyk-Kul												
	-0.04**			-0.06***	-0.03			-0.04*	0.02			0.02
	[0.020]			[0.019]	[0.023]			[0.023]	[0.012]			[0.012]
Naryn												
	-0.09***			-0.09***	-0.01			-0.01	0.08***			0.08***

	[0.020]			[0.020]	[0.025]			[0.025]	[0.016]			[0.017]
Batken	0.02			0.02	0.04*			0.04*	0.04***			0.04***
	[0.020]			[0.022]	[0.020]			[0.021]	[0.012]			[0.012]
Osh	-0.02			-0.02	-0.02			-0.02	0.00			0.00
	[0.017]			[0.019]	[0.019]			[0.020]	[0.008]			[0.008]
Talas	0.02			0.01	0.07***			0.06***	0.07***			0.07***
	[0.016]			[0.015]	[0.020]			[0.020]	[0.023]			[0.021]
Chui	-0.10***			-0.11***	-0.10***			-0.11***	-0.01			-0.01
	[0.016]			[0.016]	[0.018]			[0.018]	[0.010]			[0.010]
Month and year of interview dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Constant	-0.17	0.29	0.40	-0.06	-0.13	0.27	0.51	-0.02	0.05	0.15	0.32**	0.07
	[0.140]	[0.476]	[0.479]	[0.135]	[0.153]	[0.472]	[0.488]	[0.149]	[0.068]	[0.119]	[0.132]	[0.069]
Observations	13,928	13,924	13,928	13,928	14,400	14,400	14,400	14,400	13,014	13,014	13,014	13,014
R-squared	0.134	0.234	0.086		0.132	0.206	0.092		0.049	0.050	0.026	
Number of communities		69				69				69		
Number of households			1,626	1,626			1,627	1,627			1,625	1,625

Note: hh – household; psu – primary sampling unit; standard errors clustered by psus in brackets *** p < 0.01, ** p < 0.05, * p < 0.1

Table 7 Interactions of shocks and household characteristics

	(1)	(2)	(3)	(4)	(5)	(6)
	psu FE	HH FE	psu FE	HH FE	psu FE	HH FE
Panel A						
Drought	-0.16*	-0.16*	-0.17	-0.29	-0.19	-0.26
	[0.083]	[0.095]	[0.183]	[0.186]	[0.194]	[0.177]
Drought*Share of hh with international migrants in the psu	0.20*	0.17	0.22*	0.18	0.22*	0.18
	[0.105]	[0.106]	[0.111]	[0.116]	[0.110]	[0.114]
Drought*Log cultivated land	0.00	0.01**	0.00	0.01**	0.00	0.01**
	[0.002]	[0.002]	[0.002]	[0.003]	[0.002]	[0.003]
Drought*Log per capita income	0.01	0.01				
	[0.009]	[0.011]				
Drought*Log per capita consumption			0.01	0.02		
			[0.021]	[0.024]		
Drought*Log per capita food consumption					0.01	0.02
					[0.024]	[0.024]
Panel B						
Too much rain or flood	-0.26**	-0.24*	-0.35*	-0.28	-0.42**	-0.30*
	[0.107]	[0.132]	[0.190]	[0.231]	[0.162]	[0.178]
Too much rain or flood *Share of hh with international migrants in the psu	-0.01	-0.04	-0.01	-0.02	-0.01	-0.02
	[0.134]	[0.121]	[0.134]	[0.121]	[0.129]	[0.121]
Too much rain or flood *Log cultivated land	0.00	0.00	0.00	0.00	0.00	0.00
	[0.002]	[0.003]	[0.002]	[0.003]	[0.002]	[0.003]
Too much rain or flood *Log per capita income	0.02*	0.02				
	[0.013]	[0.016]				
Too much rain or flood *Log per capita consumption			0.04	0.03		
			[0.023]	[0.029]		
Too much rain or flood *Log per capita food consumption					0.05**	0.03
					[0.021]	[0.023]
Panel C						

Very cold winter	0.01 [0.100]	0.02 [0.118]	-0.29* [0.158]	-0.18 [0.155]	-0.34** [0.133]	-0.24* [0.139]
Very cold winter*Share of hh with international migrants in the psu	-0.03 [0.075]	-0.04 [0.068]	-0.04 [0.071]	-0.05 [0.066]	-0.04 [0.068]	-0.05 [0.065]
Very cold winter*Log cultivated land	0.00 [0.002]	0.00* [0.002]	0.00 [0.002]	0.00* [0.002]	0.00 [0.002]	0.00* [0.002]
Very cold winter*Log per capita income	0.00 [0.012]	-0.00 [0.015]				
Very cold winter*Log per capita consumption			0.04* [0.020]	0.02 [0.020]		
Very cold winter*Log per capita food consumption					0.05** [0.018]	0.03* [0.018]
<hr/>						
Panel D						
Earthquake	-0.15* [0.082]	-0.09 [0.103]	-0.02 [0.157]	-0.22 [0.180]	0.18 [0.177]	-0.02 [0.168]
Earthquake*Share of hh with international migrants in the psu	0.28*** [0.099]	0.26** [0.100]	0.30*** [0.106]	0.28** [0.108]	0.28*** [0.106]	0.27** [0.107]
Earthquake*Log cultivated land	0.00 [0.002]	0.00 [0.002]	0.00 [0.002]	0.00 [0.002]	0.00 [0.002]	0.00 [0.002]
Earthquake*Log per capita income	0.01 [0.011]	0.00 [0.014]				
Earthquake*Log per capita consumption			-0.01 [0.019]	0.02 [0.021]		
Earthquake*Log per capita food consumption					-0.03 [0.022]	-0.01 [0.021]
<hr/>						
Panel E						
Landslides	-0.70*** [0.218]	-0.72*** [0.242]	-0.82* [0.469]	-0.82 [0.505]	-0.32 [0.265]	0.00 [0.274]
Landslides*Share of hh with international migrants in the psu	0.46***	0.45**	0.50***	0.50***	0.53***	0.57***

	[0.168]	[0.173]	[0.176]	[0.182]	[0.183]	[0.183]
Landslides*Log cultivated land	0.00	-0.00	0.00	0.00	0.00	0.00
	[0.005]	[0.004]	[0.005]	[0.005]	[0.005]	[0.005]
Landslides*Log per capita income	0.07***	0.07**				
	[0.025]	[0.028]				
Landslides*Log per capita consumption			0.08	0.08		
			[0.058]	[0.061]		
Landslides*Log per capita food consumption					0.02	-0.02
					[0.034]	[0.035]

Note: hh – household; psu – primary sampling unit; shock measure – share of households in psu reporting being affected by the shock. Included control variables: depending on specification: log per capita total consumption or log per capita food consumption or log per capita monetary income; in all specifications: Individual characteristics (age, gender, marital status, ethnicity, relation to hh head, person was an international migrant last year); Household characteristics (share of consumed food that is purchased, asset index, log livestock market value, share of wage income in total income, log owned land, log cultivated land, number of hh members, share of pensioners, share of children under 14, share of females, hh head education, hh head age); Community characteristics (share of households with international migrants in the psu, size of community, drinking water access (dummy), agriculture is the major economic activity in the community, major activity by the people in community, province); month and year of interview dummies
Standard errors clustered by psus in brackets*** p < 0.01, ** p < 0.05, * p < 0.1

Table 8 Migration participation by source of funding

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
	psu FE	HH FE	psu FE	HH FE	psu FE	HH FE	psu FE	HH FE	psu FE	HH FE	psu FE	HH FE	psu FE	HH FE	psu FE	HH FE
	Migration financed with own funds								Migration financed with help of friends and relatives							
Drought	-0.02	0.00	-0.16***	-0.24***	0.06	-0.06	0.05	-0.07	-0.00	-0.02*	0.03	0.04	0.01	0.08	0.02	0.14
	[0.012]	[0.010]	[0.055]	[0.074]	[0.079]	[0.098]	[0.104]	[0.118]	[0.003]	[0.012]	[0.059]	[0.058]	[0.125]	[0.150]	[0.112]	[0.136]
Drought*Log per capita income			0.02**	0.03***							-0.00	-0.01				
			[0.007]	[0.009]							[0.007]	[0.007]				
Drought*Log per capita consumption					-0.01	0.00							-0.00	-0.01		
					[0.009]	[0.012]							[0.015]	[0.018]		
Drought*Log per capita food consumption							-0.01	0.01							-0.00	-0.02
							[0.013]	[0.015]							[0.014]	[0.017]
Too much rain or flood	-0.05***	-0.03**	-0.17**	-0.18*	-0.05	-0.04	-0.16	-0.12	0.00	-0.04***	-0.22***	-0.24***	-0.44***	-0.38**	-0.38***	-0.32**
	[0.017]	[0.012]	[0.068]	[0.101]	[0.108]	[0.164]	[0.099]	[0.153]	[0.004]	[0.016]	[0.069]	[0.082]	[0.115]	[0.157]	[0.085]	[0.123]
Too much rain or flood*Log per capita income			0.02*	0.02							0.02***	0.03**				
			[0.008]	[0.012]							[0.009]	[0.010]				
Too much rain or flood*Log per capita consumption					0.00	-0.00							0.05***	0.04**		
					[0.013]	[0.020]							[0.014]	[0.019]		
Too much rain or flood*Log per capita food consumption							0.01	0.01							0.05***	0.04**
							[0.013]	[0.020]							[0.011]	[0.016]
Very cold winter	0.00	0.01	0.02	0.05	0.01	0.04	-0.07	-0.03	-0.01	0.00	-0.03	-0.04	-0.25***	-0.30***	-0.22***	-0.25***
	[0.011]	[0.010]	[0.060]	[0.077]	[0.086]	[0.109]	[0.082]	[0.115]	[0.004]	[0.010]	[0.058]	[0.069]	[0.089]	[0.103]	[0.056]	[0.080]
Very cold winter*Log per capita income			-0.00	-0.01							0.01	0.01				
			[0.007]	[0.009]							[0.007]	[0.008]				
Very cold winter*Log per					-0.00	-0.00							0.03***	0.04***		

capita consumption																
						[0.010]	[0.013]						[0.011]	[0.013]		
Very cold winter*Log per capita food consumption								0.01	0.01						0.03***	0.04***
								[0.011]	[0.015]						[0.008]	[0.010]
Earthquakes	0.01	-0.01	-0.07	-0.11	0.05	-0.02	0.16*	0.14	0.00	0.01	-0.01	0.01	-0.10	-0.05	-0.01	0.00
	[0.012]	[0.010]	[0.064]	[0.073]	[0.081]	[0.101]	[0.090]	[0.108]	[0.005]	[0.012]	[0.051]	[0.069]	[0.104]	[0.123]	[0.084]	[0.091]
Earthquakes*Log per capita income			0.01	0.02							0.00	-0.00				
			[0.008]	[0.010]							[0.006]	[0.009]				
Earthquakes*Log per capita consumption					-0.00	0.00							0.01	0.01		
					[0.010]	[0.013]							[0.013]	[0.016]		
Earthquakes*Log per capita food consumption							-0.02	-0.02							0.00	-0.00
							[0.012]	[0.015]							[0.011]	[0.012]
Landslides	0.01	0.01	-0.25**	-0.43***	-0.22	-0.44**	-0.28**	-0.28	0.00	-0.01	-0.36**	-0.37*	-0.77**	-0.53	-0.33**	-0.03
	[0.022]	[0.027]	[0.101]	[0.143]	[0.136]	[0.186]	[0.120]	[0.174]	[0.006]	[0.020]	[0.153]	[0.185]	[0.321]	[0.466]	[0.158]	[0.217]
Landslides*Log per capita income			0.03**	0.05***							0.04**	0.04*				
			[0.012]	[0.018]							[0.019]	[0.023]				
Landslides*Log per capita consumption					0.03	0.05**							0.09**	0.06		
					[0.017]	[0.022]							[0.039]	[0.056]		
Landslides*Log per capita food consumption							0.03**	0.03							0.04**	0.00
							[0.017]	[0.024]							[0.020]	[0.029]

Note: hh – household; psu – primary sampling unit; shock measure – share of households in psu reporting being affected by the shock. Included control variables: depending on specification: log per capita total consumption or log per capita food consumption or log per capita monetary income; in all specifications: Individual characteristics (age, gender, marital status, ethnicity, relation to hh head, person was an international migrant last year); Household characteristics (share of consumed food that is purchased, asset index, log livestock market value, share of wage income in total income, log owned land, log cultivated land, number of hh members, share of pensioners, share of children under 14, share of females, hh head education, hh head age); Community characteristics (share of households with international

migrants in the psu, size of community, drinking water access (dummy), agriculture is the major economic activity in the community, major activity by the people in community, province); month and year of interview dummies. Standard errors clustered by psus in brackets; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$